

Global scenarios of the future of water

● As concerns continue to grow regarding the prospects for water around the world, what actions should be taken to ensure a water-secure future? **KEITH HAYWARD** looks at the role of scenarios in shaping and encouraging action by decision-makers and at efforts to prepare a comprehensive new set of scenarios.

Imagine a world in which everyone has enough water of adequate quality to meet their needs and the available water resources are able to satisfy the requirements of the many different uses to which water is put. What, if you are a water manager, or a decision-maker such as a politician, needs to be done now to contribute to achieving that? And if that doesn't move you to action, how about considering what the world might look like in future if you allow things to continue as they are?

Thinking about the future, particularly in relation to water, where so many factors can come into play, is not an easy task. For those charged with making decision, experts are on hand to help provide an assessment of the future and what actions may achieve. One problem here is that, while water is in many respects a local issue, and most decisions will therefore be implemented at the local level, there are nonetheless global aspects that have to be considered.

'Ultimately you have only one global water cycle,' comments Professor Janos Bogardi, Executive Officer of the Global Water System Project (GWSP), based at Germany's University of Bonn. Soon to retire from this position, he describes working at the global level as like painting a fresco – the picture appears complete from a distance, but looked at closer up 'you see only spots and in between nothing'. But he adds that global perspectives are nonetheless essential for raising awareness and for providing coherence.

Due to end in 2014, the GWSP illustrates the ongoing efforts needed to understand the global water cycle. But the challenges around anticipating the future go beyond such current knowledge limitations. 'If you look into the future, we cannot characterise the future with every aspect, and water is therefore a fascinating subject

because it is involved in everything and it is influenced by everything,' says Bogardi. 'When we see this absolute multitude of aspects we realise that no one can predict this very complex and amorphous environment within which we have to look at water problems.'

This point is echoed by Bill Cosgrove who, among other things, was senior advisor on this year's edition of one of the global reference documents on the status of water – the UN World Water Development Report, published every three years and released in its fourth edition at the World Water Forum held in Marseille, France in March. 'There are all kinds of forces that are at work, and I think we really need to take a look at how these might play out,' says Cosgrove. 'Nobody will be able to predict how they're going to play out, but we need to recognise that this is the world we live in today, with all of the uncertainties that there are, and we have to manage not only water but all of the uses of water that we have as mankind and in order to protect the environment.'

Clearly modelling is one of the most important tools available for anticipating the future, and the capability of models continues to advance, but there are limitations to what they can provide. Faced in particular with the uncertainties and complexities around water, one option is to make use of scenarios. These are essentially 'stories' in which the world progresses on different trajectories, with events unfolding according to the theme of each 'story'. Developing scenarios therefore generally involves characterising the current situation, identifying the most important driving forces behind change, formulating plots about how events may unfold, and then from these constructing a number of images of the future.

'There is nothing can help more than scenarios,' comments Janos Bogardi, adding: 'From the modelling point of view, I would say scenarios set

the borders and the frame for the model.'

Bill Cosgrove adds: 'We really need to take a systematic look at what could happen if we take different approaches, and then look for solutions, or at least approaches – things that we can do in the short term, the next five to ten years – that will be robust, that will improve the situation, or at least not make it worse, regardless of which these scenarios is going to eventually play out.'

The World Water Vision 2000

A notable attempt to offer a view of the future to help drive political action was the World Water Vision, released by the World Water Council in 2000. Bill Cosgrove co-authored that document. He recalls that at the subsequent 2002 Johannesburg Earth Summit, the UN Commission on Sustainable Development adopted a target that every country should have an integrated water resource management plan by 2005. 'I think that was a direct result of the work that we had done and published in 2000,' he comments.

The world has changed a great deal since then, such as in the area of the global economy and the impacts of globalisation. 'We now have accelerated world trade markets, where everything is being traded around the world and nearly everything that's being traded requires water to make it,' says Cosgrove. Dramatic changes in urbanisation and population growth are other examples, and our understanding of climate change has also improved greatly too.

'We have a situation where clearly the scenarios are out of date,' says Cosgrove, adding: 'The actual development didn't follow any of them. The situation to date is maybe even worse than what we thought it would have been under a business as usual scenario.' But it remains necessary to think about the future in order to at least attempt to make plans and investments in the right way. 'Immediately after the third World Water Development Report was completed, UNESCO recognised and agreed that it was necessary to do another look at the future,' he says.

The driving forces of change

'In parallel with preparing the fourth World Water Development Report, we started to work on a major project which altogether by the time it's

finished will have taken a good five years,' explains Cosgrove, who is manager of what was launched as the UNESCO-WWAP Water Scenarios Project.

