2 Climate Change and Farmer–Herder Conflicts in West Africa

Abstract

Nomadic and semi-nomadic herders such as the FulBe have a long history of migrating and also of building relationships with various sedentary farming populations in West Africa. These contacts can take various forms, from coexistence to cooperation or competition and even to conflicts over shared natural renewable resources, namely fresh water and land, which can be referred to as *Common-Pool Resources* (CPRs). The effects of climate change are already being felt in these regions, and the IPCC forecasts that they will significantly increase, with more irregular precipitation and rising temperatures. These changes could aggravate land degradation and increase the frequency of droughts, and consequently lead to declining food production and a decline in the availability of water. Climate change is thus putting a strain on delicate relationships between farmers and herders, because of its effect on CPRs. Herders and farmers of the drylands of West Africa are indeed highly vulnerable to changes in the availability of CPRs. In a context where the object of the conflict plays (or is perceived to play) a key role in the survival of the parties, there are risks of an escalation to violence and a destabilization of the security of both communities. Agro-pastoral conflicts might increase in frequency and intensity in the coming years. However, a conflict reduction lens can be applied to these climate-change-induced or -aggravated farmer–herder conflicts over CPRs in general and in particular in West Africa.

Keywords

Farmer–herder conflicts • Conflict reduction • Climate change impacts • Vulnerability • Common-pool resources (CPRs) • West Africa • FulBe pastoralists

This chapter introduces farmer–herder conflicts and the potential impacts of climate change on such conflicts, with a special focus on West Africa and on the FulBe pastoralists. The FulBe are frequently one of the parties engaged in such conflicts in this region. Farmer–herder conflicts take place in settings where populations often live under difficult natural and climatic conditions. The conflicts commonly stem from competition over access to or use of the natural resources necessary to sustain their livelihood. Furthermore, Africa is highly vulnerable to the impacts of climate change, and the projected impacts could put additional pressure on livelihoods and consequently fuel farmer–herder conflicts. This chapter is therefore composed of an introduction to farmer–herder conflicts (Sect. 2.1), an overview of climate trends and their projected impact on the study area (Sect. 2.2), and a conceptual clarification of the terms 'conflict' and 'conflict reduction' (Sect. 2.3).

2.1 Farmer–Herder Conflicts over Natural Resources

Farmer–herder conflicts oppose communities whose main activity is farming to communities who derive their livelihood from raising cattle. These two population groups often compete for the use of natural renewable resources such as land and water, and the competition sometimes evolves into more or less violent conflicts. These conflicts are widespread

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in Africa. This section introduces farmer–herder conflicts and gives background information on the FulBe, the population group that will later be studied in depth as a party to the conflicts to be analysed.

2.1.1 Farmer–Herder Conflicts: Old News or Topical Issue?

Much has been written on the Rwandan conflict and the tragic genocide of 1994. It is generally acknowledged that the conflict fault line between the Hutu majority and the Tutsi minority was an ethnic one (IISS 2009). However it is much less well-known that 'Hutu' and 'Tutsi' are not solely the names of ethnic groups but respectively mean "people who farm" and "people who own cattle" (Ejigu 2009: 891). Ejigu identifies the confrontation as a typical example of a farmer–herder conflict. Causes of such conflicts usually relate to disputes over the sharing of natural resources such as water and grazing land. Ejigu, however, emphasizes that violent conflicts such as the one in Rwanda[1] are clearly multidimensional (Ejigu 2009: 891). The causes of this slaughter have been vigorously debated and reasons such as regime insecurity and ideological manipulation of ethnicity as well as scarcity and unequal land distribution have been put forward (Ohlsson 1999: 96–112). Because of the complexity of the conflict and the magnitude of the violence, it would be inaccurate to limit a description of it to a confrontation over resources, but scarcity was certainly one dimension of the conflict and has been acknowledged as such by many researchers (Ohlsson 1999: 96).

Another case of similar complexity is that of Darfur in Sudan since 2003. Jeffrey Mazo gives a detailed account of the conflict, which he relates to ethnic competition over access to resources (such as grazing land) going back to the 1980s (Mazo 2010: 73). The conflict opposed the Black Africans to the central government, which was favouring the Arabs (IISS 2011). Referring to Prunier (2005: 4), Mazo stresses however that the Arab–African ethnic distinction is essentially an "ideological construct of the 20th century" and suggests that the divisions between pastoralists and cultivators were societal rather than ethnic (Mazo 2010: 74–75). Moreover, he argues, in line with Ban Ki-Moon (2007), the European Commission (EC 2008: 6), and Al Gore (2006), that Darfur is a "climate change conflict" (Mazo 2010: 73)[2] and that the transformation of the ecological zones and the ongoing land degradation and desertification processes were underlying causes of violence (Mazo 2010: 75; UNEP 2007: 88, 95).[3]

The same issues of competition between farmers and herders over resources plague West Africa. Nomadic herders from Burkina Faso, for instance, seeking grazing land for their livestock, are increasingly crossing borders, and their government fears that this will lead to cross-border conflicts between farmers and herders (IRIN 2010). Estimates are that 60 % of Burkina Faso's central-southern herders live on the other side of the border, in Ghana (IRIN 2010). Eighteen deaths due to farmer–herder confrontations took place between 2007 and 2010 in the south of the country, the number of wounded has not been evaluated, and, in the single year 2009, twenty-nine cases of land damage by livestock were registered in the southern province of Nahouri, Burkina Faso (IRIN 2010). Such destructive conflicts are commonplace in West Africa and can even sometimes reach another level of violence. In Nigeria, for instance, bloodshed between September 2001 and May 2004 accounted for more than two thousand deaths (IRIN 2004) and the flight of 20,000 FulBe nomads (Moritz 2006: 3). This series of violent clashes opposed Christian Tarok farmers to Muslim FulBe herders (IRIN 2004) and is said to have started with cattle theft (Moritz 2006: 29).[4]

These tragic episodes are recent illustrations of conflicts between nomadic herders and sedentary farmers that are sometimes said to be "as old as civilization" (Meier 2011: 1430).[5] Breuseurs et al. (1998: 358) consider that this contradicts the erroneous assumption according to which relationships between farmers and herders have deteriorated from a state of symbiosis to one of discord. A certain level of antagonism between these two groups might be 'endemic' to their cohabitation (Meier 2011: 1430). Although these

[1]The death toll is estimated to have been close to a million victims since 1990 when the killings began (IISS 2009), and approximately 500,000 people succumbed over six weeks in 1994, at the height of the violence (Human Rights Watch/Africa 1994: 1, 4).

[2]It is acknowledged that this statement is very political and that, as such, it contributes to shaping the understanding of the conflict as viewed through a specific prism. However, every analysis of a conflict must adopt a point of view (be it a focus on natural resources or on ethnic competition) and will always carry some political meaning and possibly contribute to a political agenda. Throughout this study, opposed perspectives are presented and weighed to give a nuanced vision of the issues at stake.

[3]This is controversial and several studies highlight additional non-environmental factors as causes of the conflict in Darfur such as "the weakening of traditional conflict resolution mechanism […]", the exclusion of some groups from political processes, and the lack of development (IPCC 2014b: 773).

[4]Very violent and destructive examples of farmer–herder conflicts are even more frequent in East Africa: in 2004, for instance, at the intersection of Ethiopia, Kenya and Uganda, 600 people died and 40,000 head of livestock were lost during clashes between farmers and herders (Meier et al. 2007, in Brinkman/Hendrix 2011: 8). East African farmer–herder conflicts have, however, been the object of more research, which is why the focus of this study is on West Africa.

[5]Several authors suggest that the oldest written reference to such a conflict might well be the murder of Abel, the shepherd, by his brother Cain, the cultivator, in the Bible, Genesis 4.1 to 4.8 (Dafinger 2004: 188; Hagberg 2001: 45; Meier 2011: 1430; Benjaminsen et al. 2009: 423).

conflicts between farmers and herders might have always existed, they are increasing in West Africa (Breusers et al. 1998: 357). Farmer–herder conflicts are an old issue in that the fundamental mechanisms of competition over resources stay the same, and a topical one in that the intensity of conflicts seems to have increased. The proliferation of modern arms can partly explain the increase in both the number of conflicts and the number of casualties (UNEP 2011: 25). It is estimated that seven to eight million small arms and light weapons are in use in West Africa today (Aning/Atta-Asamoah 2011: 354). However, simple machetes were notoriously the most-used weapons during the Rwandan genocide (Verwimp 2006: 5). Other explanatory factors include climate change and this is this aspect that this study will explore.

2.1.2 FulBe Pastoralists in Sub-Saharan Africa

In West Africa, sedentary farming populations and the ethnic group of the FulBe, which is mostly composed of nomadic herders, are often the protagonists in conflicts over the use of scarce resources like water and grazing land (Moritz 2006: 2).

The FulBe, also named Fula, Fulani, Felatta, Haalpullar or Peul (De Bruijn/Van Dijk 2003: 288), are an ethnic group featuring common political, cultural,[6] linguistic[7] and religious[8] traits (De Bruijn/Van Dijk 2003: 284–285). Fourteen million FulBes live in a region stretching from Senegal to northern Ethiopia (Dafinger 2004), and this geographical dispersion explains intra-group variations in their lifestyles (Moritz 2006: 4).

Box 2.1 Additional background on the FulBe.

- A few examples of sub-groups amongst the FulBe are the Ouada, the Wodaabe, the M'Boror and the Liptako. The production systems of the FulBe vary from one group to another because they adapt to their environment and absorb elements of the other local cultures that they live in proximity to. The importance given to pastoralism in their cultural identity also varies.
- With pastoralism as a constant, FulBe communities have more or less mobile livelihood strategies and integrate different types of income-generating activities into their lifestyle (such as farming, crafts, trade, temporary work in cities) depending on whatever opportunities exist (Wilson 1995).
- It is observed that many FulBe communities have become sedentary or semi-sedentary. Researchers find a convergence of lifestyles between local farmers and FulBe herders, in Niger for instance: one group owning more and more frequently a few animals and the other resorting more commonly to cultivation (Turner et al. 2011: 152) but it would be erroneous to believe that such a trend is definitive. FulBe communities indeed sometimes also transition to a more mobile lifestyle (Wilson 1995).
- In 1995, in most West African countries, cattle was mostly owned by FulBe herders and the FulBe often provided the labour force for herding cattle they did not own. This distribution has changed, with an increasing number of farmers taking up livestock-raising (Wilson 1995: 39).
- Some FulBe groups have a very codified and hierarchical social organization with a ruling elite, free people and slaves, while other groups are less stratified and privileges depend more on age group than inheritance (Azarya 1996: 12–14).
- Different FulBe communities have had various relationships with the colonial powers. Some have played important political roles while others have been marginalized. These relationships evolved with the independence of the African nations (Azarya 1996).

However, across the entire region, the FulBe mostly have a common pastoralist livelihood strategy (De Bruijn/Van Dijk 2003: 283). Due to the arid and semi-arid characteristics of this region (Dafinger 2004: 189), they generally practise nomadic or semi-nomadic cattle-raising (Schönegg/Martel 2006: 10). This mode of existence is a cornerstone of their cultural identity and represents an important aspect of their social life. Transhumance allows communities to form commercial and personal relationships with other population groups (SWAC/OECD 2009) (Fig. 2.1).

Nomadic habitations are temporary and can be moved by their owners, who do not return to a fixed location regularly, whereas a semi-nomadic lifestyle can include a habitation of non-temporary materials and the practice of transhumance around waterholes and over smaller distances, up to 100 km (Mabe 2003: 143; Jullien 2006: 58). Where resources are scarce, seasonal wandering, also known as transhumance, aims at providing livestock with the necessary pasture and water by moving to land with better grazing possibilities (Tonah 2003: 92; Schönegg/Martel 2006: 10). During the

[6]Cultural unity is based on the FulBe code of conduct, the 'Pulaaku', and often on their pastoralist livelihood strategy.
[7]Their language is called Fulfulde or Pulaar.
[8]Islam is the religion practised by the majority of the FulBe.

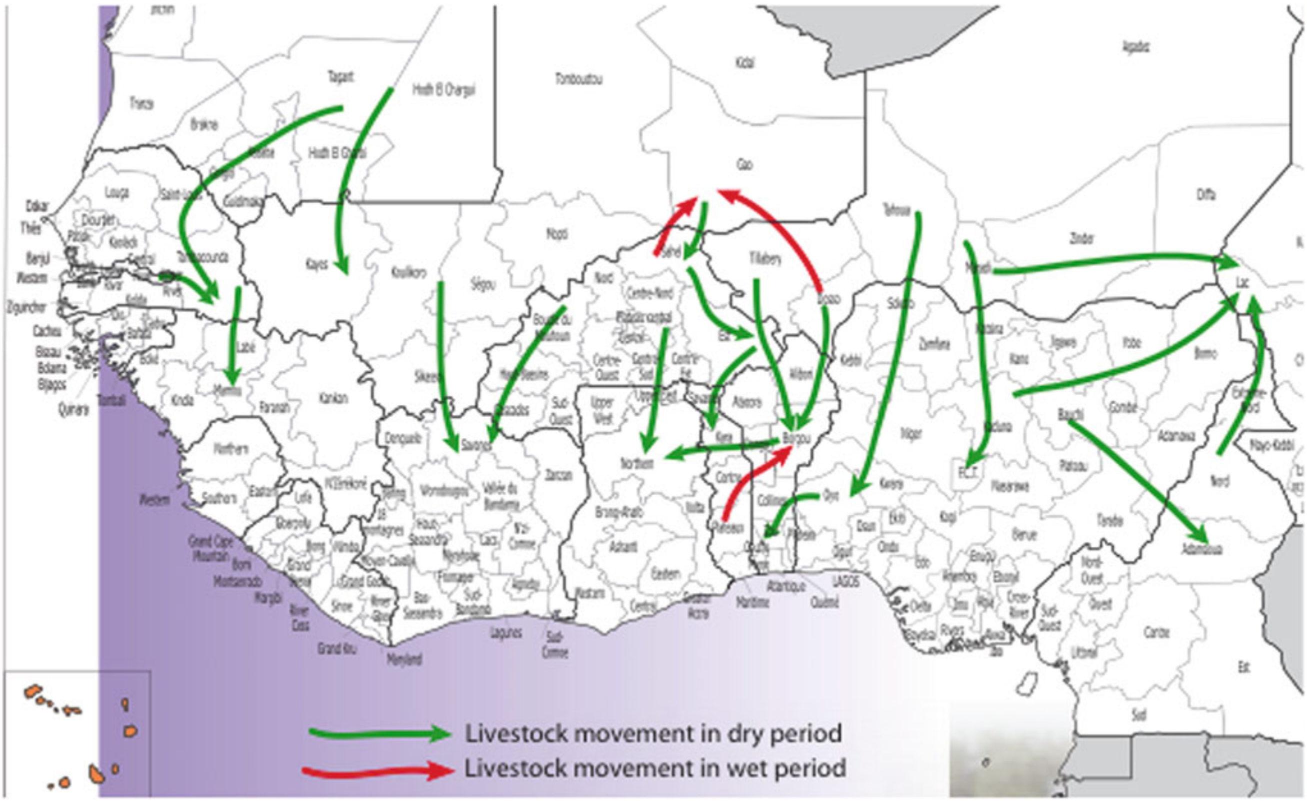

Fig. 2.1 Cross-border transhumance routes in the Sahel and West Africa. *Source* SWAC–OECD/ECOWAS (2008). The permission to use this figure was granted on 23 January 2013 by Ms. Dounia BOUTAMDJA, OECD, Public Affairs and communications Directorate

rainy season, pastoralists can live in the Sahel–Sahara zone and their livestock can spread over vast pastures where exposure to parasites is limited, while during the dry season, water becomes scarce and the pastures and sometimes the residual cultivated areas of the south become much more attractive (Jullien 2006: 58). Although transhumant pastoralist livelihoods have been harshly criticized, this extensive method is both economically and ecologically advantageous (Jullien 2006: 59–61). Transhumance allows herders to use complementary ecological zones (Abdul 2011). Without any investment in the land and under difficult climatic conditions, mobile livestock-raising in West Africa has proved to be a cost-efficient production method, well adapted to its environment. Moreover, the use of pastures in rotation prevents the depletion of the soils due to prolonged grazing and allows fields to regenerate while they lie fallow. This kind of lifestyle also permits pastoralists to react swiftly to meteorological changes and to protect their livestock from unfavourable conditions (Jullien 2006: 60). This mobility gives them flexibility and allows them to be resilient against changes in their environment.

