WWF

Introduction

linking thinking

New perspectives on thinking and learning for sustainability

Linkingthinking introduction

Foreword

"To live in the third millennium, … we shall need new thinking joined with new ways of perceiving and visioning ourselves, others, nature and the world around us."

Ervin Laszlo, *3rd Millennium – The Challenge and the Vision*, Gaia Books, 1997

Welcome to the Linkingthinking Series, an innovative resource designed to help develop both students' and your own understanding and skills with regard to relational or systems thinking. WWF Scotland commissioned these materials in the belief that the ability to think in a more connective or integrative way is essential to living in a highly interdependent world.

You do not have to know anything about systems thinking beforehand to benefit from these materials. The Linkingthinking Series was written as an introduction to systems thinking, to help educators and students develop their own latent abilities to think relationally.

You don't have to 'work through' all of the units. They have been designed so that they can be used flexibly – either as a professional development course, as a teaching course, or as a resource that can be dipped into and adapted to help enhance teaching across a wide range of disciplines.

The Linkingthinking materials have been trialled and tested. You can be confident that they will help you and your students discover some new perspectives, promote discussion and develop new skills to think effectively about complex issues.

The citizens and professionals of tomorrow will require such qualities as flexibility, resourcefulness, creativity, self-reliance and empathy, and the ability to participate actively and responsibly. The Linkingthinking materials are designed to help develop the thinking skills that underpin these qualities..

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Introducing the Linkingthinking Series

What is this about?

Linkingthinking is:

- a new and ground-breaking flexible suite of learning and teaching resources
- for teachers, lecturers and other educators, and their students
- about thinking and acting in more relational ways: the why, what and how
- about generating new perspectives, introducing systems ideas and developing relational thinking skills which are broadly applicable to different situations and contexts
- a set of ideas, tools, and activities that will help you and your students learn Linkingthinking skills easily
- a challenging, thought-provoking resource, designed to help you and your students generate new perspectives appropriate to a highly interdependent world.

The Linkingthinking materials comprise:

- two series of units: The Perspectives Series (four titles), The Focus Series (three titles)
- a freestanding Toolbox of activities
- a Glossary.

But what is 'Linkingthinking'?

It's the term used here to describe thinking about the nature and consequences of relationships. Similar terms are 'systems thinking' and 'holistic thinking'.

We are used to analytical thinking and reductionist thinking which understands things by taking them apart. But in a highly complex and turbulent world, there's an increasingly shared view that analytical thinking is not enough. Indeed, by itself, it's probably compounding our problems.

Linkingthinking is the necessary complement to analytical and critical thinking: approaches to problem solving and ways of thinking that are more holistic, systemic, ecological, inclusive and integrative.

Why this resource?

Although there is a strong argument for developing Linkingthinking ideas and skills in education, it is hardly yet recognised in current curricula and policy objectives. Because of this, there are few, if any, educational resources which help develop these essential skills.

Is this for me?

If you, your institution or organisation:

- are interested in thinking skills but think the debate so far is 'missing something'
- feel perplexed or overwhelmed by complexity in our lives
- are interested in developing understanding about how things interrelate
- are concerned by too much fragmentation and segregation in educational structures, knowledge, or policy making
- are interested in the sort of thinking skills, values and concepts that might be needed in the transition towards a more sustainable society,

then you will welcome Linkingthinking.

What is the rationale behind Linkingthinking?

The writers, partners and WWF Scotland have developed this package in the belief that Linkingthinking:

- is vital to help people cope with, understand and address the complex issues that increasingly dominate life
- is virtually ignored in consideration of thinking skills and in the debate on critical thinking
- is a perspective and skill that can be learnt and taught
- is largely unknown to and inaccessible to most people and needs to be translated into usable educational concepts and tools
- is increasingly needed in an interdependent world that urgently needs to move towards more sustainable lifestyles for the sake of all our futures.

How to use the Linkingthinking Series

It is multi-functional:

- A self-development course: the units are designed for you, the tutor, to teach yourself.
- A resource for teaching systems thinking: any part of the units can also be used to help teach and work with student groups.
- Versatile: it is useful within a wide range of subjects – geography, science, business studies, design and technology, personal and social education, etc.

It is flexible:

- The material can be used flexibly: dip into it, or use it as a whole modular course, in any order that meets the needs of users.
- The four units in The Perspectives Series (Units 1-4) are freestanding, and can be used separately, or together with other units in The Focus Series (Units 5-7).
- The three units in The Focus Series (Units 5-7) are also freestanding and can be used separately or together with other units in The Perspectives Series (Units 1-4). Note that The Focus Series was written with Scottish curricula in mind.
- Each unit consists of two parts: Part A, ‘Key Ideas’ and Part B, ‘Further Investigation’.
- There is also a stand-alone Toolbox that can be used with, or independently of, the units.

It is adaptable:

- While written for educators, many of the ideas and activities can be easily adapted for student use.

WWF Scotland commissioned a team of writers to develop the ideas of Linkingthinking and generate this resource. The units represent their personal treatment of the subject and do not necessarily reflect the views of WWF Scotland.

Acknowledgments

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linking thinking

New perspectives on thinking and learning for sustainability

A WWF Scotland publication

The mission of WWF is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by:
· conserving the world's biological diversity
· ensuring that the use of renewable resources is sustainable
· promoting the reduction of pollution and wasteful consumption

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Perspectives

unit 1

linking thinking

New perspectives on thinking and learning for sustainability

Linkingthinking, education and learning: an introduction

by Stephen Sterling

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unit 1 part A

Key Ideas

This unit is part of the Linkingthinking suite of materials that seeks to help generate new perspectives, introduce systems ideas and develop relational thinking skills which are broadly applicable to different situations and contexts.

Aims of this unit

To introduce:

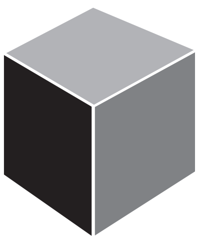
- **the reasons for and nature of Linkingthinking**
- **key terms, concepts and principles**
- **some implications for and applications to education and learning.**

1 Introducing Linkingthinking

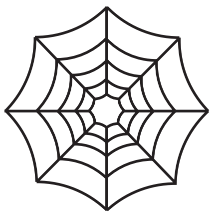
This section contrasts Linkingthinking with our more common 'boxed-thinking' and wonders whether you are already a Linkingthinker…

1.1 Thinking like a box, thinking like a web

Here is a box:



And here is a web:



What's the difference? Maybe jot a few ideas down…

Not difficult, you might say. One is a container, the other is more like a network of connections. One has six sides, the other is multi-stranded. One is rigid, the other flexible. One has definite and rigid boundaries, the other much less so.

Suppose we use these things as metaphors for the way we think. Now, what is the difference? Consider this before going on… Why might these be apt and useful metaphors?

You may have heard the expressions that we need to 'think out of the box', or about the need for 'joined-up thinking'. These have emerged in the last few years.

Reflection

- What do you think these expressions mean?
- Why do you think these expressions have emerged recently?

Here are some situations. Suppose:

- a government seeks to cut car use, but increases road building
- a government seeks to promote organic agriculture, but trials some genetically-modified crops near organic farms
- a government wants to reduce the debt burden of other countries but ties them into aid packages that extend their dependence
- a hospital tries to make people well but feeds them with nutritionally poor food during their stay
- a group of tourists go to find an unspoilt holiday destination, but manage to spoil it through insensitive behaviour.

Or, perhaps closer to home, suppose:

- you want to 'green' your house, but first throw away serviceable machines, furniture and materials in order to buy all-new 'green' goods and materials
- you want your children or students to learn self-reliance, but you do not allow them to make mistakes and learn from them.

Reflection

Conflict or complement? How can we do things in such a way that:

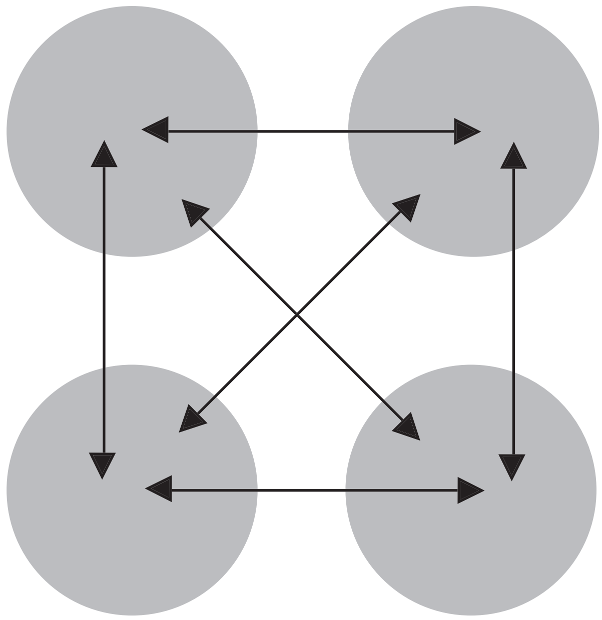
- we don't contradict what we intended in the first place?
- the effects of actions complement rather than cancel out – or conflict with – each other?
- we can minimise unintended negative consequences of actions or policies?

Can you think of other examples of contradictions or unintended consequences of actions? Check any newspaper for stories which illustrate how often effects stray beyond what was first intended…

The problem is that metaphorically, we tend to stick labels on things and 'put them in a box' such as 'housing', 'employment', 'crime', 'health' and so on. But in the real world, all issues are interconnected. They don't exist conveniently in closed boxes!

The writer Mary Catherine Bateson suggests that, despite our interconnected world, we still think mostly in a fragmented way. This is evident, she says:

> *"in every newspaper or newscast; the search for short-term solutions that worsen the problem over time; the focus on individual persons or organisms or even species seen in isolation; the tendency to let technological possibility or economic indicators replace reflection…"*
>
> Bateson, *Steps to an Ecology of Mind*, 2000



So how can we cope better with interconnection? The key is to think a bit differently, and ask some different questions. In short, we need to think 'out of the box' and look much more at the relationships between things, and between events. This is why this project is calling Linkingthinking. It has other names too:

- systems thinking
- relational thinking
- ecological thinking
- holistic thinking
- integrative thinking.

Whatever we call it, curiously, Linkingthinking hardly figures in education and the learning debate, or in the recent interest over thinking skills. Yet it could hardly be more relevant to the world as we find it now.

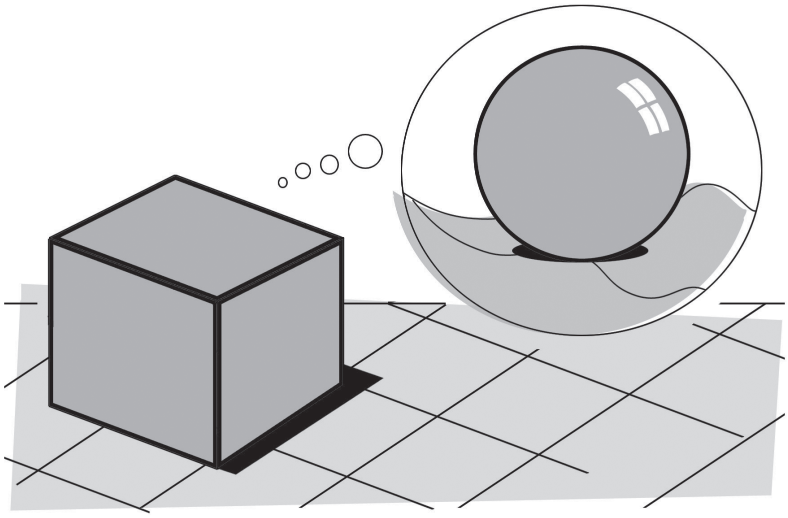
Let's go back to the metaphors – the world is much more web-like than box-like. It is highly interconnected, particularly through the effects of electronic media, mass travel and global trade. But we still tend to persist with box-like thinking. In many cases, this is no longer sufficient or appropriate, and can cause more problems than it addresses (Unit 2 has more about this.)

! Idea

Linkingthinking is the term we use to describe thinking that looks at the nature of and consequences of relationships.

! Idea

There is a mismatch between the way the world is, and the way we tend to think about it.



1.2 Doing it naturally… or learning it

Perhaps you are a born Linkingthinker:

- Do you look for connections between things?
- Do you often look at 'the big picture', that is, the wider context of some event or decision?
- Do you anticipate or notice causes or consequences beyond the immediate and obvious ones, either with respect to your actions, or others'?
- Do you think about the long term as well as the short term?

Can you remember times, places or events where you thought in this way? Perhaps you wondered 'What's the connection?' or 'So what happens next?'. This is the essence of Linkingthinking – assuming that there often is a connection, rather than assuming there isn't.

In Unit 1 section 5.5, page 21, there is a quiz relating to this that you might like to try.

While, for the sake of clarity, a distinction is made in these materials between 'Linkingthinking' and 'box-thinking', in real life, most of us do both. It's just that – taken overall – as a society, we need to do more of the former! Some people find Linkingthinking easy and natural. But others find it more difficult. Interestingly, young children seem to think and learn in a connective way quite naturally, looking for patterns and connections between things. (Is this your experience of young children?)

> *"It appears we have latent skills as system thinkers that are undeveloped, even repressed by formal education in linear thinking".*
>
> Senge, *The Fifth Discipline*, 1990, p73

Becoming a better Linkingthinker is not so much about getting an intellectual grasp – although this certainly has its place – as achieving a 'clicking in' experience, as in, 'Ah, so that's what it's all about!' This is best experienced, and we hope the activities in the text and in the **Toolbox** will help you click with Linkingthinking. This section of Unit 1 'Key Ideas' also helps you learn about some of the theoretical aspects, because learning *about* it will help you *do* it.

2 It's all relative

This section suggests that the way we view things is really important, and notes that we are generally better at seeing distinctions than making connections.

2.1 How does it look to you?

Linkingthinking is important, because:

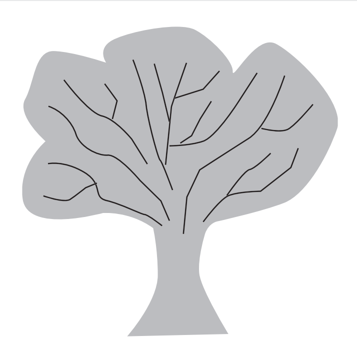
'The way we think influences what we see.'

Reflection

Does this ring true? Why (or why not)? If you are not sure, try the next activity.

Activity ➛ ➛ ➛

Here's a tree.



Yes, but what is it?

- a source of food (if it is fruit bearing)?
- a source of timber?
- a source of beauty and spiritual inspiration?
- shelter for animals or humans?
- an ecosystem of smaller plants and animals linked to the tree, and the tree to its environment?
- a provider of microclimate and a defence against soil erosion?
- one of the wonders of God's creation?
- a living being in its own right?
- something else…?

It could be all of these, and more. But the commercial forester is likely to see the tree differently from the Celtic tree worshipper, for example. It is still the same tree, however.

Make up a similar exercise for any other 'system', for example, a farm, a school, a car, a workplace. (For another example, see Part B 2.1, 'Further investigation', page 29.)

People see things and value things differently. How we see a tree, or anything else, is influenced by our beliefs, values, interests and thought patterns. Like tinted spectacles, they influence what we filter out, what we give attention to, what we value, and how we perceive or interpret the world about us. So, if seeing is believing, then also believing is seeing…what we believe tends to shape what we see and, importantly, how we act. (See quote by Mark Twain on page 31 of Part B, 'Further Investigation'.)

The Linkingthinking approach is more about how we might change the way we think, than suggesting *what* we might think about – but interestingly, changing 'how' often leads to changes in 'what' we think about. So for example, once you make the link between healthy food, nutrition and human health, you are more likely to be interested in food quality and how food is grown, produced and treated. Essentially, the Linkingthinking Series is an invitation to explore and try out some new approaches, to 'connect with ideas about connection'.

Let's start by looking at how far the idea of relationship is reflected in everyday language.

2.2 Making distinctions, making connections

Consider some common phrases:

What's that got to do with it?
Well, I just put two and two together…
That's not my concern! (his concern/their concern, etc)
What's the connection?
I can relate to that!
I've lost the thread!
He's lost the plot!
Oh! What a tangled web we weave…
We need to make a clear distinction here…
It's all relative…
Everything's related…
Only connect
It's nothing to do with me…

So in our everyday use of language we can:

- deny relationships, *or*
- draw distinctions rather than look at relationships, *or*
- recognise relationships, *or*
- recognise *and* try to understand relationships (as well as valid distinctions).

? Question

Which phrases illustrate which responses?
Can you think of times when you or others used these phrases?
Can you think of other similar common sayings?

From our earliest years, we tend to make sense of the world through two basic acts of perception:

- making *connections*, or noticing relationship:

  this belongs to that, eg 'a branch is part of a tree' (context) or,

  this is similar to that, eg 'these are both trees' (model) or 'this branches out like a tree' (metaphor)

  this influences that, eg 'this tree affects the bird population' (influence)

- or making *distinctions*, noticing lack of relationship or difference:

  this is different from this other thing, eg 'these two trees are not the same species'.

We are good at:

- *analysing* things – but less good at thinking 'out of the box', and at synthesising things
- *categorising* and *labelling* things (this is a 'health issue' 'an economic issue', a 'social issue' or an 'environmental issue', for example) – but less good at seeing the interrelated nature of the reality that often lies beneath the convenient label
- *seeing detail* and dealing with parts – but less good at appreciating overall patterns in events, in organisations, or other phenomena

- *focusing in* on one factor or one goal (eg maximising a particular achievement, increasing productivity, or maximising profits) – but less good at recognising and balancing multiple factors and goals.

? Question

Would you agree? What evidence is there to support this? Can you think of any examples that illustrate fragmentary thinking?

Sometimes we make distinctions when we should be making connections. This matters when it gets to the big issues. Do we look sufficiently at the connections between the economy and ecology, or consumption and declining environmental quality, or poverty and crime, or nutrition and behaviour, for example. At other times, we make equations when we should be making distinctions, say, between standard of living and quality of life, or between consumer satisfaction and a healthy lifestyle. At a deeper level, we are good at projecting our view of reality onto the world – but less good at looking critically about our own thinking. This too, is part of Linkingthinking.

3 Out of the box – the need for 'joined-up' thinking

This section offers three reasons why Linkingthinking is important and outlines four new global conditions that make it necessary.

3.1 Three reasons why Linkingthinking is important

"We consider that, to address the most critical challenges facing humanity, it is vital to rediscover a holistic approach to knowledge and its application."

The New Renaissance Group, *Beyond Sustainable Development,* 2001

Does it really matter if we are not very good at Linkingthinking? Here are three reasons why the Linkingthinking writing team suggests that it does:

1 Interdependence and complexity. Our societies, along with the global economy and ecology as a whole are now so linked up, that even everyday actions can impact on distant people and environments across time and geographical space. The many causes and consequences of global warming are a prime example. Box-thinking can't help much here.

2 Sustainability. Achieving a sustainable society, or at least a significantly more sustainable society than the one we now have, is the challenge of our new century. At heart, the concept of sustainability challenges us to re-examine our assumptions and beliefs, to think and act in a far more *linked-up* way than we are normally accustomed to. It is about the relationship between social, economic, and environmental wellbeing: all of these, considered together.

3 Projection. We tend to project our beliefs and ideas onto our environment (and indeed onto other people and groups). In this way, our perceptions tend to influence our surroundings. (At a simple level, for example, the colour you choose for your new kitchen, the style of car you prefer, or at another level, the buildings created by architects.) The way we see things – our worldview – strongly influences what we do, in all areas of life. But if we don't see how things relate either at a conceptual or physical level, or indeed at a spiritual level, we can end up with policies or actions which are more likely to conflict, are fragmentary, and show a lack of fit in terms of overall design and aesthetics. (This is a big subject! Unit 4 looks at it in much more detail. See also Unit 2, Part B, 1.2 'Going deeper… different metaphors'.)

Activity ➛ ➛ ➛

Have a look around you. The buildings, the furniture, the cars, the roads, the fields and hedges and so on, are all are products in some way of how they were seen by their creators. Where do things relate to each other well, or not so well? Are you thinking in aesthetic terms, or ethical, or practical? What would you change, if anything – why?

The three 'reasons' identified above are examined in more detail in the other three units in The Perspectives Series of Linkingthinking:

Interdependence and complexity:	Unit 2
Sustainability:	Unit 3
Beliefs and projection:	Unit 4

3.2 The new complexity

How many ideas or concepts can you think about at the same time? Some say that we are not good at juggling more than three ideas or concepts simultaneously. But in the last few decades we have created such complex social and economic systems and organisations, that no single person can know or fully understand them.

Here's another problem: things are so connected that actions can have consequences far beyond those we intended, or could anticipate. This was commented on, some 25 years ago, by the eminent scientist CH Waddington:

> *"I doubt if there ever has been a period in history when a greater proportion of people have found themselves frankly puzzled by the way the world reacts to their best efforts to change it, if possible for the better… recently things seem to have been going wrong so often, and in so many different contexts, that many people are beginning to feel that they must be thinking in some wrong way about how the world works. I believe this suspicion is probably correct."*
>
> Waddington, *Tools for Thought*, 1977 (pxi)

Reflection

Do you feel this is still valid today? Perhaps more so? Why – why not?

At all levels – from local to global – we seem to be surrounded by issues and problems that are complex, interrelated, and not easily solvable. Here is one quote:

> *"Climate shocks, financial instability, new diseases coupled with the spread of old ones, the rich-poor divide, uncontrolled urbanisation, corrupt governments, rising tides of refugees, there's pressure building up right across the system, and we're not noticing it until it's too late."*
>
> Homer-Dixon, 'Is security the trump card?' in *Green Futures*, April/May 2002, p30

? Question

Why do you think the author says we're not noticing it? And if he's right, why aren't we noticing it?

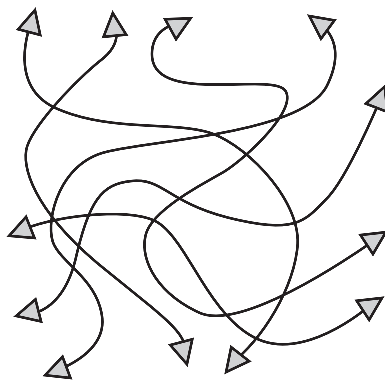
Let's explore this further by looking at the conditions affecting our lives in the new century, in 'advanced' economies, and increasingly, as a 'global society':

Activity ➛ ➛ ➛

Make a list of differences between your own lifestyle and that of your parents when they were your age, or differences that have occurred in your community in the last 40 years. What are the main changes? Can you see any interrelationships between the changes you have listed?

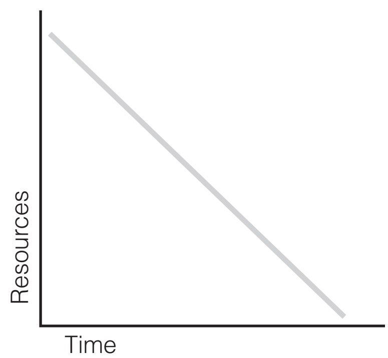
3.3 Four new global conditions

1 Complexity. This does not just mean made up of many parts (complication) but many and changing relationships and interconnections between parts. Most machines are *complicated*. But environmental and human systems are complex. In most respects, we live in an increasingly *complex* society, made more so through economic globalisation and the advances in Information and Communications Technology (ICT) in recent years. The famous 'butterfly's wings' story of chaos theory represents this new state, where in principle, a flap of its wings can be amplified to cause a storm on the other side of the world.



2 Uncertainty. In complex situations, it is simply impossible to determine or predict the outcome of an action or intervention. We live in a culture interested in certainty, prediction and control through setting measures such as 'performance indicators', and specific 'learning outcomes'. Yet increasing uncertainty means that we need to become more comfortable with ambiguity and approximation.

3 Unsustainability. One meaning of sustainability is the ability to do something long into the future without incurring a range of costs. On this basis, our modern societies are fundamentally unsustainable. The stress on life-support systems through our over-sized ecological footprint is becoming critical. (UNEP, *Global Environmental Outlook* – 3, 2002)



4 Overload/stress. This refers to the amount of information and 'stuff' we need to process in our lives. Not so long ago in human history it was possible for a knowledgeable person to be familiar with most of what was known to Western people. Not only is there a stress factor in coping with the 'information revolution' but there is a question of value: what is worth knowing, and how can we distinguish between information, knowledge and wisdom?

The surprising thing is – *all of these conditions are relatively new*:

- Most us now say that life was simpler once, or seemed so for our parents.
- There were more certainties and more simplicity even a few decades ago, more likelihood of relative stability regarding such things as jobs for life, communities, marriage, even the ability of environmental systems to support us. (Or did it just seem that way?)
- Unsustainability/sustainability was not something that worried people until quite recently (although specific environmental concerns, such as pollution, have been around longer).
- Before computers, mobile phones, fax machines, the Internet and email, 24-hour TV, 24-hour shopping and so on, there were 'just' pens, typewriters, letters, telephones, early and Sunday closing, and limited TV. A much-reduced flow of information, at a much slower pace.

So things have changed. 'So what?', you might say…

Well, in a nutshell, the argument is that these conditions of the 21st century require a different way of thinking and acting. The analytical and managerial approaches that worked a generation ago are not as effective in these new fluid and dynamic conditions.

Bela Banathy, who writes about educational change, suggests that these conditions of 'ever-increasing complexity' require:

> *"...a major shift toward attaining more understanding and human wisdom… We should create learning that enhances critical thinking, the understanding of the self, the systems and environments in which we live, and the situations we experience…"*

He calls for competence by which we can:

> *"…understand and manage complexity, cope with ambiguity and uncertainty, and grasp the connectedness and interdependence of the systems of which we are a part."*
>
> Banathy, *Systems Design of Education*, 1991, pp77/79

The implication is that currently, we don't do any of this, or if we do, we don't do it very well.

But why not? The answer seems to lie in how we think now. So before we look at the changes that Linkingthinking suggests, we need first to look at where we are now – in thinking terms, that is.

4 Spot the difference

This section suggests ten common habits of boxed-thinking, and ten beliefs of Linkingthinking and contrasts the two ways of thinking about the world.

4.1 Understanding our boxed-thinking

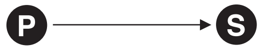
Let's go back to the metaphor of boxed-thinking. I would argue that 'thinking in boxes' is dominant in the culture of the Western world. Essentially, problems or issues are largely seen as separate, contained, and solvable. Underpinning this approach are various assumptions and beliefs, or at least, tendencies to think in a particular way. They have become ingrained habits of thought which we tend not to notice, simply because they are habits! I suggest they can be stated as below:

Reflection

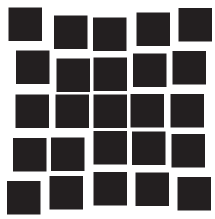
Check yourself – how far do you share these assumptions? Do you think this is a fair summary of common thinking habits? Suggest why, or why not….

10 assumptions of boxed-thinking:

1 **'To every problem, there's a solution'** belief in the power of problem-solving approaches



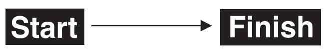
2 **'We can understand something by breaking it down into its component parts'**understanding a complex *whole* by looking at the detail



3 **'The whole (of something) is no more than the sum of its parts'** there are no *emergent properties*

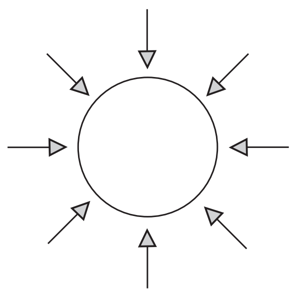
"2 + 2 = 4"

4 **'Most processes are linear'** events and phenomena have a definable beginning and finishing point



5 **'Most issues and events are fundamentally separate or may be regarded as such, and may be dealt with adequately in a segregated way'**issues are essentially unrelated

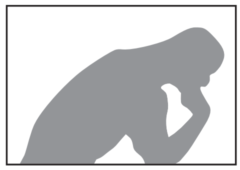
6 **'It is acceptable to draw your circle of attention or concern quite tightly, as in 'that's not my concern'** we do not need to look beyond our immediate concerns as an individual, a householder, a consumer, a businessman, etc



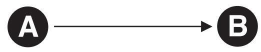
7 **'We can define or value something by distinguishing it from what it is not, or from its opposite'** a belief that economics is separate from ecology, people are separate from nature, facts are separate from values, etc

8 **'Objectivity is both possible and necessary to understand issues'** it is important to exclude our feelings and values in our analysis and judgement

9 **'We can understand things best through a rational response. Any other approach is irrational'** we need to downplay our intuition and non-rational knowing



10 **'If we know what the state of something is now, we can usually predict future outcomes'**a belief in certainty, prediction, and the possibility of control



Of course, it is not as simple as this, but these ten assumptions are a start to understanding the way we tend to think. They can be summarised by the following matching words which, taken together, help begin to map our culture's overall worldview.

Activity

Try to match the following keywords to the ten thinking assumptions above. Use the Glossary if you are unsure of any terms.

They are jumbled in the wrong order here. The answer is in Part B, 'Further investigation', page 32.

- reductionism
- narrow boundaries
- cause-effect
- atomism
- dualism
- objectivism
- determinism
- problem solving
- rationalism
- analysis

These have become *habits* of thought; a set of approaches that reinforce each other. We tend to think of this way as the 'normal' way. And it's a 'mindset' that tends to be reinforced in education too.

All ten of these assumptions are questionable in the light of our contemporary world, and in the light of what we know through the emerging 'sciences of complexity' (See Unit 2). Indeed, some of them are questionable in the light of what we may know intuitively…

Reflection

Would you agree with this last statement? Why…or why not?

At the same time however, it's important to recognise these beliefs are partly true or partly valid. And that they have been dominant because – largely – they seem to work, and have worked well.

But in a world increasingly characterised by complexity and uncertainty, they are no longer adequate. For a quote on the limits of reductionism, by James Lovelock (the creator of the influential Gaia theory that sees the Earth as whole self-regulating system), see Part B, 'Further Investigation', pages 32-33.

4.2 Seeing the world more wholly

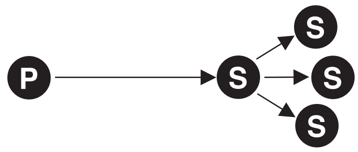
Let's revisit these assumptions from a Linkingthinking perspective.

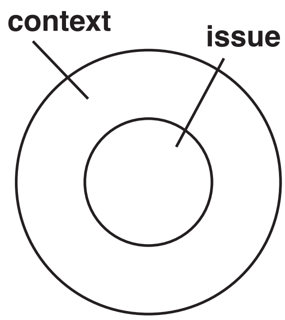
But first, see if you can jot down any 'alternative beliefs' that would help us get beyond the limits of boxed-thinking. And/or try drawing representations of alternative beliefs to complement those above. Then compare your ideas and pictures with those below.

10 beliefs of Linkingthinking

(Read these against the assumptions above).

1 Some solutions just produce more problems. Instead, we need to develop 'solutions that generate further solutions' (sometimes called 'positive synergies').



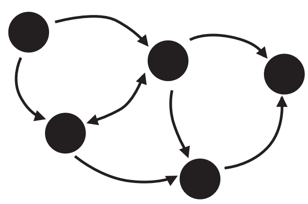


2 We often need to look at the whole, and at the larger context.

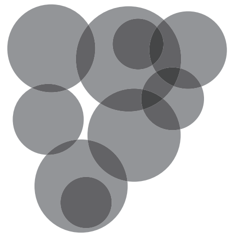
3 Complex systems show emergent properties; ie additional qualities that emerge from the interaction of the

"2 + 2 = 5"

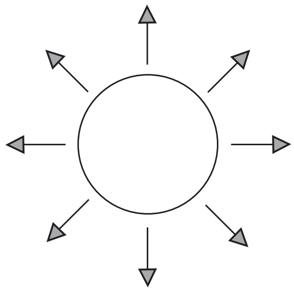
4 We need to attempt to look at all the influences at the 'start', all the knock-on effects at the 'finish' and any feedback loops. This complexity is characteristic of most human and environmental systems. (These are known as non-linear systems.)



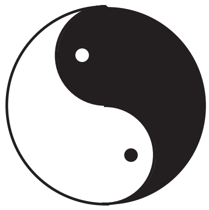
5 Most issues/events are related to other issues/events and can be better understood in the light of this interrelated reality.



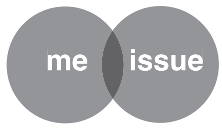
6 Complexity means that we need to expand our view of the world and be more aware of the boundaries of concern we set ourselves.



7 So-called opposites are in relationship. We tend to devalue one side against the other (ecology against economics, nature against people, values against facts, etc), and instead, need to see them in relationship rather than in opposition.

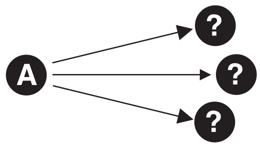


8 The decision to try to be objective is a value judgement. Total objectivity is impossible. Better to recognise how our subjective self is involved in perception and interpretation of the world.



9 Intellect needs to be balanced with intuition, and rationality with non-rational ways of knowing; spiritual and aesthetic knowing (balancing our left brain with our right brain).

10 In human and most natural systems (that is, those systems which are not mechanical) it is impossible to predict outcomes. We need to be more flexible, accept uncertainty, and not try to control everything but participate in and learn from change.



Well, these are some big ideas, all at once. If some of them seem unfamiliar or confusing, let them be for now. But you will find them echoed and elaborated in various ways throughout the Linkingthinking materials.

For now, let's notice the *paradox*: the world is increasingly complex, interdependent and unsustainable, BUT the way we think tends to be fragmentary and limited, and we live 'like there's no tomorrow'. A strange but serious mismatch.

A number of writers suggest that boxed-thinking is the main cause of the disorder or 'systemic breakdown' that we seen in the world today. For example, leading systems thinking writer Peter Senge states:

> *"…the unhealthiness of our world today is in direct proportion to our inability to see it as a whole."*
>
> Senge, *The Fifth Discipline*, 1990, p68

There is an old saying that goes: 'if you find yourself in a hole, stop digging'. But how do we do this? Increasing numbers of commentators are appealing for new ways of thinking, for a change of perception. This is not so much about abandoning our current thought habits, but becoming aware of them, changing them and extending our thinking to think in a more relational, holistic way; in other words, Linkingthinking.
David Korten, a writer on alternative approaches to development, says:

> *"When we limit ourselves to fragmented approaches to dealing with systemic problems, it is not surprising that our solutions prove inadequate. If our species is to survive the predicaments we have created for ourselves, we must develop a capacity for whole-systems thought and action."*
>
> Korten, *When Corporations Rule the World*, 1995, p11

For example, if we are interested in health, then we need to focus not only on 'the health services' but also take into account food quality, environmental pollution, stress, poverty, and other indicators of wellbeing.

A recent paper by Jake Chapman for the Demos 'think-tank', notes that policy-making:

> *"based on the reduction of complex problems into separate, rationally manageable components is no longer appropriate."*
>
> Chapman, *System Failure*, 2002

Yet even politicians have called recently for joined-up thinking, and also 'joined-up policy-making' and 'joined-up government' (even if they find it difficult!) for example, through integrating economic and environmental policy. Awareness of the need for a more integrative approach, that is, for Linkingthinking, is beginning to make an appearance in the following areas:

- everyday life
- organisation and management
- policy making
- government.

Sadly education shows few signs of addressing this as yet! The problem is that integrative thinking and approaches can be very challenging, and even threatening to established ways of doing things.

For more on the implications and shifts involved in moving towards Linkingthinking and practice, in the above areas, see Unit 1 Part B, 'Further Investigation'.

5 Going further

This section indicates some terms, states the fundamental question behind Linkingthinking, introduces the concept of 'system', suggests the three dimensions of Linkingthinking, and includes a quiz where you can check to what extent you are already a Linkingthinker.

5.1 Looking at terms

There is no single, commonly used label which describes the sort of thinking we are outlining here.
We have chosen Linkingthinking as a catchy and descriptive name, but here are some other terms you may have heard of::

- joined-up thinking
- systems thinking
- systemic thinking
- holistic thinking
- ecological thinking
- integrative thinking
- systematic thinking.

Did you notice the odd one out? One of them should not be in the same list as the others because it means something quite different! But people tend to muddle it up with the others. The answer is below.

Linkingthinking terms

The odd one out is *systematic thinking*. 'Systematic' means doing things methodically, bit by bit, in a logical sequence. This approach tends to be more reductionist than holistic. 'Being systematic' may be helpful in some situations, but it is not the same thing as 'being systemic', which means looking at the bigger context and the relationships involved.

There are *some* differences in these terms. (Look in the **Glossary** and in Part B, 'Further Investigation' if you are interested.) But for most purposes, they can be taken as meaning virtually the same thing, ie concerned with relationships and connection.

5.2 Changing the question

In essence, Linkingthinking is about a change of perspective and a change of question in dealing with the world. In the past, we have been dominated by questions of *substance* or *structure*; 'what is this idea, this phenomena, this movement, this organisation?' and so on, and questions of *function*; 'how does this work?'

According to the designer Victor Papanek, we have left out a key question. We need to go beyond 'how does it look?' or 'how does it work?' to the critical question, 'how does it relate?' (Papanak, 1995, *The Green Imperative*, p7). (See Unit 3 pages 31-33 for more on ecological design which is a field that has developed with this question as its starting point.) Note that this involves a shift of focus: close to the descriptive question 'how does it relate?' is the ethical question 'how *should* it relate?' So Linkingthinking can often involve an *ethical* dimension.

Reflection

In what sense is the question 'how does it relate?' a 'bigger' question than those we normally consider?

Edward De Bono suggests that the dominant question changes from 'what is this?' to 'what does this lead to?' or 'what does this add up to?' (De Bono, 1994, *Water Logic*, p9). Similarly, Fritjof Capra notes that systems thinking marks a *shift of attention* from 'parts' to 'wholes', from things to processes, from analysis to pattern and that it is concerned with relationship, connectedness and context.

> *"To understand things systemically literally means to put them into a context, to establish the nature of their relationships."*
>
> Capra, *The Web of Life*, 1996, p27

The problem is that we often *don't* see things systemically. We don't see the wider context. We don't ask 'what happens next if…?': we make this product, introduce this policy, make this change and so on. Beyond the immediate results we intend, we tend not to pay attention to the longer-term, distant and subtle effects of our actions.

A few years ago, an American company invented a self-chilling drinks can. It looked a very marketable product, but WWF pointed out that the gases produced by the cans would make a significant contribution to greenhouse gases. The company decided not to go ahead. Until then, the company had looked at neither the consequences nor the environmental context of the product. The company had put an invisible boundary round its system of interest which was the new drinks can, and the sales and profits it would generate.

As a modern society, we tend to be very concerned with efficiency values and performance, but much less concerned with asking questions about purpose and consequences, beyond the obvious.

5.3 What is a 'system'?

We have been making much use of the term 'system'. It now seems appropriate to try to define it. It is used quite commonly in everyday language, but often without much thought as to its meaning.

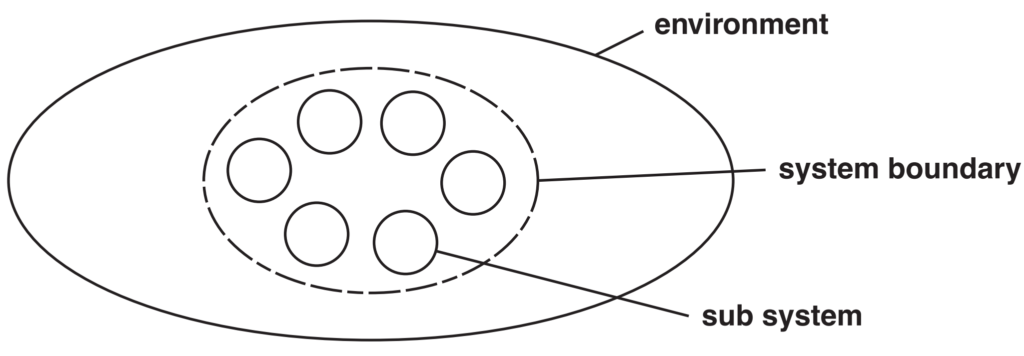
Activity ➛ ➛ ➛

What do you understand by the word 'system'? Jot down some ideas…

Put simply, a system is a set – or pattern – of relationships. Beyond this description, we can say it consists of three kinds of things:

- elements (things)
- interconnections (processes)
- purpose (function).

It also has a boundary and a context, or larger environment in which it sits. In addition, it often has emergent properties – qualities that cannot be predicted from looking at the parts alone.



Some *types* of systems:

- political, economic, technological, cultural, social, educational, belief, biological, mechanical, atmospheric, ecological.

Some *examples* of systems:

- A city, a school, an economy, a business, a family, a person, a community, an animal, a tree, a forest, a regional ecosystem.

Activity ➛ ➛ ➛

Think of some more examples!

Reflection

Notice the last three systems in my examples. What is the relationship between them?

From a systems point of view, we say that the smaller systems can be seen as part of the larger systems. So, for example, the tree is part of the forest, the forest part of the regional ecosystem or biome. So the tree is a subsystem of the forest, and the forest a subsystem of the larger ecosystem.

Looking at these types and examples of systems, it is clear that some very different things (that is, patterns of things) both material and non-material can be regarded as systems. And the word 'regarded' is important here! Each of these things can be seen systemically, or non-systemically. This is a key point: *a system is in the eye of the beholder*, based on his/her interpretation of the world. This means our account of the *purpose* of a system – its functioning and interrelations, the boundaries between it and its environment – depends largely on our perceptions of a shared reality.

If this isn't clear, try this activity.

Activity ➛ ➛ ➛

Have a think about these questions:

- Where is the boundary of any particular ecosystem? (Choose an example)
- Where does a company's responsibility stop?
- What areas of investment should ethical investment include or exclude?
- Are prisons for punishment, or for rehabilitation?
- What is the purpose of our education system? To serve the individual, or society, or the economy?
- What is the purpose of your school, college or organisation?

Different people will have different answers, depending on their system of interest and their values. This affects what they see: a system 'out there' in the real world becomes apparent when it is distinguished as such and somebody recognises a set of relationships and their boundary, with some purpose or function (a system).

But *boxed-thinkers* have a defined system of interest and tend not to think systemically, that is, they tend not to recognise patterns of relationships. Linkingthinkers tend to have a broader, more flexible system of interest and recognise systems in the world. This is not to say that Linkingthinkers are not subject to the influence of unexamined beliefs and prejudices like anybody else!

5.4 The three dimensions of Linkingthinking

It is useful to view Linkingthinking as having three dimensions. These are suggested by Peter Senge, whose work has influenced the take-up of systems thinking in business:

> *"Systems thinking is…a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static 'snapshots'. It is a set of* ***general principles*** *distilled over the course of the twentieth century…It is also a set of specific* ***tools and techniques****…And systems thinking is a* ***sensibility*** *– for the subtle interconnectedness that gives living systems their unique character."*
>
> Senge, *The Fifth Discipline*, 1990 (my emphasis)

This idea that systems thinking comprises a 'sensibility', 'general principles' and a 'set of tools and techniques' gives us a three-part framework for approaching it:

Sensibility	or Awareness	or Perception	or Valuative dimension
General principles	or Concepts	or Theory	or Descriptive dimension
Tools and techniques	or Methods	or Practice	or Applicative dimension

This framework suggests that we need *all three dimensions* when we think or work in a systems or holistic way: we need *awareness + concepts + tools*. One or two dimensions alone isn't enough.

One of the problems with holism is that it encompasses *awareness* (everything is related), but it does not always *understand* or *act* on this awareness. At the same time, much systems thinking is strong on practice and methodology, but often less good at awareness, values and worldviews – the changed 'sensibility' that a more relational view of the world implies.

(For more on differences between types of relational thinking, see Part B, 'Further Investigation', page 32.)

5.5 What does a Linkingthinker look like?

It is easier to approach this by first asking 'what does a non-systemic thinker look like?' – somebody who is not particularly oriented towards Linkingthinking! In extreme, this person has their 'head in the sand', but more likely just focuses too much on things or events.

'Well, fine', you might say, 'I don't want to go round thinking about the big picture and the longer-term consequences of everything. I'm just too busy getting on with my life!' This is a fair point. But at the same time, we can't afford not to break out of our boxed-thinking habits – when necessary and appropriate – if we want to cope with increasing complexity in our lives and the wider world, not least, because the new conditions are increasingly impinging on our every day lives.

The ten boxed-thinking assumptions listed above (see pages 13-14) help us to distinguish between a non-systems thinker – who shares them consciously or unconsciously – and a Linkingthinker, who questions their appropriateness..

These assumptions have served us well until recently. Yet they give us an insufficient set of thinking tools and, because of this, their application can often make matters worse (see the quote by Waddington on page 10 above).

Einstein had something to say about this:

> *"No problem can be solved from the same consciousness that created it. We have to learn to see the world anew."*
>
> Einstein

What do you suppose he meant by this?

Let's take some classic examples:

- One 'solution' to the problem of road congestion is to build more roads.
- One 'solution' to the problem of declining crop yields is to increase the amount of fertiliser used.
- One 'solution' to the problem of increasing bacterial infection is to increase the use of antibiotics.

Reflection

What is problematic about these solutions?

But this sort of 'simple problem solving' is what we are used to. What's more, we are resistant to changing our ways of thinking and doing. As Jake Chapman says:

> *"…individuals will not change their mode of thinking or operating within the world until their existing modes are proved beyond doubt, through direct experience, to be failing."*
>
> Chapman, *System Failure*, 2002

This is a major problem. Can you think of examples, either in your own life or in organisational life, of resistance to thinking or doing something differently 'because we've always done it this way'?

However, maybe we can speed up the process by developing our Linkingthinking skills. Problem solving is viewed from a Linkingthinking point of view in Unit 2. The 'different consciousness' that Einstein mentions is perhaps usefully summarised by the 10 beliefs (above) that challenge the 10 thinking assumptions of boxed-thinking.

If you want to go deeper, take a look at Part B, 4.1, 'Further Investigation', where I have suggested that there is an emerging set of bases for thinking that take us beyond the old (but still dominant) thinking assumptions.

Another way to discover what a Linkingthinker looks like is to consider what they might do that is different from the norm. People who think in a more relational way tend to think a bit differently than the majority.

See how you fare against this list. Try applying it to a specific situation or context with which you've been involved.

Activity ➛ ➛ ➛

Do you	Often	Sometimes	Never	Don't know
1 Examine and question your own and others' assumptions?				
2 Ask different questions about things/issues (ie deeper, and more inclusive questions)?				
3 Look for connections and patterns between events and/or ideas?				
4 Try to have a critical perspective and synthesising outlook?				
5 Value other people's views and perspectives on an issue?				
6 Look for multiple causes/consequences rather than only notice simple 'cause-effect' relationships?				
7 Look at the 'big picture', ie try to place issues in a bigger context?				
8 Think long term?				
9 Examine critically narrow, simplistic, or 'obvious' explanations in a complex situation?				
10 Suspend judgement, rather than rush to judgement?				
11 Try not to blame the components in a system (eg the people) if things go wrong, but ask questions about 'purpose' and 'relationships' in the system first?				
12 Recognise uncertainty and ambiguity, and work with them?				
13 Have a concern for the overall health and wellbeing of a system?				
14 Try to be open-minded?				

Check your score: Often – score 3 Sometimes – score 2 Never – score 1 Don't know – score 0

0 – 14 Oh dear! We hope you will use the Linkingthinking Series – lots!
15 – 20 Well, you're still largely 'in the box' – but looking out!
21 – 30 Good, you are aware of complexity and try to work with it.
31 – 42 Brilliant, but can we believe you?!

This is a formidable (and somewhat ideal) list in fact, more something to aspire to. But if you think about the opposites of these characteristics, and how engrained these 'opposites' are, it gives some idea of the need for Linkingthinking.

Activity ➛ ➛ ➛

Go through the list above and think about the opposite characteristic for each one listed. If it's helpful, think about the questions where you scored less, and why this might be the case.

6 What are some of the main ideas?

This section lists some key systems concepts, and outlines some of the principles of Linkingthinking.

6.1 Introducing key systems concepts

Systems thinking has developed as a field of study since the 1940s. It is a discipline in its own right, and a number of emphases within the field have emerged. Inevitably, many concepts and ideas have emerged with it.

It is not the purpose of Linkingthinking to introduce jargon for the sake of it. In fact, we have tried to avoid it as much as possible, but some of the ideas that derive from the discipline of systems thinking are very useful.

Here are some of the main ones you will come across. The terms are defined in the **Glossary**.

Activity ➛ ➛ ➛

Have a go at your own definitions, before checking the **Glossary**.

- System
- System of interest
- Subsystem
- Feedback
- Boundaries
- Nesting systems
- Purpose
- Context
- Synergy
- Whole/part
- Emergence
- Design
- Stakeholder

6.2 Looking at some principles of Linkingthinking

As well as giving us concepts, the study of systems over recent decades has led to the development of a number of useful principles. We have met the gist of some of these already, in the sections above.

The surprising thing is that these principles usually apply regardless of the type of system or scale of system we are talking about, whether an organism, a family, a school, a business, a marketing team, an ecosystem etc and regardless of which particular example we may be concerned with, ie '*this* school','*that* business' and so on.

Some guiding principles follow:

- **The whole is greater than the sum of its parts.** This is known as <u>emergence</u> or sometimes as 'surprise'; that is, an often unexpected quality arising from the interplay or synergy of relationships, eg beauty, health, sickness, friendship, behaviour, consciousness, intelligence, workshop outcomes, sustainability, etc. Emergent properties might be a good thing or a bad thing; think of the social atmosphere in a 'good' school and a 'bad' school, for example.
- **You often can't discover or predict <u>emergent properties</u> of the whole by looking at the properties of the parts (more complexity means less predictability, and more <u>emergence</u>).** The more connections and interactions there are, the more impossible it becomes to predict behaviour and outcomes; for example, think of a class of students, a family, an economy, a share price, etc.
- **You can never do only do one thing.** The simplest action can have consequences far beyond the original intention, which may or may not be significant. Making a cup of tea, heating a building, flushing the loo, buying a car – or at a bigger scale – investing in public transport, building a road, building an out of town shopping centre, and so on. Consequences may be personal, social, economic, environmental, etc. See the associated activity on pages 10-11 of the **Toolbox** to investigate this important principle further.

- **Everything is connected, but not equally strongly. (So while it is often safe to draw boundaries, we need to be aware of where and how we are drawing them).** We don't have to think about everything, all the time, and life would become impossible if we had to. It is often acceptable to concentrate on the 'job in hand', but if, for example, your company is taken over by a corporation on the other side of the world, your job might very well be affected. Sometimes, we need to look beyond our boundaries to understand wider influences on our system of interest, and/or understand what wider effects we ourselves are having.
- **The health of the bigger system and the health of its subsystems are intimately connected.** If you have a bad heart it could kill you, but it might be bad because you have led an unhealthy lifestyle. A family might be dysfunctional because it has a dysfunctional child in it, but he or she might be having problems because the family is having problems. And so on – there is continuous feedback between system levels.
- **A change in the part affects the whole (and vice versa)**. A disruptive child in the classroom, a new person joining a group, a new road in town, an invasive weed in the garden, one drink too many last night… And of course, it works the other way round, too. A change in the whole affects the part… a new whole-school policy, a change in mortgage rates, an epidemic, and so on.
- **Stability and resistance to change are two sides of the same coin.** Systems that last are stable systems. They have a degree of resilience in the face of change. This can be a good thing if you want continuity, or a bad thing if you want to introduce change. For example, professional groups often want to hold onto their way of doing things, which may or may not be a good thing.
- **Complex systems show delayed response.** If you put pressure on a bike pedal, you get an immediate and expected effect. If you try to change a person, an organisation, or an ecosystem, you are likely to get a range of unexpected responses and knock-on effects, taking place over an indefinite time scale – or even, no response at all! (See the principle above.)

Activity ➝ ➝ ➝

Try to think of examples of how these principles apply in some aspect of your own situation. How can you use them to understand or work in your situation more effectively?

7 What's this got to do with education and learning?

This section briefly outlines four system levels where Linkingthinking approaches might be applied – from learning skills through to moving the educational culture towards a more holistic basis.

7.1 Looking at system levels in education

You might think that Linkingthinking represents an attempt to introduce relational thinking skills into the curriculum. You would be partly right, but there is more to it than this. Introducing Linkingthinking into the curriculum is a challenge in itself, of course, but the systems approach has other, wider implications, which are outlined briefly here.

If we adopt a systems view of education and learning, it is possible to distinguish four related 'system levels' where Linkingthinking approaches have relevance and could make a significant difference if they were introduced:

1 The learning experience
This is about students learning Linkingthinking; about experiencing it, and learning about its principles, concepts, tools and skills. It is also about using Linkingthinking to learn about ecological and

sustainability values. It is because this is so rare in education that the Linkingthinking project came about.

At another level of interpretation, we can also look at learning itself from a systems point of view, and this takes us to the next level.

2 Teaching methods
Linkingthinking implies a different view of learning and teaching in contrast to the didactic, information-transfer model that can still dominate in education. Instead, active and participative learning experiences and teaching methods are emphasised, with high degrees of interaction between learners, and between learners and teachers. This is sometimes called 'systemic learning'.

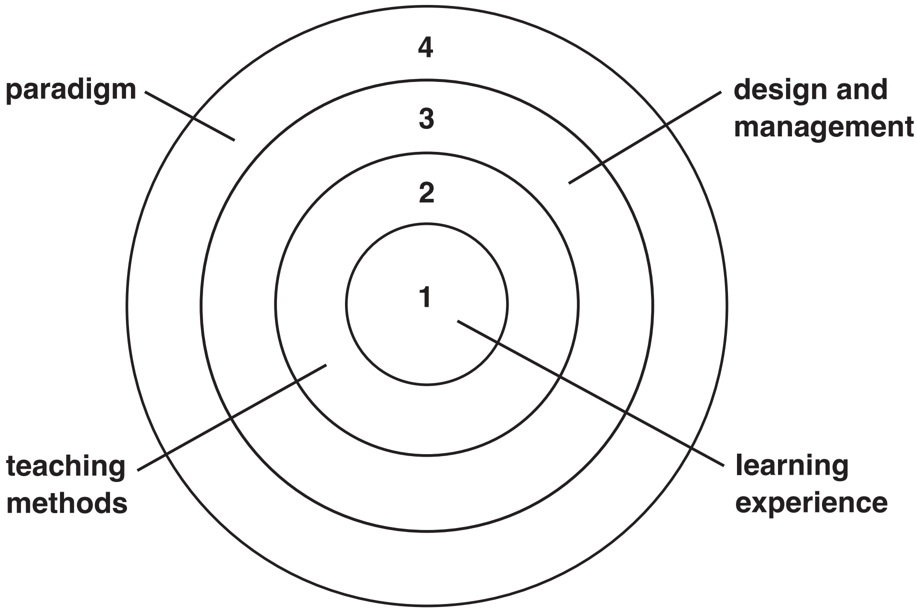
A participative pedagogy can be supported or contradicted by other parts of an institution's life. This takes us to management, the next level.

3 Design and management of education
This is about change management in educational policy and institutions. The systems point of view looks at how parts of the whole can be made more consistent and mutually supportive, rather than conflicting or fragmentary. This consistency is called systemic coherence between different dimensions of the whole: including curriculum theory and design, pedagogic style, organisational ethos and management, use of resources, and community/social links.

How far this coherence is, or is not, encouraged depends a good deal on the ethos of the institution, and this in turn rests on how education is seen; the educational paradigm which includes fundamental ideas about the purposes of and policies for education.

4 Educational approach
Ultimately, a more holistic, systemic view of education implies a changed educational paradigm with implications for educational thinking, purpose, policy and practice which are broader than those which often prevail.

These levels could be seen as a <u>hierarchy</u> of <u>nesting levels</u>, which influence each other.



The Linkingthinking material looks at the first and second levels; the learning experience and methodology, although units looking at the third and fourth levels of change may be produced in the future, Before concluding this Part A 'Key Ideas' section of Unit 1, let us just briefly review each of these levels in a bit more detail.

7.2 The learning experience

In all the recent focus on thinking skills in education, systems thinking has hardly been mentioned. This seems a great oversight. It is almost impossible to find mention of 'relational', 'integrative' or 'systemic' thinking skills in curriculum objectives. The emphasis is often on rationalistic, analytical and scientific thinking, but rarely in curriculum and policy statements is there any mention of systems thinking (or of other terms for this approach). We try to balance this up in the other units of the Linkingthinking Perspectives Series:

Unit 2 shows how Linkingthinking can be a valuable part of the learning experience, particularly in the area of problem-solving.

Unit 3 investigates how sustainable development and sustainability are fundamentally systemic issues.

Unit 4 shows where Linkingthinking applies to everyday life and society, in relation to the causes and possible solutions to ecological and social problems.

The nature of the learning experience is also a concern from a systems viewpoint. From this holistic perspective, the established picture of the 'passive learner and recipient of knowledge' is replaced by the view that all learning is essentially active and depends on the meaning and the disposition the learner brings to the experience.

Therefore, a systems view of learning supports a shift of emphasis and attention towards:

- the learner and the quality of the learning experience and learning environment
- relevance and real-world issues
- affective and hands-on learning as well as cognitive learning
- critical and systemic thinking rather than just informational learning.

7.3 Teaching methods

Systems approaches support active learning, an approach which challenges the more traditional and rather mechanistic view of teaching that emphasises information transfer. Simple didactic methodologies and passive learning are replaced – or at least complemented – by a range of participative teaching and learning strategies. These include:

- action research
- collaborative and group learning
- critical inquiry and reflection
- interdisciplinary studies
- paying attention to the hidden curriculum.

A shift in this direction involves the recognition that teachers also learn and learners also teach.

7.4 Design and management of education

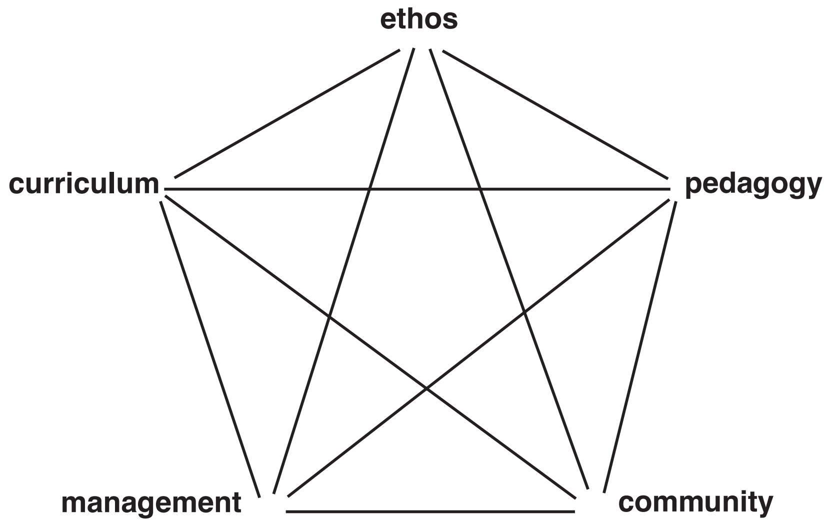
Systems thinking tells us that nothing exists in isolation: learner, teacher, institution, curriculum, pedagogy, policy, management system, community, media and culture, etc. Therefore all intended change needs to anticipate systemic effects at different levels and, as far as possible, be participatory if change is to be sustainable and generate positive effects.

Instead of fragmentation, the aim here is to work towards integrative approaches, that lead to coherent learning experiences for teachers/lecturers/students and the institution as a 'learning organisation' or community.

How do the parts relate? At least five main dimensions of any educational institution can be distinguished:

- ethos
- curriculum
- teaching styles and strategies
- management styles and strategies
- community links.

These can either be regarded in isolation – that is non-systemically (box thinking) or in relationship (Linkingthinking). A diagram here can help:



If they are seen as separate, contradictions and tensions can arise (which students are often quick to spot!). For example, lessons on healthy lifestyles, but poor food served in lunchtime; lessons on energy conservation, but wasteful use of heating and lighting; or lessons on active citizenship but all decisions in the institution are top-down.

Activity ➛ ➛ ➛

Are there areas of conflict or contradiction between these areas in your school or institution? How might you work towards more consistency and complementarity between them?

It is useful to make a distinction between *piecemeal* change, where elements of the system are changed without consideration of the effects on the whole, and systemic change where the effect on the whole is considered at the outset. The latter would involve assessing how far the five dimensions of an institution are reinforcing or in conflict.

Piecemeal change:

- involves changing parts of a system
- gives little or no consideration of the system as a whole
- is often imposed
- involves little learning
- is often short-lived.

Systemic change:

- is change *with effect on the whole system in mind*
- recognises and anticipates emergent qualities
- is achieved by purposeful, collaborative design which maximises participation
- watches and learns from the effects of change
- is often long-lived.

Activity ➛ ➛ ➛

Think of examples in your institution where piecemeal and/or systemic change was made.

7.5 Educational approach

This refers to the whole ethos of the educational culture, the beliefs and values that affect policies and practices, whether considered at national level or the level of the individual institution.

This comes back to the key idea of *purpose*.

Activity ➛ ➛ ➛

What do you think is the main *purpose* of education? Is there a difference between what you think it is (or should be) and what official policy says it is?

The current prevailing paradigm tends to emphasise education as preparation for economic life, and this involves specialisation, competition and accountability. It is shaped by an instrumental and rather managerial view of education, echoing a modernist view of public services, which is not confined to the world of education, but is also reflected in such areas as health and local government.

We would suggest that this is too narrow, and leads to a narrowed learning experience for many. A more holistic and systemic view of education implies a broader educational paradigm interested primarily in the *quality of interrelationship* – in the whole person, in the learning community, in learning as change and transformation, in education for a better world and a sustainable future.

This is partly about changing *our metaphor* for education and educational institutions – away from the factory and production-line idea, and far more towards the idea of the living system or learning community.

References

Banathy, B (1991) *Systems Design of Education*, Educational Technology Publications, New Jersey

Bateson, M C (2000) Foreword, in Bateson, G (1972, republished 2000) *Steps to an Ecology of Mind*, University of Chicago Press

Capra, F (1996) *The Web of Life*, Harper and Collins, London

Chapman, J (2002) *System Failure*, Demos, London

De Bono, E (1994) *Water Logic*, Penguin Books, London

Homer-Dixon, 'Is security the trump card?' in *Green Futures*, April/May 2002

Korten, D (1995) *When Corporations Rule the World*, Berrett-Koehler, San Francisco

New Renaissance Group (2001), *Beyond Sustainable Development*, The Conservation Foundation, London

Papanek, V (1995) *The Green Imperative*, Thames and Hudson

Senge, P (1990) *The Fifth Discipline*, Doubleday Currency, New York

UN Environment Programme (UNEP), *Global Environmental Outlook* – 3, 2002

Waddington, C H (1977) *Tools for Thought*, Paladin, St Albans

Further Investigation

This part includes further notes and references to supplement the specified sections of Unit 1 Part A, Key Ideas. The reference numbers relate to those in Unit 1 Part A.

2 It's all relative

2.1 How does it look to you?

Mark Twain was reputed to have said; "When all you have is a hammer, all your problems begin to look like nails". We are often told we live in a fragmented society… is this due to a fragmented way of seeing things? If we see things primarily in terms of relationships and connections rather than discrete things and objects, then perhaps it's more likely we will create order than disorder.

People see the environment differently. The use of metaphors helps clarify this difference. For example, the environment (or an environment) can be seen as:

- a playground
- a sanctuary
- an object of study
- an economic resource
- a wildlife reserve
- hostile or friendly
- an aesthetic experience
- a source of spiritual renewal
- something else…?

Which is dominant in our society?

3 Out of the box – the need for 'joined-up' thinking

3.3 The new complexity

Here's a quote from the eminent systems thinker Donella Meadows (who was associated with the influential 'Limits to Growth' reports of 1972 and 1992). She talks about the need for a 'new way of looking':

> *"The world is a complex, interconnected, finite, ecological-social-psychological-economic system. We treat it as if it were not, as if it were divisible, separable, simple, and infinite. Our persistent, intractable, global problems arise directly from this mismatch. No one wants or works to generate hunger, poverty, pollution, or the elimination of species… Yet those results are consistently produced by the system-as-a-whole, despite many policies and much effort directed against them. Many policies work… but some problems consistently resist solution in many cultures and over long periods of time. Those are the problems for which a new way of looking is required."*
>
> Meadows, 'Whole Earth Models and Systems' in *The CoEvolution Quarterly*, Summer 1982

Aurelio Peccei, the founder of the Club of Rome, (which launched the 'Limits to Growth' debate in the early 1970s) talked about a largely unrecognised 'world problematique' over 20 years ago. This consisted of a range of complex problems characterised by and made more intractable by their close interdependence.

4 Spot the difference

4.1 Understanding our 'boxed-thinking'

Matching thinking assumptions and 'isms':

1 problem solving
2 analysis
3 reductionism
4 cause-effect
5 atomism
6 narrow boundaries
7 dualism
8 objectivism
9 rationalism
10 determinism.

We don't bring relational thinking to the surface much, recognise it, or identify it. Most people have little or no idea what the terms 'systems thinking' or 'ecological thinking' mean, but many have some view of what holistic thinking means. Many have an intuitive sense of holism, even if they would not use this term. But these ways of thinking and viewing the world are not the usual currency of thought and discussion. As suggested in *Part A, Key Ideas,* we are habituated into more mechanistic ways of thinking which tend to be more reductionist, analytical and objectivist.

Indeed, a systemic approach suggests a necessary shift from the dominant descriptors (on the left) towards a new set of bases for thought (on the right), as follows:

'Old bases'	'New bases'
problem solving	appreciation/problematising/situation improvement
analysis	synthesis
reductionism	holism
cause-effect	multiple influences
atomism	integration
narrow boundaries	extension
dualism	complementarity between opposites
objectivism	critical subjectivity
rationalism	rational and non-rational ways of knowing
determinism	uncertainty

Note: this does not imply we should forget the bases of thinking on the left, but become more aware of them and see/use them in a broader context.

The limits of reductionism
Here's a quote about the problems with reductionist approaches to Earth Science – by James Lovelock, the originator of the Gaia theory which sees the Earth as a whole system:

> *"Make no mistake, to understand the physiology of the Earth, how Gaia works, requires a top-down view, a view of the Earth as whole system… It's no use gathering together meteorologists, biologists, marine scientists, atmospheric*

> *chemists, and so on in one place and expecting results. Because of their training they will almost always be reductionist and take a bottom-up view – a view that assumes that the whole is never more than the sum of its parts and that by taking things to pieces we can find out how they work. We need science, but it must grow from the top down as well as from the bottom up.'*
>
> Lovelock, *Gaia – The Practical Science of Planetary Medicine*, 1991, p15

4.2 Seeing the world more wholly

Here are some implications and evidence of the take-up of Linkingthinking approaches:

- overspecialisation and fragmentation in institutions, organisations and departments in all sectors and agencies are beginning to give way to more integrated structures and decision making
- single issue management is beginning to give way to integrated and adaptive management, particularly in resource management
- expert-led and top-down policy making is yielding to more participative approaches
- single disciplines and entrenchment is giving way to more inter and transdisciplinarity.

This is a recent trend and progress is tentative. But increasingly, we will need people who can think flexibly, and deal with complexity.

5 Going further

5.4 Three dimensions of Linkingthinking

Differences in similar fields of relational thinking

There are some slight differences in the meaning of these terms:

All systems thinking is holistic, but not all holistic thinking is systems thinking. This means that people who think holistically are not necessarily aware of the ideas and concepts that have become associated with the field of systems thinking.

Ecological thinking is essentially holistic, but not all holistic thinking is ecological. This means holistic thinkers don't necessarily share the ideas, values and beliefs of ecological thinkers who articulate an ecological worldview.

Some systems thinking is ecological and some is not. This means that many people use systems thinking for all sorts of reasons, but don't necessarily have an ecological perspective.

Some ecological thinking uses systems ideas, concepts and methods, but much does not. Many people who regard themselves as having an ecological perspective, often don't know much about systems ideas and methods.

References

Lovelock, James (1991) *Gaia – The Practical Science of Planetary Medicine*, Gaia Books.

Meadows, D (1982) 'Whole Earth Models and Systems' in *The CoEvolution Quarterly*, Summer 1982

linking thinking

New perspectives on thinking and learning for sustainability

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Perspectives unit 2

linking thinking

New perspectives on thinking and learning for sustainability

Developing Linkingthinking perspectives and skills in problem solving

by Stephen Sterling

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The headings and sub-headings in Part B relate to those used in Part A

unit 2 part A

2A

Key Ideas

This unit is part of the Linkingthinking suite of materials that seeks to help generate new perspectives, introduce systems ideas and develop relational thinking skills which are broadly applicable to different situations and contexts.

Aims of this unit

- **to show the need for Linkingthinking as a vital part of thinking skills**
- **to explore the difference between 'situation improvement' and 'simple problem solving' in addressing complex problems**
- **to introduce some techniques to develop Linkingthinking approaches.**

1 Why is problem solving a problem?

This section looks at the nature and limits of Simple Problem Solving, (SPS) and suggests this is rooted in the way that we see the world. A key distinction is made between two types of problems – contained 'difficulties' that can be addressed through SPS, and complex 'messes', that require a different approach. It also asks what constitutes a 'problem' and a 'solution' and suggests that our answers depend largely on our perception.

1.1 'No problem' (?)

'No problem!', says the person on the telephone, giving us some sense of assurance about some issue that has been concerning us. 'Thank goodness,' we think, 'someone is going to fix it for us'.

We tend to think in terms of problems that can be fixed or solved, and perhaps become annoyed or disappointed when some problems can't be fixed as such. 'Don't bring me problems, bring me solutions!' says the manager, exasperated at his staff's seeming inability to cope with problematic issues.

But from a Linkingthinking point of view, it is really important to distinguish between those problems that do seem amenable to solution, and those that do not. In other words, to recognise that there are *different types of problems*. When we don't make this distinction, our attempts to solve a problem can often just cause more problems further down the line in time or some other place. And it can lead us to oversimplify the problem and the solution.

Here are a few problems…	**and a few answers**
Do you have an infection?	Take antibiotics
Do you have a crime problem?	Put more policeman on the beat
Do you have a traffic jam?	Build more roads
Do you have low agricultural yields?	Use more pesticides and fertilisers
Do you have a waste problem?	Dig some bigger holes to put it in.
Do you have global warming?	Plant more trees, or even; stick some big mirrors in the sky (it has been suggested!).

These sorts of simple solutions are common enough.

Activity ➛ ➛ ➛

What sort of simple solutions might be given to the following problems, using a similar problem-solution approach?

- Feeling cold in the house?
- Too many cars on the road – congestion?
- Underage drinking?

You may have suggested things like:

- turn up the heat
- road pricing
- make youths use ID cards.

Each of these is a solution of sorts and they may indeed prove reasonably effective. But there are often deeper questions to be asked of the problem:

- **Why are you cold?** Maybe there is a problem with the insulation rather than the heating? Or maybe your overall health and circulation is the root issue?
- **Why are there too many cars on the road?** Is there something wrong with public transport? Or have we designed things so that people have to travel more?
- **Why do these young people feel the need to drink underage?** It could be a host of reasons, including youth culture, lack of alternative facilities or things to do, advertising.

Simple problem solving often raises four issues:

- the solution tends to addresses the symptoms but not the underlying causes
- the solution can sometimes give rise to further problems
- the nature of the problem itself is not questioned or seen in a larger context
- the interaction of complex factors which may give rise to the problem tends to be overlooked.

! Idea

Often, it is not the problem that is simple – it is the approach taken that is simple. (See Part B, 'Further Investigation' for more on this.)

