

WORKSHEETS ON CLIMATE CHANGE

Climate change and food security

Trends and key challenges



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Climate change is leading to an increase in global temperatures. The last three decades were each warmer than every previous decade since temperature records began in 1850. However, there are significant regional differences in the temperature increase. The average temperature is rising at a greater rate in the moderate climates of the northern and southern hemispheres than in the tropics, with northern Europe particularly heavily affected. The situation is even more dramatic in Australia, which has been suffering the effects of an enduring drought for years. Without enough ground or surface water supplies to call on, water supply will become an acute problem for some Australian towns and cities in the coming years. Poor harvests meant that the fifth continent – a granary and agricultural exporter under normal conditions – barely exported any grain at all in 2012.

The USA and eastern Europe also suffered from lengthy droughts in 2012, leading to a global decline in harvests which in turn led to rising prices for grain. In April 2011 the world market price for grain reached an historic high. The grain price index of the FAO (Food and Agriculture Organization of the United Nations) was 76% higher than in April 2010 and 3% higher than its previous peak level in 2008. In September 2012, grain prices reached their highest point between June 2012 and June 2013 with an increase of 6.5% over the average 2011 price¹.

In East Africa, more than 10 million people were affected by a massive famine in summer 2011. It was triggered by the region's worst drought in 60 years as well as high world market prices for corn and grain.

The hunger which we once experienced as a distribution issue will in the future become a true volume issue which will lead to phases of famine, particularly affecting the economically weak and disenfranchised.

Worldwide food conditions are already stretched and climate change threatens to exacerbate them further. The Fourth Assessment Report from the Intergovernmental Panel on Climate Change (IPCC) predicts grave consequences of climate change in the fields of food security and agricultural production, based on its assessment of scientific studies. The expectation is that numerous regions of the Earth will experience more frequent heat waves in the future and that the number of droughts will rise as a consequence. The FAO warns of the potential impact of climate change, particularly in small scale farming in already marginalised regions of Africa, Asia and Latin America.

Climate change threatens to further jeopardise the human right to food. That's why the UN Human Rights Council has begun considering the issue of member states' human rights responsibility in adaptation to climate change. The area of climate change and food security also plays a role in the United Nations' Millennium Development Goals (MDGs) agreed by 189 member states in 2000. The MDGs designate concrete objectives in various areas to be used as measurements in their realisation. The first goal that the community of states set was to halve the proportion of the world's population suffering under extreme poverty and hunger by 2015. According to the FAO this goal could be reached if past years' efforts in battling hunger are continued and expanded.

The MDGs build on resolutions and findings from numerous major conferences at the UN level, such as the 1992 environmental summit in Rio, and have become guidelines in international cooperation development and the struggle against poverty. The MDGs run through until 2015 when they will be linked to the sustainable development goals (SDGs) which were agreed – if not fully fleshed out – in Rio in 2012 (Rio+20).

Climate change has impacted food security in numerous ways: the increase in temperatures influences growing conditions for plants. Many plants won't be able to adapt to the increase in temperatures in their traditional growing regions, and will either spread northward (or southward in the southern hemisphere) or to mountainous regions, or disappear altogether. Climate change will alter precipitation patterns in many parts of the world. In areas of rain-fed agriculture, rains arriving just a few weeks late, or distributed to just a few heavy precipitation events, can have a major impact on harvest yields. Soil erosion also increases with individual heavy precipitation events, which reduces the potential for further high-yield cultivation. Along with changes in precipitation patterns, whole regions will become drier. Available water resources for personal usage as well as for agriculture will tighten considerably. Additionally, numerous regions are likely to see an increase in heavy rain events, heat waves, floods and droughts as well as a higher intensity of hurricanes, typhoons and other major storms. The expected rise of sea levels threatens to flood whole sections of the world's most fertile land in coastal areas and flood delta regions and contribute to the salinization of soil and groundwater supplies. A temperature increase of just 2 to 2.5°C would have a significant impact on agriculture in parts of Africa. Export goods such as cocoa and palm oil will see particularly sharp drops in harvest yields. A temperature rise of 3°C would greatly reduce food supplies in large areas of the Earth.

¹ Van de Sand, K. (2013): Die Risiken nehmen zu. Germanwatch-Trendanalyse zur globalen Ernährungssicherung 2013. Germanwatch, Bonn, <http://germanwatch.org/de/7068>, accessed 28.01.2014.

Use in the classroom

The materials presented here give pupils the opportunity to work through the links between the areas of food security and global climate change. These connections, intensifying as they are in a world of increasing globalisation and constant change, are examined throughout the various regions and in a more detailed way.

The entry point to this topic comes with a general view of the figures and current developments affecting people suffering from hunger (**M 1–M 4**). There is also the option of taking a current article on the issue from a newspaper to underscore the topicality of the issue. After looking at the regions which are particularly affected by hunger, the term “food security” is examined in more detail with a close look at the development of grain prices in global markets (**M 5–M 6**).

This is followed by a description of the role of climate change in food production and food security (**M 7–M 9**). This perspective offers the opportunity for discussion on the multidimensional links between climate change, food security and development (**M 10–M 12**).

The next materials offer a selection of case studies and points of focus, each one relating to a different continent – Africa, Asia and Latin America – and can be used independently of each other.

The materials **M 13–M 17** provide an overview of the issue of food security and global climate change in Africa. These lend themselves to work in small groups.

M 18–M 20 show how the Asian continent is affected by climate change, and offer a deeper look at the role the price trends play in food security in Asia.

M 21–M 25, meanwhile, provide an overview of the impact of climate change in Latin America and the Caribbean. There is particular concentration on the focal area of the Amazon and the effect of meat consumption on worldwide food security.

Finally there is a look at the options for adaptation to climate change risks in relation to food security. Here there should also be discussion of potential adaptive measures in relation to their different levels of action (**M 26–M 28**).

Further reading:

Bals, C. et al. (2008): Analysis, Climate change, food security and the right to adequate food; Summary Analysis – Deepening the Food Crisis? Diakonisches Werk der EKD e.V., Stuttgart and Germanwatch e.V., Bonn.
<http://germanwatch.org/en/download/2797.pdf> (Accessed 14.02.2014).

Beddington, J. et al. (2011): Achieving food security in the face of climate change: Summary for policy makers from the Commission on Sustainable Agriculture and Climate Change. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Copenhagen.
http://cgspace.cgiar.org/bitstream/handle/10568/10701/Climate_food_commission-SPM-Nov2011.pdf?sequence=6 (Accessed 14.02.2014).

FAO, IFAD and WFP (2013): The state of food insecurity in the world. The multiple dimensions of food security. FAO, Rome.
<http://www.fao.org/docrep/018/i3434e/i3434e.pdf> (Accessed 28.01.2014).

IFAD, WFP and FAO (2012): The State of Food Insecurity in the World – Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition. FAO, Rome.
<http://www.fao.org/docrep/016/i3027e/i3027e.pdf> (Accessed 29.01.2014).

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).

Neate, P. (2013): Climate-smart agriculture success stories from farming communities around the world. Technical Centre for Agricultural and Rural Cooperation, Copenhagen.
http://cgspace.cgiar.org/bitstream/handle/10568/34042/Climate_smart_farming_successesWEB.pdf?sequence=5 (Accessed 17.02.2014).

UNEP (2008): International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD).
<http://www.unep.org/dewa/assessments/ecosystems/iaastd/tabid/105853/default.aspx> (Accessed 29.01.2014).

