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**CLIMATE CHANGE**

**Where are we going?**

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## CLIMATE CHANGE: WHERE ARE WE GOING?

*The United Nations Climate Change Conference (COP15) now taking place in Copenhagen (Denmark) is deciding the fate of the planet. Everyone agrees on the substance: only a concerted global effort can meet the climate challenge.*

*But when it comes to form, opinions diverge. Listening to all the voices, taking all interests into account and drafting an agreement based on principles that everyone can endorse - this is the ethical approach UNESCO advocates in the face of climate change.*

*This special feature in an excerpt from The UNESCO Courier n° 2009-10.*

*Conception and coordination:  
Niels Boel, Danish journalist  
and correspondent for our magazine.*



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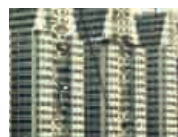
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### REFUGEES OF THE FUTURE WILL BE 'CLIMATE REFUGEES'

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# For an ethical approach to climate change

By Alain Pompidou

**O**n 30 October this year, the European Union Summit in Brussels was unable to reach a decision on who should pay for what to help developing countries cope with climate change. There is a similar risk that the UN Climate Change Conference (COP15) that kicks off in Copenhagen, on 7 December, will come to an *a minima* agreement that does nothing to guarantee future mastery of greenhouse gas emissions.

Yet no-one, or hardly anyone denies the urgency of taking measures that are both ambitious and mutually agreed upon. So it is difficult to understand why it is so hard to find the consensus to take action, whether it is making drastic cuts in greenhouse gas emissions or helping those who are most vulnerable to adapt to impending changes.

In December 1997, some 160 nations met in Kyoto (Japan) to discuss the measures to be taken to cope with global warming. The Kyoto protocol is the first legally binding programme aimed at combating climate warming. It arose out of the Earth Summit (Rio de Janeiro, Brazil, 1992) and entered into force in February 2005.

One significant reason is that the ethical terms of the international response to climate change have not clearly been laid down. Agreed, the scientific and ethical issues are complex. And it is true that powerful interests are at stake. But, since the adoption of the Kyoto protocol in 1997, we have been searching for a way for all nations to share the costs of reducing emissions and of adapting to their consequences. Without agreement on the terms and modalities of what is equitable, no solution can be found.

Knowing, but doing nothing – this is the ethical knot at the heart of the matter. It is time that the international community gave itself the means to cut this knot.

In what ways, exactly, does climate change pose an ethical challenge? It seems to me essential to take ac-

count of at least four dimensions: climate change invokes responsibilities; it has to be based on scientific evidence; it calls for international solidarity, and it implicates every one of us as individuals.

Climate change is more than just greenhouse gases. It also has a human – and tragic – face. In Papua New Guinea, the Carteret Islands are drowning, its population forced to live in exile and a whole culture destined to die out. Other islands will also soon be submerged, with millions of homeless, condemned to seek shelter and asylum in an increasingly inhospitable world. Then there is the desertification of Africa and the fifty million refugees that it will create in the next ten years, according to some predictions. If the very scale of these figures makes

them seem abstract, let us remember the women of sub-Saharan Africa who have to walk several kilometres each day to fetch water. And the more developed countries are not immune either: Hurricane Katrina, by devastating New Orleans and its coastal region, created a population of climate refugees, within the USA itself.

### **Finding a way out**

Faced with these ever increasing risks, it is our duty to ensure that we are informed, at all levels, so that we can act more wisely, for the benefit of those who have the greatest need. This brings us squarely to the heart of ethics.

What is more, the victims' faces only express part of the challenge. Human life is just one form of life on Earth, which also includes the animal and vegetable kingdoms. The melting glaciers of the Arctic endanger entire ecosystems. It

is not only the polar bear that faces extinction, but an entire marine fauna, which now feeds in polluted waters. And our actions will also affect future generations, who have no say in the matter. Is our epitaph going to read: "It's your problem, you sort it out"?

An ethical approach to climate change, then, presupposes listening to all voices, taking all interests into account and drafting an agreement that is based on principles that everyone can endorse. We are far from this today.

So, how to get out of the impasse we are in?

UNESCO's mandate is ethical in its very essence. And the Organization has taken a major step in this direction by initiating, at its General Conference in October 2009, a process that could lead to a universal declaration of ethical principles in relation to climate change. This presupposes an international consensus which may appear impossible. But, on other controversial issues, such as bioethics, UNESCO has demonstrated its ability to give birth to an agreement by consulting all parties.

Discussions between States, while essential, are not sufficient - the people have to be actively involved, too. And difficult subjects have to be tackled frankly, including the inherently ethical responsibilities that result from knowing what is happening and having the ability to act. Without a recognition of this ethical dimension of climate change, there is a danger that all the technical agreements never implemented, all the endless political compromises, will just be foam on a wave that, gradually, will submerge us all.

**Alain Pompidou** (France), Chairperson, Bureau of COMEST (The World Commission on the Ethics of Scientific Knowledge and Technology).



Sagarmatha national park, Pattar glacier (Nepal).

## We must respond to climate change today

**The climate is changing – faster than ever. Since the beginning of time, Earth's climate has been changing. From warm periods to cold, life has had to adapt and evolve. But now human activities are having an effect on the dynamics of the planet itself. And most alarmingly the pace of change has dramatically altered, threatening to push many plant and animal species towards extinction.**

*By Jacqueline McGlade*

**B**y burning fossil fuels we have added to natural emissions of greenhouse gases, which trap heat in the Earth's atmosphere. As a result, the concentration of such gases in the atmosphere is well above the level at any point in the last 800,000 years. Inevitably, temperatures are now rising too.

In 2007 the Intergovernmental Panel on Climate Change published its latest scientific report, showing that the global average temperature increased over the past century by 0.74°C. In the Arctic, the average temperature over land has increased by up to 5°C over the same period and there is now a strong chance that the North Pole will be ice free in the summer in the next two to three decades.

Glaciers are melting more rapidly than expected, accelerating the rise of sea levels and increasing meltwater floods and unseasonal water shortages in some of the most densely populated parts of the world.

It's also clear that even if we could stop human-related emissions tomorrow, the massive amount of greenhouse gases that we've already pumped into the atmosphere will cause further warming of between a half and one degree.

We can already see what a one degree centigrade rise in global temperature above pre-industrial levels looks like. And we can anticipate what a two degree increase in temperature would bring: changes in the way that plants grow, where animals migrate and the way the ecosystems function.

But a world with a three degrees temperature rise could look very different. Increased floods, storms and droughts would severely impact the way that we live – our access to water and food, and the security of our energy supplies.

By the time we get to a 4°C increase, the rise in temperatures could destroy the very fabric of our societies. Some areas that are currently habitable might be unable to support human societies, let alone accommodate the numbers that we anticipate on the planet in the next 20 to 30 years.

And we don't even talk about a world where average temperatures rise by five degrees or more.

The explosion of modern life has been built around seemingly unlimited supplies of coal, oil and gas, powering industries to meet relentlessly growing demand. The assumption all along has been that our natural environment has the capacity



to provide endless supplies of fuels and accommodate ever more by-products of energy generation.