Activity ➛ ➛ ➛

How do the simple solutions, such as 'turn up the heat', and so on, illustrate these three points? Think of examples of other common problems and solutions to illustrate these three points.

The trouble is, SPS is the dominant way of both perceiving and dealing with problems. It is often effective, in that it brings results, ie has effects! But there is an important difference between an *effective* and an *appropriate* response. For complex problems, this approach can sometimes make things worse. In these cases, SPS is often *inappropriate*.

Simple problem solving is a technical response to a problem. The emphasis is often on *remedial solutions*, rather than *preventive design* in the first place. The use of the word 'simple' here does not mean the solution is basic or rudimentary – indeed the solution maybe very sophisticated technically – but it implies an approach which reduces the problem to its elements in order to deal with it. This reductionist method is sometimes called an 'end of pipe' or 'techno-fix' approach, and it is the most common approach to problem solving, often echoed in schools, universities and professional training.

It's attractive. It carries an air of competence, a no-nonsense, 'can-do' culture, reflected in such phrases as 'trouble-shooting' and 'quick fix'. Sometimes, it's appropriate. However, issues that involve people and their values, or environmental systems – or both – are in fact rarely amenable to simple problem solving. The difficulty with it is that it offers a limited perspective; it often doesn't recognise the bigger issue(s) or connections.

! Idea

'Crisis, what crisis?'

A problem is in the eye of the beholder. For example, a long spell of sunshine is great for holidaymakers but may be difficult for farmers or growers. A fall in house prices might be good for first time buyers but difficult for those trapped in negative equity, and so on. So how should we define what constitutes a problem?

1.2 Going deeper… different metaphors

The simple problem-solving approach is a fairly deeply engrained habit in our culture. But why? If we are to move beyond it, and appreciate how and why Linkingthinking offers an important alternative, it is useful to outline a bit of background. This is a big topic, and this section does no more than present some bare bones as a conceptual framework.

Reflection

Where does 'simple problem solving' come from? Why is it so common? What is it based on? How would you answer these questions?

I think these questions relate to aspects of the way we see the world – our fundamental worldview. In brief, there is a basic conflict between seeing the world 'like a machine' (a mechanistic metaphor), and seeing the world 'like a living system' (an ecological metaphor). The first view is often associated with a reductionist approach to issues, the latter with a holistic or integrated approach. This is explored in more detail in Part B, 'Further Investigation'.

The distinction between the approaches helps us to stand back and appreciate:

- why we tend to try to control things
- why we tend to see issues in isolation and often forget the larger context
- why some solutions don't work, etc.

The metaphor of seeing things – families, organisations, institutions, schools, or communities, etc – as 'living systems' suggests a more relational way of looking at issues and problems. As noted in Unit 1, this involves a shift of attention, from parts to wholes, from structure to process, towards a concern with relationship, and context.

But how does this help us with addressing problems? Again, it is useful to distinguish between different sorts of problems and this is the next topic.

1.3 Difficulties and messes

A noted systems theorist – Russell Ackoff – distinguishes between different types of problems; those he calls 'difficulties' and those he calls 'messes'.

Difficulties are problems that are well defined, and contained in terms of location and time. We know what the problem is, and we know pretty well what the solution is or might be. There is a relatively high degree of certainty and possibility of control involved. In other words, difficulties are likely to appear to have boundaries that we can recognise and state. (Boundaries are a key systems concept – see Unit 1, the **Glossary**, and the activities 'Out of bounds' and 'Re-drawing problems' on pages 13 and 14 of the **Toolbox** respectively).

Messes are 'systems of problems' (Ackoff's phrase), which are unbounded. That is, we cannot be sure where they stop in terms of connections and influences through time and geographical space, or how the components relate to each other. We are much less able to define the nature of the issue, which is likely to be multifaceted. There is likely to be disagreement over the nature of the problem and ways to address it. Messes often persist and change over long periods of time. So messes are characterised by uncertainty and appear to us to be relatively unbounded in terms of time, space, actors/stakeholders, and their implications and ramifications.

Activity ➛ ➛ ➛

On your own or with others, brainstorm a list of problems and problematic situations affecting yourself, your locality, and at a bigger scale too (global problems). Now analyse your list according to Ackoff's distinction. Which problems are 'difficulties' and which are 'messes'? Are some 'a bit of both'?

Now consider: what solutions are currently being, or might reasonably be advanced to address these problems? For any problem-solution, is it possible to say whether it's being seen by others as a mess or a difficulty? For example, the problems of the M25 round London are a 'mess' but the 'solution' of widening the motorway seems to be treating as a 'difficulty'.

From this exercise, it is possible to see that some problems (such as say, your car breaks down and needs a new battery, or your plumbing leaks) are clearly ‘difficulties’. Others, say global terrorism or global warming, are clearly ‘messes’. Some problems initially look like ‘difficulties’ but turn out to be messier than we first thought, or vice versa. So it is useful to think about a spectrum of problem states, rather than two separate and distinct categories. Some traffic jams for example, may be more like difficulties than messes, while others are messes (and feel like it!).

Reflection

What is the connection between the section above ‘Different metaphors’ and this one ‘Difficulties and messes?’ One answer is given in the Idea box below.

The fundamental issue here is to use the *appropriate methodology for the nature of the problem identified.* We tend to use SPS, and reductionism in perceiving and addressing *all* problems. While it works for some, *it does not work for messes!* As Ackoff states:

> ***“No mess can be solved by solving each of its component problems independently of the others because no mess can be decomposed into independent problems.”***
>
> Ackoff, ‘The systems revolution’ in *Organizations as Systems*, 1980, p29

So we need to be wary of reducing problems to manageable proportions if we don’t at the same time have some sense of the wider whole. Our thinking about problems tends to follow a scientific approach, and for many years science and technology have been highly successful in studying and acting on bounded problems and issues. But they have been much less successful in dealing with messes and complexity.

As Robert Chambers remarks:

> ***“The problem-solving approach derived from systems engineering failed when attempts were made to apply it to ‘the messy, changing, ill-defined problem situations with which managers have to cope in their day to day professional lives’, where the notions of a ‘problem’ and a ‘solution’ are inappropriate, and what makes more sense is a process of learning which is never ending.”***
>
> Chambers, *Whose Reality Counts? Putting the First Last*, 1997, p196

! Idea

If we have a predominantly mechanistic view of the world, we are more likely to see all problems as difficulties and apply simple problem-solving methods.But messes require different approaches.

This is beginning to change as the new sciences of complexity emerge, helping us understand the nature of complex systems, messy problems, and the need for continuous learning.

2 What is complexity?

This section introduces complexity. It outlines why complexity requires us to move beyond simple problem solving; it asks us to think twice about labelling things as 'problems' and 'solutions'; it looks at the importance of recognising the boundaries we use, and outlines the common assumptions in simple problem-solving approaches. It then goes on to look at the difference between 'detail complexity' and 'pattern complexity' and suggests how we can improve our ability to 'see the wood'.

2.1 Embracing complexity

The idea of complexity is becoming increasingly current, led by what are called the 'sciences of complexity'. It has been interpreted in terms of its practical implications in the field of management in recent years, and is now entering general parlance. One of the books that popularised complexity states that the science of complexity is a subject:

> ***"So new and so wide-ranging that nobody knows quite how to define it, or even where its boundaries lie."***
>
> Waldrop, *Complexity – The Emerging Science at the Edge of Order and Chaos*, 1992, p9

Activity ➛ ➛ ➛

What do you mean by 'complex', or 'complexity'?

People can use it to describe no more than lots of parts, as in a difficult jigsaw, a watch or a car engine, but the term is more appropriate to describe a state of many relationships, (which of course may partly be dependent on the number of parts). However, not only does it describe many relationships, but also changing and unpredictable relationships over time. So we can make a distinction between 'complication' (number of parts) and 'complexity' (many and changing relationships).

Activity ➛ ➛ ➛

Draw 2 dots (A and B). How many relational paths are there between them? The answer is two, if you think of a two-way rather than a one-way relationship.

It sounds simple, but if you think of these two dots A $\bullet \longleftrightarrow \bullet$ B as two people, perhaps in a relationship, the potential complexity of the interaction between the two actors becomes apparent. This is because of course, it is not just a matter of paths, but of the number and quality of interactions. But let's stick with paths for now…

Draw 3 dots (A, B, C) in a triangle arrangement. How many relational paths are there between them, (counting each relationship as two-way)? Now try 4 dots (A, B, C, D) in a roughly square pattern, then 5 dots (A, B, C, D, E) and so on. See how many paths there are. (If you are stuck, the answer is in Part B, 'Further Investigation' page 25.)

It is apparent that even a simple system, made up of a few parts, can exhibit complex sets of relationships over a period of time (think of a family, for example).

Complexity is a characteristic of *living systems*, from a cell, to an organ, to a family, to a community, to a society or economy, or ecosystem. These systems are characterised by what is termed ‘non-linearity’. Until recently, however, scientists largely confined themselves to studying linear systems and equations, and if necessary discarding the non-linear parts in the description of the system. Linear systems are those where the whole is precisely equal to the sum of its parts, and where effects are proportional to cause – as in such simple physical systems as sound and light.

The big difference came with the power of computers, which allowed scientists to begin to tackle non-linear systems, and it is this work that has given to rise to what are now called the new ‘sciences of complexity’. The critical change over recent decades, according to Fritjof Capra, is the recognition that nature is ‘relentlessly non-linear’ and that also non-linear phenomena dominate much more of the inanimate world than had been previously thought (Capra, 1996, *The Web of Life*, p122).

Living systems are characterised by abilities and qualities that non-living systems do not have. These include:

- the ability to organise themselves (self-organisation)
- the ability to both change, and adapt to, their environment
- change arising spontaneously
- emergent properties.

(See Part B, 2.1, ‘Further Investigation’ page 25 for more on these.)

The importance of these ideas is that they are radically revising what we think we know about the world, and about how we might manage change. The trouble is that, until now, our ideas about cause-effect have been essentially Newtonian, based on Newton’s ideas of linear causality.

All our ideas of *control, prediction, certainty, planning, intervention* (from the outside or above) have been fundamental to our view of how we see and interact with the world, with our organisations, with the environment, our communities and each other. Now they are beginning to be questioned by the implications of complexity theory. So in embracing complexity, we need to re-evaluate some of our long-standing habits in making sense of (and in) the world.

2.2 ‘Problem-solution’

So we can accept that the world is characterised by complexity. But the big challenge is to think and act more appropriately, to allow us to participate effectively in the world rather than to try to understand and control everything (even if this were possible, which it isn’t). And perhaps too, this requires us to reorient ourselves away from a problem focus towards first seeing and appreciating what seems to be good, what works and what’s healthy.

Reflection

Is our culture too problem focused?

Mostly, we deal with complexity by employing reductionism – by categorisation and analysis. We look at parts rather than wholes (see the ‘Parts and wholes’ activity on page 16 of the **Toolbox**). It seems to make things easier. This starts with our *perception*, as we have seen in Unit 1. So new experiences, phenomena, events and people tend to be given labels. It’s hard not to give something a label; this is how we make sense of things.

Reflection

In what ways can labels hinder our understanding?

The problem with labels, categories, models and so on, is that they can just as equally lead us to pre-judge something as help us understand it. They can oversimplify, get in the way of alternative explanations, and hide relationships. They can put boundaries round phenomena that are unbounded, and can make us feel we understand something when in reality, we do not. The risk is that the wider context can be forgotten and neglected. This can be extreme: think for example of labels associated with the unpleasant 'isms' such as racism, sexism, ageism, speciesism. So for example, the phrase 'one man's terrorist is another man's freedom fighter' illustrates the problem. Both these labels hide assumptions, and the use of the terms tends to replace deeper examination of the context which gives rise to such violent phenomena.

See the activity 'What's in a name?' on pages 14 and 15 of the Toolbox .

Here are two labels we use all the time, without thinking too much about their use: '*problem*' and '*solution*'. These are relative terms! Identification of problems and of solutions depends on people's perceptions and values, and on their <u>systems of interest</u>.

Activity ➛ ➛ ➛

Here are some questions to try out, next time you see a 'problem' and 'solution' referred to in the media or a discussion:

- Who says it is a problem or a solution?
- Why would they say that?
- Would others, or do others, see it differently?
- What led it to being a problem in the first place?
- Does a different view of the problem lead to a different idea of a possible solution?
- Is the problem a 'difficulty' or is it a 'mess'?
- Who (or what) gains, who (or what) loses from a possible solution, now or later?

Once something has acquired a label, it can receive specialist treatment. So, for example:

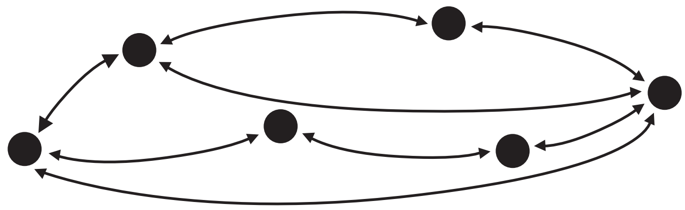
- a particular disease or part of the body is the preserve of a particular department in the hospital
- a subject is the particular concern of a discipline in the school or university
- a policy problem is the property of a particular government department.

Reflection

What other examples of specialism can you think of?

While this works for some areas of concern, this setting of boundaries is inappropriate for those issues where multiple or integrative approaches are needed. So, increasingly, we hear voices calling for more holistic medicine in health, more multi- and trans-disciplinarity in education, or more joined-up policy in government, for example. But the dominant mode of working remains reductionist.

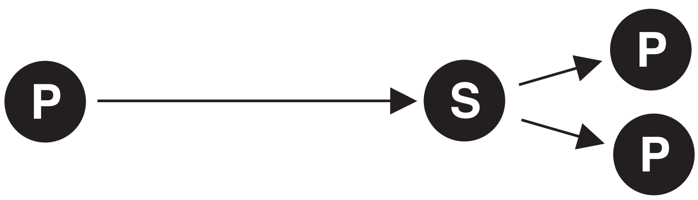
Let's explore why the fragmentary approach is often inappropriate and look at a network of relationships: in a school, a community, an organisation or an ecosystem, for example.



If we take just one arrow and assume a one-way causality (a cause-effect relationship) from this set, we can see that it is a simplification of the whole. But to deal with complexity, we tend to do just this: analyse a situation by focusing on its parts, to define a problem without looking at its wider context. Also, we tend to define a probable solution, without considering its wider context.

So if P = problem, and S = solution, we tend to think in terms of:

That is, 'this problem' needs 'this solution'. If we are dealing with a contained difficulty (see above) this approach may prove effective and sufficient. But what if the solution actually leads to new problems? If we are dealing with a mess, the situation might well be made worse in this way:



In this case, it turns out your 'solution' leads to other unforeseen problems. This can happen immediately, if your solution turns out to be your neighbour's problem (many planning disputes illustrate this principle). To take a graphic example: in 1930 Thomas Midgely Jnr discovered CFCs (chlorofluorocarbons), a substance that was to make refrigeration possible. It wasn't until 1986 that a hole was discovered in the ozone layer over the Antarctic and a definite link between this hole and the escape of CFC coolants into the atmosphere was made.

The challenge is to think about problems and solutions in their wider context, before defining too quickly what the problem is, and what the solution might be. This may well involve:

- resisting the temptation to label things too quickly (see 'What's in a name?' on pages 14-15 of the Toolbox
- noticing that instead of a single problem, there is a 'system of problems' which means that one single problem cannot be meaningfully separated out

- getting multiple perspectives on the problem: does everybody agree this is a problem? Can we generate new insights by looking at the problem from many perspectives?

See the activity 'Towards rounded solutions', pages 18-19 of the **Toolbox**.

The way we tend to view problems and solutions is closely linked to the way we see causes and effects through *causal thinking*, the next topic.

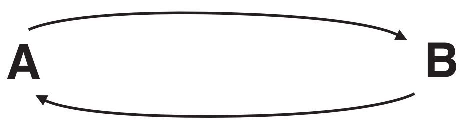
2.3 Cause and effect

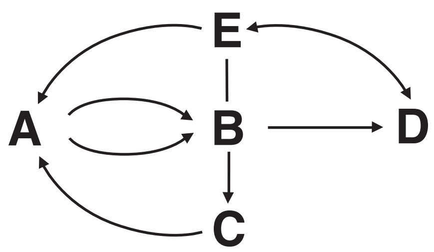
If something is going wrong; young Jimmy has 'gone off the rails'; your car breaks down; you are feeling ill; there is a rising crime rate; there is another food scare; there are race riots, etc, we tend to look for *the* cause… What is the key to this problem? What is the real cause? This is 'causal thinking'.

$$\mathbf{A} \longrightarrow \mathbf{B}$$

If B, we think, then what is A?

With the possible exception of your car breaking down, you are unlikely to find a single causal explanation of any of the above problems, although one cause might well seem more important than another.





Then too, it is more likely that if A affects B, then also B affects A. In other words, there is a feedback loop.

More likely, a C, a D and an E and more may be involved resulting in 'multidirectional feedback'. So although it might be possible to isolate a single cause and effect in any story, it would only be *part* of the whole story. The problem comes when we persuade ourselves that it is the whole story. The reality is that most causes are the effects of something else, while most effects are the causes of further events or changes. In other words, we live in a deeply systemic world, where *interrelation* is the name of the game.

To some extent, this is part of our everyday awareness, reflected in such terms as 'knock-on effects', 'ramifications' and 'side effects'. But the term 'side effects' in particular (and the economist's term 'externalities') illustrates how our use of language demonstrates the way we think. Take 'out of sight, out of mind', for example. In Linkingthinking, there are no 'side effects', and all consequences of actions and decisions are taken into account, as far as possible. This is not always easy however!

> *"One of the apparent problems of holistic thinking is that whatever you start to look at or think about, a holistic perspective always involves going further and deeper. Whenever you consider the interconnectedness of things, any issue is always only part of a bigger issue. That's just the way the world is."*
>
> John Button, *How to be Green*, 1990

Look at the diagram on pages 46-47.

Activity ➛ ➛ ➛

Form a ring with your forefinger and thumb. Move this around the diagram, alighting on different parts to give you different foci. Notice that if you only rest on one part, your perspective on the whole is clearly limited, even though your perspective is valid for that particular part. What can we learn from this exercise?

It is clear here that while it is both possible and often necessary to break issues down to manageable proportions, it is dangerous to assume that this *abstraction* is any more than a small part of the whole. In other words, we need to be conscious of where we are, and where we are not focusing our attention, and conscious of the *boundaries of our attention*. This awareness matters less if we are dealing with a contained difficulty but it may matter a great deal if we are dealing with a complex mess.

See also the activity 'What causes the cause of the cause?' on page 17 of the **Toolbox**.

Let's summarise here some more problems with simple 'cause-effect' and 'problem-solution' thinking when applied to complex issues:

Common assumptions in problem solving:

- that we know what the problem is
- that we know what the solution is
- that the cause, or causes, are close in space and time to the symptoms
- that the solution will only lead to effects close in space and time to its application
- that there will be no unexpected synergies or emergent properties arising as a result of any solution
- that once a solution is implemented, it has fixed the problem: job done √
- that solutions are universal: that what works in situation A is bound to work in situation B
- that if a solution worked well in the past, it must work again now.

? Question

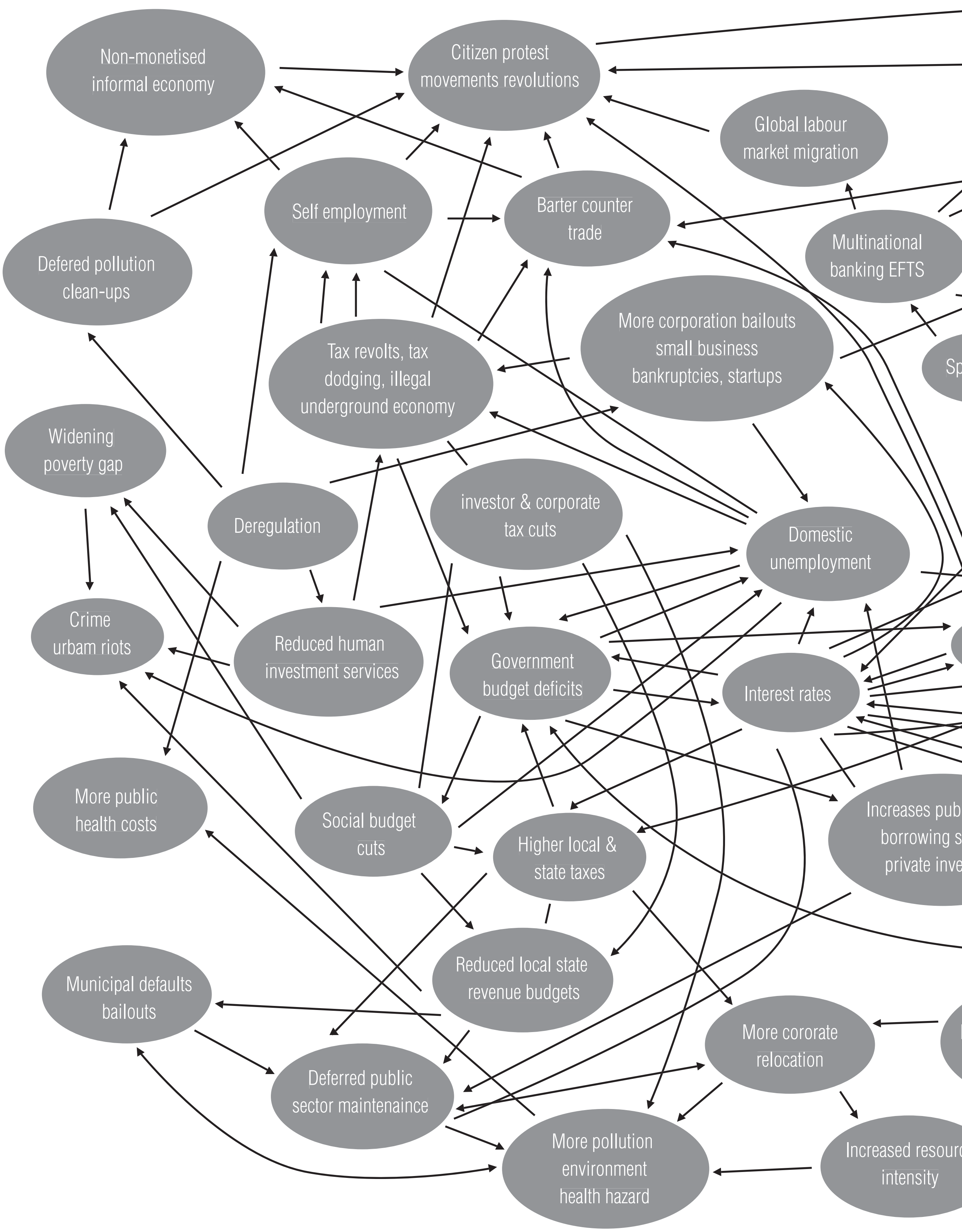
What do all these assumptions have in common?

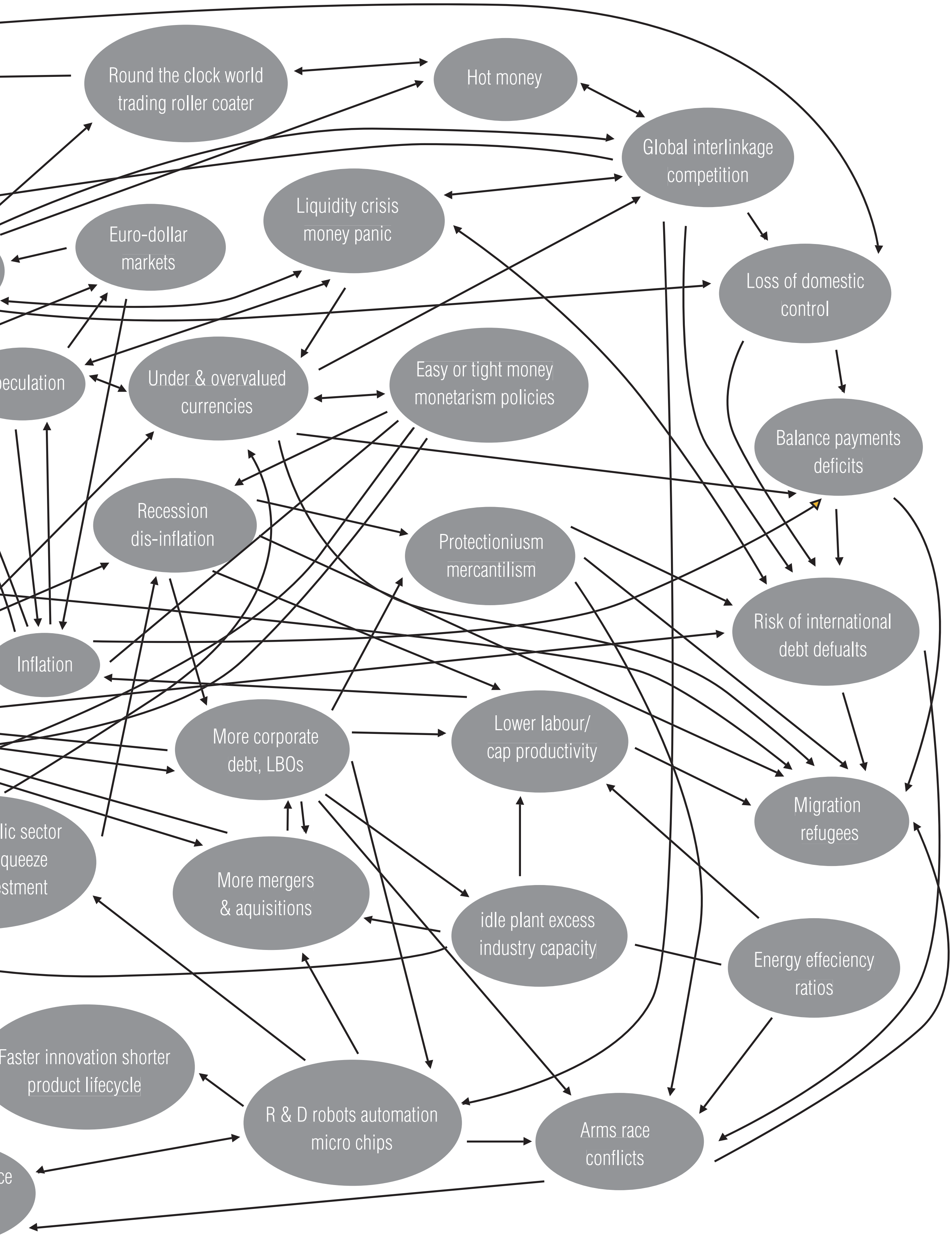
In short, we can say these assumptions are associated with boxed-thinking – the tendency to think within fairly fixed boundaries. (The basic assumptions of boxed-thinking are looked at in Unit 1.) Unfortunately, and too commonly, they can lead to a 'we know best' arrogance; think for example of the unhappy history of official aid projects (see Chambers, 1997, *Whose Reality Counts?*, for more on this).

! Idea

A key to Linkingthinking is to be aware of where we set our boundaries when we are thinking about an issue or problem. Who or what are we including or excluding in our focus, and why? (See 'Out of bounds' on page 13 of the **Toolbox** for more on this.)

From a systems, or Linkingthinking point of view, the above assumptions are often questionable, or plain wrong. They might be valid for some difficulties, but are rarely adequate for messes. Chemical dumping, systemic


Non-monetised informal economy
Citizen protest movements revolutions
Global labour market migration
Self employment
Barter counter trade
Multinational banking EFTS
Defered pollution clean-ups
More corporation bailouts small business bankruptcies, startups
Tax revolts, tax dodging, illegal underground economy
Widening poverty gap
Deregulation
investor & corporate tax cuts
Domestic unemployment
Crime urbam riots
Reduced human investment services
Government budget deficits
Interest rates
More public health costs
Social budget cuts
Higher local & state taxes
Reduced local state revenue budgets
Municipal defaults bailouts
More cororate relocation
Deferred public sector maintenaince
More pollution environment health hazard


Round the clock world trading roller coater
Hot money
Global interlinkage competition
Liquidity crisis money panic
Euro-dollar markets
Loss of domestic control
peculation
Under & overvalued currencies
Easy or tight money monetarism policies
Balance payments deficits
Recession dis-inflation
Protectioniusm mercantilism
Risk of international debt defualts
Inflation
Lower labour/ cap productivity
More corporate debt, LBOs
Migration refugees
lic sector queeze estment
More mergers & aquisitions
idle plant excess industry capacity
Energy effeciency ratios
Faster innovation shorter product lifecycle
R & D robots automation micro chips
Arms race conflicts
ce

pesticides found at the North Pole, global warming, Bovine Spongiform Encephalopathy (BSE) and Creutzfeldt Jakob Disease (CJD), crime, global terrorism, development aid are all dramatic examples of complex issues where such assumptions are shown to either be inadequate or untenable.

> *"The solutions of the past have been a major cause of our current ecological problems and social dislocation."*
>
> Janis Birkeland, *Design for Sustainability*, 2002

There is another issue here too, and one to watch from a critical thinking point of view. Where vested interests are tied to a specific solution, they will tend to identify and characterise a problem that their solution will fix. The 'son-of- star-wars missile shield', or some genetic modification (GM) developments are examples. Some product advertising also falls into this category, but you might be able to think of other, more local and smaller-scale examples.

Activity ➛ ➛ ➛

Find examples from the news or newspapers where the sort of common assumptions listed above appear to be made. List the alternative assumptions you think would be made by Linkingthinkers.

! Idea

Here is a quote we introduced in Unit 1:

> *"No problem can be solved from the same consciousness that created it. We have to learn to see the world anew."*
>
> Einstein

In other words, if our solutions fail to address the problem, or make it worse, we need to think differently about it, perhaps very differently. This involves being able to learn from our mistakes rather than repeating them.

Such learning is helped by getting a different perspective. One aspect of the difference between boxed-thinking and Linkingthinking is the amount of attention given to overview and *pattern*. This is the next topic.

2.4 'Detail complexity' and 'dynamic complexity'

'He can't see the wood for the trees', we say, when we want to indicate the need for a change of viewpoint. Our viewer is not exactly wrong; he is just missing what is sometimes called 'the big picture'.

How often do we deal with 'the trees', and how often do we attempt to see the form of 'the wood' as a whole? Some people seem better at detail, while others are better at the broader view.

Systems writer Peter Senge makes a useful distinction here; between what he terms 'detail complexity' and 'dynamic complexity' (or pattern complexity). The former concerns situations characterised by many variables and 'complex arrays of details' while the latter concerns subtle patterns of change over time, and situations where 'obvious interventions produce non-obvious consequences' (1990, Senge, *The Fifth Discipline*, p72).

Senge's idea of Linkingthinking is very much centred on dynamic complexity, with 'helping us see the deeper patterns lying behind the events and the details', rather than getting lost in the detail (1990, Senge, *The Fifth Discipline*, p73).

In our thinking heritage, where reductionism and analysis are dominant, we tend to concern ourselves with the small picture rather than the big picture. While analytic rigour about detail remains important, so too is an ability and willingness to recognise context and overview. While analysis can help us sail our boat more efficiently, overview helps us see if we are heading in the right direction.

Changing the metaphor again: just as it is difficult to navigate your way out of the wood if all you can see is the trees, so it may be impossible to learn new approaches and perspectives if we remain lost in detail. Take the example of a traffic jam: the helicopter pilot can see the situation as a whole, while the frustrated driver can only see a small part of the problem. The pilot is in a much better position then to help sort out this 'mess'.

2.5 Seeing the wood…

So, how do we recognise pattern?

Activity ➛ ➛ ➛

Have a think about this question, and come up with some of your own ideas before proceeding.

It is an important question: the whole Linkingthinking project is really about improving our ability to see patterns and links. But there are some specific things you can do to help develop this perspective:

How to look for pattern:

- **Ask different questions.** Instead of asking 'what's the cause of this?', or just looking at symptoms, look for sets of contributory factors which might interact to produce or influence the issue, problem or phenomenon you are focusing on.
- **Dig deeper.** Instead of going along with the most obvious cause or effect, explore deeper, perhaps hidden, issues that might help us better understand a phenomenon. Think of the iceberg metaphor here.
- **Also, take a 'helicopter perspective'.** Try to look at an issue from a broad perspective; 'above the issue', looking for links between things.
- **Try to recognise relationships.** Ask 'what's this got to do with that?'
- **Question boundaries.** Eg when somebody labels or describes an issue, or makes a distinction, query it and look for connections.

For example, in holistic health, the practitioner is unlikely to ask the conventional reductionist question: 'What sort of disease does this person have?' but instead: 'What sort of person in what sort of environment has this sort of disease?' By asking this question, the focus is on the bigger context, and the remedy is likely to treat the whole person, rather than obvious symptoms.

Activity ➛ ➛ ➛

Try these inquiry approaches with any story currently in the news (at any level, local, national, or international).

So far, we have looked at how we can reach a different understanding about things. But what about following this through with appropriate action? Does Linkingthinking have anything to say about this? This is the next topic.

3 How can we 'make it better'?

This section suggests how we can go beyond simple problem solving, and think more about 'situation improvement'. It outlines the difference between first-order change and learning, and second-order change and learning, and suggests that we need to experience second-order learning to move beyond our simple problem-solving mindset.

3.1 Doing nothing – or acting carefully

This unit has looked at the 'problem of problem solving', where a limited or narrow approach is inappropriate to a complex situation. But does this mean we can do nothing because we never know how things will turn out? Not necessarily. In our technological society, the ideas of intervention, manipulation and control, often with techno-fix solutions, are very deep-rooted. But here are some alternative approaches:

- **Do nothing.** This accords with the Taoist idea of wu-wei meaning non-action, or in popular parlance, 'going with the flow'. This belief is based on two ideas: that action produces reaction, which may turn out undesirable; and second, that we tend to force things to go a certain way when, in fact they might fare better without our intervention. Think for example of the gardener who is forever working to get his garden to match his vision, and his friend who does very little but lets his garden grow more naturally. The latter will expend much less energy but may still have an equally productive garden.
- **Do less.** Again, this relates to the first idea, and stresses management for self-organisation. Instead of directing and controlling, the approach here is to try to encourage the parts of any system to work autonomously but within the context and limits of the whole. (Still with the garden example, the 'forest gardening' and 'permaculture' movements have developed these ideas and practices in recent years.)
- **Act, but do it mindfully and carefully.** As far as possible this should involve trying to:
  – *appreciate fully* the situation, rather than jumping to conclusions about it
  – *anticipate fully* the systemic consequences of your action.

Full knowledge of consequences in our interdependent world is not possible:

"Ignorance is an escapable part of the human condition"

David Orr, *Earth in Mind – On Education, Environment and the Human Prospect*, 1994

However, we should at least try to act with awareness of the likely systemic consequences of our decisions. This is the beginning of what might be termed 'systemic wisdom'.

3.2 Situation improvement

Another aspect of looking at change is that of 'situation improvement'. If the idea of 'problem-solution' is too simple and static for many complex problems, then maybe we should be considering how we could make a difference that would help overall. This makes far more sense where the situation is so big or messy that we have no chance of 'solving' anything.

But there can be problems with this, too:

- Who defines the nature of the problem or situation?
- What constitutes 'improvement'?
- Who says?
- Might it mean 'improvement' at a cost to some other things?
- What criteria can we use to decide if things have improved or not?

This is important. The word 'improvement' is easily used, and often uncritically. For example, to the conservationist, 'improved pasture' means a decline in meadow flower species. A new shopping centre 'improvement' might mean the disappearance of locally-owned shops. 'School improvement' can mean the loss of aspects of school life that cannot be measured in favour of those that can. So we need to think about what people mean when they use this word 'improved': for whom and at what cost?

Activity ➛ ➛ ➛

Try this yourself or with your students. Take any knotty problem, and establish some agreement about the nature of the problem if possible. Then consider how you/the authorities, or whoever it concerns could 'improve' the situation. Consider the questions above, and any others that arise.

3.3 First-order and second-order change

Systems thinkers refer to a model of 'orders' of change and learning, which is very helpful to understanding different qualities of change .

First-order change refers to doing more of the same, that is, change within boundaries and without examining or changing the assumptions or values that inform what you are doing. Meaning is assumed or given.

Second-order change refers to a change in what you are doing as a result of examining assumptions and values. Meaning is negotiated and made transparent.

These two sorts of change and learning are sometimes called 'single-loop' and 'double-loop' learning – or learning and 'learning about learning'. (Other terms are noted in Part B, 'Further Investigation'.)

It sounds a simple model, but it makes an extremely important distinction. *Most learning is first-order learning:* that is, it is simple learning in the sense that it does not challenge or change the beliefs, values, and assumptions of the learner. Most (but not all) formal education tends to be first-order learning, concerned fundamentally with 'information transfer'– learning *about* things. To use the metaphor, it is 'working in the wood, with the trees'.

Second-order learning is more difficult and involves the learner (or learning organisation) critically examining and if necessary changing his/her beliefs, values and assumptions. Therefore, this learning experience can be said to be deeper. It is more difficult for the learner because it is challenging, and because it involves reflection on learning and change that takes place at the first-order level, then generates an awareness and understanding that goes beyond that level. Because of this, such learning is likely to be more permanent. To use the metaphor, it is 'seeing the wood', or learning about learning.

In shorthand, and applied to organisations, first-order learning and change is often said to be about *doing things better*, that is, it is often concerned with efficiency and effectiveness, whether applied to the individual, or to the institution. Second-order change is concerned with doing better things, that is, it raises questions of purpose and values; it asks 'efficiency and effectiveness in the service of what?'.

This distinction throws light on the matter of 'situation improvement'. Improvement seen from the position of first-order change tends to be managerial, instrumental and directed. From the position of second-order thinking, change tends to be more participative and owned, and questions of values, ethics and purpose arise. So any improvement arises from dialogue about what improvement means.

This raises issues of *teaching and learning styles*, and *styles of management* in educational organisations, which go beyond the scope of this unit. Some of this is covered in Unit 1, and holistic management is also looked at in relation to natural resources in Unit 4.

4 Choosing the appropriate approach

This section suggests that different types of problems require different types of approaches, and that we need to expand our repertoire from relying purely on reductionist methodologies and methods. It is not just a question of the right tools, but of the appropriate outlook. The section concludes by looking at some key ideas that inform a Linkingthinking outlook.

4.1 From reductionist to holistic methodologies

A few years ago, there was a call for thinking skills in the curriculum, and a number of development projects in the UK have worked on schemes to address this. This is important and welcome, except that there is virtually no reference to the sorts of thinking that the Linkingthinking project covers.

Some years ago, the Centre for Systemic Learning at the University of Western Sydney developed a 'hierarchy of systems inquiry'. The point of this was to indicate a *spectrum of methodologies*. While any specific methodology might be helpful anywhere, the model suggested that predominantly reductionist approaches to issues and problems were more appropriate to simple, bounded issues, while more holistic approaches were more appropriate to complex issues. The model showed that the real art is *knowing which methodology is appropriate for which context*. The more complex a situation (the more mess it is likely to show), then the more we have to move towards participative, systemic and critical methods of inquiry and learning.

simple problems/'difficulties' ⟷ complex problems/'messes'

The problem is that since we are all steeped in reductionist methods of inquiry, learning and problem solving, our attention is concentrated at one end of the spectrum. Linkingthinking seeks to help a shift towards the holistic end of the spectrum of methodologies by introducing some ideas and tools that are more systemic.

4.2 Beyond 'thinking skills'

Linkingthinking is certainly about learning new skills, but it is also about *seeing the world differently* (to quote Einstein's phrase). It is about second-order learning and beyond. If we learn new thinking skills but still see the world in the same fragmentary way, it would be unlikely to help address the many systemic problems that characterise the world.

! Idea

If we can see the world differently, then we are more likely to act differently.

Over 20 years ago, Donella Meadows wrote:

> ***"The world is a complex, interconnected, finite, ecological-social-psychological-economic system. We treat it as if it were not, as if it were divisible, separable, simple, and infinite. Our persistent, intractable, global problems arise directly from this mismatch."***
>
> Meadows, 'Whole Earth Models and Systems' in *The CoEvolution Quarterly*, Summer 1982

In the same paper, Meadows suggested how policies would look if they were consistent with a systems (Linkingthinking) view of the world whether in regard to human or natural systems. They would be:

- **Respectful** – designed to assist and encourage the system to run itself, rather than impose from the outside
- **Responsible** – for what happens rather than trying to blame outside influences

- **Experimental** – recognising that nature is complex beyond our ability to understand, and that therefore careful experiment is required
- **Attentive** – to the system as a whole, rather than trying to maximise the performance of parts
- **Mindful** – of the long term, recognising that actions taken now might have effects for decades to come
- Comprehensive – recognising that no part of the human race is really separate from any other part or from the global ecosystem. 'We all fall or rise together.'

(based on Meadows, 1982)

These principles seem as applicable to the local situation as they do the global level.

Activity ➛ ➛ ➛

Take an issue or policy of interest to you – it might be relating to transport, food, energy, education, housing, etc. Analyse it in terms of Meadow's criteria – how far does it meet them? How would it have to change to meet them?

References

Ackoff, R L (1980) 'The systems revolution' in Lockett, M and Spear, R (eds) (1980) *Organizations as Systems*, The Open University Press, Milton Keynes. (Ackoff's article originally published in 1974)

Birkeland, J (2002) *Design for Sustainability – A Sourcebook of Integrated Environmental Solutions*, Earthscan, London

Button, J (1990) *How to be Green*, Century

Capra, F (1996) *The Web of Life*, Harper and Collins, London

Chambers, R (1997) *Whose Reality Counts? Putting the first last*, Intermediate Technology Publications

Meadows, D (1982) 'Whole Earth Models and Systems' in *The CoEvolution Quarterly*, Summer 1982

Senge, P (1990) *The Fifth Discipline*, Doubleday Currency, New York

Waldrop, M (1992) *Complexity – The Emerging Science at the Edge of Order and Chaos*, Penguin

Further Investigation

This part includes further notes and references to supplement Unit 2 Part A, Key Ideas. The reference numbers relate to those in Unit 2 Part A.

1 Why is problem solving a problem?

1.1 'No problem' (?)

The difference between simple and complex problems is perhaps not as distinct as Part A would suggest. Many simple problems just appear to be simple problems. But when Linkingthinking is applied and complex causes are traced back, their complexity is often revealed.

1.2 Going deeper… different metaphors

The 'Reflection' questions in 1.2 (page 5) throw up a need to examine deeper the roots of our Western thinking. One way into this is to look at the 'three Ms':

- metaphor
- methodology
- modus operandi.

The idea of the 'root metaphor' is critical. A metaphor answers the question, 'What is the world *like*?' For over 300 years, the answer has been 'Like a machine'. Since the days of Descartes and Newton, and the beginnings of the whole scientific revolution that changed Western thought, the world has been seen fundamentally in terms of mechanism. Rene Descartes, the French philosopher, favoured the metaphor of a clock, and this was the basis of 'mechanism' in the 18th century whereby everything in the universe was seen as produced by mechanical forces. Today the image is far more sophisticated; for example, the computer metaphor, yet mechanistic ideas remain central to our thinking, particularly in relation to thinking in terms of cause-effect (see Goodwin quote below).

Along with the metaphor of mechanism arose a whole set of *fundamental assumptions* and habits of thought (see Unit 1) which influenced our interaction with the world. An important assumption and methodology was that of *reductionism* which attempts to explain a phenomenon by reducing it to its component parts. Reductionism has traditionally been part of the scientific method, and has been a mainstay of our approach to understanding in most disciplines and subjects, and in everyday life. The key question of reductionism is 'How can we, by breaking this down to its parts, understand this phenomenon?' It is a perfectly good question, and an extremely useful methodology, which has been stunningly successful in the areas of science and technology. But it is not a sufficient approach when applied to complex and living systems.

A third pillar of Western thought is the aim of *control*. If we can understand something, we are more likely to be able to control it, manipulate it, or intervene to achieve the sort of outcome we want. Until relatively recently, around the mid-20th century, mainstream opinion centered on conquering and controlling nature to maximise its utility. Indeed, this idea has never really gone away, even with the strong rise of environmentalism in recent decades, which seeks to conserve and work with nature and recognise its intrinsic value.

Against these three pillars, a new set of ideas is beginning to emerge, which takes a more *relational* view of the world. The metaphor here is ecology, not just the natural science of ecology, but a view of the world that is particularly interested in complexity, living systems and process. 'Ecology' is still a science of course, but more significantly it is a powerful idea. As the writer Wolfgang Sachs suggests, since the 1960s:

> *"…ecology has left the biology departments of universities and migrated into every consciousness. The scientific term has turned into a worldview. And as worldview, it carries the promise of reuniting what has been fragmented, of healing what has been torn apart – in short of caring for the whole."*
>
> Sachs, *Planet Dialectics*, 1999, p63

In this sense, it is sometimes called 'ecologism', to distinguish this sense of 'ecology as worldview' from 'ecology as science'. The methodology is one of holism, looking not so much at 'parts' but at 'wholes'; at context and relationship. And instead of a way of interacting with the world as a detached observer and intervenor, this new view stresses interdependence, systemic relationship and participation in and with the world.

	Modernity	**Post-modernity**
Metaphor	Mechanism	Ecologism
Methodology	Reductionism	Holism
Modus operandi	Control	Participation

There are some important points to make about these ideas:

- The shift towards more ecological ways of thinking does not imply we should forget mechanistic approaches and ideas of control (even if this were possible). They remain valid and useful. The problem occurs when mechanistic approaches are exclusively applied to problems and areas where they are not appropriate.
- We are all far more familiar with mechanistic and reductionist ways of thinking than ecological ways. So, relational thinking can feel difficult and unfamiliar.

Many of these points are touched on in this passage by Brian Goodwin, former professor of biology at the Open University who, in discussing environmental and health issues, suggests:

> *"The new sciences of complexity suggest that (emergent problems) may arise because we are failing to grasp a basic property of the complex processes that are involved in maintaining healthy environments, healthy bodies and healthy communities. Those cannot be manipulated and controlled in the ways that work for mechanical systems such as cars, computers, radios, and television sets. Their complexity is such that we cannot predict the consequences of what appear to be scientifically reasonable actions… Commercial interests encourage the adoption of reductionist principles because they seem to promise control over complex systems… But (the latter) function in terms of emergent, holistic properties, that we are only beginning to understand; and they require us to adopt a different pattern of relationships from the manipulative, exploitative style of interaction that we have learned from our science of quantities."*
>
> Goodwin, 'From Control to Participation via a Science of Qualities' in *ReVision*, 1999

2 What is complexity?

2.1 Embracing complexity

Activity *answers*

A + B = only two pathways of influence

But A + B + C = 6

A, B, C, D =12

A, B, C, D, E = 20

Abilities of living systems:

- Self-organisation. This means that the parts in a system organise themselves to affect the greater whole, without direction.
- Adaptation. This means that complex self-organising systems do not passively respond to events in a mechanical cause-effect way, but change and adapt to their environment and learn from experience.
- Spontaneity. This means that there is no one part controlling change, but change happens as a property of the system.
- Emergence. This means that qualities arise from the interaction of parts in a system that cannot be predicted from the properties of the parts.

3 How can we 'make it better'?

3.3 First-order and second-order change

These are some of the terms you might come across that refer to these two levels of change and learning:

First order	Second order
Single loop	Double loop
Learning	Learning about learning
Simple learning	Generative learning
Functional learning	Critical reflection
Cognition	Meta-cognition

References

Goodwin, B (1999) 'From Control to Participation via a Science of Qualities' in *ReVision*, Heldref Publications, Washington

Sachs, W (1999) *Planet Dialectics*, Zed Books, London

linking thinking

New perspectives on thinking and learning for sustainability

A WWF Scotland publication

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Perspectives

unit 3

linking thinking

New perspectives on thinking and learning for sustainability

Exploring sustainable development through Linkingthinking perspectives

by Stephen Sterling

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unit 3 part A

3A

Key Ideas

This unit is part of the Linkingthinking suite of materials that seeks to help generate new perspectives, introduce systems ideas and develop relational thinking skills which are broadly applicable to different situations and contexts.

Aims of this unit

- **to suggest and explore an ecologically-informed framework to understand sustainability**
- **to develop systems approaches to understanding sustainable development**
- **to explore some implications of designing more sustainable systems.**

1 Towards a 'systems view' of sustainable development

This section introduces 'sustainable development' and 'sustainability'. It looks at links between addressing sustainability and Linkingthinking; the idea of the sustainable system; and the problems of unsustainability and uncertainty.

1.1 Defining sustainable development

Here are two quotes to consider:

> *"Sustainable development means absolutely nothing to most people and never will."*
>
> Francis Sullivan, Former Director of WWF-UK

> *"Sustainable development is the only intellectually coherent, sufficiently inclusive, potentially mind-changing concept that gets even half-way close to capturing the true nature and urgency of the challenge that confronts the world."*
>
> Jonathan Porritt, Chairman of the UK Sustainable Development Commission

The term 'sustainable development' (SD) has at least two major and related problems: first it is hard to define precisely, and second it is hard to grasp! And yet, as Jonathan Porritt suggests, the idea of sustainable development is widely agreed to be central to the future of life on Earth.

The heart of the matter is the Earth's ability to sustain human life and non-human life in the near and distant future: the Earth's sustainability.

"If we carry on as normal and do nothing, the Earth will not be able to sustain human life as we currently live it. On the other hand, we can act now and totally embrace the path to sustainable living."

WWF, *Living Planet Report*, 2002

This unit introduces a Linkingthinking or systems view of sustainable development and sustainability, which aims to make it more understandable and communicable. Like any systems view of things, it looks primarily at the 'big picture' and relationships involved. The unit is informed by the 'ecological debate' on these matters. Note that it does not cover the area of arts and aesthetics, which are nevertheless important parts of any broader response to sustainability issues.

This is a topic with many implications for the whole direction of human life. This unit serves as no more than an introduction and is complemented by the other units in The Perspectives Series, particularly Unit 4.

Activity ➛ ➛ ➛

An obvious starting point would be to try to provide your own definition of 'sustainability'. Try this now. And then try to define 'sustainable development'.

From the first part of this activity you should at minimum be able to draw out the idea of something lasting indefinitely. This is the essential meaning of sustainability; the ability or capacity of something to be sustained or to sustain itself. The key report *Caring for the Earth* is clear about this:

"If an activity is sustainable, for all practical purposes, it can continue forever."

IUCN, WWF, UNEP, *Caring for the Earth – A Strategy for Sustainable Living*,1991, p10

But often 'sustainable' means more than just continuing into the future. And it implies more than mere survival.

? Question

In addition to longevity and survival, what quality does sustainability tend to imply?

The way the word is often used implies some state of *wellbeing*. By contrast, *sustainable development* can be regarded as a *process* by which we might arrive at a *condition* or state of sustainability. Through this process of sustainable development, it is hoped, we might achieve a society which is more sustainable and more harmonious than our own. Donella Meadows (1992) suggests that such a society:

"…is one that can persist over generations, one that is far-seeing enough, flexible enough, and wise enough not to undermine either its physical or social systems of support."

Meadows, *Beyond the Limits – Global Collapse or a Sustainable Future*, 1992

Most commentators are wise enough to realise that sustainability is a relative rather than an absolute state, and a dynamic rather than static one, but a goal that is worth striving for. The best known definition is that of the World Commission on Environment and Development (the Brundtland Commission) which said this process was:

"Development which meets the needs of the present without compromising the ability of future generations to meet their own needs."

WCED, *Our Common Future*, 1987

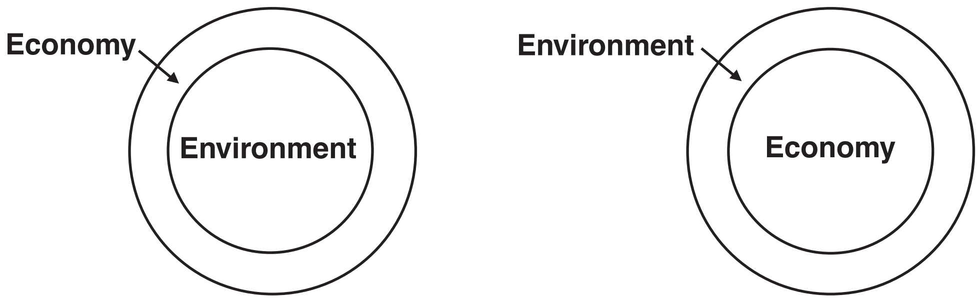
Activity ➛ ➛ ➛

Brainstorm what you think this entails or implies. How different are your answers from what we do now? Or are there signs of movement towards development that is more sustainable?

According to Lester Brown, who as president of the Worldwatch Institute has been charting progress relating to sustainability for over a decade, the bottom line is how far our global economy fits into the global ecology or ecosphere. The biggest issue, he says, is whether we can see the *economy as part of the environment*, rather than the *environment as part of the economy*. In other words, which is the wider context?

"Economists see the environment as a subset of the economy. Ecologists see the economy as part of the environment."

Brown, *State of the World*, 2001, p3



Activity ➛ ➛ ➛

What do you think this means? What do you think is the significance of this difference of view? Notice the word 'see' in Brown's statement. What we see affects what we do (for more on this see Unit 1).

You can explore this more in the activity 'Economy and ecology – which fits into which?', see page 20 of the **Toolbox**. Or save it till you look at sustainable development models in section 2.1 below.

Common to many of the definitions of and statements about sustainable development is the importance of *relationships* (the central concern of Linkingthinking):

- between present and future generations
- between biophysical (natural) and humanly created systems
- between economy and ecology
- between local and global scales
- between people's wants and needs.

In other words, the sustainable development debate has not so much refocused attention, but *expanded* our attention, to take a bigger picture into account in our thinking, policy making and decision making. This is also of course an effect of increased telecommunications and globalisation, which have made the world a more interdependent and interlinked place where actions can have distant effects in time and space.

Current ideological differences over the interpretation of sustainable development largely rest on where *conceptual boundaries* are drawn. This in turn, depends on our system of interest (or system of concern). Do we, for example, take the needs of future generations into account?

From a Linkingthinking (or systems) point of view, sustainable development requires us to question how we view and compartmentalise such things as 'environment' and 'economy', 'local' and 'global', 'present' and 'future'. This has ethical implications. By questioning our conceptual boundaries, we can begin to look increasingly at interrelationships and the wellbeing of the whole system. This is thinking that is more *inclusive*, rather than *exclusive*: thinking that expands our system of concern.

The Brundtland Report, which started the whole sustainability debate rolling, gives a flavour of this change in thinking:

> ***"Until recently, the planet was a large world in which human activities and their effects were neatly compartmentalised within nations, within sectors (energy, agriculture, trade), and within broad areas of concern (environmental, social). These compartments have begun to dissolve. This applies in particular to the various global 'crises' that have seized public concern… These are not separate crises: an environmental crisis, a development crisis, an energy crisis. They are all one."***
>
> WCED, *Our Common Future*,1987

This stands in contrast to our normal box-like thinking that tends to see things in a more compartmentalised way. (The assumptions and habits of boxed-thinking are looked at in Unit 1.)

Reflection

What evidence is there that the compartments have 'begun to dissolve'?
What pressures may have led to this change of view?

The Brundtland Commission members appear to have had some Linkingthinking qualities, because the report demonstrates *inclusive* rather than *exclusive* thinking. The report suggested we include 'the future', 'the environment', 'justice', and 'quality of life' in our thinking and decision making. These four aspects were felt to be key to sustainable development:

- **Futurity** – not doing anything which reduced the planet's ability to provide in the future
- **Equity** – fairness, particularly as regards resource access and distribution, between people living now (intragenerational equity) and between present populations and future generations (intergenerational equity)
- **Quality of life** – a fuller concept of the quality of life than that afforded by 'standard of living' (which is normally defined by consumption)
- **Environment** – ensuring that the environment is fully considered in economic decision making and activity.

Since the Brundtland Report was launched, many, perhaps hundreds of definitions of sustainable development have emerged, with interpretations ranging from the very radical to the very conservative. However, it is important to note that the definitions all indicate (to a greater or lesser extent) the need for an expanded view of things and their interrelationship.

To conclude this section, we can suggest that sustainable development, however it is interpreted, calls for a more relational or Linkingthinking view of the world. This applies as much at the local and immediate level, as it does at the global level – indeed part of the problem with sustainable development is to reconcile the 'global talk' with local action.

As outlined in Unit 1, such a view can be said to have three dimensions:

- *perception* which is expanded and more inclusive, rather than narrowly focused and exclusive
- *understanding* which explores connections as well as making distinctions
- *practice* which is integrative rather than isolated and compartmentalised.

Activity ➝ ➝ ➝

Discuss the idea that 'sustainable development requires an expanded view of things'. How far do you agree?

While Francis Sullivan's view (unit 3, 1.1) might be right, when people think and act in a way that is consistent with Linkingthinking, they are more likely to contribute to sustainable development, even if they never use the term. To find out why, we need to examine the link between systems thinking and sustainability.

1.2 Systems approaches to sustainability

At first glance, there is no obvious link between:

- Linkingthinking/systems thinking and
- sustainable development.

Systems methodologies can be used in a wide variety of settings. These range from helping to run a business more efficiently, to family therapy, to project planning, and so on, without necessarily having any reference to sustainability.

On the other hand, much of the debate and practice of sustainable development makes no overt reference to systems thinking or methodologies. So what is the link? We have seen above that sustainable development implies more attention to *context* and *relationship*, so this is one key link.

Activity ➝ ➝ ➝

Brainstorm: what do you think might be the links between sustainable development and systems thinking (or Linkingthinking)?

In brief, they are both about understanding change and improving relationships. So, for example, working towards sustainability involves such qualities as:

- recognising and *managing complexity* (see Unit 2)
- thinking in a *less compartmentalised*, more inclusive way (see Unit 1)
- working towards making *systems more sustainable*
- *situation improvement* rather than simple problem solving (see Unit 2)
- *different ways* of doing things and designing for sustainability.

We can get a better idea of the link by putting two words together: 'sustainable system'.

1.2.1 What is a system?

Let's start with the concept of 'system'.

Activity ➛ ➛ ➛

How would you define a system to somebody? What is the difference between a system and a non-system?

You might want to look at the activity 'What is a system?' at this point, pages 22-23 in the **Toolbox**.

As noted in Unit 1, a system is in essence a set, or pattern, of relationships. It consists of three kinds of things:

- elements (things)
- interconnections (processes)
- purpose (function).

It also has a boundary, indicating that it has borders and also sits within a context, or larger environment. It has emergent properties too; qualities that cannot be predicted from looking at the parts alone.

! Idea

Note that the definition of 'purpose' and 'boundary' – in particular – depend on the observer and his/her relationship with the system.

There are a number of definitions of the word 'system', which are in broad agreement. (See Part B, 'Further Investigation' on page 35 if you would like to check some definitions).

Activity ➛ ➛ ➛

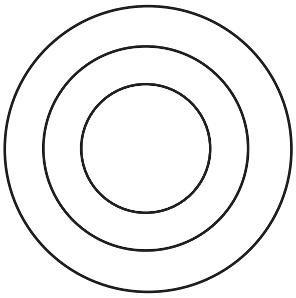
Choose a system that interests you. Think of it in terms of its: elements, interconnections, boundary, and purpose.

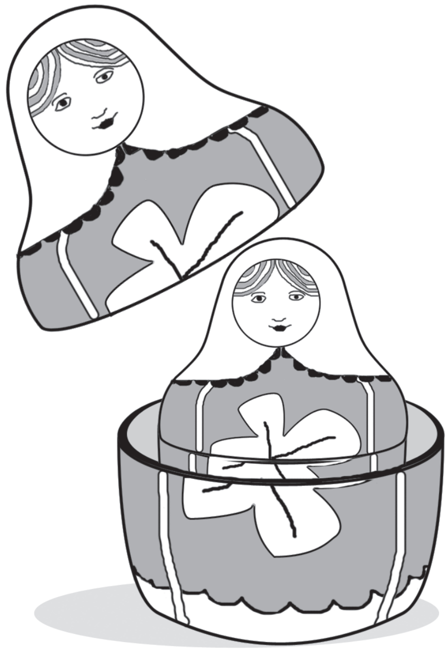
This makes more sense if you give it an example: a human body, a tree, a football team, a family, a business, a school, a belief system, and so on. The many possible disparate examples point to four key ideas:

- that where you draw the boundaries creates the system you are interested in; your 'system of interest'. For example, the liver specialist will be interested in your liver, while the holistic practitioner will be interested in your whole person and perhaps, your day-to-day environment.
- that your idea of the 'purpose' of any system might differ from somebody else's view of the same system.
- that the idea of 'system' is very versatile. It can help us understand very different phenomena, and is applicable from small scale to large scale.
- that systems are made up of subsystems and exist in a wider environment.

Looking at the fourth idea: 'subsystems' are systems within larger systems. This suggests a hierarchy of *system levels*: the molecule in the cell, the cell in the liver, the liver in the digestive system, the digestive system in the physical body, for example. Or, as noted above, the global economy within the global ecology. Some people dislike the idea of hierarchy because of its top-down connotation in human organisations, but we are using the word here to mean 'systems that nest within each other' or different levels of systems, rather like a set of Russian dolls where the higher level includes the levels below it.

Nesting systems





You may find the activity 'Parts and wholes' on page 16 of the Toolbox, of relevance here.

! Idea

The concept of 'nesting systems', which describes the relationship between system levels, is a key idea in Linkingthinking.

The word 'system' can describe a living system, or a non-living system such as a machine. What we are concerned with here are living systems, such as plants, animals, ecosystems, humans, human organisations, communities, societies and economies.

Reflection

What is special about living systems? And what do they have in common?

Living systems have the ability to *self-organise*. That is, they can change their structure or rules to adapt to changes in their environment, and evolve with their environment. This capability is key to a system's ability to sustain itself, that is its *sustainability*.

1.2.2 What is a sustainable system?

We defined sustainability above as 'the ability or capacity of something to be sustained or to sustain itself'. But can we be clearer about this?

If a system is not working very well, is falling apart, and does not show signs of being around much longer, then we can hardly say it shows signs of sustain-ability!

Reflection

Can you think of some examples known to you? What signs of unsustainability have there been, or are there now?

So, by contrast, a sustainable system has certain qualities. These include:

- *viability* – does it work?
- *integrity* – is it a recognisable, integrated whole?
- *longevity* – has it lasted? Will it last?

Activity ➛ ➛ ➛

Think about some system that interests you, eg your workplace, a local charity, a nature reserve, a business, a belief system or religion, a political system. How far does your system reflect these three systemic qualities?

We can take these ideas further by looking at such qualities as *resilience* and *adaptability* in the face of change (see Part B, 'Further Investigation' for more on this).

If we have some idea of what a sustainable system entails, this can help us in the area of *ecological design* (see Section 3 below). Clearly, systems are not in an absolute state; they can be 'more' or 'less' sustainable, while in a dynamic but relatively stable state. The whole field of '*sustainability indicators*' tries to assess whether systems are moving towards or away from relatively sustainable states.

1.2.3 A shift of emphasis

Does all this mean that *everything* should be sustainable? Seen from the viewpoint of much Eastern philosophy, everything is in flux, there is no permanence, and things rise and fall. So why all the fuss about sustainability? Part of the answer is that sustainability is not about achieving *permanence* in some monolithic or frozen state, but achieving *persistence* of pattern, recycling, and continuity.

In Unit 1 we noted that shifting from box thinking to Linkingthinking involves a shift from thinking mostly about things, to thinking primarily about relationships. This shift of thinking is really important! We need to think less about 'things-in-themselves' like objects, artefacts, or organisations, and much more about 'things-in-relationship'. Indeed, living systems like families, communities, businesses, schools, etc, *are* essentially *networks of relationships* rather than 'things'.

So sustainability is less about keeping particular things (artefacts, organisations, etc) going forever, and more about achieving sustaining and healthy relationships. But here's an interesting point:

! Idea

If we attend more to relationships, we are more likely to sustain the 'thing' we are interested in! Think of the saying, for example, 'the family that plays together, stays together'.

On the other hand, if we *do not* attend to the sustaining quality of relationships, we are more likely to undermine the sustainability of the things we are interested in.

For example, if a business maximises returns to its shareholders at the cost of the contentedness of its employees; or if a school pushes for high exam results at the cost of the wellbeing of its teachers and pupils. This is more likely to be a failing business and a failing school in the longer term. Achieving something 'at any cost' is ultimately likely to cost the very something you wanted to achieve in the first place. On the other hand, the business that looks after its employees is arguably likely to see increased productivity, and the school that cares for the wellbeing of its staff and pupils is likely to get good exam results over time.

So sustainability is about long-term health and not undermining the means of survival and wellbeing (see Unit 3 Section 3, 'How can we design for greater sustainability?'). Unsustainability, then, can be said to be the opposite.

1.3 Unsustainability

Some people say it is easier to understand and recognise unsustainability than sustainability; we know it when we see it. The pictures on the TV of devastated landscapes, of environmental refugees, of disappearing fish stocks for example, or closer to home, a declining town centre, rising crime levels, or food quality scares are not uncommon examples.

Seen at the global level, unsustainable development means that on balance the global ecosystem and human system taken as a whole, are deteriorating (see the 'Good egg or bad egg' activity on pages 21-22 of the Toolbox. Indeed, something has to change! Given current trends, to raise the present world population to North American living standards and levels of resource use employing current technology would require up to four additional Earth-like planets.

This is not the place to rehearse the global problems of unsustainable development. For more on this, look at key global reports (see Part B, 'Further Investigation'). But there are four main conclusions that can be drawn from the wealth of information and material that is now available:

- that virtually everybody agrees that the fundamental problem is a mismatch between human activities (human systems) and the *carrying capacity* of the planet as a whole (biophysical systems and the global ecosystem)
- that the current distribution of resources is grossly inequitable, with the richest one-fifth of the world's population having 85 per cent of the world's income (Carley and Spapens, 1998, *Sharing the World*)
- that the issues and problems facing us are deeply systemic, that is they are interrelated, and none can either be understood or addressed adequately in isolation or out of context
- that doing nothing about these issues is not an option; there is a high degree of urgency.

Much more difficult is to interpret these conclusions. Since the emergence of the sustainable development debate, many views on what it means and entails have arisen. Barring extreme positions, most people fall into one of two basic orientations:

- *growth with equity*: economic growth which is much more environmentally sensitive, and where wealth is much better distributed than at present
- *no growth or low growth* accompanied by a necessary change in lifestyles among the high consumers, and redistribution of resources and wealth on a fairer basis globally.

What we can say with some certainty, is that we cannot sustain the 'business as usual' scenario of increasing growth and increasing inequity. (For more on sustainability, economics and consumerism, see Unit 4.)

Reflection

Why? Do you agree with this? If so, think through the reasons why it seems so from a Linkingthinking point of view.

A Linkingthinker, Hartmut Bossel sets the challenge:

> *"Sustaining the current system with its resource exploitation, ecological destruction, and social problems will not be possible. So we must develop a vision of a society that is both physically and socially responsible, that is able to accommodate… diversity, and that moreover permits change and human development indefinitely."*
>
> Bossel, *Earth at a Crossroads – Paths to a Sustainable Future*, 1998

So, what is to be sustained? Is it just a matter of having enough 'stuff' to last us? A matter of maintaining supplies of energy and materials into the future? (This is known as physical sustainability, or 'sustainable yield'.) This was the main worry around the time of the UN Conference on the Human Environment of 1972 and the 'Limits to Growth' debate of that time.

But if securing resources was accompanied by gross inequity, as at present, such a scenario could be said to be ethically and socially unsustainable, or untenable. So sustainability is essentially *multi-dimensional*. It has 'physical, material, ecological, social, cultural, psychological and ethical dimensions' (Bossel,1998 *Earth at a Crossroads*). This comes back to the idea about sustainable development requiring an *expanded* view.

Reflection

How far do you agree with this inclusive description? Consider how far a *broad* or a *limited* meaning is intended when the 'sustainability' or 'sustainable development' terms are used in debate or literature.

Linkingthinkers would argue that sustainability is about the *survival*, the *security* and beyond these, the *wellbeing* of the whole system, whether this is seen at local level, such as community, or at global level. These are related stages; there is no wellbeing unless there is some level of security, and no security unless there is survival as a first step. So for example, aid agencies addressing extreme poverty and famine will work for immediate survival first, then for better food and economic security, then for general social, economic and environmental wellbeing.

But how do we move from unsustainable states, towards more sustainable states? It is hard to define *precisely* the changes this might require in our assumptions, policies, structures and organisations, and there are no blueprints. Sustainability issues then, are marked by high levels of *uncertainty*.

1.4 Uncertainty

Uncertainty is widely seen as one of the defining characteristics of our age. Old certainties and patterns – like a job for life, retirement, the welfare role of the state, even a stable weather pattern given the uncertain effects of climate change, have all increasingly been put in doubt or eroded in recent years as we have made a more complex and less stable world (see Unit 2).

Activity ➛ ➛ ➛

List examples of shifts from 'relative certainties' known to previous generations, to 'uncertainties' that we experience today.

Uncertainty has two aspects:

- difficulty understanding the nature of the problem or phenomena
- inability to predict outcomes.

Actually, there is another one too:

- it's scary!

The first two aspects mean, as outlined in Unit 2, that we have to question our idea of *control*; that is, being able to predict, plan and control outcomes. If we don't know what's going to happen, we need to keep a constant eye on the situation, and adapt accordingly. This new style of management has much more in common say, with sailing a boat according to the uncertainties of changing tides and weather, than driving a train according to a pre-determined timetable, set track, and known destination.

Michael Carley and Ian Christie (2000, *Managing Sustainable Development*) suggest that sustainable development requires 'adaptive management'. This involves constant learning and adapting to feedback, because often the only certainty is change itself ('sailing' then, rather than 'engine driving').

Complexity (see Unit 2) is leading to new thinking about management, whether in relation to natural or social systems, away from 'command and control' where outcomes are believed to be predictable (but often are not), towards a more participatory and adaptive model, more suited to the conditions of uncertainty.

The third aspect – it's scary – is a real problem! When confronted by the unfamiliar, people tend to revert to what they know best; they try to exert *more* control over their lives and organisations, rather than embrace complexity and ambiguity.

Uncertainty is not a reason for inaction. Even if we do not know exactly what sustainable development entails we can still move forward.

! Idea

There is "*no template for the transition to sustainability (but) there is a direction and there are principles...*" Tim O'Riordan and Heather Voisey (from a study of progress on Agenda 21 in the European Union, 1998, xv)

Tim O'Riordan and Heather Voisey put forward three principles or conditions that should underpin "any serious analysis or sustainable development". (See Part B, 'Further Investigation', page 36, for more on this.) Whatever arguments and proposals are put forward, they need to acknowledge and be *appropriate* to the conditions of complexity and uncertainty associated with sustainability/unsustainability issues. How far this is the case largely depends on how sustainability is perceived.

While most opinion among decision makers accepts there is a problem, there is a large difference between those who see it as little more than a technical challenge, and those who see it as requiring wholesale reorientation of values, technologies and practices in society at large. The former can reasonably be called boxed-thinkers, while the latter tend to be Linkingthinkers. This said, many people straddle these two views in some way. In addition, it is possible to discern a number of viewpoints along a spectrum.

To understand different responses to the sustainability question, it is helpful to look at these viewpoints. (See Part B, 'Further Investigation' – 'Different perspectives' on pages 36-37 for more on this.)