Initial work included a detailed examination of the driving forces and the preparation of an initial set of scenarios to provide a focus for the development of the scenarios proper. Reports on the drivers and initial scenarios were released at the Marseille Forum.

'We identified what we thought were the driving forces of these changes and how they might evolve in the future,' says Cosgrove. 'We identified ten driving forces, and we retained a researcher to do a literature review of each of these forces and their links or meaning for water. Some of them would be obviously about determining what the future demand was, but others were related to what tools we would have available or do have available to us now to better manage water.'

The initial work on drivers is set out in the report 'The dynamics of global water futures – driving forces 2011–2050' authored by Bill and Catherine Cosgrove. The report also provides insight into the preparation of scenarios.

The ten broad driving forces identified were: climate change and variability; water resources, including groundwater and ecosystems; infrastructure; agriculture; technology;

demography; economy and security; governance and institutions; politics; and ethics, society and culture. Following the literature review, groups of experts assessed these findings. For four drivers experts provided individual responses, but for the six drivers where it was anticipated opinions may be most divergent what are known as Real Time Delphi consultations were carried out. These gathered responses from a total of 120 experts who answered questions online, feeding responses back to participants on an ongoing basis. The assessments covered not just what developments may occur and their importance, but also gathered views on likely timings. The report presents what are considered the most important and most probable developments for each of the ten drivers, as well as what are described as 'scenario surprises' – potentially important occurrences with relatively low probabilities.

Initial scenarios

The initial set of scenarios are set out in the report 'Five stylized scenarios', authored by Gilberto Gallopin. Some of the driving forces apply to all of the scenarios, but others are said to represent 'critical uncertainties' and so can shape a different future depending on how they develop. The five draft scenarios presented in the report are: 'conventional world', 'conflict-world', 'techno-world', 'global consciousness'

and 'conventional world gone sour'. Gallopin notes in the report that while the scenarios 'should not be taken as predictions of the future, all seem plausible evolutions from the current situation'.

Based on the ten groups of driving forces, the report proposes nine critical dimensions of the scenarios, which are regarded as the 'fundamental indicators used to evaluate the desirability and sustainability of the alternative futures'. How the scenario approach works, in terms of the 'stories' involved, can be seen by looking at how different plots are envisaged for each of the critical dimensions. So in the 'conflict-world' scenario, the plot for the global economy is that the global economy resumes sporadic growth followed by a long period of instability, whereas in the 'global consciousness' scenario governments act to achieve a system which depends less on material economic growth and is sustainable in the long-term.

New partnerships

'The initial [scenarios work] was funded by UNESCO, and then the Norwegian government took up and helped us to finish and get the publications ready for Marseille, so that we would be in a position to better involve others, and hopefully they're going to fund and continue funding through the rest of this year,' explains Cosgrove.

Ensuring that the final scenarios can

Shacks in Soweto, Johannesburg in South Africa, in 2007. Under a scenario 'Conflict-world' poverty can be expected to increase in many areas of the world. Credit: Brians / Shutterstock.com.



be completed is proving to be another matter, but a way ahead has been emerging since shortly before the Marseille Forum. 'As a water person, we talk about adaptive management,' says Cosgrove, adding with a laugh: 'Well, we are doing adaptive management of this process.'

This period has however provided an opportunity to reshape how the work will go forward. For example, sessions at the Marseille Forum, on topics such as cities, hydropower and food production, made clear there is a shared need for and interest in scenarios. 'The conclusion was that we should be looking at having a common set of socio-economic scenarios,' says Cosgrove. The risk is that decision makers will be presented with different scenarios to support the case for action on different issues. 'They are automatically going to be asking, what are you talking about? Are you talking about the same thing they're talking about?'

Another important development is that the International Institute for Applied Systems Analysis, based in Laxenburg, Austria, has become involved, particularly significant because of its close involvement with the work of the IPCC. 'IIASA has been providing the secretariat and doing modelling for the IPCC, so we will be making links between the work that

they've been doing,' says Cosgrove, with clear enthusiasm for the link. 'Agreement has been reached between IIASA and UNESCO that they will work as partners in concluding the work. So our target now is to do these analyses and complete them to issue a report for the World Water Forum in 2015.' He also says that the work remains a project of UN-Water. 'Yes, it will be a set of scenarios produced in a project that's backed by UN-Water.'

IIASA's new director is Pavel Kabat, and he announced IIASA's engagement with the work at a special session on scenarios at the Marseille Forum co-chaired by Cosgrove and Janos Bogardi. He also announced the anticipated involvement of Korea, which is to host the next World Water Forum in Seoul in 2015. Following discussions with the Korean government in Marseille at 'the highest level possible', he announced plans for 'a joint venture between the Korean government hosting the next Forum, the UNESCO / UN-Water scenarios project, IIASA, and most probably the World Water Council, to carry the water scenarios project further beyond Marseille.'