UNICEF (2011): Escalating Food Prices: The threat to poor households and policies to safeguard a Recovery for All. United Nations Children’s Fund, New York.
http://www.unicef.org/socialpolicy/files/Escalating_Food_Prices.pdf (Accessed 18.02.2014)

Wheeler, T. and J. von Braun (2013): Climate Change Impacts on Global Food Security. In: Science, Vol. 341, pp. 508-513.
http://biblio-climat.fr/wp-content/uploads/2014/01/71_Wheeler_2013_Science_climate_change_food_security.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.

Germanwatch is funded by membership fees, donations, grants from the “Stiftung Zukunftsfähigkeit” (Foundation for Sustainability) as well as grants from various other public and private donors.

You can also help achieve the goals of Germanwatch by becoming a member or by donating to:

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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

Figures from the World Hunger Report

From 2011 to 2013, an estimated 842 million people were chronically undernourished and regularly had insufficient food supplies. This corresponds to around 12% of the total population of the world, which means that every

eighth person is affected. The largest share comes from developing and emerging nations, where 98% of all chronically undernourished people live.

(Source: FAO, IFAD und WFP (2013): The state of food insecurity in the world. The multiple dimensions of food security. FAO, Rome. <http://www.fao.org/docrep/018/i3434e/i3434e.pdf>, accessed 28.01.2014).

M 2

Positive development?

“The number of hungry people has reduced in recent years. In 2010, the FAO estimated that there were 925 million suffering from hunger, while the year before the organisation reported over a billion people. Even over the long term the figures have dropped: since the early 1990s 132 million fewer people are affected by hunger – a reduction of just under six per cent. Despite this positive development, FAO Director-General José Graziano da Silva warns that there are still more than 100 million children under five years who are underweight. The FAO finds this unacceptable. Da Silva maintains that the world community has the knowledge and the ability to remove all forms of food shortage and undernourishment.

The greatest successes in the battle against hunger had been achieved by 2007. Since then the positive trend has trailed off somewhat. The global financial crisis is one major reason, along with rising prices for food staples, according to the report. In early October [2012] the FAO reported that food prices had once again soared.[...]

In any case the drop in the number of those suffering from hunger is also due to a new calculation basis used by the FAO. The UN organisation reviewed its own statistics and methods and consequently corrected its estimates downwards.”

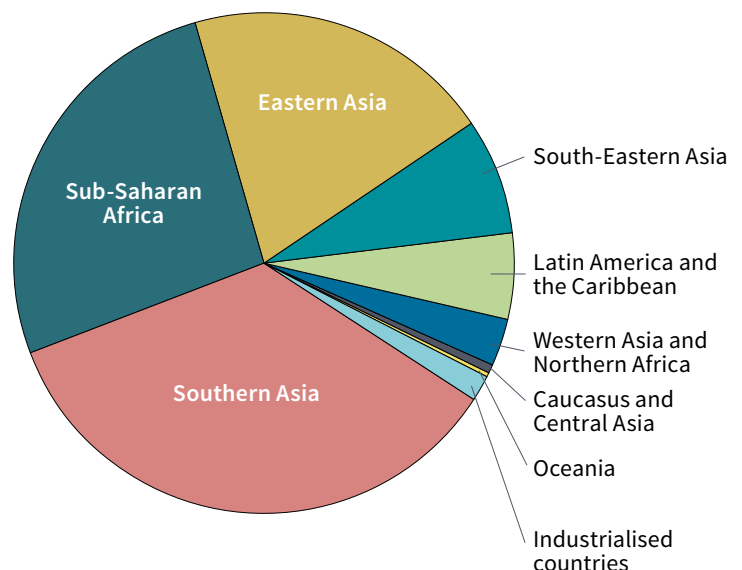
(Source: own translation of Bundeszentrale für Politische Bildung from 11.10.2012: Welternährungstag: Jeder Achte leidet an Hunger. <http://www.bpb.de/politik/hintergrund-aktuell/145913/welternahrungstag-jeder-achte-leidet-an-hunger>, accessed 28.01.2014)

M 3

Who is going hungry?

Worldwide number and share of undernourished by region in the period from 2011–2013

Country	Number (millions)	Regional Share (%)
Industrialised countries	16	2
Southern Asia	295	35
Sub-Saharan Africa	223	26
Eastern Asia	167	20
South-Eastern Asia	65	8
Latin America and the Caribbean	47	6
Western Asia and Northern Africa	24	3
Caucasus and Central Asia	6	1
Oceania	1	< 1
Total	842	



(Source: FAO, IFAD und WFP (2013): The state of food insecurity in the world. The multiple dimensions of food security. FAO, Rome, p. 12. <http://www.fao.org/docrep/018/i3434e/i3434e.pdf>, accessed 28.01.2014).

M 4

“Over the coming decades, feeding a growing global population and ensuring food and nutrition security for all will depend on increasing food production. This, in turn, means ensuring the sustainable use of our most critical finite source water.”

(Ban Ki-moon,
UN Secretary General)

(Source: http://www.un.org/waterforlifedecade/food_security.shtml, accessed 30.01.2014)

M 5

The term “food security”

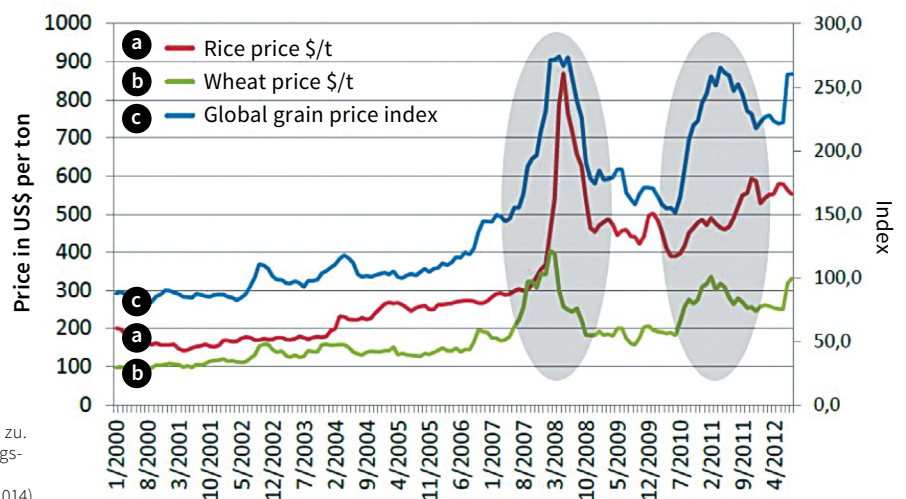
Food security can be divided into three levels:

- 1. Global food security:** the relationship between agricultural production and the world’s population; observation of global supply conditions (food availability and stability of demand).
- 2. Food security at the national level:** the relationship between the supply of food and the population in each country. Imports and exports are examined as well as production.
- 3. Food security at the household level:** affected population groups and their access to food is critical here; poor population groups can even starve in regions which produce a surplus; even where calorie provision is sufficient, low food diversity can lead to malnutrition; poor health conditions can lead to undernourishment.