In reality, of course, burning fossil fuels to drive our economies has generated the greenhouse gas emissions that are now causing global warming.

Producing and consuming energy accounts for 70% of mankind's carbon dioxide emissions. And half of these emissions are generated by China, the USA and European Union countries.

Energy demand in emerging economies, which include China, India, Brazil and Indonesia, is expected to grow rapidly, perhaps doubling in the next few decades.

If we choose to continue burning fossil fuels until supplies are exhausted, we will simply increase the amount of greenhouse gases in the atmosphere and experience even more global warming.

### **Energy efficiency**

But there is an alternative. Shifting to a new paradigm of energy generation and use, based on renewable sources and energy efficiency, would allow us to avoid many of the problems of a warmer world.

Currently, both industries and households waste a great deal of the energy we produce. In the fight against climate change, this is an obvious place to start because greater energy efficiency doesn't just cut greenhouse gas emissions – it actually saves us money. The International Energy Agency, for example, estimates that every \$1 spent on energy saving measures avoids more than \$2 investing in producing energy.

Small actions in individual households, such as shifting to more efficient household appliances, can have a huge effect when aggregated across the whole of society.

It's estimated, for instance, that the ban on incandescent

light bulbs in the European Union, which comes into effect in coming years, will produce financial savings of US\$ 5–10 billion each year and energy savings equivalent to Romania's annual electricity consumption.

Similarly, many places in America have local bans on drying clothes outside on lines, which compels people to use electric dryers. The energy needs of these dryers are estimated to be equivalent to that produced by 15 nuclear power stations.

So actions to decrease energy demand are obviously crucial because they have an immediate effect on greenhouse gas emissions from power plants. But this is just one part of the puzzle. We will still need to generate significant amounts of energy, not least because demand in the developing world is expected to rise rapidly. In meeting this demand, we must shift away from our dependence on fossil fuels and focus instead on renewables.

The EU is halfway to its goal of meeting 20% of its energy needs from renewable sources, such as wind and solar power, by 2020, but there is huge variation in the accomplishments of individual countries. The frontrunner, Sweden, already generates more than 40% of its energy from renewables – an example of what can be achieved with the right ambitions and policies.

### **A broad perspective on costs and benefits**

To keep climate change within manageable limits, we need to limit average temperature change to two degrees or less. In practice, that means that by 2050 we will need to have cut greenhouse gas emissions by at least 50% compared to 1990 levels. For industrialised countries, whose per capita greenhouse gas emissions still hugely exceed those elsewhere, the reduction will need to be more like 80%.

Energy efficiency and renewable energy obviously both



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Wind turbine, Santiago, Cape Verde.



Solar power station in Themis (France).

have a crucial role to play. It's important to stress, however, that there are different possibilities for reducing greenhouse gas emissions and we shouldn't just focus on identifying the cheapest approaches without considering their full impact. Doing most with our scarce resources demands that we avoid solutions to one problem that create new problems elsewhere.

The benefits of some renewable energy sources, for example, can be offset by the pollution they cause or their impact on water resources. Some measures to combat air pollution will help reduce global warming, some will exacerbate it.

Rather than generating externalised costs, we need to target measures that produce 'win-wins' wherever possible.

Achieving the needed changes in the ways we generate and use energy will obviously require efforts from across society. The decisions of businesses and consumers are ultimately going to determine the fate of our environment. But governments have a particularly important role in creating the incentives that guide those decisions.

A crucial element here is the price signals that we all face as producers or consumers. In market economies, we rely on prices to guide our purchasing decisions. All too often, however, market prices present a distorted image of the costs of production – excluding, for instance, costs imposed on society today or in the future as a result of pollution, climate change and so on.

Right now, fossil fuel prices often reflect the cost of extraction and distribution but fall far short of representing the full burden on the environment. Correcting these deficiencies using mechanisms such as green taxation would significantly increase the incentive for firms and individuals to invest in efficiency and renewable energy.

The challenge is considerable and will require efforts from all sectors and all countries. It's crucial, though, that we don't

delay action while we debate the allocation of responsibilities because doing so will only make the goal harder to achieve.

IEA reckons that every year we delay shifting to low-carbon energy will add an extra \$500 billion to the total cost of achieving the two degree target. A few years of delay could make the target unreachable.

Quite clearly, therefore, the costs of delay far exceed those of action. So the message is simple: we need to act now.



**Jacqueline M. McGlade** is director of the European Environment Agency. She is a leading marine biologist and environmental informatics professor of the University of London.



# Turn off the Lights Please!

© UN Photo/Devra Berkowitz



Rajendra Pachauri.

## Rajendra Pachauri talks to Jasmina Šopova

***The Intergovernmental Panel on Climate Change, which you chair, has been awarded the Nobel Peace Prize. Could this be seen as a sign of change in the world's attitude towards global warming?***

Indeed, the award of the Nobel Peace Prize to the IPCC and Mr. Al Gore is an important statement on what the Norwegian Nobel Committee sees as a danger to peace arising out of unmitigated climate change. Since the Nobel Peace Prize and the significance attached to it get a great deal of attention and coverage worldwide, hopefully people's attitude towards this issue will be affected as a result.

© Thamirez Nogueira Magalhães (Brazil)



Drawing by Thamirez Nogueira Magalhães (Brazil), one of the laureates of the contest organized by the International Year of Planet Earth (2008).

***What are the impacts of climate change on peace?***

The impacts of climate change on peace can be numerous: first, the availability of water is decreasing, water resources are under high stress in several parts of the world. Second, extreme events such as heat waves, floods, droughts and extreme precipitation, coastal flooding as a result of sea level rise, can lead to population movements on a sizeable scale. The migration of large numbers of people can have an impact on peace, since the locations where such people move to may find this to be an unacceptable imposition. Finally, the impacts of climate change on agriculture could also lead to large scale malnutrition, hunger and deprivation, which could end in conflict

within communities and further movement of large numbers away from areas where food is scarce.

***In your Nobel lecture, you highlight that scholars do not pay enough attention to the inequities arising from these changes, although they are part of the most significant aspects of the impacts of climate change. Could you develop this idea?***

Scholars have not paid adequate attention to the equity implications of climate change because thus far research has largely focused on the physical science aspects of climate change, the vulnerability aspects as well as on the options for mitigation. Now, however, there is growing awareness about equity as an ethical issue related to climate change.

***You head The Energy and Resource Institute which developed a germ that breaks down petrol. Can you explain how it works and what the results are?***

We have a major biotechnology programme in The Energy and Resources Institute, and some of our work has

sulted in the development of microbes that consume petroleum products. This technology is being used now quite extensively for cleaning up oil spills and oil sludge deposits. Once the oil has been completely eaten up, the microbes perish without any environmental effects.

***You subscribe to the philosophy of Vasudhaiva Kutumbakam, which means the whole universe is one family. What is the role of Indian traditional culture in your work?***

It is difficult for me to identify what role Indian tradition and culture play in my work, but having been brought up in this country and holding Indian tradition in great respect, I suppose everything I do is influenced by my upbringing and beliefs.

