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Institute for Environment and Human Security

Bündnis Entwicklung Hilft

Brot für die Welt · welthungerhilfe · terre des hommes Hilfe für Kinder in Not · medico international · MISEREOR Ihr Hilfswerk · cbm · Kinder in Not

Focus: food security

WorldRiskReport 2015

In cooperation with

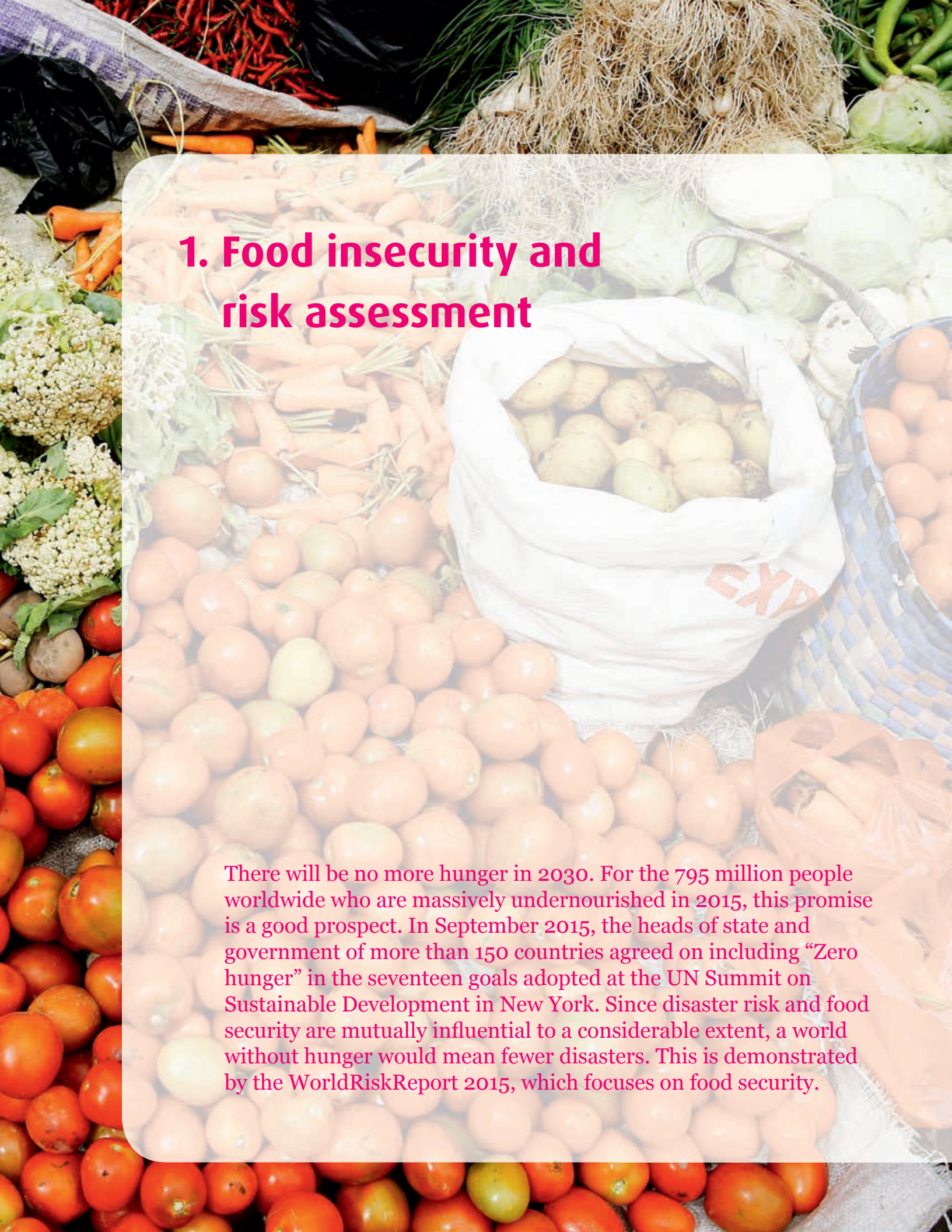
Universität Stuttgart

www.WorldRiskReport.org

The print version of the WorldRiskReport has a volume enabling fast reading. The texts of the Report are supplemented by maps, diagrams and pictures to illustrate their content. More in-depth information, scientific details of the methodology applied and tables are available at www.WorldRiskReport.org. There, the 2011, 2012, 2013 and 2014 Reports can be downloaded, too.

The term "developing countries":

Finding the right word for the "poor countries" in Africa, Asia and Latin America is not unproblematic. For one thing, different terms are used by the various global organizations (the UN, UN organizations, the World Bank) in this context. Second, any expression one might use will be questionable. "Third World" is a term that the countries thus referred to will hardly appreciate. "Developing countries" suggests that the countries in North America or Europe are developed and the countries in the other continents are underdeveloped. Of course we do not subscribe to such a simple view, but we have nevertheless opted for using the term developing countries (not in inverted commas) in this report. In accordance with UN practice, it refers to all countries in Africa, Asia (with the exception of Japan, South Korea and Taiwan) and Latin America, including the emerging countries.



1. Food insecurity and risk assessment

There will be no more hunger in 2030. For the 795 million people worldwide who are massively undernourished in 2015, this promise is a good prospect. In September 2015, the heads of state and government of more than 150 countries agreed on including “Zero hunger” in the seventeen goals adopted at the UN Summit on Sustainable Development in New York. Since disaster risk and food security are mutually influential to a considerable extent, a world without hunger would mean fewer disasters. This is demonstrated by the WorldRiskReport 2015, which focuses on food security.

The author:
Peter Mucke is Managing Director of Bündnis Entwicklung Hilft.

By 2030, food will have to be available for an additional 1.2 billion people, a figure that corresponds to India's entire present population. The world population is set to grow from 7.3 billion people in 2015 to 8.5 billion in 2030. Nevertheless, arithmetically, the "Zero hunger" goal set by the international community of states is not unrealistic. Already today, 5,000 kilocalories of food is produced per person per day, whereas an individual only requires 1,800 kilocalories a day not to go hungry. Fair distribution, avoiding wasting food, moderate meat consumption, and giving up gaining diesel, petrol, and oil from agricultural production are important elements in attaining "Zero hunger". Political will and the fulfillment of financial pledges reiterated by the governments at the UN Sustainability Summit are crucial to achieve this. The Perspectives Chapter in the WorldRiskReport 2015 (starting on page 52) presents a wide range of solution strategies and recommendations.

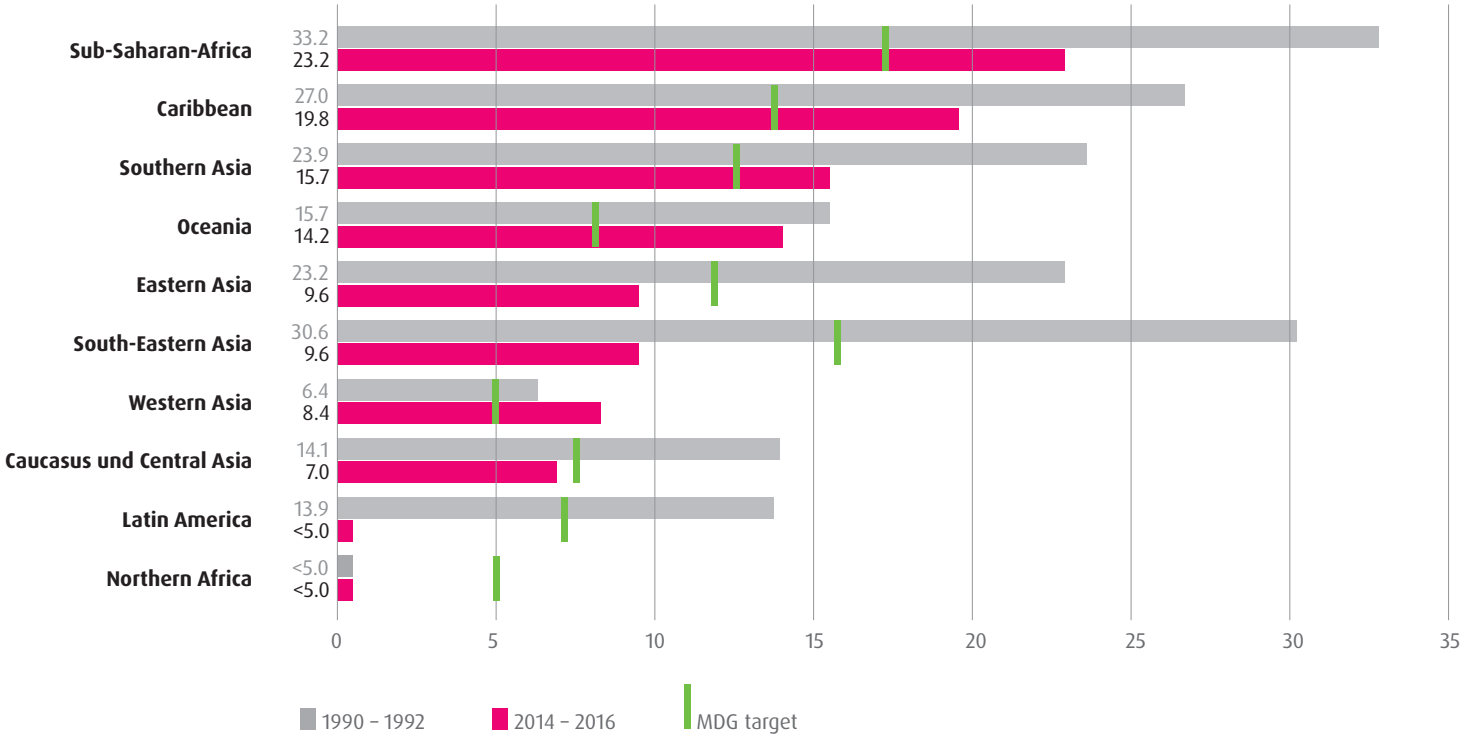
Disasters, wars and crises are a threat to "Zero hunger"

There is one fact that still continues to be an obstacle to achieving "Zero hunger": In many countries that have missed the international Millennium Goal of eliminating extreme poverty and hunger, disasters, wars or political instability have triggered or aggravated increased vulnerability and food insecurity. In these contexts, it is difficult to effectively implement measures to protect vulnerable sections of the population and improve their livelihoods (FAO/ IFAD/ WFP 2015b). Comprehensive food security cannot be attained without disaster and crisis prevention.

In accordance with its definition by the UN Food and Agriculture Organization (FAO), food security has four dimensions:

+ availability
+ access
+ utilization
+ stability.

Figure 1: Share of undernourished worldwide according to region (FAO/IFAD/WFP 2015b)



Sufficient **availability** is given, when adequate food can be provided through people's own production or via the markets (this includes production, warehousing, food imports, and food aid). **Access** to food means that all households and their members are really able to get the food that is available. Obstacles to such access include income inequalities, price levels, trade systems and restricted distribution mechanisms. Thus access strongly depends on societal, economic and political conditions. The dimension of **utilization** comprises an individual's health condition in connection with a diversified diet, clean and hygienic preparation of the food, and the existence of clean drinking water, healthcare and sanitation. The physical ability to fully take up food and turn it into energy is also crucial to an individual's health condition. Special criteria have to be applied in the case of population groups with special needs, such as infants or pregnant women. The dimension of **stability** refers to whether the three afore-mentioned dimensions are maintained over time. Stability can be threatened e.g. by armed conflicts or disasters. This may be chronic insecurity owing to recurrent bottlenecks or temporary instability, for instance during an extreme natural event (FAO/ IFAD/ WFP 2013).

Thus, food security is the result of interaction between various factors, ranging from production and warehousing through access to clean water to social and political dimensions such as the right to food, healthcare, power and property relations, as well as access to resources. Extreme natural events, like drought or floods and the impacts of climate change, can massively disturb the entire chain of food supply. Production, processing and procuring of food may be affected just as much as warehousing and the preparation and consumption of food.

Risk assessment

The relation also applies in the reverse direction. As long as there is food insecurity, extreme natural events are going to have

Glossary

+ Food security
A situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Based on this definition, four food security dimensions can be identified: food availability, economic and physical access to food, food utilization and stability over time.

+ Food insecurity
A situation that exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life. It may be caused by the unavailability of food, insufficient purchasing power, inappropriate distribution or an inadequate use of food at the household level. Food insecurity, poor conditions of health and sanitation and inappropriate care and feeding practices are the major causes of a poor nutritional status. Food insecurity may be chronic, seasonal or transitory.

+ Chronic Undernourishment or Hunger
A state, lasting for at least one year, of inability to acquire enough food, defined as a level of food intake insufficient to meet dietary energy requirements. For the purposes of this report, hunger was defined as being synonymous with chronic undernourishment.

+ Undernutrition
The outcome of undernourishment, and/or poor absorption and/or poor biological use of nutrients consumed as a result of repeated infectious disease. It includes being underweight for one's age, too short for one's age (stunted), dangerously thin for one's height (wasted) and deficient in vitamins and minerals (micronutrient malnutrition).

+ Malnutrition
An abnormal physiological condition caused by inadequate, unbalanced or excessive consumption of macronutrients and/ or micronutrients. Malnutrition includes undernutrition and overnutrition as well as micronutrient deficiencies (FAO/IFAD/ WFP 2015b).

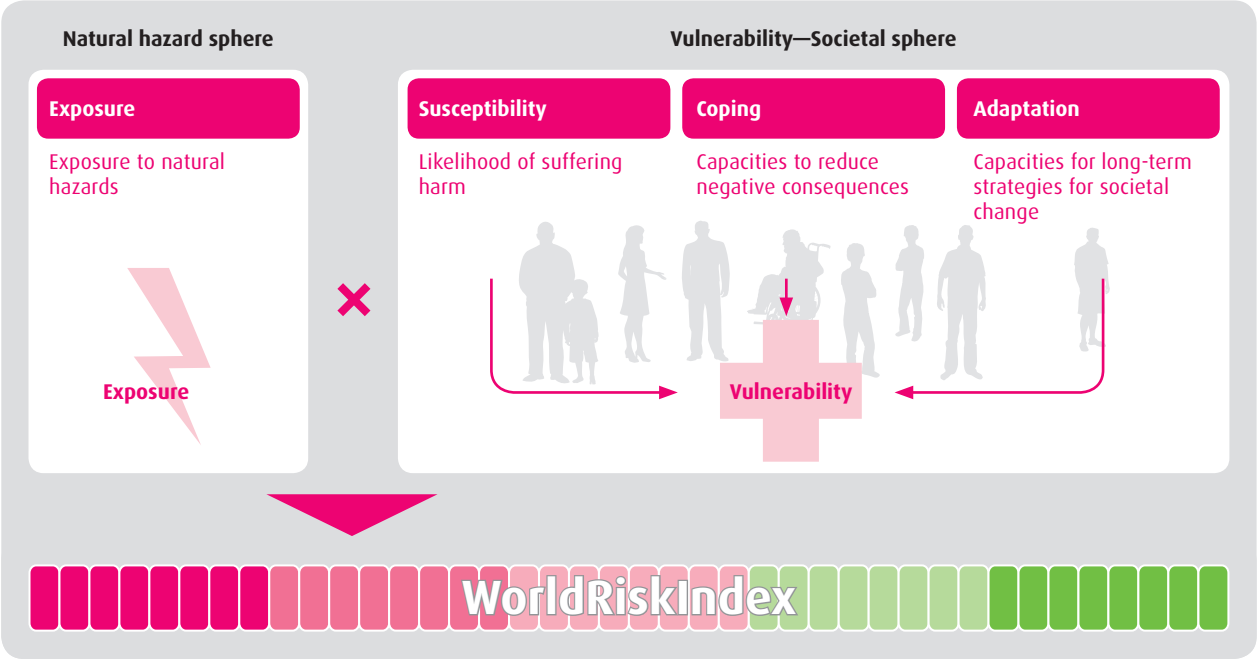


Figure 2: The WorldRiskIndex and its components

disastrous impacts. In the event of a natural hazard, a poorly fed population will be more vulnerable than one that is well fed (Bündnis Entwicklung Hilft 2011). Thus, the share of the malnourished population is one of the indicators of the disaster risk as assessed by the WorldRiskIndex 2015 (see Chapter 3).

In risk assessment, the WorldRiskReport sets out from the general notion that the severity of the forces of nature hitting people is not the only crucial factor but that a society's level of development counts just as much. It is on this basis that the WorldRiskIndex calculates the disaster risk for 171 countries worldwide (see Figure 3 on page 9).

The **WorldRiskIndex** is meant to give answers to four key questions:

- How likely is an extreme natural event, and will it affect people?
- How vulnerable are people to natural hazards?
- To what extent can societies cope with acute disasters?
- Is a society taking preventive measures to face natural hazards to be reckoned with in the future?

The representation through the Index and its four components provides answers to this and highlights both, the problems and the fields of action, very clearly. Nevertheless, it is also important to keep the limits of such a representation in mind. Just like any other index, the WorldRiskIndex can only consider indicators for which comprehensible, quantifiable data is available. For example, while direct neighborly help cannot be measured in a disaster event, it is nevertheless very important. It cannot be fed into the calculation of the WorldRiskIndex for lack of data. Furthermore, the quality of data between different countries may vary if data gathering is conducted only at national level and not by an independent international institution. This is why, in addition to the data section with a quantitative interest, the WorldRiskReport always has a focus chapter with a qualitative approach that looks at the background and context – this year of the topic "food security". Its absence, i.e. food insecurity, is closely connected to the phenomena of hunger, undernutrition, and malnutrition (see Glossary on page 7 for these terms). Children are particularly endangered. During pregnancy and in the first years of life, undernutrition and malnutrition can result in developmental

defects and disabilities. In turn, children with disabilities suffer hunger more frequently than non-disabled children, since, for example, they attend school less often and therefore cannot benefit from school meal programs (CBM 2014).

The costs and the law

It would cost an additional 160 US dollars a year for each person living in extreme poverty to eliminate hunger over the period between 2015 and 2030. To achieve and sustain this goal, the international community of states would have to raise 267 billion US dollars a year, a task that can be accomplished given that this sum is a mere 0.3 per cent of the global gross domestic product. According to the UN report "Achieving Zero Hunger", this money is needed for social security (116 billion US dollars a year), in rural development and agriculture (105 billion US dollars) and for investments in urban development (46 billion US dollars) (FAO, IFAD and WFP 2015). For the 800 million people below the poverty line, i.e. living on not more than 1.25 US dollars a day, this combination of combating hunger and investing in future productivity would enable a crucial change: getting out of spiraling poverty and entering a cycle enabling an income of one's own and investing in one's own future.

These are not mere alms or favors. The right to sufficient food was already established in Article 25 of the Universal Declaration of Human Rights with a binding international law status in 1948 (United Nations General Assembly 1948). The international community of states reiterated this right in Article 11 of the UN Social Pact in 1966 (United Nations General Assembly 1966). Each government that has signed the UN Social Pact is obliged to implement the right to food.

Refugee food insecurity

The food supply situation is particularly precarious for refugees and internally displaced individuals. In many cases, the right to food is not guaranteed by these people's own government, the neighboring countries are then overburdened, and often enough, the UN High Commissioner for Refugees (UNHCR) as well as the World Food Programme (WFP) lack the money needed. Usually, it is not extreme natural events that people are fleeing from but wars or conflicts. In 2014, more than half of all refugees under the mandate of the UNHCR came from the three countries of Syria (3.88 million), Afghanistan (2.59 million), and Somalia (1.11 million), all countries in which systems of government and social security are, to a large degree, now absent. The neighboring countries, such as Turkey (1.59 million

This has to be enough to survive

These were the quantities distributed by, for example, Welthungerhilfe in cooperation with the World Food Programme in Rubkona County in South Sudan in June 2015. As a rule, packages with a monthly ration for one family (6 persons) were handed out (90 kg of sorghum, 9 kg of pulses, 5.4 liters of oil, 900 g of salt).

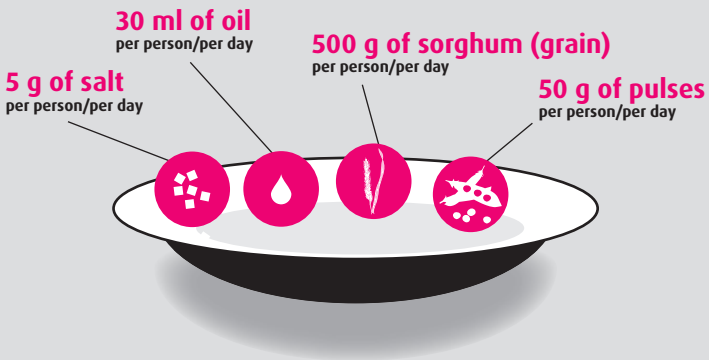


Figure 3: Emergency ration in South Sudan in June 2015

refugees), Pakistan (1.51 million) and Lebanon (1.15 million) are unable to care for the refugees on their own (UNHCR 2015). However, international support, for example in food and water supplies, is underfinanced. In Iraq, for instance, the WFP had to massively reduce the emergency rations for almost a million internally displaced people in the country (WFP 2015b). Already in April 2015, the value of food vouchers was reduced from 26 to 16 US dollars, and in August, the monthly emergency rations for the families had to be halved – to 40 instead of the 80 per cent of a family's actual needs.

"Zero hunger" by 2030

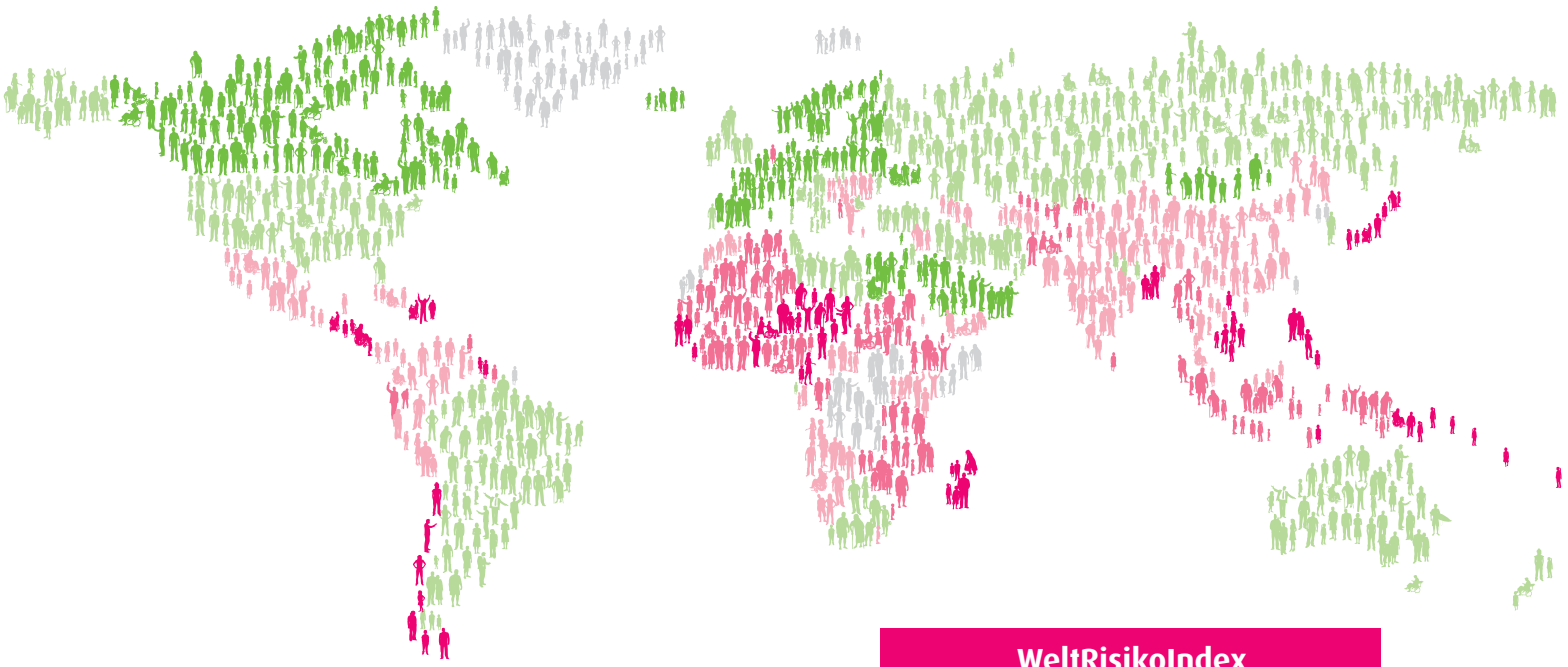
The Millennium Development Goals (MDGs) already had a strong focus on food security, and significant successes were achieved with their implementation. Nevertheless, there were regional differences. While the MDG goal of halving the number of those suffering hunger was fully achieved in East Asia and Southeast Asia, the reverse trend was observed in West Asia (FAO/ IFAD/ WFP 2015b). In the regions of Sub-Saharan Africa, the Caribbean, South Asia, and Oceania, the hunger situation improved, although the MDG goal was missed (see Figure 1, page 6). In addition, across the world, approximately two billion people are suffering from a lack of essential vitamins and minerals – so-called hidden hunger (von Grebmer et. al. 2014).

Extensive political efforts and financial support on the part of the international finance institutions and the donor countries will be required to achieve the new "Zero hunger" goal by 2030 (see Chapter 4). Models of the future relating to climate change and its impacts show that the frequency of extreme natural events is increasing, reducing the time left for both the societies hit and the ecosystems to regenerate (see Chapter 2.1). Conflict and crisis situations raise vulnerability and hence exacerbate the negative impacts of extreme natural events. Thus the "Zero hunger" goal also presupposes that climate change is stemmed, adaptive strategies against weather-conditioned and other disasters are developed and political solutions are found for millions of refugees and internally displaced persons.

In Chapter 2, this report shows where there is a particularly urgent need for action in the context of food security and disaster risk, and in Chapter 4, it provides a selection of recommendations to secure food supply and prevent disasters.

The concept of the WorldRiskReport

"Whether it be an earthquake or a tsunami, a cyclone or floods, the risk of a natural event turning into a disaster always depends only partly on the force of the natural event itself. The living conditions of the people in the regions affected and the options available to respond quickly and to provide assistance are just as significant. Those who are prepared, who know what to do in the event of an extreme natural event, have a greater chance of survival. Countries that see natural hazards coming, that are preparing for the consequences of climate change and are providing the financial means required will be better prepared for the future. The WorldRiskReport should contribute to look at these links at a global level and draw future-oriented conclusions regarding assistance measures, policies and reporting" (Bündnis Entwicklung Hilft 2011).