However, livestock herding is a volatile activity and herders' livelihoods can be drastically impacted by external factors such as livestock raids as well as by increasing climatic variability (Njeri Njiru 2012: 518–519). Mobility alone does not allow pastoralists to keep up with the increasing number and intensity of droughts, land degradation, and desertification.[9] One of the responses of the FulBe nomads has been to move their habitat and wandering routes southwards (De Bruijn/Van Dijk 2003: 287; Turner et al. 2011: 187), hoping to find more suitable grazing land (Basset/Turner 2006: 33; Tonah 2003: 92). They are moving away from the Sahelian zone, for example from Mali and northern Burkina Faso, towards Nigeria, Benin, Ghana, Cameroon, and Côte d'Ivoire (De Bruijn/Van Dijk 2003: 284–285). They also tend to develop farming as a side activity and to adopt less mobile lifestyles (Turner et al. 2011: 184, 187). Large communities who wander southwards to another country end up remaining in this emigration country and increasingly settle near farmers' villages (Hagberg 2001: 47). At the same time, cultivation areas expand so as to increase production, and thus encroach on land that was traditionally dedicated to the grazing of cattle (Mabe 2003: 143). This southwards migration of herders and northwards expansion of farming increases the pressure on natural

[9] Details are provided in Sect. 2.2.2.

resources. This stress might be the origin of or an aggravating factor of conflicts between pastoralists such as the FulBe and sedentary farmers (Courade/Devèze 2006: 31). Furthermore, the increase in the size of the cattle population can generate even more pressure on limited resources, especially in drought-prone drylands, and provoke conflicts. This seems to be the case, for example, in Burkina Faso, where the number of cattle doubled between 1997 and 2008 (reaching over eight million) and where conflicts between FulBe nomads and Mossi farmers are increasing (IDDRI 2012: 82).

Box 2.2 A few facts on transhumance herding in the Sahel and West Africa.

- 10 % of the meat produced in the world comes from extensive pastoralism. In West Africa 80 % of animal products come from pastoral and agro-pastoral production systems (Inter-réseaux 2012).
- About 40 % of Africa's land mass is occupied by pastoral areas (with variations between countries) (AU 2010). There are 50 million pastoralist households and 200 million agro-pastoralist households in Africa (Inter-réseaux 2012).
- 50 % of the economically active population of West Africa works in the livestock sector, which contributes from 5 % (in Côte d'Ivoire) to 44 % (in Mali) to the agricultural GDP (AU 2010).
- The region holds an exceptional number of livestock: 60 million head of cattle, 160 million small ruminants, and 400 million poultry (SWAC/OECD 2009).
- 70–90 % of the Sahel's cattle and 30–40 % of its sheep and goats are raised through transhumant herding (SWAC/OECD 2009).
- Approximately 65 % of the cattle meat, 40 % of the mutton and goat meat, and 70 % of the milk consumed in the region are supplied by this method of livestock-raising (SWAC/OECD 2009).
- Recent studies show that transhumant pastoralism is 20 % more productive than sedentary livestock-raising in the drylands (Inter-réseaux 2012).

2.2 Climate Change in Africa

It was previously argued that farmer–herder conflicts are not a new phenomenon. The causes (access to renewable natural resources) and patterns of conflicts might essentially remain the same. However, intensity and scale may reach a higher level (Bauer 2011: 721). Climate change may contribute to the transformation of these conflicts. Scholars[10] as well as practitioners in the field of security have come to recognize that climate change can be a threat to security and act as a threat multiplier "that may exacerbate current vulnerabilities, tensions, and conflicts" (Vanderweerd et al. 2011: 1318). The term "threat multiplier" has been used both by the UN Secretary-General Ban Ki-moon (2009: 6) in a Report on *Climate change and its possible security implications*, and by the European Commission in a joint report to the European Council in 2008 (EC 2008: 2). Both official reports stress that vulnerability can interact with climate change (EC 2008: 4; Ki-moon 2009: 6).[11] The next section summarizes the vulnerability situation in Africa and the likely deterioration of the situation due to climate change.

2.2.1 Climate Change and Vulnerability in Africa

2.2.1.1 Introduction to Climate Change Issues in Africa

Causes of the current process of climate change include the natural evolution of the climate system but also human activities (agricultural production, industry, transport) and lifestyles. It is difficult to determine the share of anthropogenic responsibility for climate change but human influence is clear: the human-induced increase in CO_2 emissions since the industrial revolution clearly coincides with an acceleration in the evolution of the climate, and in particular with an increase in global temperatures (IPCC 2007e).

Africa is the continent that has contributed least to anthropogenic climate change so far but is also the one that is expected to suffer most from its impact. Table 2.1 summarizes how little the African continent has contributed to climate change in comparison with some of the most developed countries of the world.

Emissions of greenhouse gases in Africa are very low due to its overall limited economic development (Kifle 2008: 5), its relatively low carbon economic activities (Enerdata 2010a), and its low overall energy consumption (Enerdata 2010b). In 2010, for instance, energy consumption in Africa was 3.5 times lower than that of the US and 2.8 times lower than that of the European Union (calculations from Enerdata 2010b). Only 51 % of African urban populations and 8 % of rural populations have access to electricity (IPCC 2007c: 442).

Although Africa's share of responsibility for anthropogenic climate change is insignificant, the projections are

[10] Vanderweerd et al. (2011) and Brauch/Oswald Spring (2011a), for example.

[11] These two reports also introduce threat minimizers and actions/recommendations that could help diminish the threat posed by climate change to security (see Sect. 4.3 below).

Table 2.1 Gross Domestic Product (GDP) per capita and carbon dioxide (CO_2) emissions per capita in selected countries

Countries	GDP per capita in 2011 (in thousands (current) US$)	CO_2 emissions in 2009[a] (in metric tonne per capita)
Australia	61	18.2
Canada	50.3	15.2
United States of America (US)	48.1	17.3
Japan	45.9	8.6
OECD[b] Members	37	10
European Union	34.9	7.2
Sub-Saharan Africa	1.5	0.9
Least Developed Countries	0.8	0.25
ECOWAS[c] (Economic Community of West African States.) Members	0.4–3.8 (Sierra Leone–Cape Verde)	0.04–0.06 (Mali–Cape Verde)

Source World Bank Databank (2013a, b)
[a]The most recent data publicly available on CO_2 emissions is from 2009 (World Bank Databank 2013a)
[b]OECD - Organization for Economic Co-operation and Development
[c]ECOWAS - Economic Community of West African States

that Africa is most vulnerable to its impacts (IPCC 2007c: 435; EC 2008: 6). The IPCC defines vulnerability as the degree to which a system is susceptible to and can cope with the adverse impacts of climate change (IPCC 2007a: 5). A vulnerable system is a function of three parameters: (1) exposure to the threat, (2) sensitivity, and (3) adaptive capacity (IPCC 2007a: 5, b: 21).[12] Africa presents serious weaknesses in all three dimensions. This means that climate change is likely to have serious effects on both natural and human (socio-economic) systems (IPCC 2007d: 82).[13]

2.2.1.2 Exposure

Exposure is high due to the 'unfortunate' characteristics of the climatic and geophysical systems (Busby et al. 2012: 463). The climate in Africa is generally warm and subject to inconsistent rainfall (Garcia 2008). In Central and West Africa, the climate is tropical and relatively stable all year. Inter-seasonal variations are, however, significant as one moves away from the Equator towards the north and towards the south in the direction of drier climate zones (UNEP 2008: 8). Sixty per cent of the land in Africa is covered by deserts which have been expanding (UNEP 2008: 2),[14] and aridity is a major challenge (UNEP 2008: 6). The Sahelian drylands are ecologically characterized by long dry seasons and a high level of variability in rainfall (Bächler 1994: 18; Bikienga 2001: 1047; Mabe 2003: 143).

Three West African countries, Burkina Faso, Côte d'Ivoire, and Ghana, have been selected for a case study in Chap. 6 below. Part of Burkina Faso's territory belongs to the Sahel and the rest of the country has a tropical climate with dry seasons. The northern regions of Côte d'Ivoire and Ghana share this tropical climate with long dry seasons, whereas the southern regions have a humid tropical climate (Bikienga 2001: 1047; UNEP 2008: 8). The original habitat of the FulBe, studied here as one of the conflict parties, stretches from the Sahel to northern Côte d'Ivoire and Ghana, covering Burkina Faso (see Fig. 2.2). It consequently belongs to an ecological region that can be defined as dryland, and has a climate ranging from arid to semi-arid (UNEP/GRID 1991).

African soils are home to natural riches such as diamonds in Botswana (UNEP 2008: 93) and oil in Nigeria and Angola (UNEP 2008: 192). Valuable timber also grows in the Congo Basin forest (UNEP 2008: 42). Generally, the continent hosts a high level of ecological and biological diversity (AUC/ECA/AfDB 2010: 18). Meanwhile, half of the land in Africa is unsuitable for agriculture and a further quarter is estimated to have only a low production potential (UNEP 2008: 2). Soil fertility, water retention capacity, and

[12]A later report from the IPCC, *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (IPCC 2012), uses another definition of vulnerability. It is still seen as the propensity or predisposition to be adversely affected by climate change, but exposure is no longer considered to be one parameter determining vulnerability but rather a separate factor interacting with it. In this new conceptual approach it is still posited that when a high level of exposure combines with a high level of vulnerability the adverse impacts of climate change are at their highest, and the report still sees the way to buffer people against these impacts as resilience-building (notably through disaster risk reduction and climate change adaptation; IPCC 2012).

[13]Meanwhile, resilient social and ecological systems are able to "anticipate, absorb, accommodate, or recover from the effects of" shocks such as slow-onset or rapid-onset climatic shocks "in a timely and efficient manner". Resilient systems maintain their basic structures and ways of functioning, and restore or even improve them in the face of a shock (IPCC 2012: 3). This is why resilience-building is at the centre of the protection of vulnerable societies from climate change.

[14]See Sect. 2.2.2 for a more detailed account of desertification.

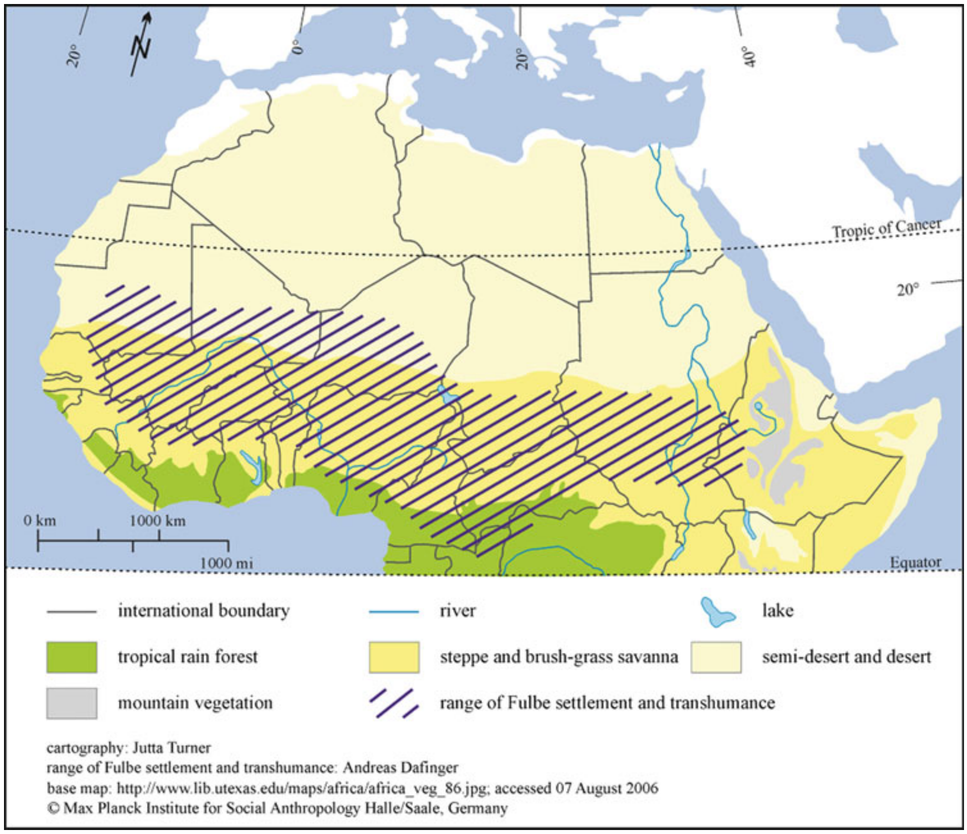

Fig. 2.2 Habitat and transhumance area of FulBe pastoralists. *Source* Dafinger (2004: 189). (Further examples of (cross-border) transhumance routes in West Africa can be found in UNEP 2011: 19.) The permission to use this figure was granted on 14 February 2013 by Ms. Jutta Turner, Max Planck Institute for Social Anthropology, Halle/Saale, Germany

nutrient value are low, resulting in limited depth for root extension (Lahmar 2011, in IDDRI 2013: 82). The continent is also prone to drought, especially in the Sahel, the Horn of Africa, and southern Africa, and when water is available, it is often of poor quality, which contributes to diseases (IPCC 2007c: 437). Africa is the continent where the highest number of people have died in drought-related famines in the last decades (UNISDR 2012). In sub-Saharan Africa, drought is the natural hazard with the greatest consequences for livelihood, loss of life, and diseases (UNISDR 2012). In addition, natural disasters such as floods, locusts, and parasite infestation are commonplace (Courade/Devèze 2006: 27; EM–DAT 2011) and can have devastating impacts on lives as well as on the means of production (fields and livestock) of affected populations.

2.2.1.3 Sensitivity

Sensitivity to climate change impacts is also high because of endemic poverty and persisting development challenges (IPCC 2001b: 491, 2007c: 435). Most of the region belongs to both the category of low-income countries (UN 2013)[15] and the category of less-developed countries (UNCTAD 2011). In 2013, the *Human Development Index* (HDI), a composite of life expectancy, literacy, and standards of living indicators, classified most of Africa under the limit of 0.52[16] (UNDP 2014) (Fig. 2.3).

Sub-Saharan Africa is among the poorest regions of the world: in 2004, 41 % of its population lived on less than a dollar a day, compared to 29.5 % in Southern Asia, the second most deprived world region (Kifle 2008: 6). The average sub-Saharan African population is growing even poorer and sees its real wealth divided by two every twenty-five years (IPCC 2007c: 440).

A clear sign of the difficulties faced by the region is that, although progress has been made and the proportion of people living in extreme poverty (for example) is falling (UNDP 2012a), the region is not on track to achieve the *Millennium Development Goals* (MDGs),[17] especially the poverty reduction target set for 2015 (WB/IMF 2011: 2).[18]

[15]Low-income countries have a GDP per capita of less than US$578 per year (2011 data, the latest available).

[16]Zero (0) represents the lowest and one (1) represents the highest HDI values.

[17]At the time of publication, the MDGs have been replaced by the Sustainable Development Goals in the framework of the Agenda 2030 (adopted in September 2015).