***You believe that each one of us can do something for a better and safer world. What advice would you give our readers?***

Each one of us can do a great deal to make this world better and safer. First, we must develop a belief in the need for protecting the environment. We must also realize the danger of treating Mother Nature with disrespect and of damaging the earth's ecosystems and natural resources. We could then find ways to minimize our footprint on the Earth's natural resources and ecosystems. This would involve simple things like switching off lights when we leave the room, using efficient energy consuming devices, using energy efficient transport such as public transport, promoting the use of renewable forms of energy... We can bring about a lifestyle change in which we reduce reusing and recycling products that we have become accustomed to. Technology will also bring about change towards lowering the intensity of natural resource use, which in turn should be supported by policies. But lifestyle changes are important too.

Climate change endangers peace, declares **Rajendra Pachauri**, Chairman of the Intergovernmental Panel on Climate Change (IPCC) and 2007 Nobel Peace Prize, in this interview published in "Planet Hot-Spot", an issue of the *UNESCO Courier* devoted to the International Year of Planet Earth (2008).



Connie Hedegaard, European Commissioner on Climate.

## Double or quits on climate in Denmark

**The European Commissioner on Climate, Connie Hedegaard, firmly believes that the UN Conference on Climate Change (COP 15) must conclude with an agreement on reductions to predicted 2020 levels of carbon dioxide emissions. Even if the outcome is not a legally binding agreement – US President Barack Obama has not received the backing of Congress – the future of the planet hangs in the balance of this conference**

*Interview by Niels Boel,  
Danish correspondent for the UNESCO Courier and coordinator for this special feature.*

***In Denmark, global warming deniers claim that the left is using alleged climate change as a Trojan horse to increase state control over society. How do you reconcile your membership of the conservative party with a commitment to combat climate change?***

The conservative party considers that it is up to us to pass on to the next generation what we have inherited from previous generations. This is the essence of conservatism. Looking after our climate and the environment is therefore the most important task for conservatives in the 21st century.

***The vast majority of scientists agree on the causes and impacts of climate change, but ordinary people do not always seem to realize the scale of the challenges we are facing. What role can politicians play here?***

A great many people, all over the world, have helped to spread awareness of this challenge, which outstrips by far the challenges of the next State or municipal budget. If we do not take up the challenge, we will simply be passing on the bill to those who come after us.

What should the relationship be between the possibilities for development in the North and in the South? How can we avoid millions of climate refugees? How to ensure access to energy resources without starting wars? We have to find answers to all of these fundamental questions at the same time, which means a policy for security.

Even though the subject is of immense complexity, it is reassuring to note that political agendas have succeeded in getting people to understand that nature imposes its own limits. We cannot carry on consuming regardless. I believe that we are seeing the beginning of a paradigm shift. Look at how long it has taken for consumer spending to take off again after the financial crisis. Why? Because people may be wondering if having a whole range of electronic gadgets has really made them any happier. Maybe they are asking themselves if they could hang onto things for a little longer. The 'throwaway' era has perhaps come to an end.

***What results must the COP15 conference achieve if it is not to be regarded as a failure?***

In Copenhagen, we have to arrive at commitments by the industrialized countries to reduce their CO<sub>2</sub> emissions, and for developing countries to pursue growth strategies





© UNESCO/Giuliana Riccio

Rooftop air conditioning units in Istanbul (Turkey).

within a perspective of sustainability. We have to arrive at firm commitments on policies for adapting to climate change and the transfer of technology, and for this we need a concrete funding plan.

The estimated cost of aiding developing countries to combat climate change is about 100 billion Euros per year from now until 2020. The funding has to come from public budgets and the carbon market, but in any case, a global "greening" of politics is needed. Instead of building yet another polluting coal-fired power station, we should be building one that is clean. Of course this will cost more. But when we say "costs more", we have to count only the difference in costs between polluting technologies and clean technologies, and not the money that we would have to spend in any case.

### ***How can we ensure the transfer of less polluting and renewable sources of energy to developing countries?***

The carbon market is one solution. If rich countries and their industries are committed to reducing their emissions, it is in their interest, when they carry out a major project in India, for example, to use less polluting technologies.

Another solution is the Major Economies Forum on Energy and Climate [created in March 2008 by President Obama and bringing together 17 countries with the aim of 'facilitating a frank exchange between developing and developed countries' *[Editor's note]* where seven or eight technological areas have been defined. Denmark is making a contribution to the Forum on wind energy.

One of the major challenges in combating global warming is keeping average temperature increase below two degrees Celsius. But we know that even an increase of 1.5°C will endanger some small island nations and low-lying coastal areas.

Yes, we talk about a 2°C maximum. But achieving this requires a scale of adjustments that it is difficult to imagine.

It means that industrialized countries have to reduce their CO<sub>2</sub> emissions by 24% to 40% compared to 1990 levels. This is enormous. If COP15 reaches agreement on this objective, it would already be an achievement.

### ***What do you think about the fact that COP15 will not conclude with a legally binding agreement?***

The United States is not ready. The Senate is dragging its heels in voting through the climate law proposed by President Obama's administration. What is important is to set a deadline in Copenhagen. Without a concrete deadline, the process could take forever.

### ***Could Denmark serve as a model in the fight against global warming?***

For the past 30 years we have succeeded in maintaining economic growth without increasing our energy consumption. This is attracting a great deal of interest across the world. What people fear most is the prospect of their growth rate falling if they take measures to slow climate change. Denmark's experience shows that this need not be the case – it is possible to be energetically efficient while increasing exports, and reducing unemployment at the same time.

Denmark has, for example, become world leader in producing energy by waste incineration. With the backing of citizens and municipalities, we have found beneficial solutions that also give a better energy yield. It is a matter of organizing refuse collection, incinerating it and distributing the heat recovered through an urban heating network. Here, in all its simplicity, is one of the reasons that Denmark can inspire other countries.

Danish Environment Minister since 2004 and Climate Minister since 2007, **Connie Hedegaard** has recently been nominated European Union Commissioner on Climate. A former journalist, she has helped to turn the country around – after it had flirted with stubborn resistance and denial on climate change issues – and to transform a responsible environment policy into the government's flagship. She is president of the COP15 climate summit in Copenhagen.

© Tomasz Koska



Kewet El-Jet, Danish-designed electric car.

# Coming to terms with climate change

By Katherine Richardson Christensen

**Only very occasionally do scientific discoveries evoke such a dramatic – and emotive – public and political response as that elicited by the last decades’ research documenting global climate change and identifying human activities as its likely primary cause. Probably the last time such a debate occurred was when Darwin published “The Origin of Species”.**

There is an important similarity between the presentation of Darwin’s theory of evolution and the discovery of human influence on climate change: both advancements in scientific understanding challenge the contemporary human ‘self-identity’. In the case of evolution, the reluctance of society to embrace Darwin’s work had its roots in an unwillingness to accept the idea that humans were ‘just another species’. In the case of climate change, many people find it hard to accept that our species really is powerful enough to alter the course of something as mighty as the planet Earth.