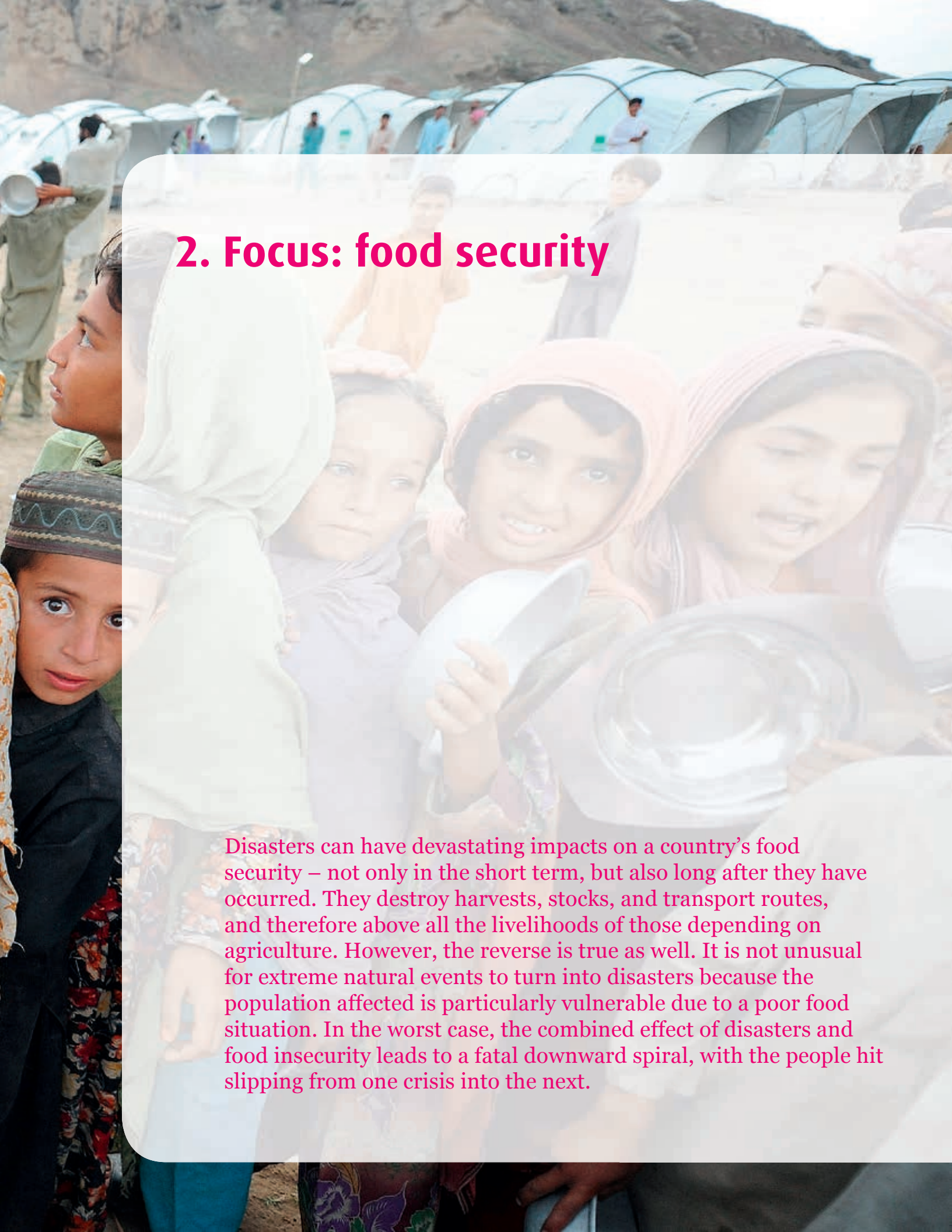


Results at a glance

Where is the highest disaster risk in the world? In other words, where do natural hazards coincide with a vulnerable society? The WorldRiskIndex identifies the disaster risk hotspots in Central America, in the Southern Sahel, in Southeast Asia, and in Oceania – conspicuously often, countries with a high or very high risk are situated close to the equator. High exposure towards natural hazards is a significant risk driver, as demonstrated by the example of Japan. Owing to its exposure (the fourth highest worldwide), Japan belongs to the class with a very high disaster risk (ranking seventeenth worldwide), although, thanks to its very good level of development, the country shows only a very low level of vulnerability (the fifteenth best value worldwide). Liberia is the opposite example. While this West African country bears only a very low exposure (rank 113 of 171 countries), Liberia is extremely vulnerable due to its very poor economic and social situation – as was also dramatically demonstrated in the 2014/2015 Ebola epidemic. Liberia ranks sixth in the worldwide vulnerability comparison. The result is that it has a high disaster risk, putting it in fifty-seventh position worldwide. Looking at the table on the right, it is noticeable that no less than six island nations are among the 15 countries with the highest risk worldwide – and the remaining nine are also situated next to the sea. This especially exposes them to sea-level rise, cyclones, and floods. The other end of the ranking mainly comprises highly developed countries all of which bear only a very low level of exposure towards natural hazards.

WeltRisikoIndex

Rank	Country	Risk (%)
1.	Vanuatu	36.72
2.	Tonga	28.45
3.	Philippines	27.98
4.	Guatemala	20.10
5.	Solomon Islands	19.29
6.	Bangladesh	19.26
7.	Costa Rica	17.17
8.	Cambodia	16.82
9.	Papua New Guinea	16.82
10.	El Salvador	16.80
11.	Timor-Leste	16.23
12.	Brunei Darussalam	16.15
13.	Mauritius	14.66
14.	Nicaragua	14.63
15.	Guinea-Bissau	13.78
146.	Germany	3.00
157.	Israel	2.39
158.	Norway	2.28
159.	Egypt	2.26
160.	Finland	2.26
161.	Singapore	2.24
162.	Sweden	2.22
163.	United Arab Emirates	1.84
164.	Bahrain	1.76
165.	Kiribati	1.73
166.	Iceland	1.55
167.	Grenada	1.44
168.	Barbados	1.22
169.	Saudi Arabia	1.10
170.	Malta	0.62
171.	Qatar	0.08



2. Focus: food security

Disasters can have devastating impacts on a country's food security – not only in the short term, but also long after they have occurred. They destroy harvests, stocks, and transport routes, and therefore above all the livelihoods of those depending on agriculture. However, the reverse is true as well. It is not unusual for extreme natural events to turn into disasters because the population affected is particularly vulnerable due to a poor food situation. In the worst case, the combined effect of disasters and food insecurity leads to a fatal downward spiral, with the people hit slipping from one crisis into the next.

2.1 How disasters and crises affect food security

The author:
Bernhard Walter is Food Policy Advisor for Brot für die Welt.

When Nepal was shaken by an earthquake on the 25 April 2015, more than 8,000 people died, and tens of thousands were injured. It soon became clear that the quake was also seriously impacting the population's food situation. Food security deteriorated in all areas affected. In remote mountain regions, not enough or barely enough food was available for 70 per cent of the population. Half of the people could only have an unbalanced diet. There was an almost total collapse of food markets, and households depending on wage labor had to come to terms with income losses of more than 30 per cent. Around 35 per cent of the households depended on food aid. In addition, the earthquake had also caused widespread losses of food stocks. In one of the worst affected areas, 80 per cent of the population lost their entire food stocks, and in all areas, people lacked 70 per cent of their reserves. In addition, many farmers were devoid of valuable farming equipment and seed – with long-term consequences, for the majority of the population in the areas hit live on agriculture (Nepal Food Security Cluster 2015).

Over the last few years, there has been a significant increase in the number of extreme natural events like the earthquake in Nepal. According to the Food and Agriculture Organization, the agricultural sector is among the most strongly affected economic areas in this respect (FAO 2015b). While out of 78 extreme natural events between 2003 and 2013, "only" 22 per cent concerned agriculture, the impacts are disproportionately high. For worldwide, 2.5 billion people directly depend on agriculture to survive. Not rarely, a natural event that harms harvests, equipment, seed or livestock can threaten the livelihoods of those affected.

Three levels of food security

Food security can generally be looked at at three levels: the global, national and household levels (Brot für die Welt et al. 2011):

+ **Food security on a global scale** is the level to set out from for an analysis of general trends and to gain an understanding of the possible impacts of e.g. climate change on agriculture. This is of importance since these trends have an effect on the worldwide level of agricultural prices and influence the decisions made by producers.

+ **The national level** is where most of the decisions on food security are taken, for example on how much finance is available for the national agricultural policy. Central elements of adaptive strategies in response to crises and disasters are defined at a national level.

+ **Food security at the household level:** Without a detailed examination of the impacts on the household level, it would not be possible to gain an understanding of the specific needs of each individual with regard to food security. Such knowledge is key to the support of groups most threatened by food insecurity in the event of a crisis.

These distinctions show that food security given in a country as a whole cannot always be equated with food security at regional level or at household level, and this also determines the measures to be taken in the event of a crisis. It can result in food particularly rich in minerals and vitamins being handed out specially to pregnant women and infants in order to address their particular situation, whereas other groups, such as nomads, receive animal feed so that they can again keep livestock to earn a living.

There are a number of potential risk drivers for all three levels of food security: natural hazards some of which are exacerbated by climate change on the one hand, and crises

Seed and education for healthy children

Since the food crisis of 2007/2008, Burkina Faso has repeatedly been hit by famine brought about above all by climate fluctuations, growing population density and changes in land use. In the spring of 2012, a drought period lasting several months led to serious food shortages. Around 2.85 million people in 170 rural communities of Burkina Faso, especially in the country's north, were threatened by hunger. At the beginning of 2012, there was a disproportionately high increase in food prices. For example, millet cost 85 per cent more than the annual average. Above all peasants without land of their own had to sell their livestock in order to be able to buy the expensive grain, and there was a drastic drop in grain production. In addition, in the same period, more than 46,000 refugees came across the border into the north of Burkina Faso from Mali, which was hit by civil war. This additionally aggravated the food situation.

As a result, around 300,000 children suffered from malnutrition. About a third of them were underweight, with 13 per cent in a state of acute malnutrition. Owing to an unbalanced diet, many children lacked micronutrients such as iron, zinc, iodine and vitamin A, which made them particularly susceptible to night blindness and developing goiters. Especially during the first 1,000 days of life, which are particularly crucial to a human being's further course of life, i.e. in pregnancy and in the first two years of life, chronic micronutrient deficiency can lead to irreversible delayed physical and cognitive development among children. Moreover, undernourished and malnourished babies are highly susceptible to infectious diseases such as diarrhea and pneumonia. As a rule, if they do not receive medical care in time, they will die of these avoidable diseases.

terre des hommes launched an emergency relief program in the drought region in the north of Burkina Faso in April 2012 together with their local partner organization "Association D'aide aux Enfants et aux Familles Démunies" (ADEFAD). 5,600 children from more than 1,000 families obtained millet bought in Western Burkina Faso. Seed for beans and groundnuts was handed out to the women. They were able to make use of the main agricultural season from May to September 2012 to grow them in.

However, the very heavy rain that started in September only partly resulted in a better harvest, but also destroyed farmland and necessitated resettlements, which in turn reduced agricultural production. terre des hommes financed further food programs and transformed the emergency relief program into a longer term program to improve food supplies in ten communities. Starting kitchen gardens and planting various varieties of vegetables such as carrots, beans and lettuce provided the village inhabitants with important nutrients. In order to spot the first signs of malnutrition in time and have diseases treated in their early stages, the women were given vouchers for a free-of-charge visit to a health center and medical care for their children.

In parallel, ADEFAD launched a training program for 200 women who learned how to provide their children with nutritious food – for example by exclusively breastfeeding them in the first six months. The results were impressive. None of their children had to be referred to a special health center because of undernourishment or malnutrition. The babies and infants attained a normal weight and grew up in good health. terre des hommes supported the ADEFAD project with 140,000 Euros up to May 2015.

Tanja Funkenberg, Officer for children's rights and health at terre des hommes

and conflicts as well as the globalization of agriculture on the other.

Natural hazards

Natural events such as earthquakes, storms, floods, droughts and sea-level rise have very different effects on food security at global, national and household level. At global level, droughts in the 2000s resulted in considerable losses of wheat and maize in the USA, Russia and Australia. These droughts were one of the most important reasons for the worldwide stocks of grain to diminish step by step, reaching their lowest level since 1974 in 2008/2009. The result was that world food prices doubled in comparison to the years 2002 to 2004 (FAO 2015a), while the number of those suffering hunger rose by 150 million to more than a billion in 2010.

For example, the droughts in the Sahel countries in the 1970s and 1980s had devastating impacts at national level, affecting around 50 million people and resulting in an estimated one million people dying of hunger and disease. But in 2011/2012 too, extreme dryness in Burkina Faso, Mali, Niger and Chad led to shortages of food (Haeseler 2012). Heavy rainfall following this period of drought triggered floods that in turn destroyed part of the cultivated land and the food stocks. In all four countries, the number of people suffering from hunger remains at a high level and is even growing in some areas (FAO/IFAD/WFP 2015b).

As the effects of the floods in Pakistan in 2010 show, just like drought, flooding can have an impact on national food security if infrastructure such as roads, bridges or irrigation systems in catchment areas of major rivers is destroyed. The fertile river flood plains are then also affected, so that failed harvests owing to excessive flooding in these areas can considerably impair national food supplies.

However, earthquakes and cyclones can also lead to national disasters. When Cyclone Mitch struck in Central America in November 1998, 10,000 people were killed in Honduras. A further two million people were made homeless, and it was only possible to accommodate a small proportion of them in emergency shelters provided by the government or privately. The harvest was almost totally destroyed. In particular, 70 per cent of the areas under cultivation with the country's two most important export products, coffee and bananas, was destroyed by the flooding that Mitch had caused (Bornhorst 1999; Mosbrucker/Mosbrucker 2008).

In coastal and island nations, sea-level rise has a long-term negative effect on food security. It leads to soil salinification and renders the cultivation of important staple food crops impossible. In Bangladesh, for example, rice growing in the coastal regions has declined because storms keep on pressing seawater into the land, where it then remains for several days. The increased salt concentration in the soil kills off the plants. Entire population groups are losing their livelihoods because of this. Saltwater advancing into low-lying areas also poses a threat to freshwater fishery, which alone in Bangladesh sustains the livelihoods of 1.35 million families (Diakonie Katastrophenhilfe 2009).

The deterioration of food security due to disasters in the wake of extreme natural events – regardless of which type – can be felt most strongly at household level. Poor households with only a small income and hardly any property or savings are particularly hard hit when all stocks or forthcoming harvests are destroyed. The collapse of infrastructure then often makes it difficult to provide these families with food in the short term. Regional and local markets are cut off from the outside world. In the regions affected, the prices of staple food rise considerably. Not only is there a lack of caloric supply but food quality is impaired, too. Now people only have food containing starch to eat, while fruit and vegetables with important micronutrients are not available. In such

situations, food aid providing staple foods is essential. Here, care has to be taken that as far as possible, aid should come from inside the country affected or from neighboring countries, be culturally adapted, correspond to dietary habits and contain the necessary micronutrients.

How long a disaster takes is crucial to the impacts on the long-term food security of (poor) households. In the long term, long-lasting droughts or those occurring at ever shorter intervals or sea-level rise in particular lower the viability of tillage or animal husbandry. For example, many pastoralists or nomads in West and East Africa can no longer earn a living and migrate to regions where there is more rainfall. But there, land is usually hard to come by, and conflicts with the local population develop.

Climate change

The frequency and extent of these natural food security risk factors are aggravated by an anthropogenic factor: climate change. Currently, we are moving on a trajectory that would make the world four degrees warmer by the end of the century (World Bank 2012). The consequences would be devastating – above all for global food security. In addition to a dramatic loss of biodiversity and the collapse of maritime and terrestrial ecosystems, there is a threat of drastic drops in yield through heat stress among many crop plants. But not only would temperatures change – there would also be strong temporal and spatial shifts in precipitation and evaporation. The frequency of droughts, floods, storms and other extreme weather events would also increase significantly according to forecasts by the International Panel on Climate Change (IPCC 2014b). Given a growing world population, this would result in an increase in distribution conflicts, violent conflicts over scarce resources and a probable dramatic rise in migration and flight. Therefore, unchecked climate change is a threat to food security and to human security.

In addition, it can be assumed that harvest shortfalls will have to be reckoned with at global level (IPCC 2014b). Those countries that are closer to the equator, especially the tropical regions and wet-dry areas with seasonal dryness, are expected to be the big losers. This is where a large share of the world population live, and it is also where the world's poorest countries lie. The areas of Sub-Saharan Africa and the densely populated areas of Asia, including the major river deltas (such as the Indus, the Mekong and the Red River), in which a rising sea level is giving additional cause for concern. In these areas, harvest shortfalls – for instance of maize, by up to 40 per cent – are expected even if there is only a relatively small increase in global warming of one to two degrees Celsius (World Bank 2013).

But even very much smaller harvest shortfalls are disastrous for regions with low overall yields. Already today, more frequent water scarcity for irrigation, increases in extreme weather events, problems with additional plant pests and diseases as well as animal epidemics, higher abiotic stress factors for livestock (e.g. heat sensitivity), a decline in biodiversity, higher evaporation rates, soil acidification and an increased decline in maritime fish stocks can be observed in areas close to the equator.

Above a global temperature rise of more than two degrees, given an increasing demand owing to population growth, considerable negative impacts on global and regional food security can be reckoned with, and, especially, fluctuations in harvest yields will be far more frequent. From four degrees Celsius on, it will hardly be possible to compensate for damage through adaptive measures (IPCC 2014b). Thus the IPCC has projected that yields from agriculture depending on rain could be halved by 2020 in some African countries. Competition for increasingly scarce natural resources raises the risk of regional conflicts which in turn are a threat to food security.

In rural areas, particularly the poor people are suffering from climate change since they have only a limited adaptive potential. Around 80 per cent of those going hungry are farmers, pastoralists, fishers, hunters, gatherers and indigenous peoples. In addition to an undersupply of calories, they suffer from a chronic lack of vital micronutrients. Often, women and children are especially threatened. Children who grow up undernourished still suffer from the effects of malnutrition in adulthood.

Crises and conflicts

While food security can be restored after disasters in the short to medium term, especially in conflict long-term food security is not ensured.

Although the incidence of armed crises between 2013 and 2014 did not rise substantially, the number of conflicts having grown from 20 to 21, more and more countries are affected by the disputes (Heidelberg Institute for International Conflict Research 2015). Reasons given for the increase in combat zones worldwide included the activities of the terror organizations "Islamic State" and "Boko Haram". Furthermore, in 2014, 424 political conflicts were counted worldwide – the highest number since the beginning of the 1990s. The World Development Report 2011 (World Bank 2011) points out that none of the countries affected by conflicts, civil wars and violence, all of which show a low pro capita income, has solved its hunger problem and that development achievements over the last 30 years have bypassed the 1.5 billion people in the conflict regions.

Not only do violent conflicts directly interrupt food supplies for the population, but in the long term, they also have a negative impact on the production cycle. Farmers cannot till their fields for an initially unpredictable period and are therefore unable to bring in any harvests. For example, still today, 13 years after the end of the civil war in Angola, agricultural production is suffering there because landmines prevent access to the fields.

Globalization of agriculture

Economic globalization has also resulted in an increasing integration of marginal countries in global economic cycles. International institutions such as the World Bank and the International Monetary Fund have recommended many countries to orient their agricultural sector on the world market and concentrate on exports. Thus food security should not rely primarily on national production but on cheaper imports. In this context, it is the local market structures and infrastructure for functioning urban-rural links and the rural regions that have above all been neglected. The risks posed by declining national production and rising prices on the world market for local food supplies were not sufficiently considered. This raised susceptibility to crises in many countries and crucially contributed to the 2008/2009 hunger crisis.

Forecasts indicate that a further two billion people will have to be fed by 2050. This alone is an enormous challenge for resource-friendly agricultural production, and in the medium and long term, it is going to tighten demands on future food security. Thus, all in all, in particular, an increase in local and regional insufficient food security owing to the impacts of natural hazards, climate change, crises and conflicts will have to be expected. Rising demand using up more natural resources and the climate-conditioned volatility of food supply are driving factors in this context.

2.2 How food insecurity influences disaster risk

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This chapter looks at whether, and if so, how, food insecurity results in higher disaster risk. What direct but also indirect influence does food insecurity have on the type and the extent of natural hazards and a society's susceptibility? How do the consequences of food insecurity influence coping capacities and adaptive capacities regarding natural hazards such as floods or cyclones?

Causes of food insecurity

In order to analyze the influence of food insecurity on disaster risk, it is necessary to look at the causes of food insecurity along the four dimensions of availability, stability, access, and utilization (see Chapter 1). Over the last decades, this has led to numerous discussions. Early approaches tended to concentrate on technological conditions affecting the productivity of agro-ecosystems and the biophysical carrying capacity of various climate zones and soil conditions as the main causes of food insecurity. The publication of Amartya Sen's seminal research on poverty and famines (Sen 1981) brought institutional explanations more to the fore, particularly regarding access to food and the corresponding entitlements: Food insecurity is not only determined by the limits of production and yields but crucially result from an unbalanced institutional and economic system. Here, problems in the distribution and the financial as well as institutional availability of food are often the chief cause of food insecurity. Recently, the utilization dimension has also been given increasing attention and has raised questions regarding the quality and use of food. Today, most scientists and practitioners agree that all four dimensions contribute to food insecurity and therefore have to be looked at in terms of their combined effects.

Food insecurity therefore results from the interaction of multiple environmental and socio-economic factors: natural hazards, the level of technology, and insufficient redistribution or trade systems are examples. Poverty is a central factor since it complicates access to means of production and results in lower purchasing power on food markets (Smith et al. 2000). Insufficient infrastructure plays a role if it hinders access to means of production, markets and transportation, thus restricting production and distribution. This problem is often caused by a lack of government or private sector investments. Political instability, corruption and/or conflicts also lead to a lower capacity of governments to maintain food security.

Rapid increases in food prices, unstable food markets, shifts in trade, and food speculation can be further causes of food insecurity. In addition, the rising demand for food owing to population growth, biofuels, livestock farming, and fodder cultivation is increasingly being discussed as a threat to food security. Looking at the household level, a large share of dependent household members, for example those who are too young or too old to contribute their labor to food production, are of central importance. If members of the household who normally maintain food production fall sick, this can put a considerable strain on the entire household.

The lack of sufficient land and water provides further limitations to achieving food security. Hence, environmental factors such as climate variability (Wheeler/ von Braun 2013) and soil degradation (Pimentel 2006) can threaten and reduce food security.

How food insecurity raises disaster risk

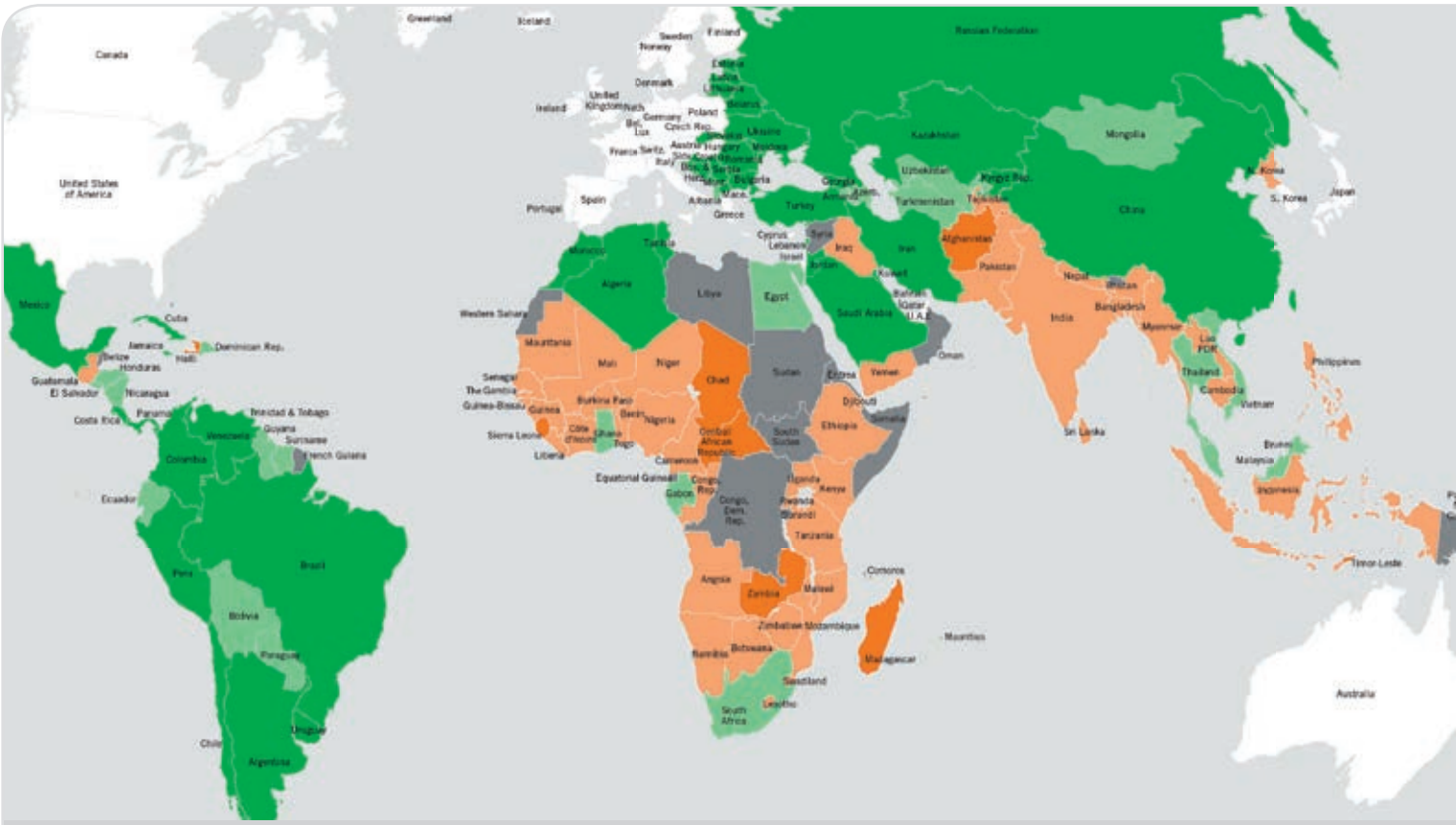
According to the WorldRiskIndex, disaster risk, i.e. the risk of suffering harm in the event of earthquakes, floods, cyclones, droughts or sea level rise, is shaped by four components: spatial and temporal exposure to natural hazards, susceptibility, coping

capacities, and adaptive capacities (see Chapter 3). Food insecurity can have an effect on all of these components, as science and practice have clearly shown.

Food insecurity and exposure: Food insecurity often forces people to expand their agricultural production into areas with greater natural hazards. Due to scarcity of land, migrants from regions with undernourishment often have to settle and farm in locations with a greater exposure that have previously not been used by the local population. For example, it has been observed that in years of drought, smallholders in West Africa are increasingly extending their crops to plains threatened by floods (Pardoe et al. in press). In addition to these spatial effects, food insecurity can also amplify temporal exposure patterns. This is primarily the case where people are forced to move their growing or production period to risky seasons. For example, fishers in Southeast Asia often have to extend their fishing activities into the typhoon season, particularly in times of food insecurity (Arnason 2006). Also, cropping that extends into the flood or dry season is an issue in many cases. Such effects drive up disaster risk not only with regard to physical wellbeing but also in relation to economic losses. In addition, food insecurity frequently leads to a direct increase or intensification of natural hazards, and therefore exposure, by exacerbating local overexploitation and degradation of ecosystems (Munang et al. 2013). The research field of political ecology deals with a wide range of case studies in which food insecure communities (have to) overexploit their local environments in a bid to secure their food-production. Deforestation of hill-slopes, for instance, has in many cases been stepped up in order to create some additional space for agricultural production). However, while there are only marginal additional yields, such measures rapidly increase the risk of landslides and flash floods (Mugagga et al. 2012). In a similar manner, overgrazing in semi-arid ecosystems has, in many parts of the world, resulted in the degradation of vegetation and an intensification of natural hazards such as flooding or desertification. At global level, too, intensive food production is indirectly contributing to an amplification of climate change-related natural hazards, since agriculture is currently contributing ten to twelve per cent of annual greenhouse gas emissions (IPCC 2014a).

