

WORKSHEETS ON CLIMATE CHANGE

Going under!

The threat of rising sea levels
for the small island nation of Tuvalu



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The scenarios and warnings of international scientists regarding climate change and its inevitable consequences must seem like a constant sword of Damocles hanging over the people of Tuvalu. In its new report (2013), the Intergovernmental Panel on Climate Change (IPCC) assumes there will be a further rise in global temperatures by up to 5.4 °C above pre-industrial levels for unabated emissions of greenhouse gases by the end of the 21st century. According to recent research, the sea level could rise by at least 26 centimetres this century, however, with an unabated rise in greenhouse gases this could even reach a sea level rise of 98 centimetres.

As an island nation, Tuvalu has always had to struggle with extreme weather, such as storm surges and flooding. But as a result of global warming, the frequency and severity of these events is expected to increase.

Even a very small rise in sea level may result in serious negative consequences for atolls and low islands¹. The effects of a storm surge or flooding are also exacerbated by natural breakwaters such as coral reefs disappearing through global warming and other reasons. Corals are exposed to a whole range of stress (stressors), namely the increasing acidification and pollution of the oceans, storms, as well as the rise in temperature and the increase in sea level.

Tuvalu fears an increasing loss of land due to the rise in sea level. In the past few years alone, the largest atoll of Tuvalu has already lost more than a metre of land.

The problematic consequences of the rise in sea level and which can already be clearly observed, include the salinization of the poor soil and groundwater, which increases the pressure on the scarce water resources and increasingly restricts the cultivation of food crops such as the domestic Pulaka.

The entire food security of the island nation is in danger. How can a small island state like Tuvalu, which is directly affected, respond to this problem? How can the residents protect themselves from this new threat, especially since there is no experience with and no precedence for this? Tuvalu is raising these questions.

Many of the previously identified negative effects of climate change are increasingly challenging for small island states like Tuvalu. They do not have the capacity to react appropriately to the consequences and adapt to them. This is partly due to the lack of access to capital, know-how and technology, but also to the size of the country.

In many cases migration, both within and outside the country, is a last resort. This is why solutions need to be found urgently to prevent a disaster. Limiting climate change is still possible. Sustained efforts at all levels can lead to an appropriate reduction of greenhouse gas emissions, but have unfortunately not got underway yet. And this despite the fact that the consequences of climate change are already clearly noticeable in Tuvalu.

¹ Ralston H. et al. (2004): Climate Change challenges Tuvalu. Germanwatch, Bonn. <http://germanwatch.org/download/klak/fb-tuv-e.pdf>, accessed 14.02.2014.

Use in the classroom

Using a specific case study, pupils learn about the direct consequences of climate change for the inhabitants of a Pacific island state.

The teaching module provides general information about climate change as well as looking at an entirely different perspective. As an introduction to the topic, a quote is used from the 2006 UN Climate Change Conference (**M 1**) and an official of Tuvalu (**M 2**).

The pupils are confronted with two dramatic statements from those affected which then prompt them to reflect and raise questions. At this point, statements could be collected on the board in the form of a brainstorming session. Then some basic information (location, climate, economy, etc.) on the island nation of Tuvalu should be picked out and dealt with (**M 3–M 7**) in a development phase. Various maps (atlas) should be referred to for this purpose.

After that, pupils work in groups to compile the current and future threat potential for the island nation and the possible consequences for the islanders that are attributed to climate change (**M 8–M 10**). The issue of “climate refugees” is already very topical in Tuvalu – materials **M 12** and **M 13** provide for this as well as for a discussion in the group. The options for the islanders to pursue a political, social or technical course of action to grapple with the causes and consequences of climate change should then be considered (**M 11–M 14**).

Further reading:

IPCC (2007): Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK.

http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg2_report_impacts_adaptation_and_vulnerability.htm (Accessed 13.02.2014)

Oliver-Smith, A. (2009): Sea Level Rise and the Vulnerability of Coastal Peoples Responding to the Local Challenges of Global Climate Change in the 21st Century. InterSecTions 7/2009. UNU-EHS, Bonn.