[18]At the time of publication, more recent data has become available: The Millennium Development Goal Report 2015, http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf (8 May 2016)

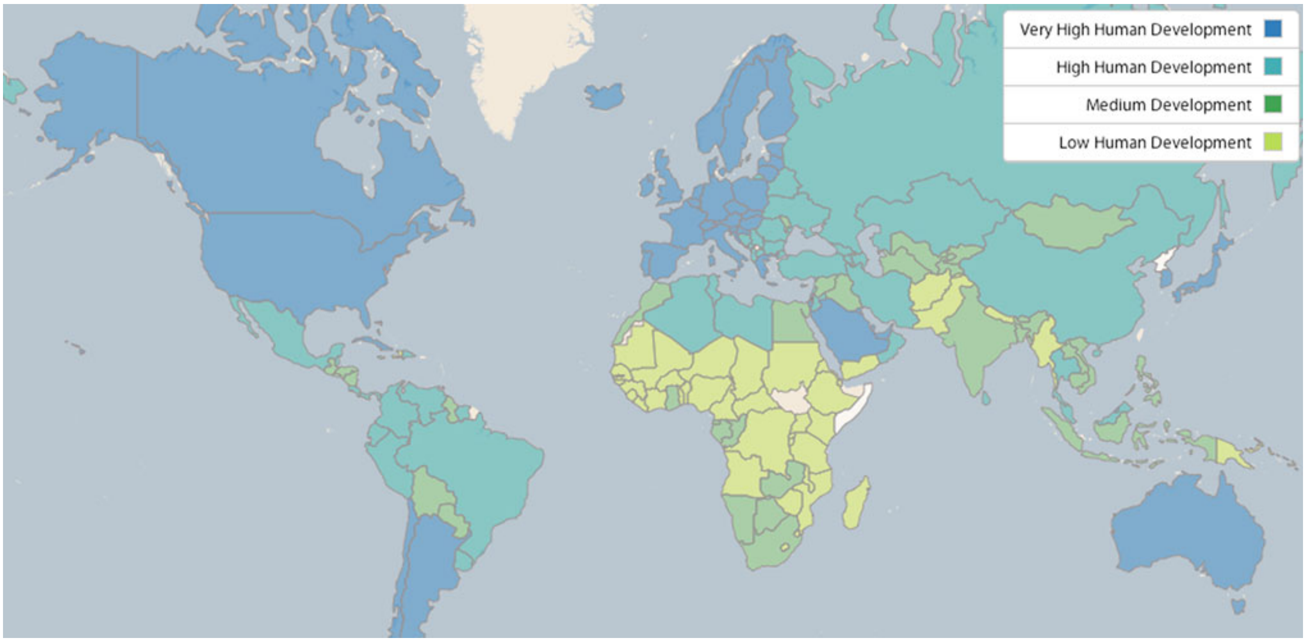

Fig. 2.3 World Map of Human Development Index, 2013. *Source* UNDP (2014). The permission was granted on 8 May 2013 by Botagoz on behalf of the Human Development Report Office, United Nations Development Programme (UNDP), in New York

A 2013 report by the United Nations[19] showed that globally, the MDG target of halving the proportion of people living on under US$1.25 per day has been met, with a decrease from 47 % in 1990 to 22 % in 2010 (UN 2013: 6). However, the Chinese growth rates over the last few years are largely responsible for this achievement, and 1.2 billion people still live in extreme poverty across the world. In sub-Saharan Africa, the proportion of people living on less than $1.25 a day has also decreased, from 56 % in 1990 to 52 % in 2005 and then to 48 % in 2010 (UN 2013: 6). This, first of all, means that almost half of the population of this region lives in extreme poverty. Secondly, despite the decrease in the poorest segment of the population as a proportion of the whole, because of demographic growth sub-Saharan Africa is the only world region that saw the absolute number of people living in extreme poverty rise steadily, from 290 million in 1990 to 414 million in 2010 (UN 2013: 6). The population of Africa exceeded one billion in 2010, and this means that one in seven people on the planet lives in Africa[20] (UNPD 2012) but, with over 400 million poor in 2010, a third of the world's poor also resides on this continent (Poku/Sandkjaer 2009: 1056).

The current growth rate of the population is 2.46 % per year (compared to 0.08 % in Europe) and the latest estimate by the United Nations (2012) is that the population of Africa could reach 4.1 billion by 2100 (UNPD 2012).[21] Cities are concentrating this growth (3.5 % of annual growth) and the urban population had already multiplied by more than ten between 1950 and 2005 (from 33 to 330 million inhabitants) (UNPD 2014). Nevertheless, in West Africa, 70 % of the population is still rural (UNEP 2011: 17).

This population growth will put additional pressure on sectors that are already facing numerous challenges. The growing number of smallholder farmers trying to cultivate marginal semi-arid or arid land that is exposed to environmental change increases degradation of resources (AUC/ECA/AfDB 2010: 5). Access to food is also insufficient throughout most of the continent, and this contributes to a poor hunger and nutrition status (Kifle 2008: 7). The latest assessment of the MDGs by the World Bank, however, emphasized the serious progress that has been accomplished and pointed out that the proportion of undernourished people in developing regions decreased from 23 % in 1990–1992 to close to 15 % in 2010–2012 (UN 2013: 10). This proportion of undernourished people also decreased in sub-Saharan Africa from 32 % in 1990–1992 to 27 % in 2010–2012 (UN 2013: 10) and to 25 % in 2013 (FAO/IFAD/WFP 2013: 1); and half of the sub-Saharan countries are close to reaching

[19] More specifically by an Inter-Agency and Expert Group on MDG Indicators, under the leadership of the Department of Economic and Social Affairs of the United Nations Secretariat (UN 2013).

[20] In 2010, the total world population reached 6.9 billion (UNPD 2012).

[21] This is an estimate according to a medium scenario, but a higher population growth is conceivable: the highest estimate is that there will be six billion people living in Africa in 2100. Even the most conservative estimate suggests 2.8 billion people.

the hunger target (WB 2011: 23).[22] Despite this progress, it is important to keep in mind that the hunger target set by the MDG was to reduce by half the proportion of people suffering from hunger (UNDP 2012a). Even if the MDG were reached, this would not represent the end of hunger. The relative number of people suffering from hunger has decreased and yet the absolute number of hungry people has practically not changed, with 875 million in 1969–71 rising to 925 million in 2010 (FAO 2010) and decreasing again to 842 million in 2011–13 (FAO/IFAD/WFP 2013: 1).[23] Worldwide, one in eight persons is considered chronically undernourished, that is to say that they do not consume enough food on a regular basis to cover their minimum dietary energy requirements (over the period 2010–2012). The vast majority of the chronically undernourished (852 million) live in developing countries. In sub-Saharan Africa the proportion of undernourished people has decreased but the absolute number is rising: 234 million people (27 % of the population) were undernourished over the period 2010–2012, while in 1990–92 this figure was 170 million (32 % of the population) (FAO/IFAD/WFP 2012: 9).

Infrastructures are also underdeveloped, notably in the health sector (IPCC 2007c: 437). In many countries child mortality (under five years old) is still higher than a hundred per 1,000 (WB 2011: 109), and it is estimated that between 0.7 and 2.7 million people die from malaria each year (IPCC 2007c: 437). Several West African countries also face generalized HIV (Human Immunodeficiency Virus) epidemics[24] and in 2011 less than half of the population needing antiretroviral therapy had access to it (UNAIDS 2012). The low capacity of infrastructures will be further challenged by population growth, especially in cities, where lack of urban planning can result in very poor sanitary conditions. The education system is poor as well and progressing slowly (IPCC 2007c: 440). The majority of children in sub-Saharan Africa do not attend school (WB 2011: 37), and in 2010 only 80% of children who attended primary school finished it 80 % (UNICEF 2012). Literacy rates are consequently low, especially women's literacy rates, since the ratio of girls attending school is lower (UNICEF 2012).

Economically, Africa is dependent on sectors that are likely to be direly impacted by climate change such as forestry, fisheries and tourism (Garcia 2008; Kifle 2008: 5). As for the agricultural sector, the UNDP estimated in 2006 that it employs 60–90 % of the active population and represents 40 % of total earnings (Kifle 2008: 6). The region exports food but remains a net food importer, and West African countries were classified as Low-Income Food-Deficit Countries (LIFDC) in 2012 by the FAO (2012).[25] Moreover, the international trade system is somewhat exploitative and the terms of trade do not favour African countries (Oswald Spring 2009: 484), in particular because of volatile commodity prices (including fuel) and of the difficulties posed by liberalization and structural adjustment policies (IPCC 2007c: 440; Chevalier 2005: 58). This limits the positive effects of economic growth, which nevertheless exceeded 5 % for many African countries in 2010 (WB 2011: 60).

Livelihoods are generally fragile and heavily reliant on natural resources, with limited access to safe water, electricity, and infrastructures. For example, about 80 % of sub-Saharan African households (compared to half the world's overall population) rely on wood-based biomass energy (fuel wood and charcoal) for cooking (WB/AFREA/ESMAP 2011). The main socio-economic livelihood strategies in the Sahelian drylands are extensive nomadic and transhumant pastoralism, as well as small-scale, rain-fed and often women-led farming (Bächler 1994: 18; Bikienga 2001: 1047; Mabe 2003: 143; Courade/Devèze 2006: 26).[26] These types of livelihoods have evolved in line with ecological conditions in the Sahelian region to make the most of the available scarce resources (Bächler 1994: 17). Nevertheless, their productivity is rather low (notably due to low mechanization) (AUC/ECA/AfDB 2010: 7) and they are extremely sensitive to any changes in environmental conditions and thus vulnerable to climate change (IPCC 2014f: 1218).

The weakness of institutional structures and governance practices must also be mentioned. It can be said that the democratization process has not really succeeded so far

[22] At the time of publication, more recent data has become available: The Millennium Development Goal Report 2015, http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf (8 May 2016) and IFAD, WFP, 2015: The State of Food Insecurity in the World 2013. http://www.fao.org/3/a-i4646e.pdf (8 May 2016).

[23] At the time of publication, more recent data has become available: In 2015, 795 million people were undernourished. More information is available at FAO, IFAD, WFP, 2015: The State of Food Insecurity in the World 2013. http://www.fao.org/3/a-i4646e.pdf (8 May 2016).

[24] The threshold of generalized HIV epidemics is set at 1 % of the population between 15 and 49 years old.

[25] FAO used the latest available data to establish the list of LIFDC in 2012: data on Gross National Income is from 2009 and data on food imports and exports is from the three years preceding 2012, for which data is available.

[26] Agro-pastoral systems vary across the study area: they essentially consist of pastoralism, hunting and gathering wildlife resources in the northern, Sahelian zone; in transhumant livestock-raising and cereals in the semi-arid zones; and, cultivation of family plots as well as some larger-scale farming in southern Ghana and Côte d'Ivoire (Courade/Devèze 2006: 22). The main cultivated crops are staple foods such as millet, maize, rice and sorghum, while livestock includes a majority of small ruminants and some cattle (UNEP 2011: 19).

(Friedman 1999: 825), and numerous states in Africa are considered to be 'failed' according to Zartman's definition "because they can no longer perform the functions required of them to pass as states" (Zartman 2005: 5, in Poku/Sandkjaer 2009: 1052), which essentially is control over violence and internal peace-keeping. Moreover, even in countries where the government is stable, sporadic conflict, violence and rebel movements are common when the focus moves away from the capital cities. A recent example is the conflict in Mali in 2012–2013. Although Mali stood as an example of a relatively quiet and stable country until 2012, the government was challenged by the rebel and jihadist groups of the north and was unable to maintain peace and security across the country (Traoré 2013; Le Drian 2013). The ungovernability of vast territories and the lack of capacity and/or access to remote locations of the central authorities and military forces represent a recurrent challenge for the countries in the region (Robert 2012). In such areas the prevalence of violent conflict is hence high (IPCC 2007c: 442). In many cases, farmer–herder conflicts take place in such remote regions, where little or no governmental authority exists to pacify the dispute.[27]

Conflict interacts with development progress in ambiguous ways: underdevelopment is held responsible for conflicts and conflicts are said to hinder development (Véron 2006: 19).[28] In the case of agro-pastoral conflicts, not only are the lives and livelihoods of those involved in the conflicts impacted but these conflicts can also threaten "the sustainability of agricultural and pastoral production systems" (Moritz 2006: 3).

Furthermore, governments are often plagued by corruption (Mabe 2003: 102), maladministration and a low capacity to act and provide services (IPCC 2001b: 491). The social safety nets, for instance, are little developed even though they have a fundamental role in protecting livelihoods and buffering people from shocks (natural disasters, fuel and food price shocks, individual accidents). Most of the time, the existing safety nets are fragmented and depend on funds from external aid (WB 2012: xi, 68). The colonial heritage is undeniably playing a part in the current governance challenges faced by African countries as described above (Véron 2006: 21).

2.2.1.4 Adaptive Capacity

Finally, adaptive capacity is significantly weakened because of the overall lack of resources, weak institutions and the absence of social infrastructures or safety nets (Garcia 2008). To adapt efficiently, not only financial resources but also technology, education and skills, information, and infrastructures are needed (IPCC 2007c: 441; Kifle 2008: 9). Smallholder farmers lack training in agricultural techniques and access to the technology that could increase the production potential of their land and protect them from the effects of climate change. One technological adaptation strategy, for instance, would be to grow crops that are less affected by climate change (for example, those that need less water), but access to technology is constrained by limited access to markets and capital (Kifle 2008: 9). Because of the low development status of Africa and despite the debt relief from which several African countries (including Ghana) have benefited, dependence on external aid is high—it represented as much as 14.3 % of Burkina Faso's GDP in 2006 (IPCC 2001b: 492; Raffinot 2009: 175, 181). Moreover, the resources for adapting to climate change are most of the time controlled by multilateral finance mechanisms (such as the Global Environmental Facility and the Kyoto Protocol's Adaptation Fund) and bilateral funding initiatives set up by most developed countries, or channelled by aid programmes (UNECA 2009).

Adaptive capacity is moreover lessened by the recurrence of crises (whether natural disasters or conflicts) that do not leave people the necessary time to recover and rebuild their lost assets and livelihoods, leaving them more vulnerable (FAO 2004: 29). In addition, because of their weakness, social safety nets are often not a reliable option to help people face climate change—social protection policies or mechanisms often do not exist. Households are consequently left with a diminished range of opportunities to face the impacts of climate change and may resort to negative coping strategies such as selling productive assets.

The situation is not entirely grim and many African countries can also rely on some strengths for adaptation, including their wealth of natural resources and long-standing tradition of dealing with variable weather (IPCC 2014f: 1226). Indigenous knowledge has been recognized as a key for adaptation to climate variability and change and for resilience-building (IPCC 2014b, f). Some practices (such as conservation agriculture) have already contributed to managing risks for food production systems. Nevertheless, these might not be enough in the face of longer-term climate change (IPCC 2014f: 1202–1203). Constraints to adaptation, including autonomous adaptation strategies by indigenous communities, remain. They include poverty and land degradation as well as policies that constrain mobility and promote sedentarization and land policies that work against traditional practices. Indigenous knowledge is eroding in a rapidly changing socio-economic context. It is also often

[27] However, some traditional authorities exist in these areas and they are not devoid of societal organization.

[28] See also the *Global Monitoring Report* issued by the World Bank on the influence of conflict on the progress towards the MDGs (WB 2011: 30) and *The World Development Report 2011: Conflict, Security, and Development* by the World Bank which estimates that countries which have hosted violent conflicts between 1980 and 2005 have, on average, a poverty rate 25 % higher than those who have not hosted any (WB 2011: 5).

neglected by policymakers (IPCC 2014a: 517, b: 758, 765, f: 1236). Moreover, the magnitude of climate change impacts, greater than the community's prior experiences, makes indigenous knowledge less relevant and even undermines confidence in this knowledge (IPCC 2014b: 765).