M 6

Development of global grain prices

Global fluctuation in prices for rice and wheat between 2000 and 2012 according to the global grain price index:



(Source: Van de Sand, K. (2013): Die Risiken nehmen zu. Germanwatch-Trendanalyse zur globalen Ernährungssicherung 2013. Germanwatch, Bonn, p. 15. <http://germanwatch.org/de/7068>, accessed 28.01.2014)



EXERCISES

1. Discuss the present state of worldwide nutrition conditions using **M 1–M 3** and explain which regions are particularly affected by hunger.
2. How should the worldwide reduction in hunger be evaluated (**M 2**)?
3. Discuss the connection between food security and water resources as presented in **M 4**.
4. Define the terms “hunger” and “food security” (**M 1, M 2 and M 5**).
5. Taking **M 6** into consideration, conduct Internet research into the factors which play a role in bringing about hunger, and the background to the nutrition crisis.

M 7

Eastern Africa: Droughts followed by torrential rain

“We have already treated more than 110,000 undernourished children”, says Elhadji As Sy [Regional Director for Eastern and Southern Africa with the United Nations Children’s Fund, Unicef], “who would have died without our assistance.” They also supplied around 100,000 households with food. Sy’s message is: “The help arrived, and you can see the results.”

That may be true. But the problems are also clearly visible.

Paradoxically, the very thing which was lacking for so long is now leading to new problems: water. The rainy season began a month ago. “When the rain comes, so does malaria”, says Sy, “particularly in areas with lots of people.” They try to deal with the threat with medication, mosquito nets and a larvae control programme. [...] Respiratory illnesses and diarrhoea are also widespread in the rainy season, latrines were flooded in the world’s largest refugee camp, Dadaab. There have been around

60 cases in Dadaab alone. “But it is under control and not an epidemic”, says Sy.

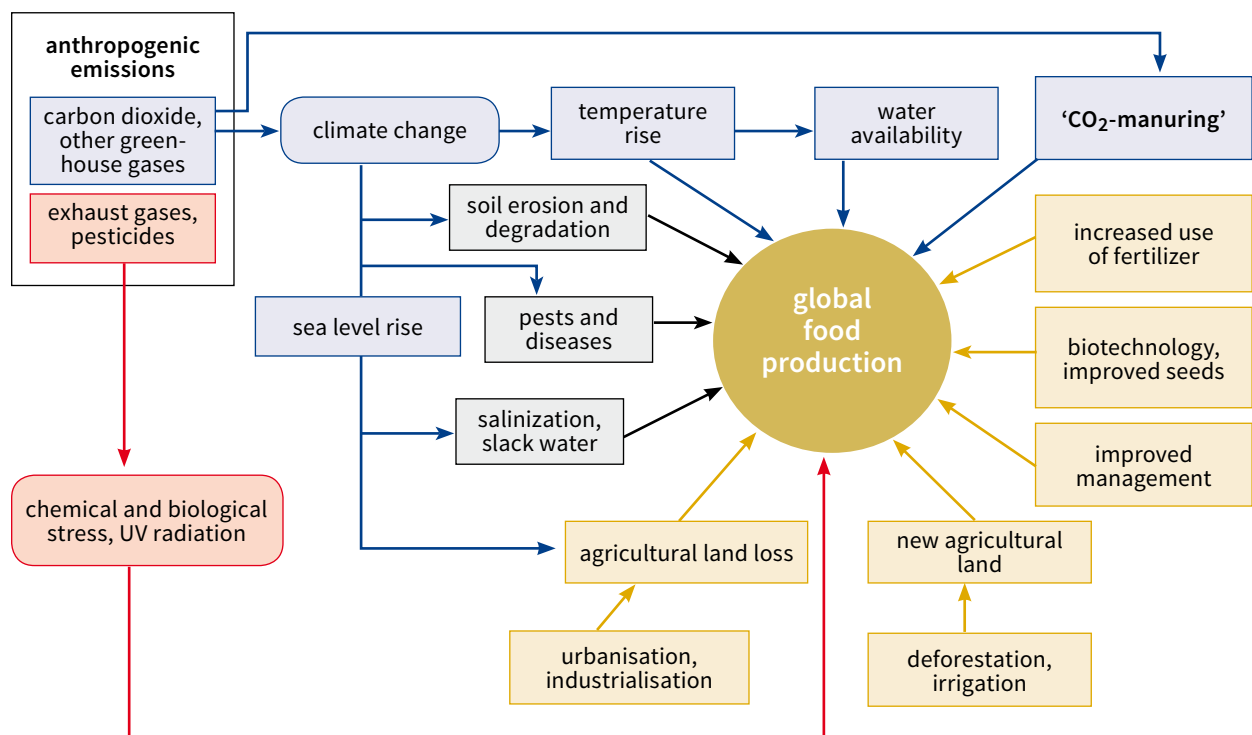
The rain also makes it difficult to distribute aid, with streets becoming impassable mud tracks. Sy hopes that the precipitation will pay off in February – in the form of a harvest which will alleviate the hunger problem. That would be of huge significance to Somalia, which has long imported the majority of its food, and currently imports almost all of it. In any case high fuel costs make transport expensive – “even when grain prices fall”, says Kilwing.

Consequently there is little hope of sustainable improvement in the short term. Cattle will continue to die because there’s no means of storing water. Farmers will continue to sell their seeds and tools out of desperation. Combined with local corruption and the continual struggle to distribute medication and food, it’s a logistical nightmare.”

(Source: own translation of Spiegel Online from 24.11.2011: Ostafrika - Auf die Dürre folgt das Regen-Chaos. <http://www.spiegel.de/panorama/gesellschaft/ostafrika-auf-die-duerre-folgt-das-regen-chaos-a-799512.html>, accessed 28.01.2014)