<http://www.ehs.unu.edu/file/get/8380.pdf> (Accessed 18.02.2014)

Park, S. (2011): Climate Change and the Risk of Statelessness: The Situation of Low-lying Island States.

United Nations High Commissioner for Refugees (UNHCR), Geneva.

<http://www.unhcr.org/4df9cb0c9.pdf> (Accessed 18.02.2014)

Ralston, H. et al. (2004): Climate Change challenges Tuvalu. Germanwatch, Bonn.

<http://germanwatch.org/en/2758> (Accessed 26.01.2014)

UNESCO (2013): Islands of the Future – Building Resilience in a Changing World. UNESCO, Paris.

<http://unesdoc.unesco.org/images/0022/002245/224512e.pdf> (Accessed 18.02.2014)

UNFCCC (2005): Climate change, small island developing States. Climate Change Secretariat (UNFCCC), Bonn.

http://unfccc.int/resource/docs/publications/cc_sids.pdf (Accessed 18.02.2014)

Germanwatch

Following the motto “Observing, Analysing, Acting”, Germanwatch has been actively promoting global equity and the preservation of livelihoods since 1991. In doing so, we focus on the politics and economics of the North and their worldwide consequences. The situation of marginalised people in the South is the starting point of our work. Together with our members and supporters as well as with other actors in civil society, we intend to represent a strong lobby for sustainable development.

We attempt to approach our goals by advocating for the prevention of dangerous climate change, food security, and compliance of companies with human rights.

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Within the series of *Worksheets on Climate Change* the following publications are available in English:

- Global climate change – General issues
- The melting glaciers – Glacial lake outburst floods in Nepal and Switzerland
- Sea level rise – Consequences for coastal and lowland areas: Bangladesh and the Netherlands
- Going under! The threat of rising sea levels for the small island nation of Tuvalu
- The threat to tropical rainforests and international climate protection
- Climate change and food security – Trends and key challenges
- Extreme events and climate change – Insurances for developing countries

See: www.germanwatch.org/en/worksheets

All worksheets are also available in German.



Observing. Analysing. Acting.
For Global Equity and the Preservation of Livelihoods.

M 1

“When in history have we had to decide to let whole countries disappear?”

(Statement by a representative of Tuvalu on behalf of 43 small island nations at the 13th UN Climate Change Conference in Nairobi, November 2006)

M 2

“We don’t want to leave this place. We don’t want to leave, it’s our land, our God given land, it is our culture, we can’t leave. People won’t leave until the very last minute.”

(Paani Laupepa, employee at the Environment Ministry in Tuvalu)



M 3

The island nation Tuvalu

Tuvalu, formally a British colony known as the Gilbert and Ellice Islands Colony, is since 1978 an independent constitutional monarchy in the southwest Pacific Ocean, located halfway between Hawaii and Australia. Tuvalu means “group of eight,” referring to the country’s eight traditionally inhabited islands. Today it consists of nine small islands, six of which are atoll islands (with lagoons)

– Nanumea, Nui, Vaitupu, Nukufetau, Funafuti (the capital) and Nukulaelae – and three which are raised limestone reef islands – Nanumanga, Niutao, and Niulakita. Tuvalu is one of the world’s smallest and most isolated island nations. All together the islands have a total of 26 square kilometres – which is one quarter the size of the city of Bonn, Germany.



Tuvalu at its widest point is only 400 metres (photo: www.sydhav.no)

(Source: Ralston, H. et al. (2004): Climate Change challenges Tuvalu. Germanwatch, Bonn. <http://germanwatch.org/en/2758>, accessed 26.01.2014)

M 4 The “.tv”-domain

In 2000 the government of Tuvalu made an effort to reduce its dependence on foreign aid and sold the country's top-level-domain “.tv”. Since then, web page operators worldwide are able to buy domains ending by “.tv”, which are obviously very popular in the television industry. That deal guarantees Tuvalu US\$ 4 million per year up to a total of US\$ 50 million, a gigantic sum for a country whose previous annual national budgets seldom exceeded US\$ 5 million.