2.2.1.5 Vulnerability of the Study Area to Climate Change Impacts

As a result of a combination of a high level of exposure and sensitivity to climate change and low adaptive capacity, the vulnerability of West Africa to climate change impacts is very high. In 2010–2011, for example, climate shocks affected over 22 million people (EM–DAT 2011).[29] The three countries which will be studied in detail are vulnerable to climate change not only because they are significantly exposed to its impact but because sensitivity is high and adaptive capacity low. For instance, the agricultural sector in Burkina Faso sustains 80 % of the population (GIZ 2011). Dryland farmers and herders are highly vulnerable to desertification and a lowering in soil productivity because the amount of land required to satisfying their needs becomes too great for their means (Safriel 2011: 838).[30]

In the three countries selected, more than 20 % of the population live below the poverty line of US$1.25 per day (WB Databank 2011).[31] The development situation is slightly different in the three countries: the World Bank estimates, for example, that Ghana might achieve the MDGs by 2015, whereas Burkina Faso is only approaching the targets and Côte d'Ivoire still lags behind (WB/IMF 2011: 25).[32] Differences in the area of undernutrition are reflected in the Global Hunger Index:[33] Ghana has progressed from an 'alarming' to a 'moderate' situation between 1990 and 2012, whereas the situation in Burkina Faso varied from an 'alarming' level in 1990 to a 'serious' level in 2011 and back to an 'alarming' level during the 2012 food and nutrition crisis; meanwhile the index has remained stable at 'serious' for Côte d'Ivoire (von Grebmer et al. [IFPRI 2013]).[34] The overall picture remains worrying. The drylands of the Sahel region are especially prone to food insecurity and have persistent high malnutrition rates. Within the last decade, the region has been hit by three droughts which resulted in food crises: in 2004–2005, in 2009–2010, and in 2012, with over ten million people affected (WFP 2012; OCHA 2013) (Fig. 2.4).

In addition, the Human Development Index remains low in Côte d'Ivoire, which ranks 168th, and Burkina Faso, positioned at 183rd in 2013 (with a value lower than 0.5), while Ghana's HDI shifted from low to medium in 2013, with a value of 0.558 and 135th position in the ranking of world countries (UNDP 2013).[35] Another indicator of vulnerability is the infant mortality rate. It is high but has decreased between 2004 and 2012 from around 60 per 1,000 to 49 per 1,000 in Ghana and from around 90 per 1,000 in the two other countries to 66 per 1,000 in Burkina Faso and 76 per 1,000 in Côte d'Ivoire (WB Databank 2013c). By comparison, this indicator has an average of 58 per 1,000 in the least developed countries. Finally, internal instability and governance weaknesses complete the picture, especially in Côte d'Ivoire (Busby et al. 2012: 480, 502) (Fig. 2.5).

2.2.2 Potential Impacts of Projected Trends in Climate Change

There is already a high level of scientific confidence in several projections of the impacts of climate change, and the fourth report of the IPCC stated that "large-scale climate events have the potential to cause very large impacts, especially after the 21st century" (IPCC 2007b: 17). The effects of climate change are already observable (Lisk 2009: 9) and unprecedented (IPCC 2014a: 1202, f). Overall projections of climate change for the three countries of the study area are increased warming, decreased and irregular rainfall, and biodiversity losses[36] (IPCC 2007b, c, 2014f; UNEP 2008: xiv).[37]

[29] Floods were the most frequent natural disaster in West Africa in 2010–2011, but droughts affected the largest number of people (EM–DAT 2011).

[30] Individuals' vulnerability of course depends on many socio-demographic factors (including wealth and gender) (IPCC 2014b: 768).

[31] Data from 2006–2011: people living below the poverty line represent 24 % of the population in Côte d'Ivoire, 30 % in Ghana and 45 % in Burkina Faso (WB Databank 2011).

[32] At the time of publication, more recent data has become available: The Millennium Development Goal Report 2015, http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf (8 May 2016)

[33] IFPRI (2011): "The Global Hunger Index is based on three equally weighted indicators: 1—the proportion of undernourished (with insufficient dietary energy intake) as a percentage of the population; 2—the prevalence of underweight in children under the age of five; 3—the under-five mortality rate."

[34] At the time of publication, more recent data has become available: Global Hunger Index 2015: http://ghi.ifpri.org/. In 2015 the index placed Burkina Faso and Côte d'Ivoire at a 'serious' levels and Ghana at a 'moderate' level.

[35] The HDI ranks 187 countries (UNDP 2013). At the time of publication, more recent data has become available: HDI of 2015 http://hdr.undp.org/en/countries (8 May 2016).

[36] Losses could reach a drop of 40 % in species abundance by 2050 (PBL 2010: 47).

[37] See Figs. 2.6, 2.7, 2.8, 2.9 and 4.4 for details on climate change impacts in the region. In addition, the FAO (2011) report *The state of the world's land and water resources for food and agriculture (SOLAW)—Managing systems at risk* synthesizes climate change risks specific to agricultural systems on a world map (Fig. 3.4, p. 33). The chief identified risks in West Africa are desertification/drought and loss or reduction of soil fertility (FAO 2011b).

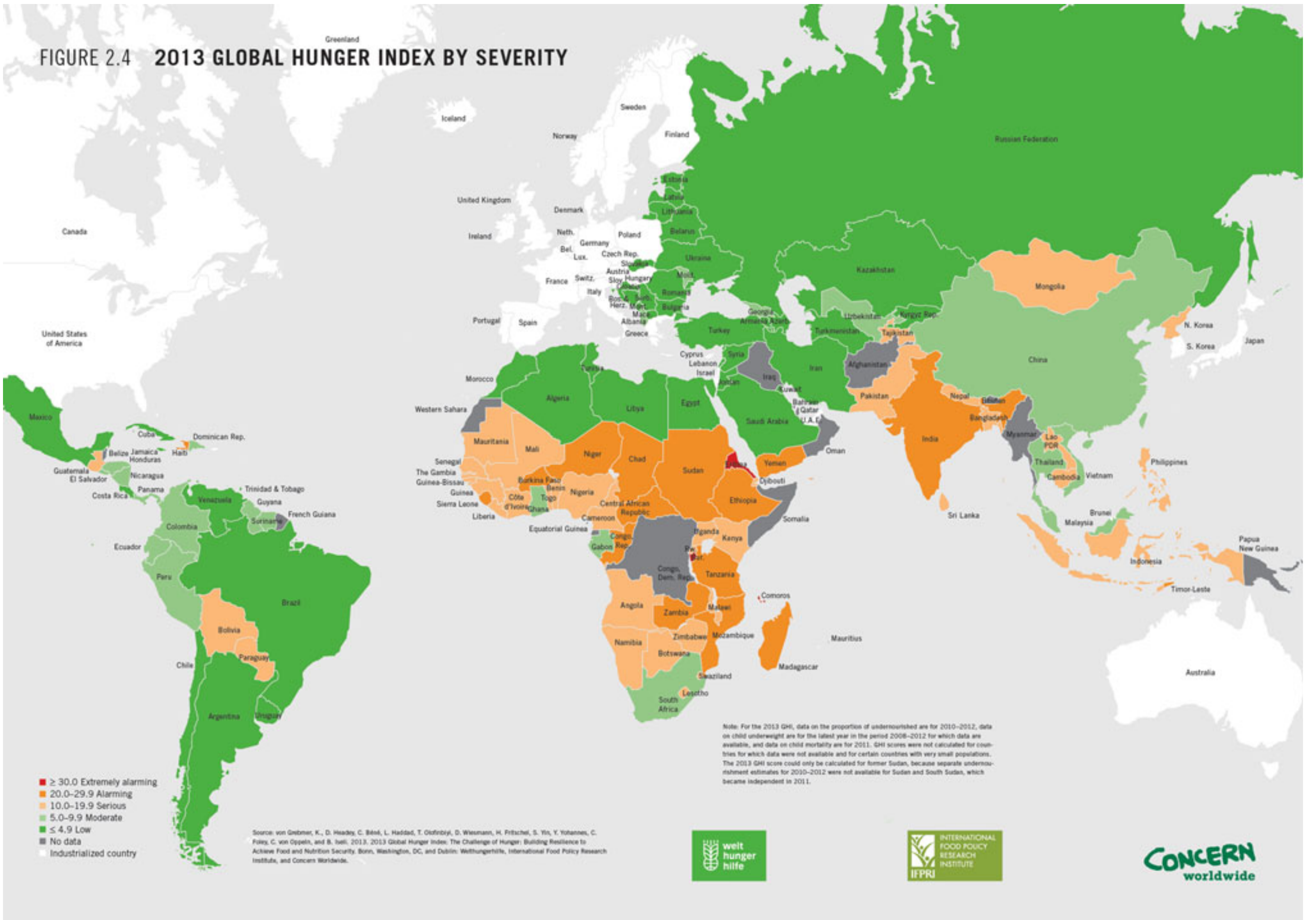

Fig. 2.4 Global Hunger Index in 2013. *Source* von Grebmer et al. [IFPRI] (2013)—Fig. 2.4. (Adapted and reproduced with permission from the International Food Policy Research Institute; at: www.ifpri.org. The report is available online at: http://www.ifpri.org/publication/2013-global-hunger-index.) The permission to use this figure was granted on 21 January 2014 by Terry Carter, IFPRI Copyright Permissions, New York, NY. At the time of publication, more recent data has become available: Global Hunger Index 2015: http://ghi.ifpri.org/

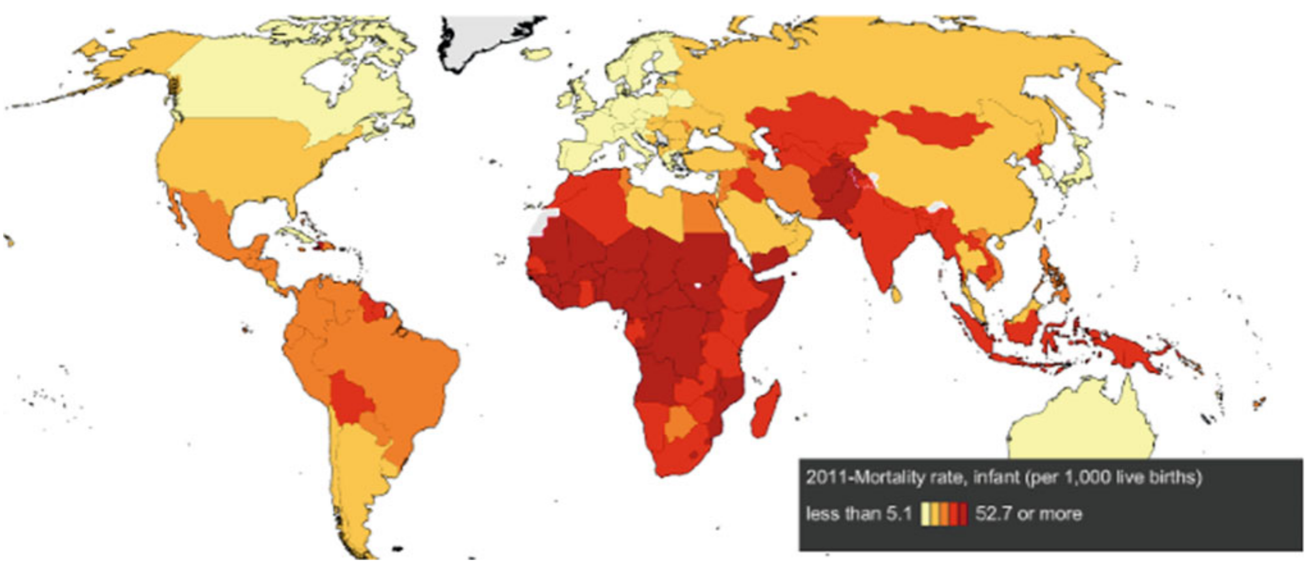

Fig. 2.5 Infant mortality rates, 2012. *Source* WB Databank (2013c). (Disclaimer: This map was produced by Staff of the World Bank. The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.) This figure is available on the terms of the world Bank's Open Knowledge Repository

In Africa, surface temperatures have already increased by between 0.2 and 2.0 °C between 1970 and 2004, and the observed physical and biological changes are a 100 % consistent with warming (IPCC 2007b: 10—see Fig. 2.6). More specifically, the temperature in West Africa increased on average by between 0.2 and 1.0 °C between 1970 and 2004 (IPCC 2007b: 10). Since the 1960s, the number of warm spells in the region has increased (IPCC 2007c: 436). Serious drought episodes were registered in 1963–1968, in the early 1970s, and in the mid-1980s; more than six drought episodes were observed between 1980 and 2001 in both Ghana and Côte d'Ivoire (Basset 1994: 150; Bassett/Turner 2006: 33; Bikienga 2011: 1047; Busby et al. 2012: 491; Turner et al. 2011: 187), and three droughts have plagued the Sahel during the last decade (WFP 2012).

Although international plans for climate change mitigation often put forward a target of a maximum global temperature increase of 2 °C (as against pre-industrial temperature levels), projections show that the warming is likely to surpass this target and could reach 3 °C or more. A higher level of warming, as a token of generally more intense climate change, means that the impacts of climate change would be amplified; crossing a certain threshold could trigger non-linear chains of impacts (New et al. 2011: 9; Schellnhuber et al. 2016). Under any scenario combining mitigation and adaptation that is likely to unfold, some damage due to climate change impacts is unavoidable (IPCC 2014d: 1045), with a high risk of adverse effects on Africa (IPCC 2014f: 1238).

2.2.2.1 Drought and Desertification

There is no doubt that the climate is already changing in Africa and general projected impact trends are sea-level rise, reduction in water availability by between ten and 40 % depending on region, unpredictability of precipitation, the extension of drought-affected areas, and species extinctions (IPCC 2007b, c, 2014f). One of the main concerns in West Africa is the question of the increase in droughts and desertification as a consequence of climate change.

According to the *United Nations Convention to Combat Desertification* (UNCCD), land degradation is a biophysical phenomenon that "reduces the productivity of land, and, particularly in drylands, can leave the soil exposed and vulnerable to climatic hazards such as drought" (UNCCD 2013: 3). Desertification is a type of land degradation; the term describes biological or physical changes towards increased aridity and reduced productivity (Mortimore/Turner 2005: 568). The term was coined in colonial times to designate a human-induced land degradation phenomenon, and has been widely used in the political and scientific spheres with no consensus about its exact definition (Herrmann/Hutchinson 2005: 539). One of the reasons for the controversies over the concept of desertification is its comprehensiveness and the related difficulties in measuring it. Desertification can happen through processes of water and wind erosion, and through chemical and physical degradation (Bächler 1994: 3). A cycle of desertification begins when an erosive crust, called *zipelle*, forms, prevents water infiltration and results in the soils being swept away during storms (Valentin/Casenave 1992, in IDDRI 2013: 82). Several different and interrelated indicators such as "declining plant biomass, soil removal, or lowering ground-water tables" can be used to assess its outcomes (Mortimore/Turner 2005: 568).

Some authors emphasize the contribution of human activities to desertification (Bächler 1994: 4; Brauch/Oswald Spring 2011b: 804), while others suggest that climate variability is its main cause (Gonzalez et al. 2012: 63; Wessels et al. 2007: 272). Anthropological causes that have been identified include deforestation, overgrazing, irrigation, agricultural intensification, and clearance practices (Bächler 1994: 22–23), all of which can be driven by population growth, while rainfall variability is the main climatic driver of desertification (Wessels et al. 2007: 272). It is difficult to measure the extent to which climate variability is contributing to desertification (Mortimore/Turner 2005: 568) and, as in the case of climate change in general, it is difficult to determine the extent to which the observed effects are a consequence of anthropogenic climate change or of natural variability. In 1994, the UNCCD stated that this type of land degradation can be caused both by human activities and by climate, but for the Sahel many studies suggest that natural climate variability is a more likely cause (Wessels et al. 2007: 272).[38]

Sub-Saharan Africa is one of the areas of most concern when it comes to the phenomenon of desertification (Rechkemmer 2009: 154) and is under a lot of scrutiny to determine coming trends. However, scientific models are not yet unanimous on what the effects of increasingly variable precipitation will be: a significant drying-out or an increase in moisture with expansion of vegetation into the Sahara (IPCC 2007c: 444; WBGU 2008: 138). During the second part of the twentieth century (1954–2002), a decrease in tree cover (i.e. diminished tree density and decline in species) has been registered in parts of the Sahel region, correlating with higher temperatures and lower rainfall and an extended very dry period from 1968 to 1997 (Gonzalez et al. 2012; Nicholson 2005: 617). The climate zone of the Sahel hence shifted southwards. This is strong evidence for an effect brought

[38]Desertification and land degradation also contribute to climate change through complex feedbacks into the global climate system, such as variations in the radiative forcing of the planet that can be influenced by changes in mineral dust loadings and in the albedo in general (IPCC 2007c: 437). (Radiative forcing is a measure of the difference between the amount of solar energy absorbed by the Earth and the amount reflected back to space.)