Another aspect of the plans discussed in Marseille was the creation of a water scenarios science community. Another of the panel speakers at the

session was Professor Edeltraud Günther, of Germany's Technical University of Dresden. Speaking subsequently to *Water21*, she comments: 'I got the feedback from many people that it's now really necessary to start talking about the way we develop scenarios, to bring together different disciplines. We have a window of opportunity – many people see the necessity for bringing together the community to establish a water scenario community.'

Building the scenarios

Günther is a social scientist who works with scenarios, often with companies, and she offers thoughts on the development of scenarios. 'Very often people use the term scenario and they mean different things when using it, so a step-wise process I think is a very important point,' she says, adding: 'One of the steps I think most important in the beginning of the development is that you really get a detailed knowledge of the existing framework conditions.' Here she points to the use of a PESTEL analysis, covering politics, economy, society, technology, ecology and legal aspects. Regarding the use of Delphi studies, she comments: 'I really have good experience with Delphi studies, because you can get as much knowledge as you would like to have.'

Wind turbines and solar panels. Under a 'Techno-world' scenario, it could be envisaged that technological innovation accelerates and carbon-based sources of energy are phased out. Credit: 1971yes / Shutterstock.com.



Günther explains that there are three types of scenarios: predictive scenarios, which start in the present and attempt to show how the future will unfold and which she sees as being of least use in this instance; explorative scenarios, which start with different possible futures and then use backcasting; and normative scenarios, which are based on a desired future. The global water scenarios work will combine the latter two types, so that the normative scenario will in effect be an updated version of the World Water Vision of 2000.

Clearly input is needed far beyond the experts directly preparing the scenarios, and Bill Cosgrove recalls that the first World Water Vision had input from some 15,000 people. The new scenarios are to be prepared with input from what was termed in the initial reports as a scenario focus group. 'I want to emphasise that it will not be a group of people who spend their time making models and developing scenarios,' says Cosgrove. 'It will be composed of people who are decision makers in the real world and representative of rich countries, poor countries, water rich countries, water poor countries, so that we get people faced with the real hard decisions actually determining the scenarios, with assistance from people who are specialised in developing them and can help them to think about the subject in a more systematic way.'

Words of caution

Such comments bode well for the project, but there are some warnings to heed. For example, Fritz Holzwarth, Deputy Director General of Germany's Ministry of Environment and Nuclear Safety, commented: 'I think politics is not really used to scenarios.' He says this is because the public does not connect with catastrophe-driven scenarios. Speaking at the Marseille Forum, he added: 'If you base political decisions on that, [it] is fairly difficult to get acceptance by the public, [which] is needed if you like to

be re-elected.'

As well as highlighting the crucial issue of communication, Holzwarth also recommended separating out areas about which there is most uncertainty, as politicians can use such uncertainty as a reason to postpone action. He highlighted Germany's Kliwas project, which is looking at climate change and inland waterways, noting that he has commented in relation to the project: 'There is a need to figure out, together with the scientists, where are the robust components, where you can build decisions on, and where are parts where it is better to say no, we will not base a decision on that.' He added: 'This is not a very scientific-driven statement, but this is my daily business I have to deal with.'

Other concerns were raised by Zafar Adeel, director of the United Nations University Institute for Water, Environment and Health and former chair of UN-Water. Speaking also at the Forum, he explained that he was co-chair of the desertification synthesis team for the Millennium Ecosystem Assessment, in which four scenarios were developed. 'Stakeholder engagement was really key, particularly in the design of scenarios,' he said. More significantly, he points to the lack of actual subsequent use of the scenarios in any decision making. 'I can say that that was essentially a failure of the Millennium Assessment – that those scenarios were not particularly useful.'

Adeel's experiences with other work, the Globally-Integrated Environmental Assessment Modeling initiative of a decade or so ago, led him to offer caution around the task of bringing together data that is on very different geographic and time scales. 'That poses a very serious challenge for scenario builders where you are trying to integrate social information with climate information with water information which are at very different scales,' he said.