To recap, we have looked at the idea of the sustainable system, at expanding our awareness and shifting attention to relationships, at unsustainability, and at the problem of uncertainty. None of this is easy, particularly if it is unfamiliar. Fortunately, there are some systems models and ideas that can help us to get a handle on this. This is the topic of the next section.

2 Getting a handle on it all...

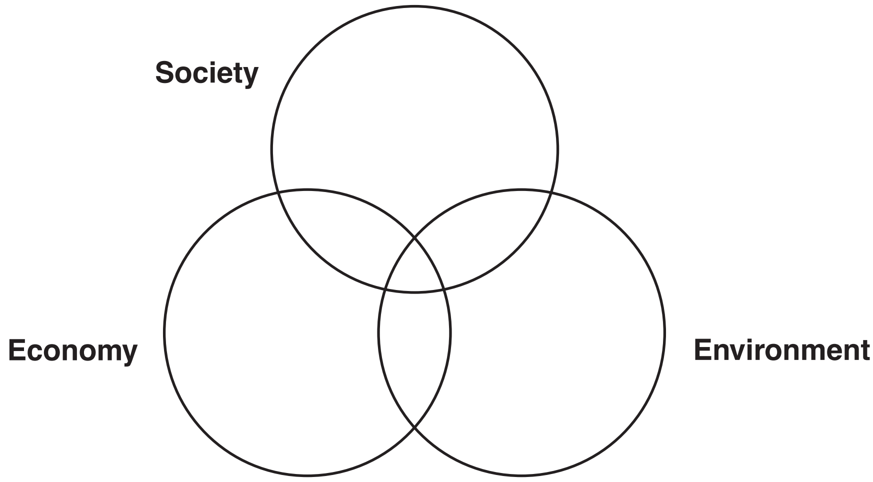
This section looks at some frameworks that help us understand sustainable development, at carrying capacity as a critically important idea, and at the core sustainability values of *efficiency, sufficiency and equity.*

2.1 Sustainable development models

Two key models which summarise the elements of sustainable development (SD) are outlined here. For more models, see Unit 4.

2.1.1 The Venn SD diagram

One of the commonest models is that of the SD Venn diagram of Society, Economy and Environment, being the three main dimensions of sustainable development.



Activity ➛ ➛ ➛

What do you think this model implies? Think of policies in any area such as energy, business, transport, energy, agriculture, housing, education, etc. Consider some actual policies or activities, either at local or national level: which elements, if any, would you place in the main three rings, which in the overlaps, and which in the 'bull's eye'?

This is a popular model, probably because it simplifies and clarifies sustainable development. It suggests that our economic, social and ecological systems are interrelated and need to be considered together. The *sustainability of each depends on the sustainability of the others and of the whole*. It is sometimes referred to as the 'three-legged stool'; take one leg away and the stool collapses.

But too often the legs do not have equal status. The problem is not that the environment is ignored, but rather that it is often seen only in instrumental terms: what it can supply the economy. This again (as noted above in section 1.1 and looked at in more detail in Unit 1), is a question of perception and *boundaries*. As the authors of *Natural Capitalism* state:

> ***"…with dangerously narrow focus, our industries look only at the exploitable resources of the Earth's ecosystems…and not at the larger services that those systems provide for free… Unfortunately, the cost of destroying ecosystem services becomes apparent only when the services start to break down."***
>
> Lovins, Lovins and Hawken, 'A Road Map for Natural Capitalism' in *Harvard Business Review*, 1999, p146

However, there are some signs of change with emerging ideas in business. The ideas of 'triple bottom line', of 'life-cycle analysis', of 'full cost accounting', and 'corporate social responsibility' all show a growing awareness of the need to take a more integrated and wider approach.

A further implication of this model is that many policies and activities have impacts in all three domains, even if only one area such as 'the environment' or 'economic development' or 'social equity' was considered during the planning and implementation phases.

While a fairly simple model, it indicates the challenge of thinking and planning in an integrated or Linkingthinking way.

Although of some value, the SD Venn diagram has itself been criticised for being insufficiently systemic, that is, for oversimplifying the relationships involved. It is stronger on the components of SD but weaker on their relationship.

Activity ➛ ➛ ➛

Consider – what are the possible limitations or weaknesses of the Venn SD model?

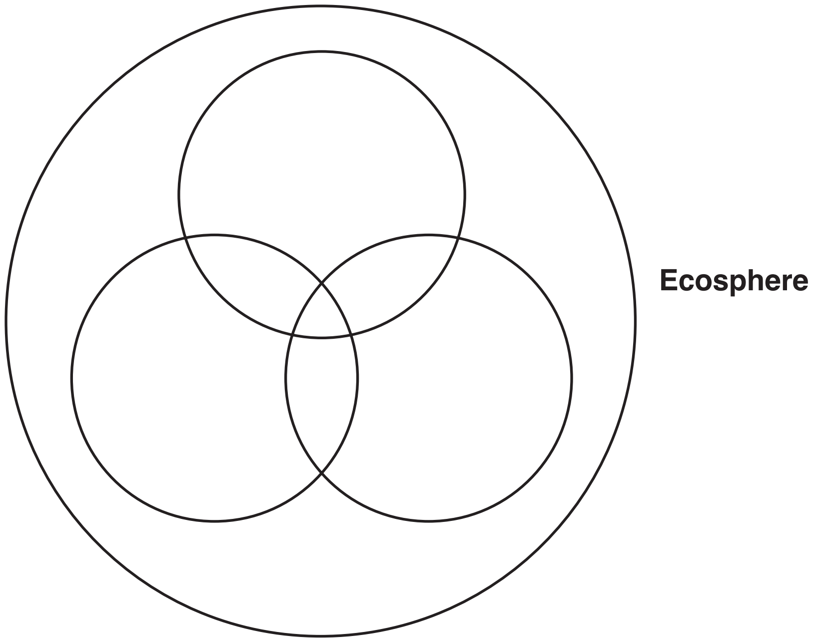
These are some of the criticism's that have been made – it is misleading because:

- it places people and society outside the environment
- it shows the environment as no more significant than the other two dimensions
- it splits social and economic systems.

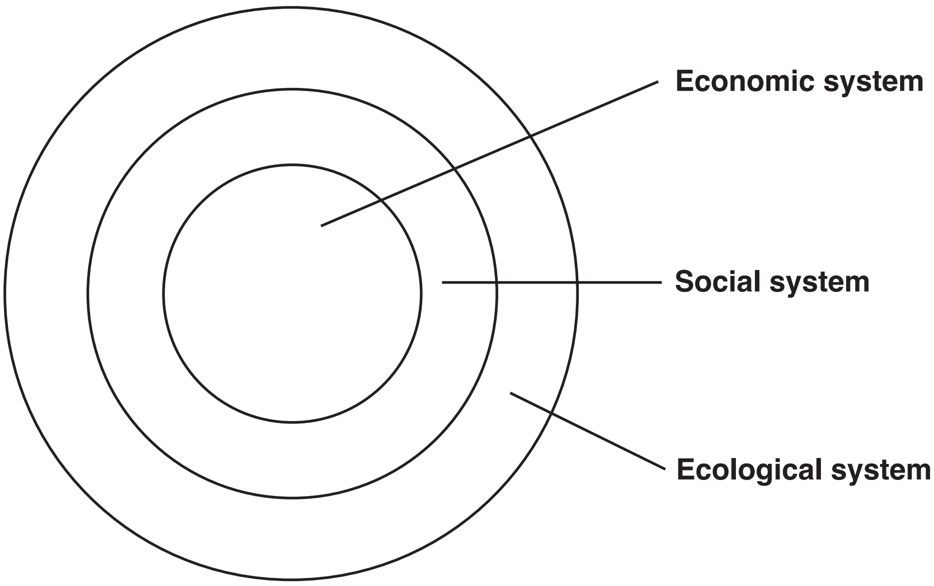
This brings us back to the quote from Lester Brown which we considered at the start of Unit 3, and to the activities 'Economy and ecology – which fits into which?' and 'Good egg or bad egg?' on pages 20 and 21-22 of the **Toolbox** respectively. (You might like to try these now, if you have not already done so.) This is not just of academic interest: if, as Brown argues, the economy is a *subsystem of the Earth's ecological system*, then it has to work within these limits:

> ***"Increasingly visible trends indicate that if the operation of the subsystem, the economy, is not compatible with the behaviour of the larger system – the Earth's ecosystem – both will eventually suffer"***
>
> Brown, *State of the World*, 2001, p4

As regards the Venn SD diagram, it might be better to set it within the ecosphere as a whole:



Or better still, draw the three areas as nesting systems:



The economic system servicing the social system (rather than the other way round), and the social system operating within the limits of the ecological system.

Activity ➛ ➛ ➛

Consider arguments *for* these models as well as their difficulties or limitations.

2.1.2 The capitals model

Another model used to describe SD, which is text based rather than graphic, is that of the 'five capitals model'. According to this model, sustainability means living within the means of the capital we have, that is, 'living off the interest' rather than depleting the capital stock (as we are now doing, reference the *Living Planet Report*, 2004). Considering the industrial history of the last 100 or so years, particularly our reliance on a diminishing supply of fossil fuels, living within our means is a 'revolutionary notion' (Lyle, 1994).

The model asserts that there are five capitals:

- natural capital
- human capital
- social capital
- manufactured (physical) capital
- financial capital.

Natural capital is seen as any natural stock or flow of energy or matter that provides valuable services. There are three categories: *resources* (such as timber, water, minerals), *sinks* such as air and water which absorb, clean or recycle waste, and *processes* such as decomposition, the water cycle, and climate regulation.

Human capital is seen as the capacity, intelligence, creativity, skills and motivation of people. The availability and extent of human capital is often compromised by poverty, inequity and by social and political exclusion.

Social capital is seen as the structures and social 'glue' that holds societies together. It includes trust and relationships, as well as structures such as families, communities, businesses, and organisations.

Manufactured/physical capital is seen as all the physical goods and built structures that humans put in place: machines, tools and technology, buildings, roads, hospitals, pipelines, power stations, etc.

Financial capital enables the other forms of capital to be owned, changed and traded. Unlike the other forms of capital, it has no intrinsic value of its own, but represents the other four forms of capital. Financial capital is then a *representative* form of wealth rather than *real* wealth.

Reflection

Not sure about this last point? Supposing you are in the desert, extremely thirsty, but with a thousand pounds in your pocket. Somebody gives you the choice; keep your money and probably die, or hand it over and have a drink. Money has no use in itself…

! Idea

The only forms of *real wealth* among these five forms are natural capital and human capital. The other forms derive from these.

Sustainability implies – as far as possible – maintaining these five stocks of capital, particularly the first two, *rather than increasing one at the expense of another*, which tends to be a common pattern now.

Activity ➛ ➛ ➛

Using newspapers or other media, find examples at any scale from local to global where it appears that one or two capitals are benefiting at the expense of others. Or examine whether claimed examples of sustainable development are managing to maintain or enhance capitals. This latter situation is sometimes called a 'win-win' position.

Part of the problem here, and it is one that the five capitals model does not really clarify, is a perception and belief that the capitals are substitutable or replaceable. So, for example, it is acceptable to replace labour with machines, or we can 'fix' soil erosion or species loss, or social breakdown with the application of technology, money, or ingenuity. To a limited degree, this has some truth, but it can also be dangerously misleading. In 1997, the journal *Nature* valued the Earth's ecosystem services (natural capital) to be at minimum $33 trillion a year. For most of these services, "there is no known substitute at any price and we can't live without them" (Lovins et al, 1999, 'A road map for natural capitalism'). So we have to pay far more attention to conserving and maintaining the health of natural capital and biodiversity.

✶ Factbox

WWF's *Living Planet Index* indicates that consumption pressures have led to a loss of more than a third (about 40 per cent) of natural capital globally from a 1970 baseline in the space of 30 years. Since the 1980s, we have been running an ecological deficit with the Earth's resources, and in 2001, our 'ecological footprint' overshot biological carrying capacity by 20 per cent.

Source: WWF, *Living Planet Report*, 2004

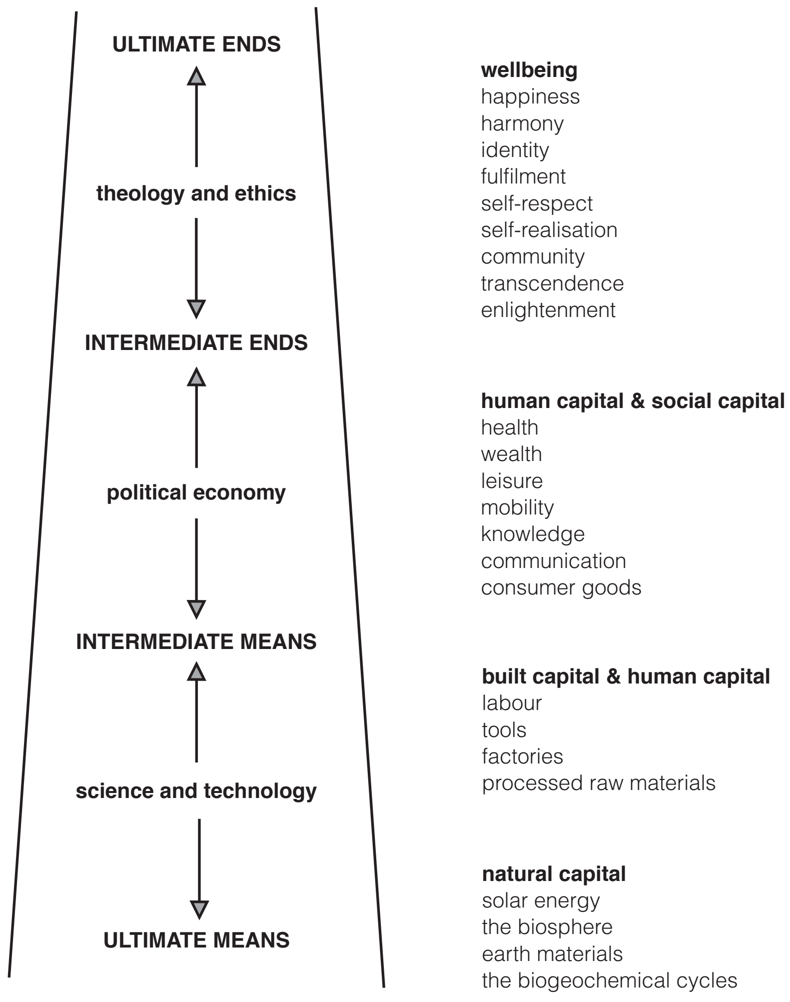
This tendency to try to 'fix' complex problems can demonstrate 'simple problem solving'. The limitations of this approach are the subject of Unit 2 in the Linkingthinking Series.

Activity ➛ ➛ ➛

Fish farming, which uses technological and controlled approaches to replace dimishing natural fish stocks is one example of subsitution. Increased mechanisation of labour in a number of industries is another. Think of other examples where attempts have been, or are being made, to fix problems by substituting one capital for another. How successful are they, taking all factors into account?

2.1.3 Daly's Ultimate Means model

In another model of sustainable development, ecological economist Herman Daly places natural capital at the base of a hierarchy, labelling it the 'ultimate means' or foundation. This shows the sustainability challenge is about providing satisfying lives and wellbeing for all (*ultimate ends*) within the means of nature (*ultimate means*). So the wellbeing of everything else depends first and foremost on the health and sustainability of the global ecosystem as the basis of life and economy. This again indicates the vital importance of conserving real wealth. A very useful model similar to Daly's can be found in Unit 4 (Wilden).



Source: Based on Herman Daly, *Steady State Economics*, Earthscan, 1992

Daly's model helps clarify some of the pressing issues of (un)sustainability:
- the depletion of natural capital
- the failure to address the poverty gap, and
- the relation between these issues as regards inequitable access to resources.

Activity ➛ ➛ ➛

What are the main differences between the three sustainable development models outlined above? Which do you prefer? Why?

One problem with all these models is that they do not shed much light on scale and *locality*. It is much easier to assess the sustainability of development projects where they relate closely to a particular place: its culture, social systems and ecosystems. It is much more difficult to track sustainability where a project relies on materials, energy sources, labour and goods brought from or taken half-way across the world. Indeed, many argue that sustainable development requires a shift back towards greater localisation and a sense of place and community.

Reflection

How far would you agree with this last point?

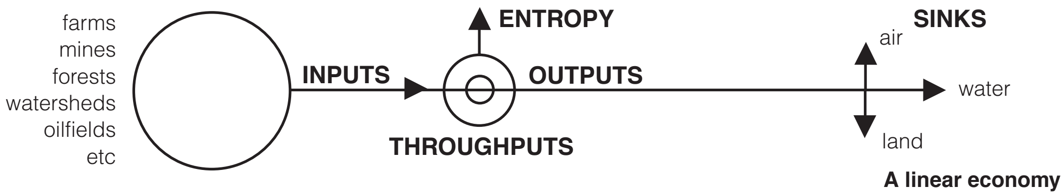
The 'globalisation/localisation' point is also important with respect to carrying capacity, which is the next theme.

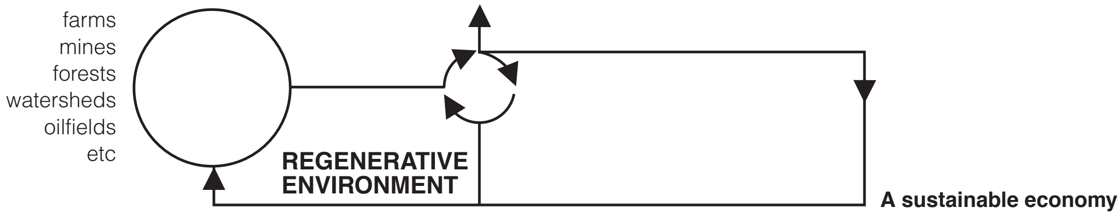
2.2 Carrying capacity

If the ecological system is the 'ultimate means' or a more fundamental system than the economy, then the conclusion from a systems point of view is that humans have to align their activities to fit within the limits and carrying capacity of the planet.

From a systems point of view, it is clear that humans take from the Earth (water, air, food, raw materials and minerals) and return wastes and pollutants back to the Earth. This is known as *throughput*. But the Earth is limited as regards its *sources* (what it can sustainably provide) and its sinks (what it can absorb without harming its future ability to absorb, regenerate and regulate natural cycles).

All news stories about pollution are stories about this throughput and the ability of the environment to deal with it. The key problem is both the amount of throughput, and the fact that our economy is fundamentally *linear*, and generates waste, whereas the Earth's life-support systems work on a *cyclical* basis where waste is recycled. And nature's systems manage to run almost entirely on the 'income' of solar energy.





Source: John Lyle, *Regenerative Design for Sustainable Development*, 1994

This quote illustrates the problem that our linear economy presents.

> *"The industrial system is less a system than a collection of linear flows... (it) draws materials from the Earth's crust and the biosphere, processes them with fossil energy… and dumps the residue back into nature. For every 1kg of finished goods we buy, about 20kg of waste have been created during production… This extract and dump pattern is at the root of our current environmental difficulties."*
>
> Hardin Tibbs, 'Industrial Ecology' in Birkeland, *Design for Sustainability*, 2002

Carrying capacity refers to the number of people (or indeed animals) who can be supported sustainably by the resource base (sources and sinks) of the area they inhabit. This suggests two principles of sustainable development (Christie and Carley, 2000):

- that use of resources should not exceed resource regeneration rates
- that waste production should not exceed the ability of the ecosystem to deal with it.

(See the Natural Step principles in Part B, 'Further Investigation', Section 3.3 page 40, for more on this).

Exceeding these limits represents unsustainable consumption of natural capital. This is hard to dispute, but recognising carrying capacity in a given area is often difficult. Calculating the number of say, sheep that can
be stocked sustainably in a given field is one thing, but the problems of human ecology are much more complex. In a closed system, food supply or other limiting factors exert *negative feedback* to limit a particular population, but as our *ecological footprints* now extend way beyond our locality, we often do not notice negative feedback.

So if you run out of water, timber or fish locally, you just get it brought in from elsewhere. Indeed, in an era of globalised trade, suppliers are quick to find substitute supplies. With global trade patterns now dominant, *most people do not see any correlation between the state of their local environment and what they consume*.

While the effects of overexploitation of primary resources, such as soil, fishing or timber are evident, the consumer many miles away has little or no idea of declining or endangered stocks unless something disappears or the price rises sharply. An example here is cod, a threatened species in the North Sea.

Working out exact carrying capacity is made difficult by:

- the problems involved in calculating regeneration rates of some renewable resources and the absorption capacity of ecosystems, given
- the fact that local economies are linked with global economies and are often not tied to their local resource base (making links with resource use and environmental effects very hard to track)
- the lack of obvious signals to consumers or businesses that indicate that carrying capacity limits are being reached or exceeded, particularly in a globalised economy
- the fact that natural systems are not static but dynamic and therefore carrying capacity is not fixed
- human ingenuity, which can increase or decrease the carrying capacity in a given area through the application of technology.

However, the idea of carrying capacity is a simple one to grasp. For example, according to Brown (2001, p257), to build a sustainable economy, governments need to re-establish a balance between:

- how much carbon is emitted from burning fossil fuels, and how much carbon is absorbed by plants
- withdrawals of water from aquifers and aquifer re-charge
- trees cut and trees replanted
- soil loss and soil regeneration, and
- human births and deaths.

For more recommendations on shifts to adjust our activities to the Earth's carrying capacity, see details from WWF's *Living Planet Report*, in Part B, 'Further Investigation', page 38.

Reflection

In what ways is carrying capacity a vital but 'slippery' idea?

One way of making it more meaningful to people is by working on *ecological footprints*. An ecological footprint means the amount of land needed to both supply resources and absorb waste for any given population. If a community's footprint is bigger than its own land area, the difference has to come from somewhere else; this is called 'acquired carrying capacity'. For example, the ecological footprint of cities is many times greater than their area.

> ***"Cities resemble entropic black holes, sweeping up the resources of whole regions vastly larger than themselves."***
>
> William Rees, 'Ecological footprints and ecological design' in Birkeland, *Design for Sustainability*, 2002

Globally, according to WWF's *Living Planet Report* in 2001, the Earth has around 1.8 global hectares of land for each of the six billion people on the planet. But our combined ecological footprint is 2.2 global hectares per person. Part of this is an *equity issue* (see below): the average Western European had a footprint of 5 global hectares, whereas the average Asian or African had a footprint of less than 1.3 global hectares.

Activity ➛ ➛ ➛

Next time you go to a DIY store, timber yard, or supermarket, check how many locations goods have come from, beyond your own region. How many items are locally sourced? What percentage for any one aisle would you estimate?

Despite the mounting evidence of unsustainability, for some people (see 'Different perspectives' in Part B, 'Further Investigation', pages 36-37), the challenge is seen primarily as a technical one. For others, it necessarily involves a shift in core values. The role of values in the sustainability/unsustainability question is considered in more depth in Unit 4.

2.3 Core sustainability values

Reflection

How do you think your own values relate to sustainability issues? A good deal? A little? Not at all? In what ways?

Activity ➛ ➛ ➛

From your understanding of sustainability and SD, what core values do you think we need to shift *from* and *towards*? As an exercise with students, this can lead to many ideas being generated. How do their own value sets compare in relation to this discussion?

To simplify matters, let's look at three *key values* associated with sustainability.

1 Efficiency

Resource efficiency is doing more with less, and is a way of increasing carrying capacity. In 1997 a book by the Lovins, *Factor Four*, caused a stir. Its basic thesis is that industrial societies need an 'efficiency revolution'; that we can do far more with less. Current resource use is so wasteful, it says, that we can increase resource productivity fourfold: that is, we can obtain four times the value out of a given unit of natural resource than we currently do, OR do twice the work using half the energy, OR live twice as well using half the resource base, OR do everything we do now on a quarter of the resources. This book, and its successor *Natural Capitalism*, shows that resource efficiency, assisted partly by the development of new technologies, is gaining ground.

As efficiency can do much to reduce total resource and waste throughput in the global ecosystem, those who believe in science and technology as providing sufficient solutions see this as the answer.

Reflection

Why is 'efficiency' a necessary but insufficient answer to the problems of sustainability? How 'efficient', that is, non-wasteful, are you in your use of resources at work or at home?

2 Sufficiency

Resource efficiency, assuming we can achieve it, buys time. But if demand for material goods goes on rising, then we soon arrive back at the limits of carrying capacity. So, for example, we might in time all be driving highly efficient vehicles, but if the number of vehicles increases we will still get gridlock and the amount of resources consumed in total will be high. As the Lovins (and their co-author von Weizsäcker) themselves admit, “insatiable consumption may outpace the efficiency revolution” (1997, p292). Wolfgang Sachs, a leading critic of unsustainable development patterns writes:

> ***“When relative improvement in resource use goes hand in hand with an absolute rise in resource use, not much is gained in ecological terms.”***
>
> Sachs, *Planet Dialectics*, 1999, p195

So we also have to look at *sufficiency*. This means resisting excessive consumption, having a sense of ‘enoughness’, and doing better at recognising and giving time to our non-material human needs such as love, security, respect, self-worth, community, green space and so on. Hence the phrase ‘less is more’. This brings us back to the importance of social sustainability, healthy relationships as a key part of sustainability and of non-material wealth. As Sachs says: ‘how much is enough’ quickly leads to the question ‘what do we want?’ (1999, p186).

This may not be as idealistic as it sounds. A recent *Worldwatch Report* (Brown, 2001) describes a study published in 2000, which reports that some 26 per cent of Americans have adopted a new worldview in the past 40 years that is largely consistent with the values of sustainability. Gardner (in Brown, p194) says that these people are characterised by:

> ***“…a concern for the environment, desire for meaningful personal relationships, commitment to spirituality and psychological development, disaffection with the large institutions of life, and rejection of materialism and status… and are likely to be active in their communities, to choose work consistent with their values, and to value healthy living.”***

But as important as sufficiency is, it does not address another critical part of the sustainability issue.

Activity ➛ ➛ ➛

Why is sufficiency (along with efficiency) a necessary but insufficient answer to the problems of sustainability? How would you define ‘sufficiency’ in your own lifestyle?

3 Equity

We may achieve much greater resource efficiency, and we may be able to constrain material growth through growing dissatisfaction with materialism and the search for more meaningful alternatives, but this does not address the whole issue of *inequity*: the growing gap between rich and poor both within and between countries. For the world’s poor, the problem is not having too much but too little. Inequity is perhaps the most difficult problem to address, and appears the area in which least progress has been made since the first Earth Summit of 1992. And, at the same time, we need to remember those as yet unborn. As the Brundtland Report of 1987 stated: “each generation should meet its needs without jeopardising the prospects for future generations to meet their own needs”. Clearly, the notions of ‘needs’, ‘poverty’, ‘wealth’ and ‘equity’ are relative terms, but it is equally clear that current patterns of resource distribution are unsustainable on ecological, economic and social grounds (Carley and Spapens, 1998, *Sharing the World*).

These three values can be seen as the *core values of sustainability*, any one of which is incomplete without the others. These values give us some grounding for understanding the conditions of ‘systems health’, while their opposites (inefficiency, overconsumption, and inequity) describe conditions for ‘systems breakdown’.

Reflection

Supposing you were in a closed system such as a space capsule, sharing it with a few fellow astronauts. In what ways would these three values help your survival? How would you put them into practice? What might happen if you didn't follow them? In the 1970s, people used the phrase 'spaceship Earth'. Is this still a useful metaphor?

2.4 Accepting the challenge

It might be useful to recap some of the key points at this stage. From a Linkingthinking point of view, sustainable development:

- requires us to *expand our boundaries* of attention or concern
- is characterised by *complexity and uncertainty*
- has *no blueprint* but does imply directions
- requires learning-based '*adaptive management*'
- requires *integrative thinking* (Linkingthinking)
- requires *reorientation* of our patterns of production and consumption
- requires a *genuine shift* in cultural and personal values and behaviour.

It sounds daunting, but real progress is being made, not least in new thinking and work in 'sustainable everything': energy, transport, agriculture, architecture, housing, construction, consumption and production patterns, and so on. This raises the whole question of *design for change*.

3 How can we design for greater sustainability?

This section introduces design for sustainability, or ecological design. It looks at some organisational principles of sustainable systems, and introduces some key ideas that inform ecological design.

3.1 Accelerating the sustainability transition

The big problems of our time – global warming, loss of biodiversity, toxic waste, lack of clean water, poverty, malnutrition and so on – should not be seen as 'side-effects' of the way we manage the planet, but the direct effects. They are the product of the 'poor design' (Birkeland, 2002) of our economic, social and technological systems.

Reflection

What do you think Janis Birkeland means by this? And how is she using the word 'design'?

The challenge is how we get from an unsustainable society towards one that is more sustainable and reflects and embodies the core values of *efficiency*, *sufficiency* and *equity* discussed above. Getting from here to there is sometimes called 'the sustainability transition'; a useful idea, as it implies a journey. But like any journey, it will not happen without *conscious intention* or *design*.

Change can happen in one of two ways, *by default* – where change happens to us; or by design – where change is intended. So design here means two things, intention and strategy.

"Design is very much more than just problem solving."

Edward De Bono, *New Thinking for the New Millennium*, 1999, p206

According to the experts, time is short to achieve desirable change by design, and avoid mounting crisis by default. A recent *Worldwatch Report* (Brown, 2001) called for an *acceleration* of progress towards a more sustainable future. Such progress requires three conditions:

- *awareness* of the challenge and the will and intention to address it
- *understanding* of the principles of sustainability
- *skills* to reorient our activities and systems towards sustainability.

This echoes the three dimensions of a more relational or Linkingthinking view of the world, which we looked at earlier (in Part A, 1.1):

- *perception* which is expanded and more inclusive, rather than focused and exclusive
- *understanding* which explores connections as well as making distinctions
- *practice* which is integrative rather than isolated and compartmentalised.

3.1.1 Ecological design

We think of design as something we apply to material things like machines, tools, houses, offices, or material systems such as energy and transport. The term 'ecological design' sounds as if is to do with natural landscaping. But sustainability requires design in all areas and all levels, including institutions and organisations, as well as things, products and landscapes. Inevitably, this extends the meaning and scope of 'ecological design'. Designers can be thought of as problem solvers, but sustainability requires a much more holistic way of thinking about problems, their interrelation (see Unit 2 for more on this), and how problems can be avoided through good design.

"Our machines, our value systems, our educational systems will all have to be informed by this switch, from the machine age when we tried to design schools to be like factories, to an ecological age, when we want to design schools, and families and social institutions in terms of maintaining the quality of life not just for our species, but for the whole planet."

Bateson, 'Understanding Natural Systems' in Zelov and Cousineau, *Design Outlaws on the Ecological Frontier*, 1997, p84

Ecological design is an emerging philosophy, theory and methodology which seeks both to fit human activity systems within the limits of the ecosphere, and to use nature's patterns of organisation to design human structures, organisations and technologies to promote wellbeing. The key questions are: 'How does it relate?' and 'How should it relate?' So, ecodesign involves ethical issues and judgements. Indeed, some call this whole approach a new design ethic.

Pioneers in the field are using understanding of natural systems to design 'differently'.

"Where do we go to get instructions for this design revolution?… the 3.5 billion-year experiment that produced life."

John Todd, inventor of 'Living Machines'

Ecodesigners then, look to living organisms as the inspiration for thinking about sustainable systems. Let's now look again at this idea of sustainable systems, first met in section 1.2 above.

Activity ➛ ➛ ➛

Here are some common design criteria: function, economic cost (price), form/structure, aesthetics.

Which of these are most important in your view?
What *additional criteria* do you think ecological design should include?

As noted above, sustainability requires us to expand our ‘system of concern’. Ecological design takes into account social and ecological costs. If we consider the recent growth of ethical investment, cruelty-free products, organic products, fairly-traded products, sustainably produced products, and so on, it gives some measure of this new ‘inclusivity’.

3.2 Principles of sustainable systems

If we look at a complex system, be it a person, a family, a community, a city, an organisation, an institution, a farm, a business or an ecosystem, we can discern general principles about its relative sustainability.

Systems specialists talk about ‘system viability’. According to Hartmut Bossel (*1998, Earth at a Crossroads*, 1988, p75) this means a system which “is able to survive, be healthy, and develop in its particular environment”. There is no widely agreed simple checklist here, but the literature indicates the sort of principles or qualities listed below are key to the viable = healthy = sustainable system.

Generally, people are happier and more used to thinking about things such as resources or organisations as just that: ‘things’ that need to be managed and manipulated. But as noted above, from a Linkingthinking point of view, it is better to see them as *networks of relationships*, which together affect the health and viability of the system as a whole. From this viewpoint, sustainability is about supporting healthy *sets of relationships*. This is done through trying to enhance the ability of living systems to sustain themselves; their *sustainability*. Note that there is a time element here – while sustainability is often considered in terms of the future dimension, we humans also like a sense of continuity from the past whether, for example, it concerns the landscape, biodiversity, or customs or traditions. Rapid or chaotic change threatens such continuity.

In more detail, it is a matter of trying to enhance qualities of viability, integrity, and longevity (introduced in Section 1.2 above). These three ideas are looked at in more detail in Part B, ‘Further Investigation’, page 35.

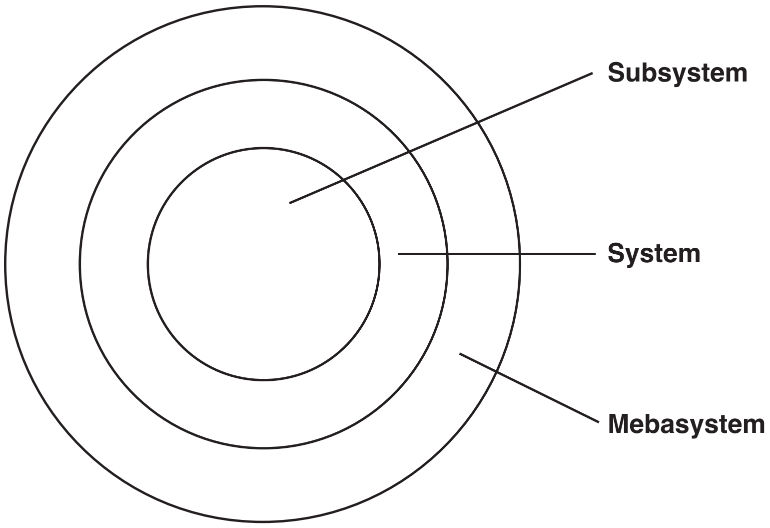
Reflection

These principles are more meaningful when applied to specific examples. Without trying to be too technical or detailed about it, think perhaps, about your family, community, workplace or local economy in these terms – how healthy is it in a broad sense, how well does it work?

Here are some further ideas about organisational principles in a system, which affect its overall sustainability. (In connection with this, you might want to also look at some systems principles in Section 6.2 of Unit 1, pages 24-25):

Interrelation between levels

This is crucial. Think again about *nesting systems*, (met in Section 1.2 above). Any system can be seen as being made up of subsystems and existing within a larger system (metasystem). The system needs to be able to coexist with its own subsystems (lower level) and with its metasystem(s) (higher level). If it undermines the health or integrity of systems at either level, then its own viability is also threatened. (See Unit 4 for more on this.)



If this is not clear, think about the examples in the Reflection box below.

Reflection

Consider here the problems in the relationship between system levels for the following cases:

- the cancerous cell in the body
- the disruptive pupil in the classroom
- a football player who is an individualist rather than a good team player
- the global economy and the global ecological system
- sheep overgrazing and soil erosion in their field.

! Idea

autonomy and integration

We can say that subsystems or parts have tendencies both towards *autonomy* (self-organisation) and *integration* within in a larger whole. Things 'go wrong' when a part exerts too much autonomy or the larger whole asserts too much integration over the parts.

From a systems perspective, each of the subsystems in the above examples is not fitting well within or pressing against the larger system of which it forms a part. Each subsystem or part is asserting too much autonomy. In each case, the viability of both the subsystem and metasystem is threatened.

Activity ➛ ➛ ➛

Think of examples where either the subsystems exert too much autonomy in a system, or the larger system hinders the self-sustaining abilities of subsystems.

In natural systems such as a forest ecosystem or the human body, there is normally a harmony between subsystems meeting their needs and at the same time meeting the needs of the greater whole, resulting in stability, efficiency and resilience in the whole system.

- Self-sustaining systems
  While no system is completely self-sustaining (as any system takes energy and other inputs from its environment) the 'sustainable system' is one that is able to store energy and resources and minimise waste to its environment (metasystem). In everyday terms this means reducing overdependence on outside resources and increasing a system's ability to self-organise, be self-reliant and relatively autonomous. In brief, the less dependent you are on outside resources, the less vulnerable you are to disruption. In terms of developing people's skills, this is the sort of thinking behind capacity-building programmes.
- Stability and adaptability
  This refers to the balance that living systems need to continuously achieve, between maintaining themselves and being able to change and adapt as changing circumstances require. This is a balancing act between the extremes of too much rigidity on the one hand (too much stability and inability to adapt) and too much rapid change on the other (leading to loss of identity, integrity and eventual breakdown). Living systems show a good deal of resilience, but can suddenly break down if pushed too far – for example: too much fishing, too many nutrients washed into a lake, too many stresses on a person, too high debt repayments on a national economy, etc.

It is not easy to apply these principles if we are unused to thinking in this way. It might be easier if we think of what happens to lead to *unsustainability*. For example, currently many individual farms are in trouble with falling incomes, over-control by supermarkets, cheaper imports of produce, as well as criticism regarding food and environmental standards.

Activity ➛ ➛ ➛

How would you interpret these problems using the organisational principles above? Some brief ideas/answers are in the box below. (Of course this is not the whole story but an illustration of the use of systems ideas).

Trouble on the farm

Using the above organisational principles, an interpretation might be as follows:

- *interrelationship?*: farms are over-integrated into national and international metasystems over which they cannot have any influence, including policies which have emphasised productivity above everything else.
- *self-sustaining?*: most farms are highly dependent on outside inputs, prices and markets over which they have no control.
- *stability and adaptation?*: changes in the farming industry (compounded in recent years by food scares and foot and mouth) have been too rapid for farms and farmers to adapt to changed circumstances or they have had to adapt so fast they have lost a sense of continuity with the past.

In response, there is growing interest in farmers' markets and localisation, farmers' cooperatives, organic agriculture and sustainable agriculture, all of which in some way help increase the sustainability of the individual farm, or of the farmers' communities, or of the industry as a whole. The emphasis is moving from quantity (having an abundance of cheap food) to quality (both of the food itself and of the environment).

In general, we need to ask ourselves how far our current production/consumption/and economic patterns are *reducing* rather than maintaining or increasing cultural, social, economic and ecological sustainability, particularly at local level. Some say increasing homogenisation, loss of diversity and of local control in many spheres is evidence of such trends.

Principles of sustainable systems give some pointers towards indicators of systems health, and importantly, also for designing systems that are more sustainable. However, such principles *do not* give us any sort of blueprint from which we can then simply design sustainable communities, sustainable agricultural, business and transport systems and so on.

This can only be done through a continuous learning process, keeping the principles in mind. This is why ecological design and adaptive management (see above) may be seen as two sides of the same coin.

Activity ➛ ➛ ➛

Think about a system (a building, an organisation, a local economy, a transport or food system) which seems to you to demonstrate more unsustainability than sustainability in practice. In what ways is this the case? What ideas or principles would bring the system more towards sustainability?

Compare your answers with some ecodesigners by looking at the next section and at Part B.

3.3 Ecological design skills and principles

Reflection

How would you define 'design'?

According to eco-designers Sim Van der Ryn and Stewart Cowan, design is:

> *"the intentional shaping of matter, energy and process to meet a perceived need or desire."*
>
> Van der Ryn and Cowan, *Ecological Design*, 1996, p8

The sustainability problem arises, the authors suggest, because our patterns of agriculture, architecture, engineering and industry are not compatible with nature's designs. They are, instead, often 'dumb design'; standardised solutions, vastly replicated, which require huge amounts of energy and resources to implement. This is contrasted with ecological design, which is:

> *"Any form of design that minimizes environmentally destructive impacts by integrating itself with living processes."*
>
> (1996, p18)

There is now a growing movement to design for sustainability at different system levels. So, Janis Birkeland (2002) explains:

> *"It is now possible to design products, buildings, and landscapes that purify the air and water, generate electricity, treat sewage, and produce food."*

Others are working on redesigning businesses and economies as a whole to work more ecologically: for example, in their article on *Natural Capitalism*, the authors Amory and Hunter Lovins and Paul Hawken suggest four key strategies to reduce and avoid future mounting social, economic and environmental costs:

- **radical resource productivity/efficiency;** cutting energy and material use by 90 per cent
- **biomimicry;** redesigning production systems to imitate natural systems (zero waste, and waste from one company becoming 'food' for another)
- **service and flow economy;** accent on the product life cycle and meeting customer needs rather than accumulation of goods
- **investing in natural capital;** restoring the health of the biosphere to enable it to provide ecosystem services and resources sustainably.

The principles of design for sustainability can apply – and need to apply – at all system levels to promote the wellbeing of people and environment throughout. For example in:

- **ecodesign** of products for homes and businesses, reducing environmental costs of products and use of toxic materials
- **eco-architecture of buildings,** using green products, increasing efficiency, promoting healthy buildings
- **construction ecology**, minimising waste and impacts in building schemes
- **community design**, reducing environmental impacts while increasing social cohesion
- **industrial ecology**, imitating ecosystem cycles in production processes
- **urban ecology**, reducing transport and energy needs while increasing the sense of community and wellbeing
- **bioregional planning**, shaping lifestyles, production and governance to fit better within the qualities of a bioregion and it's carrying capacity.

(After Janis Birkeland, 2002, *Design for Sustainability*).

So what are the principles? If we think back to the beginning of this unit, sustainability calls for an expanded awareness and ethic and much more inclusiveness than has often been (and still is) the norm.

Activity ➛ ➛ ➛

Imagine you were invited to help a design project focused at one of the levels (above). What would you include in your thinking and approach that might not feature in conventional design? Draw it, or a diagram, and then label it. Can you elaborate any principles from this that you could use to explain ecodesign to others?

Ecodesigners are at pains to point out that there cannot be blueprints (or even 'greenprints') to design issues and problems, as each situation is different. In fact, they point out the conventional standardised 'one-size-fits-all' approach is part of the problem, as it so often ignores local values, culture and environments, whether it be architecture, community building, or economic development.

However, a number of ecodesigners have developed principles at general level which can help inform decisions and be applied and modified according to the specific needs of any particular context.

Part B, 'Further Investigation' summarises a number of these schema.

Activity ➛ ➛ ➛

Consider how far:

- you agree with any of these lists in Part B, and how far they agree with any list or ideas you have generated (above)
- any principles are missing, in your view
- they accord with each other
- such principles appear demonstrated in the world generally, your locality, your household
- they could be better implemented; what would it require to change in this direction?

Activity ➛ ➛ ➛

For any of the sets of principles shown, think of any existing design you know of that illustrates some or all of them. Or, think of a current design challenge, and consider how you would use some of these principles to help you meet it.

For sustainable development to work, it has to take root locally. If the globalised economy is unsustainable and vulnerable, all the more reason to build up the self-sustaining abilities of local communities, as far as possible. Local Agenda 21 has been an important part of this movement since the 1992 Earth Summit. It may be time to redouble our efforts in this direction.

> *"A sustainable community cares for its own environment and does not damage those of others. It uses resources frugally and sustainably, recycles materials,*

minimizes wastes and disposes of them safely. It conserves life-support systems and the diversity of local ecosystems… People can do this if they make it a priority, and if they are given the necessary powers to make full use of their own intelligence and experience."

IUCN, WWF, UNEP, *Caring for the Earth*, 1991, Chapter 7

Activity ➛ ➛ ➛

What evidence is there of moves towards sustainability in your locality? What might be done to increase the strength and effectiveness of this movement?

4 Conclusion

The big question for all of us is: 'How do we need to think, what do we need to know and what do we have to do, to work and live more sustainably?'

We have suggested that part of the answer is a necessary shift towards Linkingthinking:

- perception which is expanded and more inclusive
- understanding which is more connective, and
- practice which is more integrative.

This is a huge, but very pressing challenge, both for individuals and for society. We hope this Unit will help the process.

References

Bateson, M.C (1997) 'Understanding Natural Systems' in Zelov, and Cousineau, *Design Outlaws on the Ecological Frontier*, Knossus Publishing, Philadelphia

Birkeland, J (2002) *Design for Sustainability – A Sourcebook of Integrated Environmental Solutions*, Earthscan, London

Bossel, H (1998) *Earth at a Crossroads – Paths to a Sustainable Future*, CUP, Cambridge

Brown, L et al (2001) *State of the World, Worldwatch Institute report on progress towards a sustainable society*, Earthscan, London

Carley, M and Christie, I (2000) *Managing Sustainable Development*, second edition, Earthscan, London

Carley, M and Spapens, P (1998) *Sharing the World – Sustainable Living and Global Equity in the 21st Century*, Earthscan, London.

De Bono, E (1999) *New Thinking for the New Millenium*, Viking, London

IUCN (International Union for the Conservation of Nature and Natural Resources), UNEP (United Nations Environment Programme), WWF (1991) *Caring for the Earth – A Strategy for Sustainable Living*, IUCN, UNEP, WWF, Gland

Loh, J (2002) *Living Planet Report 2002*, WWF, Gland

Lovins, A, Lovins, H and Hawken, P (1999) 'A Road Map for Natural Capitalism' in *Harvard Business Review*, May-June, Harvard

Lovins, A, Lovins, H and con Weizsäcker, E (1997) *Factor Four – Doubling Wealth, Halving Resource Use*, Earthscan, London

Lyle, J (1994) *Regenerative Design for Sustainable Development*, John Wiley, New York

Meadows, D (1989) *Harvesting One Hundredfold*, UNEP

Meadows, D H, Meadows, D L and Randers, J (1992) *Beyond the Limits – Global Collapse or a Sustainable Future*, Earthscan, London

O'Riordan, T and Voisey, H (1998) *The Politics of Agenda 21 in Europe*, Earthscan, London

Ravetz, J (2000) *City Region 2020 – Integrated Planning for a Sustainable Environment*, Earthscan, London.

Sachs, W (1999) *Planet Dialectics*, Zed Books, London

Todd, N J and J (1994) *From Eco-Cities to Living Machines – Principles of Ecological Design*, North Atlantic Books, Berkeley, CA

Van der Ryn, S and Cowan, S (1996) *Ecological Design*, Island Press, Washington DC

WCED (World Commission on Environment and Development: The Brundtland Report) (1987) *Our Common Future*, Oxford, OUP

WWF (2004), *Living Planet Report*, Gland

Further Investigation

This part includes further notes and references to supplement Unit 3 Part A, Key Ideas. The reference numbers relate to those in Unit 3 Part A.

1 Towards a 'systems view' of sustainable development:

1.2 Systems approaches to sustainability

System definitions

> *"A system is a defined whole whose properties depend on the interaction of its parts. That is, the properties of a system arise from the interrelationship of its parts, and cannot be reduced to the parts themselves."*
>
> Fritjof Capra, 'Ecology, systems and Gaia' lectures given at Schumacher College, Devon, July 1993

A system is:

> *"an interconnected set of elements that is coherently organised around some purpose. That is, a system consists of three kinds of things: elements, interconnections, and a purpose."*
>
> Meadows, *Harvesting One Hundredfold*, 1989

Sustainable systems

A sustainable system reflects certain qualities. The list given in Part A, Key Ideas is shown in more detail here, along with checklist questions:

- Viability – does it work?
  Does it show self-organising behaviour?
  Is it resilient to short-term change in its environment?
  Does it effectively use a throughput of resources to maintain itself?
- Integrity – is it a recognisable, integrated whole?
  Does it maintain itself through feedback loops and communication?
  Is it compatible with the viability of its subsystems?
- Longevity – has it lasted? Is it likely to last? How does it relate to its environment?
  Can it change, adapt and innovate in relation to a changing environment over time? Is it compatible with the viability of the larger systems within which it exists (its environment)?

Here is a different and simpler list, drawn from another source:

- robustness and resilience – how far it can maintain itself in the face of change
- effectiveness – using energy and resources effectively in maintaining itself
- adaptability and innovation – how far it can adapt to long-term changes in its environment
- co-existence – with its subsystems and with its larger environment.

(after Ravetz, 2000)

Use some of these ideas to think about a particular system – how has it reacted to change?

1.3 Unsustainability

Key global reports

The Worldwatch Institute in New York produces two yearly reports which assess movements towards or away from sustainability:

The *State of the World* report, and the *Vital Signs* report. Both are published annually by Earthscan in the UK.

WWF produces a two yearly *Living Planet Report*, which seeks to assess country by country and globally, the rate of loss of natural capital through consumption pressures.

The World Resources Institute together with other international organisations produce regular *World Resources Reports*. See for example: World Resources Institute, (2001) *World Resources 2000-1 People and Ecosystems: the Fraying Web of Life*, UNDP, UNEP, World Bank, WRI.

UNEP also produces *Global Environmental Outlook*. The 2002 issue, GEO-3, is published by Earthscan, London.

1.4 Uncertainty

Three conditions of sustainable development

In a study of progress on Agenda 21 in the European Union, (1998), Professor Tim O'Riordan and Heather Voisey suggest three principles or conditions should underpin 'any serious analysis of sustainable development' and which are mutually necessary and co-dependent:

- continuation, durability and reliability of economic performance
- stewardship, trusteeship and a duty of care towards vulnerable ecosystems and peoples, and to future generations
- localism, democratic innovation, and greater self-reliance in communities (xiv).

This is not prescriptive, but it does indicate an overall direction supporting 'sustainable systems'.

Different perspectives – technocentrism and ecocentrism

To understand different responses to the sustainability question, we need to look at a spectrum of underlying positions. In essence, this comes down to how we perceive nature and the environment. (See Unit 4 for more detail on this).

When analysing different ideas on the environment, Tim O'Riordan realised that it was possible to categorise four fundamentally different positions across a spectrum. His scheme, which was first published in 1987 has been re-interpreted in various ways but has largely been seen as a valid and useful classification.

There are two key orientations or paradigms in this scheme: 'technocentric' (people and technology-centred, or 'anthropocentric') and 'ecocentric' (environment-centred), and these are both divided into subpositions:

Technocentric		**Ecocentric**	
Optimism	Accommodation	Communalism	Gaianism

Technocentric

1 **Optimism** – 'business as usual': resource exploitation, growth oriented

2 **Accommodation** – managerialism/reformism: 'light green' changes in practice and policy; resource conservation and greater efficiency where possible; sustainable growth.

Ecocentric
3 Communalism – radical change: localisation, appropriate technology, low-growth or no-growth with equity, resource preservation where possible.
4 Gaianism – deep ecology position, with nature preservation and restoration given primacy, and a bioregional approach to human systems.

Reflection

Consider where you stand along this spectrum. Do you consider it valid? How far is a deep ecocentrism possible?

O'Riordan suggests that while many individuals' or organisations' views do not neatly fall within one of these suborientations, the model does allow a useful key to underlying shifts in the debate. The author has modified it over time to show that Western societies have shifted from the first optimist position to the light green reformatory position, and that this in itself is a significant shift of attitude The real issue is whether a further shift, in the pursuit of 'the sustainability transition' is possible as it involves changes in the prevailing worldview.

This brings us back to the basic *assumptions* we have about our world (see Unit 1), our fundamental *metaphor* about the nature of the world (whether mechanistic or organic – see Unit 2), and whether our *approach* to issues is one of intervention and control or of participation and 'working with' the grain of things.

Regarding sustainability, since the first Earth Summit conference of 1992, the basic division has been between those advocating growth-centered 'technological sustainability' (sustainable growth), and those advocating people/environment centered 'ecological sustainability' (sustainable development); complicated by the fact that those using the term 'sustainable development' often meant 'sustainable growth'. David Orr sums up the situation thus:

> *"These two perspectives are partly complementary, but their practitioners tend to have very different views about the extent of our plight; technology, centralised power, economics and economic growth, social change and how it occurs, the role of public participation, the importance of value changes, and ultimately very different visions of a sustainable society."*
>
> Orr, *Ecological Literacy: Education and the transition to a postmodern world*, 1992, p24

Reflection

How far do you agree with this analysis? Is it a question of either/or? Are these two views irreconcilable – or is there some ground for resolution?

This issue of how far these views can be resolved is an open question that is now being played out. However, new interest in, for example, the use of high technology in ecological design, and the reorientation of business through 'Natural Capitalism' is evidence that there may be more common ground than O'Riordan's spectrum model would suggest. As David Orr comments, these two views are 'partly contesting and partly complementing'.

Michael Carley and Ian Christie suggest that the two mid-positions of O'Riordans model offer a way forward:

> *"…recognising the need for sustainable growth to improve human development and environmental protection in the poor world, and the need for radical policy change and movement towards steady-state… economic development in many aspects of the industrial world's consumption and production patterns."*
>
> Carley and Christie, *Managing Sustainable Development*, 2000, p63

If we take the Earth as a whole, then as *Caring for the Earth* suggests:

> *"Sustainable growth is a contradiction in terms: nothing can grow indefinitely."*
>
> IUCN. UNEP, WWF, *Caring for the Earth*, 1991, p10

Much of this debate hinges on what we include in the notion of sustainability. This brings us back to the question of our 'boundaries'. We have suggested that sustainability implies extending our perceptual boundaries to become more inclusive, that we need to look at 'whole systems'.

There is an obvious problem with this: if we include 'everything' in our thinking, we cannot cope with the largeness of it all. It also raises political and ethical issues. How far should our boundaries extend, who decides and on what grounds? These are some of the problems of holism. It is easier to look at the detail and isolated parts than the big picture and complex relationships, which is perhaps why (as examined in Unit 2) we tend to be poor at dealing with complex problems such as those associated with sustainability.

If you want to look at the whole issue of contesting paradigms further, see the activity 'Shift that paradigm!', on pages 11-12 of the Toolbox.

Getting a handle on it all…

2.2 Carrying capacity

WWF's *Living Planet Report* (2002) warns that we must collectively make a number of radical shifts to make sustainable living a reality. Government, business and industry, and all people need to:

- adapt the production systems that provide us with food, energy, raw materials and water, so that they use resources more efficiently;
- consume our natural resources more carefully and efficiently;
- minimise consumer waste and maximise recycling;
- eliminate the use of toxic chemicals;
- close the gap in consumption between rich and developing countries;
- provide health care and birth control facilities for all; and
- protect, manage and restore the natural ecosystems (such as croplands, forests, grasslands and river basins) upon which we and future generations depend."

Of pressing importance is for governments to move energy supplies away from fossil fuels – oil, gas and coal – and promote energy-efficient technologies, buildings and transport systems. At the same time, we must more and more ensure that the polluter pays the full environmental costs of food, materials, water and energy.

3 How can we design for greater sustainability?

3.3 Ecological design skills and principles

Some versions of design principles follow. As space does not allow in-depth discussion, it would be a useful exercise to discuss what you feel these mean or imply, and/or develop your own principles. More about such principles can be obtained by going to the original sources – or checking ‘ecological design’ on the internet.

‘Biologic’

1 Use resources on a sustainable basis
Using only the ‘interest’ on our ecological capital without using up the capital.

2 Use the right tool for the job
We need to use many solutions for many-sided problems and also acknowledge that what’s right in one instance may not be elsewhere.

3 Understand basic concepts such as cycles and flows
Work with what’s really there.

4 Carefully monitor and streamline what goes in
in order to minimise unwanted waste and unintended effects.

5 Develop the habit of tracing the origins and future route of each physical interaction
to minimise the effects in the future.

6 Acknowledge the uniqueness of each location
The qualities of a particular place make it suitable for some uses but not others.

7 Use the simplest process or product to do the job
so that the environment benefits.

8 Use software (information) rather than hardware where possible
so reduce environmental impact.

9 Use design solutions that accomplish three or four things at once
For example, planting that conserves water, reduces erosion, soaks up CO_2, and has a cooling effect in an urban landscape.

10 Account for costs with the full lifetime of the product in mind
so that full costs – on health, quality of life, environment, etc – are included.

Based on David Wann, *Biologic*, 1990.

Emerging precepts of ecological design

1 The living world is the matrix for all design.
2 Design should follow, not oppose the laws of life.
3 Biological equity must determine design (the just access and distribution of resources).
4 Design must reflect bioregionality.
5 Projects should be based on renewable energy resources.
6 Design should be sustainable through the integration of living systems.
7 Design should be coevolutionary with the natural world.
8 Building and design should help heal the planet.
9 Design should follow a sacred ecology.

Todd and Todd, From *Eco-Cities to Living Machines*, 1994

Permaculture principles

Permaculture is an international movement, originally based and still centred on sustainable food production, but increasingly also addressing other human needs through design. The following material is drawn from the Permaculture website: www.permaculture.org.uk

According to permaculture, 'if we want to design sustainable systems, then the best model we have to observe and learn from is nature itself'. The following principles are simply a conscious application of lessons learnt by observing natural systems.

- work with nature, not against it
- least effort for maximum yield
- everything cycles
- yield is unlimited
- look for beneficial functional relationships
- the problem is the solution.

> *"Permaculture is a term coined by Bill Mollison and David Holmgren in the 1970s to describe a sustainable lifestyle centred around a convivial system of beliefs and ethics, based on the observation of nature and lots of common sense. The word is derived from 'Permanent Agriculture' and, since we need a future if were going to call anything permanent, 'Permanent Culture'. Permanent in this context means 'sustainable', 'durable', definitely not 'unchanging' or 'static'. Permaculture offers a framework, a way of thinking that we can use to adapt our whole approach to life, it concerns us with consciously applying, sane, ethical, and environmentally sustainable solutions to addressing all our needs."*
>
> Graham Bell, permaculture author and teacher.

The Natural Step

This is a systems-based planning methodology that stipulates four 'system conditions' through which organisations and businesses can work towards becoming more sustainable. The principles are based on scientific research. The Natural Step is an international movement that works particularly with businesses.

System condition 1: Substances from the Earth's crust must not systematically increase in nature.
This means that, in a sustainable society, fossil fuels, metals and other materials are not extracted at a faster pace than their slow redeposit into the Earth's crust or their absorption by nature.

System condition 2: Substances produced by society must not systematically increase in nature.
In a sustainable society, substances are not produced at a faster pace than they can be broken down in nature or redeposited into the Earth's crust.

System condition 3: The physical basis for the productivity and the diversity of nature must not be systematically diminished.
In a sustainable society the productive surfaces of nature are not diminished in quality or quantity, and no more is harvested from nature than can be recreated.

System condition 4: We must be fair and efficient in meeting basic human needs.
In a sustainable society, basic human needs are met with the most resource-efficient methods possible, including a just resource distribution.

References

Carley, M and Christie, I (2000) *Managing Sustainable Development*, second edition, Earthscan, London

IUCN (International Union for the Conservation of Nature and Natural Resources), UNEP (UN Environment Protection Agency), WWF (1991) *Caring for the Earth – A Strategy for Sustainable Living*, IUCN, UNEP, WWF, Gland

Meadows, D (1989) *Harvesting One Hundredfold*, UNEP

O'Riordan, T and Voisey, H (1998) *The Politics of Agenda 21 in Europe*, Earthscan, London

Orr, D (1992) *Ecological Literacy: Education and the transition to a postmodern world*, SUNY Press, Albany

Ravetz, J (2000) *City Region 2020 – Integrated Planning for a Sustainable Environment*, Earthscan, London

Todd, N J and J (1994) *From Eco-Cities to Living Machines – Principles of Ecological Design*, North Atlantic Books, Berkeley, CA

Wann, D (1990) *Biologic*, Johnson Publishing Company, Boulder, Colorado

WWF (2004) *Living Planet Report*, Gland

linkingthinking

New perspectives on thinking and learning for sustainability

A WWF Scotland publication

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Perspectives

unit 4

linking thinking

New perspectives on thinking and learning for sustainability

Linking(thinking) everyday life to natural systems and resource use

by Paul Maiteny

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unit 4 part A

Key Ideas

This unit is part of the Linkingthinking suite of materials that seeks to help generate new perspectives, introduce systems ideas and develop relational thinking skills which are broadly applicable to different situations and contexts.

Aims of this unit

- **to expand and deepen understanding of human dependence on ecological systems' natural resources**
- **to demonstrate the impacts of culture and beliefs on natural systems**
- **to show how sustainable development relates to everyday life and experience**
- **to introduce some key Linkingthinking concepts and methods.**

1 Linking human beings into ecological systems and sustainability

How does 'sustainability' of nature, and the resources we draw from it, link in with everyday life? This unit uses Linkingthinking to help address this question, suggesting that it is rooted in the habit of viewing ourselves (and all that we do) as somehow distinct from nature and other living beings.

Like other species, we've even given ourselves a scientific name, *Homo sapiens*.

Activity ➛ ➛ ➛

Think of two species of animal and summarise their characteristics. For example, the familiar mallard duck you see in ponds is called the *Anas platyrhynchos*. It has a green head, feeds by dabbling and seems to be quite bold in that it readily takes advantage of being fed by humans. What particular qualities, skills and features do you think the species *Homo sapiens* has? What does the scientific name for this species mean? Do you think that collectively, we live up to the name we have given ourselves? Do you think you live up to it? How do you think we would need to change to live up to our name properly?

If what we are and what we do is as natural as any other species, why are we so worried about 'sustainability' and destroying our 'life-support systems'? Human behaviour, values, culture, society, psychology, desires, demands and so on are blamed for damaging natural processes but aren't they natural too – just particularly complex dimensions of the ecosystem? Wolves, bees and chimpanzees also have their own 'societies'. All species have behaviours through which they strive to satisfy their desires and demands. Why should we be any different?

Activity ➛ ➛ ➛

Part 1

Are humans any less 'natural' than other species? If so, what makes us different? If not, what makes us the same?

Ways in which humans are different from other animal species	Ways in which humans are the same as other animal species

Do you think humans are more similar to or more different from other animals?

Part 2

Whether we're more or less different, we do have a stronger influence on nature than other species. So what qualities and capacities make us able to do this? Are these natural?

Special qualities and capacities that allow us to influence nature	The benefits these capacities and abilities bring for us	The impacts these qualities and capacities have on nature	How these impacts on nature 'bounce back' to affect us again

Part 3

Think about something that we humans are doing in the world that really worries or upsets you. Keeping this in mind, ask yourself: why do we choose to do these things? What motivates us to behave in the way that we do? Is it to do with politics, economics and business? Perhaps it's technology? And/or our intelligence, ingenuity and inventiveness in general? Or is it more to do with our beliefs, aspirations and priorities about what is most important in life? (Perhaps because we use and apply our intelligence in line with our values.) And how important are our feelings and emotions?

Part 4

Roots and branches: a tree of causes and consequences
(Note: there is a template for a tree of causes and consequences on page 26 of the Toolbox.)

- Create a diagram, using words and pictures, to trace the causes of the problem you have identified.
- Place the problem in the centre of the page.
- *Below this*, and linked by arrows, say what you think are the causes of the problem.

Activity continued ➛ ➛ ➛

- Then ask yourself: 'What causes *these* causes?', linking them with arrows.
- Again, ask: 'What causes these causes?'
- Continue until you can't think of any other underlying causes of the problem.
- Like this you will finally reach what you think are the *root causes* of the problem. Link *any* cause-effect relationships you see with arrows (horizontal as well as vertical).
- Now do the same above your problem, but this time asking what are (or will be) the effects or consequences of this problem if it continues.
- Eventually you will arrive at what you think are the ultimate consequences of the problem (and therefore also of its root causes).
- *Don't forget to include those aspects that you can't see*. Many powerful things like feelings, ideas, values, expectations, priorities, emotions, decisions and so on are invisible. You can only see their consequences further down the line.
- What is the 'bottom-line'? What ultimately needs to change to halt the damage that's worrying you? How do you think it can change? Who can make a difference in changing it? What part do you play in this?

1.1 Linkingthinking is about human ecology

Ecology is the study of the interrelationships between living things with each other and their contexts.

In the last activity, you applied some Linkingthinking to unpack some interrelationships of our *human* ecology. All the things we do, and all the effects they have on society and the rest of nature, are part of our human ecology. If we really want to face up to the problems we are creating, we need to look at these *human* dimensions of ecology, not just the *non-human* aspects that we so often see as separate from us. As you found in the last activity, you do have an *effect* on things around you, but perhaps you also found that this actually makes you *part* of the overall process of interrelationships, not separate from it?

Human ecology is to do with our behaviour, society, culture and even our psychology. *Behaviour* – individual and collective – is what directly impacts on natural systems. But *it is our cultures – beliefs, values, purposes, priorities and so on about what's most important to us – that shape our behaviour.* Seen like this, environmental problems are *symptoms or effects* of what human beings choose to do. We could even say that the real *root* problems are not so much to do with the environment '*out there*' but with human values and aspirations '*in here*' (pointing to myself!). They're problems with what we want, why we want it and our lack of awareness about how this impacts on the ecological system that we're part of and depend on.

Environmental problems therefore have cultural dimensions and can be defined as:

> ***"any change to the environment that is caused by humans, is damaging to the health of humans, nature and ecological processes, and which is seen as unacceptable by a group and/or individual."***

Go back to your causes and consequences tree for a moment.

Have you included any causes that are '*in here*'?

(Note: see 'Dimensions of human causes of environmenal problems' on pages 28-29 of the Toolbox.)

1.2 Linkingthinking helps us understand the ecology of cultural causes

This unit considers the influence of culture. Often overlooked, it is nevertheless an extremely important underlying cause of environmental (and most other) problems.

Activity ➛ ➛ ➛

What, to you, is culture all about? What is the purpose of it? What culture(s) are you part of (there's probably more than one)? Make a list of some other words that come to mind as you think about culture in general, and the particular cultures that you come from.

The word '*culture*' describes the meanings, values and beliefs that are shared by any particular group of people and shape their individual and collective behaviour. Culture is like a screen or a window though which people see the world, but it is one of which they are mostly unaware. It allows us to make sense of the world, each other, and of relationships of all kinds, and to communicate with each other in a meaningful way.

Human ecology, especially the *cultural* part of it strives to understand human relationships with the environment in *all* its dimensions (as shown in the activity, 'Dimensions of human causes of environmental problems' on pages 28-29 of the Toolbox). Human (and cultural) ecologists do not separate out the 'human' aspects from the rest of ecology. (As we'll see later on in the unit, this is different from what economists do.) They see everything as linked into one system of interrelationships, including human beliefs, values, desires and so on.

For example, all humans need to eat and consume. This involves taking resources from the non-human parts of nature. We develop technology that helps us exploit nature more efficiently. What we do and how we do it is determined by cultural choices (of belief, priority, etc). How much we consume and why is also a cultural choice. The effects our culture and behaviour have on nature, in turn, affect us.

With cultural ecology, you have to ask what motivates particular people (or groups) to desire particular things rather than others, and what the effects of producing and consuming them are on the wider life-support systems that everyone depends on.

Why, for example, do Western meat eaters prefer to eat cows and pigs whereas traditional Hindus won't eat cows, and Jews and Muslims won't eat pigs? Why are some people so much more concerned than others with the ecological and social consequences of their actions?

These are the sorts of questions cultural ecologists try to understand, because they are ecological questions. Other approaches to resource use and environmental problems, such as conventional economics for example, tend to ignore them (though these perspectives are, of course, also part of cultural ecology).

The culture that is now spreading throughout the world (that is '*globalising*') is based on traditional economics, not cultural ecology.

Activity ➛ ➛ ➛

Have a brainstorm (with a partner or as a group) to identify the features of the globalising culture? What are its priorities, values and beliefs? What are the effects it has on other people and on nature, both locally and globally?

People are often not aware that they are part of a culture. Are you? Do you see the way you do things, the way you live or what you believe simply to be the obvious right and normal way of doing things? This is a cultural view. It is the culture 'inside' you. Other people from different cultures see the world in a different way but are often just as convinced that other ways are wrong or strange. Similarly, people often aren't aware that all culture is part of a wider ecology.

Just imagine...

Activity ➛ ➛ ➛

…imagine yourself in the following worlds:

- Where no one speaks your language and you don't speak theirs.
- Where the colour red is a symbol for 'go' and green means 'stop'.
- Where everyone cooperates rather than competes with each other.
- Where everyone's priority is to make sure everyone else has enough before trying to get as much as possible for themselves.

How would you *feel* living in cultural worlds like this? How would you communicate? How would you try to get used to it?

Discuss with a partner what it would be like to live in such cultural worlds. How 'sustainable' would it be? How could you learn to be happy and feel at ease with yourself? If you found it unbearably boring and/or confusing, what would you do?

1.3 Do we have choices? Cultural pressures on sustainability

Even if we are not aware of it, we – as individuals and collectives – *choose* the values, beliefs and priorities we live by. We tend to forget – or ignore – that these choices are part and parcel of the overall ecology of 'Planet Earth' and have impacts upon it. Our ability (actually necessity!) to make complex choices is what distinguishes us most from other species.

And, considering our environmental predicaments, we have some important choices to make! Choices about whether we want to behave in ways that support our long-term sustainability and survival, or to sacrifice this in favour of short-term wealth and consumption. Our current problems are already, in fact, the result of choices we've made up to now. The future depends on our present and future choices.

We often hear that 'it's human nature to be greedy'. Well, this may be true. But it would be unwise to forget that many other things are also human nature… our ability for choice itself, for example. So is our ability to be aware of what we are doing, to know the consequences of our actions and to *choose to do things differently if we want to.*

Activity ➛ ➛ ➛

In pairs, or as a group, brainstorm to find as many things as you can that you believe to be 'human nature'.
What makes them 'human nature'?
What are their opposites?
Are these 'human nature' too or not? Why/why not?

1.4 Recapping on 'sustainability' and 'development'

Development is about beliefs and ideas concerning how to achieve human betterment and wellbeing. It's therefore cultural. Almost everyone aspires to some form of this. However, it's unwise to think that material (ie economic) growth, accumulation and consumption are the only – or even the best – ways to achieve it as so many people seem to do today. Others believe that spiritual and psychological development is more satisfying and long-lasting. All these are *cultural ideas, beliefs or theories* about how we can move towards satisfaction, fulfilment and ultimate happiness. The proof as to how successful we are in achieving our aim is our actual experience of life. Rather than believing what others say, we need to ask ourselves about the extent to which the ways we live make us feel satisfied. If a person or group gets richer and richer materially, do they inevitably have a greater sense of wellbeing and happiness? As the old saying goes: 'the proof of the pudding (in this case, the belief) is in the eating (the experience)'.

In this unit, sustainability is seen as being about the visible physical and social aspects of the environment – what is physically and socially needed for individual and collective survival. It emphasises that, whichever route to development and wellbeing we choose, if we undermine the basic ecological and social processes that support human life on Earth, it will inevitably be temporary.

Sustainability is a question of necessity, not of belief: no sustainability, no people!

Activity ➛ ➛ ➛

- List five things you want that you think will make your life more satisfying at the present time.
- For each item you have listed, give three reasons why you think it will improve your life.
- For each item, list two effects that the production of that item has had, or will have, on the natural environment or on other people in any part of the world.
- Compare each effect with your reasons for wanting the item they are associated with.
- Ask yourself: which effect is likely to be longer-term – the reasons I want the item or the ecological and social effects of the item? Which is more important to me – the shorter or the longer-term effects?

Reflection

If we want to 'develop' in ways that, in the long term, undermine the foundations that support future survival, is it logical to call it 'development'? Is development that undermines life-support systems not a contradiction in terms? If so, why do we continue to believe it is possible?

2 'Resources' you depend on

2.1 The origins of the word 'resources'

As with culture, we often take words and language for granted. We use them so habitually that we rarely stop to think about what they *really* mean.