A recent study in the United States actually indicated that a smaller percentage of Americans believe that humans have a role in climate change than was the case a few years ago. One of the reasons for this may be that 2008 was a relatively cold year and newspaper headlines have abounded in 2009 suggesting that 2008 temperatures may signal a global ‘cooling’ or, at the very least, can be taken as evidence that climate scientists present a very uncertain case for global warming.

Such headlines merely underscore the fact that few non-specialists understand what the climate system is and how it works. Humans experience climate through the part of the atmosphere that touches the Earth’s surface. Therefore, we (wrongly) assume that changes in surface atmosphere temperature reflect changes in the climate system as a whole.

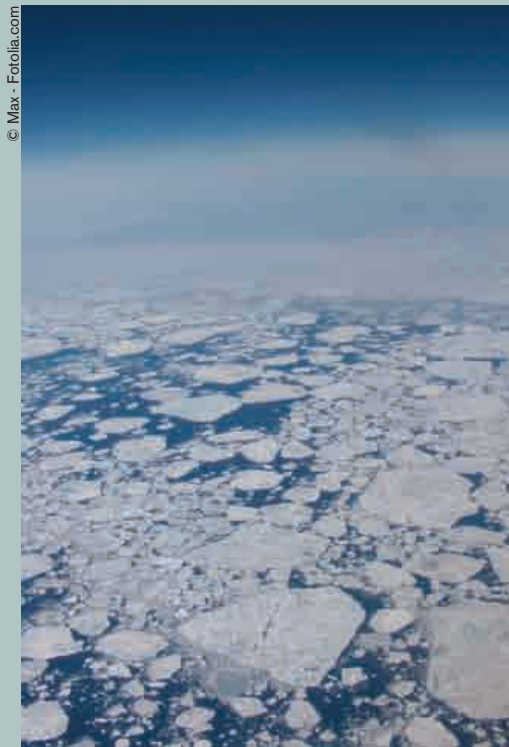
In fact, the climate we experience is a function of the

amount of energy stored as heat and the redistribution of this heat on the planet. Only a very small amount (<5%) of the heat stored on Earth is found in the surface atmosphere. In contrast, about 85% of it is stored in the ocean. Thus, temperature changes in the ocean are a more robust indicator of change in the climate system than changes in air temperature. One of the more worrying scientific results that has emerged since the 2007 Intergovernmental Panel on Climate Change (IPCC) Report is that temperatures in

the upper ocean (700 m) are increasing about 50% faster than was previously thought and an increasing trend in ocean temperature has been recorded since the mid-1970s. Thus, the fact that global air temperature was lower in 2008 than in the immediately preceding years does not give climate scientists reason to doubt their understanding of the climate system or global warming!

It is, of course, true that not all scientists agree on the role of human activities in causing climate change. However, 100% agreement among scientists is almost never achieved. Doubt is an indication of a healthy scientific process: Science only advances as long as we continue to ask questions. Most studies show that well over 90% of scientists from

relevant disciplines find the scientific facts convincing and believe that human activities are influencing the global climate. The chances that this vast majority of climate scientists is wrong are very small indeed.



Melting ice in Iceland

## Katherine Richardson Christensen

is Vice Dean at the Faculty of Science at the University of Copenhagen and a professor in biological oceanography. She was chairman of a large scientific congress “Climate Change: Global Risks, Challenges and Decisions” held as a part of the preparations for the UN Conference on Climate Change in Copenhagen from 10-12 March 2009.





Thailand: Baan Khem village was the most severely affected by the tsunami of December 2004.

## Building an effective and just climate agreement

**As industrialized countries are responsible for 70% of the tons of carbon dioxide emitted into the atmosphere since the start of the industrial revolution, they have incurred a debt that must be repaid, according to Indian environmentalist Sunita Narain. This would help emerging countries to develop without harm to the environment.**

*By Sunita Narain*

The world has still not learnt the first lesson of climate change – to share atmospheric space so growth can be shared equally. But this will require political sagacity, leadership and courage. Global warming is possibly the biggest and most difficult economic and political issue the world has ever needed to confront. The question is if the rich world, responsible for the stock of emissions already in the common atmosphere, will find the resources to pay the victims of its economic excesses? Will it find the resources to pay for the much-needed transition to low carbon economies? The issues are clear. But the answers are lost in prevarication and pretence.

The reason is simple: climate change is related to economic growth. It is, as is famously said, the 'market's biggest failure'. In spite of years of protracted negotiations and targets set under the Kyoto Protocol (opened for signature on 16 March 1998, it entered into force in February 2005) no country has been able to de-link economic growth from the growth of emissions. No country has shown how to build a low carbon economy, as yet.

The inconvenient truth is not that climate change is real, but that confronting climate change is about sharing that growth between nations and people. The rich must reduce so that the poor can grow. This was the basis of the climate agreement the

world signed in Rio (at the first Earth Summit in 1992). This was the basis of the Kyoto Protocol, which committed the industrialized world to reduce its emissions by roughly 6 per cent over 1990 levels by 2008-2012. But the world has never been serious about this agreement.

The facts are clear. Between 1990 and 2006, carbon dioxide emissions of the industrialized rich countries have increased by 14.5 percent. Furthermore, emissions from the growth-related energy sector have increased by 15 percent. This is unacceptable.

This is when we know that climate change is about historical emissions, as a ton of carbon dioxide emitted a century ago is equal to a ton of carbon dioxide emitted today. According to estimates, industrialized countries are responsible for 7 out of every 10 tons of the carbon dioxide that has been emitted in the atmosphere from the start of the industrial revolution. This is the natural debt of nations, which like the financial debt must be repaid. But this is not all. Even in terms of current emissions, the difference is clear. Between 1980 and 2005, the total emissions of the US were almost double that of China and more than seven times that of India. In per capita terms, such injustice is even more unacceptable, indeed immoral.



Kaza, Spiti valley (India).

### ***The way ahead***

Firstly the rich world must reduce emissions drastically. Let there be no disagreements or excuses on this matter. There is a stock of greenhouse gases in the atmosphere, built up over centuries in the process of creating nations' wealth. This has already made climate unstable. Poorer nations will now add to this stock through their drive for economic growth. But that is not an excuse for the rich world not to take on tough and deep binding emission reduction targets. The principle has to be they must reduce so that we can grow.

The second part of this agreement is that poor and emerging rich countries need to grow. Their engagement will not be legally binding but based on national targets and programs. The question is to find low-carbon growth strategies for emerging countries, without compromising their right to develop.

This can be done. It is clear that countries like India and China provide the world the opportunity to 'avoid' additional emissions. The reason is that they are still in the process of building energy, transport or industrial infrastructure. They can make investments in leapfrog technologies to avoid pollution. In other words, build our cities on public transport; our energy security on local and distributed systems – from biofuels to renewable; our industries using the most energy - and so pollution - efficient technologies.

