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Introduction

This climate change profile is designed to help integrate climate actions into development activities. It complements the publication 'Climate-smart = Future-Proof! – Guidelines for Integrating climate-smart actions into development policies and activities' and provides answers to some of the questions that are raised in the step-by-step approach in these guidelines.

The current and expected effects of climate change differ locally, nationally and regionally. The impacts of climate change effects on livelihoods, food and water security, ecosystems, infrastructure etc. differ per country and region as well as community and individual, with gender a particularly important vulnerability factor. This profile aims to give insight in the climate change effects and impacts in Benin, with particular attention for food security and water. It also sheds light on the policies, priorities and commitments of the government in responding to climate change and important climate-relevant activities that are being implemented, including activities being internationally financed.

Summary

The expected impact of climate change in Benin, especially the projected rise in temperature and rainfall is likely to compound the challenges already faced by the agriculture and forestry sectors, while the coastal areas will experience a sharp rise in sea level. The latter will threaten the people living along the coast where both income and population density is higher (between 250 and 1000 p/km², half of the population) than in other parts of Benin (from 0 to 250 p/km²). Since agriculture is of the greatest importance for the Beninese economy, the agricultural sector will need to adopt adaptive measures to respond to the consequences of climate change that threaten food security.

Overall ranking

Benin is ranked 149 out of 188 countries in per capita GHG emissions¹ and contributes only 0.03% to global emissions². However, Benin is highly vulnerable to global climate change, ranking 155 out of 181 countries in the ND-GAIN index³ (2017) for climate vulnerability. Benin is the

19th most vulnerable country and the 45th least ready country – meaning that it is vulnerable to, yet unready to combat climate change effects. *Vulnerability* measures the country's exposure, sensitivity, and ability to cope with the negative effects of climate change by considering vulnerability in six life-supporting sectors: food, water, ecosystem service, health, human habitat and infrastructure. *Readiness* measures a country's ability to leverage investments and convert them to adaptation actions by considering economic, governance and social readiness.

Biophysical vulnerability

Current climate. Benin is located in West Africa and its climate is influenced by the Inter-Tropical Convergence Zone (ITCZ), creating both winds from the Ocean as well as winds from the Sahara region that are dustier and warmer⁴. These two opposing wind directions cause the annual West African Monsoon – resulting in a wet **season** in the north of Benin from May to November, and two wet seasons from March to July and from September to November in the southern regions of Benin⁵. In general, most of the country experiences transitional tropical conditions, with less rainfall than in other areas at the same latitude – a climate known as the Benin variant⁶. For the whole of Benin, the annual mean **temperature** is 27°C, whereas the annual total **precipitation** is 1150 mm⁷.

Current trends. The mean average **temperature** has increased since 1960 by 1.1°C and the average number of 'hot' days⁸ per year in Benin increased by 39 between 1960 and 2003, and hot nights by 73 in the same period⁹. In contrast, the frequency of 'cold' days and nights¹⁰, annually, has decreased significantly since 1960. Since the end of the 1960s the climate perturbations have increased in Benin, which has manifested in reduced annual amplitude of rains by 180 mm¹¹, see [Map 1](#). In addition, **droughts** have intensified during the same period, especially in the 1970s

¹ <https://en.actualitix.com/country/eth/ethiopia-co2-emissions-per-capita.php> (based on 2011 data)

² WRI (2017) <http://caitz.wri.org/> (based on 2013 data)

³ GAIN index summarizes a country's vulnerability to climate change and other global challenges in combination with readiness to improve resilience. <http://index.gain.org/country/benin>

⁴ McSweeney, C.; New, M.; Lizcano, G. (2010): *UNDP Climate Change Country Profiles: Benin*, <https://digital.library.unt.edu/ark:/67531/metadc226730/>

⁵ McSweeney et al. (2010)

⁶ Jalloh, A.; Nelson, G.C.; Thomas, T.S.; Zougmore R.; Roy-Macauley H., (2013): *West African Agriculture and Climate Change, A Comprehensive Analysis*, IFPRI. <http://www.ifpri.org/publication/west-african-agriculture-and-climate-change-comprehensive-analysis>

⁷ Climate Service Center (2015): *Climate fact sheet Benin, Ghana, Togo* <http://www.climate-service-center.de/>

⁸ 'Hot' day or 'hot' night is defined by the temperature exceeded on 10% of days or nights in current climate of that region and season (see footnote 2).