With the additional money, Tuvalu joined the United Nations (on September 5th 2000) and the Pacific Island Climate Change Assistance Program (PICCAP), in part to address climate change. The new income also allowed Tuvalu to improve its health and education systems in addition to its local infrastructure.

(Source: altered from Ralston, H. et al. (2004): Climate Change challenges Tuvalu. Germanwatch, Bonn, p. 13. <http://germanwatch.org/en/2758>, accessed 26.01.2014)

M 5 Facts and figures, status 2011

	Tuvalu	Germany
Area (2011) ¹	26 km ²	357,022 km ²
Population (2011) ¹	9,844	81,797,673 million
Population density (2011) ¹	328 people/km ²	227 people/km ²
Population growth rate (2011) ¹	0.2%	0.0%
Life expectancy (2011) ²	Women: 64 Men: 65	Women: 83 Men: 78
Gross domestic product (2011) ¹	US \$ 39.3 million	US \$ 3,624,861 million
Gross domestic product per capita (purchasing parities) (2011) ¹	US\$ 3,994	US\$ 44,315
Share of the gross domestic product (2010) ¹	Agriculture: 29% Industry: 6% Services: 65%	Agriculture: 1% Industry: 28% Services: 71%
Funding from Official Development Assistance (ODA) ¹	US\$ 42.5 million	
Funding from Official Development Assistance (ODA) per capita ¹	US\$ 4,323	

(Sources:

¹ World Bank: <http://data.worldbank.org/>, accessed 27.01.2014;

² WHO: <http://apps.who.int/gho/data/node.main>, accessed 27.01.2014)

M 6

The significance of coral reefs

Coral reefs are complex ecosystems with a remarkable diversity of life, often called “rainforests of the sea.” About 4,000 species of fish and 800 species of reef-building corals have been discovered today. Coral reefs are important not only for the biodiverse life they support, but for the human population as well. Reef-associated plants and animals provide people with:

Food: One square kilometre of healthy coral reefs can produce 15 tons of food per year – enough for more than 1,000 people.

Tourism Industry: Coral reefs are a major draw for snorkelers, scuba divers, recreational fishers, and those seeking vacations in the sun. The earnings of tourism industry in relation to coral reefs is globally estimated at around 30 billion US\$.

Coastal protection: Coral reefs protect shorelines from wave action and the impact of storms. The benefits from this protection are widespread and range from the maintenance of highly productive mangrove fisheries and wetlands to the supporting of local economies built around ports and harbours. A study estimated that the costs of destroying just one kilometre of reefs range from about \$137,000 to almost \$1.2 million over a 25-year period, when fishery, tourism, and protection values alone are considered. About 20% of the coral reefs were destroyed during the last decades and further 20%, especially in the Caribbean and South-East Asia, are seriously damaged.

(Source: excerpts from Ralston, H. et al. (2004): Climate Change challenges Tuvalu. Germanwatch, Bonn, p. 8. <http://germanwatch.org/en/2758>, accessed 26.01.2014)

M 7

Threat to coral reefs

“Many [atolls] are just one or two metres above sea level. Most of them have a natural protective wall of coral reefs that break the force of the Pacific waves. For a while it was hoped that the reefs would grow with the rising sea, but instead they are dying. Coral reefs are the work of tiny creatures, coral polyps, which live in symbiosis with algae.

The polyps protect the algae from harmful UV rays and provide them with the metabolic products for food. In return the algae supply their hosts with substances rich in energy and facilitate the production of lime for forming reefs. A perfect symbiosis – but also a very fragile one which cannot survive long-term outside of

a narrow temperature fluctuation just above or below 26 °C.

If the water is too warm, the polyp expels the algae, probably because they are poisonous for them. Without the algae, the corals lose their colour, they fade and die of starvation. [...] An additional problem is that with the increasing concentration of CO₂ in the atmosphere, more carbon dioxide is absorbed from the sea water and then converted into carbonic acid. Thus, oceans are becoming more acidic, which is devastating for marine life in general and corals in particular, due to the decreasing availability of carbonate-ions, which is what the corals use to form their exoskeletons.”