It can be fascinating – and a real eye-opener – to search out the original meanings of words – their etymology. Meanings can change over time, so etymology can give us clues about how our thoughts, values and priorities differ from those of our ancestors.

Take the word 'resources'…

Activity ➛ ➛ ➛

For five minutes, on your own or with someone else, brainstorm all the possible meanings that could be attached to the word 'resources'. What does the word mean to you?

Compare notes with someone else, then look it up in a dictionary that gives the etymological origins of words.

Here is what one etymological dictionary says.

- "The word 'resource' has two parts – 're' and 'source'. It comes from Old French and Latin where '*re*', means 'to come back again' and 'source' comes from '*sourdre*' and '*surgere*' which literally mean 'to rise, or spring forth'. The original meaning of the verb to re-source was therefore 'to rise, or spring forth, again'; or 'to resurrect'.
- As a noun, it implies something that can come back or, to think of it another way, something that is *re-newable*.
- Nowadays, people often think of two types of resource: renewable and *non*-renewable. Like 'development', the idea of a '*non*-renewable resource' could be a contradiction in terms."

Reflection

How closely did your ideas about 'resources' match with the original meanings? Did you think about both parts of the word, or only the word as a whole? Why do you think that is?

Now compare your ideas with a modern day definition of 'resource' from *Webster's Dictionary*:

> *"…a source of supply or support; an available means; a natural source of wealth or revenue; computable wealth; and a source of information or expertise; something to which one has recourse in difficulty."*

Reflection

How is the modern meaning different from the original meaning? What is missing and what has been added?
What clues do you think these changes give us about how people's values and priorities in connection with 'resources' have changed over generations?
Do your thoughts about 'resources' come closer to the new or old definition? Why do you think that is?

Reflection

Did you notice anything about the modern definition?

It leaves out the etymology relating to renewal and rejuvenation. *Re*-source has become the same as '*source*', as it's simply something that is there to be taken and used without a second thought about how it can renew itself. In the modern meaning, it's not important whether it does or does not.

What do you think the change in meaning suggests about how our values have altered over time? What sort of effect might that have had on how we treat natural resources?

What do you think a society was, is or would be like where people believe that:

- *all* resources are infinite?
- *all* resources are renewable?
- *all* resources are limited but some are renewable and some are not?

2.2 What does money do to resources?

Throughout Linkingthinking we have been stressing the importance of noticing how we all see things, and what our *values and beliefs* are. This is because when human beings see and value things in certain ways, we *treat* them that way too. If we see resources as infinite, in our minds it 'allows' us to exploit them as if they really are infinite – as if 'there is no tomorrow'. This applies to how we view the rest of nature too.

When money enters the picture, and resources are valued only in monetary terms, the situation becomes even stranger. Money seems to make actual resources disappear altogether.

Activity ➛ ➛ ➛

Now you see it, now you don't: how money 'magically' hides resources
Note down three things you like about money.
Write at least half a page about what you think money is. Include what you think the function of money is and what its relationship is to resources.
Compare your ideas with someone else's.

In the past, when people consumed less, and there were fewer people too, there was much less demand on resources.

Under these conditions, it is easy to see why resources might have seemed infinite and easier to find (except, of course, things that were intrinsically scarce like gold, diamonds or truffles).

Today, there are billions more of us on the planet, all wanting to consume more than our ancestors, and from natural resources that are constantly diminishing.

Yet, somehow, it still seems that as long as we have enough *money* (the 'representative' of resources), we can have whatever we want and as much of it as we want. Resources are now all seen in terms of money, not in terms of the actual scarcity or value of the natural resources themselves. The same is true for 'human resources' like labour.

Not only that, but everyone looks around for the best 'bargain', the cheapest deal (in money of course).

Cheapness creates the illusion that resources are plentiful and that we can consume as much of them as we like – as long as we have money to pay for them. Money appears to make all things the same and comparable to every other thing.

Reflection

List as many things as you can whose value can be measured in money.
Now list those things whose value cannot be measured in money.

If money is the perfect way of measuring the value of everything then, logically, if something is rare, it ought to cost more – like rare plants and animals, oil and, increasingly, essentials like air and water as they become more poisoned by chemicals and industrial activity.

So doesn't money make sure that things don't disappear?

The catch is that, as things get rarer, they also get more *prestigious and desirable* in a consumer culture. As long as you have enough money, you can buy technologies like water filters and special products like mineral water imported from elsewhere (using another resource – fossil fuel oil). If they can, people will pay to live where the air and water are of good quality.

Demand for a resource also puts the price up so that, as time goes on, even the essentials of life become available only to those people who can afford to buy them. In this way, conflicts over money and economic inequalities between the rich and the poor are actually conflicts over access to resources. The richest fifth of the world's population consumes about four-fifths of the world's resources, leaving one-fifth for the poorer four-fifths.

In an interconnected, systemic world, everything has a value, even if no price has been attached to it. On the other hand, the globalising, monetarised culture that we live in, encourages us, as the writer Oscar Wilde put it, "to know the price of everything and the value of nothing". In our world, money has become the resource *par excellence* – the only one that really matters, apparently. However, as another saying goes, 'you can't eat money'. The real resources are what it represents.

2.3 Types of resources

Until now, we've looked mostly at physical *natural* resources. There are other types too.

Reflection

What other types of resources have already been mentioned in this unit?

Hint: Some resources come directly from nature. Others are used to *transform* natural resources into products and services. Yet others are used by people to *exchange* (or *trade*) different types of resources, products and services.

The next activity helps you to think through what types of resources go into making what you consume, how much you depend on them in your life, and how far the effects of your own day-to-day desires, decisions and actions ripple out (or link) all over the world.

The activity is a variant on *life-cycle* (or *source-to-sink*) diagrams (see the **Toolbox**, page 50.) It also has similarities to the causes and consequences tree that you did earlier. It can be used to track where many products and services come from, and end up.

Activity ➛ ➛ ➛

Where things come from, and where they end up

- Take a large sheet of paper and some drawing materials.
- Think of one of your favourite things, a product of some kind – perhaps a food, object, technological device or piece of clothing.
- Draw and/or name the item in the middle of the paper and put a dotted line around it.
- Divide the rest of the paper around your item into six sections, three on the left and three on the right.
- In the top left-hand section, note down or draw all the *materials* you can think of that have been *involved in producing that item and transporting it to you*. Include any environmental impacts. (Hint: think about what it's made of, fuels used to power machines, materials that have gone into making it, buying it, selling it, transporting it etc, where all the different materials and fuels come from originally. Do you think they all come from the same place? Think about effects on land, forests, animals and plants, water, air, atmosphere, etc.)
- In the bottom left-hand section: write the *human activities* that have been *involved in producing* the item and *getting it to you*. (Hint: think of the work and time that have gone into making it, buying it, selling it, transporting it, etc; where the workers live, what life is like in those places. What does the label or product information tell you? What do think it doesn't tell you?)
- In the middle left-hand section: estimate what percentage of the price you paid for the item you think has gone to each of the people carrying out the activities in the bottom left section. (For example, the retailer, the wholesaler, the owners of the factory and/or plantation and/or farm, the producer[s] [ie the person or people who actually extract and/or grow the raw materials, and the people who make the final product].)
- Also in the middle left-hand section: calculate what percentage of the price you paid has gone into paying for the environmental effects of making the products you identified. (Hint: you could consider the costs of the effects of extracting or harvesting materials, transporting both them and the finished product.)
- In the middle right-hand side of the paper: write down all the things you can think of that will happen to this item after you have finished with it. What will be left after you have consumed or otherwise finished with it and where will it end up? How is it dealt with? What sort of processes are involved?
- On the top right-hand side: note the physical and environmental consequences of using and disposing of the item both locally and further afield.
- On the bottom right-hand side: note the social and economic consequences of using and disposing of the item locally and further afield.
- Discuss what you've found out with others.

In the last activity you have identified many different types of resources on which we all depend. Let's have a closer look at them now. As you go through, you could indicate on your diagram which type of resource is which, and add any that you overlooked.

Activity ➛ ➛ ➛

Looking at all the resources you've listed above, try to identify any features that different resources share, and those that distinguish them from others.

You could ask questions like:

- Where do they come from?
- Can they be used up or renewed?
- Do they represent ('stand for') other types of resources?

2.4 Business sustainability and sustainability in business

Activity ➛ ➛ ➛

Give three good reasons why you would go into business.
How would you achieve that purpose?
What needs to happen for a business to be sustainable in the long term?
What do you think the effects of working towards your purpose would be on the sustainability of other people, natural resources and the natural environment in general?

People have become millionaires by selling (ie transforming into money and profits) all of the following combinations of natural and human resources:

- extracting fossilised plant matter from deep underground where it has been compressed over millions of years (oil, coal, gas) and processing it into fuel, plastics, etc
- cutting down forests that have evolved over millions of years and processing the trees into timber, packaging and paper
- extracting essential oils from aromatic plants and processing them into perfumes, shaving creams and skin moisturisers
- extracting minerals and metals from the ground and manufacturing them into agricultural fertilisers, pesticides, tools, machines, and weapons of mass destruction
- growing plants and animals organically or with chemicals...

...the list goes on and on...

The purpose of business is to create products or services at the lowest cost and sell them for the highest price possible to achieve maximum profit. In pure business, the less spent on natural and human resources, the greater the profits.

In purely financial terms, it's 'good business' not to value social, emotional and other human costs of low wages or bad conditions, nor the ecological costs of natural resource extraction and pollution. If you were to do this, your overall financial costs would go up and you would make less profit. It would also reduce competitiveness in relation to others who produce similar products without taking these costs into account.

The more profits that are made and accumulated as *financial capital* from transforming natural and human resources into money, the more money can be invested and used to make more money.

2.5 Ecological 'resources' or natural life-support systems

Activity ➛ ➛ ➛

Make a list of what you think is *absolutely vital* for human survival.

Ecological resources are the least evident type of resource, but they are also the most vital. We depend on them for our survival. They are literally our *life-support systems*. They have always been there and we've got into the habit of expecting that they always will be. We take them so much for granted that we hardly even think of them. Nevertheless, we do still damage them.

Ecological life-support systems are enormously complex webs of interrelationships that work together to keep things liveable, healthy and sustaining on 'Planet Earth'. They include relations between plants, animals and ecosystems, food chains, climate and weather patterns, soil fertility and recycling of dead matter and excrement (not to mention the rubbish we all produce). They are the processes that allow flow resources to renew themselves. Everything – but everything – is involved in this amazing planetary system, including things that could potentially damage it.

Reflection

Which aspects of our lives as human beings do you think are part of the overall planetary ecosystem?

All human beings – along with our values, priorities, and behaviours – are also a part of this overall system. Our species, *Homo sapiens* (which means wise humans), is having a more significant ecological impact than any other species; so much so that more and more evidence suggests that we are actually putting our own planetary life-support systems in *jeopardy*. This isn't a very wise thing to do.

Our influence is so powerful that it is even altering the way sun, wind, and ocean energy circulate on the planet. Our high consumption of fossil fuels – oil, coal and gas – pumps out vast quantities of carbon dioxide and other 'greenhouse gases' which have the effect of warming up the average temperature of the planet. The result is *climate change*.

Reflection

We often hear that renewable resources and technologies hold the key to stopping our onslaught on our life-support systems.
What do you think about this?
What sort of energy do renewables like wind, solar and wave power produce?
What are their disadvantages?
What renewables are available for cars, for other mobile technologies and for substituting the oil that's used for plastics?
What else needs to change apart from technologies, if anything?
Do you think that we will use the new technologies and resources in ways that are different to how we use existing technology? How could it be different?

Even if energy is *generated* renewably it may not be used in sustainable ways. Renewables could be used to over-exploit other resources like water. In the desert, solar panel powered pumps are sometimes used to extract water from deep beneath the ground many times faster than it is replenished. It is possible to turn the desert green, it's true. And it's marvellous while it lasts. But eventually the water must run out, by which time knock-on social effects have taken place – people will have become accustomed to a water-rich lifestyle and it will be hard for them to give it up.

By contrast, each of us in the rich world flushes 30 per cent of the water we use down the toilet every day. If behaviour and values continue as they are, the pressures brought on by shortages of water and other resources are bound to lead to conflicts, social problems and resource wars. Yet much of the shortage arises from people wasting and using too many resources without thinking twice.

Keep your Linkingthinking eyes, ears and brains on the news for signs of these conflicts.

Linkingthinking shows that everything is connected.
Learn to Linkthink and you'll see.

3 Ecological dependence

Only through Linkingthinking can we understand how we are related to other aspects of ecological systems, locally and globally. It should be clear by now that we are dependent on them and could not survive without them.

3.1 The rules of mutual dependences

Activity ➛ ➛ ➛

How dependent are you?
Use the table below to help you identify as many things as you can that you depend on in your life.

I depend on	I depend on it for	And without it I could not…	It, in turn, depends on…	I take care of it by

It sounds strange and obvious to say that you depend on your body, so it's important to keep it healthy. Yet we so rarely think about it. Sickness happens when the parts of your body stop working together for the benefit of your body as a whole. This might happen because of viruses, bacteria, pollution and other 'diseases' entering your body from outside, because your body is exposed to extremes such as not enough healthy food or water, or because your body malfunctions for some internal reason.

It's similar with the planet. When the parts of it needed to function properly are disrupted, the planet's health as a whole can be disrupted.

Reflection

Did you know that the words 'health', 'healing', 'holistic' and 'holy' all come from the same Old English word meaning 'whole'?

The diagram below summarises how living systems are dependent on each other. It also shows how Planet Earth is a complex network of mutual dependences. We could say that the various types of life on Earth contribute to making the Earth itself like one big living being. Just as the organs in a body interact to make the whole body possible, so the living beings of Earth interact to keep the body of Earth alive. The name 'Gaia' is sometimes given to this body. Other times, it's simply referred to as the 'Earth System'.

The parts depend on the whole (their 'environment') and the whole depends on the parts (its 'organs') operating properly in relation to the whole. If some parts start behaving in ways that disrupt other parts, eventually the whole itself will be disrupted. In turn, the parts will suffer, including the part that started the problem.

A basic picture of dependent physical relations

system/environment of living parts: carnivorous and omnivorous animals, including humans

↓ **DEPEND ON**

system/environment of living parts: herbivorous and omnivorous animals, including humans

↓ **DEPEND ON**

system/environment of living parts: photosynthesising plants (and detritovores)

↓ **DEPEND ON**

environment of non-living parts: sunlight,soil, rock, water, air

(based on Anthony Wilden's book, *The Rules Are No Game*, 1987)

3.2 Dominance, extinction and sustainability

Dependences are necessities
If they all broke down, life itself would break down.

The Inevitable Extinction Rule:

> ***'the system that destroys its environment destroys itself."***
>
> Wilden, *The Rules Are No Game*,1987

To test for dependences that are necessary to avoid 'The Inevitable Extinction Rule', imagine obliterating one or other level of this diagram and see which other levels are also obliterated. Try it with yourself to see what you can do without and what you need to survive. You can also do it to test for what you need to support your lifestyle – to distinguish between your actual *needs* and your *wants*.

Activity ➛ ➛ ➛

Go back to your table of dependences above and adjust it if you think you need to. Add a column to describe things that your lifestyle depends on but not your actual existence and survival. Do you consume a lot more than is necessary for your actual survival? Why do you do that?

When one part of a system overwhelms the others that it depends on, it will inevitably damage itself eventually. Nothing can survive if the systems that support it are destroyed. They lose their ability-to-sustain, their sustain-ability!

This is a rare occurrence in nature. But there is one animal species that seems to be moving in this direction – *Homo sapiens*. There is a great deal of data showing, for example, that human activity is responsible for reducing the sum total of other living species on Earth (reducing 'biodiversity'). We are also limiting the amount of fertile soil in which plants can grow by using it until it has no more fertility left, and by cutting down forests which hold soil on the land. The soil washes into rivers and ends up unavailable at the bottom of the sea.

Despite *Homo sapiens* meaning 'wise humans' we seem to be doing many unwise things. A wise thing to do would be to try and understand *why* we are doing these things. Is it inevitable that we behave unwisely? Or can we choose to do things differently? If so, what needs to happen for us to change?

If we can we shed light on these questions, perhaps we will feel more inclined to behave more wisely in our everyday lives. This is what we're going to explore next, but before we do, here is a sobering thought to contemplate.

Reflection

Freedom of choice gives us the ability to choose not to live up to the name we have given ourselves – ‘wise humans’. We *can* choose to do things that push other species to extinction and that damage ecological systems. On the other hand, we can also choose to see what we’re doing: that continuing in our self-interested behaviour ultimately goes against our own interests – our collective survival interests. Yet, if we did make ourselves extinct, the planetary system as a whole would carry on in some form without us.

Wouldn’t it be a shame not to have made the most of our capacities and abilities just because we chose not to pay attention to our own knowledge about what we were doing? Isn’t it all a question of priorities? And of taking some responsibility for our motives and actions?

4 What are you? Where do you fit in?

4.1 Putting people in the picture

The phrase ‘survival of the fittest’ is often attributed to Charles Darwin. Though he agreed with it, it was actually the philosopher Herbert Spencer who coined the phrase.

Activity ➛ ➛ ➛

Discuss what the phrase ‘survival of the fittest’ is referring to. What does it actually mean?

The phrase is often interpreted as referring to fitness in the sense of physical, economic or other forms of strength, or to the ‘importance’ of being good at competing. It is even used to justify aggression of many sorts. The way it’s used often implies that to be ‘fit’ is to be able to ‘fight’ well.

Looking at the phrase in its wider context suggests quite a different meaning and one much more related to the importance of dependence. Spencer said:

> *“It cannot but happen… that those will survive whose functions happen to be most nearly in equilibrium with the modified aggregate of external forces… This survival of the fittest implies the multiplication of the fittest.”*
>
> Spencer, *Principles of Biology*, 1865, p164

Activity ➛ ➛ ➛

What do you think this sort of ‘fitness’ is all about?
How does it differ from ‘fitness’ understood as strength?

This implies 'fitness' in the sense of fitting best into the systems, contexts and environments which an organism *depends* on. Many people know what it feels like not to fit into a particular social group. It can be very distressing.

But what about *ecological fitness*? Not to fit ecologically can ultimately prompt 'The Inevitable Extinction Rule'. Thanks to our big brains, we humans have multiplied our numbers and the amount that we consume enormously.

4.2 Looking at what you are…

So far, we have been concentrating on what human beings have in common with other animals – our physical needs. Of course, we *do* share the same basic needs and dependencies. But there are also many things we do – including deciding what's 'good' and 'bad' – that other animals cannot – thanks to the enormous brain we've evolved along with our intellect and capacity for self-reflection..

Activity ➛ ➛ ➛

Think about *yourself* as an example of a system.

- You know you need interrelationships with other systems in order to survive.
- You know that how you behave affects the wider system and eventually comes back on you.
- You know that you're not just a fragmented collection of bits and pieces. You are a system too.

But what *are* you really?
Apart from your *physical* make-up, what are you and how can someone really get to know you?

Are you only physical?
How much can people really know about *you as a person* – your ideas, beliefs and values, feelings and emotions – from knowing your physical needs and features alone?
What do the interrelationships between your heart, brain, liver and big toe tell anyone about who you really are?
What *else* are you apart from a physical body?

You might find using some of the mapping and diagramming techniques helpful for this activity, especially 'Rich pictures' on page 25 of the Toolbox .

4.3 Emerging qualities: there's more to you than meets the eye!

(Note. For this section refer to the activity 'Dimensions of human causes of environmental problems' on pages 28-29 of the Toolbox.)

As the last activity showed, you are much more than just your body. It's impossible to know you as a person from looking only at your physical features and parts.

Reflection

Knowing *you* also means knowing about your thoughts, feelings, emotions, desires, beliefs, what's important to you, your likes, dislikes, etc. None of these is physical or can be explained purely in terms of your body. They need your body but your body doesn't determine them. In a sense they emerge from you as a person. *And you as a person are 'greater than the sum of all your parts'.*

You also live in a social environment with family, friends, society and other influences so it's important to know about these too. They, and how you respond to them, also contribute to what you are.

All those qualities that make up 'you as a person' are called '*emergent properties*' in Linkingthinking language. What emerges from your physical and social make-up and environments can't be predicted from looking at those alone.

Islamic mystics (called *Sufis*) have pointed out how wrong we are when we assume that if we understand the number '1' we also understand the number '2' just because '1 and 1 equals 2'.

Simply logically, this is wrong. They point out that to understand the *whole system*, you also have to understand 'and', because 'and' *indicates the relationship* that makes the number '2' different from two number '1s'. The quality '2' *emerges* from 1 + 1 and is different from it.

Without 'and', there could only be two number '1s' rather than the number '2' which emerges out of their relationship. (With thanks to Chris Johnstone for this).

Linkingthinking helps to understand the *and*!

Activity ➛ ➛ ➛

With a partner, see if you can think of any things that do *not* show any emergent qualities but can be understood *only* by knowing their unrelated parts. Can you 'know' anything just in terms of what it's made of, even simple things like a mug, a chair, a pullover, a book, a building, a car, a cassette tape or CD... ?

Then list some of the *emergent qualities* that make humans *different* from other animals.

How many of these did you think of?

- our strong sense of being aware of ourselves and apparently separate from each other
- our feeling that we are different from each other and from the rest of nature
- our ability to speak and communicate in complex ways
- our ability to learn about complex things
- our ability to think intellectually about abstract things
- our ability to innovate and invent powerful technologies and ideas
- our ability and desire to understand ourselves, each other and the world
- our ability to create complex beliefs, values and purposes about ourselves and the world
- our ability to document our experiences, feelings and ideas in writing so that we can pass them on from one generation to another

- our ability to create and manage complex societies and economies
- our ability to harm and kill other species and members of our own species
- our ability to create and attach moral meanings and values to things
- our ability to *choose* how to use all of the other abilities we have and therefore...
- ...to choose how we behave and influence the impacts we have on each other, on other species and on our life-support systems.

One thing is for sure– that human *behaviour* is having a greater impact on the planet than any other species that has ever existed.

The next section focuses more on these unique impacts, and on what it is that influences and shapes our behaviour – culture, values, beliefs, interests and priorities.

4.4 Understanding the human roots of natural resources and environmental problems

Earlier in the unit there was a definition of 'environmental problem' that included a cultural dimension:

'any change to the environment that is caused by humans, is damaging to the health of humans, nature and ecological processes, and which *is seen as unacceptable by a group and/or individual'*.

The definition emphasises that conflicts over natural resources are caused by people not by the resources themselves. This is logical but very easy to forget. One important reason why conflicts arise over physical resources is because they have easily recognisable boundaries. Woodlands, meadows, wetlands or deserts are quite distinct and a river catchment is defined by the areas of highest ground around it.

But resources are not just physical: they always have *cultural boundaries* too, defined by the beliefs, identities and interests of people. Conflicts over resources are invariably between two or more groups of people with distinct cultural identities who want to use the resources for their own interests and in their own ways. The identity they share – *Homo sapiens* – is, unfortunately, generally forgotten.

The causes of such conflicts are therefore more to do with cultures and identities – who is defining (ie claiming) resources as their own – than about the physical resources themselves. Except that, if the resources were infinite and everyone could have as much as they wanted, the conflicts wouldn't arise in the first place.

Managing and resolving such conflicts therefore also has less to do with the physical resources themselves than about understanding and working with *cultural boundaries* of beliefs, values and interests.

It's as if people see the world through cultural windows or lenses of different colours. Here's an activity to give you an experience of this:

Activity ➛ ➛ ➛

Cultural windows

Look at a view through the window and describe everything you can see. Notice when something you see particularly draws your attention, or has some special meaning to you more than other things. What do you like best about the view? What do you like the least? Why is that?

After some time, compare notes with someone else who was looking through the same window. Did they see the same things? Did they see them in the same way? Did they have the same likes, dislikes, associations and meanings attached to the same things?

Even though you were *looking* at the same view, it would be surprising if everything you saw had the same meanings to both of you.

Did you notice that you were looking through a pane of glass?

Think of this as a metaphor for the combination of beliefs, values, significance, priorities and so on that you view the world through. Other people see the world through different 'panes of glass'.

It's good to be aware – though people rarely are – that you *interpret* what you see, that it can never be the whole 'truth', and that others see through different beliefs, interpretations and 'truths'.

Note that the very same *situation* can be seen as two or more completely different problems by different people or groups in ways that reflect their interests.

People often argue, fight or even go to war about their ideas, beliefs and respective 'truths'. Each side may claim that their beliefs and outlooks are truer and more ethical than the others. Often those beliefs are associated with particular resources – oil, territories, land, water and others. Examples to think about might be localised conflicts over environmental vs. development interests, or international conflicts such as Yugoslavia (Slovenia, Croatia, Bosnia, Kosovo vs. Serbia), Iraq vs. USA-UK Coalition, Israel-Palestine (aquifers beneath the West Bank), Chechnya-Russia, India-Pakistan (Kashmir), the civil wars in Sierra Leone and Liberia (diamonds), and others.

Activity ➛ ➛ ➛

Think of some examples of conflicts – past and present – between different cultures where there was, or is, also a link with resources.

- Name or description of the conflict
- The peoples involved on each side
- The resource or resources associated with the conflict or being directly fought over
- The interests of each side in securing control over the resource

Now, remember a time you got into an argument based on a difference of perspective on something?

- What was the argument about?
- Who was involved on each side?
- What were the interests involved on your side and on the other side of the argument
- What happened in the end? If resolved, how? If not resolved, why not?

Activity ➛ ➛ ➛

Now, try to think about or look at something – anything – without interpreting or judging it in any way at all through your cultural beliefs or 'windows'.

Compare your experience with a partner.

Discuss whether you think it's ever possible to see something totally objectively without judgement or interpretation. If it is, say how you do it. If not, why not?

4.5 Understanding stakeholders

People with different interests in the same place, resource or situation are called *stakeholders*. It is only possible to have a *complete* picture of the situation if we take into account all the different stakeholder interests (and therefore different perspectives) involved in the situation. (For an activity that provides an example of a stakeholder analysis, see Unit 1, Section 2.1 'Here's a tree' on page 5.) Conflicts over natural resource use arise because people (or stakeholders) involved in the situation see their interests in the resource differently. Perspectives on the resource have more to do with the conflict than the resource itself. If there were plenty of resources to satisfy all interests, there would be no conflicts over them. But because they are physically limited and those limits cannot be expanded, the only other option is to work with the *cultural boundaries* created by the different perspectives and interests on a situation.

Activity ➛ ➛ ➛

In the Toolbox are two activities that build the principles above into role-plays based on real natural resource conflicts.

The first, 'Conflicts over environment and development at Marsh Common: a stakeholder conflict role-play', is based on a real-life conflict situation that took place a few years ago. All the names of the places and organisations have been changed but the situation and reasons for conflict are largely as they were then.

A simplified version is also available on the interactive Open University/BBC website www.open2.net/systems. The author of this unit, Paul Maiteny, designed the activity and wrote most of the text on this website.

Students choose or are assigned to different stakeholders groups and each is given a set of briefing notes.

The groups' tasks are to present their cases in as convincing a manner as possible to the Chairperson (teacher) and/or jury (of other students). They are also free to make alliances and present jointly if they think this will strengthen their cases.

Students are encouraged to do whatever is necessary to feel and think their way into the roles, eg through costume, convincing campaigning style, manner and so on.

This is a long activity involving class time and time between classes for developing roles and arguments, then presenting cases and, following presentation, being cross-examined by the other groups.

The second activity, 'Towards learning together – A method for understanding stakeholder perspectives', builds on the first in that it develops the method and asks students to come up with their own natural resource conflict situation. The method can be used to analyse perspectives on any conflict or decision-making process that involves many interests, not just those involving natural resources.

5 Keeping ourselves in the picture: how nature 'depends' on culture…

5.1 How human interests impact on natural systems

Thinking back to the diagram showing the dependent relations of physical ecology, we now have to add the peculiarly human 'parts' of it: society and culture:

culture: meanings, beliefs, values, purposes

↓ DEPEND ON

society, economy, consumption (resources, means of production)

↓ DEPEND ON

living parts: human animals

↓ DEPEND ON

living parts: non-human animals

↓ DEPEND ON

living parts: plants (and detritivores)

↓ DEPEND ON

non-living parts: sunlight, earth, rock, water, air, atmosphere

OK, so culture depends on nature. We know that. But the title of this section is about nature depending on culture. Doesn't that contradict everything that this unit been about until now?

Well, yes and no.

We have also explored how strongly humans affect nature, often in a rather destructive way. It's not that the *existence* of nature depends on culture. Remember? If we humans disappeared, nature in some form would carry on without us. But our values and behaviour have such a major impact on Planet Earth that the *condition* of nature does depend to a large extent on them.

In this way nature is dependent on culture, *but only in this way*.

We forget this at our peril:

the *condition* of natural systems

DEPENDS ON

human behaviour (individual and collective) including economics and consumption

DEPENDS ON

cultural 'windows': beliefs, values, purposes, choices, priorities in relation to nature and natural systems (includes politics and religion)

Humans are now so powerful that the *condition of nature* depends on our behaviour and values.

Activity ➛ ➛ ➛

Culture and the condition of nature, past, present and future

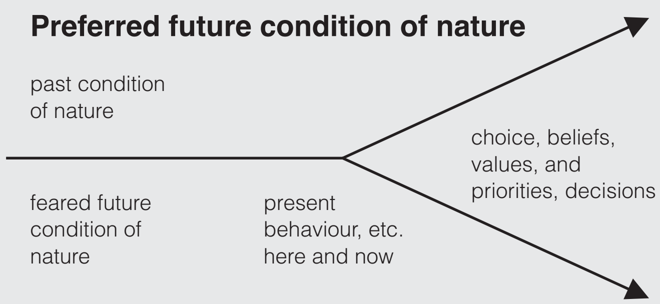
This activity is to encourage you:

1 to imagine different scenarios for nature and ecological life-support systems in the future and

2 to focus on the role of culture, values and priorities, and on the decisions and behaviour they give rise to, in generating those different possible futures.

Note: The activity is versatile and can be used to explore any possible situation in the future. For example, you could explore whether stakeholder conflicts over resources will increase or decrease in the future, what the reasons for this might be, and how they might be avoided.

Draw the diagram below on a very large piece of paper, leaving plenty of room to write or draw near the various axes.



Pick a time in history and imagine what nature was like then. What was it like outside your door? What sort of plants and animals were there? What were the air, water, climate and soil like? What was life like? What dangers were there? What did people value and not value? What were their priorities?

These are just a few questions to prompt you. Close your eyes. Relax. Let your imagination take you there.

You know what the present is like, though you might like to sit with your eyes closed to think about what you like best and least about living today. What are the benefits, the disadvantages, your delights and your fears. What are the values and priorities that have given rise to these things?

Activity ➛ ➛ ➛ continued

Now – the future…

Sit back with eyes closed and imagine what might happen to nature in the future – things that you think are most likely. Think also about how they will affect how you live, and the quality of your life.

Write or draw about them on the most appropriate 'future' axis, according to whether it is something you'd like to happen ('preferred futures') or something you fear happening ('feared futures').

Once you've done this, see how many of the likely futures are on the 'preferred' or 'feared' axes.

Lastly, sit back and visualise what your most preferred future condition of nature would be. What values and priorities would be necessary to give rise to behaviours that could make it possible? Place these visions and values in a different colour on the 'preferred futures' axis.

Consider the values and behaviours that correspond to 'preferred' and 'feared' futures. Which axes are the *probable* futures more clustered on? If on the 'feared', how can we explain this? Why should we be moving towards a future we do not prefer? What needs to change in our values and priorities to move towards futures that are preferable? What role do you play as an individual, in everyday life, in achieving this?

Reflection

- The *actual existence* of humans depends on nature, not vice versa.
- But if our culture and behaviour make the condition of nature deteriorate, our capacity for survival deteriorates with it.
- We are responsible for the condition of nature to a much greater extent than we might like.
- We are responsible for our own survival into the future to a much greater extent than we might like.

Remember 'The Inevitable Extinction Rule'? Nature will always survive in some form without people. But people, along with their economics, politics and consumption, cannot survive without nature.

What we humans do in following our beliefs, affects nature's capacity to keep humans in the picture, for good or for ill.

It's up to us to decide. There is no one else to decide for us.

Activity ➛ ➛ ➛

How many different beliefs about the purpose of nature can you identify?

- Note down the main features of each.
- Then compare notes with someone else and see if each of you can come up with any more.

Are there any themes or features that different versions have in common?

5.2 Orientations towards nature

There are many orientations towards nature, about what its purpose is, and what humans' relationship with it is.

The first can be called the *consuming orientation* and it's been around for a long time now. It is that nature exists to provide humans with raw materials or *resources* for us to consume as much as we want. With this belief goes the idea that there's really nothing to worry about. That people who worry about 'the state of the environment' are just being alarmist. That nature has always recovered from disasters before, so it will be able to cope this time too. Nature will always be able to absorb the impacts of our behaviour and will always be there for us. People who have a consuming orientation try to find a sense of meaning and satisfaction from accumulating and consuming things for themselves.

The other can be called the *contextualising orientation*. It sees humans as one part of a much bigger system – Planet Earth: that collectively as a species and individually too, we are like an organ or organs in its body which are interlinked with other organs in a great complex web. As long as the organs work together, the body will be healthy. People with a contextualising orientation find a sense of meaning and satisfaction from feeling they have a *role* to play in the bigger system.

Whichever of these views of nature you prefer, one thing applies objectively to both of them – human beings are physically dependent on nature for our survival.

6 The ecology of your personal lifestyle

6.1 Where do your interests lie, and what culture do you use to support them?

Activity ➛ ➛ ➛

What's your own 'cultural window' on nature?

Do you prefer the consuming or the contextualising orientation? Why?

Does the one you actually live by correspond with the one you prefer?

Give three indications from your personal experience that show which orientation you are.

Your view of the nature-human relationship (along with everyone else's) is vital to achieving sustainable natural resource management.

You see, *whatever you do*, it *always* expresses something about what you value, what motivates you and what you have an *interest* in. Maybe you do things mainly for yourself – to get something you have always wanted. Maybe you're interested in doing things for other people too. Or perhaps you feel you have an interest in doing things for nature.

Activity ➛ ➛ ➛

Think about a decision you made recently that led you to take a certain course of action. It doesn't necessarily have to be a major or important decision – buying a simple item while shopping will do just as well.

- What were your main reasons for making that decision?
- What motivations did it express?

6.2 Knowing your 'personal lifestyle interest and culture'

Activity ➛ ➛ ➛

Take a large sheet of paper from a flipchart.

Draw two concentric circles taking up most of the paper with plenty of space to write and draw in each of them.

In the outer circle, write, draw, symbolise or otherwise represent what concerns you most in your life. Include things that concern you directly in your everyday living and, more indirectly, in society and the world more generally.

In the smaller circle, describe how you feel you can have an influence on what you have mentioned in the other circle.

- The outer circle is how you see your 'circle of concern'.
- The inner 'circle of influence' shows what you feel you can actually do about what concerns you.
- The whole picture taken together is your 'system of interest'.
- The challenge is to expand your circle of influence.
- And also not to worry too much about what you really and truly cannot do anything about. As long as you are doing what you can, it's better to put energy into that than draining your energy worrying about what you cannot influence.

You can modify this to create a similar exercise: the outer circle should show the beliefs and values underlying your concerns, and the inner circle, the action and behaviours that you can and would like to take, to support what you believe is important.

6.3 What we want is what we get: ways of thinking about self-interest

An ecosystem can be any size, as can the system we see as being most relevant to our *interests*. At certain times, we can all be more concerned with our own self-interest and at others, with wider family, social, community or even ecological interests as well. Sometimes we are more concerned with immediate short-term interests, sometimes with the long term. Any choice we make inevitably excludes something. There are always trade-offs to be made. But the choices are down to each one of us. It depends on what we value.

All people strive to be comfortable as individuals.

For some this means *getting* what they want – it's this that gives them greatest *meaning*.

For others, working out how they can *contribute to and find a role* in the wider systems they are part of gives them the greatest *meaning.* They feel it's important to take into account of how their actions affect the wellbeing of other people, species and natural processes.

Obviously, the second type of person is more likely to be careful about the wider impacts of their behaviour.

Whenever you decide what is important to you, it may be helpful to think of your values and interests creating an imaginary *boundary* around what is most *relevant* to you. Like this, you create your 'system of interest' in line with your beliefs, values and priorities. That's what you've just done in the activity.

It is obviously important that, in seeking what we want, we do not stretch the capacity of the bigger systems we're part of – nature and others – beyond the point where they can continue both to give us what we need and depend on. We have to be careful not to 'push them to the limit'.

6.4 Your desires drive economics: economics pressurises ecology

Activity ➛ ➛ ➛

Go back to the activity in Section 1 of this Unit where you chose one of your favourite things, see page 10. What are the three main reasons for liking or wanting the product you described? Why is it one of your favourite things? What does it mean to you? Why does it mean so much to you?

Desires create demands. *Demands* create pressures to continue producing what is *in* demand. As you know, this in turn pressurises physical nature since it *supplies* the resources 'needed' to produce what we demand. Nature also has to absorb the impacts of these pressures of demand and supply as best it can.

Economists are concerned with supply and demand. So are ecologists, but their boundaries of interest are much wider.

Economists' systems of interest focus on the supply-demand dynamics of products and resources in terms of their *monetary* prices. If something is difficult to put a price on, it generally gets neglected as irrelevant and remains outside their systems of interest. In fact, they call such costs *external effects*, or simply *externalities*. They are outside their areas of interest. Impacts on natural life-support systems come into this category.

Ecologists' systems of interest focus on the supply-demand dynamics of natural, ecological systems – the 'economics' of life processes which economists cannot place a price upon and therefore do not always consider.

Reflection

Looking at your system of interest, do you think you lean more towards being an economist or an ecologist?

6.5 Economic and ecological 'inflation'

Reflection

Why do you think coats made of tiger skin are so much more expensive than coats made from mink farmed specially for this purpose?

What's the most valuable and expensive thing you or your family own, in monetary terms? Why do you think it costs so much money?

What's the most expensive thing you'd like to own? Why do you think it's so expensive?

The more products humans demand, the more pressure is put on nature (and other people) to supply us with them.

In economic terms, when demand is high in relation to supply, it becomes scarcer, and therefore more desirable to some people. The price therefore increases, and, if they want it enough, they'll pay more for it, so pushing the price up even more. In economic language this effect is called *inflation*. It's a concept that is just as relevant in ecology.

The rarer an animal species becomes, the more valuable, desirable and prestigious its parts become as commodities. Tigers, for example, have been hunted to the edge of extinction to fulfil consumer demands for fur coats and alternative remedies. The rarer such 'resources' become, the higher their prices get pushed up, making monetary rewards for hunters and dealers even greater than when there were a lot of tigers around. So hunters take greater and greater risks to find and kill the remaining tigers. It's a vicious circle. Only once tigers become extinct will it stop although, even then, if desire for something similar is still there, it will simply pass on to another animal and threaten that species.

Ultimately, the vicious circle can only be broken when demand for tigers (or whatever) disappears.

Ecological inflation – too much demand for what nature can supply – can therefore lead to extinction!

On the other hand, from an *economic perspective*, low supply and high demand for ecological 'products and services' puts up their value in *monetary* terms. Seen in this way, the last tiger on Earth will be the most desirable to kill because it will be worth the most money! But, as said, only if people continue to demand it and are willing to pay for it. Ultimately, the value of a living tiger versus a dead tiger's skin is a matter of human values, priorities, interest and, of course, choice!

The same Linkingthinking also applies to any other resources most of which we probably don't think twice about. That's why Linkingthinking about what we consume and where it comes from is so very important. We shouldn't wait for other people to tell us what consequences our demand for products lead to. We can go a long way towards working it out for ourselves – if we get the hang of Linkingthinking.

Important note. In conventional economics, ecological impacts, like the extinction of the tiger, are not seen as products, but as externalities. Only the saleable product – the skin – is considered relevant. Adding the 'price' of the externality 'extinction' into the price of the coat would make it too expensive for anyone to buy, so it's seen as an irrelevant thing to do. Instead, nature is seen as literally 'external' to and separate from humans.

Humans often assume that nature can handle and absorb all the effects of our activities without any harm being caused to it (although many pre-industrial peoples have generally had more respect towards nature). If impacts on ecological life-support systems *were* incorporated into monetary prices, it would make many products we take for granted so expensive that it would be pointless to produce them. No one would be able to afford them! That would affect '*The Economy*' which is, in the ruling belief system of our society, much more valued than the '*The Ecology*'.

But, as always don't forget 'The Inevitable Extinction Rule'.

6.6 How to reduce 'inflation'

There are *two ways* of reducing 'inflation', whether economic or ecological.

1 You can *increase supply* of the resources in demand. This is the preferred method of economics and tends to place more pressure on ecological processes

2 You can *decrease demand* for the resources in short supply. This method works more in favour of ecology but goes against economic interest because it reduces trade and therefore economic growth.

Both methods reduce the prices people will pay for the resources but only the second also reduces the pressure on the resources themselves.

Activity ➛ ➛ ➛

Think of some examples of the economic and ecological effects of supplying and demanding various products:

- Once again, think of a consumer product you've used or bought recently (or want to use or buy in the near future).
- Using the *influence* diagram method – see pages 25-26 of the Toolbox – find out and show the interrelationships between supply of and demand for the 'ingredients' for your product.

After this, think about the following questions. You could write them up in a table as with some of the other activities in this Unit.

- Is there much demand for your product? Who wants it? Will they pay a lot for it? Will they try to get it as cheaply as possibly?
- How can you keep the cost of the product low? How does this affect supply of the ingredients?
- Who supplies the 'ingredients'?
- How rare are they?
- What country is the product made in?
- Why do you think it's made there?
- Who supplies the labour to manufacture the product?
- How much do you think they get paid?
- Who are the 'middle men', the entrepreneurs, who mediate between suppliers, manufacturers, wholesalers, retailers and consumers?
- What proportion of the final product price do you think goes to the people who supplied the raw materials, to those who made the product and to the entrepreneurs who negotiated the business deals?
- What proportion of the final product price do you think pays for the ecological impacts created by the supply of and demand for the product?

Ultimately, there is always an *ecology-economics trade-off* to be made between the following:

- consumption and economic growth to fulfil short-term material demands as cheaply as possible
- safeguarding ecological life-support systems to ensure long-term survival needs but reducing choice and increasing economic costs.

There is also another factor to take into account: Another way of reducing economic costs is to minimise the amount you pay the people who make the products. It's easy to forget about this when we desire a product a great deal, but it can lead to miserable living conditions for millions of people while we in the richest part of the world enjoy the fruits of their labour.

6.7 Big feet, small planet: desire, fairness and the question of 'enough'

Reflection

Which of the options above do you think is more important to pursue and why?
Do you have any ideas about how to move towards your chosen option?
What knock-on effects would your chosen solutions have, eg on rich and poor people, and on nature?

As you've seen in this unit, the same natural system can be seen from many different perspectives. But however it's *seen* the system still has objective physical limits, even if we don't always know exactly what they are. If we wait to find out, it will be too late. This is why it's wise to take a *precautionary* approach. But people are impatient and always seem to want more. We act *as if* nature and resources were infinite, and ecological processes infinitely flexible. If they really were, we wouldn't have to think about questions of sustainability at all; they simply wouldn't arise, and neither would conflicts of perspective about how to use natural resources. There would be plenty for everyone to use as much as they liked.

Nature cannot provide an infinite amount of resources. Nor can it absorb an infinite amount of human impacts. This is why we have to make choices about priorities and back them up with action. This is needed not just in politics, but in everyone's everyday lives.

By doing activities in this part of Linkingthinking, you'll have found evidence that, when we consume, we take resources from other places on the planet. Lifestyles in the economically rich parts of world – Europe, North America, Australasia, Japan, and people who have economic power in poorer countries – depend on imports from the economically poorer parts of the world. This means they – we – depend ecologically on poorer people and their environments – especially in Africa, Asia, South and Central America. We depend on them, not just for resources to consume, but also to keep the planet functioning ecologically. The *economically poor* countries are, on the whole, *ecologically much richer* than us. For example, they have most of the forests, and animal and plant species in the world (for now, that is – the pressure on them is intense). We in the economically rich world cut down our forests many centuries ago. That's how we first became economically rich, and it's why the economically poor countries are now doing the same thing. Rich ecology and biodiversity equals potential economic riches. There's a trade-off. Everything comes from somewhere. And there are always knock-on effects.

The ecological dependence of the rich on the poor is called our *shadow ecology*. The size of the impact we have elsewhere in the world is called our <u>ecological footprint</u> (see Unit 3).

Activity ➛ ➛ ➛

There are many websites that will allow you to approximate your personal ecological footprint online. For example, take a look at the websites:
www.ecologicalfootprint.com
www.globalactionplan.org.uk/carboncalculator

The planet is groaning under the pressure of the physical human demands put upon it. But, as you know, everything is linked and the physical demand is being fuelled by two misleading cultural beliefs:

- that maximising consumption and wealth is the best way to achieve human happiness and wellbeing. This is the assumption behind the 'imperative' of maximising economic growth and consumption all over the world.
- that the planet will be able to sustain ever-growing levels of consumption.

Reflection

Remember: it is estimated that if all people in the world were to consume as much as the average North American, at least three planets would be necessary to supply the resources. Yet we hear a lot about the need to bring the poor up to the level of wealth of the rich. This is the ideal of economic 'development and progress'.

Discuss with a partner the possibilities of achieving this.

- What are the contradictions and dilemmas in this aspiration?
- If the idea is that human development and wellbeing is best achieved by maximising individual material wealth, can this be done without undermining the life-support systems that sustain our very survival? Why not?
  (Remember 'The Inevitable Extinction Rule')
- Can 'development' activity that destroys its own environment, and therefore itself, seriously be considered development? Why not?
- What other forms of activity do you think could improve life for everyone?
  Do they all require maximising consumption and material wealth?
- What could you do to help in your day-to-day life? How would you feel about doing these things?

6.8 How much is 'enough'?

Without demand (triggered by human needs, desires and priorities), there would be no consumption. Without consumption, there would be no need to produce anything. And without production, there would be no need to expect nature to supply us with anything – there would be no need for resources.

But obviously we *do* need things to live; we *do* want things to improve our quality of life; we *do* make demands on nature to supply us with resources: plants and animals to eat, water, air, housing, clothing, fuel, cars and other transport, coffee, chocolate, jewellery, cosmetics, deodorants, medicines, furniture, electricity, gas, flowers... to name but a few.

The question is: how *many* and how *much* of these do we need? How much do *you* need? Where do you/we draw the line between needs and wants? When will you/we feel satisfied and say 'I've got enough'? When will you/we decide to stop putting more and more pressure on nature to 'come up with the goods' that you/we demand?

These are really difficult questions. Global environmental problems are some of the most difficult questions that humans have ever had to face – as a species and as individuals.

There is more *information* available now about our environmental predicament than there has ever been. That means most people are now more *aware* of the problems than they have ever been. Many people would genuinely like to do something to help but it seems that just being aware and having information do not, on their own, prompt people to change their *behaviour*. Perhaps their lifestyles are too precious for them ever to think of changing. The anxiety they feel about having to change their lifestyles to reduce consumption is just too great. So people carry on with their day-to-day lives as before, putting the links between their lives and their impacts on life-support systems out of their minds. That's fair enough from one point of view. We're all free to choose for ourselves.

For other people, the problems just seem too gigantic. They get demoralised and feel that there's nothing they can realistically do anyway. Nothing they do on their own would make a difference.

Even though attitudes and awareness have grown, consumerist behaviour has not really changed, and may even have got worse. (There's a psychological reaction where people respond to anxiety by denying the problems that cause it. They cope with their fears and anxieties by covering them up with more of the same activities that cause the problem in the first place. One way to keep these feelings at bay and feel better in the short term is to consume even more!)

Activity ➛ ➛ ➛

Look at the 'Circle of concern' and 'Circle of influence' activity again – see page 32 of this Unit. Are there any other everyday-life activities that you feel you can change to have more influence on changing what's in your circle of concern?

Linkingthinking shows that everything is connected.
Linkthink and you'll see the connections.

To end this part of Linkingthinking, here is a fable that summarises many of the issues you have explored; issues of resources, dependence, tricks of culture and lifestyle management. It is a version of a well-known ecological fable about the 'Tragedy of the Commons' phenomenon. An ecologist called Garrett Hardin came up with the phrase many years ago to describe the sort of conflicts and consequences that arise when human desires place too much pressure on what is physically possible ecologically.

7 The shepherds who ignored their 'common interests'

Once, in the mountains of Persia, there were 100 shepherds, each with 100 sheep. No person owned the land. It was called 'God's Land' and shared by everyone. The land was not particularly fertile but good enough to support the sheep and the shepherds' families who depended on them for their living. The sheep provided people with thick, soft wool – a resource for clothing and shelters during the harsh winters. There was meat from the rams, and milk from the ewes. Sometimes the shepherds would exchange this for grain, fruit, vegetables and tea. Just as their flocks sustained the shepherds, so the sheep were sustained by the pastures. No pastures, no sheep, no shepherds. For generations, the shepherds had followed their flocks from pasture to pasture. They always allowed time for the grazing to replenish itself with fresh nutritious grass, ready for when they returned the next year. When there was no more grass to eat or it became unpalatable in one place, the sheep knew it was time to move on. And the shepherds knew the wisdom of 'listening' to their sheep.

One season, one of the shepherds had an idea. Why not add one extra sheep to his flock? That way he could become wealthier and have more to trade with. After all, one more sheep wouldn't have much impact on the grazing pastures. Other shepherds started to get envious. Why should he benefit more than they from 'God's Land'? Not to be outdone, they also added one extra sheep to their flocks. Competition had begun. And it set off a dynamic that was difficult to stop.

Eventually, all of the 100 shepherds had flocks of 101 sheep. Now there were 10,100 sheep grazing the common land, where once there were only 10,000. As time passed, the sheep started to get thinner and could not find a continual supply of fresh, replenished pastures as they once had. The shepherds started to worry. How were they going to feed their sheep?

Tensions grew as shepherds argued and fought with each other, racing to lay claim to the good pastureland. By this time they had grown used to having 101 sheep each. It was now 'normal' for everyone. The thought of going back to only 100 was unthinkable. Besides, no one would be foolish enough to do this first so that everyone else could benefit. Why lose out? No, it was far better to try and find ways of supporting all the sheep, even if it did mean people now lived more anxious, suspicious lives compared to the relative tranquillity of former years.

Everyone was always nervous that their neighbour was going to take advantage of them. Everyone had forgotten what their ancestors had discovered over many years of experience – that this land could only support 10,000 sheep, not 10,100. Though, in different ways, life could be tough in those days, people had lived peacefully with each other. They had had time to spend with friends, to relax and enjoy the beauty of the mountains, and explore the meaning of life. That time was now taken up with scheming against each other for more land.

Each year, the land produced less and less grazing. The sheep became thinner and thinner. The people became poorer, and ever more worried and aggressive with each other. The sheep began to starve. Then the people began to starve, starting with the children and the elders who were no longer respected for their wisdom. The pastures were then deserted and renamed 'the wastelands'. The Tragedy of the Common, of 'God's Land', had happened.

Some people believed that God had made the land less productive and were angry with God for having done this to them. Others, remembering that the problem had started when they had decided to have more sheep, believed that God was punishing them. But God had given the people the power to choose what they did; to decide their priorities for themselves. They had chosen to have more sheep today and let tomorrow take care of itself. But they had forgotten that tomorrow's sheep depend on healthy pastures today. The consequence of overgrazing the pasture today was to have nothing in the future. They had been warned many times before but had chosen not to listen.

It took many years for the pastures to recover their original richness. But recover they eventually did. The shepherds began to move back. There were lessons to be learned: about greed, about common interests, about remembering the whole, about competition, cooperation and conflict, and about meanings and purposes in life. Some shepherds remembered how the ancestors had limited their numbers of sheep so that the pastures could sustain them forever. Others believed that God had now forgiven them and that since the pastures had recovered, they could again maximise their flocks for trade and profit.

It was once again time to *choose*.

Written by Paul Maiteny, with acknowledgements to Garrett Hardin.

"Let a person once begin to think about the mystery of their life and the links which connect them with the life that fills the world, and they cannot but bring to bear upon their own life, and all other life that is within their reach, the principle of reverence for life..."

Albert Schweitzer

References

Spencer, H (1865) *Principles of Biology*

Wilden, A (1987) *The Rules Are No Game: The strategy of communication*, Routledge and Kegan Paul, London

Further Investigation

1 'Wholes', 'parts' and 'dependent relationships' in living systems

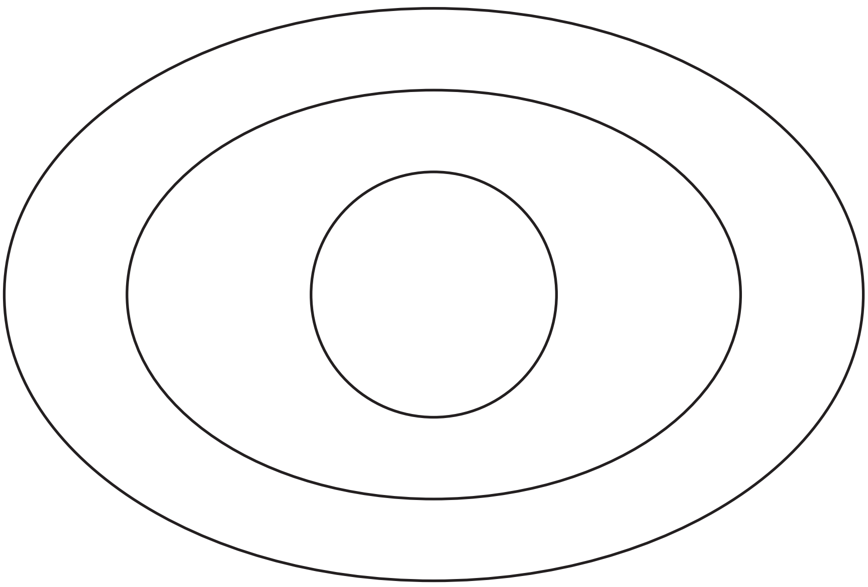
Linkingthinking is a *vital* key to understanding how to prevent natural life-support systems from deteriorating and becoming *unsustainable*. The health (which actually means *wholeness*), or *sustain-ability*, of the system as a whole depends on each part of the system literally 'playing its part', or 'taking its role' within the whole. The existence and health of the parts themselves depend on the health of the whole system in which every part has an important 'role' to play.

This section explains some more of the dynamics of this interconnectedness.

2 Principle No. 1: Nested connectedness

"Bigger fleas have smaller fleas upon their backs to bite'em. Smaller fleas have still smaller fleas and so on, ad infinitum..."

- Living systems can be any size (individuals and collectives) and are always made up of <u>subsystems</u>. (*What are your subsystems?*)
- Subsystems can be any size and are always parts of bigger systems. (*What system(s) are you a subsystem of?*)
- Any system is also a subsystem, and vice versa. (It's a question of perspective. A system can focus on itself as a subsystem of a bigger system [with a particular 'role']. A subsystem can 'focus on' the parts that make up itself as a system). The Linkingthinking philosopher, Arthur Koestler, gave the name 'holon' to systems that 'look in two directions at once'. (*Think of some situations where you are focusing on your part in a bigger system and others where you are more concerned with the parts of the system which is yourself.*)
- From the perspective of a living being, the system(s) of which it is a part is experienced as its *environment(s)*. (*What are your environments?*)
- *Connectedness* (see also *Relationship* below) is one of the most important dynamics to understand in natural (including human) systems. (*Identify some connections you have with other systems and subsystems.*)



When you look at natural systems, it is tempting to see only the 'things' – different types of soil, rocks, plants and animals – and ignore their interactions. But none of these 'things' exists independently, as an island. Not only are they connected, they are also in a web of *dependent relationships* with each other.

3 Principle No. 2: Survival and dependent relationships

- Every living being (system) seeks to survive as an individual 'whole'. (*Don't you?*)
- Every living being depends for its survival on other living beings. (*Don't you?*)
- Every living being depends for its survival on the bigger system(s) or 'whole(s)' of which itself and other living beings are 'parts' or subsystems. (*Don't you?*)
- Subsystems are always parts of bigger systems on which they depend for their 'survival'. (*Which systems do you depend on?*)
- Life is not possible without functional relationships between systems and subsystems. (*Identify some relationships you have with systems and subsystems that you need to survive.*)
- *Relationship* (see also *Connectedness* above) is one of the most important dynamics to understand in natural (including human) systems. (*Identify some relationships you have that you need to survive and feel good about yourself.*)
- *Feedback and dependence* are the two most important types of relationship to understand in understanding the sustainability of natural (including human) systems. (*Think of some things you depend on for your survival and wellbeing – we'll look at 'feedback' later on.*)

This diagram shows the dimensions of human causes of environmental problems (adapted from Wilber's *Four Quadrants* model, 1996). All quadrants necessarily inter-penetrate each other and are mutually dependent.

	Non-visible, 'inner' factors contributing to environmental problems and solutions (motivational causes 'in the mind': subjective)	**Visible, 'outer' factors contributing to problems and solutions (external manifestations of motivation 'in the world': objective)**
Individual dimension	**Experiential**	**Behavioural**
	Individual experience, learning feelings, emotions, thinking, intention, motivation which may or may not be evident to the person's everyday awareness (ie conscious or unconscious)	Individual behaviour and expression of values, etc, with visible, tangible effects on environment – socio-economic and ecological
Collective dimension	**Cultural**	**Social/Economic, Institutional**
	Shared frameworks of non-formalised belief, meanings, values, norms, judgements, interests that give shape to priorities, policy and behaviour. Can be political, religious, scientific, ideological.	Group expression with visible, tangible effects on others – socially, economically, ecologically. Formalised policies, structures, institutions.

4 Revealing stakeholder perspectives in conflict situations

The following activity builds on the ‘Here’s a tree’ activity in Unit 1, by expanding the method of revealing different perspectives on an object into a more detailed analysis of stakeholder perspectives on a natural resource conflict situation.

The method here was adapted by Paul Maiteny from ‘Soft Systems Methodology’, which was developed by Prof Peter Checkland at Lancaster University, England. He first used it in a workshop for the Agency for Cooperation and Research in Development (Timbuktu Division, Mali, West Africa).

The purpose of the workshop was to facilitate local practitioners in reflecting on their learning, research and development work from a systemic (ie Linkingthinking) perspective.

Activity ➛ ➛ ➛

- Take a very large sheet of paper, eg a flipchart, and as wide a variety of drawing materials as possible.
- In as much imaginative detail as possible, describe a problematic environmental, natural resource or development situation you are concerned about or working with. It doesn’t matter at all if you are not an expert artist. The point is to represent the situation in as much detail and with as much vibrancy and sense of fun as possible. Do not censor yourself or be too serious about what you’re doing but ENJOY YOURSELF (we all learn and do things much better if we enjoy what we’re doing). Include as many aspects of the situation as you can: who and what’s involved, contexts, everything...
- If you think of something you‘ve forgotten you can add it at any time.
- Identify all the stakeholders involved in the situation and, using the following process, explore how each sees the situation *from the standpoint of their own perspective* (ideally, find out from them personally):

T What Transformation (ie change) would this stakeholder like to occur in the situation (in simple terms)?

A Who are the Actors who would be involved in bringing about the Transformation?

S1 Who is the Primary Stakeholder from whose Perspective this situation is being viewed? What is their immediate interest in it?

S2 Who are the Secondary Stakeholders in this situation? (ie Who else will be affected by the Transformation? What are their interests in it?)

P What is this particular Perspective (ie beliefs, interests, values, priorities) on the situation and the proposed Transformation? Why, from this Perspective, is the Transformation a good/bad idea? From this Perspective, what advantages and disadvantages will come about from the Transformation?

O Who are the Owners of the task and transformation? (ie Who has the power to help, hinder or stop the Transformation? Who has the power and resources to shape, change and steer the Transformation?)

C What Constraints are there on bringing about the Transformation (physical, resource, social and cultural, including political)?

S You now have a picture of the situation as a System activity.

It hints at potential conflicts that could arise from this Perspective and what is necessary to negotiate and manage the overall situation in a way that is as meaningful and valuable as possible to this particular Stakeholder.

This type of analysis needs to be done from the perspective of each stakeholder in the situation.

The System analysis can, and should, be reviewed and updated on a regular basis from each of the Stakeholder perspectives.

Two other questions should also be kept in mind at all times, and reviewed regularly:

1 To what extent are the transformation and its effects *culturally desirable* from the perspective of the various stakeholders? Will it advantage more Stakeholders than it will disadvantage?

2 Are the task, transformation and its effects *systemically feasible*? What, for example, will be the long-term effects on the ecology that supports the community and its activities that the transformation is intended to benefit? Can the community and/or environment maintain and sustain the transformation in the long term?

References

Checkland, P *Soft Systems Methodology*, Wiley, London

Wilber, K (1996) *A Brief History of Everything*, Gill and Macmillan, Dublin (Ireland)

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Focus **unit 5**

linking thinking

New perspectives on thinking and learning for sustainability

Linkingthinking and Core Skills

by Deryck Irving

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5A

Key Ideas

This unit is part of the linkingthinking suite of materials that seeks to help generate new perspectives, introduce systems ideas and develop rational thinking skills which are broadly applicable to different situations and contexts.

Aims of this unit

- **to demonstrate the application of Linkingthinking approaches as described in units 1-4 in developing teaching methods and materials aimed at specific educational goals**
- **to explore the need for Linkingthinking in dealing with complex issues and situations**
- **specifically, to demonstrate the ways in which Linkingthinking approaches can be used in developing the Core Skills of 'Problem Solving' and 'Working with Others' – this will also have applications in addressing key skills elsewhere in the UK.**

Note: more information on Core Skills can be found on the SQA website (www.sqa.org.uk). Information on Key Skills can be found on the QCA website (www.qca.org.uk).

1 Why is Linkingthinking important in developing Core Skills?

Core Skills are a central part of all educational developments in Scotland. More importantly, core skills in general are essential to all of us in our day-to-day lives. We need to be able to communicate, to work with others and to deal with problems as we encounter them. This can be difficult in a complex world where many things seem to be in a state of constant flux.

The Core Skills of Communication, Numeracy and IT are generally relatively easy to link to other aspects of the curriculum and, therefore, cause teachers and lecturers few problems.

The Core Skills of 'Problem Solving' and 'Working with Others' are somewhat more difficult to incorporate, particularly at the Higher level where students need to work with complex issues and situations. Linkingthinking approaches offer the opportunity to develop these core skills using meaningful, real-world issues and situations.

2 Linkingthinking in 'Problem Solving'

The requirements of the Access and Intermediate levels of the Core Skill of 'Problem Solving' require students to deal with issues and situations which are familiar and straightforward. These can (usually but not always) be tackled using simple problem solving (see Unit 2 part A.)

What is simple problem solving (SPS)? Simple problem solving is the way in which most of us have learned to approach problems and is the dominant form of problem solving in Western thinking. It generally involves breaking down the issue into manageable 'chunks' and looking for linear cause and effect relationships.

Activity ➛ ➛ ➛

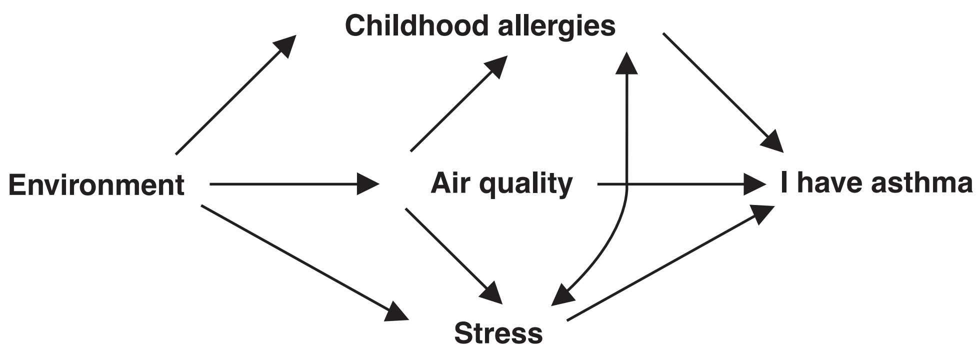
Here are some examples where SPS has been used. How effective do you think it has been in each case?

1 I have a headache. I take aspirin or paracetamol and it goes away.
2 A farmer is losing valuable land because of erosion caused by the river that runs through his farm. This is a result of the dynamics of river flow, with banks being eroded on the outside of bends and the sediment being washed downstream and deposited elsewhere. The solution to this is to straighten the course of the river and so reduce the rate of erosion. In addition, the area of bank being eroded is strengthened with rock-filled 'gabion' baskets.
3 Botanists, using laboratory and greenhouse experiments, have shown the effects of light, temperature, nutrients and so on, on the growth and development of plants.

SPS is an appropriate methodology where problems are clearly separate, where the relationships between causes and effects are clear and where causes and effects are close in time and space to each other.
SPS solution – apply a plaster. This works, my finger heals.

I have cut my finger ⟶ I am bleeding

Where problems are more complex and several factors interact (which, let's face it, is the way that the world tends to work), SPS approaches often fail. SPS has particular difficulties where activities or decisions have effects that do not occur locally or immediately. These effects are often ignored in the initial problem solving and are then tackled separately without reference to the original problem.



SPS solution – treat the symptoms of asthma. My asthma is still there.

Activity ➛ ➛ ➛

Let's look again at the examples used above.

1 I still have that headache and I'm beginning to worry about the number of painkillers I'm having to take. Why am I getting the headaches in the first place? Is it my working pattern – hours in front of a computer screen, not drinking enough water and chasing to meet deadlines? If I don't identify and tackle the causes of my headaches then no amount of treating the symptoms will be effective. *SPS failed in this case because it only looked at the symptoms not the cause.*

2 The farmer has solved his problems with erosion. However, his fields downstream from the work have begun to flood more frequently and more severely than before. He is also getting complaints from his neighbours about their land flooding. The re-engineered stretch of river has far fewer trout in it than previously and this is affecting his ability to lease fishing rights. *In this case, the farmer tried to look at the cause but failed to look at the possible implications of the chosen solution particularly those impacts that were separated, either in distance or time, from the management work he carried out.* (See Unit 7 for further discussion of river systems).

3 Ecological studies of plant communities give results that do not match up with predictions based on the laboratory and greenhouse studies. *In this case, a SPS approach has chosen to ignore the interrelation of the parts of the system under investigation.* (See Part B, 'Further Investigation' for a more in-depth look at this particular example.)

As stated in Unit 2:

'Simple problem solving often raises three issues:

- the solution tends to address the symptoms but not the underlying causes
- the solution can give rise to further problems
- the problem itself is not questioned or seen in a larger context.

Simple problem solving is a technical response to the problem. The emphasis is often on remedial solutions rather than preventative design in the first place.'

Activity ➛ ➛ ➛

Do you need to use Linkingthinking in 'Problem Solving'?
Think of an issue or situation that you feel is sufficiently complex to exceed the demands of the Access and Intermediate levels of 'Problem Solving'. This might be an issue that has recently been in the news, foot-and-mouth disease, World Aid, international terrorism etc, or it could be an issue of importance locally.

Write a brief summary of the problem in the centre of a sheet of paper, eg 'tourist numbers locally are down'.

To one side of your central problem, write down the things which you feel have contributed to the problem and draw arrows from these factors to the problem.

On the other side of the central problem, write down what you feel are the effects of the problem and draw arrows from the problem to these effects.

(See 'What causes the cause of the cause?' on page 17 of the Toolbox for a version of this approach.)

Now have a look at the solutions to the problem that have been proposed.

Using your diagram of causes and effects, look at where the proposed solutions are targeted.

- Which ones have focused on only a small part of the diagram?
- Which ones, if any, have been successful?
- Which ones have generated further problems?

! Idea

Complex issues and situations ('problems') rarely have simple solutions. We seek simple solutions by simplifying our definition of the problem (it's environmental, it's economic, etc) but simple solutions tend to generate further problems.

(See Unit 2 for further development of what we mean by simple problem solving and for some thoughts on why SPS is so embedded in our approaches to problems.)

At the Higher level of 'Problem Solving', students are required to deal with a *complex* situation or issue 'where variables may be complex or unfamiliar, relationships need to be clarified…'

What do we mean by 'complex'? How does it differ from 'complicated'? Before moving on, spend a moment trying to define the difference between these two terms.

In terms of Linkingthinking, we distinguish between 'complication' – where an issue or situation (a system as we would call it) has many components, and 'complexity' – where a system involves many interrelations. To be complicated, a system must have many parts; to be complex it may have fewer parts but there will be many relationships between these parts. Complexity is what we see in the real world; a family, an organisation, an ecosystem are all systems that are made up of many relationships.

This analogy may help to clarify the distinction.

A car is *complicated*. It is made up of many parts (many elaborate and highly technical) which have defined functions and which go to make up the entire car. Although there are relationships between these components (physical connections from steering wheel to the front wheels for example), these relationships are simple and a car can generally be repaired using a SPS approach.

Although it seems, on the face of it, to be simple, driving a car is *complex*. Successful driving involves constant adjustment and change. The driver must, consciously or subconsciously, monitor the feedback he or she is getting from the car and make appropriate changes. He or she must also monitor a host of factors which are outwith the car and outwith the driver's control (the road conditions, other road users, that dog which is about to run out from behind a parked car, etc).

So, (apparently) complicated things can be simple while (apparently) simple things can be complex. It can be necessary to go through incredibly complex learning to arrive at relatively simple skills – 'it's easy when you know how'.

The parts PLUS their relationships equal the system, not just the parts on their own. It is their interrelationships that link them into a whole all together. (See Unit 4, pages 41-42.)

3 Problems: difficulties and messes

Simple problem solving is the most appropriate method for dealing with some types of problem. Russell Ackoff (a noted systems theorist) calls these problems 'difficulties'. These are problems that are well defined and contained in terms of location and time (there are few or no long distance or time-delayed effects). In contrast, Ackoff refers to complex problems as 'messes'. That is, we can't be sure of where the problem 'stops' in terms of connections and influences or even, sometimes, what the nature of the problem is. Messes often change with time and are unpredictable.

(See Unit 2, pages 38-39 for further information on difficulties and messes.)

Activity ➛ ➛ ➛

Difficulty or mess?
Consider the types of problem that you might set as an exercise for a group of students whom you feel are tackling problem solving at the Higher level of the core skill. Write a short description of a dozen or so suitable problems.

Which are difficulties and which are messes?

The type of complex issues and situations referred to in the Core Skills Framework are likely to be 'messes'. Ackoff states that 'no mess can be solved by solving each of its component problems independently of the others because no mess can be decomposed into independent problems'. (See Unit 4, pages 41-42 and the plant growth experiment example on page 5.)

Simple problem solving is unlikely to deal effectively with complex *issues or situations* or to *clarify relationships* between issues as defined in the Core Skills Framework. Therefore, Linkingthinking approaches are needed.

Activity ➛ ➛ ➛

How did this get here?
This activity will help you to see the underlying complexity of even apparently simple objects. It can also be used very effectively with a class (see later section).

Our society and the globe as a whole is so linked up now that even everyday actions can impact on distant people and environments across time and space. We are all becoming increasingly aware of the complexity of what may have previously appeared very simple decisions or issues. This should have a significant effect on our approach to problem solving.

This will require:

- a subject item (whatever it is you are considering)
- paper and pen.

Take a 'simple' object or commodity (something lying on your desk or somewhere around your room) and ask 'what did it take to get this in front of me?'