Food insecurity and susceptibility: Susceptibility can be understood as the inherent predisposition to experience harm when exposed to natural hazards. The susceptibility of communities and individuals strongly depends on food supply, i.e. on the availability, stability, access to, and utilization of food. For instance, undernourished children run a greater risk of suffering physical harm in the event of flooding or another crisis situation. In addition, undernourishment usually leads to a lowering of physical performance, which further impedes the food security of people working in agriculture. At the same time, linkages between food and disaster risk can be observed not only with regard to undernourishment but to an increasing degree also in terms of obesity, diabetes, and other consequences of malnutrition, especially in countries with high and medium income (Shrimpton/ Rokx 2012). Effects include, for example, a greater incidence of cardiovascular diseases during heat waves (Kenny et al. 2010).

Food insecurity and coping capacities: Food insecurity has negative impacts on the ability to cope with natural hazards and crisis situations. Typically, food insecurity also implies a shortage or lack of food stock reserves at national and local level (Hendriks 2015). Hence, food cannot be obtained when it is needed most: in times of acute disasters and crises in which local food production comes to a standstill and trade or even external emergency relief cannot be performed effectively due to infrastructure disruptions. In addition, during crisis situations, there are short- or long-term increases in food prices.



The Global Hunger Index

The Global Hunger Index (GHI) is a tool designed to comprehensively display hunger globally, regionally, and by country. Each year, the International Food Policy Research Institute (IFPRI) calculates GHI scores in order to assess progress, or the lack thereof, in decreasing hunger. To reflect the multidimensional nature of hunger, the GHI combines the following four component indicators into one index:

+ Undernourishment: the proportion of undernourished people as a percentage of the population (reflecting the share of the population with insufficient caloric intake)

+ Child Wasting: the proportion of children under the age of five who suffer from wasting (that is, low weight for their height, reflecting acute undernutrition)

+ Child Stunting: the proportion of children under the age of five who suffer from stunting (that is, low height for their age, reflecting chronic undernutrition)

+ Child Mortality: the mortality rate of children under the age of five (partially reflecting the fatal synergy of inadequate nutrition and unhealthy environments).

There are several advantages to measuring hunger using this multidimensional approach. It notably reflects the nutrition situation not only of the population as a whole, but also of children, a vulnerable subset of the population for whom a lack of dietary energy, protein, or micronutrients (essential vitamins and minerals) leads to a high risk of illness, poor physical and cognitive development, or death. Furthermore, it combines independently measured indicators to reduce the effects of random measurement errors.

The 2015 GHI has been calculated for 117 countries for which data on all four component indicators are available and where measuring hunger is considered most relevant. GHI scores are not calculated for some higher-income countries where the prevalence of hunger is very low (von Grebmer et al. 2015).

WorldRiskIndex* and Global Hunger Index

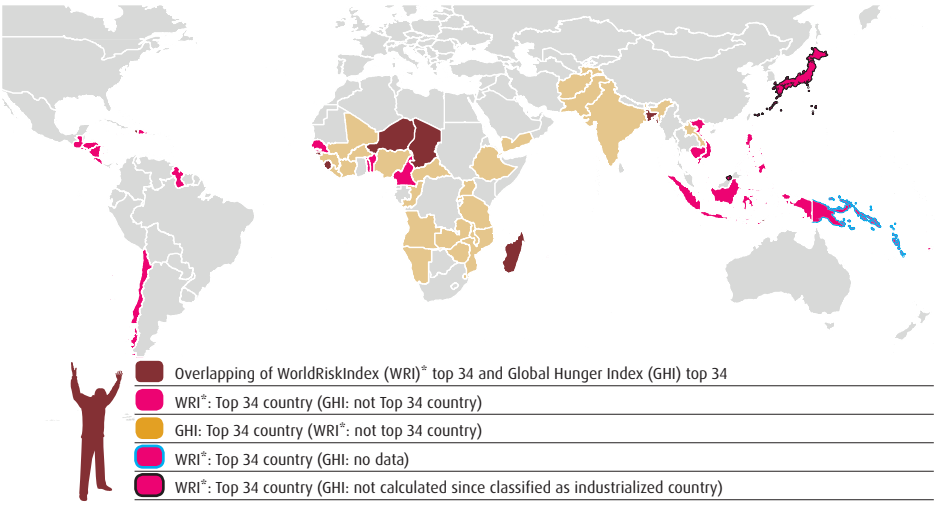


Figure 4a: Disaster risk* and hunger overlaps

Exposure and Global Hunger Index

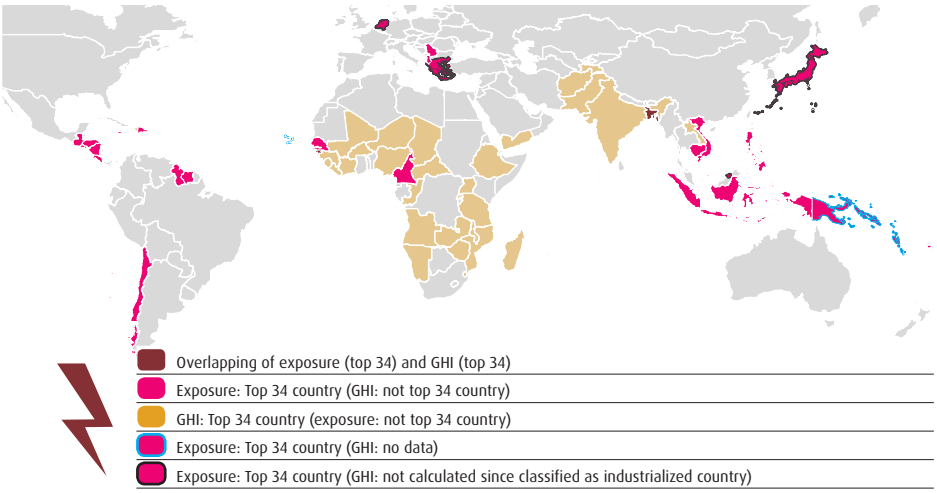


Figure 4b: Exposure to natural hazards and hunger overlaps

Vulnerability* and Global Hunger Index

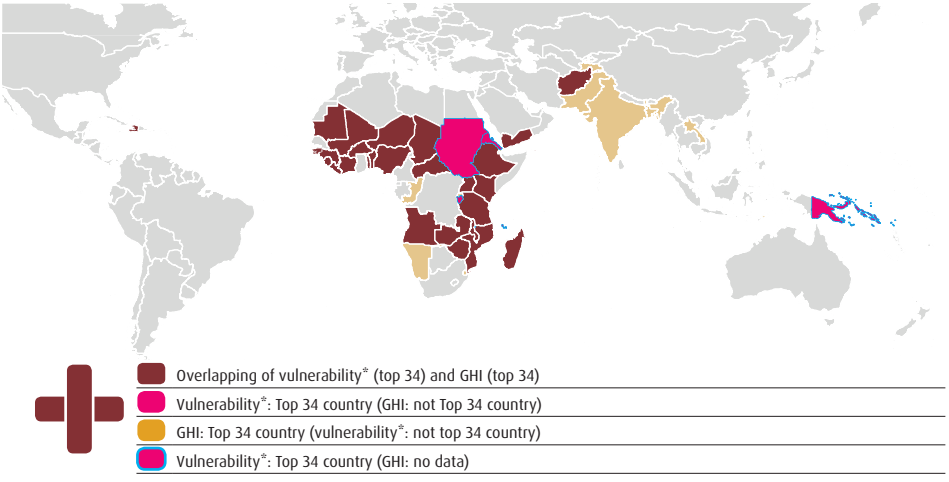


Figure 4c: Vulnerability* and hunger overlaps

Households affected by food insecurity are therefore frequently forced to sell valuables or assets, which in turn erodes their long-term coping and adaptive capacities and raises vulnerability to natural hazards as a whole.

Food security and adaptive capacities: Food security ranks as one of the most fundamental development needs, and it is usually a key policy goal. In many countries, resources are used chiefly for this purpose. In most cases, excess resources can only be increasingly allocated to other areas of sustainable development such as disaster preparedness or adaptation to climate change once food security has been achieved. As the indicators of the WorldRiskIndex show, activities relevant to adaptation include, for example, measures in the areas of education, environmental protection, and healthcare. Reallocation of resources into such areas can be observed, once food-security has been taken care of, at various levels ranging from the household level to national or global development policies (FAO/ IFAD/ WFP 2011). At the same time, food insecurity represents a significant obstacle to generating resources for adaptation. A recent study by the World Food Programme, for instance, revealed that child undernourishment leads to significant productivity losses (AUC et al. 2015). In turn, the resources generated for example for disaster risk reduction measures lag behind. Similarly, food insecurity has a wide range of impacts on concrete adaptation parameters such as education (by tying children to securing food supplies at the expense of school activities), gender balance (when precarious food situations lead to a structural discrimination of women and girls) or environmental protection (when, as described above, unsuitable production methods result in an intensification of environmental degradation and natural hazards).

Hunger and disaster risk at global level

What is the link between food insecurity and disaster risk at global level? In order to examine this question, the following section looks at the correlation between the WorldRiskIndex (WRI) and the Global Hunger Index (GHI). The GHI serves as a tool to represent the hunger situation worldwide. A global index for food insecurity could so far not be compiled by the FAO due to data gaps. Therefore, the following analysis focuses particularly on the level of correlation between hunger and the two dimensions of the WRI: exposure and vulnerability. Since susceptibility, one of the three sub-components of vulnerability in the WRI, contains an indicator that relates directly to food (see Chapter 3) and would distort the results of the correlation analysis, vulnerability and the WRI were newly calculated for the 171 countries leaving out the indicator "Share of undernourished population" (in the following marked as vulnerability * and WRI* respectively). The analyses were conducted with the latest indexes from 2015.

Based on the correlation analysis of the country data, a moderate positive relationship was identified between hunger and disaster risk (correlation coefficient r = 0.33 on a scale from -1 to +1). However, the individual components of the WRI* vary with regard to their statistical association with hunger. For example, if vulnerability* (i.e. susceptibility and the lack of coping and adaptive capacities) is considered exclusively, a very strong association with the hunger situation emerges (r = 0.91). In contrast, the above-described effects of hunger on exposure are spatially distinct. A statistical correlation between exposure (according to its measure in the WRI) and hunger (as measured in the GHI) can therefore not be detected at the global level (r = -0.02).

The three maps (Figures 4a, 4b and 4c) on page 22 show in which countries disaster risk and hunger overlap spatially (according to GHI 2015) – and where they do not. In order to visualize the differences and overlaps, 34 countries with (1) the highest disaster risk (i.e. the highest WRI* values), (2) the highest exposure, (3) the highest vulnerability * and (4) the highest GHI values respectively were

included in the analysis. The threshold of 34 is chosen so as to include all countries with "very high" risk in the 2015 WRI*. Thus, countries not highlighted in the map can still be at "high" disaster risk, but were not taken into consideration for this analysis.

Many coastal countries in South America and Southeast Asia show a high disaster risk mainly because of their high exposure, without however belonging to the 34 most highly listed countries in the GHI (Figure 4a). Their placing in the GHI can primarily be traced back to a significant improvement in the food situation in both regions over the last decades that is based both on socioeconomic progress and on special programs to promote food security. For example, looking at the GHI values of 1990, one clearly recognizes that at the time, several countries in both regions were faced with a serious or even alarming hunger situation.

The maps also show that there are common hotspots with high disaster risk and hunger. Eight of the 34 countries included in the analysis, meaning almost one quarter, show a very high disaster risk and simultaneously belong to the 34 countries with the biggest hunger problem. They comprise Bangladesh, Guinea-Bissau, Haiti, Madagascar, Niger, Sierra Leone, and Timor-Leste, as well as Chad (Figure 4a).

Analyzing the overlaps of exposure and vulnerability* with hunger yields a spatially much more differentiated picture (Figure 4b): Just three of the 34 countries with the highest exposure (9 per cent) overlap with the 34 countries with the biggest hunger problem: Bangladesh, Guinea-Bissau and Timor-Leste. On a global level, hunger in a given country is therefore not primarily conditioned by exposure to natural hazards and vice versa.

However, the maps also reveal that there is a very strong regional overlap between the countries characterized by hunger and countries with a high degree of vulnerability* (see below regarding the issue of causality): A total of 28 countries (approx. 82 per cent of the considered countries) simultaneously show a "very high" level of vulnerability* and are among the top 34 countries with severe hunger problems (see Figure 4c). The great majority of these countries (around 89 per cent) are located in sub-Saharan Africa. However, the percentages can only be taken as a very rough reference value, since for several countries with a very high disaster risk no data on the food situation is available (for instance Papua New Guinea, Solomon Islands, Tonga, and Vanuatu). Hence there is no assessment of the current hunger situation for these countries.

These results demonstrate that first, there is a global hotspot in which hunger and high vulnerability* co-exist and appear to mutually reinforce each other. Second, hunger is evidently linked more strongly to a country's prevalent socioeconomic and institutional vulnerability* than to its exposure to natural hazards. This link is also relevant to an understanding of the potential effects that climate change has on the hunger situation. Despite remaining uncertainties in global climate and yield models, the expected impacts of climate change on food security are strongest in those world regions that already represent hotspots of hunger today (Wheeler/ von Braun 2013). In addition to the potential yield effects, it is particularly the dimensions of access, stability, and utilization that are relevant to disaster risk and look set to increase owing to indirect effects of climate change (ibid.).

Yet, since statistical significant correlation does not necessarily imply causation, care has to be taken when interpreting the above results. The statistical analysis alone does not allow for drawing conclusions on the presence and details of causal effects, especially since both phenomena – hunger and disaster vulnerability – might be caused by similar external factors, such as poverty or weak institutions. Therefore, complementary analyses, like the ones provided in the first part

Country example Burundi

Empowering women to reduce the risk of drought

Alongside Eritrea, Burundi is the only country whose food situation is referred to as "extremely alarming" in the World Hunger Index 2014. Undernourished people account for 67.3 per cent of the total population. At 10.9 per cent, child mortality among the under-five-year-olds is still extremely high. With these figures, Burundi is bottom of the list of 76 countries in the Global Hunger Index.

Although nine out of ten of Burundi's inhabitants work in agriculture, the annual food deficit has been put at 470,000 tons. The country is suffering from the late effects of a civil war, population growth is high, government structures are weak, and the average areas under cultivation are small. In addition, food prices have risen sharply over the last few years – for instance, maize by 71 per cent and rice by 88 per cent between 2010 and 2012 – while purchasing power has remained more or less unchanged. Particularly in the rural regions, this has considerably aggravated the poverty and food situation. One big threat to the population's food security is the occurrence of extreme weather incidents that lead to massive harvest losses.

Between October 2010 and January 2014, together with its local partner organization "Réseau Burundi 2000 plus", Kindernothilfe conducted a food security project in the context of the self-help group approach. The project above all addressed women and reached a total of 45,600 people: 9,120 members of 465 women's self-help groups and their relatives.

These self-help groups in Burundi focused on improving the food situation by raising agricultural yield and income and on disseminating improved cultivation methods. For example, under the instruction of experts, the women grew maize, manioc, rice and potatoes in test fields using different varieties and methods so that they were able to identify the best cultivation methods by the results they achieved. In addition, the self-help groups had themselves registered at community level so that they could more quickly benefit from government services such as seed, fertilizer or agricultural extension.

In the final evaluation of the project, 59.4 per cent of those interviewed stated that they were having three meals a day. At the beginning of the project, this had only been the case with 6.7 per cent of the interviewees. 36.5 per cent of the women interviewed in the self-help groups were having two meals a day by the end of the project (previously there had been 69.8 per cent), and 4.2 per cent only had enough resources for one meal a day. This share had been at 21.4 per cent at the beginning of the project. In addition, by the end of the four-year term of the project, 27.6 per cent of those interviewed were very satisfied or satisfied (67.5 per cent) with the level of agricultural production (compared with the initial levels of 74 per cent unsatisfied and 23 per cent satisfied). Thus the project has made a significant contribution to food security and strengthened the rural population's disaster resilience.

The project was sponsored by the European Union and Kindernothilfe with funds totaling 621,000 euro. The European Union provided 528,000 Euro and Kindernothilfe 93,000 Euro.

Tanja Pazdzierny, Referentin Humanitäre Hilfe und Barbara Winker, Referentin Ko-Finanzierung bei der Kindernothilfe

of the chapter, are necessary. Furthermore, it has to be taken into consideration that the analysis was conducted at country level and inferences regarding possible causal relations at other measurement scales cannot be automatically drawn. This becomes very clear in the lack of any linkages between exposure and hunger at the national level, while these are clearly evident at the local level, as shown in the examples above.

2.3. Food security in disaster and crisis situations

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When an extreme natural event hits a country and turns into a disaster, as was the case with the 2015 earthquake in Nepal, the cyclone in the Philippines in 2013, or the 2010 floods in Pakistan, and the government is unable to cope with the size and impact of the disaster, the governments concerned often ask the international community for help in numerous sectors, including food security. However, external observers are frequently hardly able to comprehend what happens in these cases, how food aid is performed in detail, which actors are involved, and what standards they are guided by. The media above all report on large-scale food distribution. The numerous other approaches that are not so suitable for media coverage remain in the dark, as do many essential actors and the coordinating structures behind emergency relief. This article gives a brief overview of the most important procedures in the field of food security during disasters and explains the key framework conditions.

Actors

It usually takes several days for the first international emergency relief teams to reach the disaster area. Until then, and usually afterwards as well, local structures see to the chief share of humanitarian aid activities. These are of crucial importance, for it has been estimated that, for example, 98 per cent of all people buried alive in an earthquake are rescued from the debris within the first two days. Usually, it is the next of kin, friends and neighbors who come to their aid, as well as local organizations such as the national Red Cross and Red Crescent organizations and other emergency management and civil protection organizations (Munz 2007). The same applies to food and drinking water supply. Various studies show that in the immediate period during and after a disaster, there is a particularly high level of solidarity among those hit. For example, they share food and drinking water, thus providing mutual support to survive the immediate emergency (Scanlon 2007, Fischer 1998).

Only later do the international relief organizations enter the stage. Even if the organizations happen to be operating locally and maintain their own country offices or are working together with partners, their programs are usually focused on long-term development cooperation. Therefore, specialized emergency relief teams are generally flown in who first of all sound out the situation and establish the local needs. This needs assessment is often conducted by the organizations themselves, although it is increasingly being carried out as a collaborative measure in order to ensure better coordination and keep the strain on the communities affected at a minimum level (IASC 2012).

Usually, the individual relief organizations concentrate on a small number of regions in the country hit by the disaster and do not cover the entire range of humanitarian aid sectors. This decision depends among others on what needs have been established, on an organization's profile, on where it is normally located in the country and on coordination with other organizations. For example, in the aftermath of the earthquake in Haiti, the NGO Welthungerhilfe handed out food packages and provided drinking water as well as "Cash for Work" measures to clear the debris,

enabling people to earn money to buy food. Later on, the organization again concentrated on the agricultural projects it had been running before the disaster to promote food security and on restoring and building houses. Ideally, the international relief organizations collaborate with local partner organizations, since the latter have already gathered years of experience in the disaster region and sooner or later are to again assume responsibility for running the programs.

Tools

Various approaches are available to achieve food security in immediate emergency relief. Which approaches are actually applied always depends on the context (including a program's objective, the functioning of markets, implementing capacities), casts and preferences of the target group, and often, unfortunately, on the political interests of the donor countries.

Basically, there are three different approaches: in-kind, cash, and voucher. In-kind refers to the direct distribution of food. Here, one can distinguish between food procured locally, regionally, and globally. Whereas in the mid-1990s, just 13 per cent of food aid was bought locally or regionally, it was already 67 per cent in 2010. Many of the donors, such as the European Union and Canada, were thus responding to research results indicating that very often, food aid is not an efficient tool to reduce food surpluses of the donor countries and also weakens the local and regional markets in the crisis countries (Lentz 2015).

In order to be able to swiftly dispatch food to where it is needed in an emergency situation, the World Food Program (WFP) maintains UN Humanitarian Response Depots. They are situated in six strategic locations (in Ghana, the United Arab Emirates, Malaysia, Panama, Italy and Spain) on the premises of airports, and in the proximity of ports and main roads. In this manner, relief goods can be delivered worldwide within a matter of 24 to 48 hours (UNHRD 2014).

For some years, the significance of pure food aid (in-kind) has been declining. Instead, other food security measures are increasingly being used

Country example Philippines

Getting to the food package in a wheelchair

The Philippines are among the countries with the highest disaster risk in the world. In the list of 171 countries in the WorldRisk-Index 2015, this island nation comes up third. In addition to earthquakes, it is above all the cyclones occurring each year that represent a considerable danger to the country. In November 2013, Cyclone Haiyan, one of the strongest cyclones ever measured, resulted in high numbers of victims and destruction on a massive scale in the islands of Samar, Leyte, Cebu and Panay. More than 6,000 people were killed, and hundreds of thousands had to abandon their homes and seek refuge in tent camps. Entire cities were hit, and destruction is still visible in many towns and villages.

In Concepcion and Estancia, in the north of the island of Panay, Christoffel-Blindenmission (CBM) had a team on site just a few days after the cyclone had struck in order to hand out food and provide other relief services in cooperation with the local partner organization "Association of Disabled People Iloilo" (ADPI). This enabled 23,000 people to be supplied with, for example, rice, noodles, tinned food, sugar, salt, and oil. The families received food twice as well as non-food items such as toothbrushes, soap and blankets to last for two to three weeks respectively. A total of more than 200,000 euro worth of goods was distributed.

→ continued on page 28

→ Country example Philippines, continued from page 27

In the Philippines, too, there was the typical risk for such centralized distribution measures of certain population groups being left out, such as sick, elderly or disabled people and pregnant women. For them, the distribution point is often too far off, or waiting in the queue while the goods are handed out is too exhausting. Relatives caring for their next of kin who cannot leave them alone for a longer period are also at a disadvantage. In order to prevent such families from missing out on relief supplies, the municipal authorities provided CBM with data on residents. On the basis of the data, some particularly vulnerable households were identified that the relief packages had to be brought to personally, which saved those affected the tedious walk to the distribution point and waiting long in the queues.

Also, whenever possible, already in the preparatory stages of a distribution, it is important to choose a spot that is accessible for people with disabilities and easy and quick to get to for all households in a region. In Concepcion, for example, the local city hall was used for food distribution. It is situated in the city center and provides access for everyone via wide approaches and thanks to the hall being at ground level, so that no steps have to be climbed and older as well as blind people and wheelchair users can reach the distribution point easily and without being at any risk. Thanks to the facility being roofed, people waiting at the distribution point were also protected from exposure to the strong sunshine typical of the Philippines.

During the food distribution in Concepcion, CBM and their local partner, ADPI, also trained more than 100 volunteers who helped pack the food and distribute the goods – many of them people with disabilities. The integration of the local population both in the preparatory phase and in distributing the goods contributed to relief measures reaching those people more quickly who were most in need. Moreover, involving disabled people in distributing goods reduces prejudice by demonstrating the vital contributions that they can make in an emergency situation.

Oliver Neuschäfer, Emergency Coordinator at Christoffel-Blindenmission

as an alternative or in addition to food aid. The transfer of cash and vouchers is gaining more and more importance. “Cash for work”, in which cash is handed out in payment of labor provided e.g. for road building, clearing debris and the construction of dams to protect the fields, is a special type of money transfer. More and more frequently, such transfers are implemented with the aid of more recent technology, such as electronic versions of vouchers as SMS via mobiles. Between 2008 and 2011, the number of these cash and voucher projects increased tenfold, and it now accounts for more than a third of WFP activities (WFP 2012).

Most organizations apply a toolset comprising a number of approaches that is adapted to a specific context. For not all tools are suitable for every context. For example, while cash transfers are believed to be cheaper and enjoy a good reputation in terms of boosting the self-responsibility of the recipients because they offer them more freedom of decision, they will only work if local markets are in a healthy state, i.e. when food is available in principle but cannot be bought by the local population because of the high prices charged. If not enough food is available, in-kind deliveries make more sense. Here, while locally and regionally produced food is the first choice nowadays, no principle can be derived from this either. For if prices in the region are very high, buying in the region may be counterproductive, and overseas imports may well make sense. Thus more flexibility of tools was also established in the “Food Assistance Convention”, which entered force in 2013 (Food Assistance Committee 2012).

In addition, a wide range of tools are applied that can be assigned to the transition to sustainable development and usually concentrate on agricultural production and marketing (LRRD approach: “Linking Relief, Rehabilitation and Development”). Following the United Nations International Strategy for Disaster Reduction (UNISDR, see Chapter 4), they center on the resilience

of the population, the aim being to already take measures in the emergency situation or shortly afterwards that are to prevent a disaster from occurring in the long term. Examples here include the construction of protective barriers for agricultural land involving cash for work measures or the distribution of drought-resistant seed. In the ideal case, building resilience is performed cross-sectorally and takes the existing local disaster preparedness and early warning structures into account.

Standards

Irrespective of the approach used, certain standards are applied that many of the organizations working in the field of humanitarian aid have agreed on. However, these standards are voluntary commitments observing of which is not controlled. For a long time, the most important standards included the SPHERE Standards, the Humanitarian Accountability Partnership (HAP), People in Aid, as well as Quality COMPAS, each of which was supported by different initiatives. These four initiatives have since developed the Core Humanitarian Standard, which was presented in 2015. It will replace three of the four standards in future. The new Core Humanitarian Standard is based on the principles of humanity, impartiality, neutrality, and independence, and it comprises nine elements: (1) appropriateness and relevance, (2) effectiveness and timeliness, (3) strengthening of local capacities and avoidance of negative side-effects, (4) communication and participation as well as feedback, (5) complaint mechanisms, (6) coordination and complementarity, (7) continuous learning and improving activities, (8) equal treatment, fairness and support for humanitarian aid workers, (9) responsible use of resources (Core Humanitarian Standard 2014).

For the time being, the SPHERE standards remain in place as a set of rules in its own right, while the other three standards are to be replaced by the Core Humanitarian Standard. They comprise detailed minimum requirements for humanitarian aid in four sectors: water, sanitation and hygiene / food security and (mal-) nutrition/ shelter and non-food items / health. In the food security and (mal-) nutrition sector, there are regulations on, for example, how to conduct needs assessments and on the right approach to achieving food security for babies and infants as well as in the case of acute malnutrition. Proposals are also formulated on the composition of day rations in food aid – both with regard to the right number of calories and to cultural acceptance (SPHERE Project 2011).

For several years, the "Do No Harm" approach has played an important role in humanitarian emergency relief. It evolved from the experience that poorly planned aid does more harm than good, despite good intentions. For example, in the food sector in particular, poorly planned food aid projects can paralyze the self-initiative and self-help potential of the population and lead to long-term dependence. In complex crisis situations, ill-considered handing out of food (for example among individual groups in society and / or conflict parties) may aggravate existing conflicts and only further worsen food security. The "Do No Harm" approach therefore requires that contexts be thoroughly analyzed ahead of each intervention.