M 8

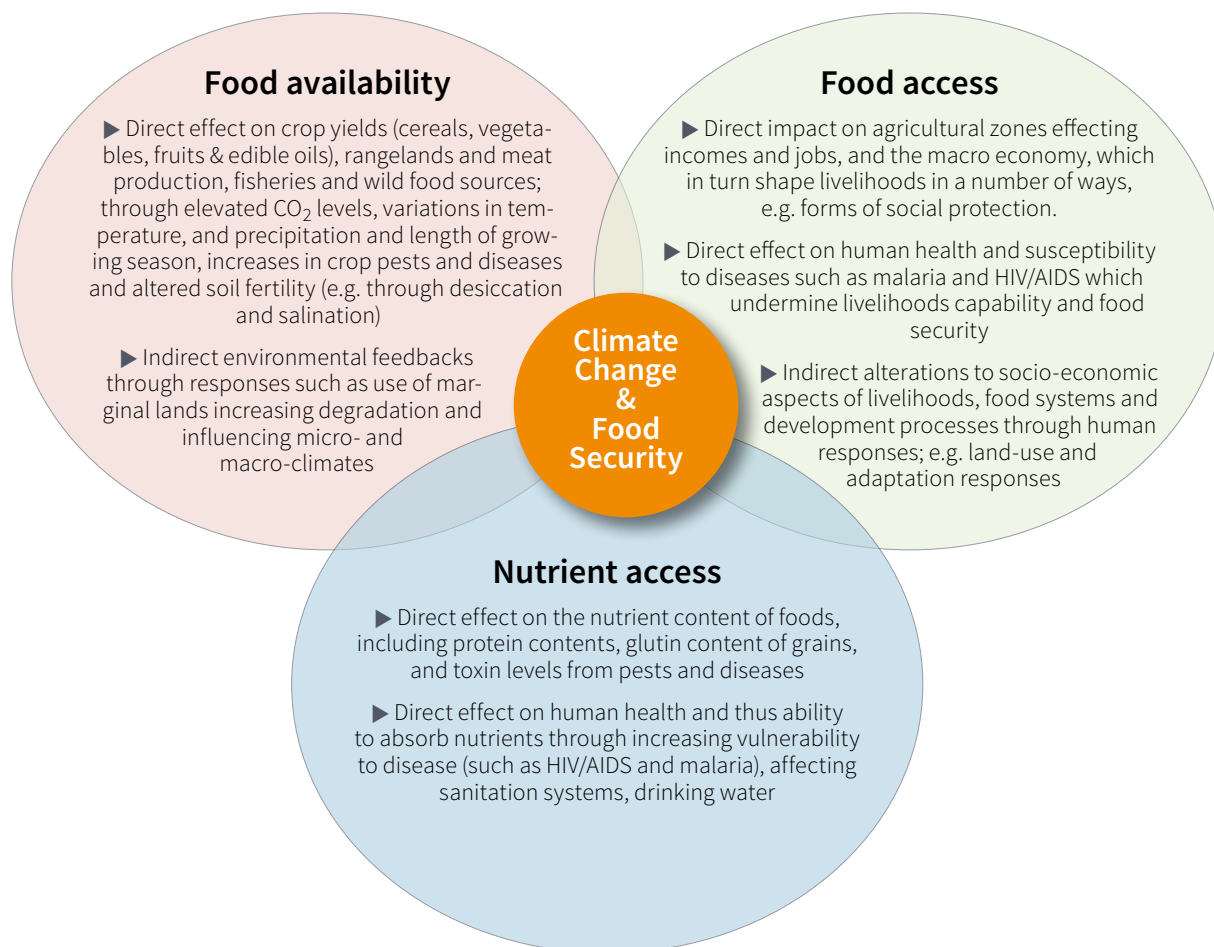
Climate change and food production



(Source: Hamburger Bildungsserver 2007)

M 9

Climate change and food security



(Source: 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, Cambridge University Press. Chapter 9, p. 455. http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg2_report_impacts_adaptation_and_vulnerability.htm, accessed 13.02.2014.)

M 10

The consequences for poor countries

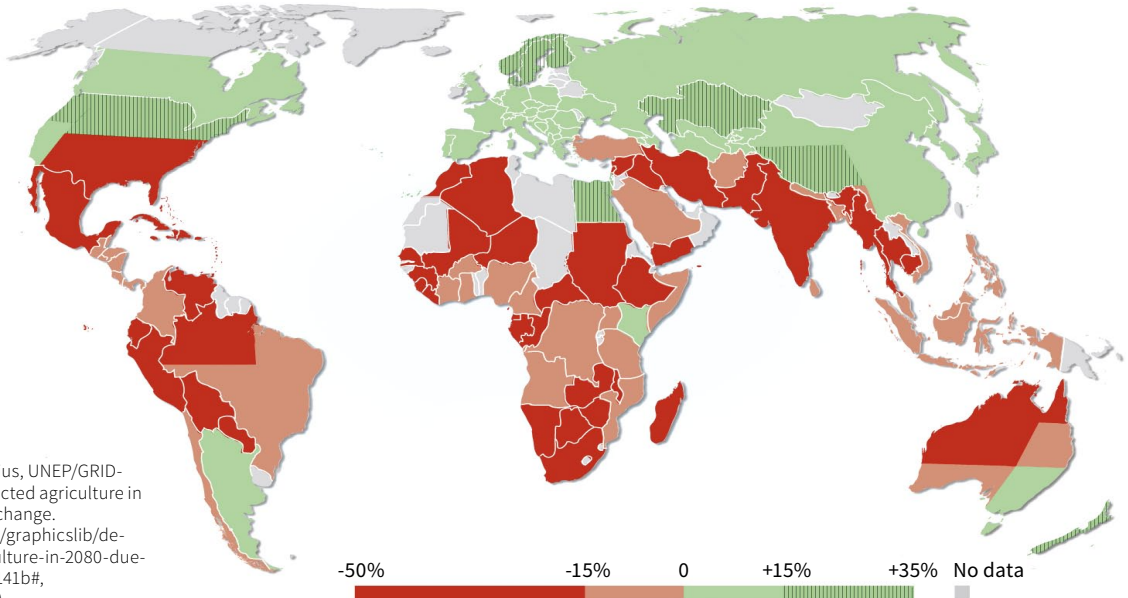
“ Even if climate science scenarios can't come up with exact forecasts for the future, it's clear that the proportion of people affected by hunger will increase as temperatures increase. One study came to the conclusion that an increase in the global median temperature of 3°C would mean that 3.3 to 5.5 billion people could live in countries or regions which can expect very sharp declines in production. The semi-arid zones of Africa are expected to see a drop in precipitation of between 10 to 20%, which would significantly worsen conditions for cattle holders. In Sub-Saharan Africa, particularly, the expected climate change will coincide with the already foreseeable regression in food security. According to estimates, further population growth over the next 30 years will double the demand for food, water and cattle feed. ”

(Source: own translation of Harmeling, S. and C. Bals (2007): Die Millennium-Entwicklungsziele und der globale Klimawandel. Germanwatch, Bonn, p. 36f. <http://germanwatch.org/de/2674>, accessed 28.01.2014)

M 11

The effect of climate change on food production

Projected agriculture in 2080 due to climate change taking into account the fertilising effect of CO₂



M 12

Climate change, agriculture and development

“Agriculture, rural livelihoods, sustainable management of natural resources and food security are inextricably linked within the development and climate change challenges of the twenty-first century. Indeed, not only is food security an explicit concern under climate change; successful adaptation and mitigation responses in agriculture can only be achieved within the ecological, economic and social sustainability goals set forth by the World Food Summit, the Millennium Development Goals and the UNFCCC [United Nations Framework Convention on Climate Change]. [...]

Climate change will superimpose itself on these existing trends [of poverty and food insecurity], significantly increasing production risk and rural vulnerability, particularly

in regions that already suffer from chronic soil and water resource scarcity, high exposure to climatic extremes including droughts and flooding, poverty and hunger [...]. Climate change pressures will be compounded by a pronounced lack of sufficient knowledge, infrastructure, organization and resources that local populations and national governments need to cope with and adapt to climate change. This will be especially true in many poor tropical arid and semi-arid regions, increasing the risk of large overall negative impacts on food security, natural resources and rural livelihoods in coming decades and further increasing the gap between developing and developed countries.”

(Source: FAO (2008): Climate change adaptation and mitigation: Challenges and opportunities for food security. FAO, Rome, p. 1-2. <ftp://ftp.fao.org/docrep/fao/meeting/013/k2545e.pdf>, accessed 28.01.2014)



EXERCISES

- Using M 7, discuss the headline “The long-sought rainy season hardly alleviates the effects of the drought – it creates new problems.”
- Describe and explain the possible impact of global climate change on food production using M 8.
- Summarise the impact of climate change on various aspects of food security using M 9. Pay particular attention to aspects which go beyond pure food production. Refer to M 8, M 10 and M 12.
- Describe the extent to which the impact of climate change on food security represents a particular problem for the poor countries of the Earth. Using an atlas, discuss the role of certain eco-zones (M 3 and M 10–M 12).

Africa under “climate stress”?