Jot down everything that occurs to you. You may choose to use pictures or diagrams as some people find that this imparts far more information than using text. (See the activity 'Rich pictures' on page 25 of the Toolbox for some ideas on how you might do this.)

Leave the note around for a while. Whenever anything else occurs to you, add this to the sheet.

Review the sheet and notice the range and complexity of issues and factors that have been identified. See the section on 'Working with Others' for an example of this activity in practice.

If you wish to look in more depth at the complexity of everyday living, take a look at the activities: 'Where things come from and where they end up' in Unit 4, page 14 and 'Living in a systemic world' and 'Life-cycle analysis', page 6-7 and 51 respectively in the Toolbox.

The parable of 'The Blind Men and the Elephant'

This is quoted as a Sufi Muslim story by Peter Senge in his book *The Fifth Discipline*:

> *"Three blind men encounter an elephant for the first time. The first grasps an ear and says 'it is a large and rough thing like a rug'. 'No, no,' says his friend holding the trunk. 'It is long and hollow like a pipe.' 'You are both wrong,' says the third as he feels the leg. 'It is strong and firm – it is a pillar'."*

The story shows us three things:

Firstly, 'to see the whole elephant' we need several people's perspectives (even the three views combined do not give us the whole picture).

Secondly, that everyone has part of the true picture and that, therefore, all perspectives should be valued.

Thirdly, if you divide an elephant into three, it doesn't give you three elephants. If we think of the elephant as a problem, solving the ear doesn't solve the elephant.

Interestingly, a version of the same story can be found in a Hindu Vedantic book. This version points out that each man described the elephant according to his own past experience. The men then started to argue until a wise person told them 'You cannot have a complete picture of the elephant. All you can do is put together your different experiences of 'elephant' and out of these experiences you can imagine a novel creature known as 'elephant'. But it is the sum of all these parts and something more, which represents the wholeness of the creature called 'elephant'.

(It is interesting to note how different cultures can be linked by common stories.)

What we are trying to do when applying Linkingthinking to Problem Solving is to encourage students to 'see the whole elephant', to recognise as much of the big picture as they can and to see underlying patterns and links which will help them to understand complex issues and situations more fully.

Unit 2 develops this thinking further and suggests that to look for pattern you should:

- **ask different questions** – look for sets of contributory factors which might interact to produce or influence the issue you are focusing on
- **dig deeper** – instead of going along with the obvious 'cause' or 'effect'
- **take a 'helicopter perspective'** – look on an issue from a broad perspective, looking for links between things
- **try to recognise relationships**
- **question boundaries,** eg when someone labels an issue, and look for similarities and connections as well as differences and distinctions.

Recent examples of issues that might have generated really good examples of the complexity and interrelatedness of issues include:

- the debate over the UK Government's handling of the foot-and-mouth disease outbreak; balancing the needs and priorities of farmers, tourist operators and the general public. This showed several examples of action being taken to minimise or resolve a specific 'simple' problem only for the action to create a different problem.
- the debates over waiting lists and waiting times in the NHS. Many options for reducing waiting lists or times have undesirable knock-on effects for health care priorities.

What examples can you think of, either locally or globally?

4 Defining the problem

How we define a problem has an implication both on how we 'solve' it and on how our solution relates to other peoples' perspectives. If we label an issue as, for example, a social issue then this brings with it an expectation of different solutions than if we label it as a health or an environmental issue.

See the activity 'What's in a name?' on pages 14-15 of the **Toolbox**.

Activity ➛ ➛ ➛

'How you look shapes what you see'
The west of Scotland has high levels of heart and lung diseases, much of which have been linked to poor diet and lifestyles. Is this a health problem? Is it a social problem? Is it an environmental problem? Is it an economic problem?

Spend some time jotting down the reasons you have heard given to explain this problem (and your own views).

Group the reasons into health, social, economic and environmental headings. Do they all fit neatly into one heading or do you need to place some under two or more?

What solutions have been suggested and/or tried out? Group these under the four headings. How successful have they been?

Discussion:
If we address this as a health issue then we are likely to look for solutions relating to health information and to medical treatment. Will this tackle those aspects of the problem which relate to poverty or to the environment in which people live?

If, however, we treat this as a social issue, then we may focus on solutions relating to poverty and social deprivation thus missing some of the medical and environmental components of the problem. In reality, as with all complex issues, this is a multi-faceted issue which needs to be addressed more holistically. This has to include a consideration of people's values and tastes. Maybe people like eating in this way and place more importance on enjoyment than on their own health.

4.1 Setting the question

The fact is that we define an issue as a problem and the aspects of the issue that we highlight in defining the problem are influenced by our own values and by our perception of the values of others. We may, for example, choose to avoid what we feel will be contentious aspects of the issue, to avoid offending people or we may choose to focus on such aspects to generate a good debate. How we define the problem will affect the way in which students will address the issue.

Activity ➛ ➛ ➛

Simplifying the question

Imagine a scenario is created relating to the possible location of a factory in Scotland (a fairly common Modern Studies/Geography exercise). If the scenario includes information on population size, potential investment and grant aid, local facilities and local infrastructure, then students can make reasoned decisions as to the best place to site a factory.

What other factors can you think of which might have an impact on the siting of the factory?

Jot down your own ideas and then spend some time thinking how these additional factors might change priorities and decisions on siting the factory.

Discussion

It is perfectly acceptable to simplify the exercise to assist students in reaching a conclusion, but it is important to be aware of the parameters we have set and their implications for the ways in which students will approach the exercise.

For example, will anyone raise environmental concerns if no environmental information is included in the scenario? Perhaps they will, since environmental issues are relatively high profile. But will anyone consider the impact of siting a large factory on the long-term sustainability of the local economy? Think of the recent problems with Motorola in West Lothian.

A classic example of how we define a problem affecting how we 'solve' it can be seen in the field of management. Much time and effort is applied to the issue of quality in modern organisations and practically every organisation has reviewed its own performance in recent years. Typically, the question asked (or the problem set) has been 'How can we do better?'.

By asking this particular question, we have created an assumption that change is necessary. If we had asked 'How well are we doing?' this would have allowed two types of answer: 'Very well, let's keep it up' or 'Not well enough, how can we do better?'.

The assumption that performance review always identifies the need for change seems to be embedded in management standards and systems across UK industry and it leads to a culture of constant re-organisation.

See Unit 4 for further discussion of the impact of values and beliefs (culture) on how we view our priorities.

5 Linkingthinking in 'Working with Others'

5.1 Can you use Linkingthinking on your own?

The answer to this question is obviously yes – you've just done it – but to gain a fuller understanding of complex situations it is often necessary to get a broader view of the issues than you own perspective allows. One way to do this is to take a participative approach to problem solving. This involves working with others and taking account of the perspectives which they bring to the problem.

5.2 An example of 'How did this get here?' used with a group

(See the Toolbox, page 42, for further information)

A group of managers and university lecturers were asked to work through this exercise considering a cup of coffee*. They generally worked in small groups although some individuals followed their own preferred style of working and worked alone. Each individual or group was asked to use a 'rich pictures' approach to produce a flipchart sheet covering what it took to get the cup of coffee to them that morning. The overall group then reassembled and looked at the views which they had developed.

A wide range of factors and relationships had been identified from the most simple 'you booked the venue and asked for coffee; the venue booked a caterer; the caterer brought the coffee', through to the very complex. The factors and relationships identified included considerations of:

- coffee growing and world trade (fair trade, working conditions in developing countries, etc)
- the environmental impact of growing and producing coffee (including the production of instant coffee)
- the energy costs of production, catering and transportation
- the management of waste from coffee production and catering
- transportation – both in terms of international trading and the delivery of the coffee to the venue
- employment (global and UK)
- organic growing versus intensive growing using chemicals
- china clay mining and the making of coffee cups.

The overall picture developed was considerably fuller than anything produced by any one individual or group and encouraged participants to look again at their own interpretation of the original question.

*thanks to Drennan Watson for originally demonstrating the coffee cup exercise.

At the higher level of the Core Skill of 'Working with Others', students must deal with complex issues. As with 'Problem Solving', this means that Linkingthinking approaches are particularly well suited to students' needs. In fact, by far the most effective way for students to 'solve' complex 'problems' is to work collaboratively with others. (See Unit 2, however, for discussion of the crucial difference between 'problem solving' and 'situation improvement'.)

Students can work as groups to build up a Linkingthinking picture of the problem which they are addressing. This will allow them to explore more fully relationships between issues and to develop more holistic solutions. To be truly effective, students will have to look at what they bring to the group and at how their own values and perspectives affect their contribution to the group.

(See Units 1, 2 and 4 for further discussion of values and perspectives.)

*All the activities and techniques outlined in the Linkingthinking **Toolbox** are designed to be used by groups of students and many of the activities in the units can be used participatively.*

6 The value of Linkingthinking in assessing 'Working with Others'

One of the problems associated with the Core Skill of 'Working with Others' is that of assessment. The assessment systems used in schools, colleges and the workplace are designed to assess individuals and are often difficult to apply when looking at the role of an individual within a group activity. One advantage of a Linkingthinking approach to a problem is that there is no 'right' answer, only interpretations of the relationships the group identifies. Individuals can set the boundaries of the system in different ways and can bring their own priorities to bear. (See Unit 2 for further development of the issues of boundaries and personal values.)

This means that there is no need for every exercise to reach consensus. This is true, as long as an individual can demonstrate an understanding of the system which they have considered and can justify their own view as a result of the group exercise (particularly if they have an insight into the differences and similarities between their own position and that of their colleagues). In fact, if the group has genuinely used Linkingthinking, you would expect a diversity of views and a range of solutions to emerge. This should help greatly in demonstrating the ability of individual students to work collaboratively.

References

Senge, Peter M (1990) *The Fifth Discipline*, Century Business

Shantanand Saraswati, H H (1992) *Good Company: An anthology of sayings, stories and answers to questions* (available from The Study Society, Talgarth Road, London)

Further Investigation

1 The problem of plant growth

Traditionally, the scientific approach to experimentation has been based on a form of SPS. In this approach, the effect of one factor is investigated by controlling all other variables and measuring the effects of changing the factor in which you are interested.

The experiments carried out by botanists have tended to look at the effects of single factors such as light, water, nutrients, gravity, pollution, etc. Regardless of the factor under investigation, the methodology for these experiments has been effectively the same. Large numbers of plants are grown in controlled conditions in identical pots and growing media. All environmental conditions other than the one under investigation are kept the same and groups of plants are then given different amounts of the factor under investigation – light or nitrates, for example. The differences in development and growth of the plants in each group are then measured. Using this approach it has been possible to identify the factors which are most important in promoting plant development at every stage from seed to mature plant and also to identify the factors which influence flowering, fruit ripening and so on.

Plants in the real world grow in conditions where many factors vary at the same time. They also have connections between their root systems through the fungi that grow on the roots of all plants. This means that, even if you have measured the effects of every environmental factor in the laboratory, merely adding the results of these experiments together will not help you to predict what will happen to plants in the real world. Nor will it predict what the knock-on effects of the fertilisers and other things will be.

2 Linkingthinking in decision making

So far in this unit, we have used Linkingthinking as a means of developing a fuller view of the world and of specific issues that we wish to consider. Problem solving (or problem influencing) is not just about having a fuller picture however, it is also about using the insight that this gives you and deciding on what to do next. You can add a dimension of decision making and action to the Linkingthinking you have done so far, simply by asking the following questions:

- What impact does this have?
- Does this need to change?
- How can things be changed?

Activity ➛ ➛ ➛

What am I drinking?
(This builds on the example of the activity 'How did this get here?' and can be done on your own although it works best with a group.)

You will need a flipchart or other large sheet of paper, pens, repositional notes or other small slips of paper.

Take some time to investigate some or all of the following questions:

How is tea/coffee provided in your establishment?

- Is there a vending machine? If so, how does the machine work (is it one of those where you have to put a sealed individual sachet into the machine, for example)?
- Is it just a kettle in the staff room? How often is this switched on and off?
- Where is the coffee from? Where is it grown and where is it bought from, both locally and internationally?
- Do you use real cups or disposable ones?
- Where does the milk and sugar come from?

What impact does this have:

- on the natural environment?
- socially?
- economically?

Brainstorm each of these impact questions. Don't worry if you are having to make assumptions – jot down impacts which you think are likely to occur – no one will be holding you to the accuracy of your answers.

Look at the likely impacts you have identified, and check that you have covered all of the following:

- local/global impacts
- impacts in relation to coffee/tea growing, processing (eg making instant coffee granules), transport, coffee/tea making (ie making the cup of coffee/tea you drink), waste management
- positive and negative impacts.

Activity ➛ ➛ ➛

Does this need to change?
Do you (or your colleagues) feel that the impacts of your establishment's tea/coffee provision are acceptable? If your answer is 'yes', then there is no need to move on (although you might want to look at the reasons why you think it is acceptable).

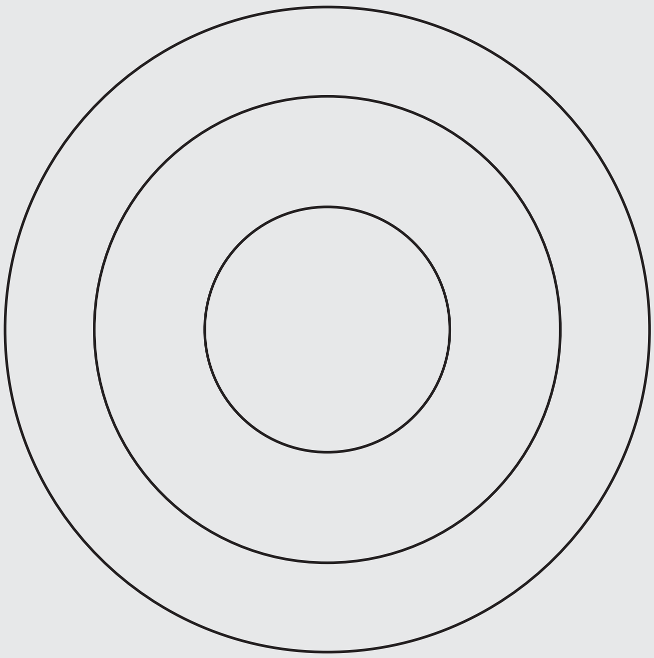
If your answer is 'no':
Take a large sheet of paper (a flipchart for example) and draw three concentric circles on it, making each large enough to fit in a number of repositional notes or similar slips of paper.

Brainstorm what could be done to make your tea/coffee drinking:

- more environmentally responsible
- more socially responsible
- cost less
- (you may wish to add to this list).

Be as imaginative as you can, at this stage the suggestions don't need to be feasible.

- Write each point on an individual repositional note/piece of paper.
- Put them all on the large sheet of paper inside the largest circle.
- Now begin to sort the points you have identified.
- Which of them are feasible and could be undertaken by your school/college (including things that the school/college could do to influence others)?
- Move these into the second circle and place any that are either not feasible or outwith the power of the school/college in the outer circle.
- Which of them could you, as an individual, undertake (including areas where you could influence the school/college to do something)?
- Move these into the inner circle and leave any that are outwith your power to change in the middle circle.



Activity ➝ ➝ ➝ continued

- Now look at the things that you have placed in the inner circle – those things that you can do directly or can do to influence others. Use one of the systems tools in the Toolbox to address the following (try 'Rich pictures' or 'Influence diagrams', for example, on page 25 of the Toolbox).

Which of these things are interrelated?

Are there synergies? In other words, are there things which you could do for one reason but which will achieve one of your other objectives?

Are there conflicts? These might include global vs local conflicts. Will changing your source of coffee to ensure that it is fairly traded lead to problems for local businesses? If so, one form of social responsibility is being valued over another.

There may be conflicts between your priorities and those of others. In these circumstances it may be necessary to examine your own values and motivation and those of others (see Unit 7 for discussion of the impacts of values, etc). It may be that your positions are not as far apart as they seem, or it may be that a relatively simple change in the way that you present your ideas is sufficient to convince others of the value of what you believe.

There might be conflicts between your own priorities. Buying organic may be better for the environment, but is it fairly traded? Which is more important to you?

There may be occasions where your actions don't have the result you expect. You may, for instance, choose to be more environmentally friendly by buying organically grown coffee. Organic coffee growing still generally involves clearing significant areas of tropical forest, and this has a significant environmental cost. Coffee can be grown under the forest canopy but it grows more slowly and therefore costs more to produce. Are you willing to pay this higher price? Is saving the forest more important than reducing chemical use?

Having addressed and weighed up these issues, you can begin to make decisions about future action.

Alternative or additional aspect:
You could look for areas where your school/college could influence higher authorities (such as your local authority) as well as looking at ways in which you can influence the school/college.

You could also look at opportunities for wider personal influence.

To do this, you might choose to use four or five circles rather than three (self, school, council, government, impossible) or to use three circles but to place the school in the centre.

This technique can be used with any problem and can be used by groups as well as individuals.

linkingthinking

New perspectives on thinking and learning for sustainability

A WWF Scotland publication

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Focus

unit 6

linking thinking

New perspectives on thinking and learning for sustainability

Bringing environmental issues into the mainstream curriculum

by John Salter

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An integrated approach to practical investigations

Key Ideas

This unit is part of the Linkingthinking suite of materials that seeks to help generate new perspectives, introduce systems ideas and develop relational thinking skills which are broadly applicable to different situations and contexts.

Aims of this unit

This unit is intended as general environmental awareness training, for use by teachers and lecturers working at a range of levels. I hope it will find particular application for those of you involved in the delivery of Higher 'Managing Environmental Resources' (MER) and most of the materials should be of direct use to candidates undertaking this award. I have adopted a light-hearted approach throughout. It was written by a big kid and I hope it will appeal to big kids everywhere.

1 Introduction

The package is presented in a number of separate sections with an introductory briefing that sets out some of the topics covered later on in Part B, 'Further Investigation'. Teacher/learner activities are included in the Toolbox that can be found at the end of the resource. I have tried to make these activities as much fun as possible and completing them yourselves, or presenting them to your students, is actually the main part of the learning experience. Please feel free to dip in and out of those sections that appeal to you rather than covering the whole package. Obviously some of you will have no particular interest in Higher 'Managing Environmental Resources' (MER), however I feel that the unit content is sufficiently generic to find a wide range of applications outside this specific programme of study. While the content is pitched at Higher and Higher National level there is still plenty of interest for lower academic ability groups.

It is almost impossible to get up-to-date written texts covering our topics, although certain underlying principles do remain constant with time. In order to ensure that you can access current, accurate data, I have provided a list of useful websites – see 'Electronic toolbox', on page 45 of the Toolbox. Each site carries its own web links and a wealth of up-to-the-minute information immediately opens up to you. There is almost too much for any one person to assimilate, so try to target your research to specific areas of interest and those that are relevant to you. Now read through the contents list again, choose your topic and off you go.

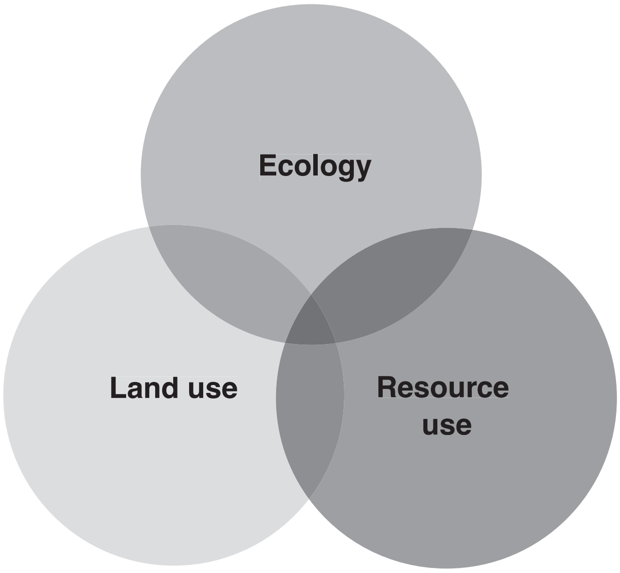
2 Higher MER – 'Managing Environmental Resources' at Scottish Higher

MER at Intermediate 1, Intermediate 2, Higher and Advanced Higher shares three common strands:

- Ecology
- Resource use
- Land use.

These three strands remain discrete and each unit may be undertaken as a stand-alone qualification. In order to achieve the award, however, candidates must complete all of the unit assessments before attempting the final exam. It is intended to create a single, integrated project covering each of the topics at the unit level. The final overarching assessment is partially integrated and requires linked-up thinking skills in addition to a more traditional analytical approach. The extent of integration in the final exam is the domain of the examiners.

The overlapping area that is covered by Linkingthinking



It is the intention here to demonstrate that the fragmentation of the units into discrete subject areas is an artificial construct, largely designed for the convenience of course programming and timetabling. I'm not suggesting that we dispense with such distinctions altogether but rather that we explore the areas of overlap in a holistic way. The notional 40 hours of study time allocated for the award would be one avenue for exploring these issues. On the other hand, the more adventurous among you may take the opportunity to treat the award entirely in a holistic manner.

3 Environmental awareness – what does it mean?

If you'll excuse me, rather than try to explain this concept, I think I'll indulge in a bit of creative writing! Please read through the following text and write down what you think.

There are currently over six billion (6,000,000,000) human beings crowded onto this small planet we call Earth. Each and every one is important, has hopes and aspirations, families and loved ones, feels joy and pain. Each one wishes for a safe and secure future and for a greater share of those little luxuries that life in the first decade of the 21st century can provide. Yet it remains a fact that the vast majority of people on the planet live out their lives in a state of abject poverty, often lacking the basic means to provide their families with decent food and clothing, housing and clean drinking water, health and education.

In the developed world, economies continue to grow. Indeed economic growth is often made the cornerstone of government policy. It seems we can't wait to extract and exploit all of our fossil fuel reserves, to burn up all that 'fossil sunlight'; sunlight, that lit the fern forests when the first amphibians crawled from their ponds; sunlight that shone down for millions of years as the dinosaurs ruled the earth; sunlight, that barely pierces the atmosphere of our polluted cities.

A handful of developed nations produce more carbon dioxide than all the rest of the world's population put together. Waste and pollution are rife. Western economies continue to subsidise their industries at the cost of global pollution. Governments act with scant regard for the long-term future of our planet, preferring indeed to look no further forward than the next election. Meanwhile global temperatures continue to rise, emissions of greenhouse gases continue to increase and world population has not yet levelled off – a recipe for disaster. The odds are stacked against us and extinction is on the cards.

But enough gloom and doom (for more gloom and doom see www.wri.org or try the United Nations website at www.unep.org).

Two hundred years ago we were all environmentally friendly: all farmers were organic farmers, all industries were sustainable cottage industries, waste was unheard of, there were only 'useful by-products'. Pollution, where it happened, was on a small scale and well within the capacity of the local environment to sustain and absorb. The internal combustion engine had not been invented. In short, we all lived a pastoral idyllic existence. (Of course clearly this is not true, as most people in those days inhabited a drab world of boring drudgery full of pestilence and death.) It is in this state of grace that two-thirds of the world's population still exist, awaiting their respective industrial revolutions.

If you think that the scenario painted in the last paragraphs is bleak, then just wait till 1.4 billion Chinese (not to mention over a billion Indians, all of Africa and South America), start clamouring for cars, central heating, air conditioning, refrigerators, exotic foreign foods, etc. If we maintain the status quo, it is probable that we will be looking back to the closing decades of the twentieth century as a relatively pollution-free golden age. Perhaps we can persuade the Third World not to develop its industrial potential for the common good, however I believe this would seem somewhat hypocritical. We do not possess the moral high ground. We have made our mistakes, degraded our environment, depleted our resources, and to all intents and purposes, benefited from so doing. 'What's sauce for the goose is sauce for the gander', the developing nations will no doubt inform us, and they will be right!

So what's to be done? Who's going to pull us out of this hole? Who got us into this mess in the first place?

Well at this point I have a little admission to make. It was I! It's my fault. I'm to blame. I can't pin it on anyone else. If the world has a problem in terms of its global environment, that problem is the fault of myself; indeed it is the fault of all of us who live in the developed world. There's no good pointing the finger at anyone else; we are the ones who have cars, central heating, fridges and DVDs. We have certain expectations about our way of life and by golly, we're not going to give them up. Cleaning up the environment is the responsibility of Government anyway, isn't it? We have international agreements to do that sort of thing, don't we?

Well actually, no. Governments are good at talking about action, but not very good at carrying things through. The average life of a democratically elected government is only a few years, while environmental problems span decades, even centuries.

Pollution does not respect national boundaries and no amount of legislation can prevent occasional environmental disasters. Anyway, what's the point of my country doing anything unless the USA follows suit? Of course, if we all take this argument to its logical conclusion, none of us will do anything and we will all choke in our own, or someone else's, filth.

A famous environmentalist once said:

"Think globally, act locally."

This is a view to which I wholeheartedly subscribe. Sustainability is the responsibility of each individual. It is much too important to be left to governments and politicians.

Activity ➛ ➛ ➛

So, having read this passage, what did you think? Take a moment or two to think over the issues I've raised. Did you agree? Disagree? Did I leave a lot out? Was it opinionated? Politically motivated? Put down your own ideas on paper before you read further.

Feedback to activity
Well, first and foremost, let me say that I really enjoyed writing that passage. It was written from the heart. It contained a number of points in which I deeply believe. It would have been an entirely appropriate diatribe for an eco-warrior or a prospective candidate for the Green Party. Reading it over later the following criticisms came to my mind:

- It was deliberately provocative.
- It was politically motivated and politically naïve.
- It was factually incorrect in parts.
- I was highly selective in the information I included.
- It was full of sweeping generalisations.
- It was highly personal and opinionated.
- It was deliberately pessimistic.

But, despite all these obvious flaws, I still stand by what I've written because it was never intended to be factually correct; it was merely a statement of my own personal feelings. We have moved out of that area where there are right and wrong answers to any particular questions and into that grey area occupied by feelings, emotions and politics. Your opinions are as valid and important as mine. What I'm trying to say is that environmental awareness is not simply about memorising facts, although this comes into it, of course, but it is a state of mind, a way of thinking about sustainable development in a holistic (joined-up) way.

I believe the passage demonstrates that I am environmentally aware because:

- I am aware of the underlying causes of environmental degradation.
- I am aware of the global effects arising from these causes.
- I recognise my own responsibility for environmental problems.
- I am dimly aware of how we might go about solving these problems.

In short, I think I've caught a glimpse of the big picture. As we work on through the package, we will tackle each of the above topics in turn.

4 The big issues

What are our global environmental problems and why should we do anything about them?

At this point we should take some time to examine the causes of global environmental degradation. First of all, what is global environmental degradation and how important do you think the issues are? Check up your Higher Support notes to make sure you know what the big issues are and what the terms in the table below mean. Rank the issues that follow in order of importance from 1 to 9:

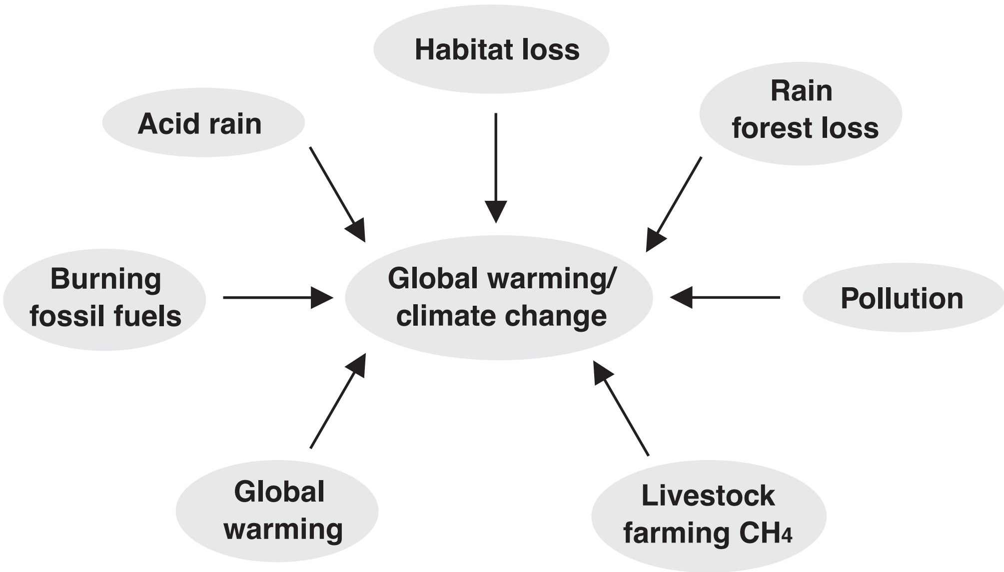
Global environmental problem	Priority
Climate change	
Global warming	
Loss of biodiversity	
Ozone depletion	
Deforestation	
Desertification	
Habitat loss	
Depletion of non-renewable resources	
Eutrophication of rivers, lochs and seas	

I hope you found that really difficult. I certainly would have done. The fact is that everything in the table is inextricably linked with every other thing; some are causes and some are effects. There is no simple way of looking at this. We need to adopt a holistic approach.

5 Cause and effect?

What are the causes and what are the effects, or can we really make such a distinction?

Using the diagram below, explore the causes of global environmental degradation. Some of the section on global warming has been completed for you:



These 'causes' are expanded in the table below:

Global environmental problem	Causes
Global warming/climate change	Burning of fossil fuels (non-renewable resources), acid rain dissolves carbonate rock (releasing CO_2), loss of rain forest reduces CO_2 fixation, livestock farming releases CH_4 another potent greenhouse gas, global warming increases atmospheric H_2O another greenhouse gas. Global warming alters ocean currents leading to further climate change, ice caps melt and less sunlight is reflected back into space, warm water expands leading to sea level rise… etc.

Can you see that all of the causes may be further linked? For instance: acid rain is a form of pollution which causes habitat loss; livestock farming may lead directly to habitat loss and a reduction in the area of rain forest; this, in turn, will have a direct effect on biodiversity. Complete the cause and effect diagram above by linking up causes and effects by arrows. Notice how the ramifications go spiralling out forever. This complexity forms a barrier to our understanding of cause and effect and it is here that Linkingthinking is essential if we are to grasp even a small part of the complexity of our topic.

You will notice that I have identified one of the causes of global warming as global warming itself. At its simplest, this means that the hotter it gets, the hotter it gets. This is an example of a rare phenomenon in biological systems called a positive feedback loop. James Lovelock, in his Gaia Hypothesis, views the Earth as a unified self-regulating system that intervenes to return the planet to a state suitable for the maintenance of life. If he is correct, a positive feedback loop of the type described above could result in a runaway greenhouse effect that might ultimately render the Earth unsuitable for human life. For more about Gaia go to www.gaianet.fsbusiness.co.uk/gaiatheory.html. Alternatively, look out for the Open University programme *Daisyworld* which is transmitted several times per year on BBC2's Learning Zone.

A series of student activities on the above theme can be found in section 6 of the **Toolbox** at the end of this resource. Please do try out some of these activities and then read on.

Well, have you made the connections? It seems that all of our environmental problems are complex interactions of cause and effect and it is by no means clear what are the causes and what are the effects. One thing that is clear, however, is that all of the problems we have looked at are caused mainly by the activities of man. Remember our diagram of cause and affect? Environmental problems arise directly from the way we manage the Earth's resources, either our land use or our resource use. From this perspective you may wish to simplify matters by saying that environmental degradation arises from one of two prime motivators:

- human greed
- poverty.

For our purposes, this is no doubt an oversimplification.

6 To have and have not

An investigation of some of the causes of our environmental problems

Often it is difficult to comprehend how unequally the world's resources are shared out. In the developed nations we maximise our resource use, burning up our fossil fuel reserves like there is no tomorrow and exploiting cheap labour and land in the developing nations in order to maintain our wasteful lifestyles at minimum cost to ourselves. Whatever way you look at it, this is greed! For example, a recent article in *The Independent* carried the following headlines:

> *"Each year the US produces 25 per cent of the world's carbon dioxide emissions from burning fossil fuels"*
>
> *"By 2020 annual carbon dioxide emissions in the US are expected to have increased by 47 million tons"*
>
> *"US energy consumption is projected to rise by 30 per cent in the next 20 years"*
>
> *"Each year the average US household burns the equivalent of 25 billion calories of energy"*
>
> *"The Paradise Power Plant near Muhlenburg, Kentucky, is the second worst polluter in the US, pumping out 190,293 tons of sulphur dioxide per year."*
>
> Source: *The Independent Magazine*, 2 February 2002

So what does this mean?

Well, it means that 250,000,000 Americans, approximately five per cent of the world's population, are responsible for a whopping 25 per cent of the Earth's global warming crisis. What is more, they have now reneged on the Kyoto Protocol and are refusing to cut CO_2 emissions, preferring instead to plant a few trees. Compare this situation with the typical developing nation struggling to feed its poverty-stricken populace. The energy used to supply a US tower block is sufficient to supply a typical African city. Virgin land is cleared for agriculture in order to grow cash crops to be sold on to the rich developed nations, the income generated being hardly sufficient to service the interest on their debts. More habitat and biodiversity is lost as desperate subsistence farmers clear land in order to feed their starving children. It seems obvious to me that the only solution to this problem is a cancellation of third-world debt and a more equitable sharing of the Earth's' limited resources.

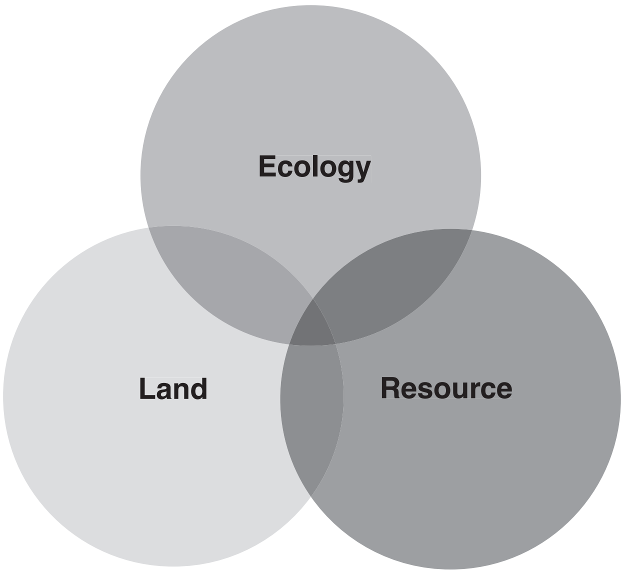
Always remember to make the connection. All of our actions have consequences: more for me means less for someone else.

7 Think globally – the big picture

Trying to make sense of environmental complexity

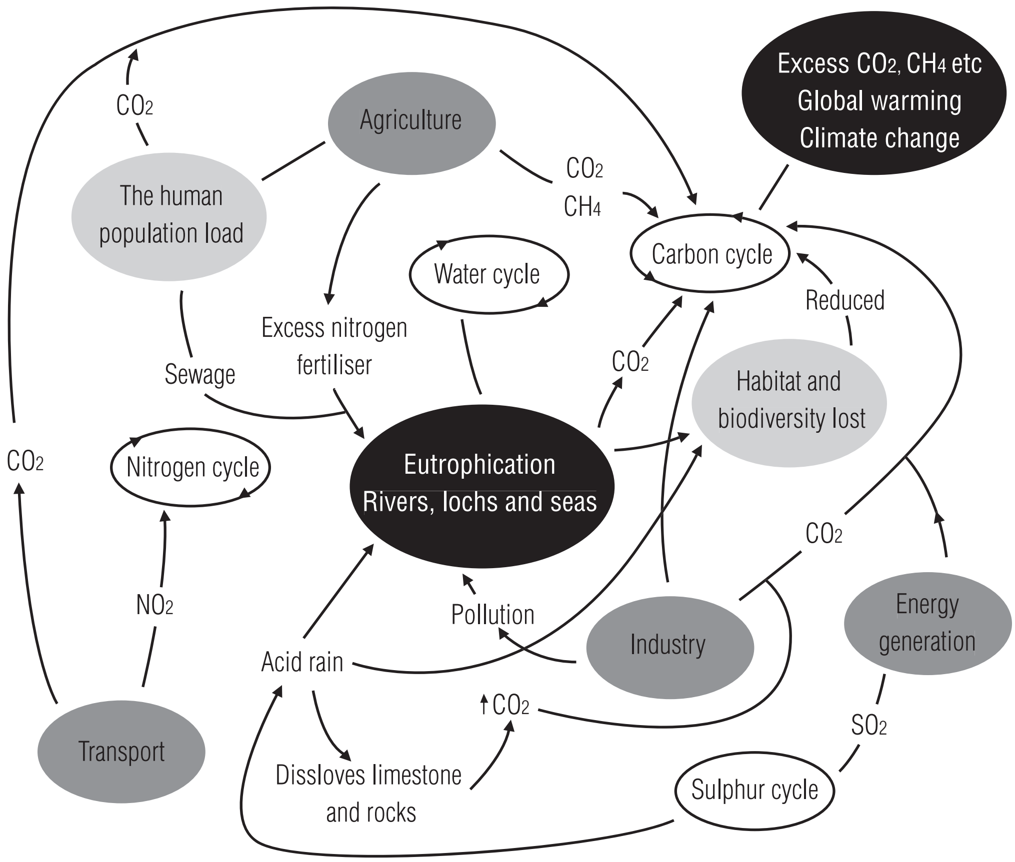
In the preceding pages, I have tried to present global environmental problems as a subtle interplay of cause and effect arising from human impacts on the environment.

The diagram I drew at the beginning of this unit would be a good way of visualising this. However, I hope I have demonstrated that indeed the colour distinctions I made between each topic were completely artificial and that our diagram simply consists of interconnected 'Green Issues' as in the diagram below:



It is now time to sketch in the big picture. The pages that follow represent a doodle I made during a particularly interesting meeting about something or other. The first diagram is incomplete and it requires you to make the links between land use, resource use and the global ecological cycles. If you need to refresh yourself about these cycles (Carbon; Water; Nitrogen; and Sulphur), please refer to your Higher Support Notes ('Investigating Ecosystems') or refer to the entries in ENCARTA Encyclopaedia. Note how the cycles are linked with human activities by the waste products that these activities produce.

I have partially completed the diagram on the next page and included an incomplete diagram as an activity in the Toolbox on page 50.



Does your completed diagram tie in with mine? There are bound to be differences as we both think about the problem in slightly different ways and this is a complex concept to grasp. However I'm sure we have the major points in common. After all, Linkingthinking would not be Linkingthinking if we all came up with the same explanations, particularly when dealing with systems of such complexity.

See if you can devise similar models linking environmental cause and effect.

8 Actions and consequences – a burger please!

Sustainability explored using a hamburger from a fast-food restaurant chain

It is now time to link what we have learned in terms of the big picture to our own personal experience. Many of our environmental problems are probably caused by ignorance. That is, we fail to make the connection between our actions and their consequences. Consider for a moment the following:

We go into a local fast food restaurant and order a burger.

'Nothing unusual about that', I hear you say, but let's look at this in more depth.

There are three phases in the life of this product:

1 production → 2 use → 3 disposal

Before you go on, you may wish to refresh your understanding of Renewable and Non-renewable Resources in your Higher Support Notes 'Natural Resource Use' or the explanations from Unit 4 of the Linkingthinking Series reproduced below.

- **'non-renewable' or 'stock' resources:** things like fossil fuels (coal, oil, gas), metals and all minerals that (in a human time-scale) cannot be regenerated by natural processes. There is a fixed and limited supply of these and they will eventually run out. All use of them depletes the total stock available. Therefore, the fewer there are and the harder they become to extract, the more expensive they become – so long as there is a demand for them.
- **'renewable' or 'flow' resources:** things like trees and all plants, animals, food, clean air, clean water, fertile soil, food (also plants and animals!) that can regenerate naturally (in a human time-scale) so that they continue to supply humans in spite of being used. Note that flow resources can be exploited at a rate that is too fast to allow them time to regenerate naturally. When people do this, they effectively turn renewable flow resources into depletable stock resources.

8.1 Production

First we need to 'grow' our cow, feed it with grass or grain, which has had fertiliser added and perhaps pesticides. The cow in turn produces methane – a potent greenhouse gas. It also produces urea and ammonia as bodily waste products, which can escape into watercourses causing eutrophication. The cow may be housed indoors using energy to keep it warm. The farmer will probably have a tractor that requires diesel. Many farms used by multi-national fast food outlets are located in Third World countries with poor animal health and welfare legislation, low wages and often involving the conversion of virgin land to ranching. On reaching maturity, our cow will be transported to the abattoir by rail or more usually by road. Once it has been processed (squeamishness prevents me from going into the finer details of mechanical meat rendering) our cow will be shipped off to the restaurant chain's processing factory, possibly on another continent. On arrival it will be processed again. Once our cow has been all ground up, it is carefully shaped back into something that vaguely resembles a bit of a cow. Waste products will be difficult to dispose of and nowadays give rise to environmental problems of their own. The meaty bit of our burger is now packaged ready for transport to the restaurant. The packaging consists of both plastic (oil based – non-renewable) and cardboard (trees – a renewable resource). The burger now sets out on its final journey, sometimes by road, often by international forms of travel (air and sea) to the retail outlet.

Meanwhile, perhaps on another continent, people have been busy preparing our bun. Farmers have been growing wheat, usually with the aid of artificial fertilisers and pesticides. The farm will be mechanised. When it is ripe, the wheat is transported to the mill and with the use of energy, it is converted into flour. Before being transported it is packaged either in plastic or paper. From here it makes another journey, again often by international forms of travel. It arrives at the bakers where it is mixed with other ingredients like sesame seeds (I won't go into too much detail otherwise we'll be here for ever) and placed in an oven requiring energy. Now our bun will be re-packaged in plastic, ready to hit the road one last time.

Somewhere in Italy a man is growing tomatoes for our ketchup. The oil for frying is swaying in the sunflower fields. Our mustard is nearing maturity and a local man (at least perhaps one on the same continent) is tending the garnish in the fields – lettuce, onion, gherkin, etc.

In Kuwait, the oil wells are providing the raw materials for packaging our burger; a foam plastic carton. After the oil has been extracted it is transported by pipeline to a terminal and, if it is not accidentally dumped into the sea, it is transferred to the waiting tankers. Arriving at the oil terminal, the crude oil is promptly pumped off to the oil refinery and split into its constituent parts. The selected fraction of this process is then conveyed by tanker to a plastics factory for final processing.

The manufacture of foam plastic is an extremely complex process and despite some knowledge of chemistry, I must admit it is one that I don't fully understand. Suffice it to say that in the old days the process involved the release of ozone-depleting gases. Nowadays, fortunately, only greenhouse gases are released. The process is also very energy intensive. On completion, our carton, along with thousands of others, is shrink wrapped in polythene and placed on a wooden pallet to be shipped to a central distribution centre, there to be unloaded and repackaged before final distribution to our restaurant, by road.

8.2 Use

Right! Now we're ready to eat – or are we?

First we need to choose which restaurant we're going to. Many of us will visit restaurants in out-of-town shopping centres that are often fairly new and are frequently constructed on green field sites involving an obvious loss of habitat and biodiversity. I won't go into details of bricks, mortar, glass, plastic and stainless steel, for fear of becoming tedious…

Of course, even if we don't elect to go out of town, we'll still need to take the car. To take public transport would be well beyond the pocket of most families. If, heaven forbid, we decide to go to a 'drive through' we will, no doubt, sit in a long queue of cars with our engine running until we reach the serving hatch and finally BINGO! Our time has come!

"I'd like a burger please!" we announce in a confident voice. We toy with the idea of ordering a fizzy drink and a portion of fries, but realise that we may never finish this writing exercise if we do. The retail sales operative disappears behind the counter and begins the assembly of our tasty meal. Our burger is deftly stripped of its outer plastic wrapper and placed on the hot oiled griddle. This is an energy intensive process; CO_2 emissions at our local power station increase as we get the boiler fired up (not to mention oxides of sulphur and nitrogen). The bun is unwrapped and opened in readiness. The garnish, (lettuce, onion, gherkin, etc.) removed from its hygienic plastic containers and carefully placed on our waiting bun. An appetising smell fills the air as our burger is griddled. Our taste buds stimulated, our retail sales operative lifts our burger and, with a practised flip, places it atop the garnish. A squirt of mustard/relish and a cheese slice, plastic wrapper removed, complete the assembly process. (I bet you thought I'd forgotten about the cheese slice in the previous section. If you're feeling adventurous you might like to jot down the environmental implications of the cheese slice for yourself.)

An individually wrapped tub of ketchup accompanies our burger into our foam plastic box. The whole process has taken no more than a moment or two. Our friendly operative returns to the serving hatch and intones, "That'll be £1.99 please". We wonder at such economy while handing over the money. "Have a nice day!" We drive off to a more picturesque part of the car park and secure an excellent view of the rush hour traffic speeding up the A90 Aberdeen road. It's a cold day so we keep the engine running to operate the heater. We unwrap our precious meal, apply the ketchup, wonder vaguely what to do with the empty wrappers, and then we're ready. We take a deep, satisfying, bite, mmmmmm…

"Oops!"

We exclaim in a restrained manner. A mixture of mustard, relish, ketchup, melted cheese, beef dripping and sunflower oil squirts sideways out of the confines of our bun and onto our dark grey business suit and our smart car upholstery. Dry cleaning is now inevitable. Solvent cleaning involves the release of a number of environmentally damaging gases; some ozone depleting, some, greenhouse. Pollution incidents at dry cleaners are notoriously difficult to detect, as any escape is soon diluted by the atmosphere and becomes undetectable (the same is true of the escape of petroleum vapours from garage forecourts). We make a mental note to have the car valeted and continue our meal with a slightly reduced sense of enjoyment. We're finished. We throw the rubbish onto the passenger seat for the time being and set off.

8.3 Disposal

Driving along through heavy traffic, the smell from the waste packaging prompts us to consider our disposal options. There are four practical options:

1 drop it out of the window.
2 stop at the first lay-by and put it in the bin.
3 take it home and put it in our dustbin.
4 return it to the burger company and ask them to re-cycle it.

Let's examine each option in turn:

1 **Drop it out the window.** Advantages: very quick and easy and involves no particular effort on our part. Disadvantages: someone might see us; it is against the law; we might get caught; foam plastic takes many years to biodegrade; foam plastic is unsightly; it blows about in the wind.

2 **Stop at the first lay-by and put it in the bin.** Advantages: quick and entails only slight inconvenience; legal; socially acceptable. Disadvantages: it may blow out of the bin in the wind; animals may rake about in the bin and spill the contents; the bin lorry has a long distance to come to empty the bin involving diesel and manpower; all the normal disadvantages of conventional waste disposal (see end of this section).

3 **Take it home and put it in our dustbin.** Yes, not bad. Advantages: we take responsibility for our own rubbish; we have control of our own dustbin and clean up any spillages; we have regular waste collection arrangements that possibly employ some environmentally positive waste disposal strategies. Disadvantages: I have drawn up the EC Preferred Disposal Strategies below:

Best				Worst
Re-use	Re-cycle	Incinerate (with energy recovery)	Incinerate (without energy recovery)	Landfill

Assuming we live in Scotland, our rubbish will probably go to landfill. This is the worst possible option. Our foam plastic will blow about on the wind and lodge itself in a nearby hedge. Even supposing that it gets anchored down by some heavy object, several passes with a bulldozer will have little effect. Foam plastic is virtually incompressible. It will occupy a very large volume for a very long time. The hole in the ground we call a rubbish dump, will fill up very quickly and then what will we do? Assuming we didn't eat the entire edible fraction of our meal, some will go to landfill as well. When buried underground this will gradually putrefy and produce a quantity of methane, giving rise to a risk of explosion and rendering the site unusable for many years.

Incineration is preferable, but who wants an incinerator in their back yard? Well nobody does, of course. Incineration is quick and cleaner but still gives rise to greenhouse gases and our carton could produce dangerous toxins called dioxins if combustion is incomplete.

Re-cycling? Well you can't re-cycle a dirty food container, can you?

4 **Return it to the burger company and ask them to re-cycle it.** This is more like it! A recent EC Directive requires companies to reuse and recycle a proportion of all their packaging waste. This, in turn, encourages companies to minimise the amount of waste they produce. Remember the 'Polluter Pays Principle'? Also there will be pressure to cut down on packaging deriving from non-sustainable (non-renewable) sources and promotion of the use of re-cycled packaging materials. We should have sorted all this out before the next millennium. There is no stopping progress.

Just one more thing, we almost forgot. The next day we rise early as usual and go through our usual morning routines. We wash and shower, brush our teeth and go to the toilet… Hang on a minute, isn't that our burger popping out to make one last celebrity guest appearance before rejoining the great global ecological cycles? Yes, our burger was forgotten but not quite gone. We flush the loo thoughtfully. Our burger sets out on its final journey carried by pure, freshwater down through the sewers to the treatment works. Here, depending on the local water authority, it will receive primary, secondary or a five star, tertiary treatment.

In the old days it would have been pumped directly into the sea to wash up on the tide line sowing a line of stunted tomato plants at the high water mark. Nowadays this is thankfully, almost, a thing of the past. Our sewage waste is treated, composted, sanitised, giving rise to large volumes of greenhouse gas and waste water. The final product is a fairly innocuous solid called 'sludge'. Although it has a wide range of potential uses including fertiliser, soil conditioner, methane generator and biomass fuel, nobody really wants to get involved with sludge. Perhaps it's the name. 'Sludge' represents a big environmental problem.

So, we've produced our burger, eaten it and disposed of our waste in a responsible way. Enjoy that? Was it a happy meal? I bet you never thought there was so much to it. We have seen the whole world in a bun. Ecology. Land use. Resource use. It's all there. If we had dug around more deeply we would have ended up with a short book. To go into detail would take decades.

Would it have made much difference if we had ordered a fish supper instead? Well, a bit. Our supply lines would have been shorter. We might have saved a bit on packaging. We would have relied a little less on Third World sources for our raw materials. But our poor old North Sea cod would have taken a step nearer extinction, and the small fish and porpoises that were accidentally trapped in the net as part of the by-catch will further reduce the biodiversity of this great planet of ours.

The exercise I have just carried out is called 'Life cycle analysis'. This particular approach has recently been set out in European law and places the onus on manufacturers of products to examine all of the environmental effects of their products from cradle to grave, before commencing with commercial production.

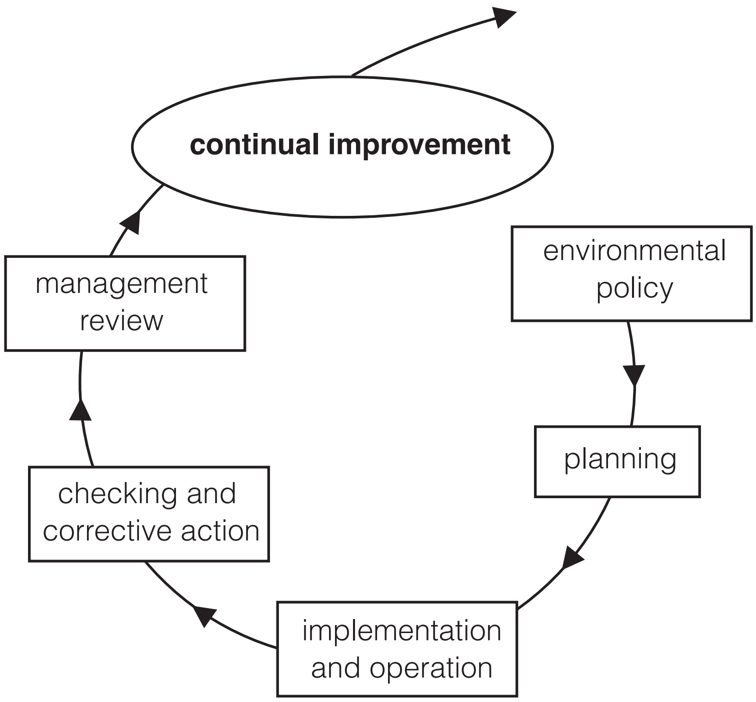
References

Lovelock, James (1991) *Gaia – The Practical Science of Planetary Medicine*, Gaia Books Ltd, London.

Further Investigation

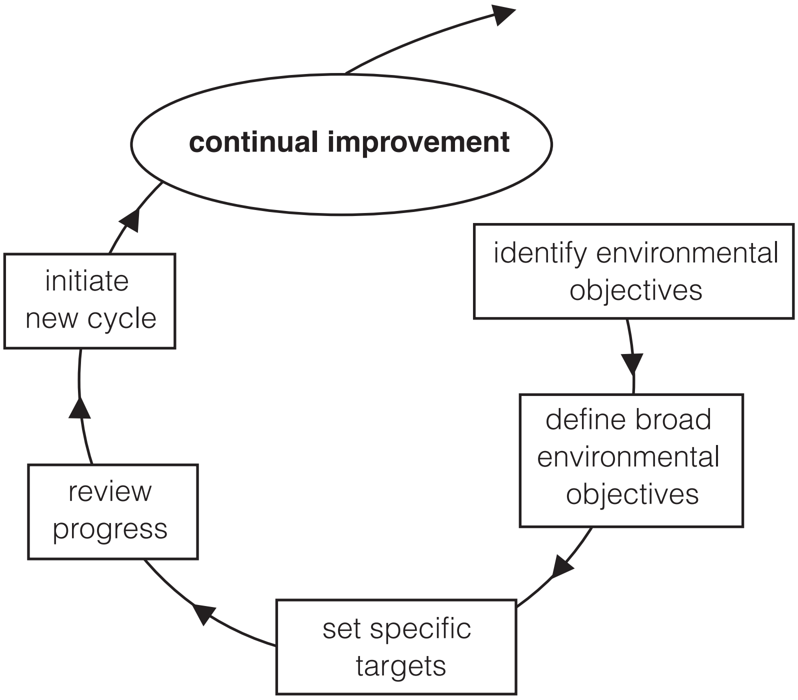
1 ISO14001 Environmental Management Systems

I don't want to spend too long outlining the finer details of ISO14001 for fear of boring. It is implemented by organisations on a voluntary basis (the 'Voluntary Principle'). Participating companies examine all of their activities and assess their environmental impact. They establish environmental policy, set environmental objectives and targets and a programme for their implementation. These activities are verified and audited periodically and senior management carry out a strategic review in order to assess performance against stated objectives. A new cycle is then initiated leading to 'continual improvement'. A model for ISO14001 is outlined below:



2 Personal sustainability plans

You may wonder what relevance this has to you. Surely this is about big business? Well, yes and no. It certainly provides a template within which companies can improve their environmental performance, but perhaps more importantly, it provides us with a model for our own personal strategy for sustainability. I have used it in the classroom to encourage students to develop their own 'personal sustainability plans'. Let's look at this in a bit more detail.



2.1 Ecological footprint – identify your environmental effects

Activity ➛ ➛ ➛

Keep a diary of all of the activities we undertake during a typical day in our life.

Draw up a table of three columns. In the first column, list all the activities. In the next column list all of the resources we consume – it is useful to discriminate at this point between renewable and non-renewable resources.

In the third column identify the principal environmental effects associated with our activities. Remember, adverse effects will normally be associated with non-renewable resource use.

Finally list environmental effects in priority order. This is our ecological footprint. We are now ready to go on to the next stage.

Diary	Resources consumed	Environmental effect
Had a hot bath	Water (R)	Energy consumption
	Energy (NR)	Waste water
	Soap (R)	Water consumption
Breakfast	Energy (NR)	Energy
	Cereals (R)	Land use
	Milk (R)	
	Water (R)	
	Tea (R)	
Drive to work	Petrol (NR)	Fossil fuels
	Car (NR)	Pollution
Etc.		

2.2 Broad objectives

Some people call them objectives and some call them aims. I'm an objectives man myself. It doesn't really matter. What does matter is that any objectives you do set for yourself are practical, measurable and achievable. It is no good setting out to achieve the impossible, you will only become disappointed and this will lead to disillusionment. I expect you have seen some evidence of my own disillusionment while reading this text. Your objectives should arise directly out of the exercise we carried out for the ecological footprint and should not be plucked out of the blue. So while 'an end to all war and the bringing about of world peace and global harmony' is a totally worthy objective, in itself it cannot be related to our identified 'footprint', nor is it a practical proposition. Don't get me wrong, I'm all for world peace, I just don't think that such an objective would be appropriate in this context.

'To work towards an end to Third World poverty'on the other hand, I consider an entirely appropriate objective, as this strikes at the heart of our global environmental problems, of which we all are a part. How can we bring this about? Well, it's simply a question of 'thinking globally and acting locally'. We might: sponsor a Third World child through her education; support initiatives to cancel the third-world debt; give generously to famine and disaster relief appeals; try to shop in an environmentally responsible manner which is not dependent on the exploitation of Third World labour or resources. In reality, I do all of the above but now we've moved into the realms of target setting, which is the topic of the next section.

So how do I set my objectives? Well, consider my footprint from the previous section. The objectives below flow directly from this:

- To work towards an end to Third World poverty.
- To reduce my dependence on non-renewable resources.
- To reduce my personal energy consumption.
- To seek out products and services from environmentally responsible providers.
- To reduce my own production of waste by adopting best practice.
- To dispose of my inevitable wastes in an environmentally responsible way including re-using, re-cycling and composting.

I think this is quite enough to be getting on with at the moment. We will be able to refine them as we go along, and if we set ourselves too much work we'll probably put ourselves off and achieve nothing. It's now time to set ourselves some appropriate targets.

2.3 Target setting

I'm going to take one of the objectives from the previous section and attach some suitable targets to it. I think 'energy' would be an appropriate example as certainly energy consumption is an environmental effect common to us all. Our targets should be practical, achievable and where appropriate, time limited. Each target will fall into one of three distinct categories:

1 No cost options: these are positive, environmentally-informed actions we can take that cost us nothing other than a bit of extra time and effort. These are possibly the best sort of environmental targets because they are simple, everyday things that we can all do.

2 Low cost options: targets which require a small amount of capital outlay but which will pay for themselves in a relatively short time.

3 Investment options: these require substantial capital investment and may not pay for themselves for 10-20 years. We would only consider such actions when say, our old central heating boiler blows up, or we win the lottery.

So let's set some targets for our objective 'to reduce my personal energy consumption.'

No cost:

- Always switch off all lights and appliances when not in use.
- Never leave appliances set in standby mode.
- Completely shut down PCs when not in use.
- Only fill the kettle with the amount of water required.
- Turn down central heating thermostat by 2 degrees.
- Check central heating timer clocks regularly and adjust as required.
- Close all internal doors before retiring to bed.
- Never leave external doors and windows open when the heating is on.
- Try to have showers rather than baths.
- Never use the washing machine or dishwasher for less than a full load.

Low cost:

- Install loft insulation.
- Fit draft excluders on all external doors.
- Replace light bulbs with low energy equivalents.
- Consider fitting individual thermostats on central heating radiators.

Investment opportunities (I'm likely only to manage one of these a year):

- Replace my old central heating boiler with a modern condensing equivalent.
- Install cavity-wall insulation.
- Install double-glazing.
- Install solar hot water panels.
- Replace my domestic appliances as they become redundant, with the low energy equivalents.

It's now time to tabulate our plan in a convenient way. It is not enough merely to set objectives and targets, we must be prepared to review our progress towards achieving these within a set timescale.

Objective	Target	Review date
To reduce my personal energy consumption	Always switch off all lights and appliances when not in use	January 2005
	Never leave appliances set in standby mode	January 2005
	Completely shut down PCs when not in use	January 2005
	Only fill the kettle with the amount of hot water required	January 2005
	Turn down central heating thermostat by 2 degrees	January 2005
	Check central heating timer clocks regularly and adjust as required	January 2005
	Close all internal doors before retiring to bed	January 2005
	Never leave external doors and windows open when the heating is on	January 2005
	Try to have showers rather than baths	January 2005
	Never use the washing machine or dishwasher for less than a full load	January 2005
	Install loft insulation	Spring 2005
	Fit draft excluders on all external doors	Spring 2005
	Replace light bulbs with low energy equivalents	Ongoing
	Consider fitting individual thermostats on central heating radiators	Before winter 2005/06
	Replace my old central heating boiler with a modern condensing equivalent	Within 3 years
	Install cavity wall insulation	Within 5 years
	Install double glazing	Completed
	Install solar hot water panels	Within 5 years
	Replace my domestic appliances as they become redundant with the low energy equivalents	Ongoing

Our review should take account of whether we have achieved each target or not. If we have achieved it, what would we plan to do next? Remember, our system does not allow us to do nothing; we are committed to continual improvement. If we haven't been successful with our targets, then why not? Did we set unreasonable targets? Were they inappropriate targets? Were they the right targets in the first place? Once we have completed our review, it will be time to go back over the process from the beginning by re-defining our ecological footprint and setting new objectives and targets as appropriate.

2.4 Sacred cows

Well, we really feel better for having done that. The environment is now safe in our hands. The trouble is we have deliberately forgotten one or two things; for instance, that great big gas-guzzling Volvo Estate parked in the drive. We could argue that the majority of the energy used in a vehicle's lifetime is that used during production and we will be keeping the same car for a very long time, hence our Volvo becomes environmentally positive. Pure fantasy, I'm afraid. The fact is that we really like the Volvo. We would not like to drive a little, energy-efficient runabout. The Volvo is our sacred cow! Surely even environmentalists are allowed some little luxuries. What about the foreign holiday? Yes, yes we know. We should not be deterred by our inability to deal with all our environmental effects. We have to start somewhere. Perhaps each of us deserves a sacred cow or two. It's a question of balance.

3 Sustainability in the balance/ecological accounting

Basically, what we need to do is balance our environmentally positive activities against our sacred cows.

Ecological balance sheet	
Positive environmental effects	Sacred cows

Our ultimate objective is to be ecologically neutral, that is making no net contribution to global environmental problems. Sadly we're nowhere near being able to achieve this. National and international intervention on a vast scale will be required to ensure sustainable energy and raw materials become a reality. Meanwhile, fortunately, the Earth has an incredible ability to absorb and mitigate the effects of our activities.

4 The weakest link – or why are we so bad at achieving our environmental objectives?

It's all very well having laws, regulations and systems in place to improve our environmental performance, but all such initiatives have to be universally recognised in order to be effective. One of the key problems I think I mentioned earlier, is the short-term view of national and local government and the conflicting priorities to which all governments are subject. For example, the need to transport people and products around the country by road clearly conflicts with the need to reduce emissions from the internal combustion engine. A 'Green Tax' on petrol and diesel might be a good way of progressing this, but, as the recent petrol crisis showed, motorists would take to the barricades and threaten civil disobedience rather than succumb to such a tax. The Work Place Parking Levy has, thus far, been shown to be similarly unpopular and unworkable. The widespread introduction of such environmental legislation could cost a government more votes than it could reasonably afford at a close-run general election.

Being good environmentalists we would, of course, support any legislation likely to cut down pollution arising from cars and other vehicles, provided that is, that we were not being asked to walk to work ourselves. We all suffer from what my wife calls 'cognitive behavioural dissonance'– knowing and believing a particular thing to be true and morally correct, while carrying out a completely contradictory action. For example, I know and believe that it will be better for the environment if I leave the car at home and walk to work, but I take the car anyway. We humans are full of such contradictions. I've listed some of the reasons why I believe we fail in our environmental obligations below:

- sacred cows – take for example, the American energy and resource intensive way of life
- resistance to change
- institutional inertia and inflexibility
- lack of commitment
- lack of resources
- conflicting priorities
- attitudes of indifference, suspicion, even hostility.

These are of course only excuses, made in the belief that we will have time to save the planet tomorrow. Collectively these excuses forge the 'weakest link'in our efforts to improve our environmental performance. All our efforts are doomed to failure if we succumb to the logic, which states that there is no point in me, my government, or the European government doing anything until the Americans come into line. If we wait for this, we may wait forever. It's time for unilateral action.

5 Systems thinking in agriculture

The systems thinking model for industry provided by ISO14001 and other environmental management systems has its counterpart in the land-based sector. Increasingly, farmers and growers are adopting novel approaches to crop and livestock production that involve a holistic approach to land use. Integrated crop management, or ICM for short, is a relatively new idea that is rapidly gaining in popularity throughout the world. It uses a holistic, whole-farm approach to land management.

Some years ago it was noticed that the yields of cotton in Chile were falling despite the application of large quantities of pesticides. At this point chemical spraying was stopped and yields began to recover. The reason for this effect soon became clear, namely, because of repeated application of the same active ingredient, pests had become resistant to the pesticides. In addition to this, populations of the pests' natural predators had been severely reduced. Agrochemicals, as a general rule, have an adverse effect on plant growth. That is, if they are applied in the absence of a target pest, weed or disease, they cause plant damage symptoms that reduce yield or quality. These effects may be acute (eg scorch), or sub-clinical (ie not immediately obvious). In the example above, when the spraying programme was stopped, yields increased again as the pests' predator population recovered and crop damage as a result of pesticide application stopped.

1ntegrated crop management, as a strategy for agricultural, pest, weed and disease control, depends on using the full range of plant protection methods, including pesticides. Wildlife and beneficial insects are encouraged, fertiliser inputs optimised, disease resistant varieties of crops are planted and more traditional approaches to farm management adopted. From this point of view, ICM represents a halfway house between intensive high input methods and organic systems. If there is a Link Environment and Farming (LEAF) Demonstration Farm in your area, it is well worth organising a visit. Contact your local Farming and Wildlife Advisory Group (FWAG) Officer for more information.

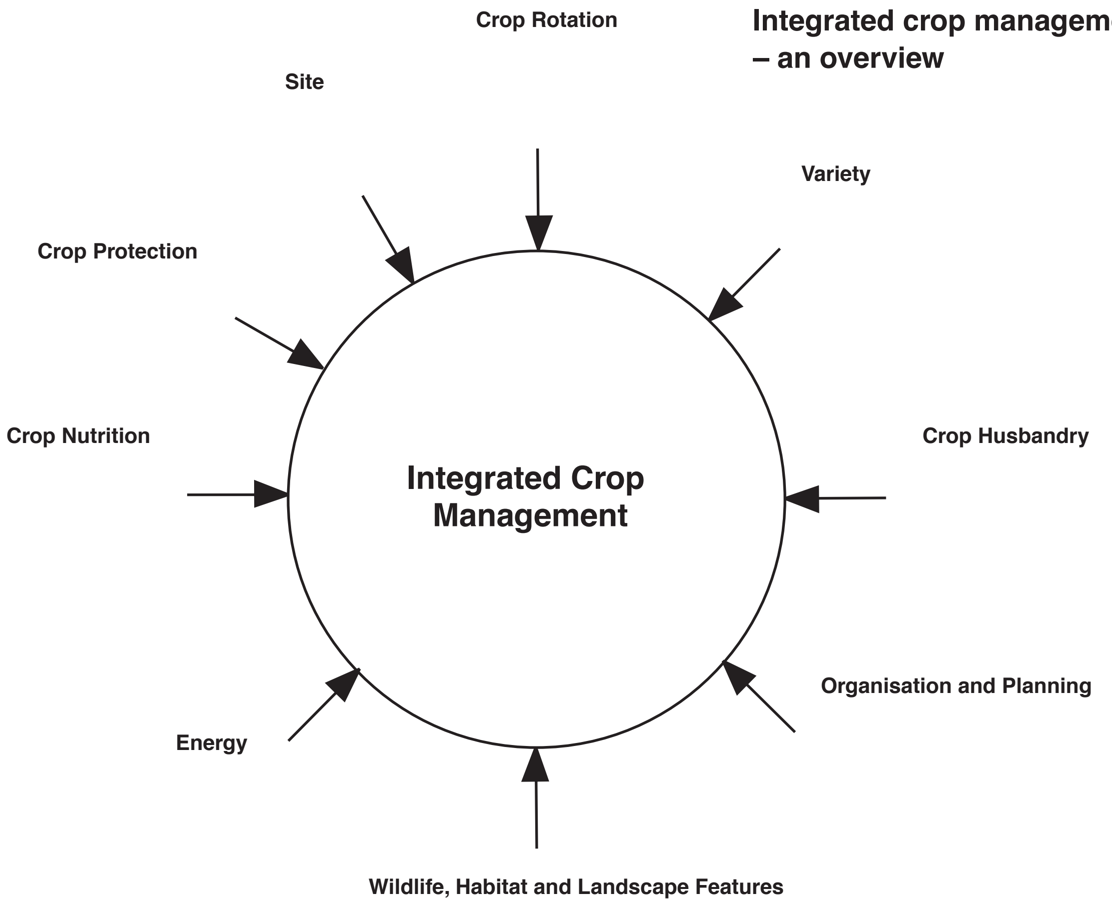
Activity ➛ ➛ ➛

Using the blank diagram below, characterise the various inputs to integrated crop management systems.

- How will fertiliser inputs compare with those of intensive systems?
- What about pesticides?
- What will be the effect on local wildlife?
- How might an endangered species such as the grey partridge benefit from the adoption of ICM?
- What is a beetle bank? What is it for?
- How do you think ICM can contribute to global sustainability?

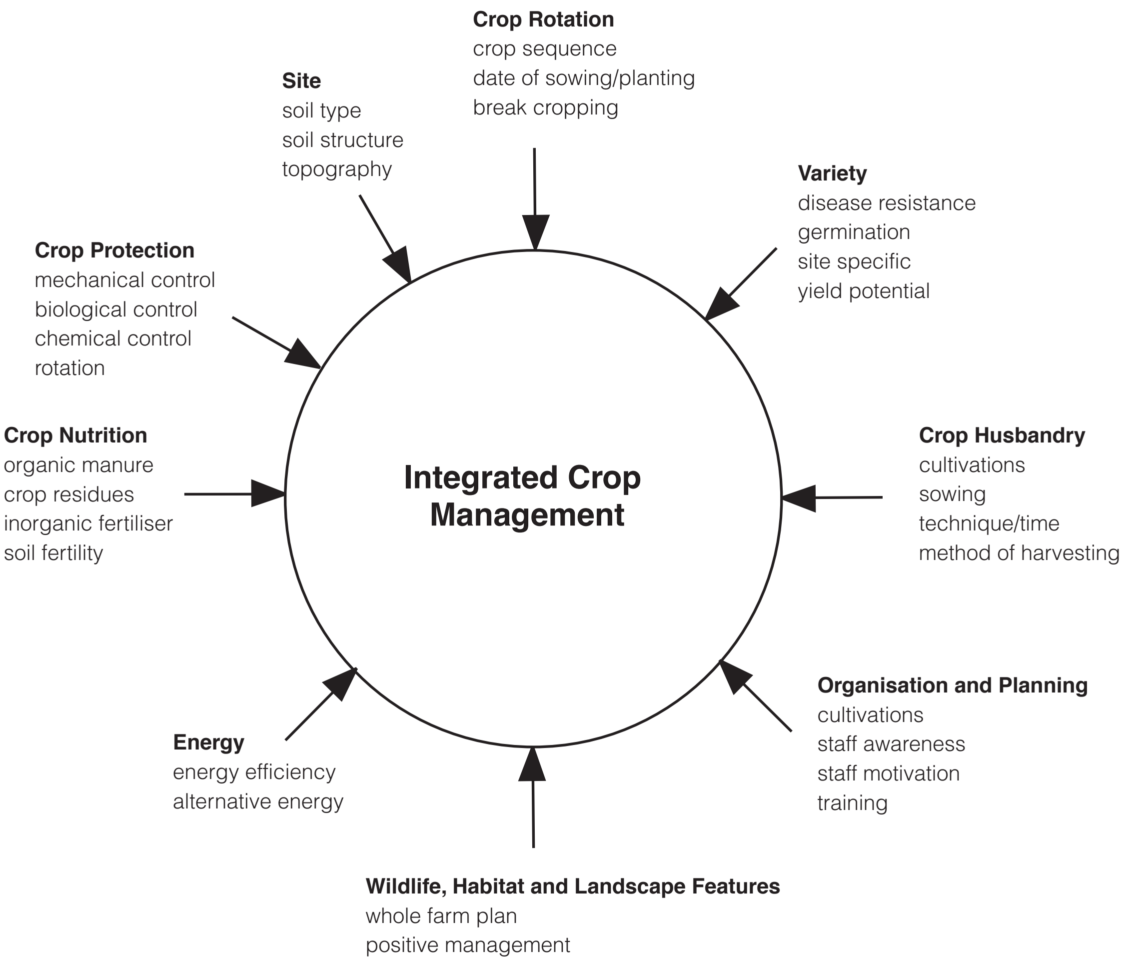
Compare your completed diagram with the one that has been filled in for you on page 27.