Coordination

International organizations can only become active with the consent of the government concerned. If a government in the face of a disaster requests international support and is furthermore not in a position to control the humanitarian mission itself, the UN Office for the Coordination of Humanitarian Affairs (OCHA) takes over aid coordination. In order to ensure that the frequently hundreds of different relief organizations are well coordinated, for example regarding who is working where and in which sector, OCHA introduced the cluster approach in 2005 in the context of the "Humanitarian Reform". It evolved as a response to the failure of international emergency relief in Darfur and now consists of eleven clusters operating both at global level (global clusters)

and in the crisis countries. Each cluster relates to a certain sector (see illustration 8) and consists of numerous relief organizations that are coordinated by a lead agency. A lead agency in a global cluster may differ from that in a crisis country itself. While the clusters have, above all, been led by UN organizations such as UNICEF and WFP, non-governmental organizations are now increasingly assuming leadership responsibilities as well, especially at national level.

Aid in the field of food and nutrition is coordinated by two clusters: the Food Security Cluster and the Nutrition Cluster. The former coordinates measures in all four dimensions of food security (for dimensions see Chapter 1). The latter concentrates on malnutrition, and thus mainly on the dimension of utilization of food. However, the access of households to food also plays an important role, so that there are overlaps between the two clusters. At global level, the Food Security Cluster is headed by the WFP and the Food and Agriculture Organization (FAO), whereas UNICEF coordinates the Nutrition Cluster. The task of these two global clusters is above all that of supporting the national clusters through capacity building in the form of training measures, improved knowledge and information management, advocacy activities and mobilization of resources as well as promoting partnerships between organizations at national and global level.

At the national level of clusters, which correspond to the respective cluster at global level, operative coordination is of particular importance. The national cluster provides packets of information such as needs assessments, maps and situation reports. It regularly holds coordinating meetings and makes the corresponding minutes of the meetings available. In many countries, it also offers a platform to organize various working groups. For example, in the context of the Food Security Cluster in South Sudan, working groups are addressing the topics of "Cash Transfer and Markets", "Crop Farming" and "Animal Husbandry". Examples of activities within these working groups include the exchange of Best Practice examples and the development of practice guidelines on the basis of an exchange of experiences.

Outlook

Humanitarian aid in general and food assistance in particular have gone through various changes in recent years, and in the course of numerous reform processes (including the Humanitarian Reform, the Food Aid Convention turning into the Food Assistance Convention, the development of the Core Humanitarian Standard) they have been adapted to the demands on professional and efficient aid. A large number of evaluations have demonstrated that improvements have been achieved in many areas. Nevertheless, there still is scope for other improvements, and practice partly still falls far short of what would be ideal. Three areas are described as examples in the following:

Local structures and initiatives: In many disasters during the past years, cooperation between local, national and international structures has proven to be difficult. In spite of the considerable importance that all humanitarian aid actors attribute to local ownership, i.e. coping with a disaster with the society concerned assuming a maximum of self-responsibility, it is precisely this that has seldom been achieved (IASC 2010). The strong formalization of structures in the cluster approach has tended to aggravate this problem. Existing civil protection and emergency response structures have not been used or have even been weakened, owing both to a lack of knowledge and analysis and also to language problems. Whether the recent UN Transformative Agenda improvement measures initiated by the UN in the meantime have been able to eliminate this shortcoming will now have to be demonstrated in new disasters such as the earthquake in Nepal. New impulses from the World Humanitarian Summit can also be reckoned with (see Chapter 4).

Conflicting interests: Despite consolidated insights on the advantages of flexible handling tailored to contexts of the tools provided for food aid, decisions on the correct composition of the toolset are not always taken on the basis of objective criteria, but are also determined by political and economic interests of various actors. Especially the USA, which are responsible for 89 per cent of trans-ocean food aid deliveries, is reluctant to restructure towards more cash and voucher programs and local procurement (Lentz 2015). Reasons for this include lobbying by farmers' and logistics companies' federations as well as by some non-governmental organizations that fear financial losses. For example, US President Barack Obama's move to amend farming legislation so that 45 per cent of food aid can be bought in the region concerned was rejected by the US Senate in 2013. The broad discussion that Obama's attempt provoked in the USA nevertheless seems encouraging.

Reactions instead of prevention: Against better judgment, both a large number of national governments and the international donor community are doing too little to address the causes of disasters and food insecurity: the high level of vulnerability and the lack of resilience in the societies affected. Instead, reactions usually only come when the disaster has already developed. The 2011 hunger crisis in the Horn of Africa demonstrated this insight in a cruel manner, for unlike with sudden events such as earthquakes, this crisis had been building up over several months. Long before the true famine broke out, various early warning systems had sounded the alarm, but nothing happened. And yet at this stage, the crisis could have been mitigated, if not prevented. The risk of natural events in the area of food security having disastrous consequences can be considerably reduced through timely and long-term measures addressing the causes of food insecurity (see Chapter 4).

The system of humanitarian aid is complex, but it is also very dynamic. Each new crisis leads to new challenges and reveals new weaknesses. There is a long list of options for improvements, and reform processes are sometimes tedious. However, one can be optimistic about the problems being tackled and solved sooner or later, depending above all on the political will of the donor countries.

2.4. The field of tension between food security and disaster risk

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This chapter describes the self-reinforcing interaction between food insecurity and disaster risk, refers to socially relevant structural framework conditions, and demonstrates solutions.

Downward spirals

Extreme natural events turn into disasters when people are vulnerable and, poverty, for instance, prevents them from doing what is necessary to protect themselves against devastating impacts. Food insecurity is one of the reasons for vulnerability, especially when a sufficient amount of food is already lacking before the disaster, and access to, use, and stability of food supplies are not ensured.

The World Food Program (WFP) stresses that four out of five people suffering from hunger live in areas that are particularly susceptible to disasters. In all, more than two thirds of the countries characterized by severe hunger are among the 34 most vulnerable countries (see Chapter 2.2). Several hotspots can be identified at regional level. These are countries or regions that have to simultaneously struggle with a high level of food security and a high disaster risk (see Diagram on pages 38/39).

The lack of resilience in agricultural and food systems leads to a downward spiral because the immediate impacts of floods, droughts, earthquakes, or cyclones are reinforced. Poor and marginalized people are most vulnerable. As these people are often smallholders, they are given special attention in this chapter. They are often already living in insecure conditions without any property rights, which raises their risk. Usually, they do not have the financial options or, often, owing to the property relations, the incentive to mitigate risks.

Smallholder production is often characterized by scarce resources and simultaneous diversification of production. Thus risks such as unpredictable harvest yields or high dependence on price fluctuations on the markets can be partly reduced. That smallholders use part of their produce for their own needs has advantages and disadvantages. On the one hand, it provides a substitute for external security nets, which are frequently non-existent. On the other, it can quickly lead to a downward spiral, for example if farm animals and tools have to be sold because of short-term cash requirements or an accumulation of debts (HLPE 2013). It is difficult for them to break out of this spiral – especially if it is continued by further disasters as a result of extreme natural events (Shepherd et al. 2013).

Against the background of climate change, too, strategies aimed at a sustainable reduction of vulnerability and improving food security are of central importance. For owing to the rising severity and frequency of extreme weather events, food insecurity and disaster risk can mutually reinforce each other. Studies conducted by the Food and Agriculture Organization (FAO) show that investing in agriculture in order to reduce poverty and hunger is up to five times more efficient than measures in any other sector (FAO 2015b).

Crisis resistance of smallholder production

Some systems to secure livelihoods have proved their worth over centuries but reach their limits when growing population pressure on the land makes more intensive forms of cultivation necessary. For example, methods that were appropriate for land lying fallow for ten years can result in a decline in productivity and soil exhaustion if applied with only short fallow periods or with none at all. Resorting to such methods can lead to the impoverishment of the families cultivating the land. Across the world, many people are living in conditions of inequality and dependence (for example,

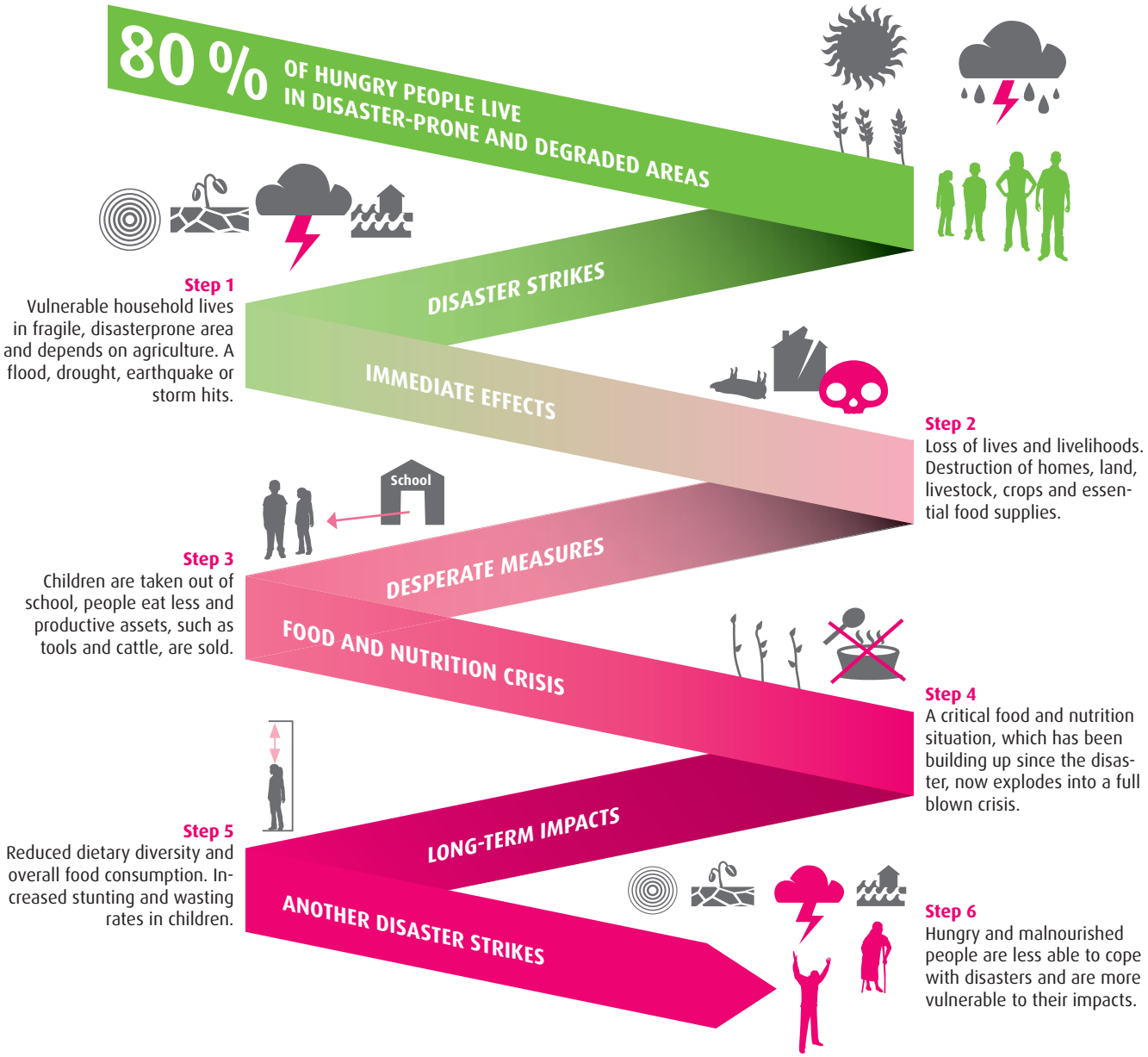


Figure 5: How disasters amplify hunger (WFP 2015c)

farm laborers, sharecroppers, families in debt bondage, people marginalized for ethnic or caste reasons) which prevent them from achieving a more or less secure food situation. In crises and disasters, this can quickly have an extreme impact.

Agricultural producers with industrial production methods (monocultures, high-yield seed, exclusive growing of crops for the market) are often characterized by severe economic vulnerability to extreme weather events (Zukunftsstiftung Landwirtschaft 2013). One of the big strengths of smallholder production is diversification and, subsequently, risk minimization. Partly, however, this leads to people clinging to handed down methods without checking whether there are alternatives, which increases the risk of action that is not or no longer adapted to local conditions. For example, in the very dry northeast of Brazil, a strategy of creating alternative sources of income and "living with drought" would have been more viable than the traditional approach of "combating drought". There are counterexamples of farmer groups who are innovative and keen to experiment, such as farmer groups in Bangladesh who have bred their own rice seed (FAKT/ Misereor 2011). But such initiatives are as yet still an exception.

Ecological systems

The World Agricultural Report shows an alarming concentration. Three quarters of the varietal diversity still available in 1900 is lost today, whereas 75 per cent of all food throughout the world comes from just twelve plant and animal species (Zukunftsstiftung Landwirtschaft 2013). This loss could well grow through the progressive patenting of traditional seed, which has led to the term of "biopiracy" (Shiva 2000). Lower varietal diversity makes the crop systems more susceptible to crises. This is augmented by increasing discrimination of traditional seed systems through international agreements on the protection of plant breeds, above all via patenting legislation, that massively complicate the conservation, use, exchange, sale, and reproduction of traditional, locally adapted seed (Stiglitz 2006).

Stopping soil exhaustion in order to supply food for the world population in future represents a further challenge. Worldwide, around 20 to 25 per cent of all soil is already degraded (Hein-rich-Böll-Stiftung 2015). In addition, owing to increased investing, Africa is set to experience developments similar to those in Latin America – following an expansion of areas under cultivation through clear-cutting, production is intensified along industrial lines, resulting in an increasing contamination of the soil and the water with fertilizer and pesticides.

Economic and political framework conditions

In the past decades, up to the mid-2000s, the structural adjustment measures pursued by the World Bank and the IMF, public investment in agriculture was massively scaled down in many countries of the South. For example, smallholders largely no longer have access to consulting and veterinary services, loans, social security to compensate for failed harvests, accessible warehousing, transportation support and buying options in emergency cases. Neither politics nor research sufficiently addresses their specific needs for sustainable small-holder production (Welthungerhilfe 2011).

Many countries of the South have poorly developed domestic markets and an infrastructure biased towards export. Since the 1980s, this has been exacerbated by the influence of international donor organizations, resulting in the role of the local market structures in functioning urban-rural links being inhibited. Given rising world market food prices, declining national production can then no longer ensure overall food supplies for the population. These crucial factors have raised susceptibility to crises in many countries and made an important contribution to globalizing poverty (Chossudovsky 2002). Special difficulties also become apparent in the event of disasters. Prices rise because an infrastructure

that was neglected in the first place can no longer provide local, culturally adapted food for the population groups affected. The lack of infrastructure, market information and storage hamper the transportation of food to the regions in special need of supplies.

Often, the land use rights, especially the informal rights of smallholders, are not secured, allowing domestic and foreign investors to purchase or lease vast tracts of land in Africa and Latin America in order to grow agricultural produce such as animal feed or energy plants for export. This "land-grabbing" is weakening local food production. It is noteworthy that the purchase of land is concentrated in countries in which people suffering from hunger already constitute a major share of the population (Zukunftsstiftung Landwirtschaft 2013).

The rising gross domestic product in emerging economies and more affluent developing countries is increasing the demand for high-value agricultural products, above all for meat. Over the last fifty years, global meat production has quadrupled from 71 to 300 million tons a year. This is problematic for global food security because meat production requires large amounts of grain and therefore much cropland (Zukunftsstiftung Landwirtschaft 2013). In addition, globally standardized food patterns are leading to dependence on a handful of chief producers in the sector of global grain production (mainly the USA, Australia, Russia and Ukraine). The further globalization of food markets and the increase in derivative trading of soft commodities have led to significant price volatility since the mid-2000s that shows through on domestic markets.

Problem-solving approaches

→ **Food sovereignty:** Already in the 1990s, the international smallholder federation La Via Campesina shaped the concept of food sovereignty, which has since been adopted and further developed by many social movements. It centers on food producers

Country example Guatemala

Orchards and kitchen gardens instead of destructive monocultures

Fifty years ago, almost impassable jungle covered the south of the Petén, the largest of Guatemala's Departments, situated in the north of this Central American country. Overfelling of precious timber, extensive animal husbandry and, most recently, the monocultures of oil palms have led to a massive destruction of the jungle. Large-scale logging and the changes in the local climate that go hand in hand with it as well as deep wells to irrigate the plantations have resulted in the drying up of springs and streams. Now it is difficult for the people in the region's settlements to maintain a supply of drinking water. The majority of them belong to the Maya-Kekchí, and they come from the neighboring provinces to the south, where they were driven from their home communities by big landowners. The Kekchí were left with marginal land that was quickly exhausted and could not be shared among their descendants. They were therefore repeatedly forced to migrate and cultivate new areas elsewhere, also in the south of the Petén.

The organization "Sagrada Tierra" (ST) is currently working with around 100 communities in the region in the field of food sovereignty and disaster prevention. medico international has been supporting ST since 2012, with a total of 67,300 euro. "The people want to learn how to improve the way they are cultivating their land. They have appealed to various government and international institutions, but none of these have provided the lasting support that they are asking for. We responded to their request, out of which our engagement developed," says Jesus Antonio Villar of ST. This is why ST is providing training and further education programs to promote, among other things, a sustainable cultivation of staple foods like maize and beans with local, non-genetically modified seed. Further activities focus on keeping poultry and the introduction of non-traditional products such as mushrooms.

→ continued on page 36

→ Country example Guatemala, continued from page 35

"But our work cannot solely be to offer answers regarding risk management and food security. What is in particular required is a process of strengthening the communities organizationally, of boosting their participation and influence to overcome poverty and generally create better and fairer living conditions," Rolando Pinelo of ST adds. This is why his organization is also strengthening local leadership resources and supporting the involvement of women and youths. For example, ST runs further education workshops for women and young people in civic participation so that they can influence local and national development plans vis-à-vis government institutions.

In its more than 15 years of dedicated activities, ST can boast visible success. Kitchen gardens and orchards have diversified cropping. For example, a network of women are selling fruit and vegetable preserves at their own shop and on local and regional markets. The introduction and enhancement of small livestock husbandry has also contributed to improving the nutritional basis of many families, as well as securing them a modest income.

Nevertheless, Rolando Pinelo states that poverty has grown in Petén. "The changes in the microclimate are making maize and bean cultivation more and more risky, and the middlemen are beating down the prices," he explains. "The options for food supplements from the rivers and woods are drying up." The peasants were therefore forced to sell parts of their land – with some of them driven by buyers applying fraudulent methods to exert pressure on the smallholders. Today, many families no longer have any land of their own.

"This is why we are constantly looking for concrete alternatives to secure the food and income of families," María Luisa Rosal of ST stresses. "But this also requires political debates over land use and the handling of natural resources, and this has to take place at national level. Protests and demands are not all that we have in mind – we want the people concerned to get the opportunity to formulate concrete proposals, setting out from their local realities."

Dieter Müller, Project coordinator for Central America and Mexico at medico international

and consumers reclaiming control of the food system. They want healthy, culturally adapted and sustainably produced food. To achieve this, agricultural producers need access to productive resources such as land, water, seed and loans, and they need land rights. The concept of food sovereignty gives priority to local agricultural production and local markets ahead of production for export and calls for fair trade relations as well as fair pricing on the agricultural markets. The government institutions have to create the legal framework conditions to enable this so that the foundations for crisis-resistant food systems are in place. Food sovereignty also implies that in the event of a disaster, those concerned are regarded as actors in their own right, with priority to be given to the recovery of their ability to act.

→ **Emergency relief without doing harm:** Despite the SPHERE principles and the "Do No Harm" approach (see Chapter 2.3), in individual cases, it is not always clear to what extent vital survival aid should be provided and when it starts to have a negative impact. Overdimensioned emergency relief can easily stifle the self-help impulse that is still existent immediately after a disaster, and it is difficult for the population to assume full responsibility for their lives, even in the medium and long term. In addition, food donations can alter cultural food patterns, and free-of-charge food aid can do lasting damage to local markets, and even ruin them in the worst case. Emergency relief therefore has to be organized with a view to avoiding these negative impacts (see Chapter 2.3).

→ **Agricultural ecology:** In close relation to food sovereignty, agricultural ecology advocates sustainable, locally adapted and diversified agricultural systems that reduce the vulnerability of farmers to external influences. Agro-ecological cycles with local resources reduce dependence on external suppliers. Varietal diversity lessens vulnerability through failed harvests. Erosion prevention, water management and biodiversity and vegetation conservation measures have an immediate

impact on food security, the microclimate and susceptibility to floods and droughts. Moreover, experience has shown that sustainably managed farms show less damage and recover more quickly after disasters.

A practical example

Successful rural development and food security strengthens resilience among the population and is therefore also always disaster preparedness. At the same time, mitigating the risk of disasters is an important element in improved food security.

The example of typhoon Haiyan in the Philippines (where it is called Yolanda) shows that sustainable agriculture oriented on agro-ecological criteria can help to durably improve the food security of the population. Georie Pitong, coordinator for the Misereor partner organization MASIPAG, a network of more than 600 organizations, explains why:

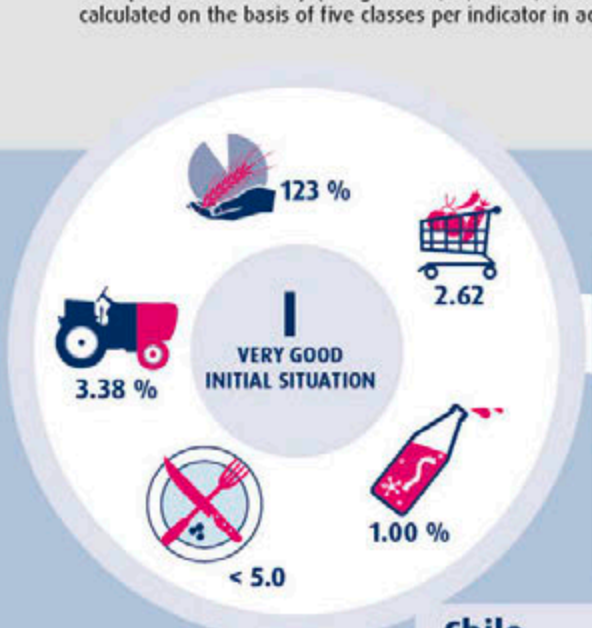
"In our region of Visayas, Typhoon Yolanda 2013 seriously affected food security among peasant families in 2013. Those families who had diversified their crops were in a much better situation. They are growing not only grain but vegetables, tubers, bananas, other fruit, rice and other staple food as well, and they keep poultry. Furthermore, they apply cultivating practices such as mixed cropping, crop rotation and maintaining varietal diversity in growing staple foods. In the days following Yolanda, such peasant families were able to gather bananas that had fallen to the ground, and the root crops growing underground, such as the sweet potato, helped them survive. Other farms doing conventional crop farming and specializing in a single product were hard hit and had to rely on help from outside, and even more so if they were only growing forage maize. The population affected received relief supplies from the government and from international organizations, although the fastest deliveries only arrived after three days at the earliest. Therefore, the families had to take care of getting food themselves during the first few days after the typhoon, and those who had a variety of crops were much better off. Moreover, they were in a better position to quickly resume their own production, for example with fast-growing vegetable varieties, and the fruit trees that had survived were already bearing new fruit after just a few months. Peasant families can take precautions that natural events do not turn into major disasters for them. Getting organized locally is very important for peasant families, not only for the food security of the households but also with regard to more far-reaching community issues. Such organizations enable members to improve their practical knowhow of sustainable crop-growing methods, and they develop a greater level of social awareness. This plays a very important role when it comes to making a joint effort to cope with the negative impacts of natural disasters and recovering from them."

Bündnis Entwicklung Hilft

Food insecurity in exposed countries

Where natural hazards coincide with unstable supply situations

The risk of an extreme natural event turning into a disaster also crucially depends on the nutrition situation of the population. In order to identify the need for action, both the current state of food security (measured here by the Global Hunger Index) and a selection of influential factors (average calorie supply, the relative food prices, the share of agriculture in the Gross Domestic Product [GDP] and the supply of clean drinking water) need to be examined. Based on these five indicators (see lower left Table for details), this map of the world represents food insecurity for 64 of the 68 countries which, according to the WorldRiskIndex 2015, are highly or very highly exposed to natural hazards (owing to an insufficient data base for food security, Papua-New Guinea, the Solomon Island, Tonga and New Zealand are not included here). The map shows that there is a special need for action to improve food security (categories III, IV, and V; result of a mean value calculated on the basis of five classes per indicator in accordance with the quantile method) regarding those countries in which exposure and food insecurity coincide. For each of the five need for action categories, the map of the world gives an example of a country with its five indicator values. Here are two examples. Sierra Leone (category V) is a country that is above all very heavily threatened by droughts. It is enormously susceptible to crises, also because of the population's high economic dependence on agriculture which is reflected in its share of GDP. In contrast, Chile (category I), while highly exposed to earthquakes, has a low level of food insecurity in comparison, the reasons being that there is hardly any hunger, drinking water supply is good, and the relative food prices ensure a good provision of food for the population.



Chile

Sierra Leone

In the same category:
Australia
Bosnia and Herzegovina
Brunei Darussalam
Cuba
Greece
Ireland
Japan
Korea
Netherlands
Romania
Trinidad and Tobago

In the same category:
Bangladesh
Burundi
Cambodia
Cameroon
Guinea-Bissau
Haiti
Madagascar
Niger
Senegal
Timor-Leste
Zimbabwe

Indicators for food insecurity		Minimum of the 64 countries	Maximum of the 64 countries
A	Percentage of the population **without access to improved drinking water supply.** The following water sources are referred to as not improved: unprotected dug wells, unprotected springs, vehicles with small tanks /barrels, tankers, water in bottles, surface water.	e.g. Australia < 5.0 %	Chad 49.17 %
B	**Percentage of agriculture in GDP:** cultivation of grain, fruit, nuts, including crops for drinks and spices, animal husbandry, dairy farming, forestry, fisheries, aquaculture.	Trinidad and Tobago 0.62 %	Sierra Leone 56.75 %
C	The **Global Hunger Index** is based on four indicators: 1. Share of undernourished people among the population. 2. Share of children below the age of five years who are wasted.3. Share of stunted children below the age of five years. 4.Share of children dying before their fifth birthday.	z. B. Chile < 5.0	Chad 46.4
D	**Country-specific average calorie supply** as the percentage of the country-specific average energy demand.	Haiti 91 %	Ireland 146 %
E	**Relative food prices in a country:** ratio of food expenditure to overall consumer spending taking into consideration purchasing parity in relation to the U.S.A. Inflation-adjusted.	Ireland 1.23	Haiti 9.73

Data for the indicators (most up-to-date respective version) provided by: WHO/UNICEF (A); The World Bank (B); Welthungerhilfe/IFPRI/Concern (C); FAO (D); FAO (E).