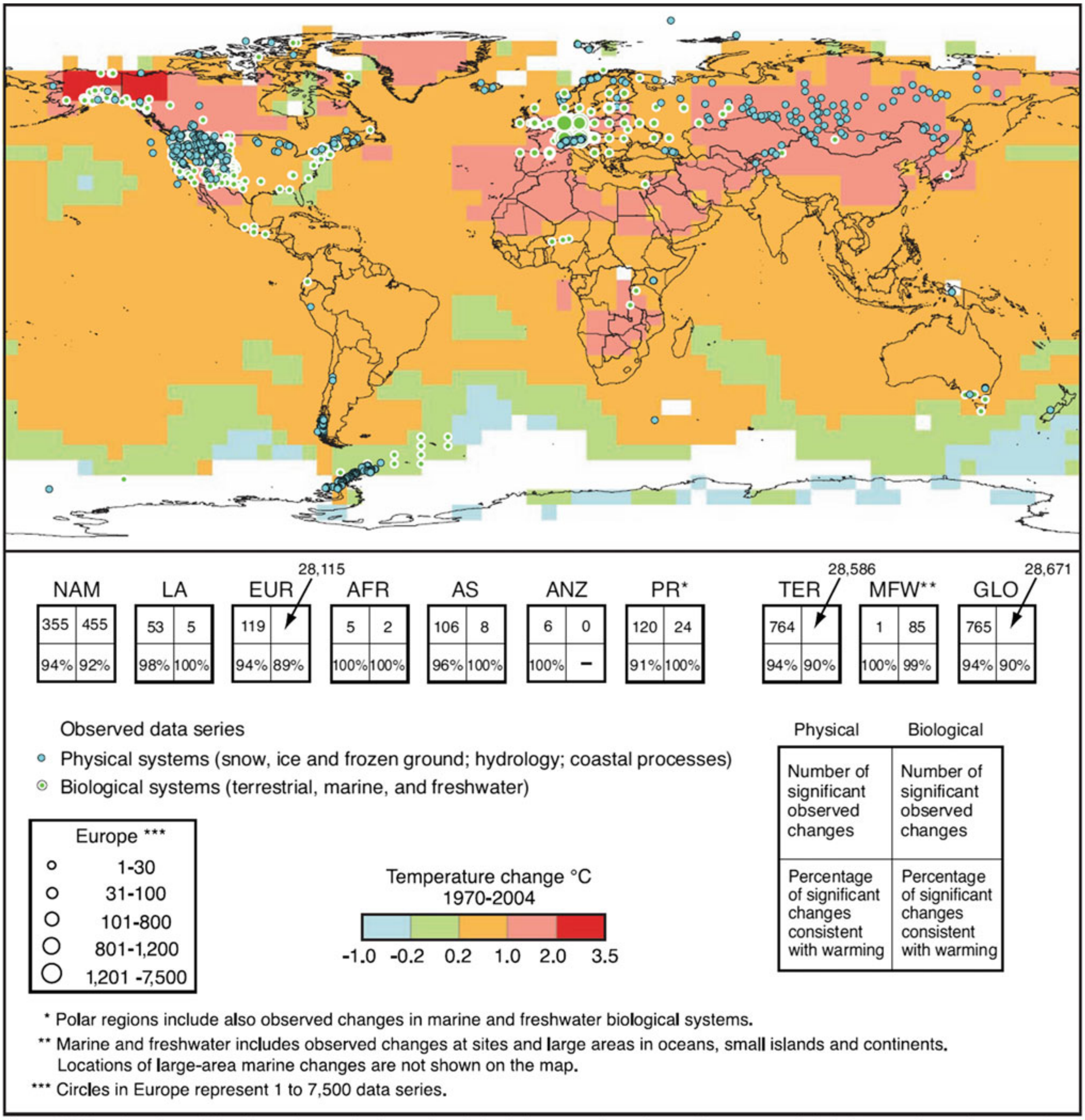

Figure SPM.1. *Locations of significant changes in data series of physical systems (snow, ice and frozen ground; hydrology; and coastal processes) and biological systems (terrestrial, marine, and freshwater biological systems), are shown together with surface air temperature changes over the period 1970-2004. A subset of about 29,000 data series was selected from about 80,000 data series from 577 studies. These met the following criteria: (1) ending in 1990 or later; (2) spanning a period of at least 20 years; and (3) showing a significant change in either direction, as assessed in individual studies. These data series are from about 75 studies (of which about 70 are new since the Third Assessment) and contain about 29,000 data series, of which about 28,000 are from European studies. White areas do not contain sufficient observational climate data to estimate a temperature trend. The 2 x 2 boxes show the total number of data series with significant changes (top row) and the percentage of those consistent with warming (bottom row) for (i) continental regions: North America (NAM), Latin America (LA), Europe (EUR), Africa (AFR), Asia (AS), Australia and New Zealand (ANZ), and Polar Regions (PR) and (ii) global-scale: Terrestrial (TER), Marine and Freshwater (MFW), and Global (GLO). The numbers of studies from the seven regional boxes (NAM, …, PR) do not add up to the global (GLO) totals because numbers from regions except Polar do not include the numbers related to Marine and Freshwater (MFW) systems. Locations of large-area marine changes are not shown on the map. [Working Group II Fourth Assessment F1.8, F1.9; Working Group I Fourth Assessment F3.9b].*

Fig. 2.6 Changes in physical and biological systems and surface temperature (1970–2004). *Source* IPCC (2007b): 10-figure SPM1. The permission to use this figures was granted on 24 January 2013 by Ms. Sophie Schlingemann on behalf of World Meteorological Organization about by climate change in the region and for its effect on the process of desertification (Gonzalez et al. 2012). However, a less dry period seems to have begun and since the 1990s there have even been some signs of vegetation recovery (TROFCCA 2005: 13, 15). Satellite imagery allowed the detection of an increase in the greenness of seasonal vegetation, sometimes designated as "the greening of the Sahel".[39] This trend seems to be continuing in the early 2000s and to be coinciding with an increase in rainfall (Nicholson 2005: 616; Gonzalez/Tucker 2012; Olsson et al. 2005). Some scientists recommend not underestimating the explanatory power of factors alternative to climate variability such as land management and migration (Olsson et al. 2005), while according to others land management practices could not explain a greening on this scale (Mortimore/Turner 2005: 590). This recent change in moisture is gradual and below the level of previous wetter times in the Sahel such as of the period 1931–1960 (Nicholson 2005: 617; Gonzalez/Tucker 2012: 596). "The fluctuations between 'wet' and 'dry' in the Sahel/Sudan zones are extreme even on decadal and multi-decadal time scales" (Nicholson 2005: 631). For this reason, the scenario by which increasing variability in rainfall due to climate change will increase desertification and droughts in the future deserves attention (WBGU 2008: 138). It is estimated that "10–20 % of drylands are already degraded" today (MA 2005, in Brauch/Oswald Spring 2011b: 815), and that in Africa, "up to two thirds of productive land area is affected by land degradation" (UNCCD 2013: 3). Some projections of the impacts of climate change include an aggravation of the phenomenon and a potential increase in arid land of between 5 and 8 % by 2080 (Njeri Njiru 2012: 515). Some assessments indicate that increasing drought and water scarcity combined with land overuse could result in the loss of as much as 75 % of arable, rain-fed land in North Africa and the Sahel (EC 2008: 6). In Burkina Faso, for instance, the UNCCD has already estimated in 2008 that 47 % of the land is degraded and 37 % is at high risk of being degraded (notably in the region of the Central Plateau, which is one of the most populated) (IDDRI 2013: 82).

2.2.2.2 Impacts on Socio-economic Systems in West Africa

The projected consequences of climate change trends in West Africa for socio-economic systems include a decline in food production and water availability, an increase in absolute poverty (IPCC 2007c: 444; UNEP 2008: xiv), and population displacement. Concerns about climate change are an addition to concerns about other environmental problems in West Africa, namely deforestation, uncontrolled urbanization, and human-induced land degradation (Mabe 2003: 205; Moyo 2009: 898). Climate change is a challenge on the path toward the MDGs/the Sustainable Development Goals, specifically for those relating to the eradication of poverty and hunger and to ensuring environmental sustainability. The latest (fifth) IPCC report asserted that "climate change poses a moderate threat to current sustainable development and a severe threat to future sustainable development" (IPCC 2014e: 1104).

Estimates of the numbers of people already displaced for environmental reasons in sub-Saharan Africa vary from 10 million to 25 million (Rechkemmer 2009: 152). Up to a sixth of the inhabitants of Burkina Faso have already had to leave their villages (Laureano 2011: 894). Future migration patterns are difficult to model because there are so many drivers, but it is likely that climate change will play an increasingly important role (IPCC 2014f: 1239).

Nowadays 20 % less food is available to sub-Saharan African populations than there was twenty-five years ago (Oswald Spring 2009: 484).[40] Droughts, increasingly volatile precipitation,[41] and desertification are expected to contribute to an overall decrease in agricultural yield in developing countries (Fig. 2.7).

Projections vary depending on the regions and the type of crops (IPCC 2014f: 1218), as well as on assumptions about adaptation measures and farmers' behaviours (IPCC 2014a: 491). The situation in high latitudes, for instance, will become more favourable to cultivation. In West Africa, millet and sorghum are likely to benefit from higher levels of precipitation but this positive effect would disappear if the increase in temperatures were more than 2 °C (IPCC 2014f: 1218). Generally, crops are negatively sensitive to extreme temperatures (above 30 °C; IPCC 2014a: 488). Wheat and maize production are expected to decline globally and especially in tropical regions due to warming (IPCC 2014a: 515). Bean yields in sub-Saharan Africa are expected to drastically decrease while cassava (or manioc) might benefit from increasing temperatures and higher concentrations of CO_2 (IPCC 2014f: 506, 499). Increased CO_2 concentration in the atmosphere[42] could well contribute to increased rates of photosynthesis and thus plant growth (for instance for wheat and rice). However, an increase in CO_2 is usually accompanied by an increase in ozone (O_3), which has a negative impact on yields (IPCC 2014a: 493). Moreover, recent findings have established that grain grown in an

[39]See *Journal of Arid Environments* 63 (2005) for detailed and critical information on the desertification and greening trends in the Sahel.

[40]See Figs. 2.8, 2.9 and 4.4 for details.

[41]Increasingly volatile precipitation can translate into various patterns such as shorter or delayed rainy seasons, absence of rain, or concentration of precipitations during a short time interval, leading to floods.

[42]The increase in CO_2 rates in the atmosphere is one of the best-known consequences of climate change.

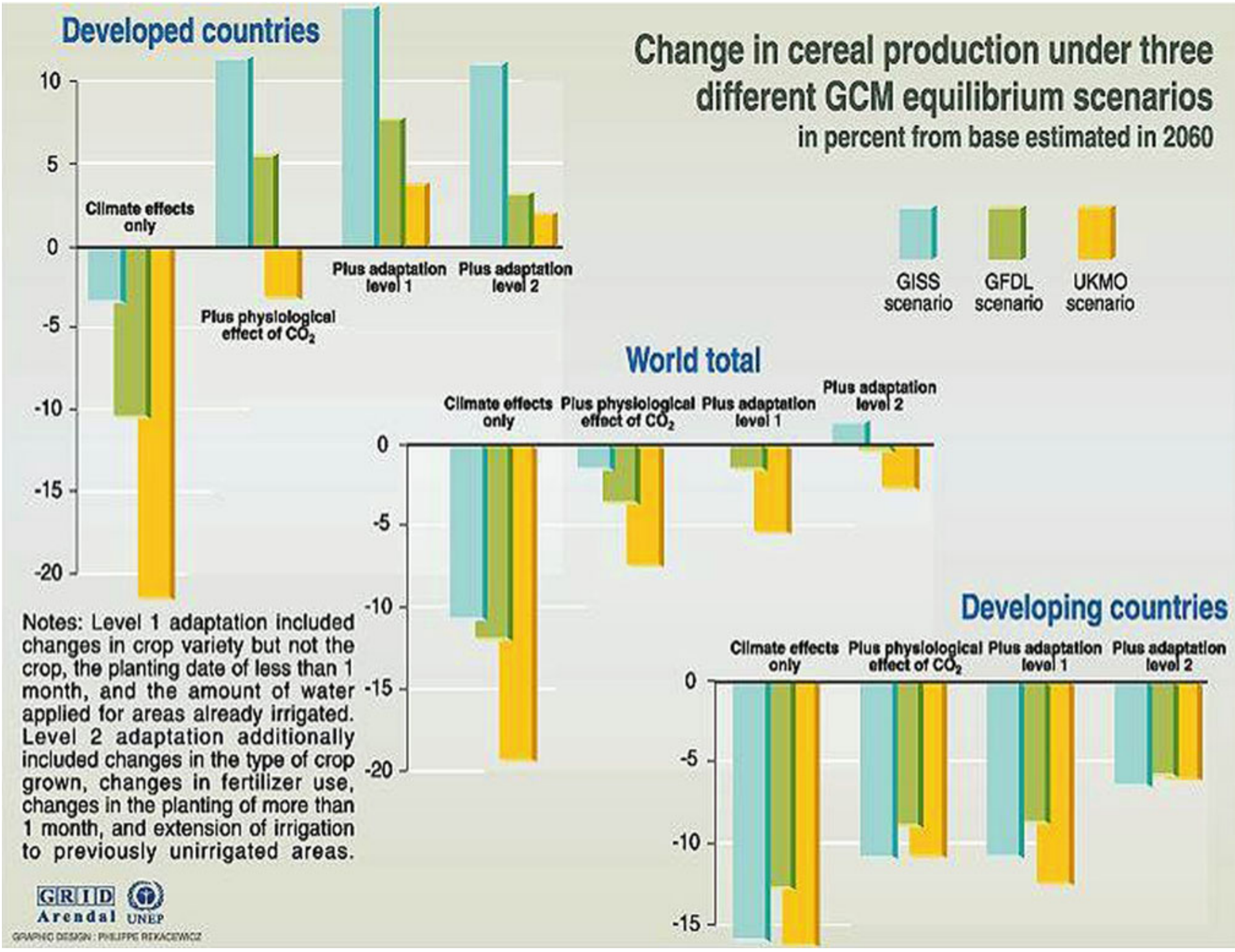

Fig. 2.7 Change in cereal production under three different global climate models—equilibrium scenarios (in percentages from base estimated for 2050). *Source* Rekacewicz [UNEP/GRID–Arendal] (1996). (Other estimates for cereal production by 2050 by the FAO can be found on a world map available at: http://www.fao.org/climatechange/53883/en/.) [This link was not operational any more on 26 June 2016]

atmosphere containing high levels of CO_2 might be less rich in nutrients (such as zinc, iron and protein). These changes could in turn have an impact on human and animal nutrition and health (IPCC 2014a: 501).