These countries also know it is not in their interest to first pollute, then to clean up; or first to be inefficient, then save energy. But technologies that exist are costly. It is not as if China and India are bent on first investing in dirty and fuel-inefficient technologies. They invest in these, as the now rich world has done: first add to emissions; make money; then invest in efficiency. The agreement must recognize this fact and provide technology and funds to make the transition in the world. It is this that is most critical.

### ***A quota system***

The world must seriously consider the concept of equal per capita emission entitlements so that the rich reduce and the poor do not go beyond their climate quota.

This allocation of the earth's global sinks to each nation, based on its population, will create a system of per capita emission entitlements, which taken together are the 'permissible' level of emission of each country. This would create the framework for trading between nations, as the country that exceeded its annual quota of carbon dioxide could trade with those countries with 'permissible' emissions. This would create the financial incentives for countries to keep their emissions as low as possible and to invest in zero-carbon trajectories.



As much as the world needs to design a system of equity between nations, nations of the world need to design a system of equity within the nation. For instance, it is not the rich in India who emit less than their share of the global quota. It is the poor in India, who do not have access to energy who provide us the breathing space. India, for instance, had per capita carbon emissions of 1.5 tons per year in 2005. Yet this figure hides huge disparities. The urban-industrial sector is energy-intensive and wasteful, while the rural subsistence sector is energy-poor and frugal. Currently it is estimated that only 31 percent of rural households use electricity. Connecting all of India's villages to grid-based electricity will be expensive and difficult. It is here that the option of leapfrogging to off-grid solutions based on renewable energy technologies becomes most economically viable. If India's entitlements were assigned on an equal per capita basis, so that the country's richer citizens must pay the poor for excess energy use, this would provide both the resources and the incentives for current low energy users to adopt zero-emission technologies. In this way, too, a rights-based framework would stimulate powerful demand for investments in new renewable energy technologies.

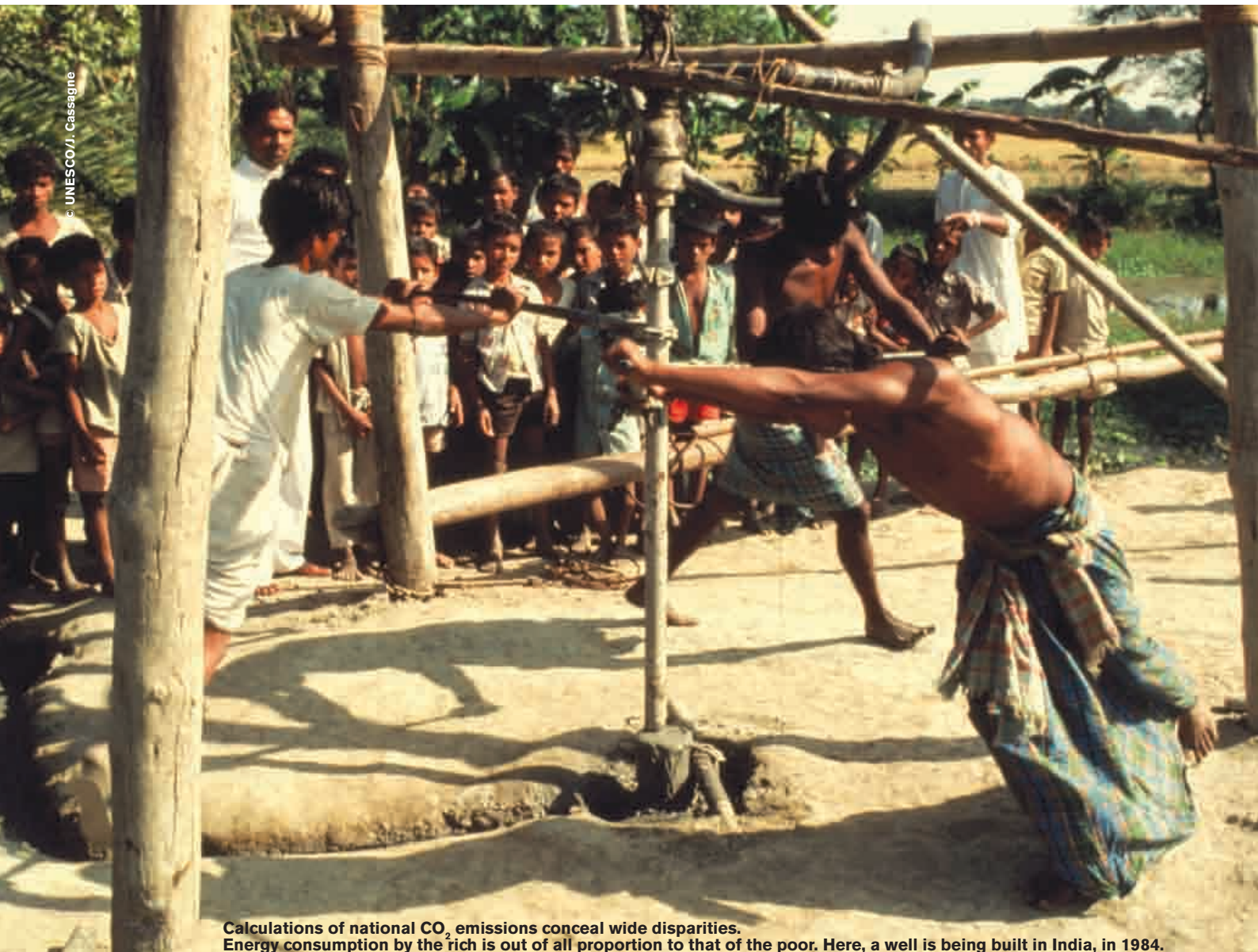
This rights based agenda is critical in the resolution of the climate change challenge. The fact is that climate change

teaches us more than anything else that the world is one; if the rich world pumped in excessive quantities of carbon dioxide yesterday, the emerging rich world will do it today. It also tells that the only way to build controls would be to ensure that there is fairness and equity in the agreement, so that this biggest cooperative enterprise is possible.

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**Sunita Narain** is an Indian environmentalist and political activist. She is director of the India-based Centre for Science and Environment and of the Society for Environmental Communications. She is also publisher of the magazine *Down To Earth*.



Calculations of national CO<sub>2</sub> emissions conceal wide disparities. Energy consumption by the rich is out of all proportion to that of the poor. Here, a well is being built in India, in 1984.

© UNESCO/J. Casagagne

# Refugees of the future will be ‘climate refugees’

**Land-use change can have even larger effects than greenhouse gas warming, believes the Italian climatologist Filippo Giorgi. Member of IPCC, the Intergovernmental Panel on Climate Change (Nobel Peace Prize 2007), Mr Giorgi is also the head of the Earth System Physics Section in UNESCO’s ‘Abdus Salam’ International Centre for Theoretical Physics (Trieste, Italy).**

*Interview by Jasmina Šopova.*

## **Will climate change increase the divide between rich and poor?**

Climate change will not be felt by all countries in the same way. Developing countries are more vulnerable because of their lower capacity to respond to climate change. This will likely enhance the large imbalances across countries we see today and increase friction. In some cases, expected changes such as sea level rise and widespread increase in drought conditions might lead to massive population migrations, the so called climate refugees, and this will of course increase tension.