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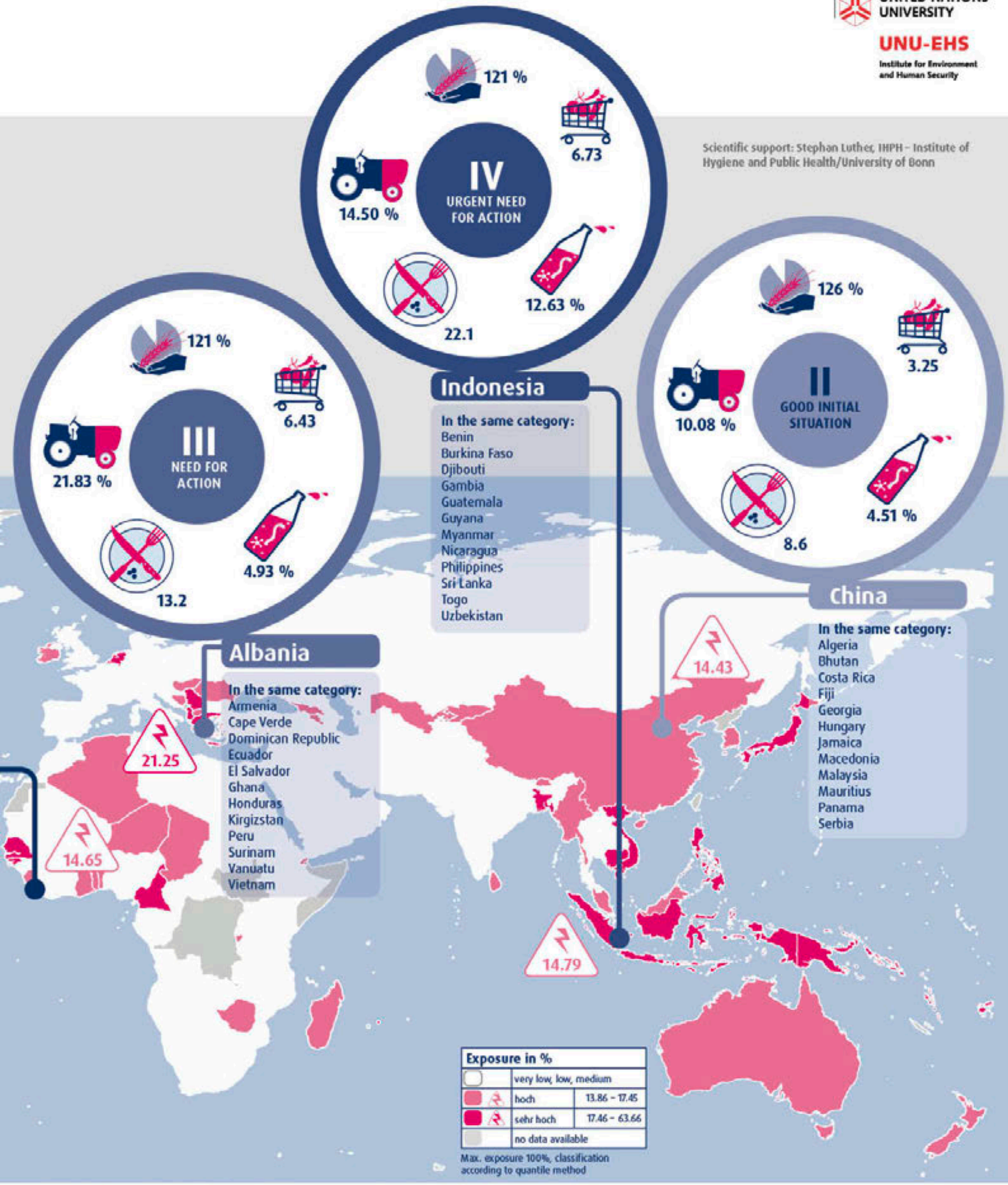
Scientific support: Stephan Luther, IHPH – Institute of Hygiene and Public Health/University of Bonn



Exposure in accordance with WorldRiskIndex 15. For calculating method and data base, see www.WeltRisikoBericht.de

3. The WorldRiskoIndex 2015

Vanuatu was hit by “Pam” on March 15, 2015. This cyclone has been referred to as the worst disaster in the history of the island nation. Year after year, Vanuatu has been the country with the highest disaster risk in the ranking of the WorldRiskIndex, which has been established since 2011. So, was the disaster predictable? No, the WorldRiskIndex is not a crystal ball; it does not purport to predict extreme natural events. This is borne out by the great earthquake in Nepal on April 25, 2015. According to the data available on exposure in the WorldRiskIndex, there was only a low likelihood of a quake. Nevertheless, the consequences of this quake are a dire confirmation of the key statement in the Index: If a country with a high level of vulnerability is hit by an extreme natural event, there is a high likelihood that it will turn into a disaster.

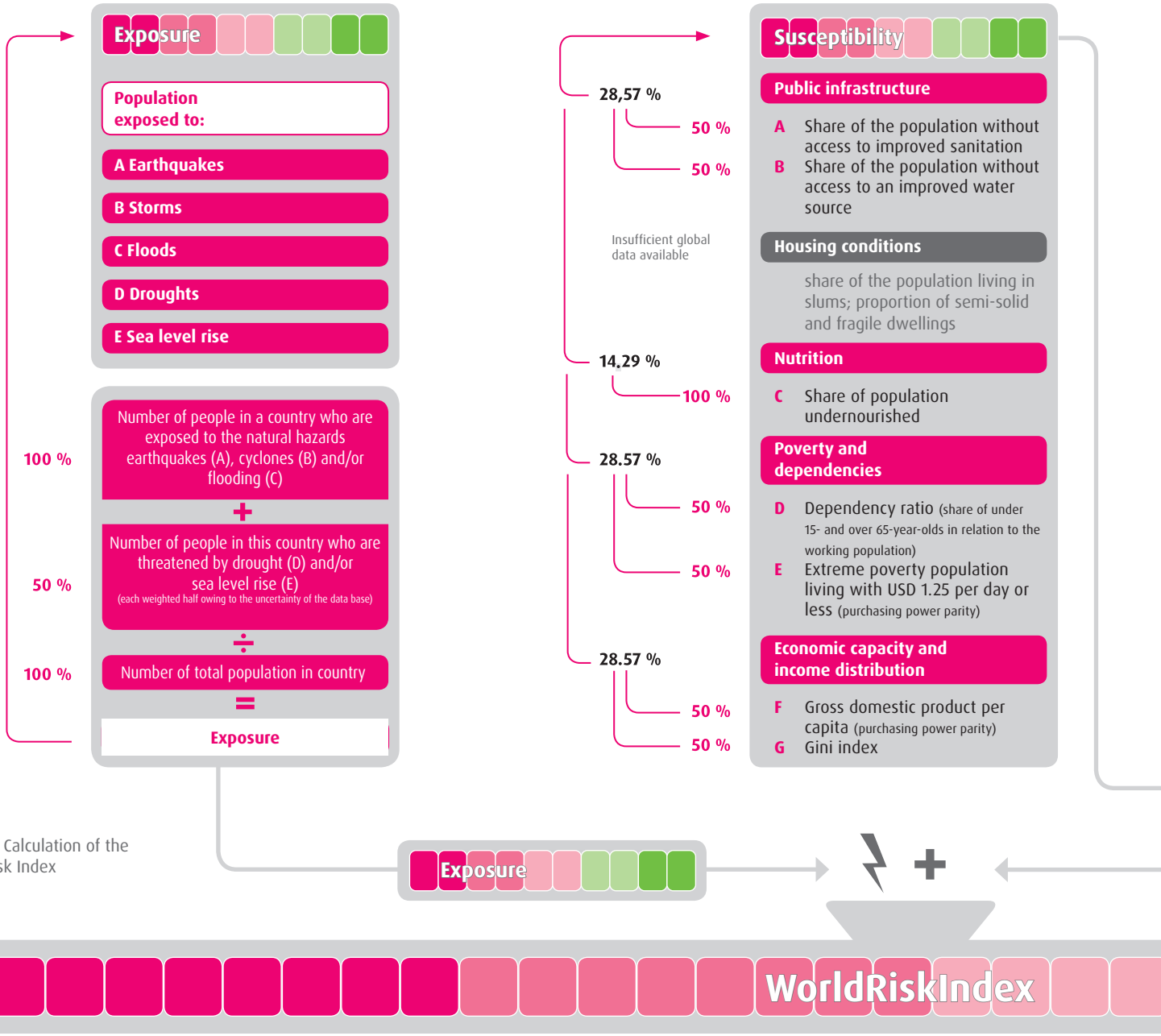


Figure 6: Calculation of the World Risk Index

The concept

The authors:
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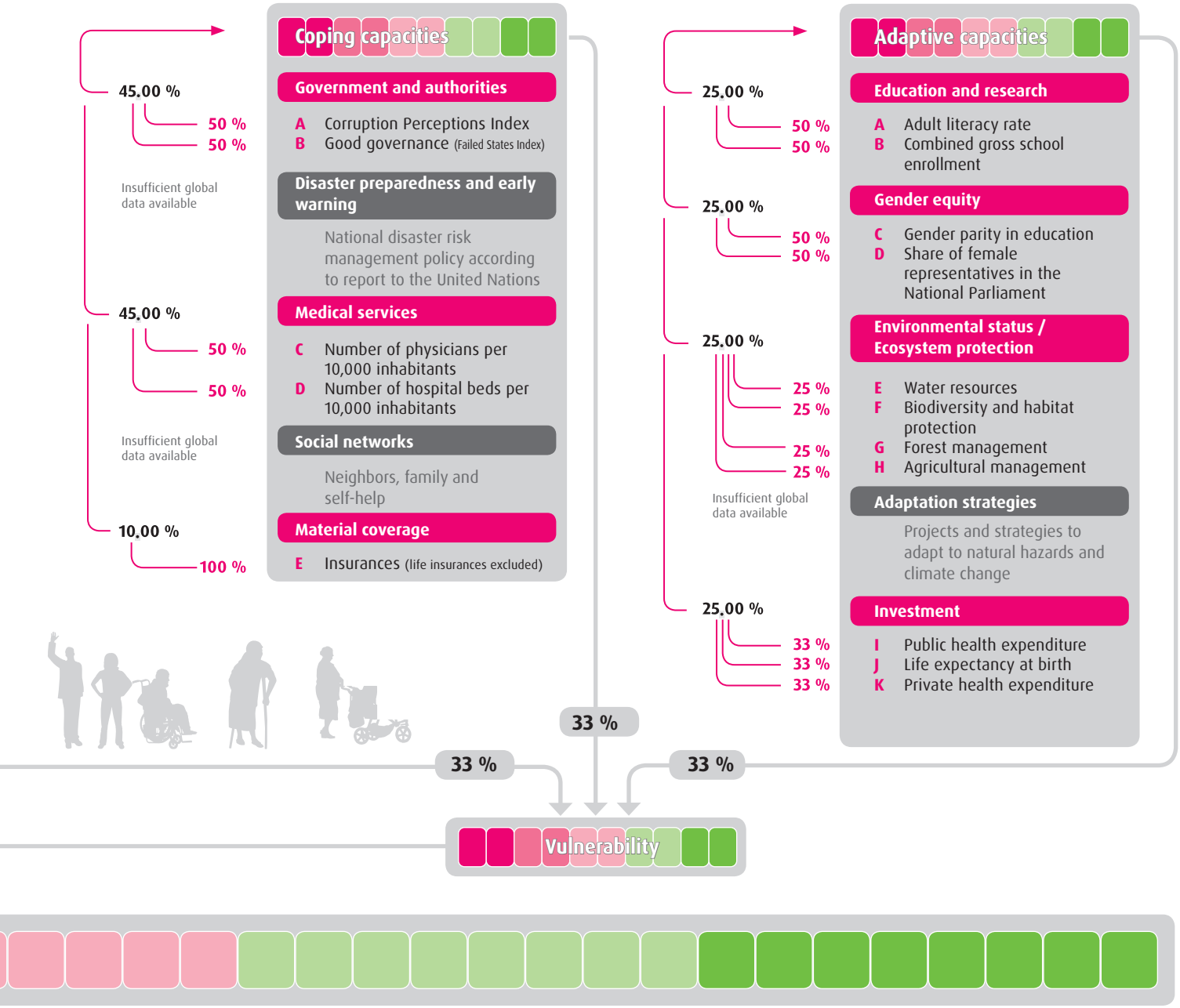
From a scientific angle, the WorldRiskIndex is a mathematical model and a visualization instrument that systematically combines exposure to extreme natural events and societal vulnerability in risk values and charts. It is based on 28 indicators enabling statements on potentially threatened areas or countries and on the social, economic and ecological conditions of societies. The individual dimensionless index values are transformed into a Geo-Information System (GIS) and are represented in maps. This enables a comparison of 171 countries, a discussion of the results with decision-makers and them being addressed in public debates.

The WorldRiskIndex is not a forecasting model, i.e. it does not make any statements on when the next disaster is going to occur. Rather, it demonstrates that risks in the context of natural hazards and the potential effects of climate change are not solely the result of extreme natural events but that they are also determined by societal conditions. Nobody



can influence the strength of an earthquake or a tropical cyclone, but preventive measures can be taken to reduce the impacts of these natural hazards, for example through quake-safe building methods or well organized civil protection and emergency management (Bündnis Entwicklung Hilft 2011, IPCC 2014b).

The WorldRiskIndex consists of the four components exposure (exposure to natural hazards), susceptibility, coping capacities and adaptive capacities. The Index as a whole is calculated from 28 indicators using data that is available worldwide and accessible to the public (Birkmann et al. 2011, Welle et al. 2014). Assigning of specific indicators to the four components and their weightings is described in the modular structure of the Index in Figure 6 above on this page. The four components and their combination in the WorldRiskIndex are explained in the following:

→ **Exposure** means that an entity (population, built-up area, infrastructure component, environmental area) is exposed to one or more natural hazards (earthquakes, cyclones, droughts, floods, and sea level rise).

→ **Susceptibility** is understood here as the likelihood of experiencing harm in the event of a natural hazard process. Thus, susceptibility describes structural characteristics and framework conditions of a society.

→ **Coping and coping capacities** comprise various abilities of societies and exposed elements to minimize negative impacts of natural hazards and climate change through direct action and the resources available. Coping capacities encompass measures and abilities that are immediately available to reduce harm and damages in the occurrence of an event. The opposite value, i.e. the **lack of coping capacities**, which results from the value 1 minus the coping capacities, was used for the calculation of the WorldRiskIndex.

→ **Adaptation**, unlike coping, is understood as a long-term process that also includes structural changes (Lavell et al. 2012; Birkmann et al. 2010) and measures and strategies dealing with and attempting to address the negative impacts of natural hazards and climate change in the long run. In analogy to the coping capacities, the **lack of adaptive capacities** is included in the WorldRiskIndex.

→ **Vulnerability** comprises the components of susceptibility, lack of coping capacities and lack of adaptive capacities (Bündnis Entwicklung Hilft 2011) and relates to social, physical, economic and environmental factors which make people or systems vulnerable to the impacts of natural hazards and the adverse effects of climate change or other transformation processes. Moreover, the term vulnerability also covers the abilities and capacities of people or systems to cope with and adapt to the negative impacts of natural hazards. So in a comprehensive sense, the term relates to the vulnerability of societies.

→ The **WorldRiskIndex** is calculated by multiplying exposure with vulnerability, since risk is understood as interaction between exposure and vulnerability.

A detailed description of the concept, the indicators used and the method to calculate the WorldRiskIndex (Birkmann et al. 2011) is given in the WorldRiskReport 2011 and at www.WorldRiskReport.de.

The WorldRiskIndex 2015 calculates the risk for 171 countries from 28 indicators, five indicators of which relate to the area of exposure and 23 to the area of vulnerability. In all, 15 of the 23 vulnerability indicators have been updated (see table in the menu item “Indicators” at www.WorldRiskReport.de). For the remaining eight indicators, the data from the previous year was used, since no updated data was available. There has been no new data for the five indicators on exposure since 2012.

Within the component of **susceptibility**, updated data sets are available for five of the seven indicators:

C → share of population undernourished
D → share of under 15- and over 65-year-olds in relation to working urban population
E → share of population living with USD 1.25 per day or less (purchasing power parity)
F → per capita gross domestic product (purchasing power parity)
G → Gini Index.

Within the component of **coping capacities**, three of the five indicators have been updated:

A → corruption perception
B → good governance
C → number of physicians per 10,000 inhabitants.

Seven out of eleven indicators in the WorldRiskIndex have been updated for the component **adaptive capacities:**

A → literacy rate
B → combined gross school enrollment
C → gender parity in education
D → share of female representatives in the National Parliament
I → public health expenditure
J → life expectancy
K → private health expenditure.

The worksheets for the 28 indicators together with the latest data sets and their sources are available at www.WorldRiskReport.de.

Results of the WorldRiskIndex 2015

Since no new data is available on exposure, the changes in the country rankings relate exclusively to changes in vulnerability, as they already did in the WorldRiskIndex 2013 and 2014. The results of the individual values for 171 countries are listed in the table in the annex. The graphic representations of the Index can be viewed on Map C on the right fold-out page of the cover and on the World Map on pages 48/49.

From a scientific angle, changes in the indicators over a short or limited period have to be interpreted with caution since data quality and data currency in the individual indicators sometimes differ considerably (Freudenberg 2003; Meyer 2004). Nevertheless, taking these uncertainties into account, the values and classifications of the countries for last year's and this year's Index can be critically reviewed, and clear shifts within the vulnerability components can be analyzed (Bündnis Entwicklung Hilft/United Nations University 2014).

The indicators chosen and their changes over time allow certain options for risk reduction to be derived from them. In this respect, the ranking lists ought to serve the purpose of initiating discussions and measures among political decision-makers in the context of disaster preparedness and development planning.

Susceptibility

Almost all of the countries with the highest levels of susceptibility are located in the Sahel Zone and the tropical regions of Africa, as Map B1 on the left fold-out page of the cover and the Top 15 table demonstrate. Among the Top 15, with the exception of Haiti, all countries belong to the African continent. In comparison to last year, among the Top 15 countries, the Central African Republic and Tanzania have seen the biggest changes. The Central African Republic dropped from rank 10, with a value of 61.54 in the previous year, to rank 3 and the value of 63.51 in 2015. This is above all due to an increase in the undernourished population from 28.2 per cent to 37.6 per cent and a reduction in the per capita gross domestic product from USD 980.81 to USD 606.16. In contrast, although the undernourished population share rose by 1.6 per cent, Tanzania improved, having climbed from rank 3, with a value of 64.27, to rank 11 and a value of 59.46. The main reasons for this are above all a reduction in the share of the population having to live on less than USD 1.25 per day and an increase in the per capita gross domestic product. In detail, the poverty indicator fell from 67.87 per cent to 43.48 per cent, and the gross domestic product rose from USD 1,684.41 per capita to USD 2,591.15.

The 15 countries with the highest susceptibility worldwide

Country	Sus. (%)	Rank
Madagascar	65.08	1
Mozambique	63.66	2
Central Afr. Rep.	63.51	3
Burundi	63.29	4
Liberia	62.32	5
Zambia	62.29	6
Haiti	61.67	7
Eritrea	61.59	8
Chad	61.14	9
Malawi	60.43	10
Tanzania	59.46	11
Niger	59.04	12
Comoros	58.64	13
Togo	57.97	14
Sierra Leone	57.32	15

The 15 most exposed countries worldwide

Country	Exp. (%)	Rank
Vanuatu	63.66	1
Tonga	55.27	2
Philippines	52.46	3
Japan	45.91	4
Costa Rica	42.61	5
Brunei Darussalam	41.10	6
Mauritius	37.35	7
Guatemala	36.30	8
El Salvador	32.60	9
Bangladesh	31.70	10
Chile	30.95	11
Netherlands	30.57	12
Solomon Islands	29.98	13
Fiji	27.71	14
Cambodia	27.65	15

The 15 countries with the highest lack of coping capacities worldwide

Country	Lack of C. C. (%)	Rank
Sudan	92.89	1
Afghanistan	92.36	2
Chad	91.14	3
Haiti	90.76	4
Yemen	90.51	5
Central Afr. Rep.	90.35	6
Guinea-Bissau	89.61	7
Guinea	89.32	8
Eritrea	89.21	9
Iraq	88.98	10
Zimbabwe	88.75	11
Burundi	87.75	12
Uganda	87.57	13
Nigeria	87.42	14
Myanmar	87.15	15

The 15 countries with the highest vulnerability worldwide

Country	Vuln. (%)	Rank
Central Afr. Rep.	74.78	1
Chad	74.19	2
Haiti	73.36	3
Eritrea	72.91	4
Afghanistan	72.49	5
Liberia	71.97	6
Niger	71.87	7
Sierra Leone	71.67	8
Guinea	70.63	9
Mozambique	70.16	10
Guinea-Bissau	70.09	11
Burundi	70.03	12
Mali	69.69	13
Madagascar	69.58	14
Comoros	68.19	15

The 15 countries with the highest lack of adaptive capacities worldwide

Country	Lack of A. C. (%)	Rank
Sierra Leone	72.05	1
Central Afr. Rep.	70.49	2
Mali	70.44	3
Chad	70.28	4
Niger	70.20	5
Guinea	69.86	6
Afghanistan	69.33	7
Liberia	68.91	8
Eritrea	67.93	9
Haiti	67.64	10
Guinea-Bissau	67.42	11
Cote d'Ivoire	65.95	12
Benin	65.11	13
Ethiopia	64.91	14
Yemen	63.89	15

The 15 countries that are most at risk worldwide

Country	Risk (%)	Rank
Vanuatu	36.72	1
Tonga	28.45	2
Philippines	27.98	3
Guatemala	20.10	4
Solomon Islands	19.29	5
Bangladesh	19.26	6
Costa Rica	17.17	7
Cambodia	16.82	8
Papua New Guinea	16.82	9
El Salvador	16.80	10
Timor-Leste	16.23	11
Brunei Darussalam	16.15	12
Mauritius	14.66	13
Nicaragua	14.63	14
Guinea-Bissau	13.78	15

Lack of coping capacities

The cartographic representation of the lack of coping capacities (Map B2, left fold-out page of the cover) shows hotspot regions in Africa and Asia, as the Top 15 table also demonstrates. The biggest shifts in ranks in all 171 countries have been recorded for Saudi-Arabia and Rwanda. Saudi Arabia moved from rank 96 to 110, through a slight improvement in the "Governance" indicators ("Corruption perception" and "Good governance"), but primary through an increase in the number of physicians from 9.39 to 24.91 per 10,000 inhabitants. This is expressed in a shift from the former "medium lack of coping capacities" class to the class with a "low lack of coping capacities". In contrast, Rwanda worsened by eight ranks, from rank 62 to rank 54, which can be traced back mainly to the "Corruption perception" index, followed by "Good governance".

Lack of adaptive capacities

The hotspot regions for the lack of adaptive capacities (Map B3, left foldout page of the cover) can be found mainly in West Africa and the Sahel Zone as well as in parts of Southeast Asia. However, the biggest shifts have occurred in other regions. In comparison to the previous year, Brazil, for example, moved from the class with a "medium lack of adaptive capacities" to the class with a "low lack" and climbed seven positions from rank 97 to 104. The crucial factors here are a reduction in the illiteracy rate and increase in the number of female representatives in the National Parliament as well as a rise in public health expenditure by 46 per cent and private health expenditure by 19.25 per cent. A comparison with the Top 15 table from 2014 shows that Afghanistan improved from rank 1 to rank 7 while the Central African Republic dropped from rank 13 to rank 2. In Afghanistan, changes mostly concern an improvement in the literacy rate and public as well as private health expenditure, whereas in the Central African Republic, public and

private health expenditure dropped by 26 per cent and 27.3 per cent respectively.

Vulnerability

Both the map for vulnerability (Map B, right foldout page of the cover) and the Top 15 table show that the countries with the highest vulnerabilities can be found mainly on the African continent. With the exception of Haiti and Afghanistan, all 15 countries with the highest levels of vulnerability are in Africa. In comparison to the previous year, the Central African Republic significantly worsened in terms of susceptibility and adaptive capacities (see above), so that rank 1 has been recorded for vulnerability (still at rank 5 in the previous year). Other conspicuous examples from the list of the 171 include Brazil, which, compared to the previous year, improved by five ranks, having moved from the class with "medium vulnerability" to the class with "low vulnerability (above all thanks to improved adaptive capacities, see above). In the previous year, South Africa had ranked 103rd, while this year, it is at rank 97, which has also resulted in a shift from the class with "low vulnerability" to the class with "medium vulnerability". The reasons for this can be found in the component "lack of adaptive capacities", in concrete terms above all in a decline in combined gross school enrollment and in gender parity in education.

Exposure to natural hazards

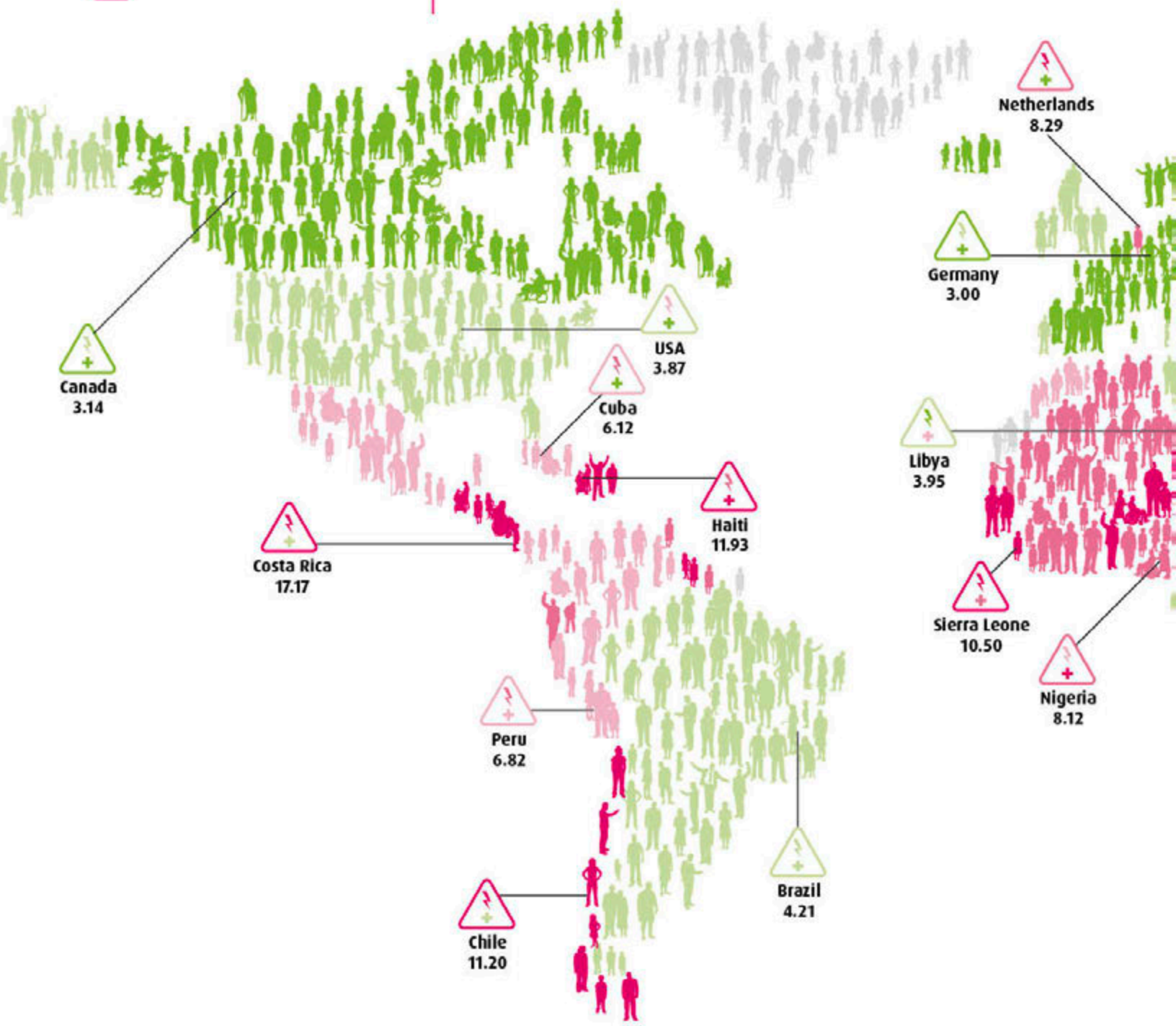
No updated information has been available in this component since the WorldRiskReport 2012 as the data concerned is not updated annually but only at longer intervals because of the small temporal changes in exposure. For this reason, the world map for exposure (Map A, right foldout page of the cover) shows the same global hazard zones as in the previous years. The hotspot regions are Central America and the Pacific coastal countries of South America, parts of Southern Europe and West Africa, as well as Southeast Asia and the Pacific islands.