The many effects of climate change interact with one another, making it difficult to establish with certainty what the outcomes would be, but projections mostly agree on a decrease in agricultural yield in sub-Saharan Africa. Decreased production can in turn have an impact on export revenues (from high-value crops such as coffee and cocoa) (IPCC 2014f: 1219). The 2013 UNCCD report *The Economics of Desertification, Land Degradation and Drought* showed that up to 12 % of Africa's agricultural GDP is being lost due to environmental degradation, "with 85 % resulting from soil erosion, nutrient loss and changes in crop" (UNCCD 2013: 5). Moreover, lower agricultural yield also directly endangers the very many African farmers who depend on subsistence agriculture and essentially rain-fed agriculture for food production. The impacts of a 5 °C increase could be the reduction of the growing season in most of sub-Saharan Africa (up to 20 % in the Sahel) (New et al. 2011: 12; IPCC 2007c).

Livestock production will also be affected by the decrease in crop yield (fodder) (IPCC 2001a: 1219). Herders will have difficulty finding adequate pastureland or accessing cultivated fodder, and watering increasing numbers of cattle will become more difficult with climate change because of the depleted waterholes (Bauer 2011: 725; Lisk 2009: 9; IPCC 2014a: 502, f: 1219;). Furthermore, evidence suggests that high temperatures are detrimental to animal growth (IPCC 2014a: 508).

Massive biodiversity losses and species extinction are another possible scenario and can have an impact on economic activities such as ecotourism, e.g. visits to national

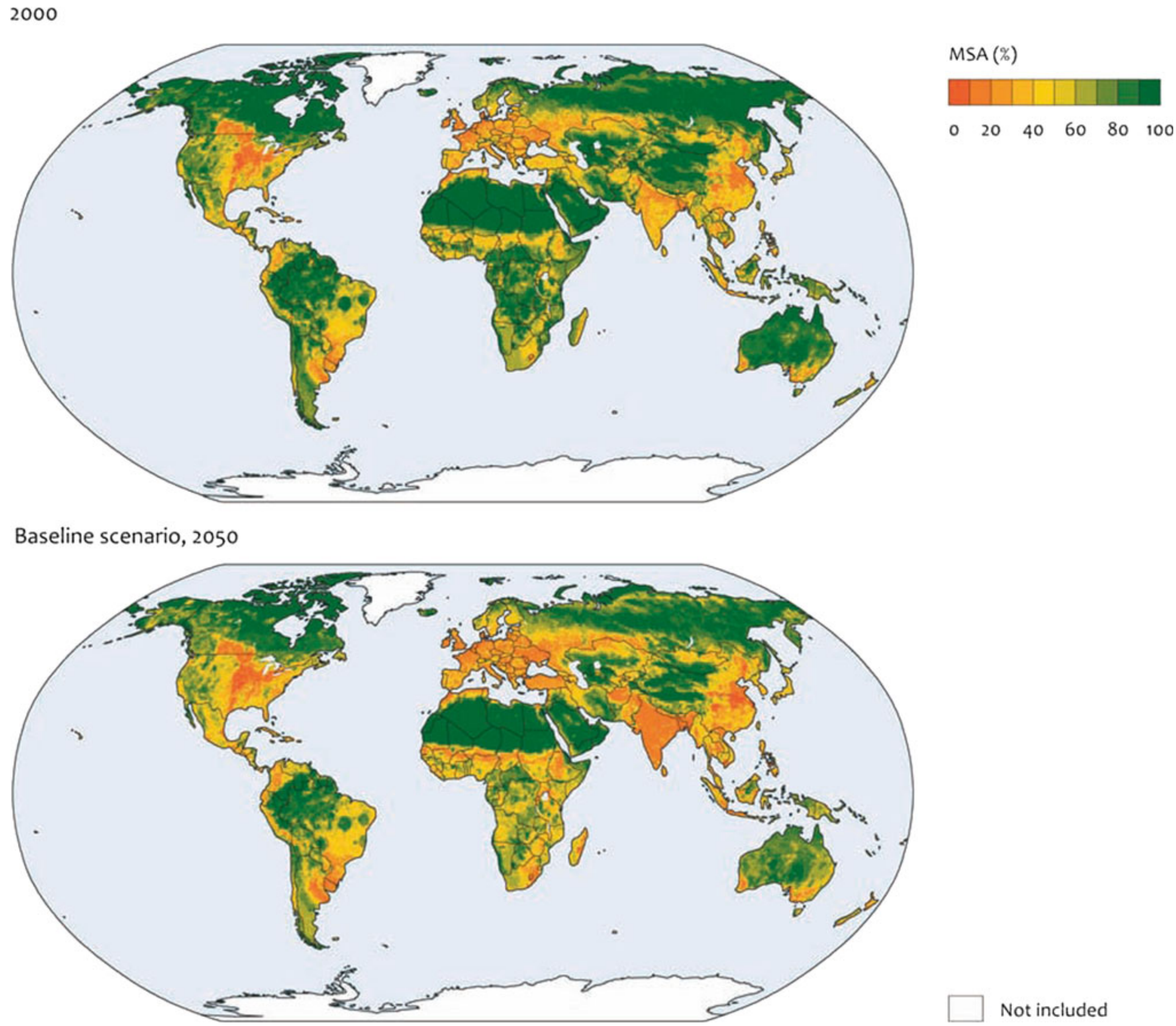

Fig. 2.8 Maps of Terrestrial Mean Species Abundance in 2000 and for the Baseline in 2050. *Source* PBL (Netherlands Environmental Assessment Agency) (2010: 47)—Fig. 3.6. The permission to use this figure was granted on 23 January 2013 by Mr. Ben ten Brink, PBL Netherlands Environmental Assessments Agency

parks (Lisk 2009: 11), as well as subsistence activities like livestock grazing and the harvesting of wild resources,[43] but also on other services provided by ecosystems such as their contribution to nutrient cycling (MA 2005: 40), water purification and pollination of crops (IPCC 2014d: 1042). Associated with decrease in water ability and increased droughts, this can contribute to health and nutrition degradation and the spreading of infectious and water-borne communicable diseases (Lisk 2009: 10). The range and resistance of pests, weeds, and diseases will evolve due to climate change with risks to agricultural production and livestock production (IPCC 2014a: 508, d: 1042) (Fig. 2.8).

Finally, climate-related hazards represent one of the most serious threats to food security: destroying crops and other means of livelihoods, eroding the capacities of the poor, and impeding food transport. The incidence and frequency of natural disasters are expected to increase with climate change (IPCC 2014a: 494).

To sum up, climate change contributes to challenging food production and traditional and "well-adjusted ways of life", especially in the Sahel region (Bächler 1994: 17) (Fig. 2.9).

[43]Wild resources play an important role in complementing agro-pastoral livelihoods. They comprise fuel wood, fruit, roots, medicinal plants and bush meat (UNEP 2011: 21). There has been little study of the impact of climate change on these resources so far but some type of effects can be expected (IPCC 2014a: 494).

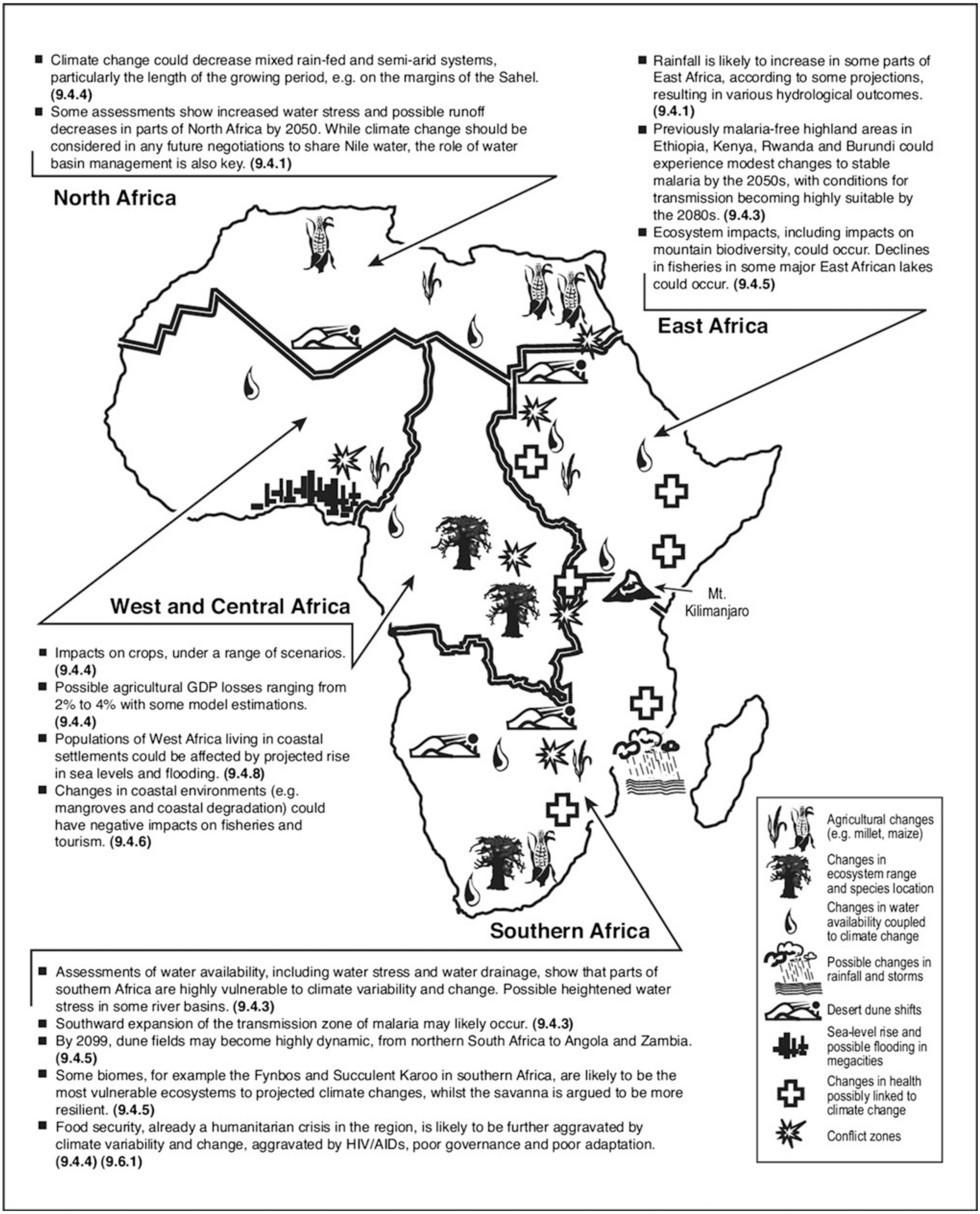

Fig. 2.9 Examples of current and future possible impacts of and vulnerabilities to climate change in Africa. *Source* IPCC (2007c: 451)—Fig. 9.5. (The notes that originally accompanied the figure in the IPCC 2007c report read: "Examples of current and possible future impacts and vulnerabilities associated with climate variability and climate change for Africa (for details see sections highlighted in bold). Note that these are indications of possible change and are based on models that currently have recognised limitation.") The permission to use this figures was granted on 24 January 2013 by Ms. Sophie Schlingemann on behalf of World Meteorological Organization

2.2.3 Climate Change: A Security Challenge for Vulnerable Societies in West Africa

The impacts of climate change, including an increase in temperatures, could result in "unprecedented security scenarios", and the European Commission anticipates that climate change could contribute through desertification to "a vicious circle of degradation, migration and conflicts over territory and borders that threatens the political stability of countries and regions" (EC 2008: 1, 4). Moreover, some argue that "the greater the warming, the greater the security risks to be anticipated" (WBGU 2007: 1).

Vulnerable communities in West Africa face traditional development issues as well as the challenges of climate change. The impact of climate change on natural systems can have an effect on socio-economic systems and especially affect the livelihoods (nutrition, health, income) of people who are vulnerable and highly dependent on ecological resources, e.g. subsistence farmers and pastoralists. In turn, both natural and socio-economic changes can influence political stability and security. Climate change puts additional pressure on environmental and social systems in which conditions are already dire and which may subsequently reach a tipping point (Bauer 2011: 721). Past this limit, people turn to coping mechanisms, some of which have negative effects on the household or the community. Cascading events can be triggered and lead to conflict and possibly violence.[44] If inhabitants increasingly compete for the remaining resources and are left with too scarce resources, they may resort to force to ensure they can access and use them (Willms/Werner 2009: 26).

Meanwhile, the decision to migrate in the hope of finding more favourable living conditions is a common example of adaptation to climate change (WBGU 2008: 116–129), both for pastoralists and farmers' communities. This decision is the result of a combination of push factors (lack of economic opportunities, poverty, lack of public services, environmental degradation) and pull factors making the destination area attractive (economic dynamism, availability and better quality of land) (IDDRI 2013: 83). Although environmentally-induced migrations are not a new phenomenon (WBGU 2008: 116) and remain relatively easy due to the porosity of borders in West Africa, they have become more common (Rechkemmer 2009: 151). These migrations can result in conflicts or competition over resources in the transit and/or host region between immigrants and earlier inhabitants (WBGU 2008: 121), especially in the case of scarcity and poor development in the transit or host region (Njeri Njiru 2012: 515).[45] As for pastoralist populations such as the FulBe, although mobility contributes to their resilience to environmental change and natural climate variability, this coping mechanism might become insufficient when the pressures that have originally contributed to shaping it change rapidly (which is the case with the current acceleration of climate change) (UNDP 2005: 66).[46] Vulnerability is heightened and pastoralists are forced to a more drastic displacement (migration). They might thus enter areas where they might compete with other population groups to access the natural resources they need for survival.[47]

Several recent reports deal with the risks of climate change for security, focussing specifically on the study area of this research. In a joint report by the FAO and GRET (*Groupe de Recherche et d'Echanges Technologiques*)[48] from 2006, climate volatility, soil erosion and dryness are seen as the main underlying environmental factors in potential conflicts over land or water resources in the sub-Saharan drylands. These three environmental features are also likely to be increased by climate change (FAO/GRET 2006: 26). The 2011 *United Nations Environment Programme* (UNEP)[49] report *Livelihood Security* goes further and maps climate hot spots within West Africa.[50] A hot spot of varying intensity covers an area spreading from Burkina Faso to northern Ghana, south-eastern Mali, and south-western Niger (UNEP 2011: 50–51), that is, it covers most of the northern part of the study area and coincides with the settlement area of the

[44]Mitigating climate change is an option to limit climate change impacts and to try avoiding the stage of tipping points and coping mechanisms. However, mitigation strategies can also have potential for conflict. Increased use of biofuels for instance can lead to competition over agricultural land and in Africa conflicts have been registered between investors and local users whose livelihoods rely on this land (Bergius/Webersik 2013: 34).

[45]See Fig. 4.1 in Sect. 4.2.1 for the destabilization of soil security in Africa.

[46]Scholars in the field of environmental migration stress the connections between vulnerability and environmental migration (as an opportunity or as a coping strategy of last resort), and they see a clear need for further research on how collective action and equality-building can reduce vulnerability (ESF 2012).

[47]This causal chain is presented in more detail in Chap. 4, Sect. 4.2.1.

[48]GRET is a French developmental non-governmental organization.

[49]This report was issued in cooperation with the *International Organization for Migration* (IOM), the *Office for the Coordination of Humanitarian Affairs* (OCHA), the *United Nations University* (UNU) and the *Permanent Interstate Committee for Drought Control in the Sahel* (CILSS).

[50]"The maps, which were produced through a technical cooperation with the University of Salzburg's Centre for Geoinformatics, focus on four climate indicators based on the best available data: precipitation (1970–2006), temperature (1970–2006), occurrence of drought (1982–2009), and occurrence of flooding (1985–2009). The potential impact of projected sea-level rise in the region is also mapped. The data is then combined to identify potential 'hotspots', including areas where the most extreme changes in the four individual climate indicators have taken place, as well as areas where the most cumulative change in these four climate indicators has occurred" (UNEP 2011: 7).

FulBe (see Fig. 2.2). This confirms that this area is under climatic stress, and that this could encourage conflicts or southwards migration of the FulBe. In the UNEP report, the climate data is then combined with conflict occurrence and population growth[51] and one can observe that the three countries selected for detailed case studies belong to zones with conflict potential (UNEP 2011: 50–51).