However, the solution to the climate change problem requires a probably unprecedented global co-operation effort across countries, so it offers a great opportunity for international collaboration and coordinated action. All countries will have to sit at the same table to solve the problem.

## **According to the ‘Climate Change Index’ you published in September 2006, the Mediterranean and North-eastern European regions are the most prominent ‘Hot-spots’? Why?**

The index is based on changes in the averages and the variability of temperature and precipitation. The Mediterranean and North-eastern Europe emerged as the most prominent hotspots, but not for the same reasons.

For the Mediterranean the main problem, indicated by model projections, is important warming and a marked reduction in precipitation in the spring and summer seasons. This is due to a northward shift of the storm track (storms increasingly travel north of the Mediterranean) and the intensification of lo-

cal soil moisture-precipitation feedbacks (decreased precipitation leads to drier soil and warmer conditions, which in turn inhibit precipitation etc.). The models also project an increase in variability during the warm season, which implies a relatively large increase in the occurrence of extremely warm and dry seasons (even warmer and drier than the summer of 2003). This would lead to severe increased aridity and perhaps even desertification, especially in the southern Mediterranean countries.

In North-eastern Europe, the main effect is a large increase in precipitation related to higher frequency and intensity of storms, conditions more prone to flood events, and important warming in the cold season. The latter is due to the melting of snow, which decreases surface reflectivity and induces a higher absorption of solar radiation, thereby intensifying warming.



Drawing by Francisco Ferreira de Campos (Brazil), one of the laureates of the student contest organized by the International Year of Planet Earth (2008).

## **You seem to be particularly concerned by the effects of land-use changes.**

The problem is that current model projections of climate change do not include land-use change and for some regions this is an important source of uncertainty that needs to be better addressed in the future. We have indications that land-use change can have large effects, even larger than greenhouse gas warming in particular in some specific regions, for example West Africa. But at the global scale the effect of land-use change is minor compared to that of greenhouse gases. I also think the effects of

atmospheric aerosols and dust may be important at the regional scale and need to be better addressed in the future.

Excerpt from an interview published in “Planet Hot-Spot”, an issue of the *UNESCO Courier* (n°3-2008) devoted to the International Year of Planet Earth (2008).





Mount Huangshan in the mist, one of the natural sites in China inscribed on the World Heritage list.

## Record-breaking China

**China, along with the United States, is the world's largest producer of CO<sub>2</sub>. According to Pan Jiuha, member of China's delegation to the UN Summit on Climate Change in Copenhagen, his country is not ready to commit to an emission reduction number. Nonetheless, China is ready to reduce greatly its 'carbon intensity' and is beginning to break records in energy efficiency.**

*Pan Jiahua is interviewed by German journalist Bernhard Bartsch*

### **What are your expectations for the outcome of Copenhagen?**

China, together with quite a few other nations including the G-77 developing countries, is pushing for the implementation of the Bali action plan that was concluded in 2007 (Conference on Climate Change, Indonesia). In this action plan, it is clear that deep cuts have to be made by 2020 and that developing countries need to take measurable, reportable and verifiable mitigation action. Financing and adaptation of technology should also be included in the Copenhagen document.

### **Are you optimistic that these goals can be reached?**

That mostly depends on the United States. I think the political will of the White House is evident. But without the approval of Congress, Obama will not be able to make very concrete commitments. And if the US is unable to provide a number for emission cuts by 2020 in Copenhagen, I don't think we will have a very specific emission reduction number.

### **From a Chinese perspective, what is the number to which the US should commit?**

The Intergovernmental Panel on Climate Change (IPCC) has recommended that the rich countries should reduce their emissions by 2020 by between 25 and 40 percent, based on the year 1990. The Chinese government's position is that developed countries should reduce their emissions by at least 40 percent. The reason is mainly that developed countries should take the lead. Currently, their emissions are several times the developed countries' average. If the rich nations cannot reduce emissions successfully, they would give developing countries a very poor example.

### **Is China willing to commit itself to any targets?**

The Bali road map makes no requirement for developing countries to commit themselves to a number of reduction. But it seems like the US will only accept a target if China and other large developing countries agree to do the same. After all, China is the world's largest producer of CO<sub>2</sub>.



In China, eleven million people migrate to urban areas every year.

It is very irrational of the Americans to come up with such a demand. It is only an excuse for their own inaction. Their per capita emissions are four to five times that of the Chinese, and in terms of capital and technology and institutional capability the US are supposed to be much superior. If they go back to their own history, they can easily understand China's situation: We have some 11 million people going to the urban sector every year. These people need housing, infrastructure and employment – none of that is carbon free. In fact, our energy structure is still very carbon intensive: China's energy consumption is only three quarters of that of US, but total emissions are a bit more.

So at the current stage of industrialisation and urbanisation and poverty alleviation, China is not in a position to commit itself to emission reduction targets. This is very much in accordance with the Kyoto protocol and the principle of "common but differentiated responsibilities".

Nonetheless, China as a developing country has taken serious and substantial mitigation action that has proven to be very effective. If you look at China's efforts, no other country has something comparable to show. At the UN summit in September, President Hu Jintao said that China is ready to make a significant reduction of carbon intensity.

China is going to increase its renewable energy to 15 percent. That is very ambitious. Although China has no uranium reserves of its own, we will increase nuclear power from currently only 10 GW to 70 GW in ten years. No other country could come up with such a large investment in such a short period of time.

And look at our energy efficiency increase. In the 11th Five Year Plan (2006-2010), we have a 20 percent energy intensity reduction. In the 12th Five Year Plan, I don't think we will have such a high target, but it will still be high, probably somewhere between 10 to 15 percent. Not a single country – not the US, not the Europeans and not even the Japanese – has reached such a target in five years.

***The targets are impressive, indeed. But in the past, China has not always been able to reach its targets.***

I think there should be no problem for China to reach the 20 percent energy reduction target. The reason is very simple: we should thank the financial crisis. Some energy intensive sectors are very adversely affected. Less demand for steel or cement

also leads to reductions in the combustion of coal. So the energy mix is changing.

***But isn't this only a short-term effect?***

You are certainly right. But the financial crisis has demonstrated that China's production capacity in these sectors already meets demand. We can produce 550 million tons of steel annually and 4 billion tons of cement. That is enough. The idea that China will continue to grow exponentially is wrong.

***So when do you expect China's coal consumption to peak?***

For energy consumption, the current understanding is that the very capital and energy intensive process of urbanisation will peak before 2020. Between 2020 and 2030 we will then have a phase of consolidation, and after 2030, China will go into a rather low-energy kind of post-industrialisation phase. The energy increase will be minimal and total energy consumption will probably peak some time around 2035. However, the peak of coal should be well before 2035, because we have very aggressive investments in nuclear and renewables like wind, solar and hydropower.