WorldRiskIndex 2015

The global hotspot regions of risk have not changed in comparison to the previous years and continue to be in Oceania, Southeast Asia, Central America and the Southern Sahel. In comparison to 2014, Togo and Indonesia have swapped classes. Last year, Togo was in the class with a "high risk", and now it is in the class with a "very high risk". This is because of Togo's worsening vulnerability that is due to an 85 per cent increase in people having to live on less than USD 1.25 per day and a rise in the unequal distribution of income (Gini Index from 39.29 to 45.96), which has led to a difference in ranks of five. In contrast, Indonesia has slightly improved in terms of vulnerability thanks to an increase in its coping capacities, in concrete terms in the area of the "governance" indicators and the adaptive capacities owing to a rise in public and private health expenditure. Thus, Indonesia now bears the value that the "high risk" class starts off with.

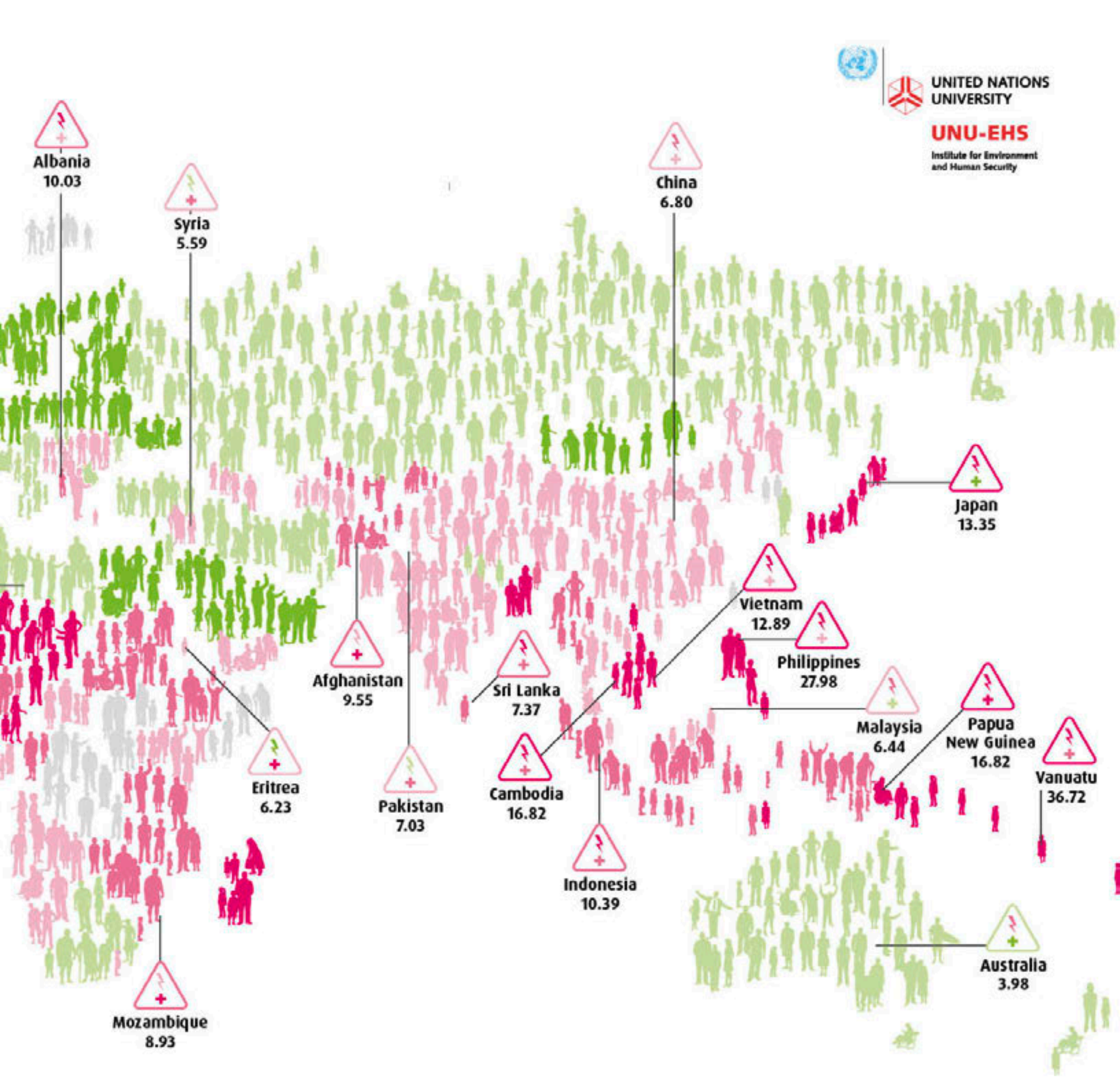
Bündnis Entwicklung Hilft

WorldRiskIndex



WorldRiskIndex (WRI) in %		Exposure in %		Vulnerability in %	
very low	0.08 – 3.46	very low	0.28 – 9.25	very low	25.73 – 35.09
low	3.47 – 5.46	low	9.26 – 11.53	low	35.10 – 44.23
medium	5.47 – 7.30	medium	11.54 – 13.85	medium	44.24 – 51.53
high	7.31 – 10.39	high	13.86 – 17.45	high	51.54 – 63.09
very high	10.40 – 36.72	very high	17.46 – 63.66	very high	63.10 – 74.78
no data available		no data available		no data available	

Data: Source IREUS, based on the PREVIEW Global Risk Data Platform, CReSIS, CIESIN and global databases; detailed information at www.WorldRiskReport.org;



Country	WRI	↯	+
Albania	10.03 %	21.25 %	47.19 %
Afghanistan	9.55 %	13.17 %	72.49 %
Australia	3.98 %	15.05 %	26.48 %
Bangladesh	10.26 %	31.20 %	60.76 %
Bosnia and Herzegov.	6.18 %	14.02 %	44.06 %
Brazil	4.21 %	9.53 %	44.23 %
Chile	11.20 %	30.92 %	36.19 %
Costa Rica	17.17 %	42.61 %	40.29 %
Germany	3.00 %	11.41 %	26.32 %
Eritrea	6.23 %	8.55 %	72.91 %

Country	WRI	↯	+
Haiti	11.93 %	16.26 %	73.36 %
Indonesia	10.39 %	19.36 %	53.67 %
Japan	13.35 %	45.91 %	29.08 %
Cambodia	16.82 %	27.65 %	60.84 %
Canada	3.14 %	10.25 %	30.68 %
Cuba	6.12 %	17.45 %	35.09 %
Libya	3.95 %	7.80 %	50.64 %
Malaysia	6.44 %	14.60 %	44.10 %
Mozambique	8.93 %	12.73 %	70.16 %
Netherlands	8.29 %	30.57 %	27.12 %

Country	WRI	↯	+
Nigeria	8.12 %	12.06 %	67.39 %
Pakistan	7.03 %	11.36 %	61.91 %
Papua New Guinea	16.82 %	24.94 %	67.46 %
Peru	6.82 %	14.40 %	47.38 %
Philippines	27.98 %	52.46 %	53.33 %
Sierra Leone	10.59 %	14.65 %	71.67 %
Syria	5.59 %	10.56 %	52.97 %
USA	3.87 %	12.25 %	31.58 %
Vanuatu	36.72 %	63.66 %	57.68 %
Vietnam	12.89 %	25.35 %	50.87 %

Max. = 100 %, Classification according to the quantile method. ↯ = Exposure, + = Vulnerability

4. Food security: recommendations for action and perspectives

Food insecurity hardly ever results from natural circumstances but is crucially conditioned by social injustice and economic imbalances. It can be aggravated both by political instability and climate change. In all cases, those suffering from an insecure food situation are ill-prepared to face extreme natural hazards – there is a much higher disaster risk. Thus, in combating food insecurity, each investment pays its way double becauseit simultaneously reduces disaster risk. The reverse effect is that if disaster risk drops, food security will rise. These relationships have to be accepted by political decision-makers at global and national level as well as actors in development cooperation and business as the starting point for effective measures.

The international agenda

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2015 and 2016 are two particularly important years for achieving the goals of food security and significantly reducing disaster risk. Five fundamental international processes are reaching important milestones that feature international conferences and their corresponding agreements (see Figure 7 below).

Regarding their topics and goals, the international agreements negotiated during these conferences are closely intermeshed. The Sendai Framework for Disaster Risk Reduction 2015 – 2030 ("Sendai Framework") follows the Hyogo Framework for Action 2005 –2015, and contains an extensive package of measures to reduce disaster risk. Here, food security plays a key role in two respects. First, poverty and hunger are mentioned as underlying factors of disaster risks. Tackling poverty and hunger forms a central element in reducing these risks. Second, the Sendai Framework attaches more importance to being well prepared for crisis situations rather than opting for pure intervention during the crisis. Here too, food security plays a crucial role (United Nations General Assembly 2015a).

Figure 7: International conferences relating to food security and risk reduction

The Sendai Framework is also to be reflected in the more comprehensive Sustainable Development Goals (SDGs), the successors of the Millennium Development Goals, although with a much broader remit. Whereas the Millennium Goals were above all focused on combating poverty and its consequences, and therefore on the developing countries, the SDGs have been designed with a view to worldwide sustainable development and therefore represent an agenda for all nations (United Nations General Assembly 2015b). Moreover, the SDGs also prescribe a higher benchmark in poverty eradication. Whereas Millennium Goal 1 called for a halving of extreme poverty and hunger by 2015 (see Chapter 1 on implementation), SDG 2 demands a complete elimination of both poverty and all forms of undernourishment and malnutrition by 2030. SDG 13 focuses on measures to reduce risks and to prepare for disaster situations (awareness raising), especially in the context of climate change. Like the Sendai Agreement, this Goal attributes considerable importance to preparatory and preventive measures. In addition to direct measures such as building dykes, setting up early-warning systems or quakeproof designs for buildings, addressing the underlying factors having an unfavorable impact on risk development – above all poverty, conflicts, discrimination, bad governance, and corruption – plays an important role.

The national states are responsible for implementing both the goals of the Sendai Agreement and the SDGs. However, the process will be moderated by the United Nations in order to combine the goals in a common framework and feed them into international agreements. The Sendai Agreement calls on the governments to formulate and implement national goals for risk reduction. However, it is just as important, albeit not yet sufficiently considered, to improve the international support mechanisms for crisis situations that the coping capacities of individual states are inadequate for. This is pointed out e.g. in the preparatory documents for the World Humanitarian Summit (OCHA 2013). Here too, the transition from mechanisms focusing predominantly on intervention (i.e. providing assistance in crisis situations) to increasingly preventive measures is going to be of importance. In providing international aid, care has to be taken that support is oriented on local needs rather than on the interests of those providing it, that it integrates local actors as much as possible, and that it does not endanger existing mechanisms, e.g. those in the food sector (see Chapter 2.3).

The 2015 Climate Conference in Paris (COP21) is to result in a binding agenda on compliance with the so-called Two Degree Goal. A global rise in temperatures of two degrees in comparison to the values before the Industrial Revolution is generally regarded by researchers as a limit above which complete adaptation is no longer possible and grave damage has to be reckoned with in the long term. The Two Degree Goal was reiterated at the precursor conference in Lima in December 2014 (COP20 2015). In spite of many uncertainties regarding modeling as well as insufficient data, there are many indications that global warming has the greatest influence on agricultural yields where the biggest problems with food security already exist today, i.e. in Africa and South Asia (Wheeler/von Braun 2013).

Finally, the conference in Addis Ababa addressed fundamental aspects of financing future development agendas and presented them in the Addis Ababa Action Agenda (AAAA) (United Nations General Assembly 2015c). The AAAA calls on the industrialized countries to honor their pledge to provide 0.7 per cent of their gross domestic product for development cooperation, a promise that has so far been kept by only a few countries. However, the AAAA also clarifies that the considerable financing requirements cannot be met solely by traditional development cooperation and aid programs. Rather, it is necessary to increasingly involve the private sector without freeing bilateral aid

from responsibility. Further important requirements that the AAAA refers to include sustainable industrialization, eliminating trade obstacles, developing national and international taxation mechanisms, combating illegal business and facilitating knowledge and technology transfer. All these topics are of central importance to food security and reducing disaster risk in the long term. One concern that the AAAA finally voices is so-called additionality: Money from the private sector should really constitute additional resources and should not be passed to account as government development cooperation.

Raising food security through a lower disaster risk

Disasters often have a negative impact on food security (see Chapter 2.1). The fewer disasters a country has to cope with, the better this will be for food security. Therefore, specific measures have to be implemented to reduce vulnerability and promote resilience towards disasters. In the following, basic recommendations are given that do not, however, lay claim to completeness, as is also the case with those in the further sections of this chapter.

1. Knowing the needs

In order to effectively promote resilience in the food sector, a corresponding knowledge base has to be developed.

Recommendations:

- → The national governments of those countries most susceptible to crises and most dependent on humanitarian aid have to set up monitoring centers. Data on the food situation and on coping strategies in the event of a disaster should be established regularly. These measures require the support of international donors.

- → The development cooperation actors ought to take stock of the impact and effectiveness of measures to promote resilience on a continuing basis. Data, e.g. on food security, should be established at various levels (individuals, households, communities, further environment) and for different socioeconomic or ethnic groups of the population.

- → Science and research ought to check the effectiveness of early warning systems in order to identify the institutional and political obstacles to an early response. The insights gained from such checking processes have to be implemented by the national governments, which may require the support of international institutions.

2. Being proactive rather than merely responding

Being prepared can mitigate crises and prevent disasters. Measures to this end include lowering susceptibility, strengthening coping capacities and developing adaptive measures (see Chapter 1). The respective national governments are responsible for this.

Recommendations:

- → The national governments have to include measures to build up resilience in the disaster preparedness strategies. One example is the improved storage of food. It ensures that no food stocks are lost before or during a disaster, thus raising the resilience of the population.

- → The farmers ought to work towards a diversification of food production and thus mitigate the effects of increasing climate change. In addition, they ought to use seed that is adapted to the weather conditions and soil quality of the

environment they are living in. In order to achieve this, the national governments and international institutions have to stop the monopolization of the seed sector by a few large companies. For example, local farmers' seed exchange systems linked with communicating experience and knowhow can raise resilience towards disasters.

→ Development cooperation actors ought to support farmers protecting their fields against floods as well as desertification. Suitable measures include building dykes, irrigation and drainage systems based on ditches and rainwater retention basins or building terraced fields.

→ Agriculture ought to abandon monocultures, for they damage the ecology of the soil and one-sidedly withdraw nutrients from it, thus creating a gateway for pests and necessitating the use of pesticides and herbicides that put a further strain on the soil and destroy biodiversity. In addition, owing to a lack of boundaries such as hedges and dykes, the soils are much more susceptible to erosion and drifting.

→ The insurance industry ought to expand the potential of micro farming insurances, which provide smallholders with coverage for weather-related damages and failed harvests, enabling them to make a new start. Micro farming insurances may require subsidies from government authorities or international aid programs.

3. Reducing climate vulnerability, limiting changes in climates

The international community of states bears the chief responsibility for strategies to limit climate change and its impacts. This must by no means be restricted to adaptation measures alone but also has to address the multitude of causes of climate change.

Recommendations:

→ National governments have to devise and implement food security strategies to cope with extreme weather events. Public or government financing must be provided for projects to strengthen the resilience of communities through better food security.

→ The chief negotiators in the international climate negotiations have to rigorously limit climate change and support the two degree limit. In the food sector, this also includes restricting CO2 emissions from industrialized agriculture in the food sector.

→ Given the increase in extreme weather events, development cooperation actors ought to support smallholders farming on a sustainable basis in particular in adapting their production to the (new) local conditions. This increases the prospects of preventing food supply bottlenecks in the event of a crisis. One example is the use of drought-resistant or appropriate seed. International donors ought to promote this e.g. in the framework of climate funds.

Lower disaster risk through higher level of food security

Hunger aggravates disaster risk (see Chapters 2.2 and 2.4). Reducing hunger is therefore also a fundamental prerequisite for risk reduction. The human right to food is an enshrined international right. Hence food security measures are not charity but a commitment (see Chapter 1).

→ continued on page 58

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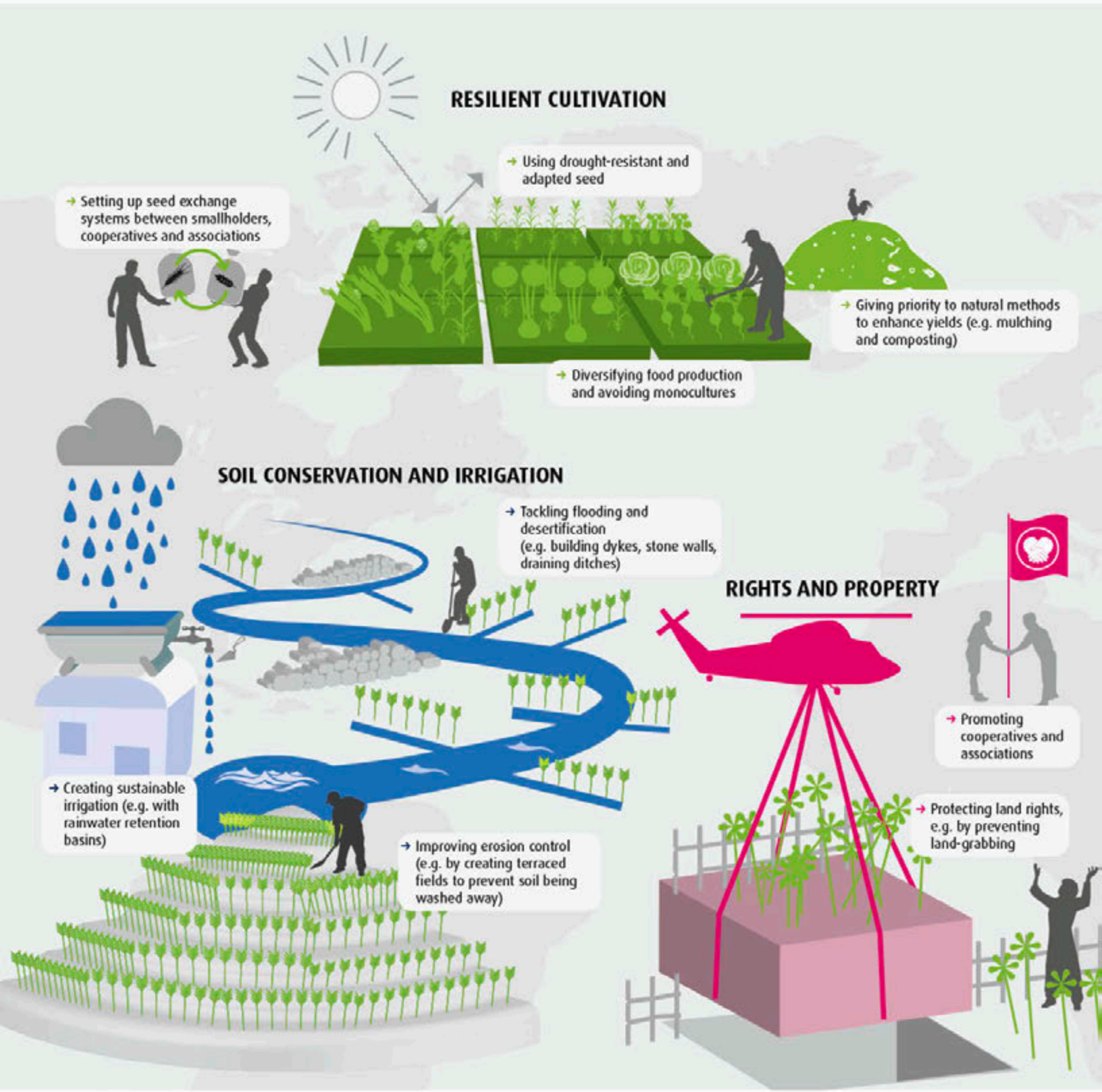
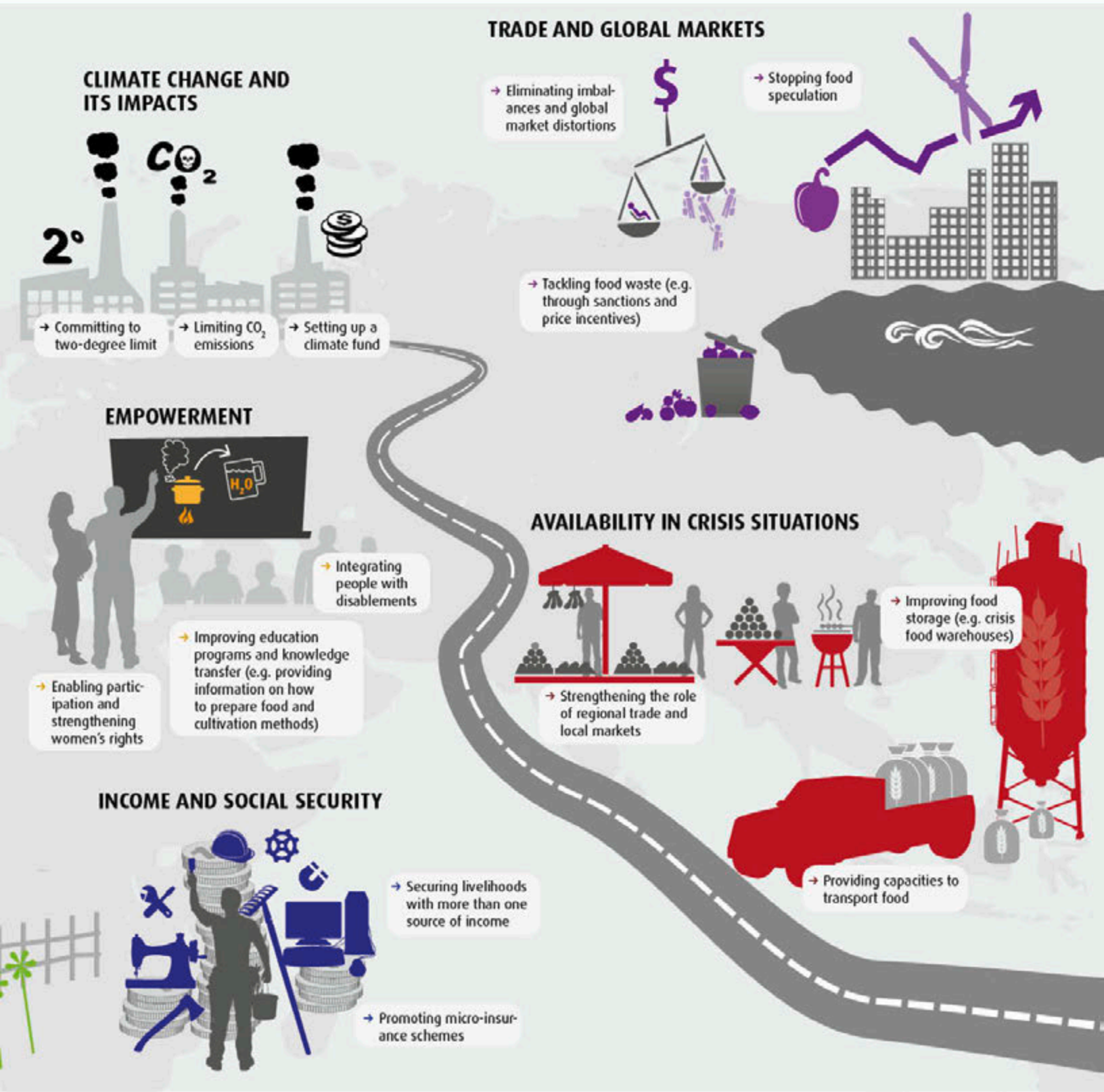
Securing food supplies, preventing disasters

A selection of measures to raise food security




TRADE AND GLOBAL MARKETS
→ Eliminating imbalances and global market distortions
→ Stopping food speculation
→ Tackling food waste (e.g. through sanctions and price incentives)
CLIMATE CHANGE AND ITS IMPACTS
2°
CO_2
→ Committing to two-degree limit
→ Limiting CO_2 emissions
→ Setting up a climate fund
EMPOWERMENT
H_2O
→ Integrating people with disablements
→ Improving education programs and knowledge transfer (e.g. providing information on how to prepare food and cultivation methods)
→ Enabling participation and strengthening women's rights
AVAILABILITY IN CRISIS SITUATIONS
→ Improving food storage (e.g. crisis food warehouses)
→ Strengthening the role of regional trade and local markets
→ Providing capacities to transport food
INCOME AND SOCIAL SECURITY
→ Securing livelihoods with more than one source of income
→ Promoting micro-insurance schemes

→ continued from page 55

1. Strengthening rural areas

Three out of four people suffering from hunger live in rural areas (WFP 2015c), which is where food is usually produced. Therefore, rural areas in developing countries ought to be strengthened with the aim of people there being able to achieve permanent access to sufficient, healthy, and culturally adapted food.

Recommendations:

- The national governments have to focus on developing infrastructure, transport capacities, and markets in rural areas and provide government financing to this end where required. This ought to be part of the national risk reduction strategies. Here, owing to its especially important role in local food security and to safeguard it in the short term in the event of a disaster, supporting smallholder agriculture is paramount.

- Since the absence or unclear formulation of land ownership and use rights has a very negative impact on food security and readiness to be prepared, the national governments have to give high priority to clarifying and securing these rights – even though this represents one of the biggest challenges some countries are facing. This gives smallholders in particular legal security while also offering the landless new prospects.

- The national governments and the development cooperation actors have to promote alternative sources of income to agriculture that in particular offer the opportunity to cover at least part of farmers' demand in the event of a failed harvest. This can significantly lower the risk of food insecurity – also after disasters.

- Farmers themselves ought to grasp the initiative to achieve more yield security in agricultural production. Suitable methods include improved growing methods, diversified cultivation, resource-friendly agriculture (e.g. irrigation management and higher soil fertility through composting and the use of mulch), promoting the cultivation of nutritious regional food and avoiding post-harvest losses. Development cooperation actors ought to assist farmers in implementing these measures.

- The development cooperation actors ought to support smallholders in getting organized in cooperatives in order to commonly store, process and sell agricultural produce. In addition, smallholders ought to be offered training in innovative approaches and access to agricultural extension services.

2. Redesigning framework conditions

In rural regions, intact agriculture attuned to local and regional needs can make an important contribution to food security in times of crisis, which is why regional and local markets must have the opportunity to hold their own given an industrially and world market oriented agriculture and food model. This cannot be achieved solely by the laws of the market. Here, the concept of food sovereignty and its role in risk reduction can serve as a basis for strengthening local markets (see Chapter 2.4).

Recommendations:

- National governments in developing countries have to be allowed to promote sustainable agriculture without having to face accusations of inadmissible subsidies in the context of international trade agreements. The reform of national and international trade rules has to strengthen local markets and regional economic cycles. To promote food sovereignty, developing countries must have the opportunity to

protect themselves against cheap food imports, orient pricing of agricultural produce on the production costs and give priority to achieving the right to food for the population ahead of export orientation.