To sum up, the north of the study area is composed of drylands, experiences the consequences of climate change, and is the original home to one of the conflict groups studied in this research, the FulBe. The study area also registers regular conflicts. One can thus assume that agro-pastoral conflicts involving the FulBe in the north of the study area are at least to a certain degree influenced by the climate hot spot while those in the southern area can to some extent be explained by the southwards migration of a population whose livelihoods are disrupted by climate stress.

2.3 Conflicts, Conflict Analysis and Conflict Reduction

The sections above have shown how climate change in West Africa might impact vulnerable societies, including by inducing or aggravating conflicts over the use of natural resources. In order to enable an adequate analysis of farmer–herder conflicts, this section provides conceptual clarifications of the terms *conflict* and *conflict reduction*, as well as specifying what is meant by agro-pastoral conflicts.

2.3.1 The Concept of Conflict

The term *conflict* is not self-explanatory. There are two main ways to understand conflicts: an opposition of positions which does not include violent action, or an incompatibility of positions involving violent behaviours or hostile attitudes (Swanström/Weissmann 2005: 7; Zartman 1991: 300). The two dimensions can overlap (Zartman 1991: 300). The following broad and flexible interpretation of conflict will therefore be used in this study: a *conflict* is the opposition between two or more individuals or groups with opposed interests concerning the way to deal with an issue (Giesen 1993: 92) and who might use violence. According to Georg Simmel's definition from sociology, conflict is first of all a form of social relationship (Dietz/Engels 2010: 6) and it might not necessarily involve violence. Violence[52] is indeed more than just a higher degree of conflict: resorting to it is the proof of a qualitative transformation of the conflict (Guichaoua 2009, in Ubhenin 2012: 531).

Societal conflict is omnipresent (Nohlen/Schultze 2005a: 485) and arises when parties perceive that their interests or aims are irreconcilable (Pruitt et al. 1994, in Schönegg/Martel 2006: 42). The opposed interests are defined subjectively (Swanström/Weissmann 2005: 9) and can concern the allocation of desired material or immaterial resources that are possibly scarce, social disparities, or the validity of values or norms (Giesen 1993: 93; Nohlen/Schultze 2005a: 485).

There are many different types of conflict depending on the object of the conflict, the opposing groups, and the level of violence used. The intensity of a conflict can vary over time and follow very different evolution patterns (sometimes linear but sometimes also cyclical). The intensification of a conflict, resulting in the use of violence, is usually called escalation, while de-escalation happens when actors turn to using less violent means of opposition or stop using violence. Both processes are possible but once a certain level of conflict has been reached (and especially once actors have started resorting to violence), participants' respective positions are increasingly entrenched and de-escalation becomes more complex (Mitchell 1995). Cognitive distortions often accompany conflict escalation. The initial realistic conflict of interests is coupled with non-realistic components because of mounting frustration (Senghaas 2013: 60) and the primary conflict becomes hidden within a spiral of violence and counter-violence (Galtung/Fischer 2013: 61). Therefore, it is often said that "violence breeds violence" (Galtung/Fischer 2013: 35) (Fig. 2.10).

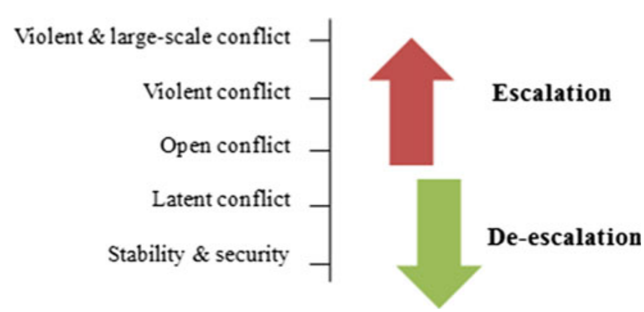

Fig. 2.10 Intensity of conflict—escalation and de-escalation. *Source* The author (2013)

[51]See map *Areas most affected by major changes in individual climate indicators—Sahel Region*; at: http://www.unep.org/disastersandconflicts/portals/155/disastersandconflicts/docs/sahel_maps/Map11_UNEP_map_A3_climate_indicators_SummaryMap_20110719_300DPI.pdf, and map *Areas most affected by changes in climate—Sahel Region (Presentation of Climate Hotspots and Conflict Areas)*; at: http://www.unep.org/disastersandconflicts/portals/155/disastersandconflicts/docs/sahel_maps/Map12_UNEP_map_A3_hotspot_map_20110719_300DPI.pdf.

[52]Violence can be defined as "any avoidable insult to basic human needs" and can target the body, mind or spirit (Galtung/Fischer 2013: 35).

Anarchy and chaos no longer govern societies that have left the state of nature: there are rules regulating violence (North et al. 2009: xi), and in the case of the modern state, the (sometimes only theoretical) Weberian state has a monopoly on the legitimate use of violence (*Gewaltmonopol des Staates* in Weber 1919). Perfect societal harmony remains a utopia, however (Giesen 1993: 93). Conflict is not simply a disruption of harmony (Nohlen/Schultze 2005a: 485) but also has the useful social function of calling attention to social taboos and tensions, opening communication, and bringing forward the transformation of a society, for instance in the distribution of power (Schönegg/Martel 2006: 42). Conflict in general belongs to all societies and can even be considered as a motor for societal change and progress (Giesen 1993: 126). This theory draws on Charles Darwin's theory of evolution. This scientific movement started with a focus on natural processes and was broadened to social processes in the late nineteenth and early twentieth century. Darwin explained evolutionary processes by the "survival of the fittest" in a hostile and competitive environment. In the social sphere, a context of competition over values or resources and the resulting conflict between social groups can be the trigger for innovation, adaptation, and the creation of new societal organizations (Giesen 1993: 88). It is, however, important to avoid determinism and to remember that a changing society does not necessarily tend toward progress, and that evolution toward less civilized forms of conflicts is possible (Giesen 1993: 126–127). Conflict can either bring on constructive problem-solving or escalation into violence.

2.3.2 Conflict Reduction

Climate change, which Mazo, in line with Diamond (2005), sees as a significant "driver of instability, conflict and collapse, but also of expansion and reorganization" (Mazo 2010: 12), might well be a driver of societal change. Conflict is deeply associated with change (Zartman 1991: 339), since it can encourage it. Moreover, it is also possible to use change to reduce conflict (Mitchell 2005: 3) and prevent it from becoming protracted and dysfunctional (Zartman 1991: 299). There are many different methods of dealing with conflicts in order to avoid such a worsening of the situation: prevention, provention, management, reduction, and resolution. All these approaches engage with conflict in order to maintain or restore security.

Conflicts, inherent to social life, "cannot be avoided" but can possibly be "kept in bounds" (Zartman 1991: 299) thanks to conflict prevention, 'provention', management, resolution, transformation and/or reduction practices. These concepts are theoretically differentiated but very often overlap or are used on a continuum when engaging with conflict (Zartman 2000, in Swanström/Weissmann 2005: 28). The differentiation is consequently quite artificial, especially since scholars cannot agree on a definition of these different concepts (Swanström/Weissmann 2005: 28). In an attempt to clarify them, it can be said that *conflict prevention* either addresses structural underlying causes that could be a source of conflict or deals with emerging tensions in a diplomatic manner when conflict is still latent (Swanström/Weissmann 2005: 19). Secondly, the *provention* approach, developed by John Burton to avoid the negative connotations of 'prevention', suggests the "prevention of an undesirable event by removing its causes" (Burton 1990: 3). Thirdly, *conflict management* is "the limitation, mitigation and/or containment of a conflict without necessarily solving it" (Tanner 2000, in Swanström/Weissmann 2005: 24). On the other hand, *conflict resolution* aims at doing precisely that: finding a solution to the opposition of interests between the parties (Swanström/Weissmann 2005: 5–6). Zartman classifies all three concepts (prevention, management and resolution) under the title of conflict reduction practices (Zartman 1991: 299). Finally, *conflict transformation* is the evolution of a conflict so that it can be conducted without resorting to violent means but rather through dialogue (Galtung/Fischer 2013: 13). Every practice aimed at limiting a conflict consequently could be said to belong to *conflict reduction*. However, in a later publication by Zartman et al., "conflict reduction" was used in a much narrower way: it became simply a stage in conflict resolution (Zartman et al. 2009: 632).

Inspired by these different approaches, the definition of conflict reduction proposed here is *the limitation of the destructive effects of conflicts*. The primary concern should be a reduction in or halt to violence and the protection of human lives. "The reduction of violence, and its consequent human, economic and political losses, has a value in and of itself" (Zartman et al. 2009: 10), which is why conflict reduction is defined as a range of practices or institutional arrangement contributing to the avoidance of the escalation of conflict to violence or contributing to the termination of this violent phase. Violence encompasses in this case material destruction, human suffering, armed conflict and possibly war, and forced displacement. It can be conceptualized in terms of cycles where violence fuels violence (revenge and retaliation) (Albrecht 2006: 3, 5), or can be seen as climbing "an escalation ladder with thresholds" (Mitchell 2005: 10). Both images give the impression that only escalation is possible, whereas processes, however complex they might be, exist to stop or reverse this tendency (Albrecht 2006: 5; Mitchell 2005: 11). Violence may not disappear completely but can be limited and managed (North et al. 2009: 13) (Fig. 2.11).

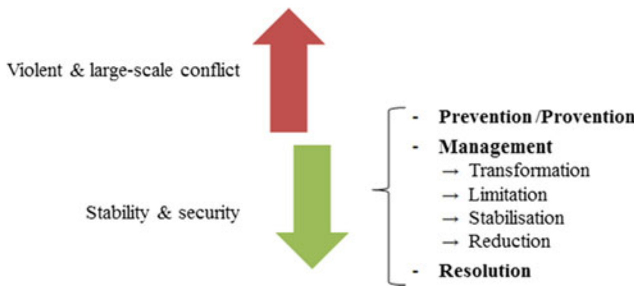

Fig. 2.11 Practices aimed at restoring security. *Source* Author's compilation from Nohlen/Schultze (2005a: 485–486), Swanström/Weissmann (2005: 11), Zartman et al. (2009: 632)

Because the power asymmetry between parties largely determines the conflict, one of the first things to do when engaging with conflicts is to "consider strategies of altering asymmetry as a means of reducing or even resolving conflict" (Mitchell 1995: 32, 45). Although both conflict parties may try to increase asymmetry to their advantage, peace is more easily attained between 'equals' (Mitchell 1995: 36). This might be difficult in cases where the conflict has become institutionalized in favour of one of the parties.[53] The reduction of power asymmetry can contribute to the transformation of perceptions, making parties aware of other options or in favour of settling the conflict (Burton 1990: 204; Mitchell 1995: 40).

There are several techniques to reduce conflicts. Bächler, for example, suggests 'transforming' the conflict to lead to a stage where it is 'ripe' for resolution (terminology by Zartman in Burton 1990: 88) and meanwhile reducing the conflict and its violence level, since conflict goals can most of the time be attained by non-violent means (Zartman et al. 2009: 11). The conflict transformation approach necessitates among other things the direct participation of conflict parties and the involvement of stakeholders and of a third party (Bächler 2002: 533, 534, 535). In fact, all the different methods of engaging with conflict (prevention, prevention, management, transformation, resolution, and reduction) mention the intervention of a third party (Albrecht 2006: 5). This mediation can help the conflict parties accomplish what they could not on their own (Zartman 1991: 316) such as the reduction of power asymmetries (Mitchell 1995: 36), analysis or contribution to the analysis of the conflict relationships (Bächler 2002: 533; Burton 1990: 204), and the transformation of mutual perceptions.

[53]See Chap. 6 below on the ethnicization of land rights in Côte d'Ivoire, for instance.

2.3.3 Agro-pastoral Conflicts and Milestones of Conflict Analysis

It was previously stated that farmer–herder conflicts oppose groups of population who are differentiated by their livelihoods and by the activities from which they derive their subsistence. Farmers in Africa are mostly sedentary and live on small plots and from rain-fed agriculture (Bauer 2011: 725; Lisk 2009: 9). Herders or pastoralists depend largely on mobile and extensive livestock herding. During certain seasons, farmers and herders share grazing/growing land and waterholes. This proximity creates interactions and sometimes conflicts because of resource allocation issues. Conflicts might arise between farmers and herders, but also between herders, between farmers, or between the central administration and both groups (Ejigu 2009: 890). The focus here is on the conflicts between farmers and herders that are caused by resource allocation and scarcity, or by perceived scarcity and perceived disparities in resource allocation (Moritz 2006: 3). These conflicts sometimes escalate to violent action such as material destruction (mostly of crops) and theft, physical violence, and in the worst-case scenario the death of some of the protagonists (Moritz 2006: 16–17).

Box 2.3 Individuals in farmer–herder conflicts

Looking at the individual or community level, it is easy to understand how these questions become survival dilemmas and can come to confrontation. Herders leaving their region of origin and sometimes voluntarily infringing on farming areas are indeed constrained to do so if they do not want to see their livestock (and main source of income and subsistence) perish, while farmers who lose a harvest also see their livelihoods put in jeopardy (IPS 2007).

2.3.3.1 The Object of Conflict: Common-Pool Resources

Observers tend to immediately identify land and water resources as the object of the conflict between farmers and herders. When different groups of stakeholders have an equal interest in a resource, natural or man-made, this resource can be classified in the category of the 'commons'. Resources of this sort are also called common goods and are one type of goods among the four identified by economic theory. A typology of these goods is determined by applying the criteria of rivalry and excludability. Common goods are rivalrous but non-excludable (see Table 2.2). In other words, the utilization or consumption of a common good depletes

Table 2.2 Typology of economic goods

	Excludable	Non-excludable
Rivalry	Private goods	Common goods
Non-rivalry	Club goods	Public goods

Source Simeonov (2012: 14)

the total quantity of this good in a manner detrimental to other (potential) users (rivalry) but it is impossible to prevent someone from doing so (non-excludability). The other types of goods are private, club and public goods.

Rather than using these clear-cut criteria and in order to present a richer picture which is closer to reality, a more refined definition of the types of goods is possible. This is characterized by the ease with which users (and free-riders[54]) can be excluded from (accessing and using) the good and by the extent to which consumption by one user subtracts from consumption by another (IEA 2012: 57) (Table 2.3).

In cases in which it is difficult to exclude people from using a resource (common or public goods), free-riding problems arise and there is no incentive for people to produce, replenish, or conserve the resource. Moreover, in the case of common goods, consumption subtracts from the total available quantity of the resource. The resource thus tends to deplete since "most people correctly understand that, even if they themselves abstain from using the resource, the depletion will still not be stopped as others (the free-riders) will deplete it anyway" (IEA 2012: 57). Unlike public goods, the negative externality of providing a common good is higher than the positive externality of conserving it (Bardhan/Dayton-Johnson, in Ostrom et al. 2002: 92). Consequently, common goods are likely to be underproduced and overconsumed (IEA 2012: 57). This is most often designated as 'the tragedy of the commons' using the expression coined by Hardin in 1968.[55]

Common goods can also be labelled *Common-Pool Resources* (CPRs; IEA 2012: 57). The type of resources at the root of farmer–herder conflicts, namely arable or grazing land and fresh water resources, falls into the category of CPRs. It is very relevant to use the prism of CPRs management and of the prisoner's dilemma in a study of farmer–herder conflicts since Hardin himself based his analysis of the 'tragedy of the commons' on a case of overgrazing of common pastures.[56] The two groups are competing for the use of CPRs. The use of some units of land and water by farmers or herders subtracts a quantity of the resource from the possible use by the other group. During one agricultural season, growing crops and grazing are mutually exclusive, since once one activity has been completed, the unit of land concerned has been used (it is depleted). The same applies to units of water used to irrigate crops or water cattle. Furthermore, if practices are not adequate, the resource might not be able to replenish with time (for example if the fields do not lie fallow regularly), and the entire CPR will thus be lastingly depleted. Adverse climate change impacts can make this situation worse. This is a prisoner's dilemma in which individually rational decisions (i.e. "consume as much CPR as possible") lead to collective irrational outcomes (i.e. depleted resources) (Ostrom 1990). To avoid depletion, it would be necessary to exclude some people from accessing the water or land and regulate the use of the CPR, but this process is often difficult and/or costly, for example because it requires setting up barriers and surveillance. Trapped in such a dilemma, farmers and herders are likely to engage in conflictive behaviour, among other reasons to be able to control the resource. Since climate change is putting external pressure on the overall level of resource available (for example: less water is available in waterholes with irregular precipitation), the two user groups might have even more causes for conflict.