(Source: own translation from Kleber, C. and C. Paskal (2012): Spielball Erde: Machtkämpfe im Klimawandel. C. Bertelsmann Verlag, München, p. 78f.)



Exercises

1. Which adverse affects could Tuvalu be facing in the next few years as a result of climate change? (M 1 and M 2)
2. Conduct a spatial analysis for the island nation of Tuvalu using materials M 3–M 6 and the Atlas.
3. Evaluate the economic structural data of the island nation (M 4–M 6).
4. Discuss the possible impact of climate change for the inhabitants and the ecology of the Pacific atolls. (M 6 and M 7).

M 8

Tuvalu and rising sea levels

Many small Pacific islands are only about 3–4 metres above average sea level at their highest point. Tuvalu's highest point is only just over 4 metres from the water, but in fact on average it is only 1.5 metres. Bearing this in mind, it is not surprising that the Intergovernmental Panel on Climate Change (IPCC) considers the rising sea level as the biggest threat of all the consequences that global warming presents for small islands.

Measurements have shown that the sea level has risen between 12 and 22 centimetres in the last century. The IPCC assumes in its Fifth Assessment Report that it will rise even further, by the end of this century between 28 and 98 centimetres.

Such a development will have far-reaching effects that are already partly noticeable in Tuvalu today. These include

flooding, loss of coastal regions and the gradual salinization of drinking water and soil. There are also negative effects on crops, groundwater resources and biodiversity on land and at sea. With a rise of one metre, two-thirds of the island atoll would be flooded and the rest would be exposed to stronger wave activity.

As a large proportion of houses, infrastructure and economic activities are situated directly on the coast, a rise in the sea level means that not only the life and health of the residents are at high risk but also their social and economic activities. The sea has always dominated life in Tuvalu and is inextricably linked with social and physical space. Therefore, a change in sea level is not an abstract risk but a challenge for everyday life.

(Source: excerpts, updated, supplemented using Ralston, H. et al. (2004): Climate Change challenges Tuvalu. Germanwatch, Bonn, p. 6. <http://germanwatch.org/en/2758>, accessed 26.01.2014; IPCC (2013) Climate Change 2013: The Physical Science Basis. Working Group 1 Contribution to the IPCC Fifth Assessment Report. Chapter 13.)

M 9

Climate change – also a matter of nutrition for Tuvalu

“For Tuvalu, healthy ecosystems are extremely important because subsistence agricultural production, as well as cash crop agricultural production, are essential to the economical, societal, and dietary welfare [...]. About 80 percent of the population 15 years and older participate in agricultural production and fishing. The remaining population generally has paid jobs either in the public or private sector on urban Funafuti or Vaitupu. [...]

Pulaka, or giant swamp taro, is a gigantic rubber plant, that can grow up to 4 meters high with corms up to a meter long and weighing up to 100 kg. The entire plant (leaf, stalk, corm) can be consumed [...]. *Pulaka* is the main taro of small Pacific islands like Tuvalu. Given the lack of land availability and the nature of the land on the islands it is not surprising that special techniques have been developed for its production. It grows in pits that are dug deep into the coral down to the fresh water lens [see M 10].

It can take four years to mature but can stay in the pits for up to 15 years. Pulaka trees, however, cannot tolerate saltwater, and in recent years an increasing number of pulaka trees have been rotting in the ground because seawater has seeped up into the pits [...].”