M 13

Susceptibility to climate change in Africa

Climate change vulnerability in Africa

-  Desertification
-  Sea level rise
-  Reduced freshwater availability
-  Cyclones
-  Coastal erosion
-  Deforestation
-  Loss of forest quality
-  Degradation of woodlands
-  Coral bleaching
-  Spread of malaria
-  Impacts on food security



(Source: adapted from Delphine Digout, UNEP/GRID-Arendal (2005): Climate change vulnerability in Africa. http://www.grida.no/graphicslib/detail/climate-change-vulnerability-in-africa_1387, accessed 13.02.2014)

M 14

Decline in agricultural crops

“ The IPCC has come to the conclusion that hydrological circulation (water circulation) has changed as a result of the rise in temperature. In the northern hemisphere, for example, there has been an increase in continental precipitation in the last decade, while other regions (including northern and western Africa) saw a fall in the same period. In many regions of the Earth, changing cultivation conditions and irregular precipitation along with high temperatures already make it very difficult to increase or even maintain harvest yields using traditional

cultivation methods or cultivated plants. Traditionally dry areas are particularly hard hit, with a disruption to food supplies from agriculture already leading to major humanitarian and economic problems. These signs indicate, on the one hand, that climate change is already leaving its imprint in people’s lives, while also underpinning the sobering data provided by scientists. On the other hand they are the first foretaste of the impact of climate change we can expect in the future as temperatures increase further. ”

(Source: Germanwatch (2011): Globaler Klimawandel: Ursachen, Folgen, Handlungsmöglichkeiten. Germanwatch, Bonn, p 19. <http://germanwatch.org/de/3428>, accessed 28.01.2014)

M 15

Africa's agriculture and climate change

“ Unlike other agricultural regions of the world, Africa has only a few regions in which fields are irrigated by rivers or reservoirs. So the projected changes to the climate are expected to severely impact food security. It is estimated that in the near future, climate change will reinforce the risk of drought years in some countries of northern Africa, with yields from rain-fed agriculture falling by 50%. This would mean a significant dete-

rioration in an already critical situation in Africa and increase malnutrition on the continent. The IPCC predicts that by 2020, between 75 and 250 million people living in sub-Saharan Africa will be faced with increased water stress caused by climate change. This situation could worsen even more with a fall in fish stocks caused by massive overfishing, aggravated by rising water temperatures in seas and coastal areas. ”

(Source: adapted from Germanwatch (2011): Globaler Klimawandel: Ursachen, Folgen, Handlungsmöglichkeiten. Germanwatch, Bonn, p. 19. <http://germanwatch.org/de/3428>, accessed 28.01.2014)

M 16

Report from Cameroon

“ The rainy season used to start around the middle of March, but these days it is almost impossible to predict when it will begin. Sometimes the dry season lasts too long and seeds dry up in the ground. But if the rain sets in too early and if it then rains too much, we can't work the soil or sow. And the harvest can spoil if the rainy season lasts too long. Corn, for instance, goes mouldy

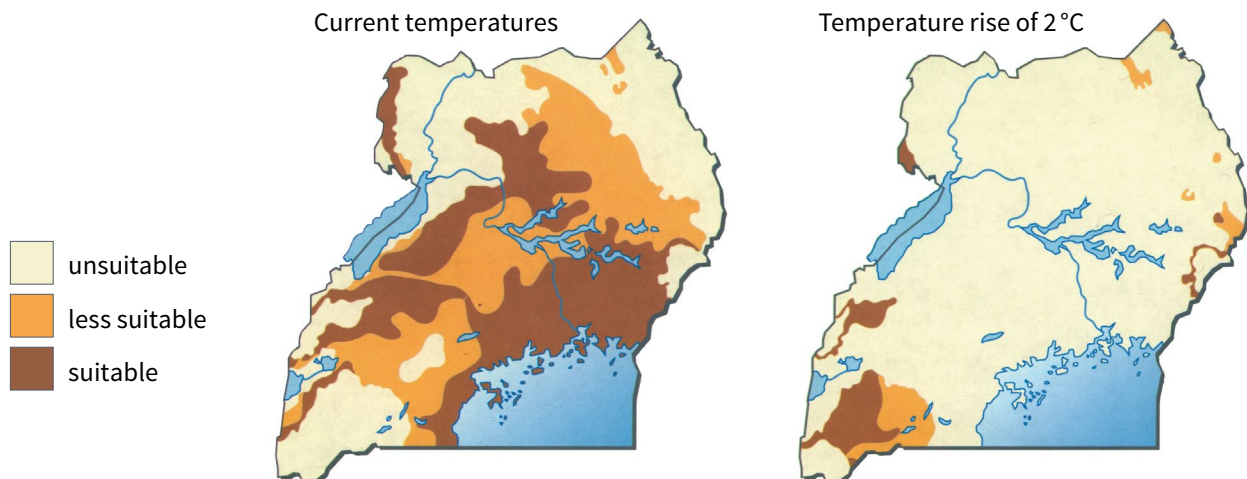
if it can't dry properly at the end of the rainy season. And transport becomes a lot more difficult during heavy rainfall. That's why more harvests are spoiling on the farms. ”

Carole Mboue, secretary and farmer, ADEID
("Action for equitable, integrated and durable development",
environmental and development organisation, Cameroon)

(Source: Verbraucherzentrale (2010): Globaler Klimawandel. Klimawandel und Treibhauseffekt. Verbraucherzentrale Bundesverband, Berlin, p. 14. <http://germanwatch.org/de/2562>, accessed 28.01.2014)

M 17

Impact of temperature increase on coffee cultivation in Uganda



(Source: Verbraucherzentrale (2010): Globaler Klimawandel. Klimawandel und Treibhauseffekt. Verbraucherzentrale Bundesverband, Berlin, p. 14. <http://germanwatch.org/de/2562>, accessed 28.01.2014, from Simonett (1989) and Taye Kufa at the World Coffee Conference 2010)