Integrated crop management – an overview



6 Integrated crop management – an overview

Balancing economic production with environmental responsibility



7 Organic systems

Organic systems are, of course, even lower impact than ICM. Organics allow only natural fertilisers and only a very limited range of 'organic' pesticides. The Soil Association 'Standards for Organic Food and Farming' specify a whole-farm approach to land management and are not simply concerned with production of a particular end product, eg beef, oats, turnips, etc. Some of the areas covered by the Standards are listed below:

- soil management
- crop rotations
- manure and plant wastes
- transport
- weed, pest and disease control
- environmental pollution
- packaging materials
- animal health and welfare
- ethical considerations

So we can see that organic production is far more than simply cutting our inputs of fertilisers and pesticides; it's a whole package of environmental measures. There are obvious drawbacks to organic systems, but these tend to be economic rather than environmental. Try going down to you local supermarket and completing the 'Supermarket sweep' exercise on page 52 of the Toolbox.

Clearly organic products are more expensive than the conventional equivalent.

The problem is that caring for the environment costs commitment and money. Sixty years ago, all UK farmers were organic and the nation could not feed itself. Our meat came from New Zealand, our wheat from Canada, coffee from Kenya, sugar from Jamaica and tea from Ceylon (ie Sri Lanka). We had a Commonwealth to look after us and our inability to feed ourselves did not matter.

- What would happen to the British acreage of crops and livestock if all of our farms were to become organic farms and the population depended on these for their food?
- Do you consider that this would be environmentally positive?
- List five effects that this would have on the countryside.
- How could we afford to transport our food around the world in the old British Empire days?

The topic of food production certainly raises many interesting questions about the way we lead our lives.

8 Ecology, land use, resource use

An integrated approach to practical investigations

There's an old school of thought that believes that all you need to study ecology is a notebook, a pencil, a pair of wellies and a minibus. I must say that I very much favour this approach. No amount of virtual field trips, CD-ROM presentations or classroom simulations can compensate for the experience of being outside, interacting with the environment. I appreciate that, particularly in schools, everything mitigates against field trips, but I don't think you should let this deter you. Because time is of the essence and opportunities for fieldwork rare, you should ensure that you maximise the effectiveness of your time in the field by adopting an integrated approach to your practical investigation. In addition to economies of time and scale, this will mean that you approach your fieldwork in a joined-up, holistic way and encourage your students to make the connections between actions and consequences.

Below I have tried to create an exemplar for how such an investigation could be carried out. I have selected a river system as my area of study, as these are particularly amenable to a systems approach and most of you will have a suitable waterway in your area.

Activity ➛ ➛ ➛

Select a river or stream in close proximity to your school or college.

Carry out a map survey of the area. Make a note of any points of interest; note any industries, weirs, dams, mills, etc located in the survey area. Use a dictionary of local place names to study the land use and industrial history of the site. Obtain old maps of the area: how has the river been adapted to meet human resource needs? Obtain the land capacity from agriculture maps: what is the land adjoining the river principally used for? Pinpoint suitable areas for more intensive study.

Carry out a preliminary site visit. Note the land use systems on the adjoining land. Record any industries located in the survey area. Carry out a survey of the sections of the river you hope to study. 'River habitat survey' is a particularly good model for this. Although it is perhaps a little too complex for some ability groups, the methodology is easily adapted to suit individual class needs.

Back in the classroom, plan your investigation in greater detail. Set a clear objective, eg to investigate the interactions between land use, resource use, water quality and the ecology of the River Leven in Fife.

Plan out how you intend to study the area. Get each student to produce a clear plan of action. Contact a local industry on the river to arrange a visit. Suitable industries might include: a distillery; paper mill; power station; tannery; woollen mill; cereal mill, etc. Get in touch with a local farmer and arrange a visit. Ask the class to list what they would like to achieve from these visits. They should produce a list of questions they would like to have answered about the shared impact of river use. Suitable questions might be:

- Why is the industry sited on a river?
- What do the industries use the river for?
- What are the effects of the industry on river habitat quality, water quality and the local ecology?
- Has the industry ever been responsible for a serious pollution incident?

Farmers should be interviewed about farming methods in general and their effects on the river in particular.

Two precise locations can now be selected for carrying out a comparative ecological study: a before and after survey. One site should be located well upstream of the industrial and land-use effects you wish to investigate, and the other immediately downstream. If you have the resources, you may be able to split the class into two groups to achieve this. Suitable survey types might include:

- Biological surveys of plant and animal life within the river and its adjoining corridor. Special reference should be made to biological indicator species and specific adaptations to the habitat; in effect, a sophisticated pond dip. An excellent resource for this is the *Biodiversity Pack 1: Animals (Science)*.
- Water quality survey including nutrient load (N, P, K), pH and water clarity. Involve your Chemistry Department if possible.

Back in the classroom, the results should be written up in a normal report format. The interaction between land use, resource use and river habitat quality should be highlighted. The report should make positive recommendations as to how environmental quality could be improved, and include an integrated environmental management plan for the river catchment. Reports can be obtained from WWF on their 'Wild Rivers' project to help with this.

References

Merrick, L (1998) *Biodiversity Pack 1: Animals (Science)*, Pearson Publishing

linking thinking

New perspectives on thinking and learning for sustainability

A WWF Scotland publication

The mission of WWF is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by:
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Focus **unit 7**

linking thinking

New perspectives on thinking and learning for sustainability

Using Linkingthinking in a real system

by Deryck Irving

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unit 7 part A

Key Ideas

This unit is part of the Linkingthinking suite of materials that seeks to help generate new perspectives, introduce systems ideas and develop relational thinking skills which are broadly applicable to different situations and contexts.

Aim of this unit

To demonstrate the ways in which Linkingthinking approaches can be used in investigating an obvious system found in the real world.

Voices – a riddle

A Who are the voices speaking to?

B Who is each voice?

Notes on how to use the following material:
This is intended as an interactive reading so people are thinking about the answers as they read. It could be made into more or less of an 'exercise' as suits. Readers could be asked to match pictures of the voice 'owners' to each bubble. This depends on where it might be used – eg exhibition or journal, the likely age group, etc. It may need some adaptation to fit different contexts. The hope is that the different perspectives, because they are diverse, will show up how partial the perspectives are. Maybe only the river itself can take a holistic view? On completion, readers could be asked to write what the river would say back to all the different voices, or to write some fresh voices, or to identify two voices which might be in conflict with each other and write a dialogue between them.

Answers:
A A river
B Voices – 1 Salmon 2 Farmer/landowner 3 distillery manager 4 property developer 5 canoeist
6 harp 7 angler 8 hydro-engineer 9 nematode worm

1 *I know exactly what you are. You're a ceiling. You give me a ceiling that defines my world – you colour it silver, blue, black. I hide in your indigo pools, slip and glide through the world below the ceiling, casting my eye for the flash of my quarry behind washing leaves or amongst your caves and mountains. The booms and echoes of alien life above you rush me away to safety. You move, sometimes fiercely. You and I travel in harmony on a common journey to salt-water but then I must turn and travel against you to find my home. I pitch myself against you, shatter through your ceiling to shock and gasp in the other world of dry space, where I find mirror images of the peaks and gullies and waving greenery I know.*

2 *Rubbish, you're a boundary – see how you've defined my land for centuries. You're a godsend for my tatties in the summer I must admit, after four weeks without rain. And you make me money if we work together – if I take down trees, clip long grass for the tread of those city toes, fence back the cattle from your edge. But every winter I wait for you to steal away my land. You gallop through. Go towards Willy's on the other side, not mine, can't you? I am your steward, your guardian, a watchman over you. And yet I have to fortify against you, help nature be robust. Just do us a favour and leave my best pastures alone this year, eh?*

3 *Sorry, but you're nothing as measured as a line or ceiling. What you are is an image. An image to open the purses of foreigners. We depend on you, it's as simple as that. Your pristine reputation is our unique selling point. We have to work together to keep up appearances, to keep you clean and pure. We capture you with other ingredients and 18 years later the cork 'phops' out to pour liquid gold. And we depend on you to take away the waste. We tend you with biological treatment plants but we're still watched. It's all so strict these days. When it's not clean enough for you we have to put it on the land instead.*

4

To hell with all those – you're a bloody nuisance. Threatening perfectly good land, I don't know, you should be ashamed. It's nice flat land that I've got tabs on for 80 new houses. You haven't turned on us for, what was it I heard, a hundred years or so? So just keep off, keep away. People need somewhere to live, you know. The engineers will come up with a plan to widen or deepen or straighten you so you're less of a threat to my punters; perhaps a wall to keep you on the right track. We'll take a small risk with you. Everything will be fine if you just know your place. OK?

5

Hey – we think you're fun! You carry us. Sometimes you're kind. Sometimes, tiring of us on your back; you become Scotland's 'bucking bronco'. You bounce us through the 'washing machine', tumble us over rocks, catch us out with your side-swipes, and then surprise us with miles of sedate glide. We bathe with you, sparkle your drops off our paddles, tremble before your fierce chutes. We learn new skills, new strokes to control the way we travel with you. We dry ourselves after your dooking games and laugh. Loudly. You spit us out from hills into a sea mouth where we cheer, take photos, discard tangerine and lime-coloured clothes in front of you and tourists, both nonchalant at our nakedness. And then we pack up the piles of gear that it takes to beat you at your games, and travel away at five times your speed thumbing our noses and in awe of you and grateful to you for the journey.

6

How small-minded they all are. You're an inspiration – you prompt the fingers of a woman to ease and pluck my strings into life. You inspire her with the tunes which cause my listener to close his eyes, to surprise himself with the human bubbling up inside the man. He discovers a place where fairies whisper his name from out of sight, behind his ear. I tinkle a channel in his mind that speaks to him of you – stirring whirlpools in hearts and minds and history. Lyrical, light and liquid. The sunlight sparkling over you is captured in a flow of notes that I cascade to the core of the man who listens.

7

You're a wild, untamed thing. I like the way you go where you please, do your own thing. It's good to feel you nudging around me, right up to my chest when conditions call for it. I wear your colours in wool, cotton, plastic – sensitive to your spirit. You bring me a stillness I don't have in the city. A week of your surfaces flashing heather-clad hillsides, pinewoods, scurrying grey clouds, and I relax. These things I learn about my sport, the hunt and play, is just an excuse to be near you – a sort of purpose to the solitude we share. I don't mind paying for the privilege, to experience your true essence without disturbance, especially as it helps to make you safe. Fresh air strokes my lungs, clears my mind and palate for the rasp of whisky and exchange of the day's yarns that will surely follow after you and I say goodnight.

8

Let's be practical about this, you're a working thing, a fine resource. You provide my job and the nation's comfort. Driving to my next inspection I see you stepping down through the land. Your roar and splash on rocks discards the heat and energy as you go. A few miles more and I'll adjust the gates and valves to harness more of you, turn on a million kettles, the football stadium lights. What a great commodity you are.

9

You're an oozy home. I love your dirt. I need your sediment, thick and murky. You must notice me squirming at your base, munching up bacteria. My wrigglings mean very little to people except scientists who see me as an indication that you are dirty. What an insult. I hope I mean more to you? I cleanse you. I stay still when you are an eternal fidget – passing over and over me, always renewing yourself, here and gone.

Written by Linda Cracknell

1 From source to sea – the linear river

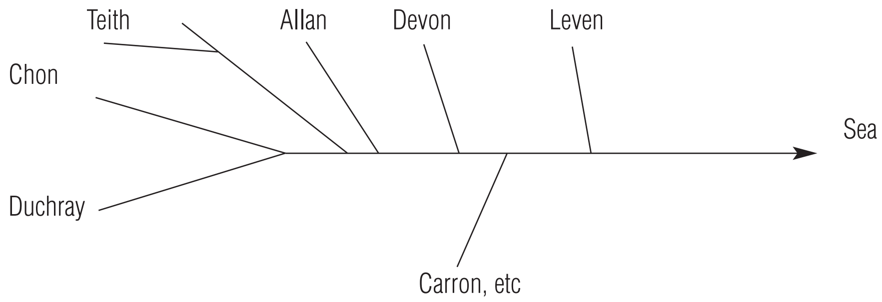
Think of a river.

Most of us think of rivers as being linear. They rise at their headwaters and flow downhill until eventually they reach the sea. The river is a line from A to B, from source to sea.

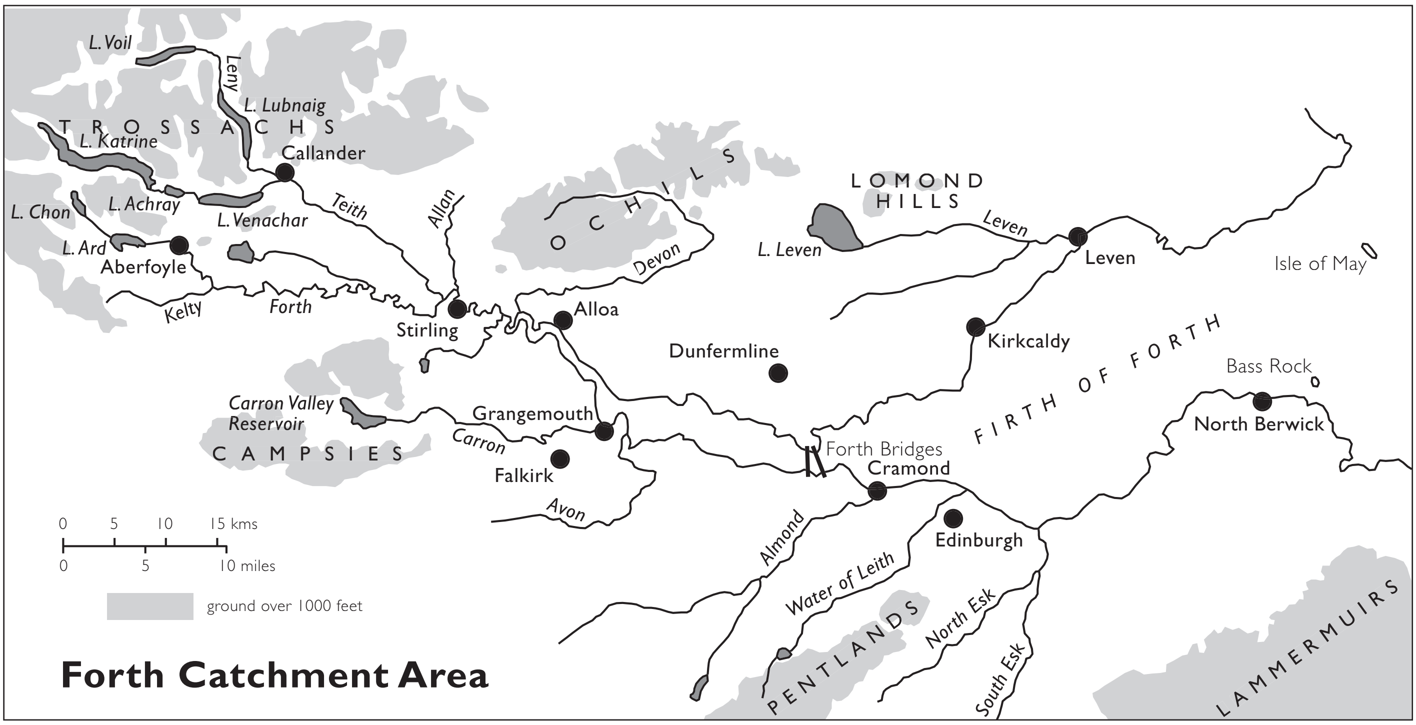
Let's look briefly at one of Scotland's major rivers. Does it fit this simple, linear model?

The Forth has two separate sources – one, the Duchray on the eastern slopes of Ben Lomond, and the other, the Chon which flows through Loch Chon and Loch Ard. So the Forth is at least two lines, but the model is still linear.

It is also joined near Stirling by the Teith which itself has two sources and by the Allan. Further east it is joined by the Devon, the Carron, the Leven, the Almond and many others.



Each of these rivers has its own tributaries and several of them flow through lochs. So even thinking only about the physical geography of the river, this 'simple' linear model is becoming far from simple.



2 Creating a broader picture

A river is more than just a channel of water. As the opening riddle highlighted, the river is many things: home for a variety of wildlife; a resource for anglers; a dump for waste products; a source of water for distillers; a nuisance (and a necessity) for farmers; a flood risk for people living nearby; a source of inspiration and calm; a thing of beauty (or a sad indicator of environmental damage)… and no point on the river is static and isolated from the rest.

Activity ➛ ➛ ➛

Think of a river that you know reasonably well. Now select a particular point on this river. Let's consider the quality of the river. At this stage it doesn't matter what measure of quality you apply, so don't get hung up on scientific measurement. Your measure of quality could be completely aesthetic; the exercise will still work.

What factors could affect the quality of the river at your selected point? Jot down those you can think of. Are these factors specific to the one point that you are thinking of or are they somehow linked to somewhere else?

Discussion

While different people (and different rivers) will produce different lists of factors, it is a fair bet that the factors you have identified can be grouped into three categories:

- those which relate directly to your point on the river – eg a particular bridge and its echo; oxygen level or nutrients in the water; clarity of the water; a bad smell; particularly good fishing spots; a kingfisher's nest

Activity continued ➛ ➛ ➛

- those which relate to the impact of surrounding land-use – eg litter from visitors or blown in from elsewhere; particularly good (or bad) views across surrounding countryside; puddling of the banks by cows; pollution from agricultural; urban run-off or from industry
- those which relate to land and river use upstream – water quality; pollution; debris from floods; the flow rate of the river at a particular time (in spate or at its driest), etc.

(Note that some of the first category factors are in fact a result of the factors grouped into the other two categories.)

You may have identified a fourth group – we will come back to this in a moment.

If we now think about the issue of flooding, you can see that, as well as the surrounding land affecting the river, the river also affects the land immediately surrounding your point or, more often, downstream. This effect is both negative (in terms of flood damage) and positive (providing nutrients to soils and maintaining water levels in wetland habitats, for example).

Now, let's get back to the possibility that you have identified a fourth group of factors. The factors discussed above have effects which are local or which occur downstream. There are, however, others – perhaps less obvious – which can have effects upstream or which originate away from the river entirely:

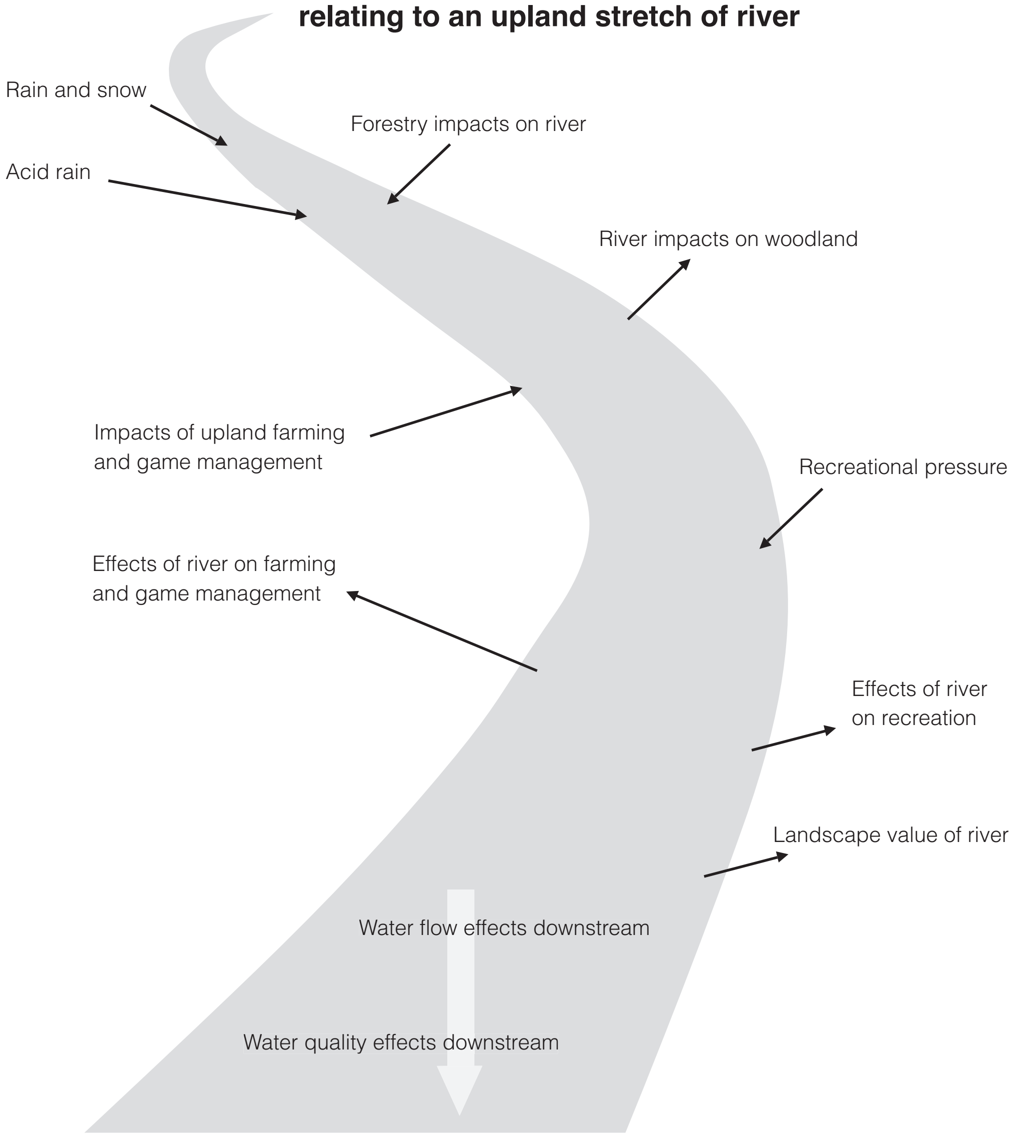
- Air-borne pollutants (such as those which result in acid rain) are produced by factories, homes and vehicles in the lower reaches of the river (or indeed, many miles away from the catchment) but can have an impact on the headwaters of the river.
- People living in the larger towns and cities in the lower reaches of the river may have recreational demands on the upper reaches of the catchment, either through using the river itself (anglers, canoeists, etc) or through using the surrounding land.
- Less directly, people over a large area also have an impact on the management of land around the river through the effects of the products which they buy.
- A further, indirect effect of people over a larger area relates to the political decisions made by the politicians whom we choose to elect.

Can we maintain our model of the river as a linear feature? Surrounding and upstream land-use has an obvious role to play, as does upstream management of the river itself. This would fit a boxed-thinking view of a river – a body of flowing water bounded by its physical geography. However, the river has an impact on surrounding land. We need to consider the river as a system that includes the surrounding land. We need to bear in mind that some of the factors identified above have effects that occur at a later time and/or at a considerable distance from their source. It must also be remembered that there is a human dimension to rivers. Rivers have played, and continue to play, an important part in people's lives both economically and spiritually.

In addition, we need to begin to consider the ways in which all these factors are interrelated. This realisation has led to the development of the concept of integrated catchment management. For integrated catchment management to really work, we need to adopt more holistic thinking when taking management decisions. Linkingthinking has a key role to play here.

(See Units 2 and 5 for discussion of boxed-thinking as a contrast to Linkingthinking.)

A simple digram showing some of the interactions relating to an upland stretch of river



(Note: effects and impacts can be seen as either positive or negative, depending on the values and perspective of the observer.)

Let's look in more detail at one aspect of the above diagram. This involves 'stepping down' a systems level to look at one aspect of the diagram in isolation and then back up a level to look at it in context.

If we contrast some of the older, intensive forestry plantations which were planted right up to the river edge and the more recent areas where space is left around rivers and streams, we can begin to see the complexity of the system.

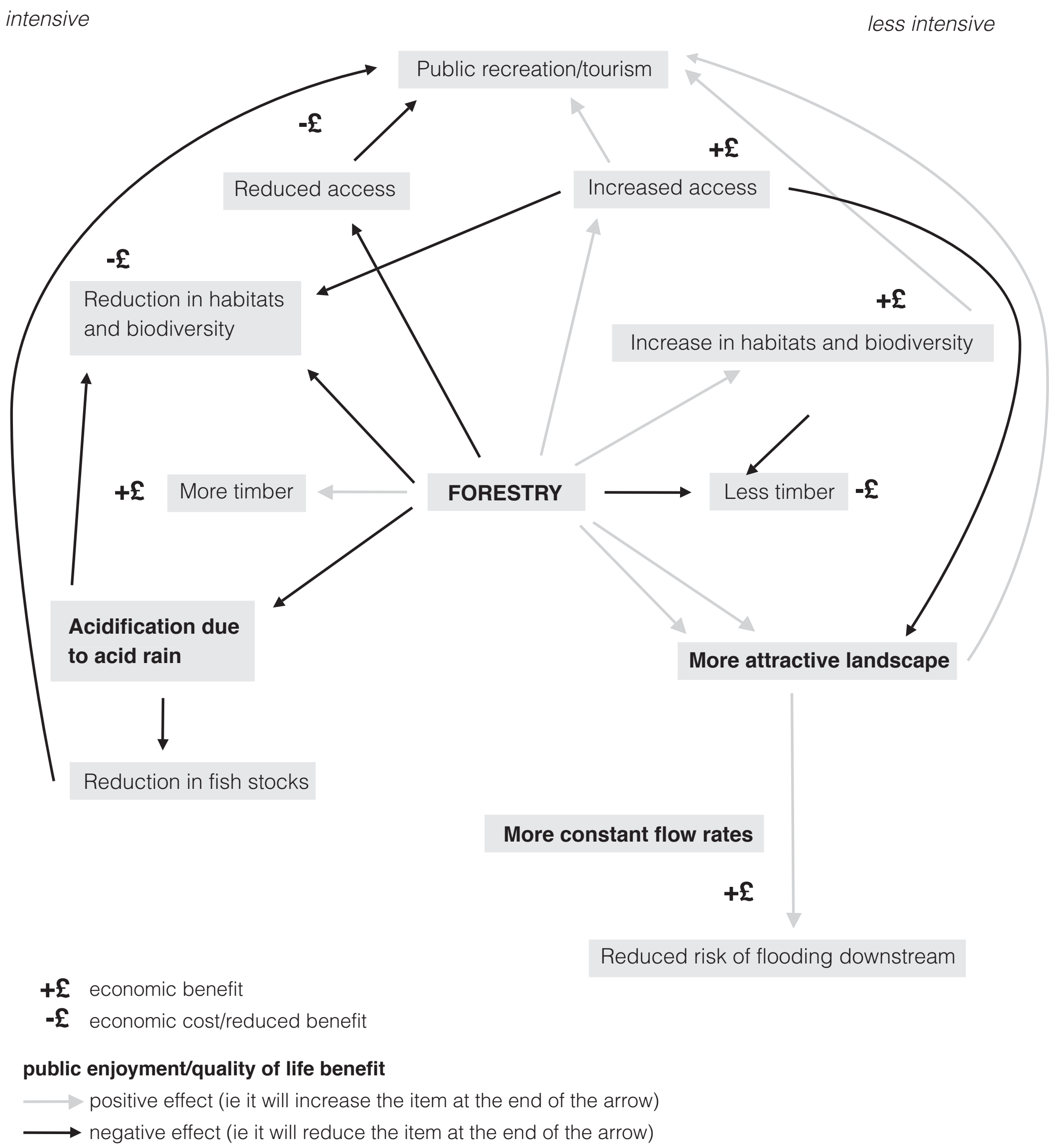
At the simplest level:

intensive		**less intensive**
more timber £ ←	Forestry	→ less timber £

Note: that timber is more costly to produce close to the river because it grows less well and is harder to harvest, so the costs and benefits are not as clear cut as they may seem.

Note: similar simplistic stances have been taken at some time by all the key land management interests. Can you think of any that relate to game management, fisheries management, and tourism or conservation management?

Let's look more closely at the forestry example:



Here's further explanation of a number of points:

1 The link between landscape and income from public recreation:
Communities in the uplands are increasingly dependent on tourism for their economic survival. Tourists may be attracted by the history and tradition of the area but are primarily interested in seeing the landscape and environment. Any management of the environment that has beneficial impacts on the appearance of the landscape will help to maintain this interest and the associated income for local communities.

2 The link between access and income from public recreation:
Many of the tourists visiting the uplands will travel by car or coach and will spend little or no time in the outdoors. However, significant numbers of visitors do wish to walk, mountain bike and climb or otherwise enjoy the outdoors. Improved public access to the forests, along with other areas, attracts more visitors and has a benefit for local economies.

3 The link between habitat diversity and income from public recreation:
Many people in the UK have an active interest in wildlife and nature. Such people, either individually or as part of organised tours, choose to visit Scotland to see its native fauna and flora. As with the outdoor sports mentioned above, this brings money into local communities.

Changes in forest management which result in significant increases in habitat quality will increase the wildlife interest of an area. Particularly when coupled with measures to encourage access and to provide countryside interpretation, this can lead to significant increases in visitor numbers and to benefits to the local economy.

It should be noted, however, that increased access for any form of recreation might have a detrimental effect on habitat quality or on landscape value.

This introduces the concept of synergy. Synergies occur where effects arise from the interaction of parts of a system and they can be both positive (work on improving forests for wildlife making them more attractive to people, for example) or negative (increasing access for people reducing the value of the site for the wildlife that people are coming to see). If we think and plan in a more holistic Linkingthinking way, then synergies are more likely to be positive.

Note: in systems thinking, synergies are often referred to as emergence.

Activity ➛ ➛ ➛

Sustainable rural forestry
Government initiatives in recent years have highlighted the importance of sustaining rural communities. This means, in part, that there need to be sufficient economic opportunities for people living in rural areas. With this simple economic objective, look at the diagram on the previous page and try to decide which of the following will create opportunities for work:

- forestry
- conservation
- hillwalking
- fishing.

Can you pick the most sustainable option just by selecting one?
(See Units 3 and 4 for further discussion of sustainability.)

I suspect that your answer was no. It is only through taking an approach based on a combination of land uses that a sustainable option can be found. This finding is further supported when you begin to consider the longer term sustainability of rural communities (ie will people continue to be able and want to live in these communities) and the importance of quality of life as well as economic considerations.

3 Stakeholders – another level of complexity

The preceding sections should have helped to show the complexity of river catchments as systems, but so far we have only considered some of the factors which relate to rivers. We have also only looked at one perspective (yours or, depending on how persuasive my case has been, mine).

Going back to the riddle for a moment, we can see that the river not only provides different things for different people, it also means different things to different people. People with an interest in a system (in this case the river) are generally referred to as stakeholders. (See Unit 4 for further information on stakeholders – pages 26-27 – and 'systems of interest' – page 32.)

Activity ➛ ➛ ➛

Identifying interests
Imagine that you have been asked to develop a plan to improve recreational use of the River Forth. This includes managing access and maintaining/improving the quality of the river itself.

Spend a few minutes identifying the different interests that have a link to the river and how they might interpret the phrases ‘managing access’ and ‘maintaining/improving quality’. You may find that writing down the interests you identify, and grouping them according to common interpretations is a useful tool in developing a picture as you work through Part B of this unit – ‘Further Investigation’.

The interests you identified may have included the following:

- landowners
- anglers
- the general public
- organisations which extract water from the river
- environmental organisations
- statutory organisations and water authorities.

These groups are likely to have differing priorities for maintaining or improving river quality and managing access. Indeed, they may have different understandings of the reasons for management in the first place.

The general public may wish to have open access to the river and may view quality largely in aesthetic terms, for example. Anglers will want access for fishing and will define quality in terms of the river’s ability to support healthy fish populations. Landowners and environmental bodies may wish to restrict access to areas where damage to the river and its surroundings will be minimised – they may, however, define damage differently.

Some organisations (whisky distillers, mineral water companies) may base their whole image and processes on water quality. Water quality may also have health considerations (such as the problems caused by blue-green algae in Loch Leven – see Part B; ‘Further Investigation’ pages 26-30).

Activity ➛ ➛ ➛

Using the activity 'Revealing stakeholder perspectives', page 43 in Unit 4 (or simply the approach used in 'What is a tree', page 7 in Unit 1) try to identify the values and culture which underpin the priorities of the different stakeholders.

- Are all the apparently conflicting priorities really conflicting?
- Do the priorities that seem to be the same really support each other, or are there hidden conflicts?

Remember that the social/people aspects of systems are every bit as important as the physical aspects. Because we all bring our own interests and values to bear when developing our view of the world, we all see a different system (or a different version of the system) bounded by our interests, values, etc. Therefore, it is only through investigating the 'people bit' of the systems and the links between this and the physical parts of the system that we can develop a meaningful picture of the river.

Note: you may also find 'Influence diagrams' useful in exploring physical and social 'knock-on' links and their interrelationships.

Your view of the river system needs to take these values and perceptions into account. Any successful plan to improve recreational (or any other) use of the river will need to acknowledge these different interests and their perspectives, even if it cannot ultimately meet the requirements of all of the interested groups. A successful plan will identify and promote positive synergies and thus meet the priorities set by as many of the interest groups as possible.

Note:

1 Remember that the categories of interests identified above are not mutually exclusive. Landowners are among the most likely organisations to be extracting water from the river and may also be anglers or members of environmental groups. Many anglers also have environmental interests and are members of environmental groups, and so on.

2 Because we used an example based on management changes, the stakeholder group we identified above is the more 'obvious' one. It is important to remember that stakeholders potentially include everyone from those with 'concrete' connections such as landowners right through to those with very 'tenuous' links, such as those who have a family connection to an area but have never been able to visit the area itself. While I have called these links 'tenuous' they may be as strongly felt as the links between landowners and land.

4 Using river catchments to demonstrate Linkingthinking approaches

River catchments are very useful examples of systems for demonstration or teaching purposes for a number of reasons:

- they have obvious geographical boundaries
- all land uses and activities within a catchment will have implications for the river
- the river has an influence on environmental, economic and social factors
- river catchments are excellent examples of nested systems with tributaries functioning as systems in their own right but also as components of the larger river system
- actions and effects can be seen to be separated in distance and time (for example, run-off and flooding)
- UK Government and European legislation and policy is pushing towards integrated catchment management
- catchment management plans already exist for a number of river catchments and provide a useful source of information on issues affecting specific rivers

- the geographical boundaries of river catchments often extend over political boundaries (the Forth catchment for instance, covers parts of Perth and Kinross, Stirling, Falkirk, Clackmannan, Fife, West Lothian, Midlothian, Edinburgh and East Lothian) so they offer a clear opportunity to look at the effects of setting artificial boundaries on the ability to apply Linkingthinking effectively.

(See Unit 1 for an introduction to basic systems concepts and terminology.)

The fact that river catchments are such intuitively obvious systems invites us to see them and to manage them using Linkingthinking approaches rather than box-thinking, fragmentary approaches.

Investigation of river catchments can be approached from many contexts, including:

- geography – river catchments offer an excellent opportunity to explore the interconnections between geographical factors or between geography, culture and society
- history and archaeology – since river catchments are meaningful at a human level, taking a whole catchment view can provide interesting insights into historic (and prehistoric) settlement and activities. If nothing else, the catchment provides a backdrop for historical events.
- river management – Linkingthinking approaches can be used to develop the integrated management of river catchments, either from a river perspective or
- land management – from the perspective of the management of land within the catchment
- environmental and conservation concerns – river catchments offer valuable insights into the ways in which environmental/conservation concerns integrate with other social and economic concerns
- town and country planning – study of river catchments is of value in many aspects of planning, most notably flood control or prevention (both in terms of managing rivers and of siting developments)
- natural resource management and sustainable development – as already stated, river catchments are among the most obviously interconnected of natural and human systems and are therefore valuable in introducing concepts which can then be more broadly applied.

5 The Forth – a short case study

The Forth catchment covers over 4,000km2, a large proportion of eastern central Scotland.

The River Forth rises as two separate sources: as one the Duchray on the eastern slopes of Ben Lomond, and the other as the Chon which flows through Lochs Chon and Ard. It is joined by a number of other rivers as it flows east, including: the Teith and Allan just west of Stirling; the Devon near Alloa; the Carron at Grangemouth; the Almond at Cramond; the Water of Leith at Leith Docks; the Esk at Musselburgh; the Leven at Leven and the Tyne near Dunbar.

The upper reaches of the river are dominated by forestry and open moorland. Once it reaches the Carse of Stirling, the major influences on the Forth are agricultural. The river in this area flows through fields created in between the 1760s and the mid 1800s. This involved drainage and the removal of up to two metres of peat. The peat was broken up and floated down the river – this had a significant impact on the lower reaches of the river ruining oyster beds and the salmon fishing. (See Part B, 'Further Investigation'.)

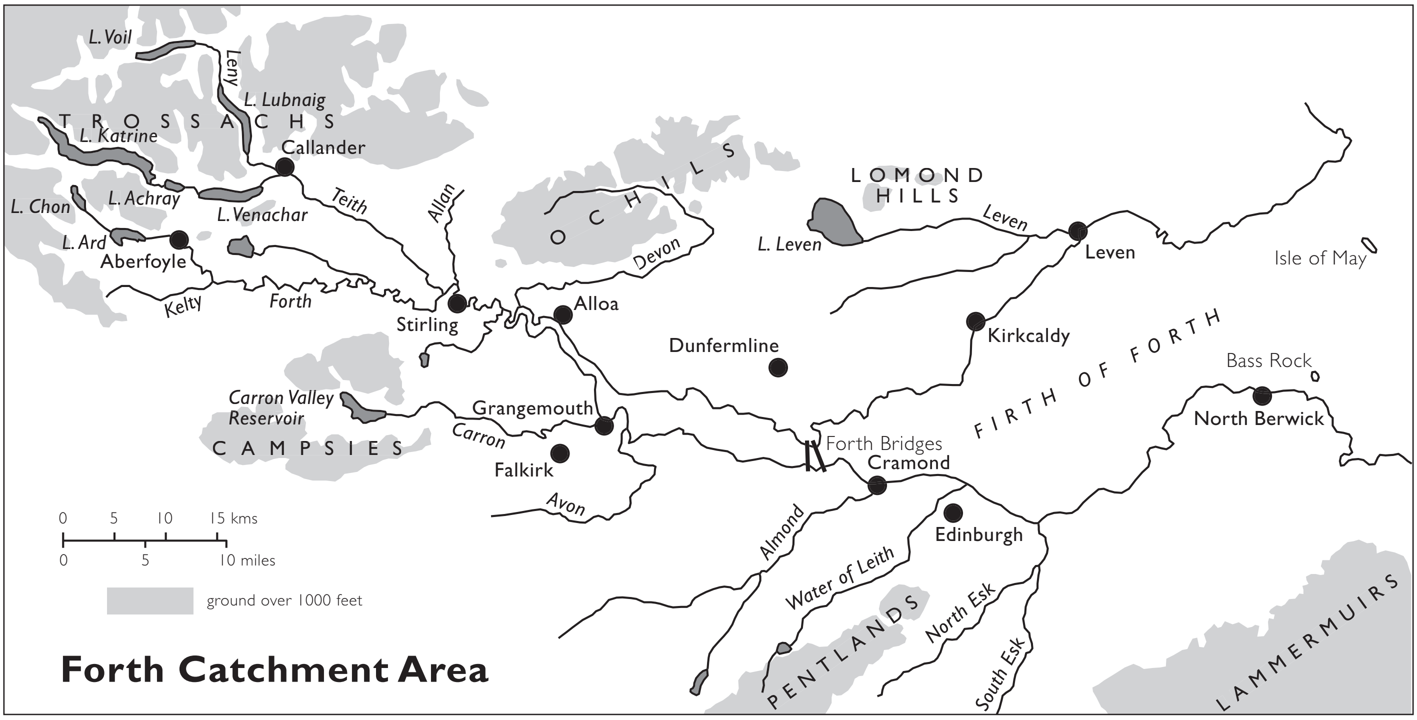
The River Forth and its tributaries have been affected by run-off from agriculture and from the M9 motorway; by industrial activities and by the impact of urban areas (Cumbernauld on the Bonny Water and Stirling on the Forth).

Between Stirling and the Forth Bridges, the Forth is estuarine in nature and is again affected mainly by industrial and agricultural activity. Just before reaching the bridges, the Naval dockyard at Rosyth has traditionally had significant implications for local employment. A ferry link has been established between Rosyth and Zeebrugge. Beyond the bridges, the Forth becomes a firth and is effectively marine in nature. The Firth of Forth itself has shipping pressures, gas exploration and tourist attractions (particularly in terms of the natural and built heritages).

The position and size of the Forth has been important to local populations for thousands of years and the area around the river, estuary and firth is rich in archaeological sites. Over 800 sites are known in the coastal strip around the estuary and firth, spanning the whole of human occupation from signs of the early hunter-gatherers through to Second World War defences. Today, there are cities, towns and villages throughout the catchment, from the Trossachs' villages through Stirling, Falkirk, Dunfermline and Edinburgh out to the mouth of the Forth which is flanked by the villages of the East Neuk of Fife to the North, and by North Berwick and Dunbar to the South.

Many events of great importance in the history of Scotland have occurred within the catchment of the Forth including the death of Alexander III which precipitated conflict with England and the battles of Stirling Bridge (over the Forth) and Bannockburn (a minor tributary) during the ensuing war.

5.1 The Forth catchment as a system



As a physical system, the Forth catchment looks like this:

As in any river catchment, the Forth is a good example for showing systems interactions because it is an easily recognisable system with clear geographical boundaries that will allow you to demonstrate many of the Linkingthinking concepts to students.

Activity ➝ ➝ ➝

Where is the boundary?
Look again at the map of the Forth catchment. In terms of physical geography the boundary of the catchment is clear; outside this boundary, rainfall does not flow into the Forth. You might want to look again. Where does the Allan rise? It isn't on our map.

Now consider some of the 'outside' factors that affect the Forth catchment:

Pollution:
- Where does the airborne pollution come from? Remember the prevailing winds in Scotland tend to be westerlies.
- Where are the cars and lorries which cause much of the pollution going? Why?
- Where are the chemicals which cause agricultural or domestic pollution made?
- etc.

Recreational use:
- Where are visitors coming from?
- Where are they going next?
- How are they affecting pollution levels?

Water extraction:
- Human intervention, particularly the great civil engineering works of the 19th century, has allowed water to flow out of the catchment. Where is the water from the Forth catchment going? While the water from Carron Valley goes to households and businesses within the Forth catchment, Loch Katrine (near the head of the Teith) provides water for Glasgow.

Political policy:
- Where are decisions taken?
- By whom?
- What factors affect these decisions?

Where do you think the boundary should be 'drawn'? Is it the physical limit of the catchment? Does it include Westminster or Brussels, since political decisions are taken there? Does it include the whole of the world since the Forth is part of the global hydrosphere?

The Forth also has the advantage of showing how even the most obvious boundaries are not the only, or even the most appropriate, boundaries of a system.

The answer is that the boundary depends on what it is that you want to look at within the Forth's system. Successful Linkingthinking involves setting boundaries wide enough to get a truly meaningful picture (ie one that includes all the important factors and their relationships) and narrow enough to give a truly meaningful picture (ie one that you can still comprehend). So, considering rivers purely in terms of their geographical catchment isn't necessarily wrong as long as that is the most appropriate boundary to set for our purposes. To look successfully at complex systems we need to be aware that we are still likely to be working in a box, set by the boundaries we choose to recognise.

6 Why isn't river catchment management integrated?

The clearance and drainage of the Carse of Stirling produced excellent arable land for farmers and landowners in this section of the Forth catchment. However, it destroyed the livelihoods of those who lived downstream and who depended on oysters or salmon for their income. This is not integrated, but it was 200 years ago.

Unfortunately, even though problems of this scale are unlikely to occur now, there are still major problems being caused by fragmented, box-thinking, approaches to the management of river catchments.

One perennial problem relates to flooding both in rural and urban areas. Well-intentioned but often ill-conceived 'improvement' of rivers has, in many areas, resulted in significant flooding problems in areas downstream. At the same time, we have increasingly built houses and other buildings in floodplain areas. This is a good example of the problems that arise when solutions to problems are focused on the interests and worldview of one set of stakeholders. This is usually the result of those with the power to implement their ideas doing so uncritically, believing that they are best placed to solve things.

Another, recent example relates to the Forth catchment specifically. In 2002, Glasgow had a major health scare over water quality. Water coming from Loch Katrine, via Mugdock reservoir to the North of the city was found to have unacceptably high levels of a bacterium called cryptosporidium which can cause severe diarrhoea. The source of the bacterium was traced to contamination of the water in Loch Katrine by sheep faeces. At the height of the health scare, 140,000 households were having to boil all the water that they were using for washing, cleaning teeth, cooking and drinking. Questions were raised in the Scottish Executive over the reasons for the problem and over the ways in which it was handled.

When you look more closely at the problem that arose, there are many factors which come into play, including:

- the grazing of livestock close to reservoirs
- the age and condition of Glasgow's Victorian water supply system
- the effectiveness of the water authority's monitoring system which picked up the high levels of cryptosporidium before serious health problems occurred
- the problems encountered when trying to inform the public of potential risks
- poor public perceptions of scientific advice in light of previous experience (BSE, foot-and-mouth, etc).

Again, a more holistic approach to planning and managing water supplies is needed to foresee, prevent or cope with problems such as the one outlined above. Can you think of any ways in which a Linkingthinking approach to water provision could have avoided these problems, or coped better with them?

The EU's Water Framework Directive and the work being carried out by the UK Government to implement the Directive should lead to integrated catchment management becoming more evident.

So why isn't catchment management already integrated?

Activity ➛ ➛ ➛

Who calls the shots?
Which organisations and individuals determine how river catchments are managed? Take a moment to brainstorm this question and list your answers.

How many of these organisations or individuals can make decisions without reference to others?

Do any in your list set the agenda within which management decisions are made? If not, are there other 'outside' organisations setting the agenda for the organisations and individuals you have identified?

To what extent are decisions examples of 'joined-up' thinking representing the views, aspirations and requirements of several of the groups at the same time?
(See the activity 'Joined-up thinking' on page 7 of the Toolbox)

Here are some of the people or groups I have managed to identify from the above activity. Try working through the activity using these groups. Who is calling the shots?

- The people and organisations who own stretches of the river – the 'riparian owners' as they are called. The responsibility for river management in Scotland lies with the riparian owners. This means that river management can sometimes be very fragmented and poorly coordinated.
- Riparian owners can include: private individuals, estates, community organisations, commercial organisations, voluntary groups, local authorities, statutory agencies, etc.
- The stakeholders with an interest in how rivers are managed and what they are managed for (eg angling groups for fish, environmental organisations for biodiversity).
- The organisations which fund work within river catchments. This includes; river management, forestry, agriculture, tourism development, house building, etc.
- The organisations that apply controls on management activities: local authorities, SEPA, River Purification Boards, Water Authorities, etc, even the police in cases of criminal activities affecting management (pollution events for example).
- The government departments involved, in the broadest sense, in river catchment management – at various stages over the years this has included departments at Scottish and UK level with responsibility for: agriculture, environment, rural development, inward investment, housing, transport, regional development, planning, urban renewal, health, etc.
- The European Union through legislation, guidelines, subsidies and other forms of funding.
- (All of the rest of us – either directly, in terms of how we treat rivers and use water generally, or indirectly, in terms of the politicians we elect and the companies from which we buy products which influence the river catchment.)

Activity ➛ ➛ ➛

Select a handful of the groups and individuals from your own list or from mine and consider these follow-up questions:

- What are their objectives and priorities?
- From what perspective are they approaching catchment management?
- How often do you think that they are able to look at and take on board the perspectives of others?

The answers to these questions should show one of the main reasons why catchment management isn't integrated. As individuals and as a society, we all have a tendency to fragment systems to make management (or indeed lifestyle) decisions more straightforward.

! Idea

We all tend to look only at the things we perceive as directly relevant to our interest and, therefore, we only see what we look at – and only from the perspective/set of interests/priorities we are looking at it from.

(See Units 2 and 5 for further exploration of this 'simple' approach to problem solving.)

The major reason for catchment management not being integrated, however, is that Government policy, over decades, has also taken a fragmentary approach. The policies that affect rivers have been generated from widely different and unconnected perspectives, often with inconsistent or conflicting objectives.

However, a recent radical change in this approach has come from Europe. The Water Framework Directive (WFD) promotes integrated management of water and aquatic ecosystems. The central feature of the WFD is the use of river basins as the basic unit for all water planning and management actions. This recognises that water respects physical and hydrological boundaries, but not political and administrative limits. Mainly through the development and implementation of River Basin Management Plans, the WFD's overall objective is the achievement of 'good status' for all of Europe's surface and groundwater within a 15-year period.

Scotland was the first component country in the EC to transpose the WFD into national law as the Water Environment Water Services (Scotland) Act 2003 (WEWSA). The general aim of the WFD was further enhanced by the inclusion into the WEWSA of sustainable flood management following sustained and effective lobbying by WWF and its partner environmental NGOs. The Scottish Executive selected the Scottish Environment Protection Agenct (SEPA) as the competent authority for implementing the WFD/WEWSA in Scotland. A National Stakeholder Forum was formed to discuss integrated river basin management planning. Further details of progress can be found at www.sepa.org.uk/wfd/index.htm.

We started this unit looking at river catchments as ideal subjects for an educational investigation using Linkingthinking skills. River catchments offer opportunities for us all to develop more holistic ways of looking at local and global issues through reference to an obvious system. It is important to remember, though, that since river catchments are such obvious systems, it is only through applying Linkingthinking-type approaches that we can hope to manage them wisely.

Further Investigation

Introduction: Looking at some of the Forth's tributaries as subsystems

The aim of this section of the unit is to show how Linkingthinking can be used to develop a greater personal understanding of the Forth as a system. This means that, unlike the rest of the package, this section does not have many activities for the reader to work through, though the activity below might help your understanding of Linkingthinking.

Activity ➛ ➛ ➛

Try to determine more about the author from the way in which the picture of the Forth is developed. What is his background; what are his interests; what values is he bringing to bear?

1 'The Forth' within the Loch Lomond and the Trossachs National Park

Within the National Park, there are several tributaries of the Forth:

- the Chon, Duchray and Kelty which become the young River Forth
- the rivers which connect Lochs Katrine, Achray, Venachar and join with the Larig, Lochs Doine and Voil, the Balvag and Loch Lubnaig to become the Teith – this then joins the Forth near Stirling. (See OS Landranger sheet 57)

What is the area like?

The river catchment in this area is typical of much of upland Scotland. Nevertheless, it is unusual, both in the high numbers of visitors to the area and in the National Park status accorded to Loch Lomond and the Trossachs. In these respects, it is perhaps more like the English Lake District.

The landscape is made up of lochs, burns and larger rivers, moorland, acid grassland, rocky crags and peaks and woodland (some semi-natural oak woods but predominantly commercial plantations of Sitka Spruce).

Why is it like this? – Successive questioning

This is based on a technique called 'The Five Whys' described by Rick Ross in *The Fifth Discipline Fieldbook* (see the Toolbox). The technique is designed to look more holistically at 'problems' by questioning more deeply. This reduces the risk of making simplistic 'snap' decisions. Each 'round' of questioning reveals more complexity and thereby allows a fuller appreciation of issues and the development of more effective 'solutions'.

In this case, however, I am using the concept behind the 'Five Whys' not to problem solve but to investigate what something is like. Used in this way, the successive questions don't always have to be 'why', nor do you have to restrict yourself to five rounds of questioning. Let's follow the process through:

1.1 Why is the area like this?

The list below is the tidied-up version of a brainstormed list produced in answer to the above question.

Because of its geology:

- underlying rocks
- glaciation
- the Highland Boundary fault.

Because of the climate:

- temperature
- rainfall.

Because of planning and other controls.

Because of land and river management:

- historic
- current.

1.2 The next round of questioning:

How does the geological history of the area affect the way it looks today?

The current form of the landscape is heavily dependent on a combination of geological factors. The underlying rock types play a major role in determining the nature of the soils in the area. The relative hardness of the various rock types has an influence on where and how erosion occurs and therefore an effect on the overall shape of the land. The two major influences at work on this underlying geology are water and ice.

It is easy to see signs of erosion, both by water and by ice, almost everywhere in the Trossachs. Rivers and burns have carved their way into the soils and bedrock and so have shaped the landscape over millennia. More dramatic has been the influence of ice during the various Ice Ages that Scotland has experienced. The ice sheets sculpted the land, deepening and widening valleys, and moving rock and sediment many miles. In the process, the routes of rivers have sometimes been dramatically changed – in fact, by the end of the most recent Ice Age, what had previously been the headwaters of the Forth now formed part of the Clyde catchment.

These stories of ice and water are common to all upland areas in Northern Britain, but one aspect of local geology is strikingly important in the Trossachs. The Highland Boundary Fault, which runs from Helensburgh on the Clyde to Stonehaven in Aberdeenshire, passes straight through the Loch Lomond and Trossachs National Park. North and west of the Fault lie hard metamorphic rocks typical of the Highlands with poor, acidic soils. South and east of the Fault lie softer sandstones and conglomerates, which break down to produce fertile agricultural soils. This distinction has had an enormous impact on the history of settlement and management of the Forth Valley.

How does the climate of the area affect the way it looks today?

The prevailing climate, both now and in the past, has had a significant effect on the appearance of the area. Rainfall and temperature have both had major effects on the type of vegetation that can survive. Plant communities must be able to cope with soils that are generally acid and often waterlogged. They must also be able to cope with cold, wet weather in both summer and winter. High rainfall levels are instrumental in causing the development of peat and its characteristic flora.

Rainfall and temperature also affect the landscape through erosion. High rainfall leads to greater erosion by burns and rivers. The freezing and thawing of water in winter also plays a significant part in the erosion of rocks.

How do planning and other controls affect the way the area looks today?

Over the centuries there has been a whole range of controls on development and other activities introduced, relating to all or part of the catchment. These include:

- those put in place by individual landowners (for example, the access restrictions on grouse moors, forestry sites, nature reserves, etc)
- those which are community based and applied either by law or by custom (grazing rights, for example)
- those introduced by law (the Local Authority role, planning controls, conservation of protected species, etc).

All of these controls have an effect on the way in which land is managed, and accordingly, on the appearance of the landscape.

How has land and river management affected the way the area looks today?

Let's look, very briefly, at the different ways in which managing the environment has affected what we see today.

The first human inhabitants of this area (c 7000 BC) were semi-nomadic hunters and gatherers. At this time much of the Forth catchment (and much of Scotland as a whole) would have been wooded. The hunter-gatherer lifestyle would have had very little effect on the landscape, although there is evidence from pollen analysis to suggest that areas of woodland were cleared (perhaps by burning) to create better grazing for wild animals or to encourage the growth of particular plants. Presumably, there may have been some management of rivers, lochans and lochs to make fishing easier as well.

4000 BC is recognised as the beginning of the Neolithic period in Scotland. The Neolithic is characterised by the development of a farming economy (although there is some evidence for farming earlier than this). Domesticated animals and cultivated plants were introduced. It is at this stage that people began to truly manage their environment. This involved the clearing of woodland to create pasture and space for growing crops. This was the origin of the open countryside that we now associate with much of Scotland. There was considerable woodland clearance in the Bronze Age as agriculture intensified, leading to the balance of woodland and open areas that we see today.

Although farming technology improved, the rural landscape probably changed very little, right through the Iron Age and into the Medieval period – the mix of farmland, woodland and moorland would have been fairly constant. Woodland would have been used as a source of fuel and timber for buildings and for hunting. The major changes to the landscape over this long period of time would have related to human habitation and settlements.

The next big changes to the landscape correspond to major advances in agriculture. The Agricultural Revolution allowed more intensive farming and also better drainage – this would have had an impact on the appearance of the area. An even bigger impact would have resulted from the introduction of sheep to the uplands and the associated reduction in the number of people living on the land. This reduction in population gave our upland areas the empty, wilderness feel they have to this day. Sheep grazing, meanwhile, reduced the nutrient levels in the soil and prevented the re-establishment of trees and scrub, thereby creating the acid, nutrient-poor grassland conditions that we find today. (If you want to understand the consequences of clearing people off the land, take a trip to the west of Eire where population levels have remained higher – it's like Scotland with people. The effects of sheep grazing can be clearly seen anywhere where they are excluded: the National Trust for Scotland's centre at Ben Lawers is a particularly good place to see this.)

The Victorian era brought a new concept to Loch Lomond and the Trossachs – tourism. Wealthy people began to visit the area to experience the wilderness and the ferocity of nature. This meant that certain areas began to be managed, to enhance their appearance (perhaps to maintain or enhance a view). One aspect of Victorian tourism was fishing and the hunting of both of grouse and of deer. This led to the development of the great Scottish sporting estates.

This period also saw the beginning of large-scale civil engineering works to provide a clean and safe water supply for Scotland's cities. The creation of reservoirs had a significant impact on the landscape in certain parts of the area, with valleys being partially flooded to create larger bodies of water. This continued into the early part of the 20th century (Loch Katrine, for example, was damned in the 1920s).

During the 20th century, increased mechanisation of agriculture led to changes in the rural landscape, as field sizes increased and previously unsuitable areas were drained and turned into agricultural land. This effect was perhaps most significant in lowland areas. More significant in the uplands was the development of commercial conifer plantations. Huge tracts of upland Britain were forested for the first time in centuries. These forests are generally of exotic species rather than native ones and are quite artificial rather than natural in their shape, density of trees, and so on.

Commercial forestry has had a major impact on the way upland Britain looks. This is as noticeable in the Loch Lomond and Trossachs area as anywhere else. At the same time, the conservation movement has flourished and parts of the area, including Ben Lomond, have begun to be managed for wildlife or heritage purposes. Initially, these areas were merely protected, but increasingly they are managed to encourage public awareness and understanding and to conserve features of value.

Also during the 20th century, tourism has continued to expand in scale and importance with local, national and international visitors coming to Loch Lomond and the Trossachs. From the middle of the century people (particularly from urban areas) began to visit the mountains to walk, climb or cycle.

By the late 20th century, the management of areas with a sole objective was becoming more unusual. Farmers were looking for alternative sources of income and diversifying their activities to include tourism and other activities. Forestry areas were increasingly opening up to public access, with the older blocks of monoculture spruce being replaced by more mixed woodland. More and more, foresters are managing forests for multiple purposes with timber production, wildlife, public recreation, education and so on. As already mentioned, areas managed for conservation have evolved from preserves (Keep Out!) to educational and visitor resources.

For this area, the new millennium begins with the establishment of Scotland's first National Park. The aims of National Parks in Scotland are:

- to conserve and enhance the natural and cultural heritage
- to promote the sustainable use of the natural resources of the area
- to promote understanding and enjoyment by the public of the special qualities of the area (including enjoyment in the form of recreation)
- to promote sustainable social and economic development of the communities in the area.

1.3 The third and subsequent rounds of questioning

Following on from the answers relating to geology and climate, the subsequent questioning might look at the ways in which geology and climate interact to influence soil, growing conditions and river conditions, for example. Or they might look at what will happen if the climate changes.

To keep things relatively simple, let's assume that we have already looked in more depth at these questions and concentrate on the subsequent 'whys' as they relate to land and river management. We could (and if we wanted a full picture, we should) look at the ways in which these effects on the landscape work. For this exercise, however, we will look at people's motivation and pick up on some of the key points in the history of land and river management.

Why did people manage the land/river in this way?

The way in which people choose to manage their environment says something about their needs but also something about their values, attitudes and beliefs. (See sections 5 and 6 of Unit 4 for discussion of the importance of 'culture'.)

Mesolithic hunter-gatherers probably saw the natural environment as a resource to be used before moving on. There would need to be a degree of balance in how the resource was used; but as long as you followed the movements of prey species and allowed areas to recover, then you would be able to find the food and other necessities for life. While there must have been a degree of enjoyment and aesthetic appreciation of the environment, the practicalities of survival were probably uppermost in people's perceptions. At this stage, the broader environment was a backdrop to human activity.

Once people are farming, then these views change. The natural environment needs to be cleared and controlled to allow farming to succeed. The environment becomes something which is to be managed if you are to be successful, and natural processes become both beneficial (in that they ensure your crops grow) and threatening (they also cause weeds and predators to grow and can suddenly destroy your crops).

Initially, farming would have been on a family or village scale. Once you are managing the land, however, it becomes a resource that can be owned. This in turn leads to the possibility of owning more and more of the resource. The development of large estates in Scotland was significant because it allowed management of land over wider areas and in a more planned way (a small family farm needs small woodlands for timber – an estate can have forests). It also led to the situation where tenants could be viewed as part of the land resource and, where economics dictated, removed in favour of a more valuable commodity (sheep). Without the ‘culture’ of land ownership, it is unlikely that the grazing density of sheep that we see today would have been achieved. (See Unit 4, pages 38-39 for the parable of the shepherds.)

By Victorian times, the UK had a large urban population and a new industrial owners class which began to look to the countryside with a nostalgia born of the grim conditions in towns and cities. Poets and novelists played their part in developing this romantic view of nature and the monarch herself became part of the new tourism, which attracted people to the Highlands, and to other areas such as the Trossachs and the Lake District. Ironically, at a time when people were developing the technologies which could dramatically change the environment (agricultural and forestry machinery, the railways, etc), the attraction of the environment was its unspoilt and wild nature. Rather than a trial to be endured or a resource to be tamed, nature became a wild and exciting ideal drawing people to admire its splendour and awe. Much of the writing from this time suggests that people found the mountains both awesome and awful – there is as much fear as admiration.

For the first time, management of the land for anything other than a productive end becomes part of landowners’ thinking. Land and rivers can be managed for the effect that they have on visitors (the fact that visitors will also pay for the privilege of shooting grouse and deer, or fishing for salmon and trout, is an added incentive).

In post-war Britain, (ie after the Second World War), there was an understandable push to ensure that the country was self-sufficient in food and other resources. This resulted in steps being taken to increase production from farmland and from forestry. This went hand in hand with advances in science and technology, meaning that agriculture and forestry could become more and more mechanised and could use both fertilisers and pesticides to increase yields. During this time we see an increasing rate of drainage and removal of hedgerows in farmland, to increase the amount of productive land. We also see the move to large-scale commercial forestry in the uplands.

Paradoxically, as the country (and most of the developed world) moved towards greater production, there had to be an increase in the subsidies offered to farmers and other land managers, suggesting that ‘more productive’ is not the same as ‘more efficient’.

We are now in a situation where we have more leisure time and are sufficiently far away from the post-war imperatives to look more clearly at what we want to do with the land. At a time when many of us who live in urban areas want to use the countryside as a recreational resource, we are also questioning the viability of many of the traditional land management types.

Over the past 20 or so years, farmers (particularly in the uplands) have struggled to make any money and have turned increasingly to alternatives to farming (tourism links being popular). At the same time, it has been recognised that forestry as a purely commercial exercise (a timber production line) has not been especially effective but that our forest areas have other benefits. The mission of the Forestry Commission has changed considerably over the last 50 years, from one of producing the maximum amount of usable timber to one which recognises wildlife conservation and public enjoyment of our forests as being significant ends in their own right. Over the same period of time, natural heritage and conservation bodies have moved from protectionism into a position where education and public enjoyment of the environment are seen as important parts of conservation activities.

! Idea

People's attitudes and expectations through the ages affect the way an area looks today. These attitudes and expectations, and the way in which they have changed, explain both the ways in which the area has been managed, and the ways in which activities have been controlled and constrained.

2 The Leven

The River Leven flows from Loch Leven in Perth and Kinross to Leven on the Fife coast. The overall length of the river is about 26km. In the past, the river was much used by mills, particularly the textile mills of the 18th and 19th centuries. In the 1820s, there were approximately 40 mills on the river. Today there are only three paper mills, a distillery and a hydroelectric scheme.

The river has also played a role in the broader history of this part of eastern Scotland. The Loch and river have links to Scotland's royal and feudal history (for instance, Mary Queen of Scots was imprisoned on Castle Island on Loch Leven), its ecclesiastical past (Scotlandwell, for example, was an important stop for pilgrims in the Middle Ages), as well as its industrial heritage.

Loch Leven is the largest naturally eutrophic loch in the British Isles (eutrophic means having a high level of natural nutrients). It is surrounded by farmland and supports internationally important populations of birds. The loch is a National Nature Reserve, Site of Special Scientific Interest, a Specially Protected Area and a RAMSAR site (NNR and SSSI are UK designations of important sites; SPA and RAMSAR are international designations). The loch is also an internationally renowned site for trout fishing.

The river and loch today are somewhat different than they originally were. This is due to a drainage scheme carried out between 1828 and 1832.

This scheme was designed to create extra farmland around Loch Leven and to ensure continuous water supplies to the mills on the river. The level of the Loch was dropped by up to nine feet and the overall size of the Loch reduced by almost a quarter. The scheme also involved cutting a new channel for the river and adding sluice gates to control water flows out of the Loch.

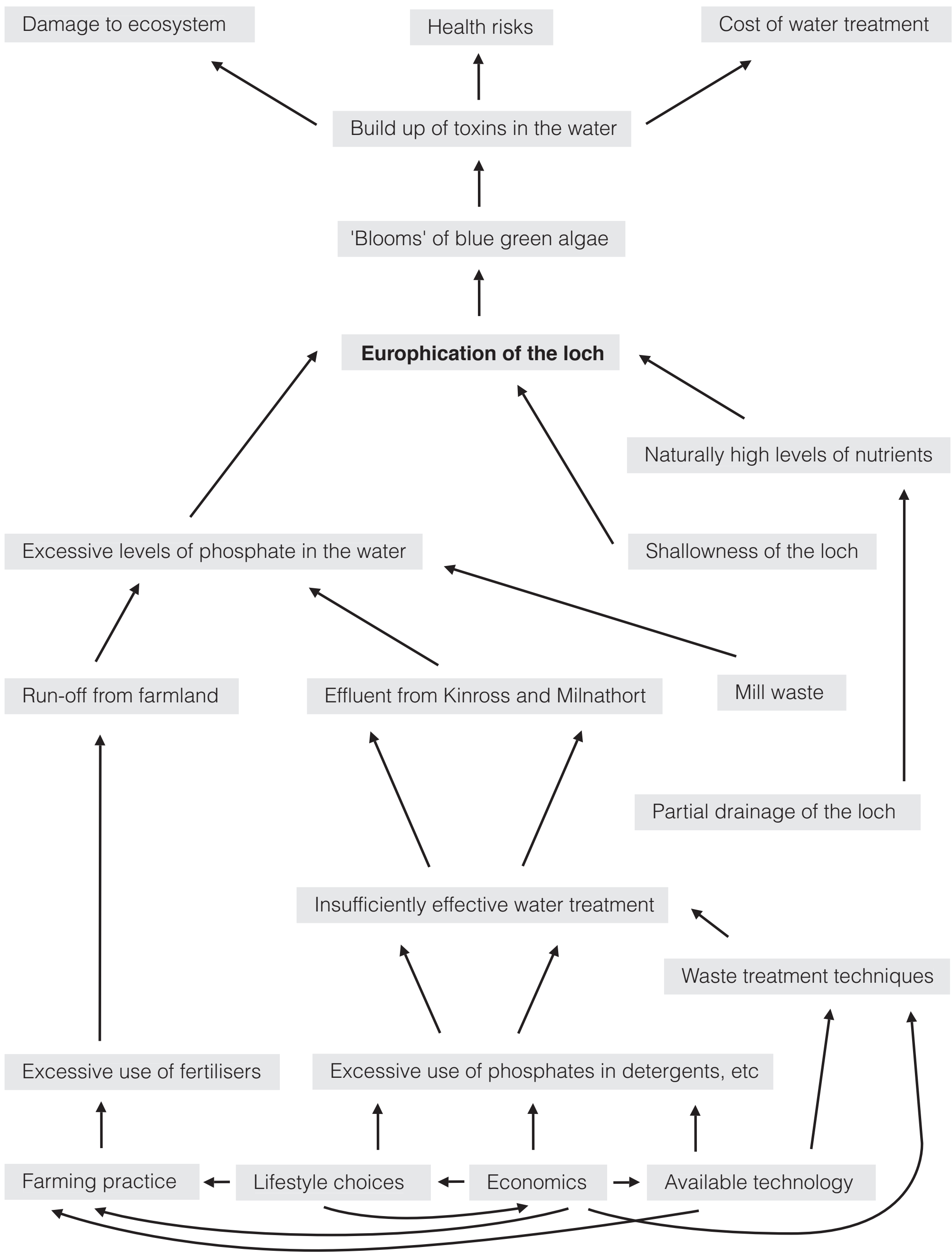
This work had a number of effects:

- it created new farmland
- it controlled the flow down the River Leven
- it led to the extinction of char in the Loch (char are a fish related to trout – they need deeper water than the current loch offers)
- it prevented salmon and sea trout from reaching the loch
- it reduced the depth of an already shallow loch further.

This latter point has had its part to play in Loch Leven's most pressing problem. Nutrient levels, particularly phosphate levels, in the loch are too high – a problem known as eutrophication. Why is this a problem? Surely we have already said that Loch Leven is important because of its nutrient levels? Eutrophication in this case is caused by artificial sources of nutrients and leads to problems for the environment and for human health. Where has the problem come from? What can be done?

The following exploration of the problem of eutrophication in Loch Leven uses a technique called 'the cause of the cause of the cause'(see page 17 of the Toolbox for more details).

The problem of eutrophication in Loch Leven



Discussion

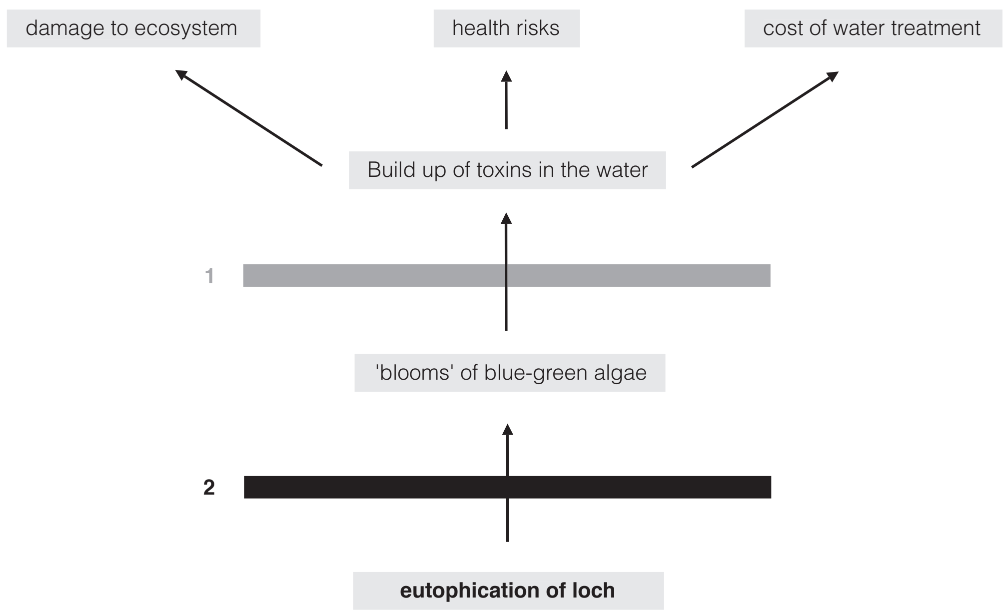
As can be seen from the above systems diagram, there are three main direct causes of the eutrophication problem: agricultural run-off, sewage and waste from the two nearest towns, and industrial waste from a local mill. The problem is particularly severe in Loch Leven because it has a naturally high level of nutrients. A small increase can lead to problems and, because the loch is very shallow (typically less than 5m), this means that excess nutrients are all trapped within the upper layers of the water where blue-green algae can grow.