(Source: Ralston, H. et al. (2004): Climate Change challenges Tuvalu. Germanwatch, Bonn, p. 10f. <http://germanwatch.org/en/2758>, accessed 26.01.2014)

M 10

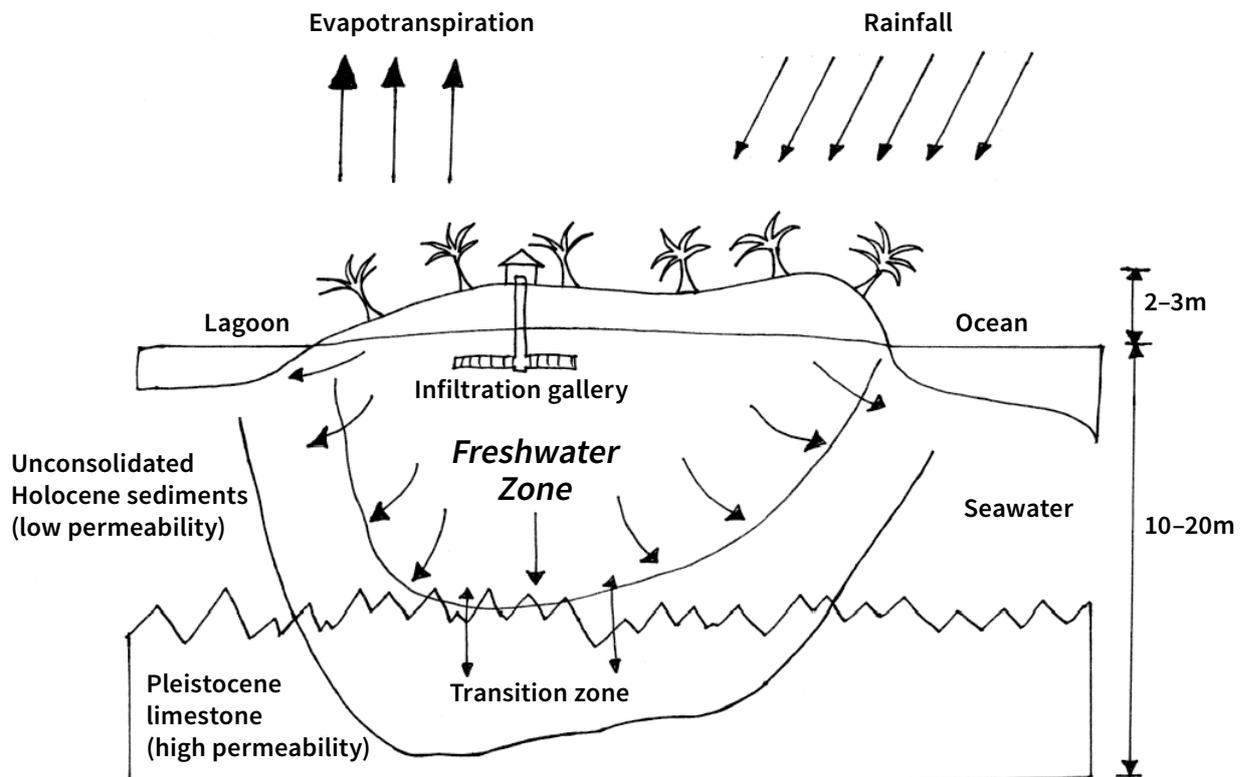
Clean drinking water – a challenge for Tuvalu

“If rainwater were to become insufficient, the residents of Tuvalu would have to turn to the very limited ground water supplies. These reserves are located in the so called freshwater lens [...].

[...] A journalist, visiting Tuvalu’s airstrip in the late afternoon in February 2002, describes such a “strange thing”

during spring tide. “Water is beginning to bubble up through holes in the ground. At first it only makes a few salty puddles. But by 6 p.m. much of the side of the airstrip is underwater. It’s knee-deep around the Meteorological Office and lapping at people’s houses in several parts of the island.””

(Source: Ralston, H. et al. (2004): Climate Change challenges Tuvalu. Germanwatch, Bonn, p. 12. <http://germanwatch.org/en/2758>, accessed 26.01.2014)



(Source: Ralston, H. et al. (2004): Climate Change challenges Tuvalu. Germanwatch, Bonn, p. 13. <http://germanwatch.org/en/2758>, accessed 26.01.2014; according to Scott, D. et al. (2003): Pacific Dialogue on Water and Climate. Synthesis Report. SOPAC, p. 14. <http://www.oas.org/cdwc/Documents/SIDS%20Paper/Pacific%20Report%20-%20Final.pdf>, accessed 27.01.2014)

EXERCISE

5. In groups, make a sketch to show the impact of climate change on the island nation of Tuvalu and briefly present your results. (M 8–M 10).