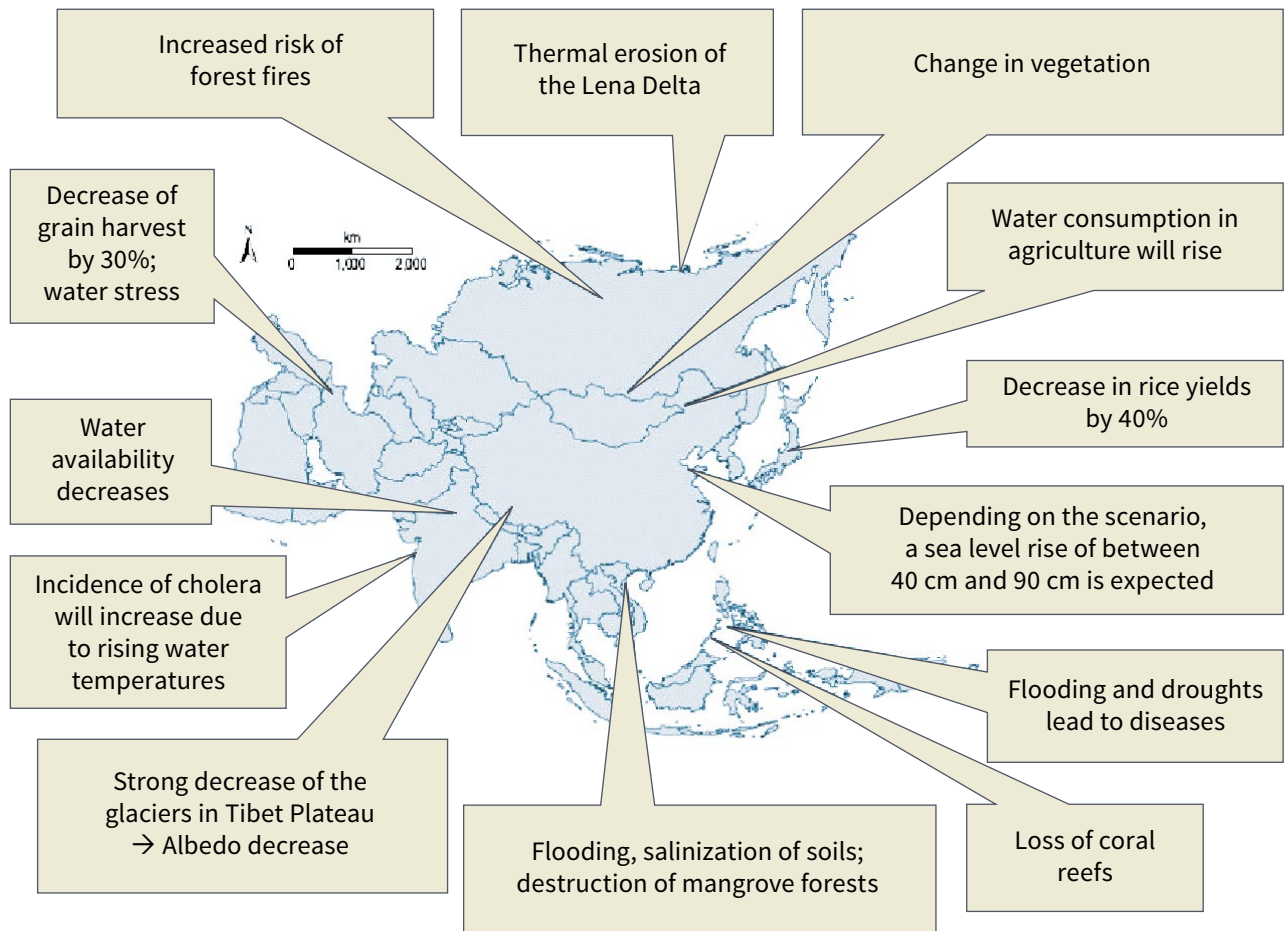
EXERCISES

- Using M 13, describe the vulnerability of various regions of Africa to the impacts of climate change.
- Using M 14–M 17, discuss the impact of climate change on African agriculture and consider the possibilities for adaptation to the consequences in the various agrarian sectors. You can also use the Internet for your research.

Asia – higher prices for food products

M 18

Vulnerability and climate risks



(Source: 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, Cambridge University Press. Chapter 10, p. 481. http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg2_report_impacts_adaptation_and_vulnerability.htm, accessed 13.02.2014.)

M 19 Regional projections

Observed past and present climate trends and changes

Region	Country	Changes in temperature	Changes in precipitation
East Asia	China	Warming within the last 50 years, more evident in winter than summer, rate of increase higher in minimum than maximum temperatures	Annual precipitation dropped in the last decade in north-eastern and northern China, increased in western China on the Yangtze and along the south-eastern coast
	Japan	Temperature increase up to 1.0°C in 20 th century, 2 to 3°C in major cities	No significant trend in 20 th century, although fluctuations increased
	Korea	Annual average increase 0.23°C per decade, increase in daily intervals	Heavy rains more frequent in recent years
South Asia	India	0.68°C increase in annual average temperature for the century, greater warming after monsoon season and in winter	Increase in extreme precipitation in north-west during summer monsoon in recent decades, fewer rainy days along the east coast
	Nepal	+0.09°C per year in the Himalayas and +0.04°C in the Terai region, more winter	No clear long-term trends discernible in precipitation records from 1948 to 1994
	Pakistan	Increase between 0.6 and 1.0°C in average temperature in coastal regions since early 20 th century	10 to 15% drop in coastal belt and arid prairies, increase in summer and winter precipitation in northern Pakistan in last 40 years
	Bangladesh	Increase of approx. 1°C in May and 0.5°C in November over 14 years between 1985 and 1998	Long-term precipitation anomalies since 1960s
	Sri Lanka	Increase of 0.016°C per year between 1961 and 1990 across whole country	Tendency towards increase in February and decrease in June
South-East Asia	overall	Increase of 0.1 to 0.3°C per decade reported for period between 1951 and 2000	Downward trend between 1961 and 1998. The number of rainy days has fallen throughout South-East Asia
	Indonesia	No uniform temperature data available	Precipitation reduction in the south and increase in the north
	Philippines	Increase in annual average, maximum and minimum temperatures increased by 0.14°C between 1971 and 2000	Increase in annual precipitation since the 1980s and number of rainy days since the 1990s, greater fluctuation in beginning of rainfall from year to year

(Source: Germanwatch (2007): Klimawandel und Ernährungssicherheit in Asien. Germanwatch, Bonn. p. 4. <http://germanwatch.org/de/download/6705.pdf>, accessed 28.01.2014)

M 20

Price explosion in food products: Asia fears famine

“ In many parts of Asia, rampant inflation is making food products almost unaffordable. While food prices have soared to record highs across the world – higher than during the food crisis of spring 2008 – almost nowhere has seen the kind of severe increases as Bangladesh, India and Pakistan. [...] Most people in these countries [have to] spend 80% or more of their income on food. By comparison: in Germany, where the Federal Statistical Office has just announced a price increase for food products, it’s around 10%.

The majority of people in Asia already live in poverty, and so the price increase hits the people particularly hard. In India, where according to UN estimates around 40% of the approximately 1.2 billion inhabitants are forced to survive on less than two dollars a day, the cost of food products has increased by almost 20% compared to the previous year. Vegetables have increased by even more. [...]

In neighbouring Pakistan, prices for flour, vegetables, fruit, cooking oil, lentils, milk, eggs and meat have risen so sharply that many politicians are talking about an “existential crisis”. In spring 2010 the Pakistani news magazine “Herald” was devoted to the price explosion in the food market. [...] The magazine quoted an Islamabad doctor who said people could die of undernourishment. And that a police officer earning just 8500 rupees a month, around 70 euros, is more or less obliged to take bribes to feed his family.

In late July [2011] Pakistan was overrun by catastrophic floods, with around a fifth of the country under water. Arable land and cattle stocks were destroyed, and food prices increased dramatically once again: generally by

around 100%, in some regions up to 300%. This year, when the complete scope of crop shortfalls becomes apparent, they could climb even higher. Unscrupulous merchants are using the opportunity to pad prices even more and are blaming it on the flood.

But there is cause for concern elsewhere in Asia: in Vietnam rice prices have doubled in just a few months, in China rising prices have been declared a priority and, as in India, grain and rice from state reserves have been put on the market to increase supply and force prices down.

The United Nations is already warning of unrest of the kind seen in 2008, when people in Asia, Africa and Latin America took to the streets and gave vent to their anger. [...]

The UN sees unfavourable weather conditions and associated crop failures as the main culprit for high prices. Erosion, salinization and insufficient irrigation mean that hundreds of thousands of hectares of arable land become unusable every year. According to the Federal Statistical Office, natural disasters such as the floods in Pakistan and forest fires in Russia have led to shortages in the wholesale market for grain, seeds and fodder – and with them a price rise averaging 20%. Furthermore, the cultivation of biofuels is increasingly forcing out food production. Rising energy prices also make agricultural production more expensive, and with it food products.