- The national governments and authorities must see to it that purchase of land or leaseholds are socially compatible. Especially in the case of large area investments, care should be taken to involve local organizations. Steps have to be taken to counter the growing practice of landgrabbing. The Voluntary Guidelines on the Responsible Governance of Land, Fisheries and Forests (FAO 2012) ought to be observed.

- In the industrialized countries, political decision-makers, business and consumers should reject any produce originating from farming practices that destroy the natural resources in the long term – such as animal feed from soy monocultures or the use of agricultural commodities such as cane sugar as biofuel. They should put an end to all practices of food speculation and, furthermore, prevent whenever possible all forms of food waste and loss along the entire value chain of agricultural products up to the point of consumption.

3. Promoting research and innovation in the food sector

More research and knowledge transfer is needed to improve the resilience of local food systems and smallholder production. This applies both to new technologies and to research on traditional cultivation methods or food fortified with micronutrients. Climate change and the necessary adaptation measures are also an important topic.

Recommendations:

- National governments and authorities have to support a broad debate on the application of new insights in science and their combination with local knowledge and knowhow.

- The national governments have to ensure that agricultural ecology innovations are introduced in large area agriculture in order to simultaneously meet the demands of the growing cities and the needs of a largely poor rural population in developing countries. Here, the innovative potential and the economic potential of the private sector need to be integrated.

- National governments, especially those of countries with changing climate conditions alternating between extreme drought and heavy rainfall, must support the development of suitable adaptation measures. Examples here are the optimization of irrigation and reservoir systems, resistant grain varieties and better storage.

- Science and research ought to further examine biofortification, i.e. breeding food plants with higher micronutrient content, because it can make an important contribution to food security. However, research in this area should also examine possible risks and long-term negative impacts (e.g. through transgenic methods). This and other initiatives based on fortifying food with micronutrients should be integrated in comprehensive food policies.

Aspects of measures to achieve more food security in the event of a crisis

Unintentional effects of measures to achieve more food security aid can be caused both by unsuitable approaches and a lack of participation in developing them as well as a lack of professionalism and a poor coordination in the implementation of the disaster intervention.

1. Helping without doing harm

Since food insecurity can have disastrous consequences in the event of a disaster, it is important not to make any mistakes in an acute situation and work as efficiently as possible. Over the last few years, there have been considerable developments in the humanitarian system (see Chapter 2.3). Nevertheless, it is still being criticized for doing harm despite its good intentions.

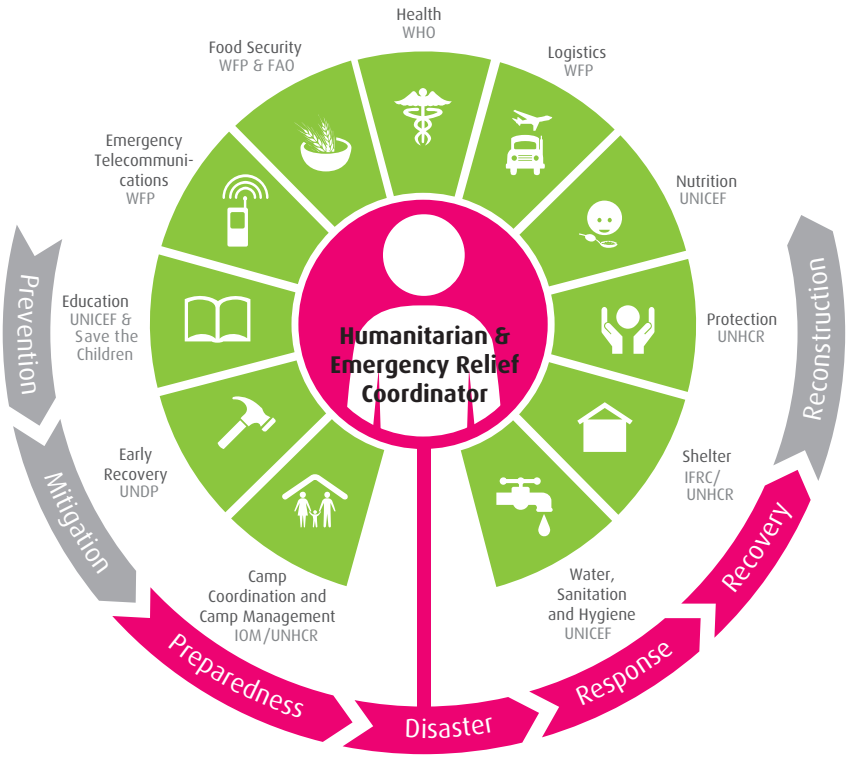


Figure 8: The international cluster system in humanitarian aid (OCHA 2012)

Recommendations:

- International organizations and donor countries must provide food aid in disaster situations that has been tailored to the respective context and is based on thorough analysis. Action must not be guided by seeking reductions in levels of surplus produce.
- Donor countries have to ratify the Food Assistance Convention (Food Assistance Committee 2012). The transition from the Food Aid Convention to the Food Assistance Convention, which provides for more flexibility in food aid, has to be consistently implemented.
- Actors in development cooperation and humanitarian aid have to ensure that the transition is made from emergency relief projects to long-term development projects in the food sector and is already taken into consideration in planning emergency relief measures. Development programs with the aim of raising resilience always ought to contain components developing local capacities and strengthening local structures. In this manner, dependence can be reduced and exit strategies for relief organizations can be put in place.
- Actors in humanitarian aid have to continuously monitor the development of emergency relief standards. In future, complying with standards has to be subject to accountability on the part of the actors, which needs to be newly introduced at aninternational level.

2. Focusing on vulnerable groups of the population and strengthening participation

Special attention has to be given to considering weaker groups of the population such as smallholders, landless people, or indigenous peoples. This also applies to people with impairments, since they are often the most vulnerable in hazardous situations. Furthermore, the considerable contribution to food security made by women has to be recognized, as do the special needs of pregnant women and infants (see Chapter 1).

Recommendations:

- National governments have to see to it that suitable forms of participation in the field of food security and disaster preparedness are created at local, national, and international level.
- National governments have to give special attention to vulnerable groups of the population. Women's equality must enjoy high priority. This includes securing land rights for them or preventing them from losing these where necessary.
- It is up to the national governments to support educational measures on sustainable cultivating methods, the preservation of food, and healthy dietary practices, taking women into particular consideration.
- For actors in humanitarian aid and development cooperation, the top priority must be that of securing food supplies for infants and pregnant women. Wherever necessary, in addition to directly ensuring food supplies, improvements have to be achieved in mother-and-child care through adequate access to healthcare (e.g. because of malnutrition due to infestation with parasites and/or disease) and hygiene.
- Actors in humanitarian aid and development cooperation have to ensure that vulnerable groups of people in particular, such as persons with impairments or elderly people, are not disadvantaged in food programs or during food handouts in emergency situations. The measures therefore have to be inclusive and barrier-free.

3. Improving coordination, strengthening local disaster protection

In many disaster situations, there has been justified criticism of a lack of coordination and ill-guided aid. Those offering help have to address this and respond accordingly. Wherever criticism is justified, consequences ought to be drawn immediately.

Recommendations:

- Actors in humanitarian aid ought to continuously improve the coordination of international and national aid in disaster events and give priority to involving those hit by the disaster and the local actors. Special attention ought to be given to not weakening the capacities of the national and local authorities and civil society. Suitable partners have to be identified in time among the national and local authorities. Emergency relief programs then have to work with these structures and build their activities on them; they must not work in parallel to them. Otherwise, there will be too big a danger of communities and countries becoming permanently dependent on humanitarian aid.
- Organizations heading a cluster have to eliminate the lack of participatory approaches, which has also been identified for the cluster of "food security", for example by getting rid of language barriers, better access to coordination meetings and more public relations activities.
- Actors in humanitarian aid and national governments have to ensure that, with a view to sustainability, communication between the clusters and national structures is performed in each phase – from

disaster preparedness through responses to rehabilitation.

→ Science and research are called on to reduce the knowledge deficit among international actors regarding the disaster protection structures at local level and provide analyses in this area before the disasters occur and the UN clusters are set up.

Options for implementation and intervention

The international processes described above provide a comprehensive basis for the implementation of the recommendations. While the SDGs form the framework in this context, the Sendai Framework and the preparatory documents of the World Humanitarian Summit focus on important special topics. The formulations in these agreements and documents are, of necessity, general and have to be put into concrete terms at various levels.

One important instrument for the implementation of the SDGs will be a system of indicators that is planned to be developed by March 2016. It should be insisted that this system remain adaptable over the next few years and give experience gained due consideration. Also, so-called assessment procedures will have to be created for the monitoring of progress made in implementation. Here, national statistics authorities are going to assume an important role. One challenge will be to develop systems of indicators and assessments in a manner making them meaningful while not putting too much of a burden on the responsible authorities. This challenge also arises from the fact that some of the indicators will be difficult to measure.

The above-described international processes are closely linked to the issue of food security in many ways – with regard to all four dimensions defined by the FAO: availability, access, stability and use. Availability is strongly codetermined by agricultural yields, and these are in turn considerably influenced by climate factors, both in a positive and a negative sense. The strongest negative influences are apparent in the countries of Sub-Saharan Africa and South Asia, i.e. in countries that are already experiencing problems regarding food security and also showing a high level of vulnerability towards natural hazards (Wheeler/von Braun 2013). This unfavorable coincidence will have to be considered in every risk reduction strategy in these countries, both at national and at international level.

However, this relationship also implies the positive consequence of enormous synergies. Progress in food security is going to reduce disaster risk in many respects and lead to more resilience among the population. Efforts at national and international level are also required for access to food supplies and stable food supplies, both to create suitable institutional and infrastructural conditions at national level and to promote fair trade systems and world market structures. Here, fair above all means that local and regional markets can hold their own in international systems. This is of crucial importance since, especially in crisis situations, they represent a stabilizing and hence risk-mitigating factor. One very important objective has to be to support functioning national and local structures and not to weaken them by intervening from outside. This also applies to development cooperation, humanitarian missions as well as private sector activities.

Country	WRI	Rank
Afghanistan	9.55 %	40.
Albania	10.03 %	37.
Algeria	7.53 %	61.
Angola	6.62 %	84.
Argentina	3.62 %	131.
Armenia	6.18 %	94.
Australia	3.98 %	124.
Austria	3.61 %	132.
Azerbaijan	5.98 %	98.
Bahamas	4.21 %	122.
Bahrain	1.76 %	164.
Bangladesh	19.26 %	6.
Barbados	1.22 %	168.
Belarus	3.07 %	145.
Belgium	3.26 %	140.
Belize	6.60 %	85.
Benin	11.41 %	24.
Bhutan	7.71 %	58.
Bolivia	4.82 %	112.
Bosnia a.Herzegov.	6.18 %	93.
Botswana	5.43 %	104.
Brazil	4.21 %	123.
Brunei Darussalam	16.15 %	12.
Bulgaria	4.26 %	119.
Burkina Faso	9.48 %	41.
Burundi	10.59 %	33.
Cambodia	16.82 %	8.
Cameroon	11.12 %	28.
Canada	3.14 %	142.
Cape Verde	10.17 %	36.
Centr. Afr. Republic	7.02 %	73.
Chad	11.05 %	29.
Chile	11.20 %	26.
China	6.80 %	80.
Colombia	6.72 %	82.
Comoros	7.48 %	63.
Congo	7.35 %	67.
Costa Rica	17.17 %	7.
Cote d'Ivoire	9.06 %	42.
Croatia	4.21 %	121.
Cuba	6.12 %	96.
Cyprus	2.76 %	150.
Czech Republic	3.46 %	137.
Denmark	2.95 %	149.
Djibouti	9.94 %	38.
Dominican Rep.	11.34 %	25.
Ecuador	7.44 %	65.
Egypt	2.26 %	159.
El Salvador	16.80 %	10.
Equatorial Guinea	4.69 %	115.
Eritrea	6.23 %	91.
Estonia	2.42 %	156.
Ethiopia	7.45 %	64.
Fiji	13.47 %	16.
Finland	2.26 %	160.
France	2.76 %	151.
Gabon	6.25 %	90.
Gambia	12.11 %	19.
Georgia	6.55 %	86.
Germany	3.00 %	146.
Ghana	8.65 %	46.
Greece	7.06 %	71.
Grenada	1.44 %	167.
Guatemala	20.10 %	4.
Guinea	8.50 %	48.
Guinea-Bissau	13.78 %	15.
Guyana	11.61 %	22.
Haiti	11.93 %	21.
Honduras	10.70 %	31.
Hungary	5.41 %	106.
Iceland	1.55 %	166.
India	6.88 %	78.
Indonesia	10.39 %	35.
Iran (Islamic Rep.)	4.83 %	111.
Iraq	4.76 %	114.
Ireland	4.46 %	118.
Israel	2.39 %	157.
Italy	4.54 %	117.
Jamaica	12.07 %	20.
Japan	13.35 %	17.
Jordan	4.68 %	116.
Kazakhstan	3.67 %	129.
Kenya	6.95 %	75.
Kiribati	1.73 %	165.
Korea, Republic of	4.79 %	113.
Kuwait	3.26 %	141.
Kyrgyzstan	8.25 %	52.
Lao P. D. Republic	5.67 %	100.
Latvia	3.42 %	138.
Lebanon	4.96 %	109.
Lesotho	6.97 %	74.
Liberia	7.89 %	57.
Libyan Arab Jam.	3.95 %	125.
Lithuania	2.98 %	147.
Luxembourg	2.46 %	154.
Madagascar	11.16 %	27.
Malawi	8.27 %	51.
Malaysia	6.44 %	88.
Mali	8.75 %	45.
Malta	0.62 %	170.
Mauritania	8.14 %	53.
Mauritius	14.66 %	13.
Mexico	6.23 %	92.
Mongolia	2.96 %	148.
Morocco	6.76 %	81.
Mozambique	8.93 %	44.
Myanmar	9.01 %	43.
Namibia	5.59 %	102.
Nepal	5.23 %	108.
Netherlands	8.29 %	50.
New Zealand	4.23 %	120.
Nicaragua	14.63 %	14.
Niger	11.41 %	23.
Nigeria	8.12 %	54.
Norway	2.28 %	158.
Oman	2.75 %	152.
Pakistan	7.03 %	72.
Panama	7.30 %	69.
Papua N. Guinea	16.82 %	9.
Paraguay	3.65 %	130.
Peru	6.82 %	79.
Philippines	27.98 %	3.
Poland	3.27 %	139.
Portugal	3.56 %	135.
Qatar	0.08 %	171.
Rep. of Moldova	4.88 %	110.
Romania	6.50 %	87.
Russia	3.84 %	128.
Rwanda	7.32 %	68.
Saudi Arabia	1.10 %	169.
Senegal	10.89 %	30.
Serbia	6.89 %	77.
Seychelles	2.56 %	153.
Sierra Leone	10.50 %	34.
Singapore	2.24 %	161.
Slovakia	3.52 %	136.
Slovenia	3.57 %	134.
Solomon Islands	19.29 %	5.
South Africa	5.43 %	105.
Spain	3.10 %	143.
Sri Lanka	7.37 %	66.
Sudan	8.02 %	55.
Suriname	8.36 %	49.
Swaziland	7.55 %	60.
Sweden	2.22 %	162.
Switzerland	2.46 %	155.
Syrian Arab Rep.	5.59 %	101.
Tajikistan	7.16 %	70.
Thailand	6.38 %	89.
The f. Yugoslav Rep. of Macedonia	6.14 %	95.
Timor-Leste	16.23 %	11.
Togo	10.59 %	32.
Tonga	28.45 %	2.
Trinidad and Tobago	7.48 %	62.
Tunisia	5.46 %	103.
Turkey	5.37 %	107.
Turkmenistan	6.90 %	76.
Uganda	6.63 %	83.
Ukraine	3.09 %	144.
United Arab Emirates	1.84 %	163.
United Kingdom	3.58 %	133.
United Republic of Tanzania	7.94 %	56.
United States	3.87 %	127.
Uruguay	3.93 %	126.
Uzbekistan	8.56 %	47.
Vanuatu	36.72 %	1.
Venezuela	5.89 %	99.
Viet Nam	12.89 %	18.
Yemen	6.00 %	97.
Zambia	7.55 %	59.
Zimbabwe	9.88 %	39.

Countries not listed in the WorldRiskIndex

- Andorra
- Antigua and Barbuda
- Dem. People's Republic of Korea
- Demokratic Republic of the Congo
- Dominica
- Federated States of Micronesia
- Liechtenstein
- Maledives
- Marshall Islands
- Monaco
- Montenegro
- Nauru
- Palau
- Samoa
- San Marino
- São Tomé und Príncipe
- Somalia
- St. Kitts and Nevis
- St. Lucia
- St. Vincent and the Grenadines
- South Sudan
- Tuvalu

Rank	Country	WorldRiskIndex	Exposition	Vulnerability	Susceptibility	Lack of coping capacities	Lack of adaptive capacities
1.	Vanuatu	36.72 %	63.66 %	57.68 %	35.69 %	81.16 %	56.20 %
2.	Tonga	28.45 %	55.27 %	51.47 %	28.78 %	81.80 %	43.82 %
3.	Philippines	27.98 %	52.46 %	53.33 %	32.00 %	80.06 %	47.94 %
4.	Guatemala	20.10 %	36.30 %	55.36 %	34.52 %	80.08 %	51.48 %
5.	Solomon Islands	19.29 %	29.98 %	64.34 %	44.55 %	85.66 %	62.82 %
6.	Bangladesh	19.26 %	31.70 %	60.76 %	39.05 %	86.55 %	56.69 %
7.	Costa Rica	17.17 %	42.61 %	40.29 %	21.60 %	64.34 %	34.94 %
8.	Cambodia	16.82 %	27.65 %	60.84 %	39.50 %	86.95 %	56.07 %
9.	Papua New Guinea	16.82 %	24.94 %	67.46 %	55.29 %	84.07 %	63.02 %
10.	El Salvador	16.80 %	32.60 %	51.53 %	29.83 %	74.90 %	49.85 %
11.	Timor-Leste	16.23 %	25.73 %	63.09 %	51.31 %	81.46 %	56.48 %
12.	Brunei Darussalam	16.15 %	41.10 %	39.28 %	17.76 %	63.28 %	36.80 %
13.	Mauritius	14.66 %	37.35 %	39.25 %	18.24 %	61.53 %	37.98 %
14.	Nicaragua	14.63 %	27.23 %	53.75 %	37.03 %	80.37 %	43.85 %
15.	Guinea-Bissau	13.78 %	19.65 %	70.09 %	53.24 %	89.61 %	67.42 %
16.	Fiji	13.47 %	27.71 %	48.63 %	24.84 %	75.10 %	45.93 %
17.	Japan	13.35 %	45.91 %	29.08 %	17.64 %	37.88 %	31.72 %
18.	Viet Nam	12.89 %	25.35 %	50.87 %	25.90 %	76.73 %	49.98 %
19.	Gambia	12.11 %	19.29 %	62.81 %	44.57 %	83.21 %	60.65 %
20.	Jamaica	12.07 %	25.82 %	46.75 %	26.40 %	72.03 %	41.81 %
21.	Haiti	11.93 %	16.26 %	73.36 %	61.67 %	90.76 %	67.64 %
22.	Guyana	11.61 %	22.90 %	50.70 %	28.97 %	78.83 %	44.31 %
23.	Niger	11.41 %	15.87 %	71.87 %	59.04 %	86.35 %	70.20 %
24.	Benin	11.41 %	17.06 %	66.84 %	53.97 %	81.44 %	65.11 %
25.	Dominican Republic	11.34 %	23.14 %	49.00 %	28.67 %	73.80 %	44.53 %
26.	Chile	11.20 %	30.95 %	36.19 %	19.69 %	58.03 %	30.84 %
27.	Madagascar	11.16 %	16.03 %	69.58 %	65.08 %	83.69 %	59.98 %
28.	Cameroon	11.12 %	18.19 %	61.13 %	42.60 %	84.75 %	56.05 %
29.	Chad	11.05 %	14.89 %	74.19 %	61.14 %	91.14 %	70.28 %
30.	Senegal	10.89 %	17.57 %	62.00 %	46.77 %	80.33 %	58.90 %
31.	Honduras	10.70 %	20.01 %	53.50 %	35.10 %	81.39 %	44.00 %
32.	Togo	10.59 %	15.56 %	68.10 %	57.97 %	85.28 %	61.04 %
33.	Burundi	10.59 %	15.13 %	70.03 %	63.29 %	87.75 %	59.04 %
34.	Sierra Leone	10.50 %	14.65 %	71.67 %	57.32 %	85.63 %	72.05 %
35.	Indonesia	10.39 %	19.36 %	53.67 %	31.21 %	80.28 %	49.51 %
36.	Cape Verde	10.17 %	20.26 %	50.19 %	32.86 %	70.54 %	47.18 %
37.	Albania	10.03 %	21.25 %	47.19 %	20.13 %	74.00 %	47.43 %
38.	Djibouti	9.94 %	16.34 %	60.86 %	36.34 %	82.84 %	63.39 %
39.	Zimbabwe	9.88 %	14.96 %	66.04 %	55.76 %	88.75 %	53.62 %
40.	Afghanistan	9.55 %	13.17 %	72.49 %	55.77 %	92.36 %	69.33 %
41.	Burkina Faso	9.48 %	14.32 %	66.17 %	54.03 %	83.83 %	60.65 %
42.	Cote d'Ivoire	9.06 %	13.67 %	66.29 %	46.81 %	86.09 %	65.95 %
43.	Myanmar	9.01 %	14.87 %	60.60 %	34.85 %	87.15 %	59.80 %
44.	Mozambique	8.93 %	12.73 %	70.16 %	63.66 %	84.50 %	62.32 %
45.	Mali	8.75 %	12.55 %	69.69 %	54.29 %	84.34 %	70.44 %
46.	Ghana	8.65 %	14.48 %	59.72 %	44.52 %	77.48 %	57.15 %
47.	Uzbekistan	8.56 %	16.18 %	52.94 %	29.75 %	77.73 %	51.36 %
48.	Guinea	8.50 %	12.03 %	70.63 %	52.72 %	89.32 %	69.86 %
49.	Suriname	8.36 %	18.12 %	46.13 %	27.51 %	70.85 %	40.01 %
50.	Netherlands	8.29 %	30.57 %	27.12 %	15.09 %	42.47 %	23.80 %
51.	Malawi	8.27 %	12.34 %	66.98 %	60.43 %	84.03 %	56.49 %
52.	Kyrgyzstan	8.25 %	16.63 %	49.61 %	26.66 %	76.08 %	46.08 %
53.	Mauritania	8.14 %	12.47 %	65.29 %	48.03 %	86.20 %	61.66 %
54.	Nigeria	8.12 %	12.06 %	67.39 %	53.26 %	87.42 %	61.51 %
55.	Sudan	8.02 %	11.86 %	67.61 %	51.38 %	92.89 %	58.56 %
56.	United Rep. of Tanzania	7.94 %	12.01 %	66.11 %	59.46 %	83.57 %	55.30 %
57.	Liberia	7.89 %	10.96 %	71.97 %	62.32 %	84.67 %	68.91 %
58.	Bhutan	7.71 %	14.81 %	52.07 %	30.35 %	74.19 %	51.68 %

Rank	Country	WorldRiskIndex	Exposition	Vulnerability	Susceptibility	Lack of coping capacities	Lack of adaptive capacities
59.	Zambia	7.55 %	11.37 %	66.46 %	62.29 %	79.97 %	57.11 %
60.	Swaziland	7.55 %	12.76 %	59.18 %	44.84 %	79.92 %	52.79 %
61.	Algeria	7.53 %	15.82 %	47.58 %	22.63 %	77.05 %	43.07 %
62.	Trinidad and Tobago	7.48 %	17.54 %	42.68 %	19.74 %	68.51 %	39.78 %
63.	Comoros	7.48 %	10.97 %	68.19 %	58.64 %	84.79 %	61.14 %
64.	Ethiopia	7.45 %	11.12 %	67.04 %	56.15 %	80.04 %	64.91 %
65.	Ecuador	7.44 %	16.15 %	46.07 %	27.99 %	73.97 %	36.25 %
66.	Sri Lanka	7.37 %	14.79 %	49.86 %	25.33 %	78.23 %	46.03 %
67.	Congo	7.35 %	11.65 %	63.13 %	50.98 %	85.86 %	52.56 %
68.	Rwanda	7.32 %	11.98 %	61.11 %	54.09 %	80.27 %	48.96 %
69.	Panama	7.30 %	16.45 %	44.35 %	27.05 %	67.18 %	38.82 %
70.	Tajikistan	7.16 %	12.98 %	55.15 %	34.36 %	76.43 %	54.64 %
71.	Greece	7.06 %	21.11 %	33.45 %	17.78 %	50.82 %	31.75 %
72.	Pakistan	7.03 %	11.36 %	61.91 %	36.71 %	86.50 %	62.51 %
73.	Central African Republic	7.02 %	9.39 %	74.78 %	63.51 %	90.35 %	70.49 %
74.	Lesotho	6.97 %	11.40 %	61.17 %	48.50 %	78.36 %	56.65 %
75.	Kenya	6.95 %	10.69 %	65.03 %	53.82 %	85.92 %	55.35 %
76.	Turkmenistan	6.90 %	13.19 %	52.31 %	27.03 %	75.96 %	53.94 %
77.	Serbia	6.89 %	18.05 %	38.18 %	18.07 %	65.95 %	30.51 %
78.	India	6.88 %	11.94 %	57.59 %	36.37 %	79.75 %	56.64 %
79.	Peru	6.82 %	14.40 %	47.38 %	28.05 %	73.38 %	40.69 %
80.	China	6.80 %	14.43 %	47.10 %	25.27 %	70.57 %	45.46 %
81.	Morocco	6.76 %	13.25 %	51.00 %	27.48 %	75.27 %	50.25 %
82.	Colombia	6.72 %	13.84 %	48.57 %	27.71 %	74.76 %	43.25 %
83.	Uganda	6.63 %	10.16 %	65.26 %	54.32 %	87.57 %	53.90 %
84.	Angola	6.62 %	10.18 %	65.00 %	48.86 %	85.84 %	60.31 %
85.	Belize	6.60 %	13.31 %	49.60 %	27.77 %	74.19 %	46.83 %
86.	Georgia	6.55 %	14.69 %	44.62 %	24.95 %	63.77 %	45.15 %
87.	Romania	6.50 %	15.77 %	41.25 %	21.73 %	61.12 %	40.90 %
88.	Malaysia	6.44 %	14.60 %	44.10 %	19.10 %	67.13 %	46.07 %
89.	Thailand	6.38 %	13.70 %	46.55 %	19.63 %	75.14 %	44.89 %
90.	Gabon	6.25 %	11.95 %	52.28 %	33.25 %	73.72 %	49.86 %
91.	Eritrea	6.23 %	8.55 %	72.91 %	61.59 %	89.21 %	67.93 %
92.	Mexico	6.23 %	13.84 %	45.01 %	23.72 %	71.56 %	39.75 %
93.	Bosnia and Herzegovina	6.18 %	14.02 %	44.06 %	19.62 %	69.68 %	42.88 %
94.	Armenia	6.18 %	14.51 %	42.57 %	20.65 %	70.86 %	36.19 %
95.	T. f. Y. Rep. of Macedonia	6.14 %	14.38 %	42.70 %	20.53 %	63.85 %	43.72 %
96.	Cuba	6.12 %	17.45 %	35.09 %	17.74 %	56.84 %	30.69 %
97.	Yemen	6.00 %	9.04 %	66.32 %	44.57 %	90.51 %	63.89 %
98.	Azerbaijan	5.98 %	13.16 %	45.42 %	21.84 %	70.05 %	44.36 %
99.	Venezuela	5.89 %	13.15 %	44.80 %	23.48 %	74.73 %	36.18 %
100.	Lao P. D. Republic	5.67 %	9.55 %	59.38 %	39.52 %	84.33 %	54.30 %
101.	Syrian Arab Republic	5.59 %	10.56 %	52.97 %	25.89 %	84.49 %	48.54 %
102.	Namibia	5.59 %	10.41 %	53.71 %	45.80 %	71.00 %	44.32 %
103.	Tunisia	5.46 %	12.45 %	43.86 %	20.68 %	72.92 %	37.98 %
104.	Botswana	5.43 %	10.55 %	51.48 %	36.35 %	67.64 %	50.44 %
105.	South Africa	5.43 %	12.08 %	44.94 %	29.63 %	68.94 %	36.23 %
106.	Hungary	5.41 %	15.61 %	34.68 %	16.12 %	53.13 %	34.80 %
107.	Turkey	5.37 %	12.25 %	43.83 %	20.01 %	68.36 %	43.12 %
108.	Nepal	5.23 %	9.16 %	57.09 %	40.97 %	80.69 %	49.62 %
109.	Lebanon	4.96 %	11.14 %	44.50 %	19.68 %	70.33 %	43.50 %
110.	Republic of Moldova	4.88 %	11.11 %	43.91 %	21.82 %	67.52 %	42.40 %
111.	Iran (Islamic Republic of)	4.83 %	10.19 %	47.44 %	19.80 %	80.66 %	41.87 %
112.	Bolivia	4.82 %	8.98 %	53.66 %	37.45 %	79.62 %	43.91 %
113.	Korea, Republic of	4.79 %	14.89 %	32.17 %	14.53 %	46.79 %	35.18 %
114.	Iraq	4.76 %	8.08 %	58.87 %	29.22 %	88.98 %	58.42 %
115.	Equatorial Guinea	4.69 %	8.22 %	57.08 %	30.48 %	84.93 %	55.83 %
116.	Jordan	4.68 %	10.53 %	44.44 %	21.42 %	68.08 %	43.82 %