M 11 Fear of going under

“Most experts agree that unless something happens soon in the fight against climate change, the popular internet domain “tv” might be the only thing that remains of Tuvalu.”

Somehow Tuvalu is always present – at least this far. For example, when the international community [...] negotiates measures to combat rising sea levels and global warming. [...] Because the 11,000-inhabitant nation at the other end of the world is directly affected by the impact of climate change. “Tuvalu is symbolic because it is a nation that could go under,” says Fanny Heros of the French non-governmental organisation “Alofa Tuvalu” which campaigns for the nine atolls in the South Pacific.

With just 26 square kilometres of land, the tiny nation is ranked just ahead of the Vatican. The ring-shaped islands are only a few centimetres above sea level. The highest “peak” is four metres from the water. In some places the narrow atolls only have space for a road. Therefore, Tuvalu is threatened from all sides; from the rising sea levels, soil erosion, storms and tidal floods.

The signs of change are already being noticed by people today. The only water now available for drinking is rain

water. The sea level lies just 20 centimetres below the ground and only coconut trees are able to thrive under these conditions. They keep erosion at bay but are bent over by the increasingly recurring storms.

However, the inhabitants of Tuvalu have not given up the fight, as Fanny Heros reports, although 3,000 Tuvaluans have already emigrated mostly to New Zealand and Australia. The plan of the remaining islanders is different – the aim is to be a forerunner in matters of environmental policy and to save resources. 70 percent of waste in Tuvalu is organic and this is now converted to energy in a biogas plant or used as compost. Coconut oil is used as a basis for the production of biofuels. High gardens protected from flooding ensure the food supply and help to minimise the import quota and the associated emissions of environmentally harmful greenhouse gases. [...]

Misereor desk officer Corinna Broeckmann is familiar with the problems of Tuvalu and other states in the region. “This is a topic for the whole of Oceania, where all of Micronesia with Kiribati and the Fiji Islands are at risk,” warns the employee of the Catholic relief organisation. ”

(Source: own translation of excerpts from Die Welt from 09.04.2009: Der Inselstaat Tuvalu ist dem Untergang geweiht. <http://www.welt.de/wissenschaft/umwelt/article3533071/Der-Inselstaat-Tuvalu-ist-dem-Untergang-geweiht.html>, accessed 27.01.2014)

M 12 Flee or adapt?

“Some countries, such as the Pacific island nation of Tuvalu, reject the idea of resettling its own people on principle. Tuvalu calls for global warming to be limited to below 1.5 degrees Celsius. Then [there would be] no need for resettlement and Tuvalu could survive. All activities should focus on mitigating emissions and adaptation. Some individual politicians and scientists in Bangladesh

demand that the rich industrialised countries should accept refugees and migrants on a permanent basis from areas of the country that are no longer habitable. However, in the past at UN climate negotiations, developed countries have repeatedly tried to force migration off the international agenda and instead want to restrict the discussion to national adaptation strategies. ”

(Source: own translation of Amnesty International et al. (2013): Auf der Flucht vor dem Klima, p. 3., <http://germanwatch.org/de/6245>, accessed 27.01.2014)

M 13

Resettlement as a last resort

Tiny Kiribati in the South Pacific with around 100,000 inhabitants has no future. At least this is how it seems for Kiribati President, Anote Tong, who has been fighting climate change for years and has almost no hope left at this point. The atolls of Kiribati barely protrude out of the water and will be quickly washed over with a rising sea level. This, according to Tong, is already increasingly happening. “The most serious impact of climate change is that we have already been forced to relocate several villages on our atolls. Seawater is also flowing into the groundwater more and more. This could end up being the biggest problem...”