***This is very ambitious, but the bottom line is that it will hardly be enough to keep global warming below two degrees Celsius.***

You are certainly right. That is why we have come up with the carbon budget proposal. From a starting point to an end point, we will sum up all global emissions and then divide them by the world population on a per capita basis. Then you can see how much every country has used already and how much it has left. And if there is a shortage you buy and if you have a surplus, you can use your own. This will lead to a new financial mechanism: The carbon using rights can flow from poor to rich countries and capital will flow from rich to poor countries.



**Pan Jiahua**

is Director of the Climate Change Programme at the Research Centre for Sustainable Development at the Chinese Academy of Social Sciences, China's leading government think tank.



# Kenya: burning sun and dusty soil

Severe droughts have left Kenya and the rest of East Africa in short supply of water and food. For the purpose of this article, climate expert Dr. Dominic Walubengo took us on a road trip to the heart of Maasai country to demonstrate how climate change is affecting the rural population of Kenya.

*By Søren Bjerregaard Jepsen, Danish journalist*



© UNESCO/Pierre A. Pittet

Droughts afflict Africa.

We are halfway through the desert, near a town called Kajiado when the dry truth about climate change in Kenya kicks in once again. The journey tells a sad story about dead cattle, dry rivers and a way of life that is being destroyed by the CO<sub>2</sub> emissions the world is gathering to discuss at the COP15 Climate Change Conference in Copenhagen in December.

Dr. Dominic Walubengo works for the Kenyan organisation FAN, supported by the Danish NGO MS ActionAid Denmark. He advises the Kenyan government on climate and environment. He is going to Copenhagen with a message about a country and a continent in desperate need of new technologies and new ways of living if the rural populations are to survive the droughts that increasingly afflict the East African region.

"Kenya and large areas of the rest of Africa need more than money. We need help to adjust to the changing climate. We have to find new ways of living for the pastoralists and we need new technologies," says Dominic.

Kenya's capital, Nairobi, is deservedly dubbed 'the green city in the sun'. Driving south from the city, the landscape slowly shifts from green to brown to grey. Fifty kilometres on, dust from the plains dominates the horizon, fading slowly to blue as you gaze skyward.

As one of Kenya's leading climate experts, Dominic is also a first-hand witness to climate change. He has proud Maasai blood in his veins, inherited from his mother, though he

has not lived the nomadic pastoralist Maasai life himself. He sadly contemplates the bloated carcasses of cattle by the roadside, dead from starvation and thirst. A couple of years ago, large healthy herds of cattle and goats roamed the fertile plains.

How have the living conditions changed? "The pastoralist knows how to handle drought. It has hit Kenya many times before and it has always decreased the number of livestock. The difference is that it used to come every 10th year. Since 1984, the droughts have become more and more frequent and now one takes over from the last. Some places have now had a drought for 3 ½ years. There are not enough good years in between for the pastoralists to build up their herds of goats and cattle," Dominic says.

As we drive through the parched countryside Dominic points out a dried-up river that used to supply water for people and livestock in the area. A year ago there was water, the area was green, and the women were growing maize and other vegetables on their plots of land. Now they survive on relief aid distributed by the government and NGOs.

## **Four million Kenyans rely on relief aid**

"They expect that 148,000 people in this area will soon be dependent on relief aid. The pastoralist tribes are nomads, so they used to walk many miles to find food for their cattle. Now they often walk in vain. They look for green grass hundreds



Effects of desertification in Kenya.

of kilometres from their homes, but their cattle and goats are dying. I just heard about two Maasais in this area who committed suicide. They live and die with their livestock, and when there are no cattle left they do not know any alternatives," Dominic says.

Black, leafless trees and soil the colour of fired clay leaves an impression of a country not suitable for living. We pass an ostrich and enter a Maasai shamba – a small farm that several families use as their base. The proud smile on Tembe Resuka's lips welcomes us.

"We need rain more than ever, and when we need it the most, it always comes. So now it has to come," she says with no hesitation. Her husband is several hundred kilometres away with the family's three remaining cows. A year ago, they had 20 head of cattle and 500 goats.

How bad is the situation? "In Kenya there are around four million people that need relief. Kenya used to be self-reliant in food production, but the output has dropped and nothing changes. Soon three-quarters of Kenya will be relying on food from the rest of the world. The drought hits everybody living in the rural areas and everybody without a steady income. The whole of East Africa is affected. Outside Kenya it is bad in the northern parts of Tanzania, North and Eastern Uganda, Somalia and Ethiopia," Dominic says.

### **Copenhagen has to succeed**

The road from Kajiado to Nairobi passes through the affluent suburb of Karen where many politicians, wealthy businessmen and expatriates reside. There are more Maasai herds here than in Kajiado, and cattle graze on grass along the roadside, sustained by the rain that fell here in early October. Some of the Kenyan leaders participating in COP15 live in this green oasis.

"The politicians are demanding a lot of money in Copenhagen. However, that is not enough. If African countries just get money because the Western world feels guilty about CO<sub>2</sub> omissions, nothing will change. The money will be spent and lost in the political system," Dominic says.

Dominic has advised the Kenyan leaders before and his ideas formed the backbone of Kenya's Forest Act of 2005 that has involved local communities in the preservation of Kenya's few remaining forests. When it comes to COP15 he hopes to make a contribution. And that the Western world

will take the climate related problems in Africa seriously and help with knowledge and technology.

What should Kenya ask for? "I'm telling the politicians that we have to ask for help. It is necessary that we get new technologies like wind turbines, solar power and so on. Moreover, we need the necessary knowledge to keep them running. We need education for Kenyans and technical support from the Western world. I am proposing that this be our main message at COP15," he says.

As we drive in the lush, affluent suburbs of Nairobi the need for radical changes in the rural areas can be hard to envisage. However, the need is evident in other parts of Nairobi. The slums are growing every day and experts estimate that about half of the 4 million people living in the city are slum-dwellers.

What is the solution? "People are moving from the countryside to the slums, because there is nothing left for them in their rural homes. Many have given up farming and their cattle have died, so they move to the slums to look for jobs. It would be a much better solution if we can help them find other ways of living where they come from, such as refining their crops and other businesses that can lead to sustainable incomes. Much can be done in this area," says Walubengo.



Kenya's leading climate expert **Dr. Dominic Walubengo** is advising the Kenyan government at the UN climate change conference in Copenhagen.





Perito Moreno glacier, in the Los Glaciares national park, Argentina.

## Adios to the snowy heights

**The retreat of glaciers in the Andes region is a clear indicator of climate change. Vulnerable tropical glaciers now melt away at a much faster rate than anticipated by scientists a few years ago. Combined with changing precipitation patterns, this leaves millions of people exposed to an unstable and insufficient water supply for drinking, irrigation and hydropower.**

*By Ebbe Sønderriis, Danish journalist*

**D**r. Edson Ramirez heads a team of scientists that has monitored several glaciers in the Andes since 1990-91, among them the famed Chacaltaya, close to Bolivia's capital La Paz.

No need anymore. The 18,000 year-old glacier that delighted thousands of visitors has gone, leaving the ski hut and other remnants of what was once "the world's highest ski resort" utterly misplaced on barren stones.