He also pointed out that the demand for scenarios is increasingly at the national level, even though the

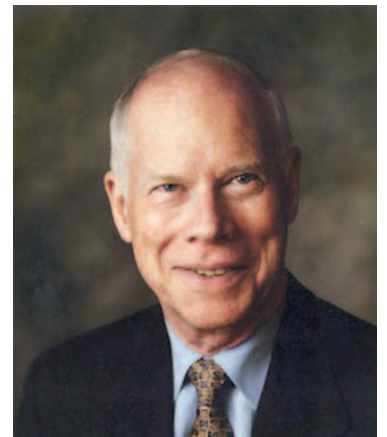
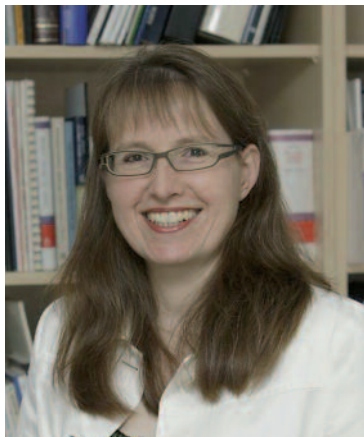
tendency in water management is to anticipate application at the basin level. Giving Qatar, UAE and the provincial governments of Canada as examples, he commented: 'You have to pay particular attention to the geographic scale... I would argue that although we all think in terms of watersheds, it is actually the national governments which have to make policy decisions, so sometimes that is where you would need to go.'

Janos Bogardi, who as a water resources expert describes himself as a 'benevolent critic' when it comes to scenarios, says: 'I fully agree that we cannot do without scenarios, but scenarios have a lot of weaknesses, first and foremost because people are really influenced by their current belief system or current discourse.' Seismic shifts in the global situation, such as the financial turmoils of recent years or the collapse of the Soviet Union, were not predicted, and human history suggests further large scale conflict is conceivable. 'I would really lobby for either many scenarios or broadening the scenarios, so not so much business as usual and then a little bit more pessimistic and a little bit more optimistic – I would put [in] a little bit more [of a] wild card to see how systems perform if we really go into an extreme situation,' he says.

Edeltraud Günther sees challenges also. 'For scenarios, the biggest challenge is the time perspective,' she says. 'When developing scenarios we have to think until the year 2100 [or] 2050. For companies, 2020 is already long-term, and so that's the biggest challenge, really to think long term.' Needless to say, politicians struggle with the long-term too.

Application at the local level

The need for emphasis on anticipating the use of the scenarios by decision makers means there is a particular concern to link the global scenarios with use at a local level. Janos Bogardi points out that uses such as drinking water can certainly operate below the



From left to right
Janos Bogardi
Edeltraud Günther
Bill Cosgrove

basin scale, although in the case of megacities this use can cover more than one basin. Similarly, he sees a need for both global scenarios and versions shaped for different broad regions or continents, depending on water resource or economic differences, for example. There are tools for developing scenarios at different levels. The challenge, believes Bogardi, is to link everything up, looking at how scenarios for different levels, such as for a company, a city, or a segment such as irrigation, would relate to the global scenarios. 'This I believe is an essential research area where certainly some discussions and agreements and also research is probably needed,' he says.

Edeltraud Günther explains that, in her work with companies, her approach is to start at the global level and then to downscale this to the local level working with, for example, IPCC or economic scenarios. This means both downscaling data, such as climate data on temperature and precipitation, but also scenarios of, for example, what types of technology we will have. 'The other challenge [is] to really bring it down to a specific situation,' says Günther, by which she means that it

has to be possible to convert concerns raised by the scenarios into specific actions about which, say, a company can make investment decisions. As an example she refers to a company she has worked with, which was considering measures to put in place in anticipation of an increased risk of flooding due to climate change. It decided to retain its existing premises, but to locate production to upper floors with just stock storage on the ground floor.

Taking the initiative forward

The work that lies ahead is going to involve both a core group of experts and the much wider group who will have input to the scenarios. Ultimately the scenarios are going to have to be seen as the result of the process that gives ownership to this latter group. 'I think that's the challenge – that we bring together from the very beginning people who want to work with those scenarios, who have some idea how important they are, and who want to integrate them into their decision making,' says Günther.

The actual name for both the groups involved and the final product are still to be decided, and Günther notes, for

example, that in the climate change arena the IPCC name is hardly one that can be readily understood by most people. But it is how entities and processes are perceived, in terms of authority and independence, for example, that is important. 'The name as such is not so important, but it's important that we have a common voice and we have owners for that,' comments Günther.

One further important point is that, while scenarios are very much pictures of the future, the aim of preparing them is very much about action in the present, and here Bill Cosgrove offers thoughts about how the scenarios should be viewed. In his opinion, the aim should not be for decision makers to try to create specific responses to specific scenarios. 'What are the things that we can do now that will lead us in the right direction regardless of how the future's going to turn out,' he says. 'Those things, believe me, they'll require enough effort and enough investment to get them done... and those are the ones that I will hope we'll be able to identify for the decision makers so that the scenarios exercise can be used to move ahead.' ●



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