Rank	Country	WorldRiskIndex	Exposition	Vulnerability	Susceptibility	Lack of coping capacities	Lack of adaptive capacities
117.	Italy	4.54 %	13.85 %	32.75 %	17.20 %	54.92 %	26.14 %
118.	Ireland	4.46 %	14.74 %	30.28 %	15.53 %	46.47 %	28.83 %
119.	Bulgaria	4.26 %	11.66 %	36.51 %	18.64 %	55.88 %	35.02 %
120.	New Zealand	4.23 %	15.44 %	27.42 %	16.57 %	44.05 %	21.63 %
121.	Croatia	4.21 %	11.53 %	36.55 %	18.03 %	55.74 %	35.88 %
122.	Bahamas	4.21 %	10.71 %	39.36 %	18.84 %	53.32 %	45.93 %
123.	Brazil	4.21 %	9.53 %	44.23 %	24.06 %	66.25 %	42.39 %
124.	Australia	3.98 %	15.05 %	26.48 %	15.78 %	42.68 %	20.98 %
125.	Libyan Arab Jamahiriya	3.95 %	7.80 %	50.64 %	25.09 %	76.48 %	50.35 %
126.	Uruguay	3.93 %	11.10 %	35.41 %	20.26 %	50.71 %	35.27 %
127.	United States	3.87 %	12.25 %	31.58 %	16.38 %	48.71 %	29.65 %
128.	Russia	3.84 %	9.38 %	41.00 %	21.27 %	58.91 %	42.83 %
129.	Kazakhstan	3.67 %	9.11 %	40.30 %	17.62 %	62.58 %	40.70 %
130.	Paraguay	3.65 %	7.03 %	51.97 %	28.74 %	78.80 %	48.37 %
131.	Argentina	3.62 %	9.55 %	37.91 %	20.32 %	58.50 %	34.91 %
132.	Austria	3.61 %	13.60 %	26.53 %	14.91 %	37.23 %	27.47 %
133.	United Kingdom	3.58 %	11.60 %	30.88 %	17.21 %	46.80 %	28.62 %
134.	Slovenia	3.57 %	11.59 %	30.80 %	14.95 %	50.98 %	26.48 %
135.	Portugal	3.56 %	10.93 %	32.56 %	17.57 %	47.73 %	32.37 %
136.	Slovakia	3.52 %	10.21 %	34.47 %	14.42 %	54.27 %	34.71 %
137.	Czech Republic	3.46 %	10.82 %	31.95 %	15.11 %	50.11 %	30.62 %
138.	Latvia	3.42 %	9.26 %	36.89 %	21.17 %	53.18 %	36.33 %
139.	Poland	3.27 %	9.79 %	33.45 %	17.40 %	53.11 %	29.84 %
140.	Belgium	3.26 %	11.66 %	27.98 %	16.25 %	38.09 %	29.60 %
141.	Kuwait	3.26 %	9.04 %	36.01 %	11.58 %	63.86 %	32.58 %
142.	Canada	3.14 %	10.25 %	30.68 %	15.22 %	46.72 %	30.10 %
143.	Spain	3.10 %	10.23 %	30.31 %	16.64 %	48.71 %	25.58 %
144.	Ukraine	3.09 %	7.50 %	41.14 %	18.66 %	61.15 %	43.61 %
145.	Belarus	3.07 %	8.46 %	36.28 %	16.60 %	60.54 %	31.69 %
146.	Germany	3.00 %	11.41 %	26.32 %	15.47 %	37.49 %	26.00 %
147.	Lithuania	2.98 %	8.88 %	33.52 %	17.62 %	49.16 %	33.77 %
148.	Mongolia	2.96 %	6.52 %	45.33 %	30.07 %	64.50 %	41.40 %
149.	Denmark	2.95 %	10.87 %	27.15 %	15.39 %	39.43 %	26.63 %
150.	Cyprus	2.76 %	7.44 %	37.11 %	14.73 %	58.13 %	38.49 %
151.	France	2.76 %	9.25 %	29.78 %	16.67 %	44.12 %	28.54 %
152.	Oman	2.75 %	6.41 %	42.82 %	15.71 %	63.70 %	49.05 %
153.	Seychelles	2.56 %	5.99 %	42.79 %	22.01 %	63.12 %	43.23 %
154.	Luxembourg	2.46 %	9.12 %	27.02 %	12.88 %	41.06 %	27.11 %
155.	Switzerland	2.46 %	9.56 %	25.73 %	14.57 %	37.78 %	24.84 %
156.	Estonia	2.42 %	7.23 %	33.46 %	18.03 %	50.94 %	31.39 %
157.	Israel	2.39 %	6.41 %	37.26 %	19.54 %	58.92 %	33.31 %
158.	Norway	2.28 %	8.58 %	26.51 %	14.08 %	39.12 %	26.34 %
159.	Egypt	2.26 %	4.72 %	47.89 %	20.99 %	76.81 %	45.88 %
160.	Finland	2.26 %	8.19 %	27.59 %	15.85 %	39.51 %	27.41 %
161.	Singapore	2.24 %	7.82 %	28.62 %	14.05 %	49.94 %	21.88 %
162.	Sweden	2.22 %	7.97 %	27.89 %	15.53 %	41.67 %	26.46 %
163.	United Arab Emirates	1.84 %	5.93 %	31.08 %	10.36 %	56.35 %	26.53 %
164.	Bahrain	1.76 %	4.27 %	41.21 %	12.88 %	66.69 %	44.07 %
165.	Kiribati	1.73 %	3.05 %	56.68 %	41.19 %	83.69 %	45.17 %
166.	Iceland	1.55 %	5.67 %	27.34 %	14.74 %	43.16 %	24.11 %
167.	Grenada	1.44 %	3.13 %	46.23 %	24.70 %	69.15 %	44.82 %
168.	Barbados	1.22 %	3.46 %	35.27 %	17.06 %	50.69 %	38.07 %
169.	Saudi Arabia	1.10 %	2.93 %	37.55 %	14.76 %	65.96 %	31.92 %
170.	Malta	0.62 %	1.65 %	37.76 %	15.25 %	59.94 %	38.08 %
171.	Qatar	0.08 %	0.28 %	30.13 %	9.04 %	44.88 %	36.47 %

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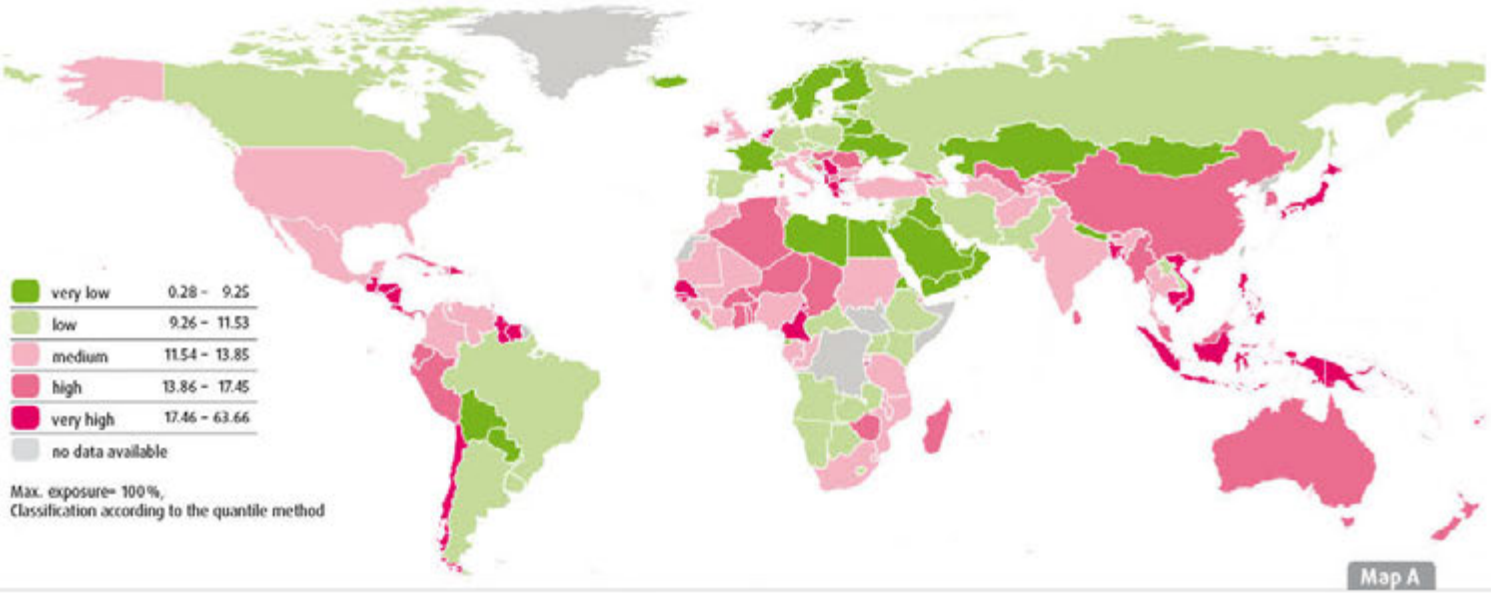
Exposure

Exposure of the population to the natural hazards earthquakes, storms, floods, droughts and sea level rise.



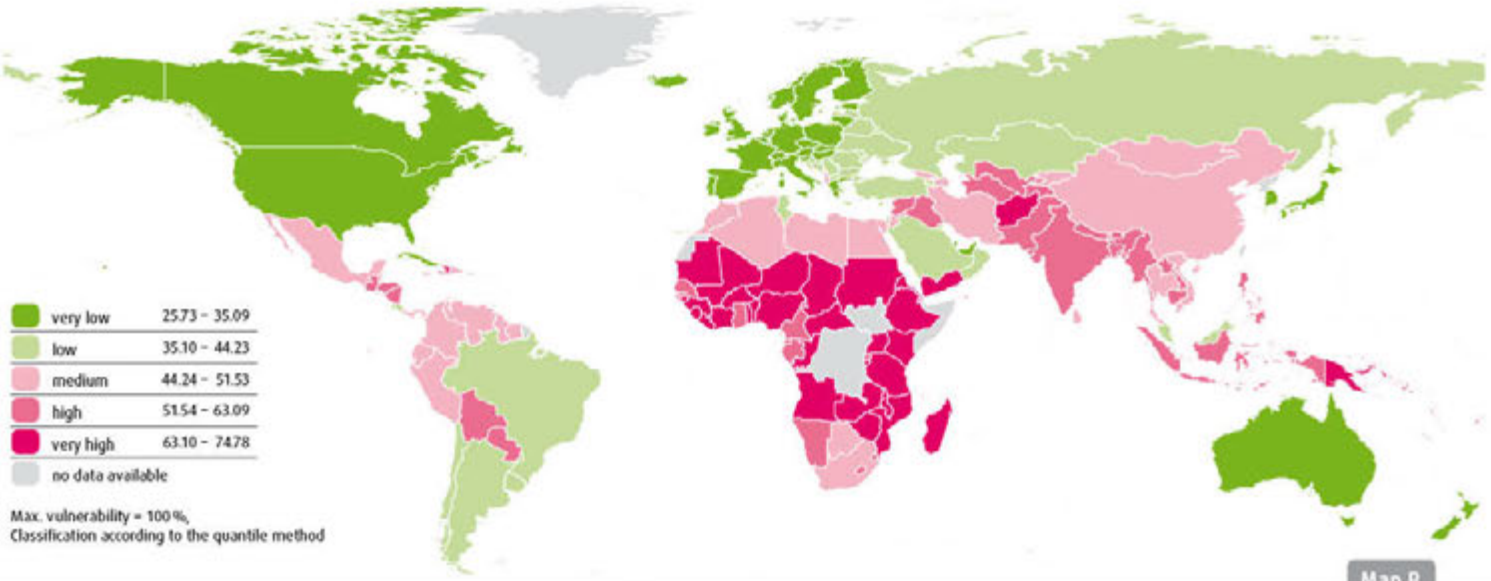
very low	0.28 – 9.25
low	9.26 – 11.53
medium	11.54 – 13.85
high	13.86 – 17.45
very high	17.46 – 63.66
no data available	

Max. exposure= 100 %,
Classification according to the quantile method

Map A

Vulnerability

Vulnerability of society as the sum of susceptibility, lack of coping capacities and lack of adaptive capacities



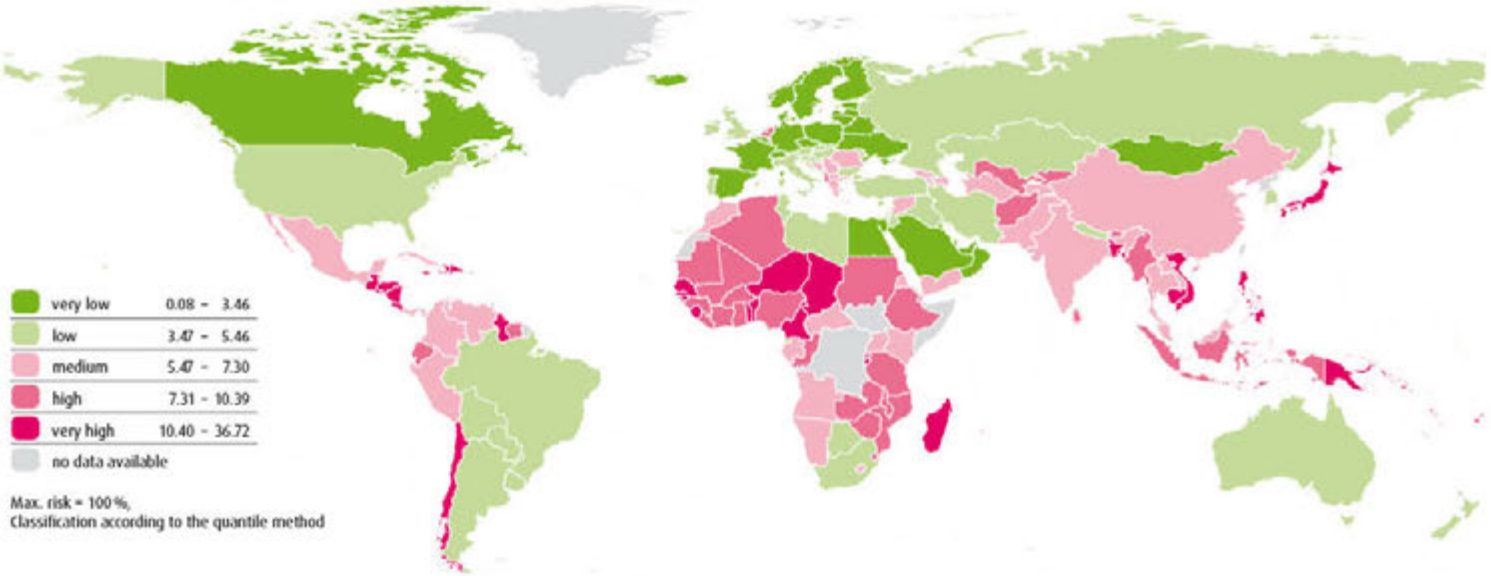
very low	25.73 – 35.09
low	35.10 – 44.23
medium	44.24 – 51.53
high	51.54 – 63.09
very high	63.10 – 74.78
no data available	

Max. vulnerability = 100 %,
Classification according to the quantile method

Map B
Map C

WorldRiskIndex

WorldRiskIndex as the result of exposure and vulnerability



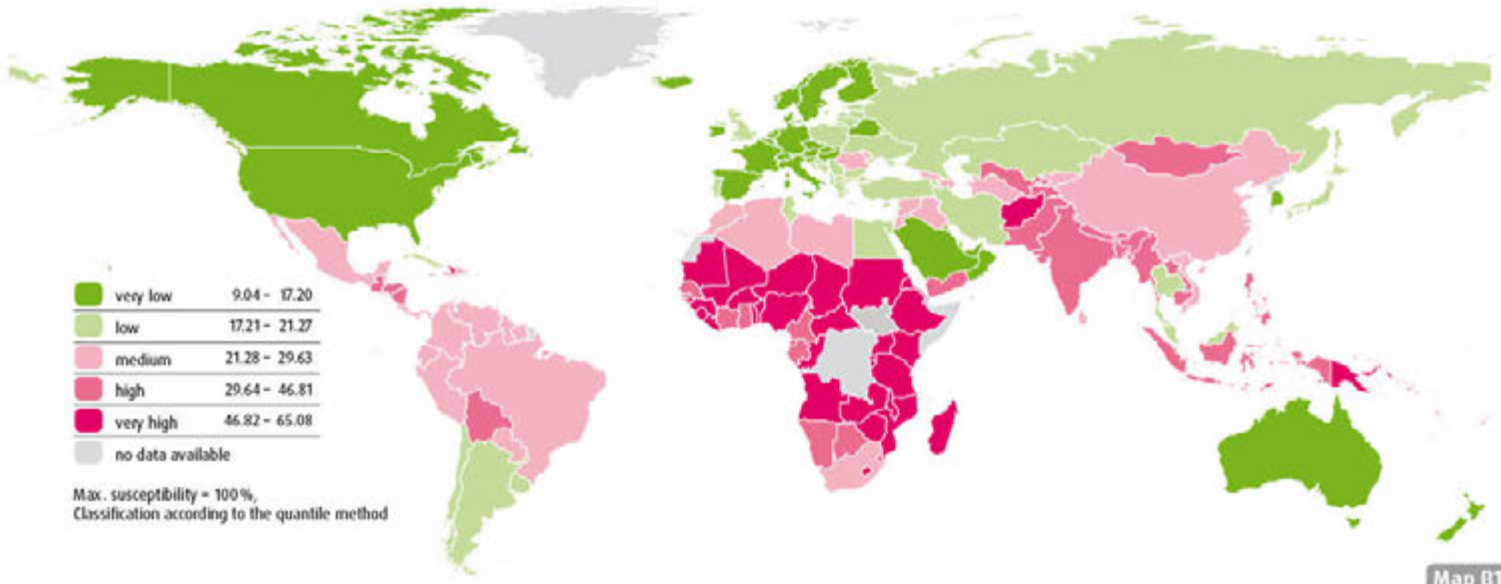
very low	0.08 – 3.46
low	3.47 – 5.46
medium	5.47 – 7.30
high	7.31 – 10.39
very high	10.40 – 36.72
no data available	

Max. risk = 100 %,
Classification according to the quantile method

Data: Source IREUS, based on the PREVIEW Global Risk Data Platform, CReSIS, CIESIN and global databases; detailed information at www.WorldRiskReport.org

Susceptibility

dependent on public infrastructure, nutrition, income and the general economic framework



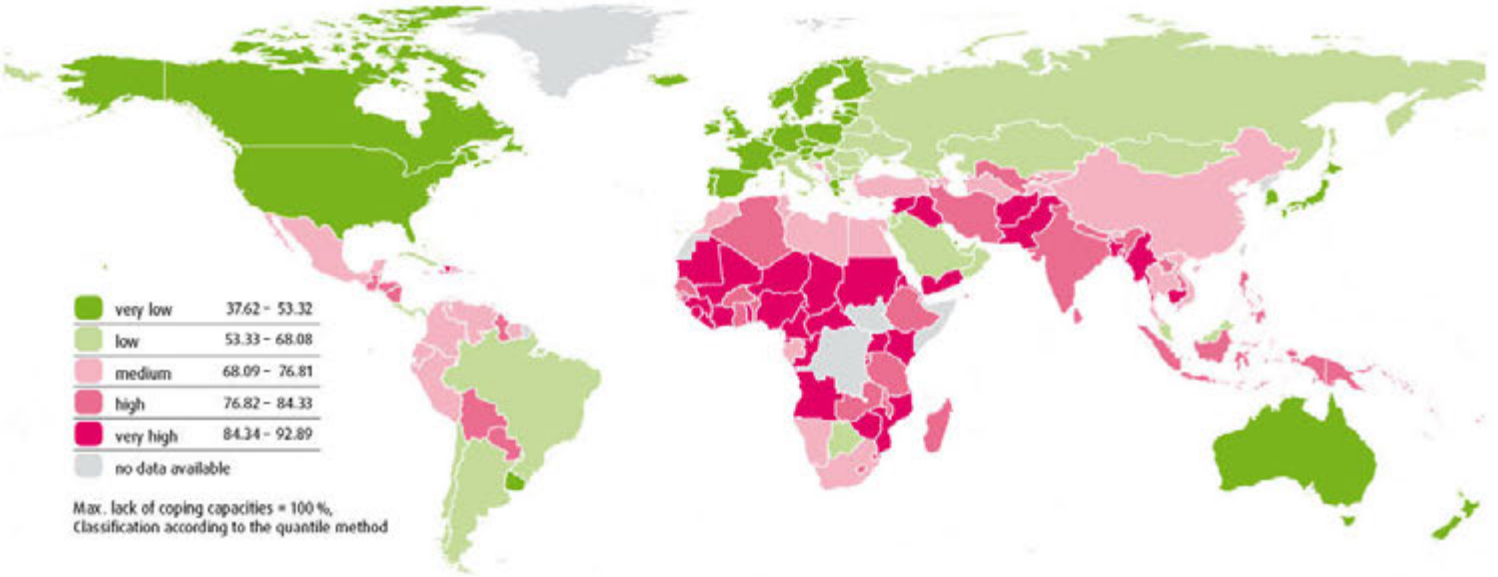
very low	9.04 – 17.20
low	17.21 – 21.27
medium	21.28 – 29.63
high	29.64 – 46.81
very high	46.82 – 65.08
no data available	

Max. susceptibility = 100 %,
Classification according to the quantile method

Map B1
Map B2

Lack of coping capacities

dependent on governance, medical care and material security



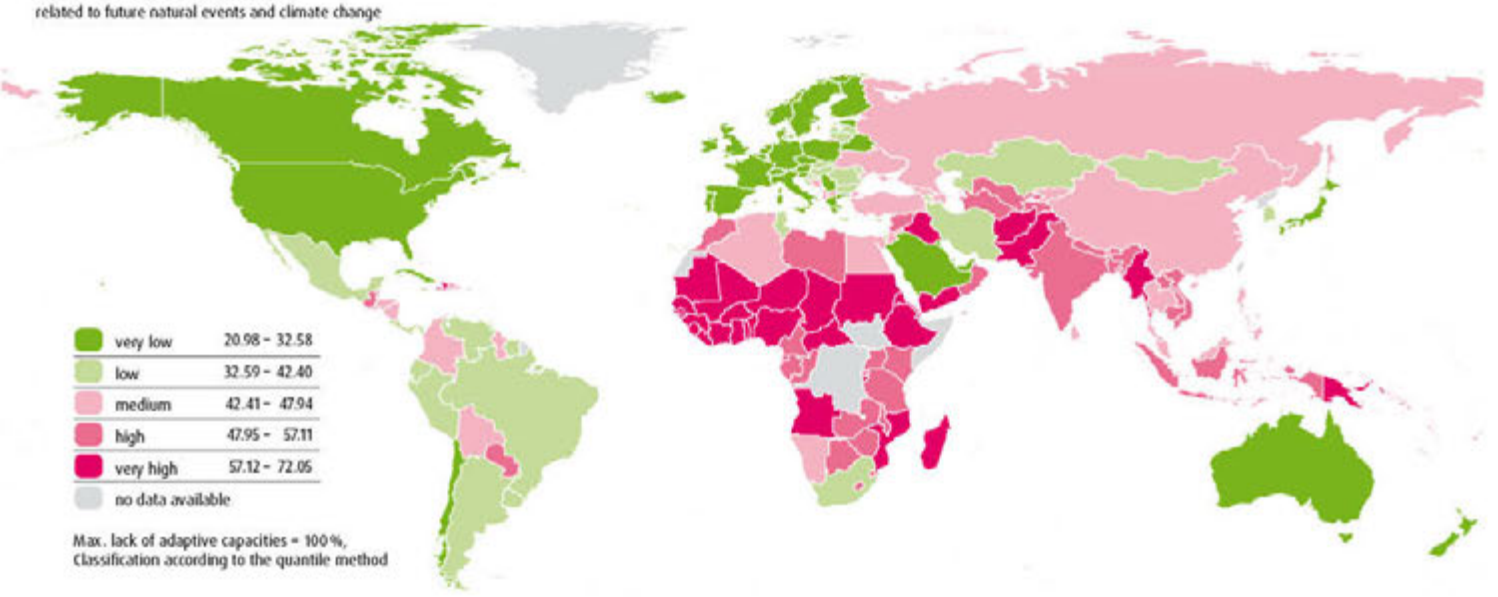
very low	37.62 – 53.32
low	53.33 – 68.08
medium	68.09 – 76.81
high	76.82 – 84.33
very high	84.34 – 92.89
no data available	

Max. lack of coping capacities = 100 %,
Classification according to the quantile method

Map B3

Lack of adaptive capacities

related to future natural events and climate change



very low	20.98 – 32.58
low	32.59 – 42.40
medium	42.41 – 47.94
high	47.95 – 57.11
very high	57.12 – 72.05
no data available	

Max. lack of adaptive capacities = 100 %,
Classification according to the quantile method

Data: Source IREUS, based on the PREVIEW Global Risk Data Platform, CReSIS, CIESIN and global databases; detailed information at www.WorldRiskReport.org

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