However experts also see growing prosperity in Asia and an associated change in nutritional habits as a reason for the shortage. ”

(Source: own translation of Spiegel Online from 21.1.2011: Preisexplosion bei Lebensmitteln: Asien fürchtet Hungersnot. <http://www.spiegel.de/wirtschaft/unternehmen/preisexplosion-bei-lebensmitteln-asien-fuerchtet-hungersnot-a-740601.html>, accessed 28.01.2014)



 EXERCISES

12. Using **M 18**, **M 19** and an atlas, and potentially also the Internet, describe three selected countries in Asia with respect to the impact of climate change.

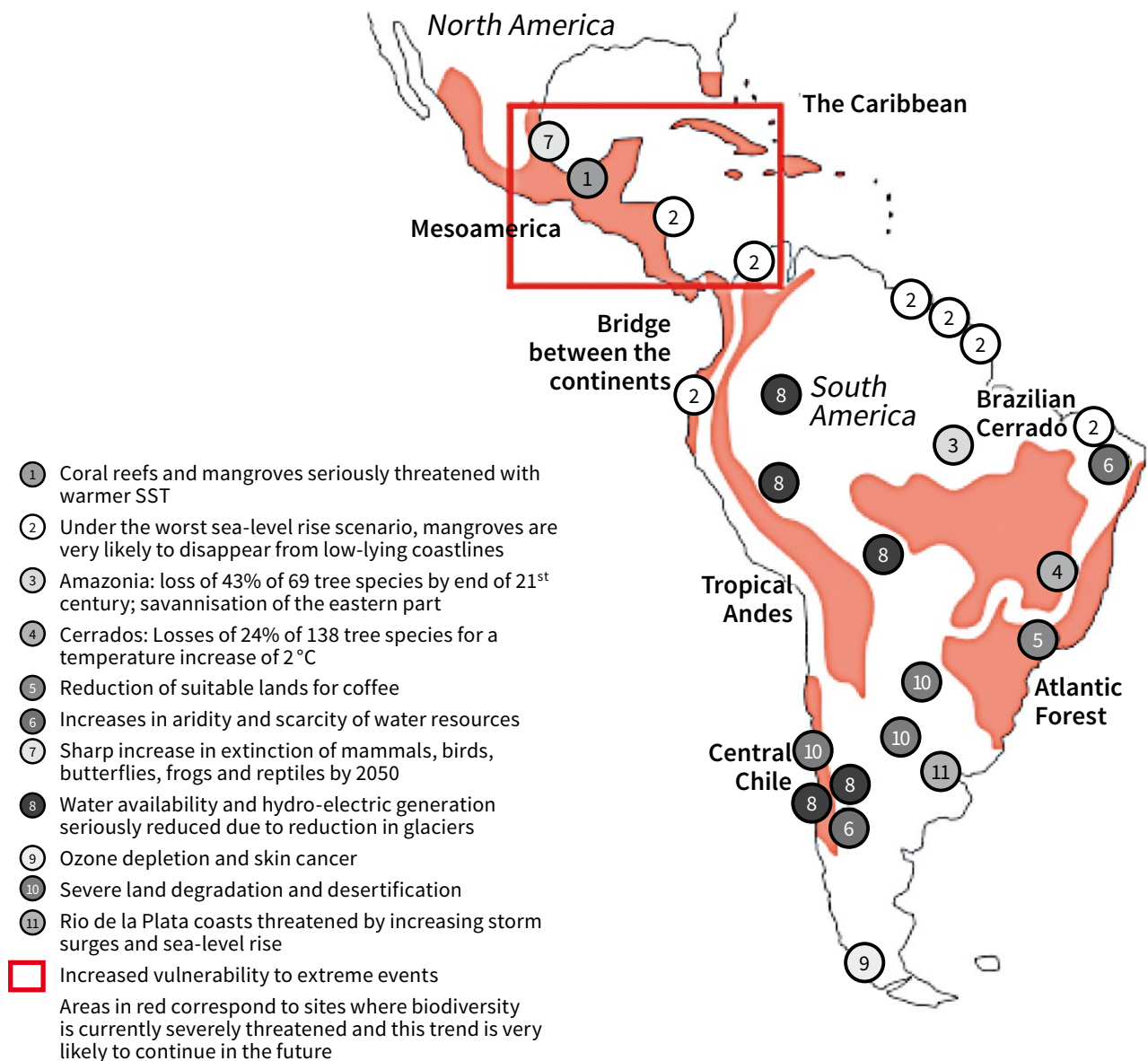
13. Work together using **M 20** and building on **M 18** and **M 19** to create an overview of the consequences of climate change for agriculture and food security in Asia.

14. Using the example of **M 20**, list the climatic and non-climatic causes of food price increases in Asia.

Latin America – various potential threats – hotspot Amazon

M 21

Key hotspots for Latin America



(Source: 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, Cambridge University Press. Chapter 10, p. 481.
http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg2_report_impacts_adaptation_and_vulnerability.htm, accessed 13.02.2014.)

M 22 Projections for the 21st century

If emissions climb too high by the end of the 21st century, an average temperature rise of up to 6°C has been projected for Latin America (IPCC scenarios), which is approximately comparable to global average values. Even if the weak climate protection measures promised to date

are implemented, a temperature increase of 3–4°C is expected. In both scenarios, weather and climate extremes will occur more frequently, which will have an adverse effect on many sectors and ecosystems. With 4°C warming, parts of the Amazon region could become a steppe.

M 23 The Amazon in climate change

Prognoses assume that agricultural yields (soy beans, for example) will rise in the more moderate zones of Latin America. However in the drier regions, climate change will increase soil salinization. Agricultural farmland for a few particularly important crops, such as soy beans and grasslands for animal production, will decrease. The rise in temperature and associated loss of soil moisture, coupled with anthropogenic deforestation could mean that

in a few decades tropical rainforests will turn into savannah landscapes. The Amazon region is under particular threat. This would be accompanied by a dramatic drop in biodiversity and soil quality. The Amazon region would thus transform from one of the most significant global CO₂ sinks (drawing CO₂ from the air) to a large-scale emitter of CO₂.

M 24a Impact of meat consumption on food conditions

“One highly relevant factor in the worldwide food situation is the demand for meat: depending on the animal and feed, a pound of meat requires between 2.6 and 7 pounds of grain [...], which is then no longer available for direct human consumption.”