The melting of Andean glaciers has gone on for many decades, but the recent acceleration of the process has taken scientists by surprise. Ten years ago, Ramirez and his colleagues concluded that the glacier would survive until 2015. But in March this year he had to face the facts: "Chacaltaya has disappeared. It no longer exists."

"The vulnerability is far greater than we expected," he says. "The retreat of glaciers in the Andes has accelerated in recent years. It is now three times faster than it was before. We expect many other relatively small glaciers to disappear in the coming decade."

"In our region the glaciers perhaps are the best indicators of climate change. However, the impacts of changing precipitation and the profound changes of many other ecosystems, like wetlands for example, may be even more severe."

Ninety-nine percent of the world's tropical glaciers are located in the Andes: Peru (71 percent), Bolivia (22 percent), Ecuador (4 percent) and Colombia (3 percent). Since many rivers originate from these glaciers, their melt waters contribute to the water supply of the capital cities La Paz, Quito

and Lima and other large Andean cities.

The glaciers and their water basins provide a large part of the power used in the region, since 70 percent of the region's power generation is hydroelectric.

Irrigation water, essential for the particularly arid Pacific basin, is primarily of glacial origin.

Glaciers act as regulators of the hydrological system in almost all of the Andean areas. They play the role of gigantic reservoirs, capturing the precipitation in the wet season and releasing freshwater throughout the dry season.

Since the mid-1970s, surface temperatures in the region have increased by 0.32 – 0.34 degrees Celsius per decade. In the same period the shrinking of glaciers has accelerated. Many of them have lost more than half of their previous area and volume.

### **Water scarcity and unpredictable rainfall**

At first the melting of glaciers means more water running in the rivers. In the absence of adequate water storage reservoirs the surplus water is wasted – or even causes flooding.

In the long term, however, as the glaciers diminish and melt away, the volume of water resources is drastically reduced. According to a World Bank report earlier this year, Peruvian glaciers have lost more than a fifth of their mass in the past 35 years, reducing by 12 percent the water flow to the country's coastal region, where more than half the population lives.

The destabilisation and the eventual disruption of water supply aggravate the already existing conflicts about scarce water resources, as clearly illustrated by the case of Bolivia's capital La Paz and its adjacent slum city El Alto. Water for the city mainly comes from a reservoir at the base of the glaciated mountain cluster Tuni Condoriri. Since the mid-1950s the glaciers there have shrunk by 40 – 50 per cent. Ramirez and his team have projected the Tuni and the Condoriri glaciers to be extinct by 2025 and 2045 respectively.

People from all over the country are migrating to the capital in hopes of a better life. As a result, the population of El Alto has grown from 200,000 to about 900,000 in less than 20 years - without any urban planning.

Several years ago, Ramirez published a study warning that water shortage would soon begin in El Alto and the outskirts of La Paz. Today, he says, supply in some periods is only 40 – 50 percent of demand.

heavier rainfalls have important impacts on agriculture and the management of dams, increasing the need for water storage and water saving.

The effects of climate change in the Andes region are closely related to the ENSO (El Niño-Southern Oscillation, most commonly referred to as El Niño) – a periodic temperature increase in the Western Pacific occurring every few years.

“The El Niño events are more frequent and more intense now than they were in the past. We know from analyses of ice cores that the frequency of El Niño events in the past has been up to 12 years. Then it fell to 7 years, 4 years and now it seems to be less than two years. Whether this is a natural variability or a consequence of global warming is difficult to say. It is one of the big questions in the scientific community,” Ramirez says.

Anyhow, in years with El Niño conditions the melting of glaciers in Bolivia and southern Peru is intensified not only



Building a road on the high plateaux of Bolivia.

“Climate change restricts water resources. In my opinion, however, the water shortage in El Alto and La Paz is not only a problem of climate change. It is also a problem of water management,” he says. “In the medium term, we need to solve the problems of net distribution of water, and maybe we need to control the population density of the city.”

“We may also need to construct other types of infrastructure, such as dams and reservoirs,” he says.

Uncertainty is the keyword of climate change impacts in the Andes region, as it is in other parts of the world.

“One of the most important factors is the rainfall,” Ramirez says. “Big problems can be expected if in the future the quantity of precipitation decreases. After all, the quantity of water coming from glaciers is relatively small, compared to the 80 percent coming from rainfall. However, while climate models can reproduce temperature increases with some accuracy, it is very difficult to say if precipitation will increase or decrease. That is the big question.”

### **No more seasons**

“We are observing changing patterns of precipitation. The distribution in time has changed since the 1980s,” he says. Shortening of the rainy season and more concentrated,

by higher temperatures, but also by less precipitation.

Large investments are needed for Bolivia to adapt to present and future water shortages: water reservoirs and storage tanks, dams, canals, efficient drip-irrigation, refurbishment of municipal water systems to avoid leaks etc.

“The responsibility for climate change is unequally distributed. Obviously many regions emit more greenhouse gases than South America. In the case of Bolivia, the CO<sub>2</sub> emissions are very low, but the impacts of climate change are bigger than in other regions. Countries like Bolivia and Colombia do not have the tools necessary for adaptation programmes. We need financial budgets to access the necessary technologies.”

“So, the outcome of the Climate Conference in Copenhagen is very, very important. We need to consider the Earth as one system – and the cooperation of the developed countries towards developing countries is very important,” Edson Ramirez concludes.

**Dr. Edson Ramirez** is an experienced glaciologist and the assistant director of the Institute of Hydraulics and Hydrology of the Universidad Mayor de San Andrés in La Paz.





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[f.ryan@unesco.org](mailto:f.ryan@unesco.org)

**Director**

Saturnino Muñoz Gómez

**Editor in Chief**

Jasmina Šopova - [j.sopova@unesco.org](mailto:j.sopova@unesco.org)

**Editorial assistance**

Katerina Markelova - [k.markelova@unesco.org](mailto:k.markelova@unesco.org)

**EDITORS**

**Arabic**

Bassam Mansour - [b.mansour@unesco.org](mailto:b.mansour@unesco.org)  
assisted by Zaina Dufour - [z.dufour@unesco.org](mailto:z.dufour@unesco.org)

**Chinese**

Weiny Cauhape - [w.cauhape@unesco.org](mailto:w.cauhape@unesco.org)

**English**

Cathy Nolan - [c.nolan@unesco.org](mailto:c.nolan@unesco.org)

**Portuguese**

Ana Lúcia Guimarães et Nelson Souza Aguiar  
[a.guimaraes@unesco.org](mailto:a.guimaraes@unesco.org)

**Russian**

Victoria Kalinin - [v.kalinin@unesco.org](mailto:v.kalinin@unesco.org)

**Spanish**

Francisco Vicente-Sandoval - [l.iglesias@unesco.org](mailto:l.iglesias@unesco.org)

**Photo**

Fiona Ryan - [f.ryan@unesco.org](mailto:f.ryan@unesco.org)  
and Ariane Bailey

**PDF Layout**

Gilbert Franchi

**Web Platform**

Stephen Roberts, Fabienne Kouadio, Chakir Piro  
[s.roberts@unesco.org](mailto:s.roberts@unesco.org)

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