Table 2.3 Refined typology of economic goods

		Excludability	
		Easy	Difficult
Rivalry	**Large**	Private goods	Common goods
	Small	Club goods	Public goods

Source IEA (2012: 57)

2.3.3.2 From Conflict to Cooperation

However, the above analysis presents traditional views of CPR that have been challenged. A few specific arguments are presented here and will be developed in later chapters. Despite a certain level of antagonism between herding and farming groups (Meier 2011: 1430), increased geographical proximity represents a risk of increased conflict but also an opportunity for closer interaction and cooperation (Turner et al. 2011: 188). Historical contextualization is necessary to understand the links between migrating pastoralists and host populations. From cooperation to bloodshed, pastoralists moving southwards are received differently across the region (FAO/GRET 2006: 21–22).

[54]People who consume a resource but do not contribute to it (contribution to the production of the resource, to its conservation, or simple payment of a fee for consuming it) (adapted from IEA 2012: 57).

[55]Hardin, Gareth, 1968: "The tragedy of the commons", in *Science* 162: 1243–1248.

[56]'Commons' originally meant common pastureland.

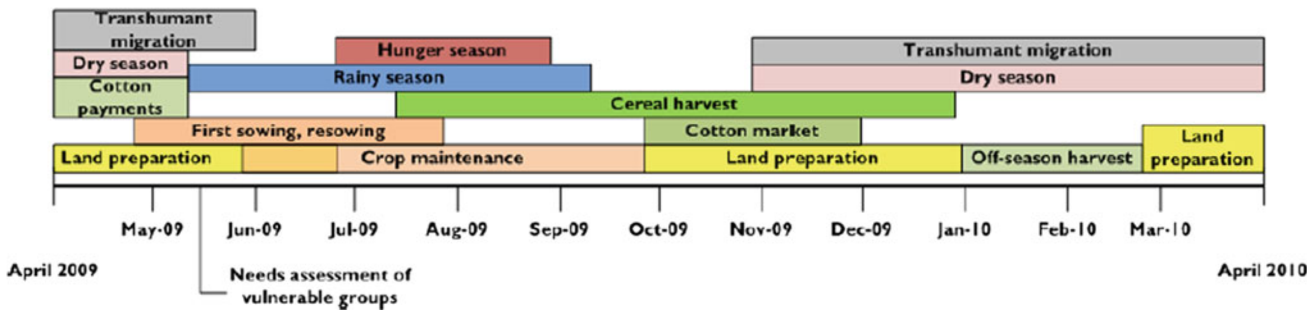

Fig. 2.12 Example of intersection of the dry season and harvest period in Burkina Faso. *Source* Timeline of Critical Events: Seasons and Agriculture in Burkina Faso FEWS NET in USAID (2009: 1)

FulBe herders have always interacted with local sedentary populations, for example with the Mossi and Karaboro in Burkina Faso, with the Senufo in Burkina Faso and Côte d'Ivoire, and with the Brongs in Ghana (Breusers et al. 1998; Hagberg 2001; Tonah 2002a: 46). Seasonal transhumance has contributed to the development of complex host–stranger or host–client relationships between nomadic herders and farmers (Moritz 2006: 8), and in the 1960s and 1970s the local population welcomed the herders moving to their region with hospitality (Tonah 2002a: 43). Host–stranger relationships are much codified, starting with the exchange of gifts (Moritz 2006: 8). Trekkers made the first contacts. Personal alliances and social networks developed (Basser/Turne 2006: 37) in peaceful cooperation and economic integration involving exchange of milk for vegetables, for example (De Bruijn/Van Dijk 2003: 291–292; Moritz 2006: 8). Social ties between groups have developed, sometimes consolidated through marriages (Abdul 2011). Longstanding relationships have even resulted in some commonality between the two groups, with the FulBe adopting some aspects of the local culture in their own lifestyle and vice versa.

Some locals might however have no direct interest in the presence of the FulBe and are more likely to enter into conflict with the nomadic herders (Moritz 2006: 8). The balance can then easily be broken in cases of competition for land use (pasture or cultivated fields), crop damage by livestock and related unpaid compensation, arguments over field boundaries, non-payment of taxes on access to water points, or stolen or lost cattle belonging to a farmer and entrusted to a herder (Bassett 1988: 455; Basset 1994: 158; Hagberg 2001: 47; IPS 2007; Turner et al. 2011: 196). Such situations can be caused by the deliberate decisions of individuals facing a "survival dilemma" (Brauch 2008) and going against community rules (Moyo 2009: 901), or may be purely accidental. First-hand accounts of farmer–herder conflicts in Côte d'Ivoire, for example, mention the negligence of hired herders who let cattle graze on cultivated areas or are even asked to do so by their employer because it is the only way to ensure the animals get sufficient fodder (IPS 2007). It would be erroneous to assume that herders are always the instigators of the conflict. Herders are sometimes forced to move camp because farmers disrespect the land allocations and try to take over the land at the edge of the herders' camps for cultivation because it has recently been fertilized with cattle manure (Basset 1988: 466). Such occurrences create tensions in the community that can be intensified by socio-economic, ethnic and cultural competition between groups (Moritz 2006: 10).

Theoretically, the peak time for competition for land and water between farmers and herders should be during the time when the dry season, when the herders move southwards to more temperate zones where most of the farmers live (Basset/Turner 2006: 34), coincides with the growing season. For most of the time this corresponds to the lean season, which is a time of exacerbated vulnerability for farming communities, whose food stocks are depleted, and who are then engaged in agricultural work (Courade/Devèze 2006: 27) (Fig. 2.12)

Cohabitation becomes problematic when herders bring cattle to cross over or graze near fields that have not yet been harvested or have been recently sown. After the harvest and until the next sowing, cattle can graze the fields without unleashing the wrath of the farmers (Moritz 2006: 5–6). Cohabitation at this time of the year can even result in productivity-enhancing arrangements between the two groups (called *contrats de parcage*), by which herders are allowed to let their cattle roam on harvested plots and graze crop residues (and are even sometimes remunerated for it). The fields benefit in return from animal manure as a natural fertilizer (FAO 2011b: 148). This is an example of a well-integrated crop and livestock production system. If the rules for the use of the CPRs are abided by, collective benefits are possible thanks to the creation of these cooperation mechanisms, which can also be termed successful "institutions for collective action", following Elinor Ostrom's (1990) work.[57]

[57]More information is given in Chap. 4.

Box 2.4 Example of farmer–herder cooperation in West Africa

The region of Guiè in Burkina Faso is an example of successful CPR management that integrates livestock and crop production, protects resources from degradation despite harsh climate conditions, and ensures good levels of yield. The pilot was launched in 1989 by the non-governmental organization *Association Zoramb Naagtaaba* (AZN) and includes some soil and water conservation techniques as well as allowing cattle access to harvested parcels of land, which provides fodder for the animals while land is fertilized by their manure (UNEP 2011: 63).

2.3.3.3 Additional Pressures

Since the 1970s increased droughts and scarcer resources in West Africa have forced nomadic groups such as the FulBe herders to move their routes and general habitat southwards (Basset/Turner 2006: 34–35), while the total area of cultivated land has tended to expand (Courade/Devèze 2006: 30). Moreover, increasing variability in precipitation patterns can disrupt the agricultural and pastoral calendar, leading to a longer period during which farming activities overlap with the period of dry-season wandering. These factors increase the size of the coexistence area and/or its duration and consequently also increase the associated risks from competition. In addition, harsh environmental conditions that destabilize livelihoods can encourage diversification of activities for all population groups as a means of ensuring subsistence (for example, farmers keep a few sheep and herders cultivate small areas of land). This strategy can lead to direct competition for resources, because the overlap between population groups is no longer only geographical but also occupational (UNEP 2011: 72).

The main apparent object of opposition in farmer–herder conflicts is access to natural and renewable resources, which allows these conflicts to be categorized as environmentally-induced conflicts. Considering the environmental stress created by (anthropogenic and natural) climate change on natural resources, these conflicts can be said to be aggravated by climate change. It is even possible to consider that without this external pressure from climate change, the level of scarcity would in some cases not be such as to result in violent conflict or indeed in any conflict at all. It is, however, impossible to determine the extent of the influence of climate change on conflict, which is why the general terminology of *climate-change-induced or -aggravated conflicts* is used henceforth. This refers to a category of environmentally-induced conflict in settings where the impacts of climate change are high, such as in the study region in West Africa.

2.3.3.4 Non-environmental Dimensions to Farmer–Herder Conflicts

Agro-pastoral conflicts are not only environmentally and climate-change-induced or -aggravated conflicts. As shown above, the ways in which the community organizes and regulates farmer–herder interactions also plays an important role. Agro-pastoral conflicts thus have both a natural and a societal dimension. They cannot be purely defined as environmental conflicts and have to be conceptualized within their social context (Dietz/Engels 2010: 9) and approached as multidimensional (social, political, economic and ecological) processes (Dietz/Engels 2010: 3).

In fact, conflicts between farmers and herders may not even be about scarcity of resources (Moritz 2006: 4). They might arise between a farmer and a herder (or between a group of farmers and a group of herders), but they may not concern agricultural and pastoral activities (Moritz 2006: 13). These conflicts often crystallize over natural resources, although these might only be the alternative object of an indirect conflict (Nohlen/Schultze 2005a: 486). Even when the object of the conflict is indeed the scarcity of resources, this does not mean that the societal aspect of the conflict should not be examined, because nature and scarcity are not just ecological but also social constructions (Dietz/Engels 2010: 9). Farmer–herder conflicts are not simply about scarce resources but are more specifically about competitive access by different societal groups who intend to use the resources differently. These conflicts can thus be designated as conflicts over resource allocations and resource use (*Verteilungs- und Nutzungskonflikten*), so as to highlight their societal aspect (Dietz/Engels 2010: 17–18).

On the other hand, since the fault line between the two groups is often also an ethnical one,[58] there is a tendency to consider that farmer–herder conflicts are ethnical disputes (Breusers et al. 1998: 358). If the definition of an ethnical conflict is an opposition "between groups with sociocultural differences" and who define themselves thanks to this exclusive membership (Mabe 2003: 50, 52), farmer–herder conflicts are indeed ethnical since differences in lifestyles (sedentary or nomadic) and subsistence activities (farming or herding) often coincide with ethnic, religious and community distinctions. However, ethnicity is often a mere channel of and not a cause of conflict (Mabe 2003: 50; Ohlsson 1999: 112). The mobilization of followers for a conflict necessitates a strong identity basis, such as an ethnical one, which can explain the transformation of a conflict over

[58] In Burkina Faso, for example, conflicts often oppose the Mossi to the FulBe (Breusers et al. 1998).

material or immaterial resources into a fundamentally ethnic opposition (Mabe 2003: 50). This is an essentialization of the differences between the conflict parties. Such conflicts can become violent because the other is perceived as a threat to one's being and identity and no longer as a mere opponent on a question of resources. Besides, ethnicity is a concept that largely came about from studies of origins and classifications by colonizers, influenced by evolutionist theories (Mabe 2003: 52). It has since been used so often that one tends to think only in terms of ethnicity in Africa (Mabe 2003: 52). Such a bias should be kept in mind because, even when it comes into play, ethnicity is not the primary determinant of the conflict groups in this study—differences in livelihood strategies are (Ejigu 2009: 892).

2.3.3.5 Other Milestones of Conflict Analysis

Apart from its causes and potential channels, there are many factors that should be taken into account when analysing a conflict. Since conflict has been defined as an incompatibility of interests and might not have an objective cause, it is, needless to say, of fundamental importance to understand how the interests of the actors contrast (Burton 1972: 9–10, 1990: 204); but the structures of the conflict, its dynamic processes and its evolution are also important because conflicts are neither linear nor stable over time (Dietz/Engels 2010: 8). The power (a)symmetry is a determinant of the structure of the conflict and of the relationship between the actors (Dietz/Engels 2010: 7, 20) and should be taken into consideration. Dimensions in which there can be asymmetry include coercive capacity, access to the decision-making process, and bargaining ability (skills and access to institutions) (Mitchell 1995: 41–42). Secondly, attention should be paid to the different levels of the conflict, in a hierarchical as well as in a spatial sense (Dietz/Engels 2010: 10), as well as to the links between them (Nohlen/Schultze 2005a: 588). In the case of conflicts over the allocation and use of resources, the different levels noticeably influence one another (Dietz/Engels 2010: 18), and a localized conflict (at the community level) can bring in actors from a higher level (the region or even the central state, for instance) with the risk of a more global destabilization (Moritz 2006: 16). Finally, like all conflict groups, the categories of 'farmer' and 'herder' are not homogeneous (Moritz 2006: 22–25) and actors within groups can differentiate themselves by hierarchy/class and relative power, specific private interests (Dietz/Engels 2010: 21), activities, gender, and interpersonal relations (Moritz 2006: 8). This must to be remembered when it comes to empirical analysis (see Chap. 6), although a certain level of generalization will be maintained.

2.4 Summary

Chapter 2 has shown how an 'ancient' category of conflict (Moritz 2006: 2) between farmers and herders in Africa over natural renewable common-pool resources, more specifically land and water, can be impacted by climate change. Nomadic and semi-nomadic herders such as the FulBe have a long history of migrating and building relationships with various sedentary farming populations. These contacts can take various forms, from coexistence to cooperation or to

During the dry season in the Sahel, an erosive crust can form and make farming difficult. *Source* Senegal, 2014, Joya Chowdhury

Floods in the North province, Burkina Faso. *Source* Burkina Faso, 2006, Jacqueline Gounelle

conflicts over shared natural resources or Common-Pool Resources (in this case fresh water and land). Climate change might put a strain on these relationships.

Farmer–herder conflicts might thus increase in intensity in coming years. Herders and farmers of West Africa often live in vulnerable natural and human systems where the effects of climate change are already being felt and are likely to increase significantly. In particular, the projected increasingly irregular precipitation and the rising temperatures in West Africa could contribute to aggravating desertification and augmenting the frequency of droughts, and consequently lead to, among other things, a decline in food production and availability of water. Access to and use of resources may become more and more competitive and conflictive, giving way to climate-change-induced or -aggravated conflicts.

It was also argued that farmer–herder conflicts are not only environmental but also societal conflicts. As such, these conflicts belong to normal functioning societies and can even be a positive impetus for change. However, it is also possible that conflict, especially in a context where its apparent object plays a key role in the survival of the parties, will escalate to violence and deeply threaten the security of both communities. To respond to such challenges, practices of engaging with conflict have been developed. Conflict reduction is one of these approaches, and is aimed at upholding or restoring security to avoid escalation to destructive violent action, or at least to limit the scope of violence.

The subject of this research is the reduction of these climate-change-induced or -aggravated farmer–herder conflicts over CPRs in general and in West Africa in particular. This chapter has provided the necessary information and definitions of the conflicts studied and their background, including the impacts and projected impacts of climate change in the region. It is now possible to analyse the connections and possibly the causal relationship between climate change and agro-pastoral conflicts. In the next chapter, different approaches that conceptualize the linkages between environmental change and conflicts will be scrutinized, and the circumstances in which the environment becomes a source of conflict will be identified. This step is essential in order to then identify factors that can help prevent escalation to conflict and/or violence.

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