Fodder required (in pounds) to produce 1 pound of meat:

▶ Chicken	2.6
▶ Pork	6.5
▶ Beef	7.0

This refers to maximum values in the US production system

(Source: Van de Sand, K. (2013) Die Risiken nehmen zu. Germanwatch-Trendanalyse zur globalen Ernährungssicherung 2013. Germanwatch, Bonn, p. 8f. <http://germanwatch.org/de/7068>, accessed 28.01.2014)

M 24b

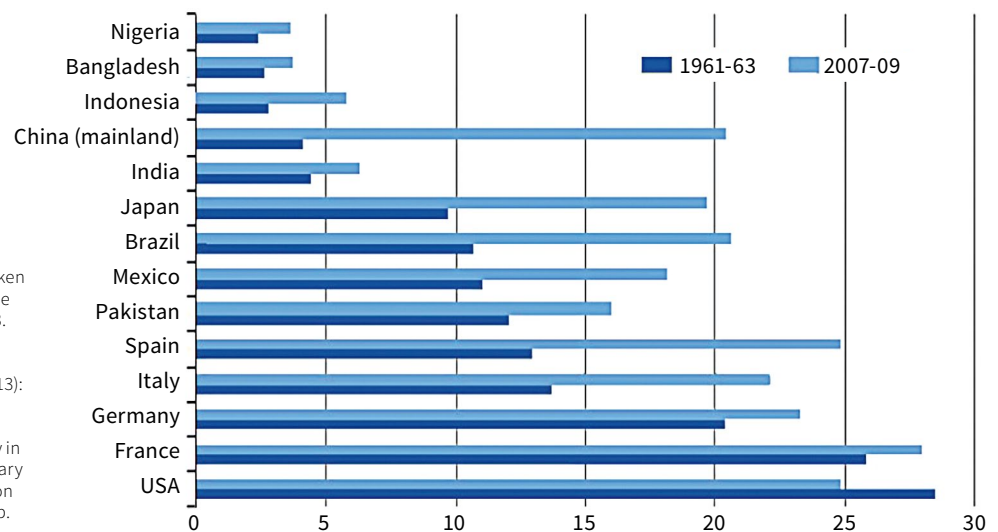
Development of meat consumption

“ The last few years have been interesting in terms of production and consumption of meat, because in this period, the major emerging countries, essentially the BRIC countries (Brazil, Russia, India, China) have seen a comparative strengthening of income. Higher income brings about greater consumption of meat, which means that the demand for meat is growing in developing and emerging countries. [...]

The graphic below shows that the proportion of animal-based food has significantly increased in poor developing countries and particularly in emerging countries over the last 50 years – in poorer countries still at the low level of around 5%, in China and Brazil about 20%, which is almost the same as rich industrialised countries like the USA, Japan and Germany. ”

(Source: Van de Sand, K. (2013) Die Risiken nehmen zu. Germanwatch-Trendanalyse zur globalen Ernährungssicherung 2013. Germanwatch, Bonn, p. 8f. <http://germanwatch.org/de/7068>, accessed 28.01.2014)

Average proportion of animal-based food (in %) of daily energy input from food products, 1961 to 2009



(Source: Van de Sand, K. (2013): Die Risiken nehmen zu. Germanwatch-Trendanalyse zur globalen Ernährungssicherung 2013. Germanwatch, Bonn, p. 8f. <http://germanwatch.org/de/7068>, accessed 28.01.2014; based on Pies (2013): Equality of opportunity through food security, p. 24, based on IFAD, WFP und FAO (2012): The State of Food Insecurity in the World – Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition. FAO, Rom, p. 19 and 26).

M 25

Meat for the world

“ In the first ten months of 2012, Brazilian marketers sold 1.03 million tonnes of beef and earned a good 12% more than for the equivalent period in the previous year. At the same time this brought an increase in turnover of just under 7%.

Russia was once again the main recipient, taking 22% of beef exports. Hong Kong, with around 17%, and Egypt,

at 11%, were also major recipients. Deliveries to Egypt experienced major growth (+44%).

Germany hardly figures as a recipient of Brazilian beef any more. With just under 5800 tonnes it represents a drop of almost 22% and just 0.6% of Brazil's entire exports. At the same time turnover fell by 35%. ”

(Source: Top Agrar from 23.1.2013: Rindfleischexporte aus Brasilien gestiegen. <http://www.topagrar.com/news/Markt-Marktnews-Rindfleischexporte-aus-Brasilien-gestiegen-1040808.html>, accessed 28.01.2014)

EXERCISES

- Evaluate the map M 21 and identify the climate change hotspots with reference to their adverse impact on future food conditions (M 22).
- Explain the consequences that worldwide meat consumption has on food security and what trends we might expect in the future (M 24a and M 24b).
- Using texts M 23–M 25, respond to the statement “Soy and beef – a blessing for Brazil”.

Adaptive measures and food security – what are the options?

M 26

Adapting to climate change in Bangladesh

Questions for Fedausur Rahman, head of the Prodipan organisation (Bangladesh):

“What is Prodipan doing to help people in the face of climate change?

Firstly we are explaining the background of climate change to them. Because while many people feel its effects, they don't know what causes it. And then we show them how they can adapt their lives to changes in the climate. For example, by growing products which can withstand salt water, such as reeds, which are used in

the production of matting and fencing, or other grasses which can be sold at the market. We explain to them how they can set up rainwater tanks from which they can draw drinking water so they're no longer depending on salinated water from wells. And we help them to explore new income streams, for instance by using small loans to open up a tailor's or develop a shrimp farm.”

(Source: Brot für die Welt (2007): Antworten auf den Klimawandel. Projektinformationen Bangladesch/Prodipan. No longer available online)

M 27

Typology of adaptive responses to climate change impacts in the context of agricultural productivity and food security

Response	Proactive	Reactive	Inaction
International	Guidelines for national adaptation strategies, support for development of new crop varieties	Food aid measures	No responses are taken to instigate context-specific behavioural responses
National	Grain storage, investments and changes in agricultural policies to adapt crop mix and agricultural practices to changing climate	Changes in tariffs and fiscal policy to augment food imports; disaster relief and food aid	No small-scale proactive investments in infrastructure that confer only local adaptive benefits
Local	Small-scale infrastructure investments for groundwater recharge, irrigation and flood protection, local seed banks, and coordination of adaptive responses	Collective action and reciprocity in overcoming obstacles in agricultural production and mitigating the effects of shortages of food and water	Mitigation ignored as an active response
Individual	Diversification of livelihood, investment in human capital, and alteration of agricultural practices	Migration	Adjustment of increased vulnerability and/or reduced welfare

(Source: Paavola, J. and W.N. Adger (2002): Justice and adaptation to climate change, p. 9. <http://www.tyndall.ac.uk/sites/default/files/wp23.pdf>, accessed 28.01.2014)

M 28

Africa's adaptive capacities

In Europe, government authorities, scientific research institutes, agricultural associations, etc. have already begun a systematic evaluation of the impact of climate change. Farmers are already receiving initial recommendations for how they can best respond to changing growing cycles. In most developing countries the situation is completely different. Although it is precisely the tropical and sub-tropical countries that are most at risk from climate change, in many of these countries, particularly in Africa, government institutions have barely acknowledged the issue of climate change. Rural areas have been neglected in the last two decades and this continues to inform government actions. National elites in many countries have

barely taken notice of small scale farming. In many countries, too, governments are particularly weak altogether, barely able to ensure tax revenues, with institutions often plagued by corruption. Furthermore, some African countries are affected by civil war situations. In Africa, especially, many countries lack proper research institutes and an adequate number of expert climate researchers, breeding experts and agricultural researchers. Moreover, it is particularly the poorer developing countries which lack the financial resources to carry out the required adaptation programmes. And so the scope for adaptive measures is much lower in Africa than it is in Asia or Latin America.

(Source: own translation of Bals, C. et al. (2007): Klimawandel und Ernährungssicherheit. Trends und zentrale Herausforderungen. Erste Ergebnisse eines gemeinsamen Studienvorhabens. Bonn/Stuttgart, p. 12)


EXERCISES

18. There are a number of diverse measures for adapting to climate change, in different dimensions. Using **M 26 and M 27**, describe opportunities for adaptation, and then investigate them with regard to different time periods.

19. Using information from **M 27 and M 28**, discuss the central problems faced by Africa in adaptation, paying equal attention to aspects which are not directly determined by the climate.