In turn, the problems of agricultural, urban and industrial effluent are caused by the ways in which phosphates are used in fertilisers and detergents, and the ways in which we choose to use these products. These decisions are themselves affected by a range of factors including awareness, understanding, the options which individuals or organisations feel they have economically, and so on.

How can we change things for the better?

Linkingthinking is partly about building a more complete picture of how the world works, but it can also be about finding ways to do things differently. When we have a picture of a system, we can begin to look for the best places in that system to make meaningful and effective change.

Looking at the picture on the previous page, we can look for ways to reduce the problem of eutrophication. There are a number of places we could try.

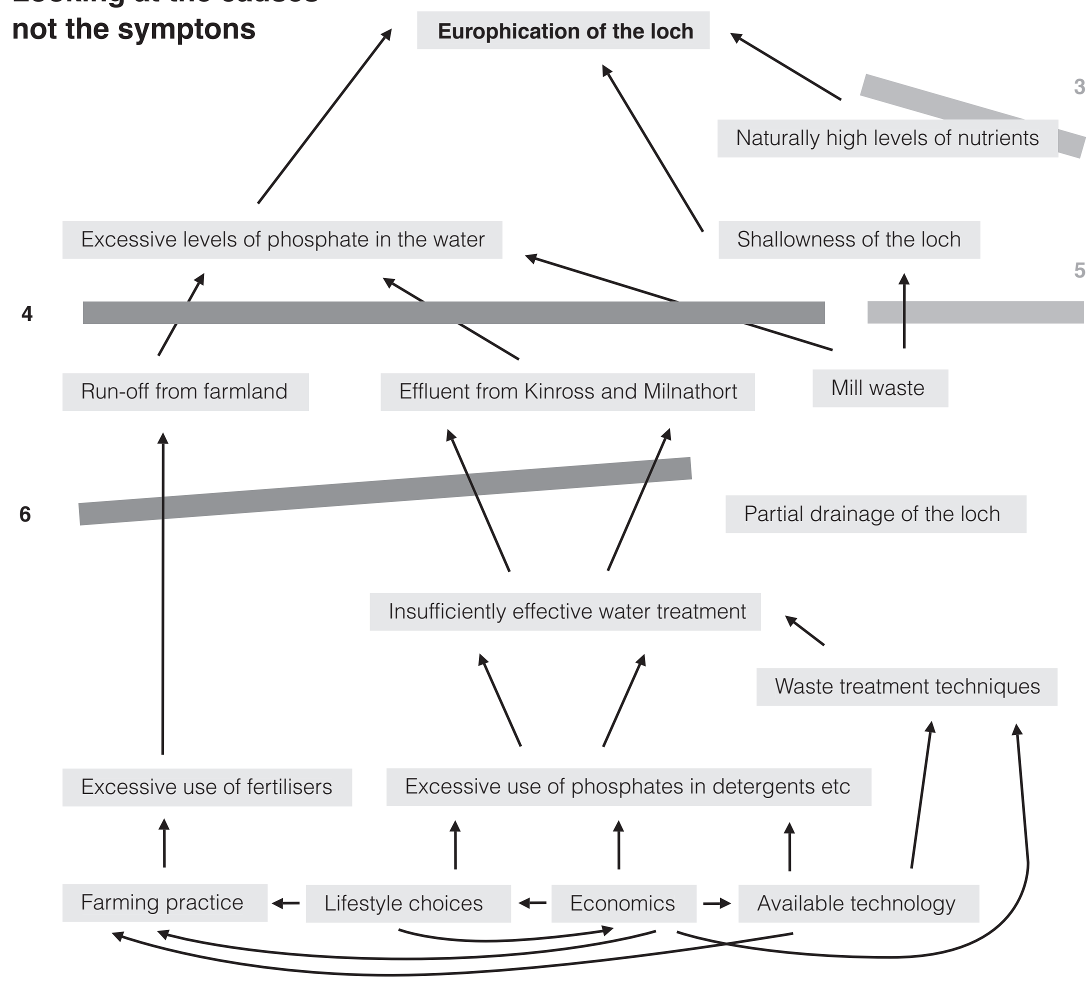


1 It is conceivable that you could prevent the toxins produced by the blue-green algae building up in the waters of the loch – perhaps by flushing them through the system more quickly – this is not, however, currently practicable.

2 In smaller bodies of water (particularly where the problem is less acute), it is often possible to reduce or prevent algal blooms. This is often achieved by placing barley straw in the water. On the scale of Loch Leven, however, this is clearly not a practicable option.

Even if one of these options could be used, this is ‘end-of-pipe’treatment – treating the symptoms not the causes. Such approaches are rarely sufficient to deal with complex problems and often lead to other problems (excessive cost or environmental damage would be fair bets in this case).

Looking at the causes not the symptons



3 Could we reduce the natural levels of nutrients? This seems unlikely on the scale of the loch, and of course it would cause as much environmental damage as the eutrophication.

4 It might be possible to prevent the pollution from farmland, towns and industry from reaching the loch. This would be a large-scale engineering feat and would result in the pollution being transferred to somewhere else. But it is possible and, as long as the sites where the run-off, etc is relocated can cope with the phosphate levels, then this option could work – particularly for the urban and industrial sources of pollution that can be more easily isolated. To isolate agricultural sources would probably involve digging a moat around the whole loch.

5 Part of the problem at Loch Leven results from earlier drainage work. Could we reverse this drainage and make the loch deeper and larger again? This could be an enormous task and is unlikely to be acceptable to local farmers, local people who might lose gardens or even houses, or to the nature conservation bodies who would lose important reserves. It is also uncertain whether an increase in water depth and quantity would be sufficient to overcome the problem of eutrophication.

6 The final potential choice is to reduce the amount of pollution being produced. This looks to be the best option but its success is dependent on many factors. These factors include technological ones but, more importantly, include much that is to do with attitudes, values and understanding. (See Unit 4 for further exploration of the role of values, beliefs, etc in Linkingthinking.)

What is happening at Loch Leven?
In recognition of the complexity of the problem and of the number of stakeholders involved, the Loch Leven Catchment Management Project was set up in 1995. This project has, from its inception, been participative and has involved all the major agencies with an interest in the loch's problems, along with local residents and organisations. The project has produced a catchment management plan, which focuses on reducing the nutrient input to the loch.

3 The Water of Leith

The Water of Leith rises in the Pentland Hills south of Edinburgh and flows for 35km until it reaches the Firth of Forth at Leith Docks.

In its upper and middle reaches, the Water of Leith is a fairly typical Scottish river with the usual pressures and problems associated with upland and agricultural areas. Water is taken from Harperigg Reservoir at the head of the Water of Leith and piped to Edinburgh.

The lower reaches of the river are within the City of Edinburgh and this stretch of the river is similar to small rivers in other cities. Historically, these rivers have suffered a great deal of damage due to industrial activity. To a degree, these problems still exist. Current problems within the city relate to litter (particularly large debris such as shopping trolleys and traffic cones) and to the run-off from roads and other hard areas.

Urban rivers have some unusual features, which are often fascinating to explore using Linkingthinking or similar approaches. For example, why does the Water of Leith have such problems with exotic plants such as giant hogweed and Himalayan balsam, which tend to choke out natural vegetation?

An exploration of this question can come up with the following factors which contribute to the problem:

- the growing conditions are suitable for these plants*
- these plants spread well along rivers and other linear 'corridors'(such as roads and railways) – Himalayan balsam spreads particularly well along rivers using the river current to transport its seeds
- these plants were planted in Victorian times as curiosities
- the Royal Botanic Gardens are close to the Water of Leith.

* An interesting example of this comes from the River Don in Sheffield. In several places along the river, there are fig trees growing but they are all very much the same age. This is a result of two factors coming together to produce ideal conditions for fig seeds to germinate:

1 the availability of figs in the diet of people living in Sheffield (the seeds reach the river through the sewage system);
2 industrial use of the river raising the temperature of the river water.

Once industry started to save energy by re-using heat (and once industry in Sheffield began to decline), the conditions were no longer suitable and fig seeds stopped germinating.

The Water of Leith has been cleaned up over the years and provides a very pleasant recreational area for many Edinburgh people. Its major impact for many is, unfortunately, far less pleasant and enjoyable. In April 2000, Edinburgh experienced some of its worst floods in a century. The Water of Leith was one of the rivers involved. The impacts of this flooding reached the national news not only because of the effects on people's houses, but also because of the dramatic pictures of the national rugby stadium at Murrayfield, with the pitch and lowest ranks of seats underwater.

Scottish Executive figures show the extent of flood risk as a social and economic problem. In Scotland, there are about 71,000 residential and 6,000 commercial properties built on river floodplains. In Edinburgh alone, there are 11,000 properties classified as being at risk from flooding (from rivers, burns and coastal flooding).

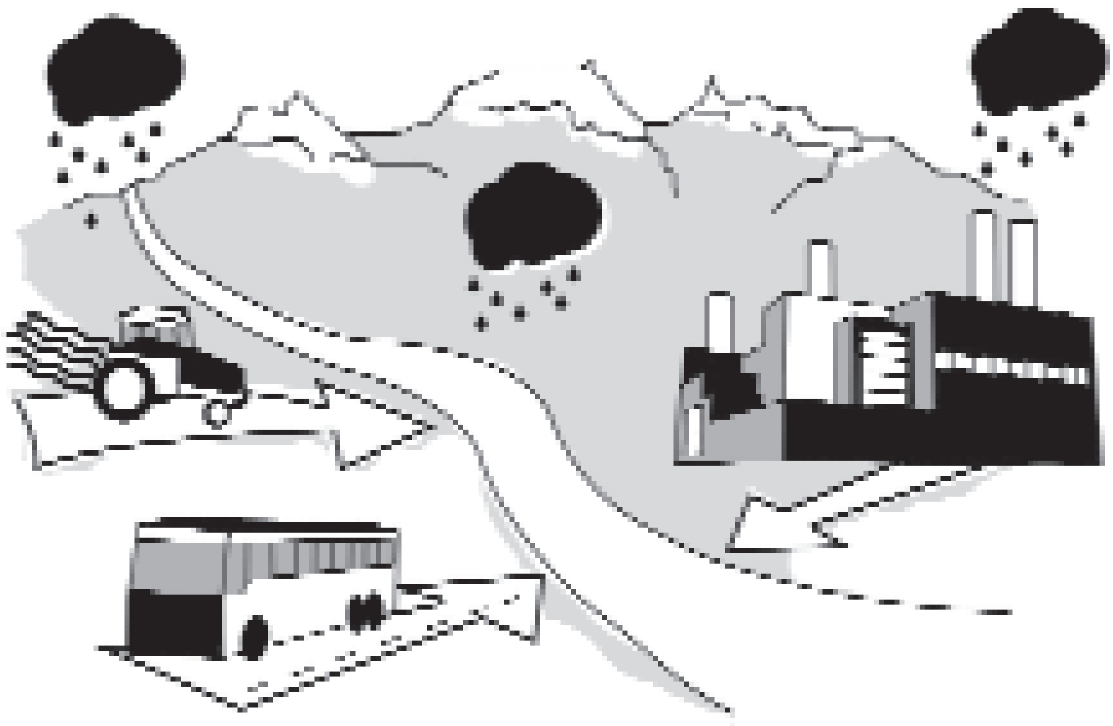
Why do urban areas flood?

The simple answer to this is that there is too much water in rivers, burns, etc at one time and that the watercourses cannot cope with the flow. But why does this happen and what can we do differently?

There are three components to the flooding problem:

1 the amount of water flowing into and down the river
2 the speed at which the water is flowing down the river and the variability in this flow rate – if water reaches the urban area in a sudden surge, then this is more of a problem than the same amount of water spread over a longer time period
3 the ability of the river channel to cope with the water flowing down it.

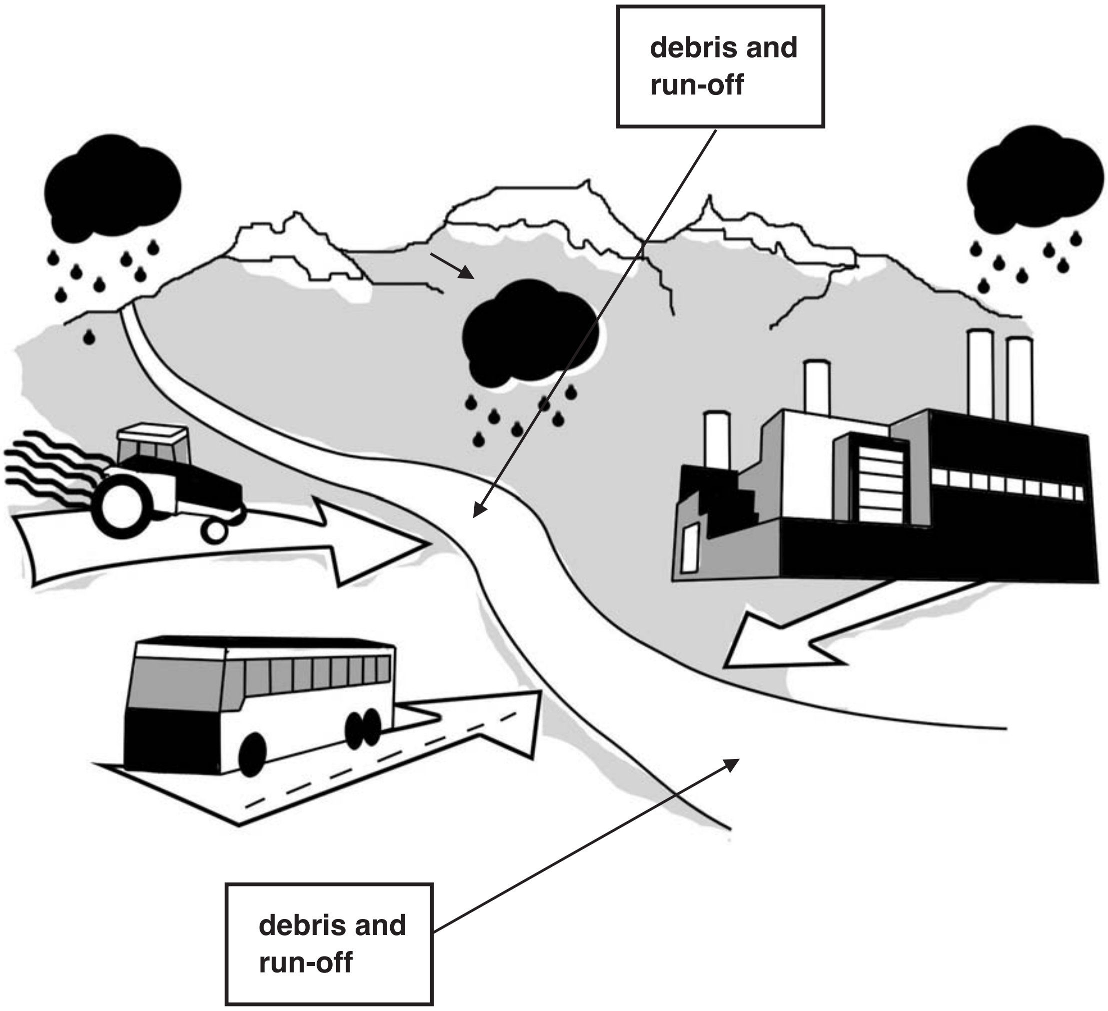
Let's try a pictorial representation of the system.



The amount and flow rate of water in the urban river is dependent on:

- the amount of rain falling in the urban area and upriver
- the speed at which water flows off the land – this is why York has serious flooding problems. Water flows very quickly through the limestone rocks in the Yorkshire Dales and straight into the rivers, delivering surges of water downstream.
- the speed at which water flows off roads and hard surfaces in and around the urban area.

Let's now add an extra dimension to the picture. It is not just water that flows into the river. Trees, litter, supermarket trolleys and other debris fall, are washed or are thrown into the river. In spate conditions, these are washed downstream and can become jammed against bridges and in culverts. This reduces the river channels' ability to cope with the water flow.



Why do flooding problems seem to be becoming more serious?

Looking at the diagram, the following components have changed and contribute to a worsening problem:

1 Rainstorms may be getting more severe. It could be that more water is falling more quickly.
2 Drainage on agricultural land has increased the speed at which water is transferred into the river.
3 More development has taken place on floodplains. This means that more buildings are at risk and that water flows into the river more quickly (water flows more quickly off tarmac and concrete than it does from farmland).
4 Less small-scale management of riverbanks, etc is taking place resulting in more debris getting into our rivers.

We can see examples of the above from the April 2000 floods in Edinburgh.

Dr James Curran of SEPA was quoted in *The Scotsman* newspaper as saying that an increase in the severity of rainstorms was the main cause of flooding, but that urban sprawl had a part to play:

> *"…if you have more built-up areas, then the rain runs off more quickly and flooding happens more quickly".*

Surveys showed that in many of the areas worst affected by flooding, there had been problems with the capacity of the river channel. For example:

- Greenbank Road, four basements flooded – choked gullies.
- Figgate Park flooded – footbridge choked with debris.

In other cases, development had taken place in the floodplain, and flood controls had proved insufficient to deal with the flooding experienced. For example:

- 140 houses at Bonnington Mills were flooded (some to a depth of 1.5m). The City Council's Flood Assessment Report states that 'the development was built approx. 1983 on an area beside the river which was susceptible to flooding, and was protected by a stone and brick wall along the bank. This wall was not designed as a flood wall, was not able to cope with this magnitude of flood and collapsed under water pressure, allowing the area to flood to river level.'

- 80 houses flooded to a depth of 1m in Roseburn. The flood protection scheme in this area had been designed to cope with the level of flood expected once every 50 years. The level of flooding experienced in April 2000 would be expected only once every 180 years.

What could be done to reduce flood risk?

- Could we change the amount of water flowing into the river catchment? Since this effectively means reducing rainfall, this can only be a long-term aim of our efforts to control global warming.
- Could we change the capacity of the river? This has traditionally been the engineering approach to flooding. Attempts can be made to enlarge culverts and the spaces under bridges, to widen or deepen the river and to straighten bends. This work focuses on problem spots and is intended to ease the flow of water surges and thereby reduce the risk of the river breaking its banks. This is treating the symptoms and is therefore only partially effective.

  One effect of this approach is to shift the problem downstream. In urban areas there is the additional difficulty of lack of space for these types of engineering works. The Water of Leith often flows through a corridor between buildings or other sites which is little wider than the river itself and which closely follows the line of the river. In such conditions, there is little that can be done to change river capacity.
- Could we change the rate at which water flows into the river? This is increasingly the approach adopted to control flood risk, particularly where attempts are being made to manage catchments in a more integrated way (for example through Local Authority floodplain planning). The purpose of management in this case is to create 'sponges' which will take up water at peak times and release this water more slowly, reducing the effect of surges. In rural and more open areas this can be achieved by creating or enhancing wetland habitats along suitable stretches of the river. In more heavily developed urban areas, engineering approaches are used to create slower flows into rivers and therefore to reduce flood risk.

Examples of more integrated and sensitive approaches to flood control can be seen in the work on the Black Devon in Clackmannanshire and, outside the Forth Catchment, on the Earn at Comrie (information on both of these projects is available from WWF Scotland).

4 Other sections of the Forth catchment suitable for further investigation

4.1 Flanders Moss and the Carse of Stirling

The Carse of Stirling is an area of low-lying farmland situated to the west of Stirling. Located on the Carse is Flanders Moss – one of the most important lowland bogs in the country. The Carse is affected by most of the problems which affect lowland farmland in Scotland – agricultural pollution of watercourses and flooding problems being, perhaps, the most obvious.

The real interest in the Carse from my perspective, however, lies in the lessons that can be gleaned from the history of the area. About 6,500 years ago the area now called the Carse was inundated, with the sea reaching as far as modern-day Aberfoyle. Evidence for this includes several whale skeletons found when drainage was taking place in the 1800s and the fact that, even today, much of the Carse is less than 10 metres above sea level. This inlet of the sea silted up with time and became land. In the post-glacial wet conditions, up to two metres of peat built up on the Carse. Flanders Moss is a small relic of this vast lowland bog.

Between 1766 and the middle of the 19th century, the peat was stripped from most of the Carse and the land drained to produce rich, agricultural land. Most of the peat was simply flushed down the river, causing immense pollution problems lower down the Forth and effectively destroying the oyster industry and much of the salmon fishing industry. This not only provides a really graphic example of the problems that still occur with relation to pollution from agricultural sources, but also has interesting links to other aspects of Scottish history.

For example, an understanding of how the Carse must have been prior to the clearance and drainage does a lot to explain the importance of Stirling as a strategic site from prehistoric times. It is also interesting to note that the expertise used to drain the Carse came in part from Holland, indicating the types of trade links that existed between Scotland and Europe. At the same time, much of the labour was made up from Highland families displaced during the clearances.

More recently, EU subsidies have had a significant impact on the crops grown on the Carse (as they have in all parts of the UK). The crops which attract subsidies have changed over the years and this has had an impact both on the way in which the Carse is managed and the way that it looks – think about the landscape impact of oilseed rape, for example.

The Carse of Stirling was one of the regions looked at in an EU-wide project on the 'Wiser Use of Floodplains'.

4.2 The Almond

The Almond is another tributary of the Forth worth looking at from a Linkingthinking perspective. The source of the Almond is in North Lanarkshire and it flows through the industrial (or ex-industrial) areas of West Lothian joining the Forth at Cramond just west of Edinburgh – a distance of 48km.

The Almond is one of the most polluted rivers in Scotland due to a number of factors:

- the fact that much of the river course is urbanised
- the pollution caused by effluent from abandoned coal mines and tips
- intensive agriculture in the lower reaches of the river.

As with the Carse of Stirling, much can be learned from the history of the Almond. The river has been important in the development of the area and it is worth looking at the reasons for this importance. Linkingthinking approaches are useful in identifying the factors which have contributed to the development of this part of central Scotland. They can also be used to draw lessons from the way in which the area has developed.

Aspects of local history that might form part of your investigation of the Almond include:

- settlement by the Romans at Cramond and how this linked to the rest of the Roman Empire
- the development and decline of a number of forms of transport – the Almond is crossed by the Union Canal (which was obsolete before it was completed), the railway, the M9 motorway and flight paths into Edinburgh airport
- the development and demise of a number of industries in the area (coal, shale oil, semiconductors, etc) and their effects on the local population and environment.

These offer the opportunity to look at the sustainability of social and political systems, technologies and economies. (See Units 3 and 4 for further discussion of sustainability.)

An additional reason for considering looking at the Almond is that it was the first Scottish river to have an integrated management plan. (For details, contact West Lothian Council, Almondvale Boulevard, Livingston, West Lothian EH54 6QG.)

Reflection

It is important to remember that by looking at these tributaries individually we have, to a degree, been box-thinking rather than Linkingthinking. The subsystems represented by the tributaries all link together and can have influences on each other.

End note: The author is an ecologist by training, with an interest in archaeology and in social justice issues. Does this provide any insights into the way in which Linkingthinking has been applied?

References

Websites:

Scottish Environmental Protection Agency For a wide range of resources and information relating to river management, the EU Water Framework Directive and to Integrated Catchment Management, including information on the Catchment Management Plan for Loch Lomond: www.sepa.org.uk

Wiser Use of Floodplains Report on this EU funded project: www.floodplains.org

The Herald Newspaper reports on problems with Glasgow's water supply: www.theherald.co.uk

The Scotsman Newspaper reports on flooding in Edinburgh: www.scotsman.com

City of Edinburgh Council Information on the extent and nature of flooding in 2000: www.edinburgh.gov.uk

Loch Lomond and Trossachs National Park Information on the priorities and activities of the National Park: www.lochlomond-trossachs.org

Scottish Executive Report on Climate Change and Flooding: www.scotland.gov.uk/cru/kd01/ccfo-15.asp

Publications

Browne, M and Mendum, J (1995) *Loch Lomond to Stirling – A Landscape Fashioned by Geology*, Scottish Natural Heritage

Forth Naturalist and Historian (1993) *Central Scotland – land, wildlife, people*, Stirling University (also forms the basis of a CD-ROM schools resource *Heart of Scotland Environment*)

Main, Lorna (2001) *First Generations – The Stirling Area from Mesolithic to Roman Times*, Stirling Council

Senge, P, Kleiner, A, Roberts, C, Ross, R and Smith, B (1994) *The Fifth Discipline Fieldbook*, Nicholas Brearley Publishing

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Toolbox

linking thinking

New perspectives on thinking
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The Linkingthinking Toolbox

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Toolbox

Introduction

What is the Toolbox?

The Toolbox is a 'stand-alone' resource and is part of the Linkingthinking suite of materials that seeks to help generate new perspectives, introduce systems ideas and develop relational thinking skills which are broadly applicable to different situations and contexts. The Toolbox consists of a group of activities that can be used with groups to introduce key perspectives, ideas and skills that are important in Linkingthinking.

How to use the Toolbox

This is a flexible resource:

- You can use just one or two activities only if you wish.
- You don't need the main Linkingthinking units to be able to use the Toolbox effectively.
- If you do have one or more of the other units, you can use the activities here to extend the ideas and exercises in those units.
- The activities are targeted at educators, but most can be easily adapted to other levels.
- The activities can be used widely in many subjects – most activities can be adapted to help users look at a wide variety of topics.
- It is possible to use these activities in any order, depending on levels of prior understanding. Some activities are simpler than others.
- The activities are designed to develop systems thinking skills which are broadly applicable to different situations and contexts. They are not, therefore, content oriented. However, learners might need to research a situation or local issue before attempting an activity. Alternatively, undertaking an activity may in itself indicate gaps in knowledge where research is required by the learners to inform discussion.
- 'Extension' activities are shown which indicate how further work or discussion might be undertaken. This is often more applicable to more advanced students.

Organisation

The activities are grouped according to the units to which they mainly relate. But some activities link to, or can be used with, more than one unit if you wish – this is shown in the unit description 'Links with'.

We have used a classification showing which main learning goal the activity seeks to develop:
- 'Perspectives' (P)
- 'Ideas' (I)
- 'Skills' (S)

1.1 Living in a systemic world

Why do this

Linkingthinkers emphasise that we live in a highly connected world: what is sometimes known as a 'systemic world'. This phrase is heard a good deal less than other descriptions of our life and times, such the 'information age', the 'post-modern society', and the 'globalised world'. But if the world is highly interrelated, it makes sense to recognise and try to understand the nature of systemic connection, and the possible consequences of our actions. This activity is designed to explore systemic connection in the world between people, places, events, times, issues, environment, etc.

The activity can be conducted at a very simple level of discussion if the group has never encountered systems thinking.

Links with

Can be used anywhere, but particularly with Unit 1, Part A.

Purpose of activity

To explore the systemic nature of the world (complexity) and encourage students to consider: 'what are appropriate ways of thinking about this?'

Resources needed

Old (recent) newspapers, felt pens, flipchart paper, glue sticks

What to do

Students form groups of two or three.

Stage 1
Take a newspaper spread and choose an article that interests you. Cut it out and paste it on to a piece of flipchart paper. (Different pairs can choose different articles.)

- What's the story? Summarise it in a sentence or two.
- In what way does the story illuminate the idea of living in a systemic (ie connected) world? (Look for interrelations, systemic connections between issues, causes/effects, problems, and solutions. Look both for where connections have been recognised and where they have not, by the writer or people featured in the story. What are the likely causes that led to this story, what are the likely consequences of this issue – immediate or long-term?)
- Can we draw out any ideas about systems, ie systems concepts, from the story?

Stage 2
- Put your answers and ideas on the flipchart as annotations.
- Each pair should then be encouraged to share their findings with the whole group by holding up their flipchart paper. The facilitator should then note on a flipchart/whiteboard any observations from the group that help take understanding further, and use these as a basis for discussion.

Discussion and debriefing

What can we conclude from this? The facilitator should be able to draw out the following:

1 that the world is systemic (evidence from exercise). But so what..? (This leads to the next point.)
2 that we need to think in a more Linkingthinking or systemic way to live well (ie experience wellbeing) in a systemic world, and minimise problems
3 that not thinking systemically in a systemic world can cause problems – for us, for others, for future generations or for the environment, for example.

The facilitator can point to a number of things:

The problem of unintended consequences – 'side effects', 'by-products', 'hidden costs', 'externalities'. Why do things keep happening that we didn't reckon with? Are there examples from the exercise? Why don't we take more account of 'knock-on effects' and feedback?

Comment

This is a useful activity to get people to think about real stories in a different way – that is, in a more systemic way.

Connections in newspapers can be anything, for example:

- between interest rates, house prices and people's consumer spending
- between industrial or agricultural pollution and loss of wildlife

- between an accident and the effect on related people's lives
- between a government policy and the effect on the ground (intended or unintended)
- between social exclusion and crime.

The activity also helps the tutor discover to what extent the group has some sense of systems thinking, and any knowledge of systems concepts.

Extension

A group that has some understanding of systems concepts might begin to suggest examples (based on the newspaper stories) that can lead to a listing of systems concepts or similar ideas that help describe the examples. Alternatively, the facilitator, as a consequence of the exercise, can draw out some of these.

Such ideas might include interdependence, boundaries, limits, feedback, wholes, context, process, etc.

Another possibility – particularly if a pair has chosen an article that is not particularly fruitful on this exercise – is to encourage them to look for connections between issues covered in separate articles in the same newspaper.

Any connections can be illustrated by trying out simple drawings and arrows. This encourages representation through diagrams (an important tool in systems work).

Source: Stephen Sterling

1.2 Joined-up thinking

Why do this

This term has emerged in recent years from a growing recognition of complexity and the associated need to avoid looking at and addressing issues in isolation. As it is a phrase students might have heard, it is a useful starting point to begin to introduce Linkingthinking ideas and perspectives.

Links with

Units 1-4, but particularly Unit 1, Part A section 1

Purpose of activity

To explore the meaning and nature of 'joined-up thinking'.

Resources needed

Writing materials

What to do

The facilitator introduces the term, and writes it up on the flipchart. Ask the students to consider it for a few moments, and ask those who have heard of it, where they heard it. Ask the students what they think it means – in a whole group session – and record key points on the chart. (Use a 'mind-map' or similar technique for this recording if you can.) Why do they think the term has only recently emerged?

Discussion and debriefing

This activity should give you some foundations to build on. You can ask the students what they think characterises 'non joined-up thinking'. Which form of thinking do they think is most common? Why? What do we have to do differently to be 'joined-up thinkers'?

Introduce too the ideas of 'joined-up policy' and 'joined-up government'. Can they think of examples of where policy or government is coherent/coordinated/mutually reinforcing, ie 'joined-up', OR where it is incoherent, uncoordinated, and working to different, competitive or conflicting ends?

Comment

This activity, like other introductory ones here, helps the facilitator gauge the present understanding of the students and begin to build on it.

Extension

With older students, if you wish, you can use similar exercises to introduce all the terms mentioned in Unit 1, Part A section 1.1: 'holistic thinking', 'ecological thinking', 'systems thinking', etc, and then look at and discuss students' perceptions of similarities and differences between these terms. (See Glossary also for help on this.)

Source: Stephen Sterling

1.3 All change, please?

Why do this

We all know we live in a world of rapid change, but much of the time we are caught up with surviving in it rather than trying to grasp the nature of the changes. This activity can help students generate some perspectives on key changes, and can also help prepare them to think about the future. It can be adapted for simple or fairly advanced levels of study.

Links with

Units 1-4, and particularly Unit 1, Part A section 3 on 'Four new conditions'. Also relates to Unit 2, Part A section 2 on 'complexity'.

Purpose of activity

To encourage students to consider social change (and related economic, technological, political, cultural and environmental change) over the last half-decade or so, and how this has given rise to new conditions.

Resources needed

No specific resources required, apart from writing materials, but preliminary research would help develop some 'data'.

What to do

The facilitator asks the students to think about how society was when their parents – and then their grandparents – were their age. It would be best if the students were encouraged to research these questions in their own or other's families beforehand. What have been the main changes – social, political, economic, technological, and environmental? The students write these down, and compare notes in pairs. This could be done graphically as 'Then' and 'Now' lists, which might be illustrated. An additional or alternative exercise, if required, would be to write the changes as a time line or flow chart with approximate dates.

Ask students to think about changes in specific areas – such as telecommunications, social customs and entertainment, transport, energy, food, consumption and waste.

The students might start by considering these changes at a personal level, then may go onto local community, regional, national or global levels.

Discussion and debriefing

This activity is likely to produce a wealth of material and ideas that can be used as a basis for discussion. You might angle the discussion towards – or introduce – the 'new conditions' suggested in Unit 1, Part A section 3 (complexity, uncertainty, unsustainability, and stress) and supplement these with students' ideas.How do we need to think, or think differently, to cope with these conditions?

Comment

This activity will help the facilitator gauge the extent of students' thinking about social trends across time and at different levels – if these are considered – from personal to community, national and global scales.

Extension

Ask the students to consider which changes they think are 'good', 'bad' or 'neutral', and have them give reasons for their views. Is this a better or a worse time to live than, say, being their age 50 years ago? In what ways might it be considered both 'good' and 'bad'? What 'trade-offs' have we made – say, between economic prosperity and environmental quality, or mobility and community?

Ask the students if they feel that, generally, education – including non-formal and informal channels – prepares people for the 'new conditions'. How does it, or how doesn't it?

Use sources such as the current issue of the Worldwatch Institute's *State of the World* reports or *Vital Signs* reports (published by Earthscan each year) to generate discussion or study on current trends in any area of concern that the group identifies.

Source: Stephen Sterling

1.4 Only connect!

Why do this

In 1971, ecologist Barry Commoner said that one of the laws of ecology is that 'everything is connected to everything else'. But not equally strongly! Sometimes the connection is so distant or tenuous that we don't need to bother about it. But there are many instances where we do need to pay far more attention to connections. This activity encourages students to begin to think in a more connective way, and begin to see things a bit differently. It can be followed up with the 'What's in a name?' activity, if wished.

Links with

Part A of Units 1 and 2, particularly

Purpose of activity

To encourage students to begin to recognise connections between events/phenomena and develop new understanding through this recognition.

Resources needed

Small strips of paper about 2.5 x 10 cms, in sets of three per student, flipchart paper and glue sticks

What to do

Stage 1

The students are asked to take three pieces of paper. On the first one, they should write down what they consider to be an 'environmental issue', on the second, an 'economic issue' and on the third, a 'social issue' that concerns them. Keep it as short as possible, one or two words only. It could be on a local, national, or global scale. If they need help, here are some ideas, in no particular order, that you could introduce. (An alternative is to have strips of paper ready prepared with words on them, and to hand these out randomly.)

recycling	poverty	water
pollution	inequity/injustice	technology
housing	global warming	crime
health	community	drugs
traffic	resource depletion	terrorism
cars	trees	internet
employment	waste	
food	cities	consumerism
species loss	soil erosion	tourism
fossil fuel use	population	happiness
renewable energy	leisure	landscape
sea	air	income
biodiversity	quality of life	
globalisation amenity		

Working alone, the students are then asked to think of anything that connects any two, or all three of the issues, and make a note of it.

Stage 2

The students are asked to find a partner, and discuss whether there is a link between any four, five or all six of their issues, whether they have been expressed at a local or global scale. Work on what the link(s) might be – it may not be immediately obvious.

They should stick the relevant issues on a piece of flipchart paper, and draw circles round them. Then draw arrows connecting the issues, and annotate them to show connections. They can add extra ideas, information or questions, as they think necessary.

Discussion and debriefing

The students will find some issues don't appear to connect at all, while others will lead to all sorts of rich connections being made. You can bring out the point here that not all issues connect equally, either thematically or across time and space. The time and spatial dimensions are aspects of relation that should arise from this exercise.

The limits and meaning of 'environmental issue', 'economic issue', etc as descriptive labels, might also come out. This aspect can be explored further in the activity 'What's in a name?'.

Comment

You can discuss the skills that this exercise implies:

- judging when it's necessary to look at the 'big picture' to achieve a new perspective
- the ability to critique how we tend to label issues and put boundaries around them conceptually. (For example, is this issue really 'just' an environmental issue?)
- the ability to consider relationships rather than 'hard' distinctions.

You might also discuss the nature of the connections that have been identified. Are they causal. If so, are they weak, or strong? Or have connections been made because of apparent parallels or patterns?

Extension

A variation is to take 'one issue' and brainstorm on how many issues are contained within that 'one' issue. Draw on a flipchart in the same way as noted above, to arrive at a deeper understanding of this issue. The exercise might lead onto discussion of system boundaries (and how we perceive them), and levels of systems within larger systems. (See 'Out of bounds' activity).

Source: Stephen Sterling

1.5 You can never do only one thing

Why do this

'You can never do one thing' is one of the fundamental ideas of systems thinking. As events, things and actions are interconnected, we often find additional and unanticipated things happening as a result of what we first intended. We call these all manner of names: 'knock-on effects', 'ramifications', 'side effects' and so on. Such consequences might be negative or positive, or both. This activity helps students understand that there is often a difference between what is intended and inadvertent effects, and the need, therefore, for more 'systemic awareness'.

Links with

Unit 1, Part A section 6, and Unit 2, Part A generally

Purpose of activity

To develop systemic awareness and foresight.

Resources needed

Writing and drawing materials

What to do

This method can be applied to almost any human action, machine or system. Choose something that interests you and your students. Some ideas are given below. Pick a simple, local topic to begin with.

Human action:
Making a cup of tea; developing GMOs (genetically modified organisms); lowering fuel duty; building a road; developing farmers' markets; riding bicycles; using slug pellets in the garden

Machines:
Cars; computers; televisions

Systems:
Your school or college; supermarkets; local transport system; a power station

The key questions are these: 'What is this for?' and 'What does it do?'.

These questions illustrate the difference between intended purpose and the many other effects that can happen.

You will probably get several answers to 'What is this for?'. See if they can be ranked as the main purpose and secondary purposes. These answers can be developed and displayed on a whiteboard or flipchart.

Now ask the second key question: 'What does it do?' (or 'What happens in addition?'). Students may find this more difficult, depending on the topic, but persist and draw out other effects that this action/machine/ system has.

An illustrative example follows.

Cars
What are they for?
- to transport people and possessions
- to lend status (for some people)
- to create jobs and boost the economy.

What do they do?
- transport people and possessions
- lend status (for some people)
- create jobs and boost the economy.

And also:
- create a demand for roads
- pollute the air and contribute to global warming
- a local economy through favouring out-of-town shopping centres
- harm people through accidents and affect health through pollution

- contribute to congestion
- change the landscape and townscape
- help sustain demand for oil exploration.

All of these are essentially unintended effects. (Few people are in favour of these, apart from those whose system of interest coincides with some of them, for example, road builders or oil exploration companies.)

Each of the side effects has further knock-on effects, and you can explore these too, perhaps using system influence diagrams or futures wheels techniques.

Discussion and debriefing

In the example above, one's view of cars is a function of whether you depend on them, or whether you are a car driver, a pedestrian, cyclist, or bus driver, perhaps. Each has a different system of interest. The key question now is whether the intended purpose can be met in a way where there are fewer negative consequences. This brings us onto the question of design.

Some points to draw out here:
- Different people have different perspectives.
- Actions always have additional consequences – sometimes minor, sometimes major.
- There may be a better way of doing something, where negative consequences are better anticipated and minimised, or positive consequences are maximised.

Comment

This activity raises some important points about how we tend to concentrate on a single benefit and ignore systemic costs. It raises ethical questions about, for example, technological innovation and responsibility.

At a more advanced level, you can introduce the concepts of emergence and synergies here.

Extension

Try the 'Towards rounded solutions' activity.

Source: Stephen Sterling

1.6 Shift that paradigm!

Why do this

The idea of 'shifting paradigms' has probably been overworked by those in the environmental movement. Hence John Button, in his *Dictionary of Green Ideas* remarks: "…paradigm can mean a model, a world view, a cultural context, a consensus, a set of attitudes – almost whatever you want it to mean." He regards "paradigm shift" as "the ultimate in green-tinted jargon, to be avoided whenever possible" (Button, 1988, p329).

However, many Linkingthinkers suggest that Linkingthinking implies a change of worldview, and it is therefore necessary to clarify the key ideas involved.

This activity is based on sets of descriptive key words that are often used in debate. One set is associated with the *reductive paradigm* that is dominant in Western culture, and the other set is associated with the more *holistic paradigm* that challenges the limits of the former.

Note: This activity is only likely to work with a mature or adult group interested in this topic. Or tutors can try it themselves!

Links with

Units 3, Parts A and B (see section B.1.4) and Unit 4, Part A

Purpose of activity

To clarify key terms associated with contesting paradigms (worldviews).

Resources needed

Prepare two lists of descriptor key words, print out, and cut up into individual words. These might include the following:

Mechanistic, materialistic, dualistic, linear, analytic, reductionist, objective, techno-scientific, technocentric (or anthropocentric), fragmentary, segregative, systemic, organic, holistic, integrative, ecocentric, non-linear, synthesising, subjective-objective, ecological

Make up sets of all the words *mixed up together*.

What to do

Working in pairs or small groups, the students are asked to sort the words into two sets. Ask each group to present their results and comment on how they found the exercise.

Discussion and debriefing

This will inevitably lead to discussion on the meaning of these key words, so be ready for this. You will need to lead the group through various discussions:

- if different groups came up with different groupings
- how far these two sets of words are sufficiently different (to qualify as different paradigms)
- how far a more holistic/ecological paradigm can incorporate aspects of the mechanistic paradigm, or whether it's in opposition to them.

Extension

Knowledgeable students might be asked to pair up oppositional words between the sets, eg reductionist-holistic, mechanistic-ecological. Ask them to justify and explain their matching – even where this goes 'wrong' it will generate useful discussion.

Ask how far, in their view, aspects of each paradigm are in evidence in everyday life, in education, in government, in science, etc. What evidence is there – if any – that we might be moving towards a more integrative, holistic view?

Source: Stephen Sterling

2.1 Out of bounds

Why do this

A key idea of systems thinking is the importance of boundaries or borders. We use these all the time, to ‘rule things in’ and ‘rule things out’ of our immediate concerns (to define our system of interest). Physical boundaries are obvious – a wall, fence, a kerb and so on – but conceptual boundaries are less so. We tend to focus on the present, the local, and things of immediate concern and often ignore the future, the distant or global, and what appear to be less urgent concerns. We often focus on what affects us, rather than others, or the environment.

As the activity ‘What’s in a name?’ shows, our use of language also often sets boundaries. This next activity encourages students to become more aware of their involvement in boundaries: how and why we use boundaries – and also of their effects and possible hazards.

Links with

Unit 1, Part A section 5 and Unit 2 generally

Purpose of activity

To raise awareness of conceptual boundaries, and why we use them.

Resources needed

Sheets of paper

What to do

Decide what the focus might be – say environmental issues, or social issues (bearing in mind that these words themselves imply conceptual boundaries!).

Ask students to make two columns. In the first column, get them to list three issues under the chosen focus they would be interested to work on, and in the second column, three issues they would not be interested to work on.

(Alternatively, brainstorm a whole list of issues first, and then get them to select those that are of interest and those that are not, or less so.)

Ask them to compare their lists. Ask them to say why they have ‘ruled in’ and ‘ruled out’ certain issues.

From this exercise, try to draw out the reasons why we draw boundaries around our concerns. The bases include:

- the influence of our values and beliefs
- the influence of our interests and concerns (relates to first point)
- how far we feel we have any knowledge of the issue
- how far we feel we have some influence over the issue, or potentially so
- the extent to which an issue appears more immediate in time, and geographically.

Which of these – or any additional factors – influenced the students’ choices of issue?

Discussion and debriefing

Discuss how far we feel we need to draw boundaries. We cannot be interested in, nor do we have the capacity to deal with, everything! But also discuss how we might be more aware of <u>when</u> and <u>how</u> we (or others) are drawing boundaries, so that we do not unnecessarily limit our thinking and perspective. Being more aware of boundaries and making them explicit can also help in <u>conflict resolution</u>.

A query might arise regarding whether the students should be considering local, or national or global issues. Use this as a further illustration of boundaries.

Comment

Boundaries are a key concept in Linkingthinking, cropping up throughout all the units.

Extension

Ask students to read a newspaper with ‘boundary awareness’. They should mark the stories they decide to read. Then consider which bases for their choice were operational (use the list above or any additional factors). They might also consider how they chose which newspaper to read in the first place. Instead of a newspaper, they could assess a discussion on TV or radio, in terms of how others use boundaries (Unit 1, Part A section 2.2 ‘Making distinctions, making connections’).

See also the activity ‘System of concern/System of influence’.

Source Stephen Sterling

2.2 Re-drawing problems

Why do this

We set conceptual boundaries all the time in thinking about and discussing issues. While this is inevitable, if we can become aware of how we use boundaries and re-draw them as we wish, we can often generate new insights and perspectives on problems and issues. If we accept Einstein's statement that, "No problem can be solved from the same consciousness that created it", this ability seems critical. The activity helps students develop this useful ability.

Links with

Units 1-4 but particularly Unit 2, Part A

Purpose of activity

To generate fresh insights on a problem or issue by re-drawing boundaries.

Resources needed

Sheets of paper

What to do

Identify a problem. This might be personal, institutional, social, environmental or economic. Ask students – as individuals or small groups – to write down, very briefly, thoughts and ideas that illuminate the problem in some way. When writing, scatter these around a sheet of paper, roughly equidistantly.

Now draw boundaries around ideas that appear similar ie ring them. What do these ideas have in common? Does the grouping of ideas help generate new insights about the problem?

Now, draw boundaries around ideas that seem *dissimilar*. Does this help generate new insights?

Discussion and debriefing

One value of this exercise is to get different groups working on the same problem, then comparing their work. They will often have different perspectives and draw boundaries differently, and this can be of real value in generating 'multiple perspectives'.

Comment

How we perceive a problem depends partly on how we 'draw' it (either mentally or on paper). If we can draw different boundaries, the nature of the problem often seems to change and different ways of addressing it can become apparent.

Extension

Get the students to draw a large boundary around the outside of their work on their sheet of paper. What might this represent? What other dimensions, aspects or considerations that relate to this problem might they have inadvertently 'ruled out'? Critically, this involves looking at the bigger context. How far is there a fit or conflict between the identified issue and bigger contexts: these might be such things as the institution, the community, society, or the biosphere, depending on the issue in question.

This question of scale or level is looked at in the 'Parts and wholes' activity.

Source Stephen Sterling based on an idea from Open University material.

2.3 What's in a name?

Why do this

We all use language to communicate. Labels and descriptors are indispensable to communication, but sometimes they can be a barrier. We sometimes stop with the label rather than really thinking about the thing it describes. The systems thinker Gregory Bateson pointed out that we can often confuse 'the map' with the 'the territory'; that is, give more attention to our abstractions than the phenomena they represent. This activity helps demonstrate this point, and encourages students to think more broadly about an issue and about the terms that we might use to describe it. It can be adapted quite simply to the age group.

Links with

Unit 1, Part A, particularly section 1.1, and Unit 2, Part A, particularly section 2.2

Purpose of activity

To generate thinking about the limits of terms we might use to describe an issue, and about the complex world our use of language can sometimes obscure.

Resources needed

None – or make cards, each with one descriptor name on, if you wish (see list below)

What to do

The students are asked to name an environmental issue (or if you prefer, it could be a 'social' or any other kind of issue). (Don't stipulate whether this should be at local, national or global level.) Take whatever they come up with – species loss, global warming, water pollution, whatever. Write this topic down in large letters on a piece of paper or card and place on a chair, or on the floor.

Divide the group into a number of subgroups depending on the number of descriptors you want to use. For best effect, arrange the groups around the chair in a semi-circle, or circle, so that each subgroup physically represents a different perspective on the issue.

Here are some descriptors (you might want to delete from or add to this list, or simplify for the age group):

Economic, social, ethical, political, historical, scientific, technological, aesthetic, health, human rights, non-human rights, spiritual, quality of life, intergenerational.

Say to the group:

'You have defined an environmental issue. But is it only an environmental issue? In this activity, I want you to explore it by thinking about it in different terms too.'

Give each subgroup one descriptor. They are asked to think how the descriptor applies to the chosen topic. This might take five to ten minutes, including discussion within the subgroup.

Each subgroup then speaks to the whole group, using this wording:
'…(*name of issue*) is a (*name of descriptor* eg 'economic') issue because…'

While they speak, you can if you wish, construct a spider diagram on the board to illustrate main points.

When each subgroup has had a turn, then ask the whole group: 'What sort of issue is this?' It is likely to be seen as having many dimensions.

Ask the group: 'Do we miss some of these dimensions if we just think of it as an 'environmental' issue'? 'Is there such a thing as a purely environmental issue?'

Similarly, do we miss other dimensions when we say something is a 'health' issue, an 'economic' issue or whatever?

Discussion and debriefing

Some descriptors will apply more strongly than others, but ask students to think of connections with the topic even when there seems to be no link, or a weak link.

This activity ties in with the story of the five blind men and the elephant (see Unit 5, pages 8-9). Use this story with the group to illustrate the point and use as a basis for further discussion.

Comment

The words we use influence how we see the world. What is an 'environmental issue'? This exercise should help the group realise that the world is often far messier or more complex than our labels and 'thought boxes' allow.

Not only do we separate out a set of problems called 'environmental' which somehow are seen separately from 'political' and 'economic' problems, but we then separate out the environmental problems from each other: that one's 'global warming', that one's 'energy conservation', that one's 'air pollution', that one's 'transport', etc.

You can relate this to the discussion in Unit 1 about the difference between 'box-thinking' and Linkingthinking.

Extension

A variation is to use discipline names rather than descriptors such as 'geographical', 'scientific', 'historical', 'sociological', etc. Connections between the answers that each subgroup supplies can also be a source of further discussion.

Source: Stephen Sterling

2.4 Parts and wholes

Why do this

A systems view sees the world as if it were made up of 'parts and wholes', where wholes are parts of greater wholes, and so on up a hierarchy of what are called nesting levels. The analogy of the Russian doll is sometimes given to illustrate this pattern of relationships. For example, letters are often part of a word, words are often part of a sentence, and sentences are often part of a paragraph, which is part of a chapter, which is part of a book. Each 'break' is both a whole and a part, and each level a context for the parts it contains. If you want to go further upwards with this example, a book might be part of a library, which might be part of an institution.

In any hierarchy, we can either choose to focus attention upwards or downwards. If we follow a reductionist method, we will look at 'parts' rather than 'wholes', in the belief that wholes can be explained by looking at the properties of parts. But this can lead us to ignore relationships and context and emergent properties.

Often, in complex systems, more insight can be gained from a holistic approach, ie looking at the whole; for example, the holistic health practitioner looks for the overall pattern of health. Going up a level or two or more – to the larger context – often allows us to see what is going on, what might be done or why an action might be taken.

Links with

Unit 3, Part A section 1.2

Purpose of activity

To practice recognising parts and wholes.

Resources needed

Sheets of paper. Russian doll if available

What to do

If you have a Russian doll, use this to introduce and illustrate the idea of nesting systems – of things within things.

Take an example from the list below – or use your own example – and trace parts and wholes *above* and *below* the level described:

- an organ of the body, eg liver
- a room in a house
- a car engine
- a curriculum.

These levels can be drawn as linked boxes above and below the level described.

Discussion and debriefing

As attention moves down the hierarchy, there will be more likelihood of multiple branching; for example, the car engine is made up of many parts rather than one, and this can be shown on the diagram if wished.

Where students stop on their up-hierarchy or down-hierarchy is up to them, and this is a key point about where we *draw our boundaries* of attention. On the liver example, do we stop at the whole of the human body, or do we look at the social and environmental context in which that human lives? This might be a vital question to a holistic health professional trying to treat a sick person, for example.

Comment

As well as shifting attention up and down, we can also look across 'horizontally'. In the organ example, we may ask if the problem is with the liver or the stomach. In the engine example, is the problem with the engine or is that noise coming from the suspension? If so, are there connections across this level of focus?

In Linkingthinking the prime emphasis is on shifting attention upwards, to look to the bigger context. This can act as a balance to our tendency to always reduce and fragment in our approach to understanding and inquiry.

Source: Stephen Sterling

2.5 What causes the cause of the cause?

Why do this

Conventional approaches to problem solving tend to abstract or highlight a specific 'cause' and 'effect' in a situation. By identifying the 'cause' and acting on that, it is thought that we can change the effect. This can definitely work, but is often too simplistic and ignores patterns of feedback. This activity helps students appreciate why this is so, and how a bigger picture is often required.

Links with

Unit 2, Part A section 2

Purpose of activity

To raise awareness of the complexity of chains of causality and feedback, and question the notion of simple causality.

Resources needed

Whiteboard or flipchart and pens

What to do

Get students to identify any problem or interest that a group can work on together. It may be better to give it real context. They may decide, perhaps, to look at football hooliganism, poverty or loss of wild birds. But whatever example they choose, you might want them to tie it down to a specific example, time and place. This is so that opinion can be backed up by real-world research if desired.

Ask the students to write the problem in the centre of a whiteboard or flipchart and ring it as a 'bubble'. Now ask the students to think of the main *cause* of this problem. Write this down on the left of the problem, ring it and draw an arrow to the problem. Now think of one of the main effects of this problem, and ring this and place to the right.

It is likely that the students will have some disagreement on deciding one main 'cause' and 'effect' of your identified problem. Begin to discuss and write in other 'causes' and 'effects' that people came up with. Now work out towards the edges of this diagram. What things may have caused the causes? Put these in too. And what things may have caused these newly identified causes? Now do the same for 'effects', ie what effects might produce (that is, cause) what other effects? You should have quite a complex diagram by the end.

Discussion and debriefing

A number of points should emerge from this exercise. See how many of these ideas your students come up with:

- that there are differing opinions about the nature of any problem, and that these multiple perspectives can be valuable in generating new insights
- that any 'cause' can also be an 'effect' and vice versa
- that influences often can be traced almost indefinitely backwards and envisioned forwards into the future
- that some influences are likely to be linked through feedback loops
- that it's possible to focus in on any one area of the problem map, but, if we do, we need to recognise that it is only part of the story. (This is a boundary issue.)
- that intervention should be accompanied by caution! We often cannot know what effects our actions will have 'downstream'.

Comment

Newspapers and media commentary are full of explanations about what causes what. But the idea of causality is fundamentally a mechanistic 'Newtonian' notion. In complex systems, simple causality (linearity) is extremely rare. It is more appropriate to think in term of systems.

Extension

Do any of the bubbles link up? Show feedback loops between them, if so. Get students to look at newspapers to identify where stories either explain problems through simple causality, or recognise the systemic nature of a situation (but probably without using these terms). Try to draw and build up a systems diagram to represent a newspaper story.

Source: Stephen Sterling

2.6 Towards rounded solutions

Why do this

The problem with simple problem solving is that 'solutions' can lead to more problems, which are often unforeseen. This activity increases awareness of this issue and the need to think towards 'rounded solutions' that take more account of the systemic nature of the world.

Links with

Unit 2, Part A sections 2 and 3 and also Unit 3, Part A

Purpose of activity

To raise awareness of systemic effects of solutions and of the need to think more holistically.

Resources needed

Whiteboard or flipchart and pens

What to do

Give your students a list of 'solutions' (a few ideas follow but you might want to compile a list, perhaps topical to what's happening locally).

The first question to work on is: 'If this is seen as the solution, what is the problem?'

Then: 'Who do you think has defined this problem, and in this way? Why? Would other groups see it differently?

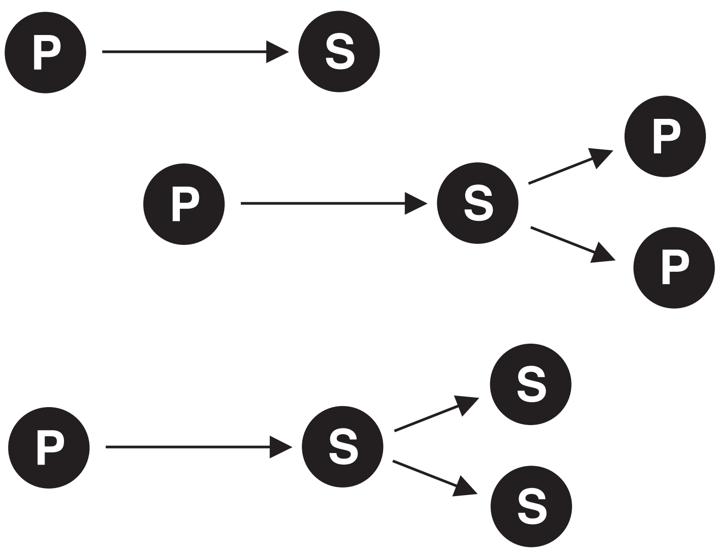
Some solutions:

- GMOs (genetically modified organisms)
- pesticides
- a bypass for a town or city
- a farmers' market
- a power station
- disposable plates
- a reservoir
- a nature reserve.

Now work in groups on a chosen topic. Use 'P' to denote problem and 'S' to denote solution. Draw the diagrams below:

Now ask students to work on their chosen topic, at both ends of the 'Problem-Solution' equation. Does the S in turn generate more Ss than Ps? (Or is it likely to?) Or does it seem to generate more Ps than Ss? If the latter, go back to the perceived original problem. Maybe it's not really a problem at all. Or maybe it can be seen in a different light; one that questions the originally proposed solution.

For example, the problem that the power station is meant to address may not be a shortage of supply, but rather inefficient use of what supply there is. So the appropriate solution path might be to work on education and energy conservation rather than increasing supply. The problem that the pesticides are meant to address may not be that too many pests are taking the crop, but rather that there aren't sufficient predators in the system to control the pests. So the appropriate solution path might be to cut down on pesticides while building up biodiversity on the farm.



Discussion and debriefing

This activity should generate many different viewpoints and a great deal of discussion about the perception of problems and solutions, and the difference between taking a reductionist and a Linkingthinking approach. Try to draw out this difference. But also help the students recognise that there are often no easy answers, and that the reductionist approach has its place in some circumstances. Further, that sometimes 'side-effect' problems are unavoidable and a trade-off has to be decided between the benefits and disadvantages of any 'solution'.

Note that simple problem solving again relates to the issue of where *boundaries* are drawn.

The *multiple perspectives* that different students might offer are an asset in thinking about such issues – draw this out. Note that different perspectives can also be generated by identifying knock-on effects, by being creative and, if necessary, thinking about 'wacky solutions', and by changing the boundaries of the group's attention.

Comment

This activity should come before working on synergy and design (Unit 3). Ecological design is about re-thinking problems and designing solutions that generate further solutions (positive synergies).

Extension

If you want to dramatise this activity and have some fun, you can draw some large Ps and Ss on cards, and have students hold these cards, with themselves perhaps linked by string or rope to show links.

Source: Stephen Sterling

3.1 Economy and ecology – which fits into which?

Why do this

The issue of whether the economy should be seen as part of (ie a subsystem of) the global natural environment, or whether the environment is a subsystem of the economy is vital to understanding sustainability. Traditionally, the environment has been both regarded and treated by economists and others as a subsystem of the economy, as if the former were either inexhaustible or expendable. Seen from a systems (Linkingthinking) point of view, it is critically important to recognise that this view is fundamentally fallacious and ignorant of physical facts. Because the environment supplies essential resources and sinks for the materials and energy (natural capital) that feed the economy and without which it cannot survive, the economy is essentially a dependent subsystem of the total environment.

Links with

Unit 3, Part A, particularly sections 1.1 and 2.1

Purpose of activity

To recognise that the economy needs to be recognised as supported by and dependent on the environment (rather than the other way round).

Resources needed

No special resources required

What to do

Draw two circles, one inside the other (nesting systems). Ask the students: which should be labelled 'economy' and which 'ecology'? A reasonable (but evasive!) answer might be 'that the diagram doesn't work because they are part of each other'. But the question is not how they affect each other but 'which is more fundamental,' ie which would not survive or be sustained without the other?

Quote Lester Brown's concern in Unit 3, Part A section 1.1, page 5 regarding whether the economy should be regarded as part of the environment, or the environment as part of the economy. Put this to the students (see Activity in text). Find out what they think and what their reasons are.

If they have trouble, ask them to think of any material thing they consume. Then trace back, if they can, where its components come from, and where waste goes either in the production or consumption phase. With the possible exception of 100 per cent recycled or re-used goods, materials and energy can ultimately be traced to the environment. Another perspective is to imagine a spaceman's view of the Earth: the Earth as a natural whole system is immediately apparent as the context for all human activities.

Ask if the natural environment can survive without a human economy. Conversely, can the human economy survive without an environment to provide *sources* and *sinks*, that is resources and the ability to absorb waste? The answers should be 'yes' and 'no' respectively!

Discussion and debriefing

This is a critical distinction. Ultimately, unless the global economy 'fits' the global ecology, both are imperilled. There is plenty of evidence (see 'Unsustainability' in Unit 3) to suggest that the economy is pushing against and exceeding environmental limits, with damaging consequences for both. In other words, the success of the global economy is undermining its means of survival.

Extension

The relationship between economy and ecology can be simply drawn as a systems map, consisting of a circle (economy) within a greater concentric circle (environment or global ecosystem).

Thinking and discussion generated by this exercise can be taken further in the 'Good egg or bad egg?' activity which follows.

Source: Stephen Sterling

3.2 Good egg or bad egg? Sustainable development scenarios

Why do this

Many people find sustainable development confusing. This simple model is a helpful way of understanding fundamental differences between 'sustainable' and 'unsustainable' scenarios.

It reinforces the idea that the economy needs to be seen as a subsystem of the environment. For this reason, it would be best – though not essential – for students to tackle the exercise 'Economy and ecology – which fits which?' first.

The egg metaphor is useful. In a good egg, both the yolk and the white are in good condition. In a bad egg, either or both might be in poor condition. In this analogy, human society (the yolk) is contained by the overall ecology (white).

Links with

Unit 3, Part A particularly sections 1.3 and 2.1

Purpose of activity

To clarify the essential difference between 'sustainable' and 'unsustainable' scenarios.

Resources needed

Diagram 'The Egg of Sustainability' by Robert Prescott-Allen, (in IUCN, 1995)

What to do

Hand out the 'Egg of sustainability' diagram. Don't explain the egg analogy.

Ask students to carry out the following exercise:

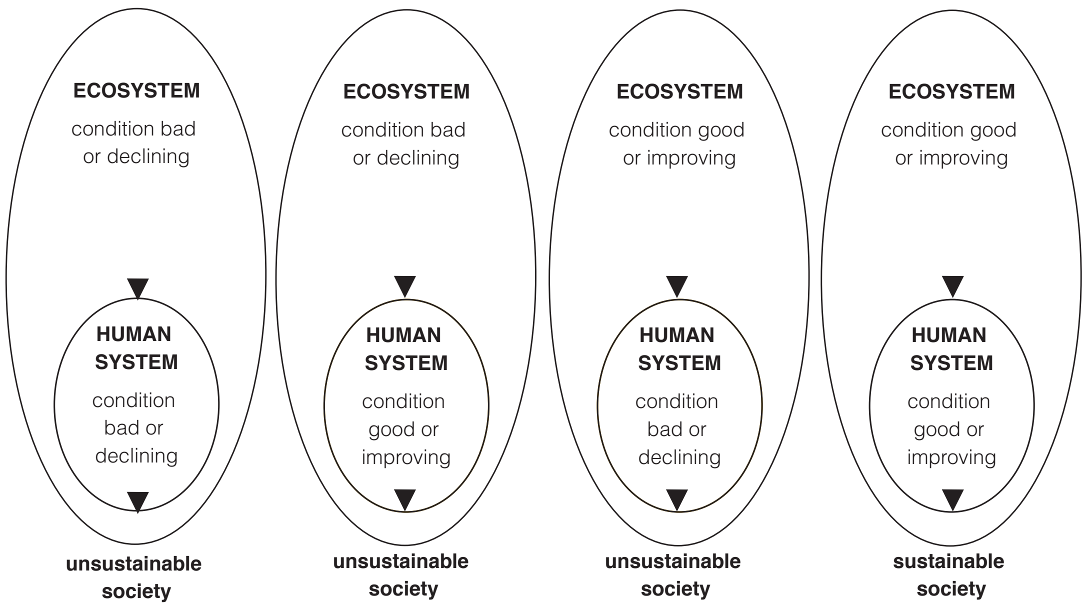
- label each of the four diagrams either as 'Unsustainable society' or as 'Sustainable society'
- compare, justify and discuss their labels
- try to think of examples of each scenario, either at a local or global scale.

Discussion and debriefing

Only the last scenario, where both the human society and ecology are good or improving, can be said to be sustainable. See if the students can explain the relevance of the egg analogy.

Comment

This will help the tutor gauge current understandings of sustainability. The activity should generate debate – what are the limitations and implications of this model. For example, what does 'good and improving' mean? What scale does this model work on – local, global?



Extension

Consider what sorts of indicators we might use to help determine a movement towards more or less sustainable scenarios. Is a lack of indicators, or use of the wrong indicators, part of the problem as regards the commonness of unsustainability rather than sustainability conditions?

Another avenue for exploration and study is to look at those societies in the past that collapsed due to their undermining of their natural resource bases.

Source: Stephen Sterling, based on the diagram from the following reference:

References

International Union for the Conservation of Nature and Natural Resources (IUCN) International Assessment Team, 'Assessing Progress Towards Sustainability: A New Approach' in Trzyna, T (1995) *A Sustainable World – Defining and Measuring Sustainable Development*, IUCN/ICEP, p155.

3.3 What is a system?

Why do this

The word 'system' is used frequently without much thought about what it means. We talk of the 'braking system' on a car, the 'education system', the 'tax system' and so on. If we are to get more proficient at Linkingthinking, it's helpful to consider more closely the meaning of the word.

Links with

Most units, and particularly Unit 1, Part A (especially section 5), and Unit 3, Part A (especially section 1.2).

Purpose of activity

To clarify what constitutes a system, to raise awareness of our role in defining systems, and generate further understanding.

Resources needed

No special resources required

What to do

Ask your students: 'What, in your opinion, is a system?'. And later: 'What is not a system?'. Discuss what things or properties distinguish a system from a non-system. Working in pairs, divide a piece of paper in two and list these properties under two headings: 'System' and 'Non-system'.

Discussion and debriefing

The students will probably find it hard to come up with something that is not a system – after a while, everything starts looking like a system! The distinction is often made between a system and a heap. For example, a pile of bricks has no particular relationships, but if made into a wall they constitute a simple system (see definitions below).

Some common distinctions are below:

System	Heap
Parts are related in a greater whole	Unrelated parts or components
Has integrity, which is changed or damaged if you take parts away	No effect on other parts some away
The pattern of the parts is important	The arrangement of parts is not important
There are dynamic relations in the system	There are no dynamic relations in the heap

After O'Connor and McDermott, *The Art of Systems Thinking*, 1997

Comment

There is no 'hard' definitional boundary between what comprises a system and what comprises a non-system. Some things show more systemic qualities than others do, and this depends on their complexity (see Unit 2).

A non-system has no *emergent* properties, but systemic qualities can develop. For example, take a group of random people in a lift – is this a system? Probably not, but if the lift (system!) breaks down… then yes! They would organise and connect and develop systemic qualities. Similarly, a conference or course often forms stronger systems properties (emergent properties) over time, starting with people not knowing each other but forming relationships as the event runs on.

An important point here is that what constitutes a system depends largely on the viewpoint of the observer, and on his/her view of any system's purpose. (See Unit 1 on this.)

Extension

Can students come up with a definition of a system? Depending on the level of your students, you could compare their definitions with any or all of the definitions below:

"A system is a defined whole whose properties depend on the interaction of its parts. That is, the properties of a system arise from the inter-relationship of its parts, and cannot be reduced to the parts themselves."

Fritjof Capra, (1993), 'Ecology, systems and Gaia' lectures given at Schumacher College, Devon, July 1993

"A system is an interconnected set of elements that is coherently organised around some purpose. That is, a system consists of three kinds of things: elements, interconnections, and a purpose."

Meadows (1989) *Harvesting One Hundredfold*, UNEP

"A system is something that maintains its existence and functions as a whole through the interactions of its parts."

O'Connor and McDermott (1997) *The Art of SystemsThinking*

Second, ask the students what types of system they can think of. Types of system might include: political, economic, technological, cultural, belief, biological, atmospheric, ecological, social, family, community, settlements, transport, education, educational institutions, and so on.

See Unit 1 for more on this.

Source: Stephen Sterling, based on a standard systems thinking exercise

3.4 Designing for sustainability: preservation or continuation

Why do this

We seem surrounded by 'stuff' that doesn't last long in our 'throwaway society', but which doesn't get recycled or re-used either. The late Victor Papanek, a designer interested in ethical and sustainable design, noted the paradoxical challenge that such design presents to designers:

"…to design things that will last, yet come apart easily to be recycled and renewed."

Papanek, V *The Green Imperative*, 1995, p238

This illustrates the paradox about sustainability. Is it about preservation (things lasting forever) or resilience and continuity? We seem better at designing things that eventually become permanent waste (and don't come apart easily) than keeping them in the form of permanent potential. Nature's design demonstrates the latter, and arguably we should be taking a (biodegradable!) leaf out of her book. This is what the emerging field of *'ecological design'* seeks to do.

Links with

Unit 3, Part A, section 3

Purpose of activity

To encourage students to think about sustainable design principles in relation to designing for 'continuity' rather than for 'preservation'. Some initial and follow-up research will enhance this activity.

Resources needed

No special resources required

What to do

Give out Papenek's statement.

Encourage discussion – given that we are concerned with sustainability, why is this a paradox?

Have students make two columns, or prepare a worksheet in advance. In the first column write 'Design for sustainability?' and in the second write 'Design for unsustainability?'. Ask them to think of and list things that appear designed to last, yet come apart easily to be recycled and renewed. Some of the newer models of expensive car might fall into this category, for example, but it might include something simple like a bicycle. Get them to look at the room around them or think of home if they have trouble getting started.

For the second column, ask them to think of things and list things that seem 'not designed to last, and yet are hard to re-use or recycle'. This might lead to a long list! Examples here include relatively new products, such as most computers and mobile phones, as well as older products like batteries.

Which column has the more entries? Why might this be? Which things might be situated 'between the columns'? Many things appear to be built not to last in useable form, and yet later become lingering and persistent waste or pollution. What examples can you think of?

Discussion and debriefing

What does this exercise tell us about sustainability and the difference between preservation and continuity? The question marks in the columns indicate that the distinction is not always easy.

Overall, we need to think more in terms of 'persistent systems' rather than preserved elements. For example, the forest persists but individual trees in the system have a limited life before becoming recycled. Similarly, we might want the small farm to persist, but we do not want pesticides that are permanent and do not biodegrade harmlessly. We might want computer systems, but we don't want old models to clog up landfill sites (this is an increasing problem).