Small and overpopulated

Kiribati is not only small, it is also completely overpopulated. Up to 15,000 people are crowded onto one square kilometre. The atolls are often only one or two hundred metres wide, so where are you supposed to go, asks Tong. He does not believe that the rise in temperature can be arrested fast enough to save his little Kiribati.

So the 60-year-old president is working on drastic emergency plans. Resettling the entire population, for example, “We are considering all the options and cannot rule out that soon it will no longer be enough to move places within the country. It might be necessary to move our whole country and resettle the population outside the borders.”

Discussions with East Timor are underway, says Tong, but still need time. First of all, Kiribati, the desperately poor country, acquired a little land in the Fiji Islands to grow vegetables there. Because in Kiribati itself there will soon be no more space left.

Money for dykes and flood protection measures

Australia, itself a climate polluter, is helping in the construction of a dyke to secure the survival of Kiribati, says Mark Dreyfuss, in the Labour government responsible for climate change. “We have provided a large part of 600 million Australian dollars for the Pacific in order to ease the effects of climate change. Kiribati receives money for the construction of dykes, Samoa, Tuvalu and Nauru for drinking water storage, and Fiji for flood protection measures.” Kiribati’s President remains sceptical – and looks to the future at the same time. “We are now following the strategy of training our people so that they do not just come out of this as climate refugees, but can migrate at any time and in dignity because of their knowledge.”

A sensible strategy, but not likely to be implemented tomorrow if you look at the current poverty and the level of education in Kiribati. Maybe not even the day after tomorrow, when the sea washes over the entire atolls.

(Source: “Tagesschau” from 07.12.2012: Wie sich Kiribati auf den steigenden Meeresspiegel einstellt. no longer available online)

M 14 Loss and Damage

Insights into the UN climate talks in 2012 in Doha, Qatar:

“The momentum of the negotiations was significant, which revolved around the topic of “Loss and Damage” on the last night of the conference. It addressed above all climate damage that can no longer be avoided by adaptation and a reduction of emissions. In particular, the small island states – many of them threatened by physical destruction caused by climate change – and the Less Developed Countries (LDCs) were urged to take substantial steps by setting up an international mechanism.

Due to the high pressure that the most affected developing countries and civil society were able to build up on the subject, the United States also finally had to agree to a decision that resolves to develop a special institution for the principle of “Loss and Damage”. The detailed plan will be on the agenda in 2013 [...].”

(Source: own translation of Harmeling, S. et al. (2012): Der Gipfel von Doha: Aufbruch ohne Rückenwind. Analyse des UN-Klimagipfels 2012. Germanwatch, Bonn, p. 7. <http://germanwatch.org/5980>, accessed 27.01.2014)

A year later at the 2013 climate talks in Warsaw, “Loss and Damage” was an issue at the highest political level. Developing countries continued with their demand by following a “Warsaw International Mechanism”.

The mechanism will push the issue in the coming years and promote coordination (e.g. in disaster precautions, humanitarian intervention and adaptation) and will explore ways of supporting developing countries in “Loss and Damage” as part of the Framework Convention on Climate Change (UNFCCC). The fact that an active group can promote “Loss and Damage” is now welcomed and thus large-scale risk management can make technical progress. This group plans to deal with issues including insurance solutions, early warning systems regarding tipping points in the climate system, systemic (cascading) climate risks and migration induced by climate change, debates about the definition of national self-help forces and about strengthening the role of solidarity mechanisms in times of increasing climate disasters.

(Source: own translation of Kreft, S. et al. (2013): Schwaches Ergebnis trotz Verlängerung beim Klimagipfel im Warschauer Stadion. Germanwatch, Bonn, p. 25f. <http://germanwatch.org/7735>, accessed 27.01.2014)

Exercises

6. Describe the options available to the inhabitants of Tuvalu and other island nations to adapt to climate change (M 11–M 13). Do you see any additional course of action? Where do you see difficulties, if any?
7. Evaluate and discuss the measures taken by the international community and individual states to protect the Pacific island countries (M 13–M 14).
8. Resettlement, adaptation to the consequences or the reduction of greenhouse gases? Discuss on these topics (M 12 and M 14).