Generally, sustainable design is more about elegance, persistence and continuity in systems than trying to make things last forever in isolation.

Comment

Paradoxically, design for unsustainability may lead to products that last too long and cause problems or pollution (this may be intentional as in 'built-in obsolescence' in consumer goods. Or it may be unintentional as, for example, in chlorofluorocarbons (CFCs)), while design for sustainability often involves products that can be re-used, repaired, and, if necessary, recycled.

Another point to make here is that, from a Linkingthinking point of view, there is no 'away' to throw to. All unused waste represents a loss and a possible future problem – material becomes permanent waste, rather than available as permanent potential.

You might want to mention here the difference between a linear and a cyclical economy. This introduces the notion of 'sustainable systems' and organisations rather than products, and is another level of discussion for more experienced students.

Extension

Consider items in the second column. How might any of these be redesigned so that they can earn a place in the first column? What evidence is there in product design that sustainability is being taken more into account? Students could research these issues with appliance and home furnishing stores.

Source: Stephen Sterling

4.1 Linkingthinking using diagrams

Why are diagramming techniques useful?

Writing and talking are very linear. They flow in one direction. With diagrams, it's inherently easier to convey more of a sense of a whole picture with interrelationships, causes and effects, feedback influences, etc. You can also convey complexity much better in a diagram.

The following are some examples of diagramming techniques that might be helpful to you in the unit activities and also for you to use as Linkingthinking tools in looking at situations in general.

For some interactive practice and tutoring at doing systems diagrams, see the following Open University websites:

- http://open2.net/systems/thinking/index.html on this site click on 'Models'
- http://systems.open.ac.uk/materials/t552/index.htm on this site, click on the type of diagram (top of screen) that you'd like to know about. The systems map option gives a good tutorial that's fun to do.

Rich pictures

'Rich pictures' are pictures of a situation including as many dimensions of it as possible – components, connections, relationships, influences, cause-and-effect, and so on, used to give an impression of complicated situations, including as many aspects of the situation as possible. It's best to use pictures, cartoons and symbols when you draw one up as this helps your imagination expand. As well as these objective notions, 'rich pictures' should depict subjective elements such as character and characteristics, points of view and prejudices, spirit and human nature. If you are working with a client, you should try to draw these from the actors themselves, at least initially, rather than focusing on your own interpretation of the situation. These were developed as part of 'Soft Systems Methodology' (see 'Towards learning together', activity 4.5).

A good description of the 'rich pictures' tool and an example of it in action can be seen at:

http://smart.knet.ca/archive/fsworkshop/index.html

This shows how local communities in the Keewaytinook Okimakanak First Nations looked at ways in which telecommunications could be used to improve local government.

Causes and consequences tree

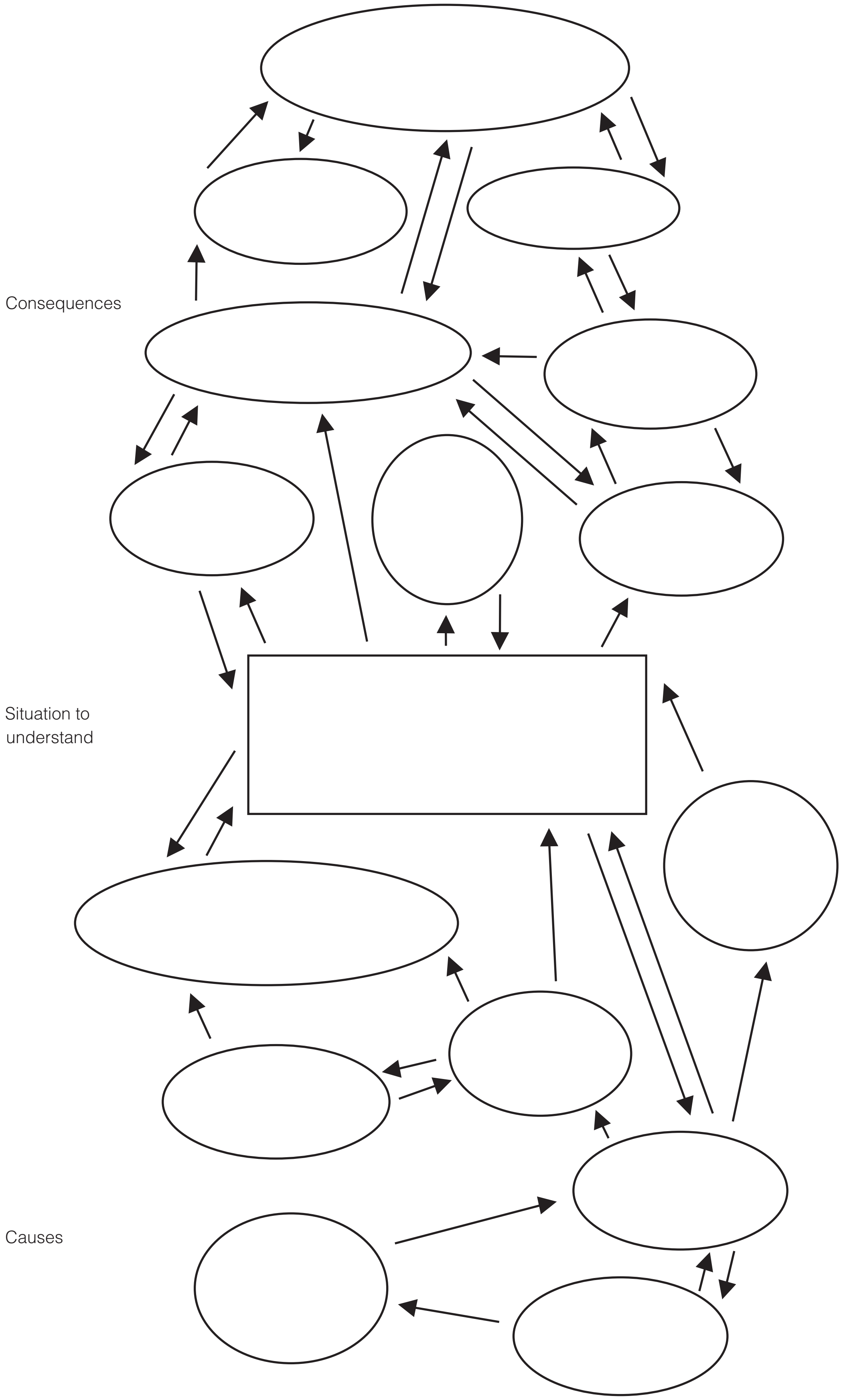
A causes and consequences tree diagram is useful for showing the main structural features of a situation and the important relationships they have with each other, but in a simpler way than a rich picture. It can be used to give a broad view of how you see things in the situation you're exploring. Influence diagrams can be used as the starting point for a multiple-cause diagram by more clearly defining the type of influence.

To draw an influence diagram, place the problem or situation you want to understand better in the centre of the page. Then describe in words the most important parts of the situation that have a causal influence on bringing about that situation. Describe each of them in the lower part of the page and link them together with arrows according to how which part influences which other part, leading eventually to the main situation you're trying to understand.

Do the same in the upper part of the page, but here you're looking at the effects that the situation gives rise to.

As with the 'rich picture', don't forget things that you can't actually see like the values, beliefs, priorities and interests of people. And don't forget to put yourself in the picture. See page 26 for an example of a causes and consequences tree.

A schematic causes and consequences tree



4.2 Systems of concern/systems of influence

Why do this

Environmental and sustainability problems, especially global ones, can appear so daunting that it feels as if nothing can be done as an individual to help the situation. The scale of change needed can seem so enormous and unconnected with everyday life as an individual. When you do see the link with everyday life, the thought of the amount of change needed in your lifestyle to reduce consumption levels can provoke a great deal of anxiety. Also, there are many other, more immediate concerns and pressures in life that demand attention – health, family, making a living, emotional wellbeing. So people carry on with their day-to-day lives as before, without a thought to the contributions they make to worsening the sustainability predicament, or to the contribution they *could* make to improving it. While attitudes and awareness have grown, consumption behaviour has not substantially changed, and may even have worsened. (There is a psychological reaction whereby people respond to anxiety by denying the problems that cause it and stifle it by doing more of the activities that help them to cope with their anxiety – like consuming more!)

This activity aims to help you focus in on what you can realistically do, and how you might be able to do more, by distinguishing between your genuine *System of concern* and your realistic *System of influence*.

Links with

Unit 4

Purpose of activity

To identify what is genuinely important, relevant and meaningful to you.
To identify what you can actually do in line with what's important to you.
To recognise the connection between what is genuinely a priority to you and what you actually back up with action and behaviour change.

Resources needed

Large sheet of paper and drawing materials

What to do

Draw two concentric circles on your sheet of paper, leaving enough space to write between them and in the centre circle. The outer circle is the boundary of your *System of concern*. The inner circle is the boundary of your *System of influence*.

Inside your System of concern, brainstorm all those things that you feel concerned about, however, big or small, environmental, social, economic, personal, anything – after all, it's all connected, isn't it?

Now, looking again at what's in your System of concern, distinguish between those things you feel you have no control or influence over at all and those you feel you have some degree of control or influence over, however small. Copy the latter into your System of influence.

Now, ask yourself whether you spend more time and energy focused on things within your System of concern or your System of influence.

Discussion and debriefing

People who spend more time in their System of concern tend to be reactive, focusing on the enormity of the problems, other people's responsibility and circumstances that they have no control over. They can be accusatory, blaming other people and feel like victims. Over time, this results in feeling demoralised and able to do even less. These attitudes cause their System of influence to shrink.

People who put more energy into their System of influence tend to be proactive, focusing time and energy on those things they can do something about, however little. They are cautiously optimistic but also reflective. Their energy is positive and enlarging and, over time, this causes their System of influence to expand. Of course, feeling concerned for things outside the System of influence is still an important spur to action. It's just that these people do not dwell on what they cannot do, but put energy into what they can do.

Source: Adapted by Paul Maiteny from Stephen Covey's *The Seven Habits of Highly Effective People*, 1992, London: Simon and Schuster.

4.3 Dimensions of human causes of environmental problems

Why do this

The following model can be helpful in distinguishing between different aspects of any situation.

	Non-visible, 'inner' factors contributing to environmental problems and solutions	Visible, 'outer' factors contributing to environmental problems and solutions
Individual dimension	**Q1. Psychological**	**Q2. Behavioural**
	Individual experience, learning, feelings, emotions, thinking, intentions, motivation which may or may not be evident to the person's everyday awareness (ie conscious or unconscious)	Individual behaviour and expression of values, etc, with visible, tangible effects on environment – socio-economic and ecological
Collective dimension	**Q3. Cultural**	**Q4. Social/Economic, Institutional**
	Shared frameworks of non-formalised belief, meanings, values, norms, interests that give shape to priorities, policy and behaviour. Can be political, religious, scientific, ideological.	Group expression with visible, tangible effects on others – socially, economically, ecologically. Formalised policies, structures, institutions.

Note: All quadrants necessarily inter-penetrate each other

Source: Adapted by Paul Maiteny from Ken Wilber's Four Quadrants model

Links with

Unit 4, particularly 4.3 and 4.4

Purpose of activity

To demonstrate that all dimensions in the quadrant model are necessary for any human system to function effectively and sustainably. Exclude one and the whole becomes dysfunctional, partial and distorted.

Resources needed

Large sheet of paper and drawing materials

What to do

Take a well-known issue as an illustration, for example the case of 'mad cow disease' in the UK. Draw the quadrant on a flip chart and ask the students to consider the factors contributing to the problem and its solution, and to place them in the relevant quadrant. If any links are identified, draw these in with linking lines.

Discussion and debriefing

A hypothesised cause of the disease was the policy decision (Q3) and individual decisions of farmers (Q1) to allow cows to be fed animal substances (Q2). This was made on the basis of beliefs and values (Q1 and 3) that this would boost economic productivity (Q4). Adverse biological effects in the cows (Q2) have been passed onto humans (Q2). This generated anger and dismay in some quarters; denial and defence in others (Q1 and 3); consequences on the economy (Q4) and on farmers' livelihoods (Q2 and 4); and eventual changes in beliefs (Q1 and 3) surrounding cow fodder, animal welfare, eating habits, and the trustworthiness and competence of policy-makers' motivations and priorities (Q1 and 3), and actions (Q2 and 4). Further interrelationships could also be drawn out.

A systemic approach to policy decisions entails taking interrelations of *all* quadrants into account.

4.4 Conflicts over environment and development at Marsh Common: a stakeholder role-play

Note. A simplified and interactive version of this role-play can also be accessed on the Open University/BBC website http://open2.net/systems/thinking/. The author of this Linkingthinking unit, Paul Maiteny, designed the activity and wrote much of the text on this web

Why do this

It's tempting, and easy, to believe that different people see the same situation in exactly the same way. But they rarely do. Conflicts over natural resource use arise precisely because people (or stakeholders) involved in the situation see their interests in the resource differently. Perspectives on the resource have more to do with the conflict than the resource itself. If there were plenty of resources to satisfy all interests, there would be no conflicts over them. But because they are physically limited and those limits cannot be expanded, the only other option is to work with the *cultural boundaries* created by the perspectives on, and interests in, a situation.

Links with

Unit 4

Purpose of activity

It can be hard to empathise with other people – to put ourselves into their shoes, feel what they might be feeling, see their perspectives and values as valid, especially if we don't agree with them or see their interests as threatening our own. This activity is designed to help with that. The activity that follows builds on the method used here so as to analyse perspectives on any conflict or decision-making process that involves many interests. The main purposes of this activity are:

- to gain experience of stakeholder conflicts over a natural resource
- to gain first-hand experience of how the same situation is seen and interpreted as many different problems and sets of interests
- to enhance understanding that resource conflicts are not caused primarily by the resource itself but by the beliefs, values, priorities and interests of stakeholders
- to develop empathy and debating skills.

Resources needed

Flexibility of time – up to two or more class sessions depending on how activity and ensuing discussion are developed. A copy of one briefing note per group.

What to do

This role-play is based on a real-life conflict situation that took place a few years ago. All the names of the places and organisations have been changed but the situation and reasons for conflict are largely as they were then. The role-play revolves around the proposed development of a theme park on 'Marsh Common'. The main stakeholders are:

The National Environment Council (NEC)
The Trust for Bird Protection (TBP)
The Wildlife in the Virtual Planet Trust (WVPT)
Environment League (EL)
The Wetlands Foundation (WF)
Music and Film Corporation (MFC)
Urban Development Corporation (UDC)
Marsh Borough Council (MBC)
Local residents (non-environmentalists)
Local residents (environmentalists)

Students should choose or be assigned to different stakeholders in small groups. Each group is given their respective briefing notes but must not see each other's.

The groups' tasks are to present their cases in as convincing a manner as possible. They are also free to make alliances if they think this will help. They should be encouraged to do whatever is necessary to feel and think their way into the roles, eg through fancy dress, convincing campaigning style, manner, etc.

Ideally, some class time and time between classes should be put aside to developing their roles and arguments. In the following class, each should be given up to 20 minutes to present their case, jointly with other groups if they think it will strengthen the case (not forgetting differences of interest within the 'for' and 'against' camps, however).

Following presentation, each should, in turn, be available for questioning by the other groups.

The facilitator's role is to act as chairperson of the inquiry, asking pertinent and probing questions about benefits, motivations and anything else they consider important in the decision-making process. Either the chairperson or preferably a jury of students not involved in presenting cases should make a decision, summarising their reasons on the basis of arguments and cases presented.

It is quite possible that you will not reach a definitive decision, but discussion of the issues emerging should be given as much time as is necessary to assimilate the main purposes and learning points.

MARSH COMMON CASE

Stakeholder role briefing notes 1 – The Consortium perspective (NEC, TBP, WVPT, EL)

Your task is to argue the case convincingly for developing your preferred scenario for the future of the marshes. This is not to say that you are not open to reasonable and sensible negotiation, identifying common ground, even compromising, so long as you achieve your primary goal(s).

Five national conservation organisations are collaborating against development of the Marshes. You are working for one of the following four:

1 The Natural Environment Council

This is a government-sponsored agency charged with designating and protecting Sites of Special Natural Interest (SSNIs) according to various criteria that indicate the particular sensitivity of a site and/or the rarity of particular species or habitats.

No facility for public participation is included in SSNI legislation. They are designated and managed purely for scientific interest/conservation. As a government agency, NEC must represent these interests in relation to Marsh Common, as enshrined in its terms of reference. It has a brief for environmental education but, at present, this does not allow for any development of SSNIs. These are inviolable from the NEC's point of view.

2 The Trust for Bird Protection (TBP)

The TBP's overriding priority is to protect birds and their habitats. It is a well-respected organisation.

3 The Wildlife in the Virtual Planet Trust (WVPT)

WVPT's priority is to conserve what is left of London's natural space and to promote the creation of new ecological sites in the capital for the benefit of London residents.

4 Environmental League (EL)

EL's campaigns include nature conservation, but this is only one aspect of a broader environmental brief which encompasses issues such as global warming, ozone hole depletion, biodiversity, consumerism, and community level action and development ('Think Global, Act Local').

Although the 'core businesses' (which their memberships support) in all your organisations differ slightly from each other, the TBP, WVPT and EL nevertheless support the NEC's inviolability line and will not support any building or other modification of the site that is not to do with enhancing its conservation value. SSNIs are intrinsically valuable in scientific ecological terms and this should be enough to ensure their continued integrity for prosperity, especially since it is backed up by legislation protecting SSNIs.

As for the Music and Film Corporation's (MFC) mitigation package – leaving 400 acres for nature out of a total of 2,000 – this is not adequate to sustain the sensitive species living on the marshes. It is simply not ecologically possible to concentrate wildlife into a smaller space than it needs naturally, at least without intensive and difficult management. And who is going to be responsible for that, both practically and financially? Nor is it possible to artificially re-create habitats to the extent necessary and expect that the species will survive there. Species will disappear.

You feel as though you have to defend the case for the marshes, whereas the onus should be on the developers to show that there will be no damage or loss of species. You are suspicious of the motives and methods of MFC's ecological consultants.

You all have environmental education programmes, but these come second to the primary task of environmental conservation and campaigning for changes in policy, attitudes and behaviour in line with your various approaches.

You do not agree with the approach of the fifth conservation group involved – the Wetlands Foundation (WF). WF was founded by a one-time hunter who realised that shooting depended on sustaining populations of birds to shoot, and their habitats. Environmental education is a high priority for WF as it is seen as the key to attitudinal and behavioural change on the part of the public. In fact, WF has a number of sites all over the world that combine natural habitats and educational facilities.

You suspect that WF is more willing than you are to negotiate with developers and local residents on a compromise for the development vs. conservation of Marsh Common. While campaigning alongside you against the theme park, WF is more likely to be amenable to MFC's mitigation package of an ecological park within the development and the purchase of wetland elsewhere. It is also more flexible in its views about the inviolability of SSNIs.

You see all this as conceding defeat and 'the thin end of a wedge' that would set a precedent for the future. You are also very aware that WF is in the business of environmental education centres bordering on zoos and may have a vested interest in arguing for on-site education and interpretation facilities. Could WF's idea even turn into some sort of ecological theme park? Any development would detract from the matter in hand – saving the marshes for nature conservation!

MARSH COMMON CASE

Stakeholder role briefing notes 2 – The Wetlands Foundation perspective(s) (WF)

Your task is to argue the case convincingly for developing your preferred scenario for the future of the marshes. This is not to say that you are not open to reasonable and sensible negotiation, identifying common ground, even compromising, so long as you achieve your primary goal(s).

Five national conservation organisations are collaborating against development of the Marshes.

You are working for the Wetlands Foundation (WF). This was founded by a one-time hunter who realised that shooting depended on sustaining populations of birds to shoot, and their habitats. Environmental education is a high priority for WF as it is seen as the key to attitudinal and behavioural change on the part of the public. In fact, WF has a number of sites all over the world that combine natural habitats and educational facilities.

You are more willing than the other conservation NGOs to accept a compromise position on Marsh Common between development and conservation with developers and/or local residents. You suspect that not doing so will result in a 100% 'lose-win' situation against conservation. Hence, while campaigning alongside the other groups against the theme park, you are less likely to reject a mitigation package that includes an ecological park within the development and the purchase of wetland elsewhere. You are less convinced by arguments regarding the inviolability of SSNIs. If on-site education and interpretation facilities are likely to increase local opposition to the theme park – by making the site accessible and interesting (a mini ecological theme park?), and making locals feel as if they are being considered by the conservationists – then you are willing to develop them. Besides, this is precisely where WF's experience lies.

The other four conservation groups are:

1 The Natural Environment Council (NEC)

This is a government-sponsored organisation that protects Sites of Special Natural Interest (SSNIs) according to various criteria that indicate the particular sensitivity of a site and/or the rarity of particular species or habitats.

No facility for public participation is included in SSNI legislation. They are designated and managed purely for scientific interest/conservation. As a government agency, NEC must represent these interests in relation to Marsh Common, as enshrined in its terms of reference. It has a brief for environmental education but, at present, this does not allow for any development of SSNIs. These are inviolable from the NEC's point of view.

2 The Trust for Bird Protection (TBP)

A long-established NGO whose overriding priority is to protect birds and their habitats.

3 The Wildlife in the Virtual Planet Trust (WVPT)

This forms part of the Wildlife Trusts Partnership (formerly the RSNC: Royal Society for Nature Conservation). WCT's priority is to conserve what is left of London's natural space and to promote the creation of new ecological sites in the capital for the benefit of London residents.

4 Environmental League (EL)

EL's campaigns include nature conservation, but this is only one aspect of a broader environmental brief which encompasses issues such as global warming, ozone hole depletion, biodiversity, consumerism, and community level action and development ('Think Global, Act Local').

Although their own 'core businesses' (which their memberships support) differ slightly from each other, the TBP, WCT and EL support the NEC's inviolability line more than WF does. They will not support any building or other modifications of the site that are not to do directly with enhancing its conservation value. SSNIs are considered intrinsically valuable in scientific ecological terms and this should be enough to ensure their continued integrity for prosperity, especially since it is backed up by legislation protecting SSNIs.

As for the Music Film Corporation's (MFC) mitigation package – leaving 400 acres for nature out of a total of 2000 – you agree with the other conservationists that this is not adequate to sustain the sensitive species living on the marshes. It is simply not ecologically possible to concentrate wildlife into a smaller space than it needs naturally, at least not without intensive and difficult management. And who is going to be responsible for that, both practically and financially? Nor is it possible to artificially re-create habitats to the extent necessary and expect that the species will survive there. Species will disappear. However, if it's a case of losing everything or reaching a compromise, you know which you will go for.

You feel as though you have to defend the case for the marshes whereas the onus should be on the developers to show that there will be no damage or loss of species. You are suspicious of the motives and methods of MFC's ecological consultants.

The NEC, TBP, WVPT and EL all have environmental education programmes but they view them as less of a priority than WF does in relation to the primary task of environmental conservation and – in line with their various approaches – campaigning for changes in policy, attitudes and behaviour.

MARSH COMMON CASE
Stakeholder role briefing notes 3 – The developers' perspective(s)

Your task is to argue the case convincingly for developing your preferred scenario for the future of the marshes. This is not to say that you are not open to reasonable and sensible negotiation, identifying common ground, even compromising, so long as you achieve your primary goal(s).

Three primary stakeholders are in broad agreement regarding the need to develop Marsh Common. These are the Music and Film Corporation (MFC), Urban Development Corporation (UDC) and Marsh Borough Council. You are representing the views of MFC and UDC. Among the secondary stakeholders in support are the British film industry and the government tourist agencies.

Your arguments for the development are quite straightforward. Marsh is an economically depressed area in great need of rejuvenation and opportunities such as this. The theme park, to be called 'Virtual Planet', will create hundreds of jobs for local people as well as other economic benefits. Locally, tourism will be stimulated, morale boosted and migration from the area halted or slowed down. 'Virtual Planet' will not only be a theme park but a whole entertainment complex including film studios. It will give the British film industry, and hence the national economy, a real boost and put it back on the map – in Marsh! Furthermore, this is a perfect catalyst for realising the government's policy of developing the Forth Lagoon.

MFC does not have a strong preference for Marsh, though language would be a distinct advantage over locating overseas. Nevertheless, if delays are too protracted, it may well be easier and less costly to opt for overseas and a more direct competition with 'Virtual Paradise'. Overseas offers a far smoother ride through the bureaucracy. It is quite obvious to you that both the British government and Marsh Borough Council will be worried by this, and that you can use it as a lever to ease the process through as quickly as possible. You also suspect that local people will find it hard to resist such a glamorous and seemingly lucrative opportunity, especially compared to the options that the conservationists are putting forward.

Although conservation and the environment are very fashionable topics at present, you suspect that the conservationists have a lot to learn on the marketing front and that most local people are not sympathetic to their arguments. The overwhelming perception of the marshes is as an inaccessible wasteland that something should be done about. The conservationists seem to be suggesting that they be left as they are. At least your mitigation package, including an ecological park and the purchase of wetland elsewhere will offer an opportunity to see, experience and learn about nature in a pleasant environment and may even produce good publicity. 'Virtual Planet – MFC, the ecologically friendly entertainment company.' You are confident that you will win through. You have already avoided a public inquiry.

There could be an opportunity to exploit a possible chink in the conservationists' solidarity in the form of the Wetlands Foundation (WF). Whereas all the others take a hard line on the inviolability of the site, the WF already has a foot in the 'entertainment' business with educational wildfowl collections (or are they zoos?). Maybe they can be brought round to seeing the ecological park in the mitigation package as being in their interest. After all, education is a key to environmental awareness. It's no good keeping all the knowledge to yourself and then putting a fence around what only you know about. That's elitist.

MARSH COMMON CASE
Stakeholder role briefing notes 4 – Marsh Borough Council's perspective

Your task is to argue the case convincingly for developing your preferred scenario for the future of the marshes. This is not to say that you are not open to reasonable and sensible negotiation, identifying common ground, even compromising, so long as you achieve your primary goal(s).

Three primary stakeholders are in broad agreement regarding the need to develop Marsh Common. These are the Music and Film Corporation (MFC), Urban Development Corporation (UDC) and Marsh Borough Council.

You are representing Marsh Borough Council. Months ago you approved planning permission to develop Marsh Common but such a huge opportunity came unexpectedly. You are keen to make the most of the opportunity.

Amongst the secondary stakeholders in support are the British film industry and government tourism agencies.

Your arguments for the development are quite straightforward. Marsh is an economically depressed area in great need of rejuvenation and opportunities such as this. 'Virtual Planet' will not just be a theme park but a whole entertainment complex including film studios. It will give the British film industry, and hence the national economy, a real boost and put it back on the map. But more importantly, it will put Marsh on the map! It will create hundreds of jobs for local people as well as stimulating other economic benefits including tourism. Morale will be boosted and migration from the area halted or slowed down. 'Virtual Planet' will be the perfect catalyst to make Marsh Common (and Marsh as a whole) the centre of excellence in the government's plans to develop the Forth Lagoon.

It is important that MFC does not experience obstacles. Though language would be a distinct advantage over locating overseas, if there are too many delays MFC could decide it would be easier and less costly to opt for overseas and be in more direct competition with 'Virtual Paradise'. You suspect that local people will find it hard to resist such a glamorous and seemingly lucrative opportunity, especially compared to the options that the conservationists are putting forward.

The main obstacle is still likely to be the conservationists, however. Although the environment is very fashionable at present, you suspect that the conservationists have a lot to learn about marketing and communication and that most local people are not sympathetic to their arguments. The overwhelming perception of the marshes is as a useless and inaccessible wasteland and that something should be done about it. Conservationists seem to be suggesting that they be left as they are. At least the ecological park in MFC's mitigation package will give your electorate the chance to see, experience and learn about nature in a pleasant environment. You are confident that the development will go ahead. You have already avoided a public inquiry and granted planning permission.

There could be an opportunity to exploit a possible chink in the conservationists' solidarity in the form of the Wetlands Foundation (WF). Whereas all the others take a hard line on the inviolability of the site, the WF already has a foot in the 'entertainment' business with its exotic wildfowl collections (or are they zoos?). Maybe they can be brought round to seeing the ecological park in MFC's mitigation package as being in their interest. After all, education is a key to environmental awareness. It's no good keeping all the knowledge to yourself and then putting a fence around what only you know about. That's elitist.

MARSH COMMON CASE
Stakeholder role briefing notes 5 – The local residents' perspective (non-environmentalists)

Your task is to argue the case convincingly for developing your preferred scenario for the future of the marshes. This is not to say that you are not open to reasonable and sensible negotiation, identifying common ground, even compromising, so long as you achieve your primary goal(s).

You are, on the whole, in favour of the development. You can see the economic benefits, especially for the young people and the image of Marsh Common – 'the Dustbin of Marsh'! Marsh is an economically depressed area in great need of rejuvenation and opportunities such as this. 'Virtual Planet' will not just be a theme park but a whole entertainment complex including film studios. It will give the British film industry, and hence the national economy, a real boost and put it back on the map. But more importantly, it will put Marsh on the map! It will create hundreds of jobs for local people as well as stimulating other economic benefits including tourism. Morale will be boosted and migration from the area halted or slowed down. 'Virtual Planet' will be the perfect catalyst to make Marsh Common (and Marsh as a whole) the centre of excellence in the government's plans to develop the Forth Lagoon.

As for the nature conservation value of the marshes, you do not really understand the arguments. It's as if the conservationists have some sort of 'secret knowledge' that is kept from local people. Anyway, they've only shown an interest since MFC arrived on the scene. They're outsiders, just like MFC.

You wonder how rare the insects and plants on the marshes really are. Surely they can't be that important and there must be plenty of them elsewhere. There doesn't seem to be any nature on the marshes at all. How can there be with all that rubbish, pollution and radioactivity? Those are real environmental issues. They could make us ill. So is the nature on the marshes really worth fighting for? If there are important species, then they'll move somewhere else if they have to. Anyway, surely MFC's mitigation package will give them somewhere to go. Couldn't they concentrate more wildlife onto the 400 acres offered by MFC rather than spreading it out over the whole 2,000?

With a better managed wildlife area, with facilities – including, say, an interpretation centre – you, as local residents, would be able to appreciate and enjoy the marshes much more. They'd be more accessible, more attractive, and you would begin to acquire some of the 'secret knowledge' the conservationists have. Actually, some of you would like to have the pleasure of more contact with nature. But at the moment you don't understand what all the fuss is about – a piece of grass, or what? It's as if there's a set of rules that keeps people away from nature sites. Do they see US as the pest-species? If no one goes there, how do they know that the things are so rare?

You don't find arguments linking the marshes with environmental problems like global warming, the ozone hole, rainforest destruction or species extinctions very convincing. You can't compare a dragonfly or a piece of grass to whales or tigers, can you? And those problems are so far away. At the marshes there are other problems like rubbish, pollution, radioactivity and other more immediate dangers. Those are far more important.

You understand better the economic arguments for the development, although you're not sure what the real implications of the proposal would be on the ground. What would be built, where, and how would it affect people? It's difficult to imagine. It couldn't be worse than what you've got at present though – 'the Dustbin of Marsh', that's what they call Marsh Common – the place with all the waste-tips!

You feel that none of the outsiders, conservationists or developers, seem to care what happens to you. You just feel powerless in the middle of this conflict, yet feel it's your ground, your council and your village. Even the TV programme hardly mentioned you.

MARSH COMMON CASE
Stakeholder role briefing notes 6 – The local residents' perspective (environmentalists)

Your task is to argue the case convincingly for developing your preferred scenario for the future of the marshes. This is not to say that you are not open to reasonable and sensible negotiation, identifying common ground, even compromising, so long as you achieve your primary goal(s).

You are ambivalent about this development.

You can see the economic benefits, especially for the young people and the image and future of Marsh Common – the 'Dustbin of Marsh' as it's called. Marsh is an economically depressed area in great need of rejuvenation and opportunities such as this. 'Virtual Planet' will not just be a theme park but a whole entertainment complex including film studios. It will give the British film industry, and hence the national economy, a real boost and put it back on the map. But more importantly, it will put Marsh on the map! It will create hundreds of jobs for local people as well as stimulating other economic benefits including tourism. Morale will be boosted and migration from the area halted or slowed down. 'Virtual Planet' will be the perfect catalyst to make Marsh Common (and Marsh as a whole) the centre of excellence in the government's plans to develop the Forth Lagoon.

On the other hand, many of you have moved to Marsh to get away from the hustle and bustle. If this development happens, just imagine the traffic, the crowds! The A13's already full of traffic jams and the railways are notoriously unreliable. Hollywood and other outsiders will swamp the character of the local village.

There are other reasons for conserving the marshes too, though you understand why other residents do not see it as important. The conservationists haven't been all that good at communicating their reasons in ways that locals can relate to. It's as if they have some sort of 'secret knowledge' that local people can't have. And they've only come out of the woodwork since MFC arrived on the scene. They're seen as outsiders just like MFC.

But, as well as your concern with preserving your relatively quiet lifestyle, you believe that conservation of the marshes has to be seen in a wider context. We can't keep chipping away at our environment or we'll have nothing left. It's suicidal! You don't notice it if you only think local – about your immediate environment and interests over the short term. You've got to think globally and long term too. The theme park will be yet another contribution to our deteriorating environment. You relate arguments about conserving the marshes with environmental problems like global warming, the ozone hole, rainforest destruction or species extinction. Just because dolphins and tigers are more obvious, exotic and attractive than a cranefly or special grass doesn't mean that they have any less right to be protected! They just don't SELL so well.

And those other problems aren't as far away as they seem. It's all part of one big system. The problems of rubbish, pollution, radioactivity and other more immediate dangers at the marshes are less important in a way because they can be cleared up more easily. But if more cars come to Marsh, that'll contribute even more to the greenhouse effect. The greenhouse effect is closer than we think and we all have something to do with it. Just because we can't see it like we can see rubbish, doesn't mean it's less important. Though, of course, the media picks up on things that you can see, whether they're horrible or attractive. That's what the media's about. What's needed to help save Marsh is a dolphin or an elephant to counteract all the negative images. You've got to be careful about what you see on telly and in the papers. It can be very deceptive and misleading.

You don't understand the details of wildlife management as the experts do, but you do realise that MFC's mitigation package – leaving 400 acres for nature out of a total of 2,000 – will not be an adequate substitute for the marshes. It won't be able to sustain all those sensitive species. It's simply not possible to concentrate all the wildlife into a smaller space than it needs, at least not without intensive and difficult management. And it's especially difficult to create habitats artificially and expect that the species will survive there. And anyway, who is going to do it all and pay for it? Species will definitely disappear if MFC have their way.

On the other hand, NEC and most of the others' hard line on not touching the SSNI at all – no building or other modification of the site that is not to do with enhancing its conservation value – is also too extreme. OK, SSNIs are intrinsically valuable in scientific ecological terms but that argument just doesn't wash for most people, even if it is backed up by legislation protecting them. It won't convince them to save the marshes, especially when most people see them as a dangerous, filthy and inaccessible dump on the doorstep. This should be enough to ensure their continued integrity for prosperity, especially since it is backed up by legislation protecting SSNIs.

Most people think the insects and plants can be found elsewhere or that they'll move somewhere else. There doesn't seem to be any nature on the marshes at all and people will keep on believing this if they aren't allowed to experience it. Local people would be far more inclined to support the conservation of the marshes if they knew more about them. A better managed wildlife area, with facilities – including, say, an education and interpretation centre – would help local residents to appreciate and enjoy the marshes much more. They'd be more accessible, more attractive, and residents would begin to acquire some of the 'secret knowledge' the conservationists have. Some people really would like to have the pleasure of more contact with nature. But, at the moment, most don't understand what all the fuss is about.

You feel that none of the outsiders, conservationists or developers, seem to care what happens to you. You just feel powerless in the middle of this conflict yet feel it's your ground, your council and your village. Even the TV programme hardly mentioned you.

4.5 Towards 'learning together' – a method for understanding stakeholder perspectives

Why do this

This builds on the stakeholder role-play activity by developing the method and asking students to come up with their own natural resource conflict situation.

It's tempting, and easy, to believe that different people see the same situation in exactly the same way. But they rarely do. Conflicts over natural resource use arise precisely because people (or stakeholders) involved in the situation see their interests in the resource differently. Perspectives on the resource have more to do with the conflict than the resource itself. If there were plenty of resources to satisfy all interests, there would be no conflicts over them. But because they are physically limited and those limits cannot be expanded, the only other option is to work with the *cultural boundaries* created by the perspectives and interests on a situation.

The method here was adapted from 'Soft Systems Methodology' (developed by Prof. Peter Checkland at Lancaster University, England) by the unit writer, Paul Maiteny, for use in a workshop in Timbuktu, Mali. The purpose of the workshop was to help local practitioners reflect in a systemic (ie Linkingthinking) way on environment/development conflicts they were facing in their work.

Source: Paul Maiteny, loosely based on Checkland's 'Soft Systems Methodology'.

Links with

Unit 4

Purpose of activity

It can be hard to empathise with other people – to put ourselves into their shoes, feel what they might be feeling, see their perspectives and values as valid, especially if we don't agree with them or see their interests as threatening our own. This activity is designed to help with that. It is a method that can be used to analyse perspectives on any conflict or decision-making process that involves many interests, not just those involving natural resources.

The activity can also be done as a role-play.

Resources needed

- Large sheets of paper
- Writing materials
- Open mindedness and receptiveness to others' views
- Patience

What to do

- Take a very large sheet of paper, eg flipchart, and as wide a variety of drawing materials as possible.
- In as much imaginative detail as possible, describe a problem situation you have been or are currently working with. It doesn't matter at all if you are not an expert artist. The point is to represent the situation in as much detail and with as much vibrancy and sense of fun as possible. Do not censor yourself or be too serious about what you're doing but ENJOY YOURSELF (we all learn and do things much better if we enjoy what we're doing!). Include as many aspects of the situation as you can: who and what's involved, contexts, everything... If you think of something you've forgotten, you can add it at any time.
- Primary stakeholders: Identify all people who have direct interests in the situation and outcome. Who will be most directly affected?
- Secondary stakeholders: Identify all people who have indirect interests in the situation and outcome. Who will be indirectly affected? These are interests that are more distant (but perhaps just as significant) in global terms or the longer term.
- For each stakeholder, explore the following from the standpoint of their own perspective (ideally, find out from them personally).
- Perspectives: What are the perspectives and beliefs of the various stakeholders about the situation? What is the purpose of the resource, or other object of conflict, from their perspective? Who thinks it is a good/bad idea and why? To what extent do the perspectives of the different stakeholders correspond and conflict? From their points of view, what benefits and disbenefits would come from outcomes based on other stakeholder perspectives and their future effects?
- Aims and objectives: What are the aims and objectives of each stakeholder with regard to the object of the conflict? What is the most desirable outcome from their perspectives? Who stands to gain and lose from different stakeholder outcomes?

- Power and influence: How much power and influence do different stakeholders see other stakeholders as having with regard to the decision-making process? For example: Whom do they see as making the final decisions about outcomes? Who do they see as currently 'owning' the object of conflict and/or the decision-making process? Who do they see as being involved in carrying out tasks? Who do they see as having the power to steer decisions, and why?
- Constraints: From the perspectives of stakeholders, what constraints are there that could influence outcomes – eg physical, resource, social, cultural, political?
- System: You now have a picture of the situation as a 'System of Human Interests and Activity'. It indicates potential conflicts that could arise and the ingredients needed to negotiate and work towards solutions that are as meaningful, valuable and satisfying to as many stakeholders as possible within the constraints of the situation.

Other important points to keep in mind:

- Are the task, transformation and its effects systemically feasible? In other words, what will be the long-term effects of outcomes on the ecology, and the community and its activities? Is the transformation intended to benefit the ecology and the community? Can the community and/or environment maintain and sustain the impacts of any changes in the long term?
- It should be remembered that those with greater power and influence could significantly skew outcomes against those with less power and influence. Attention should always be paid to whether as equitable an outcome is achieved as possible. The analysis can, and should be, reviewed and updated on a regular basis.

Discussion and debriefing

General discussion can take place on the value and learning gained from going through this process. Strong points and weak points can be identified in relation to facilitating communication, understanding and resolution of the conflict.

Discussion can follow on the pros and cons of working with the physical dimensions of the situation and the cultural perspectives/systems of interest that shape the human involvement in the situation.

5.1 How did this get here?

Purpose of activity

This activity is designed to demonstrate two important points:

- that even simple everyday objects are parts of very much more complex systems and, therefore, decisions on what you do with these objects are more complex than you might imagine
- that other people's perspectives may differ dramatically from your own, but they are important in developing as broad a view as possible of an issue or situation.

Resources needed

A subject item (whatever it is you are considering), flipcharts and pens

What to do

Divide your group into small subgroups (no more than three or four to a group). Take a simple object or commodity and ask: 'What did it take to get this here?'. Ask the groups to spend 15 minutes or so brainstorming this question and jotting down the factors, issues, people, etc which occur to them. You may suggest that they use pictures or diagrams to help show how things interact.

Subgroups should then feed back their thoughts and create an overview sheet that includes everything that all the subgroups have identified (plus anything that occurs to people as the feedback progresses). Subgroups should then be encouraged to review their own sheets against the overall range of issues and factors that have been identified. It is important to remember that none of these views is right or wrong: they are simply different interpretations of the system. The combination of all the views gives a more holistic picture of the subject than any one of the participants could produce individually. Participants should be encouraged to look at how their personal values and beliefs influence the significance that they have given to particular issues and factors.

As a further step, the overall group can be asked to discuss the ways in which the factors identified interact. This involves looking for links and relationships – commonalities, conflicts, feedback effects, etc.

An example of the exercise in action: *

A group of managers and university lecturers were asked to work through this exercise considering a cup of coffee. They generally worked in small groups, although some individuals followed their own preferred style of working and worked alone. Each individual or group was asked to produce a flipchart sheet covering (in words or pictures) what it took to get the cup of coffee to them that morning. The overall group then reassembled and looked at the views that they had developed.

A wide range of factors and relationships had been identified from the most simple: 'you booked the venue and asked for coffee; the venue booked a caterer; the caterer brought the coffee', through to the very complex. The factors and relationships identified included considerations of:

- the cultural factors and personal values that contribute to the demand for coffee in the first place
- coffee growing and world trade (fair trade, working conditions in developing countries, etc)
- the energetics of growing and producing coffee (including the production of instant coffee)
- the energetics of catering and the management of waste from the catering process
- transportation – both in terms of international trading and the delivery of the coffee to the venue
- employment (global and UK)
- organic growing versus intensive growing using chemicals
- china clay mining and the making of coffee cups.

Where participants had drawn rather than written their thoughts, this gave extra information, not only in terms of relationships which had been indicated with arrows, etc, but also because a great deal of their own values and beliefs could be identified in the drawings. For example, some had used a skull and crossbones to denote pesticides or a dollar sign to denote world trade.

Thanks to Drennan Watson for originally demonstrating the 'coffee cup' exercise.

Source: Deryck Irving

5.2 Circles for action

Purpose of activity

This technique maximises the effectiveness of brainstorming and allows individuals or groups to sort information from brainstorming, so that they can then apply other systems tools to develop solutions to complex problems.

Links with

An example of the technique is included in Unit 5, Part B

Resources needed

- Pens
- Flipchart and paper
- Repositional notes or other small slips of paper (you will either need some way to stick these onto your flipchart pad or you can work on the floor/tables)
- A problem to solve

What to do

In order to explain this technique clearly, we will use an example.

Stage 1

Addressing the problem through brainstorming.

Let's imagine that we want to look at the question 'How can X make society more sustainable?' (X could be humanity as a whole, the government, the local council or you yourself.) You could address this question directly, but you would not be 'looking at the whole elephant'. (See Unit 5, pages 8-9, for the parable of the blind men and the elephant.)

Instead of asking the specific question, start with the question; 'How can *we* make society more sustainable?'. Stress that the term 'we' should be given the widest possible interpretation.

Brainstorm answers to this question, encouraging participants to be as inventive as possible and not to worry at this stage whether their suggestions could ever be carried out. Continue until you have exhausted the ideas being generated (either in one session or coming back to the question on a number of occasions). Record the ideas on a large sheet of paper/flipchart to allow everyone involved to contribute and comment.

Stage 2

Sorting the suggestions

Using the flipchart pad, draw a series of seven concentric circles, which are each large enough for several repositional notes to be attached. (You will see as you work through this description that the number of circles can be changed to suit your needs.)

Transfer all the suggestions from your brainstorming to repositional notes (one suggestion per note).

Place all the suggestions on the flipchart within the boundary set by the largest circle.

Ask the participants to separate the possible/feasible from the impossible/unfeasible. Move the notes around until the impossible or unfeasible suggestions are all in the outermost ring and all the other suggestions are within the boundary set by the second largest circle.

Now ask the participants to separate out any suggestions which require action by the international community – leave these in the second ring and move all the remaining suggestions inside the boundary set by the third largest circle.

Now ask the participants to separate out suggestions that require action by the national government. Leave these in the third ring and move the all the remaining suggestions into the area bounded by the fourth largest circle.

The participants should then separate out the suggestions that require action at a national level from NGOs or other agencies. Leave them in the fourth ring and move the remaining suggestions inwards.

Continue for local government and then other local/community organisations (churches, etc) finishing with the suggestions that relate to individual action all grouped in the inner circle. Encourage participants to move around any of the suggestions until a broad consensus is reached (this is why we have suggested using repositional notes) and to add new notes whenever something occurs to them.

Ask the participants to go back and check that each circle, from the individual to the national government, includes suggestions that involve encouraging/lobbying for action at the levels outside them in the circle. Individuals should be pressing for change at community, local government, national, national government and international levels. Community/local groups should be lobbying local and national government, and at the international level, etc.

Now ask them to look at all the circles, from national government, down to local/community, to check that each circle includes enabling the circles within in it to act.

You have now created a series of possible answers to your original question 'How can X make society more sustainable?' using a method which is less likely to miss options than if you had focused on the original question alone.

It is now possible to look at the suggestions in the ring that interests you, using the systems tools contained elsewhere in this Toolbox, and to identify the best ways to improve the situation described in the initial problem. (You could also look at why a particular ring interests you – are you avoiding personal responsibility? Do you feel disenfranchised, etc?)

A similar exercise could be used to consider why each level is important and how the levels interrelate.

Ban all fossil fuel use

Develop and impose targets on fossil fuel use
Press for international targets to be developed and imposed
Implement targets at the national level

Lobby government to work with the international community to develop targets
Work with government to develop inputs to international debate
Work with government to develop national fuel and transport initiatives

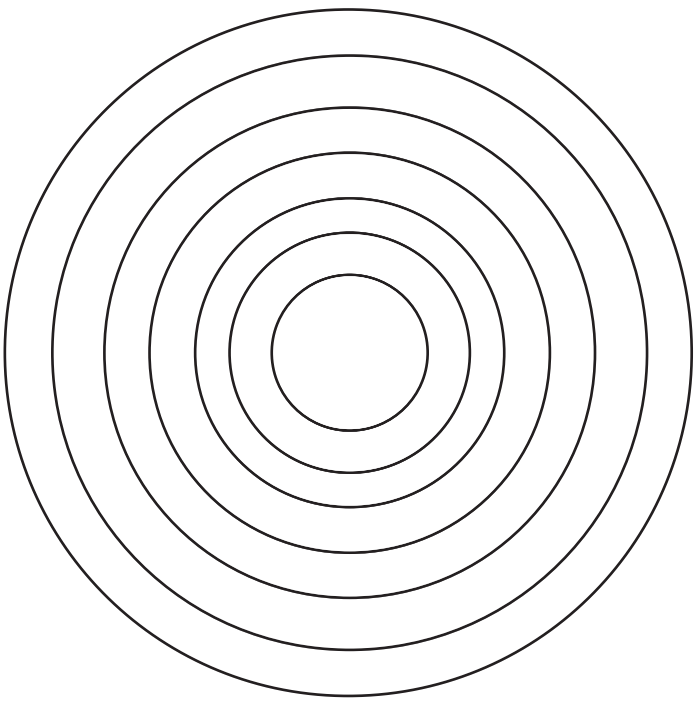
Work with government to develop national fuel and transport initiatives
Develop public transport at a local level

Lobby local government for improved public transport
Input to national and international debate

Lobby government to work with the international community to develop targets

Lobby local government for improved public transport
Input to national and international debate
Use less fuel

Source: Deryck Irving



6.1 Electronic toolbox

This list gives you access to a vast library of information without leaving the comfort of your own home, thus saving you fuel, paper and money.

Information required	Likely sources
Global environmental issues / international treaties, declarations and protocols / global environmental statistics, etc.	www.unep.org www.wri.org
For european union legislative processes / policies / procedures / environmental regulation	www.europa.eu.int www.eea.eu.int
Specific Scottish issues / policies and procedures / environmental legislation / environmental statistics / education	www.scotland.gov.uk
UK environmental policy and law / news / environmental education	www.defra.gov.uk
Environmental regulation / pollution, etc	www.sepa.org.uk www.environment-agency.gov.uk
Nature conservation / biodiversity, etc	www.snh.org.uk
Environmental education / formal / 5-14 / Higher Still / work-based training / Further and Higher Education	www.sqa.org.uk www.wamitab.org.uk www.lantra.co.uk www.LTScotland.com
Non-governmental environmental organisations – environmental awareness	www.rspb.org www.foe.org www.wwf.org.uk www.greenpeace.org www.oxfam.org
Town and Country Planning	www.rtpi.org.uk

6.2 Basic principles and definitions

Activity

Undertake your own research to define the foundation concepts that follow:

- sustainable development
- precautionary principle
- voluntary principle
- polluter pays
- renewable resource
- non-renewable resource.

6.3 Who's who in the environment

Activity

It is important to look at the roles and responsibilities of organisations active in the environment. Conduct some research to identify organisations with specific statutory obligations in the following areas:

- environmental protection and regulation
- nature and landscape conservation.

Next, you should describe the roles, responsibilities and management aims of these organisations.

Finally identify non-statutory voluntary organisations in the environmental sector and examine their roles and responsibilities . How do they operate?

6.4 The big issue

Activity

Rank the issues that follow in order of importance on a scale of 1 to 9:

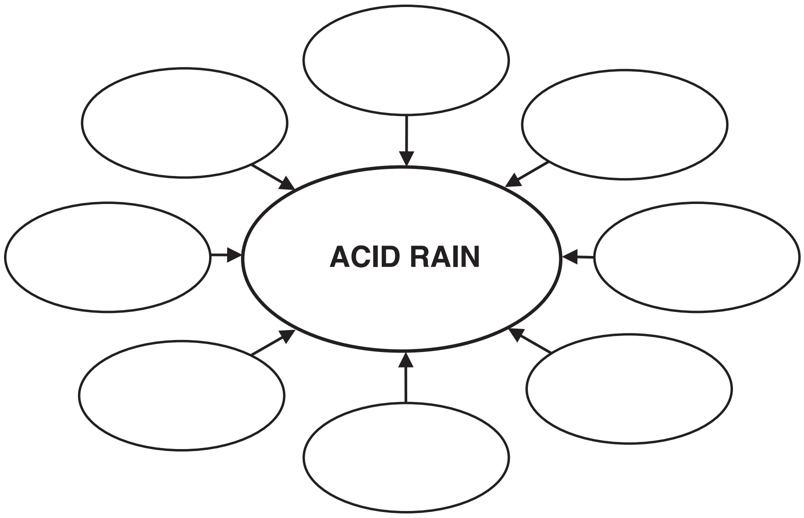
Global environmental problem	Priority
Climate change	
Global warming	
Loss of biodiversity	
Ozone depletion	
Deforestation	
Desertification	
Habitat loss	
Depletion of non-renewable resources	
Eutrophication of rivers, lochs and seas	

6.5 Cause and effect? Your turn!

Using the diagrams below, repeat the exercise we did in the main section of Unit 6, pages 10-11 for each of the environmental effects in the centre circle:

Activity

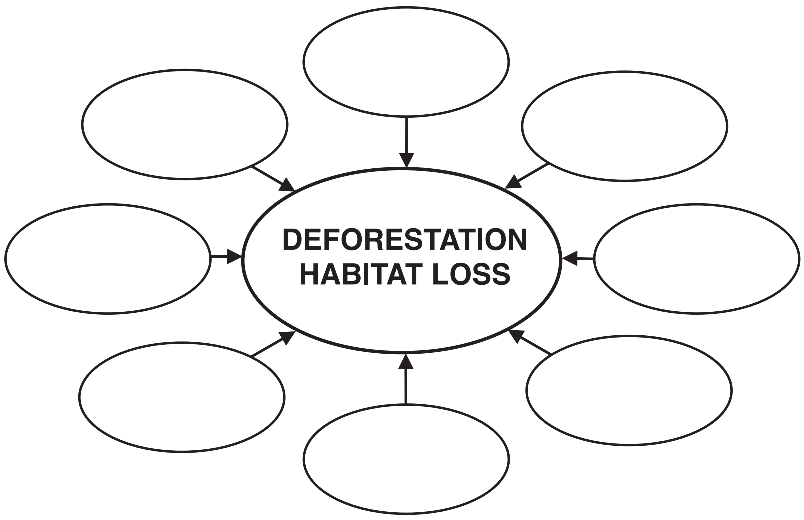
Acid rain



Activity

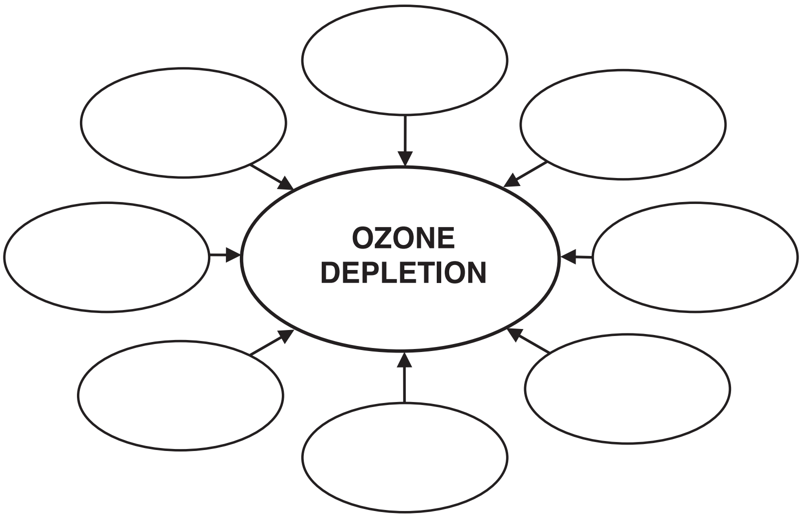
Deforestation/habitat loss

Remember: social, environmental and economic conditions may come into play here. Think about it… why do we cut down trees and clear the forests?



Activity

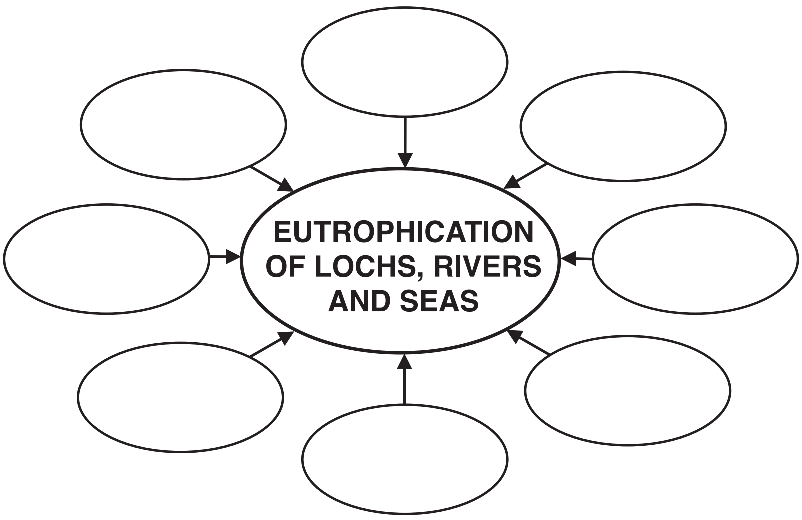
Ozone depletion



Tip: You probably found that you had far too many bubbles this time. Ozone depletion is largely a single-cause problem: chlorofluorocarbons (CFCs). That is why it has been so relatively easy to reverse. Of course, we are not through the woods yet as we still have to ensure that the world's developing/emergent nations do not adopt CFCs as the standard for refrigeration or air conditioning and in the process resurrect the problem.

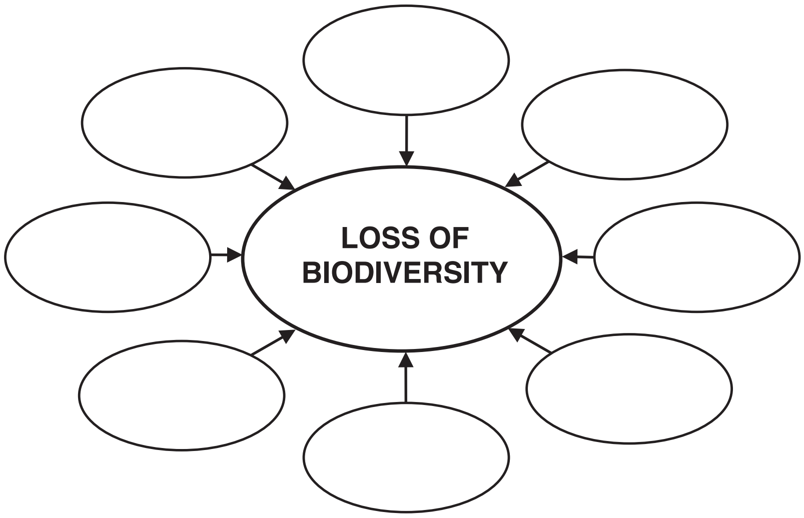
Activity

Eutrophication of lochs, rivers and seas



Activity

Loss of biodiversity



6.6 Who wants to be a millionaire?

Activity

I often try out this activity with my students (I came across it at our local Sunday school) to try and demonstrate just how unjust the current situation is.

Prepare a set of labelled cards (I find old business cards are excellent for this) in the following proportions:

12 x South-east Asians	10 sweets
3 x Africans	4 sweets
1 x Russian	4 sweets
1 x US	10 sweets
2 x European	10 sweets
2 x Latin American	3 sweets

Get each student to pick a card. Now take a bag of sweets and divide them as shown in the second column above. Now ask each nationality to come out in turn and share out the sweeties as shown. Ask the class if they thought that was fair.

Who gets the most sweets per head? Who gets the least?

Assuming a recommended daily intake of 1.5 sweets, what proportion of the world's population suffers from malnutrition?

How many sweets would the US, Russian and European citizens have to give up to ensure that the world's population is adequately fed?

How could we share out the Earth's resources more equitably?

6.7 The big picture

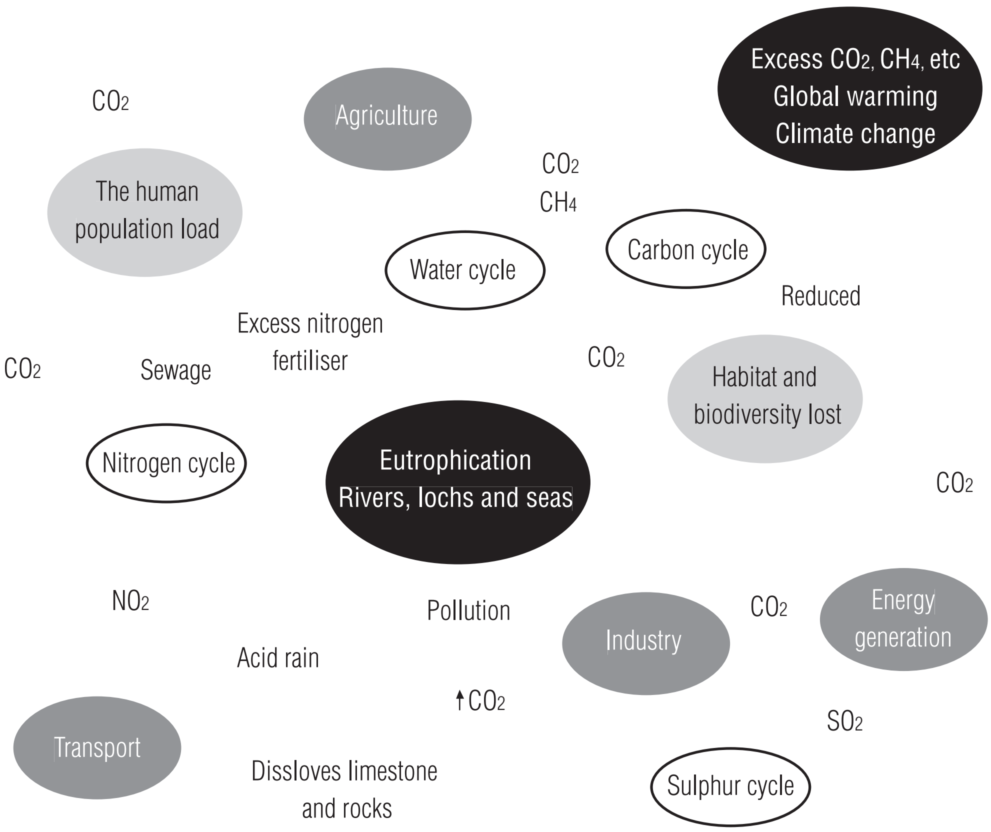
Activity

Look at the following diagram and draw in arrows linking human activities with the global cycles via the waste products these produce.

I've partially completed the diagram in Unit 6, page 13, but please don't look at this until you've exhausted your ideas.

Does your completed diagram tie in with mine? There are bound to be differences, as we both think about the problem in slightly different ways and this is a complex concept to grasp. However, I'm sure we have the major points in common.

See if you can devise similar models linking environmental cause and effect.



6.8 Life-cycle analysis activity

Activity

1 Organise the group/class into teams.
2 Provide each team with a card labelled with a particular product, eg egg mayonnaise sandwich, a small family car, a cup of instant coffee, etc. Try to select products appropriate and of interest to your class or group.
3 Ask each team to consider all of the environmental effects of their particular products under the following headings: production; use; disposal. I usually provide each team with a sheet of flipchart paper and ask them to draw out the table below. Alternatively you can ask each team to present their findings as a flow chart. Ensure that the team do not give away the identity of their product.
4 Ask each team to present their findings in turn.
5 Ask the remainder of the group to identify the product being described.

Explain that each product, as well as each individual human being, has a unique ecological footprint.

Production	Use	Disposal

6.9 Supermarket sweep

Go down to your local supermarket and complete the table below:

Product	Organic price	Conventional price	% Difference
Baked beans			
Tomatoes			
Lemons			
Bread			
Biscuits			
Sausages			
Eggs			
Carrots			
Tea			
Coffee			
Breakfast cereal			
Etc			

Well, what did you find out? I expect organic produce was 30 - 50 per cent more expensive than the conventional equivalent.

Why should this be so? List five reasons why organic produce is more expensive.

1

2

3

4

5

Source of all Unit 6 related activities: John Salter

Notes

Notes

Notes

linkingthinking

New perspectives on thinking and learning for sustainability

A WWF Scotland publication

The mission of WWF is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by:
· conserving the world's biological diversity
· ensuring that the use of renewable resources is sustainable
· promoting the reduction of pollution and wasteful consumption

www.wwf.org.uk

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Glossary

Words and phrases underlined throughout the Linkingthinking units are featured in this Glossary.

analysis	The division of an abstract or physical whole into its component parts to examine and understand them.
atomism	A theory that says that complex wholes can only be understood by looking at the individual and smallest parts.
boundary	The division or distinction between a system and its environment – as drawn by the observer's sense of the system's purpose. This boundary may or may not correspond with a recognised physical, legal or cultural division.
boxed-thinking	Thinking in a compartmentalised way. Much more emphasis on 'things-in-themselves' than 'things-in-relationship'. Opposite in emphasis to Linkingthinking or systems thinking. Boxed-thinking is close to simple causal thinking which tends to isolate causes and effects. Also referred to as 'box-thinking'.
carrying capacity	The ability of an ecosystem to support organisms or people while maintaining its productivity, adaptability and abilities of renewal (after IUCN, *Caring for the Earth*, 1991).
cause-effect	A linear relationship between a cause and an effect, (or limited number of known effects).
context	The environment of any system (which affects and is affected by the system). Context often provides meaning. Seeing things in context is a key part of Linkingthinking.
design	The conscious shaping of materials, energy and processes to meet an identified need. In a broader sense, design also means change by careful intention rather than by default.
determinism	A belief that outcomes can be predicted from initial changes, and therefore it is also a belief in the possibility of control.
dualism	A view of the world which sees the world as made up of binary opposites: eg spirit-matter; science-religion; mind-body; reason-emotion; people-nature. In the dominant social paradigm, these pairs are seen as largely oppositional. In the holistic paradigm, they are seen as largely complementary.
ecological design	The purposeful design or shaping of matter, energy and processes to fit in with or emulate natural processes in order to minimise environmental cost and maximise multiple benefits. Other terms used include 'ecodesign', 'sustainable design' and 'regenerative design'.
ecological footprint	The area of land needed to support any defined number of people and their standard of living in terms of provision of resources and absorption of waste.
ecologism	A term used to describe a 'system of thought' or worldview where the metaphor of ecology is used as the basis of the worldview. As distinct from ecology as a natural science.

ecosphere	The planetary totality of ecosystems, including the biosphere, lithosphere, hydrosphere and atmosphere.
ecosystem	An interrelated system of plants, animals and other organisms together with non-living elements of their environment.
emergence	The phenomenon by which qualities arise from the interaction of parts of a whole.
emergent property	A quality that arises from the interaction of the parts of a whole, but which cannot be attributed to any of the parts themselves, and cannot be predicted looking at the parts.
environment	From a systems point of view, this means the context within which a system exists, including everything that affects the system, and which in turn might be affected by it.
feedback	An output or information from one system influencing another system as input (or re-influencing the original system). Feedback can be either 'negative' which has a dampening or balancing effect on change in the system, or 'positive' which has an amplifying effect on change in the system. An example of negative feedback is the effect of eating something until the feeling of hunger has gone, or adjusting the temperature of a shower. An example of positive feedback is an unchecked fire, the arms race, or growing trust in a relationship. This can be a 'vicious circle' or a 'virtuous circle' depending on whether the growth is wanted or not.
feedback loop	A link whereby an effect is fed back to a system and influences the behaviour of the system – as in, for example, noticing the consequences of our actions and adjusting our actions in the light of this information.
hierarchy	A vertical arrangement of systems – sub-subsystems within subsystems, and these subsystems within metasystems.
holism	A belief or view that a complex whole cannot be understood only by looking at the parts but by appreciating that 'the whole is greater than the sum of the parts' .
linear causality	If A then B. In this relationship, any cause gives rise directly to effects that can be known and predicted, and therefore controlled.
Linkingthinking	A term used in the Linkingthinking project to describe thinking that focuses attention on the nature of and consequences of relationships. Broadly equivalent to systems thinking.
metasystem	The larger system, in relation to smaller systems which are contained within this larger whole.
natural capital	The stock of biodiversity, life-support systems, and renewable and non-renewable resources.
nesting levels	How systems are positioned and relate, one inside another: eg the cell in the stomach, the stomach in the digestive system, the digestive system in the body. The boundaries of such system levels depend largely on how they are perceived by the observer.

objectivism	A belief that reality can best be understood by the observer distancing his/her beliefs, values, opinions, feelings and intuition from the observation, and a belief that this is necessary and possible for any valid claim. An objective view tries to look at a system from the outside. A subjective view proceeds from or acknowledges the observer's system of belief in perceiving a system in the first place. This is largely a question of where we place the boundaries.
paradigm	A coherent set of beliefs, assumptions, ideas and practices. Sometimes used interchangeably with 'worldview', and sometimes used to describe the ideas and practices that guide a specific sector, such as medicine or education.
part	A component of a system. Any part might be made up of smaller parts (subsystems), in which case it is also a whole and a metasystem to its parts. (For example, the liver is part of the body, but a metasystem to the cells that make up the liver).
perception	How people see, view or think about the world.
permaculture	An international ecological design movement, originally based and still centred on sustainable food production, but increasingly also concerned with meeting other human needs through sustainable design. The term suggests the need for and possibility of a 'culture of permanence' or sustainability.
problem solving	An approach to resolving problems where the nature and extent of the difficulty and the likely answers are both approximately known.
purpose	Goal or organising principle in a system.
rationalism	A belief that everything, in principle, can be explained through reason, which is seen as the only basis of valid knowledge.
reductionism	A belief or view that a complex whole can best be understood by examining its individual parts. Also means the methodology used to do this.
relationship	Something (A) is in relationship with something else (B) when A is affected by the presence or absence of B.
stakeholder	A person or group with an interest in something like a project, design, decision or outcome, whether or not this interest is articulated.
subsystem	A lesser system within a larger system, and a component part of the larger whole.
sustainable development	A process by which progress towards a condition or state of sustainability is made. IUCN (1991) define it as "improving the quality of human life while living within the carrying capacity of supporting ecosystems" .
sustainability	The capacity or ability to sustain something far into the future. Continued survival, security and wellbeing.
synergy	The interaction of two or more components to produce an effect which is greater than the sum of their parts (see emergence). Resulting 'synergies' (emergent properties) may be positive (healthy), neutral or negative (dysfunctional).
system	A perceived common field of activity or function bounded by the perception or purposes of the observer. It has an interrelated set of elements organised around a purpose, and a boundary that distinguishes it from its context or larger environment in which it sits.

system of interest	A thing – or set of things or areas – that is important and meaningful to us, (or to somebody else, or to another group or organisation). We tend to put a conceptual boundary around those things that are of interest to us, and externalise those things that we consider are of less or no interest to us. Same as 'system of concern'.
systemic coherence	Where the parts of a system exist in an integrated state of harmony and mutual support, rather than disintegration, conflict and harmful competition.
whole	A whole is an integrated state, ie showing integrity or wholeness. Any whole can be a part of something larger (a stomach in the body, a carburettor in the car, for example). A living system 'whole' is characterised by a high degree of internal interconnection (or 'systemicity').
worldview	A set of beliefs, values and ideas which forms a coherent view of reality and which influences how people perceive, interpret and operate in the world. Every individual has a worldview and, at social level, there is a shared cultural worldview.

Some other relational thinking terms

ecological thinking	Used to describe thinking, values and beliefs that derive from or give expression to a worldview based on the metaphor of ecology. This is often presented as counter to, or incorporating and going beyond, a mechanistic worldview which can be seen as the fundamental orientation of modern society.
holistic thinking	Often presented as 'opposite' to reductionist thinking. A concern with 'the whole' rather than 'the part', and a belief that 'the whole is greater than the sum of the parts'.
joined-up thinking	A popular term that has emerged in the last decade. Often used in a policy-making context to mean developing policies that complement each other rather than conflict. It carries the implication that most policy making is not 'joined-up' but fragmented and sometimes mutually conflicting.
systems thinking	Ways of thinking which look primarily at process, relationship, pattern and context. Systems thinking regards the world as if it were made up of interacting systems. A whole disciplinary field has grown up around systems thinking in the last half-century. Systems thinking is a form of (applied) holistic thinking.
systemic thinking	Usually used as a synonym for 'systems thinking' (although there is a distinction at a more advanced level of study).
systematic thinking	Not the same thing as systems thinking. Systematic means doing things methodically, bit by bit, in a logical sequence. This approach tends to be more reductionist than holistic.

Compiled by Stephen Sterling