⁹ McSweeney et al. (2010)

¹⁰ 'Cold' days or 'cold' nights are defined as the temperature below which 10% of days or nights are recorded in current climate of that region or season (see footnote 2)

¹¹ UNDP; Beninese Ministry of Environment and Nature Protection (2008): *Convention-cadre des Nations Unies sur les changements climatiques (PANA-Benin)*, http://unfccc.int/files/adaptation/napas/application/pdf/02_ben_pp.pdf

and 1980s, and rains have intensified by 100 mm/h enhancing soil **erosion and floods**¹². Moreover, the annual count of wet days as well as the annual maximum 30-day total rainfall showed a substantial decrease over the 1960-2000 period¹³.

Climate change. Northern regions are especially threatened by encroaching deserts; the borderline of which gradually shifts to the lower latitudes, while the agricultural production capacity in the intensively cultivated south is endangered by nutrient mining (unreplenished removal by crops of nutrients such as phosphorous, nitrogen, and potassium). Under climate change, this situation is most likely to worsen, with accelerated **desertification** in the north and more frequent occurrence of torrential rains and **floods** in the south, but much less in the Middle Belt. The most notable climate risks are drought, late and intensive rains, and floods, in addition to extreme winds¹⁴. See [Map 2](#) for projected **precipitation** change under different climate change scenarios.

Climate models project an increase in the normal annual maximum **temperature** for the whole country, ranging from slight (1–1.5°C) to substantial (2.5–3.0°C)¹⁵, see [Map 3](#). The mean annual temperature is projected to increase by 1.0 to 3.0°C by the 2060s, and 1.5 to 5.1°C by the 2090s. The range of projections by the 2090s under any emissions scenario is around 2.0-2.5°C¹⁶. With the current rate of **wetlands destruction** (due to human intervention), the coastal wetland is projected to reduce by 40% by 2080. **Sea levels** are expected to rise by 0.4 to 0.7 meters by 2100, probably resulting in coastal disasters (complete coastal erosion, floods, and storm waves)¹⁷.

The negative consequences of intense and successive periods of drought and floods could affect **food security**: they may reduce the production of food by 6% by 2025 if no adaptive measures are taken. As for **water resources**, the consequences of climate change (decline of precipitation) could result in 40% to 60% reduction in the availability of water resources, further influencing Benin's food production¹⁸, see [Map 4](#). Moreover, according to the Global Climate Change Alliance (GCCA) the consequences of the degradation and destruction of gallery forests in the Ouémé river basin – caused by charcoal non-sustainable timber extraction and

extensive fallow-based agricultural practices – is being exacerbated by climate change¹⁹. This is not only a significant problem for forest-dependent communities, but also for downstream regions, which increasingly suffer from devastating floods during the rainy season.

Socio-economic vulnerability

Key facts:

GDP (PPP) per capita (2016) ²⁰ :	USD 2,168.2
Population (July 2017) ²¹ :	11,175,692
Projected population (2050) ²² :	23 930,000
Population density per km ² (2016) ²³ :	96
Human Development Index (2016) ²⁴ :	167 out of 188 countries
Corruption Perceptions Index (2016) ²⁵ :	95 out of 176 countries
Gender Inequality Index (2016) ²⁶ :	144 out of 188 countries
Adult literacy (2015) ²⁷ :	38.4% (male 49.9%; female 27.3%)

Agriculture is an important economic sector in Benin, contributing 36.3% of the GDP and employing around 70% of the population²⁸. The major staple food crops are yams, cassava, and maize, and the major cash crops are seed, cotton, and cashew nuts²⁹. Cotton is the main export commodity, comprising about 25-40% of all exports. Benin's economy remains largely undiversified and extremely

¹² UNDP; Beninese Ministry of Environment and Nature Protection (2008)

¹³ Climate Service Center (2013)

¹⁴ Centre for World Food Studies (SOW-VU) (no date): *The impact of climate change on crop production and health in West Africa, An underutilized Middle Belt in West Africa*, <http://www.sow.vu.nl/Activities/Benin.html>

¹⁵ Jalloh et al. (2013)

¹⁶ UNDP; Beninese Ministry of Environment and Nature Protection (2008)

¹⁷ UNDP; Beninese Ministry of Environment and Nature Protection (2008); Benin Dashboard: http://sdwebx.worldbank.org/climateportalb/home.cfm?page=country_profile&CCode=BEN&ThisTab=ClimateFuture

¹⁸ Climate Service Center (2013)

¹⁹ Global Climate Change Alliance (GCCA) (2013): *From Integrated Climate Strategies to Climate Finance Effectiveness – Experiences from the GCCA*. <http://www.gcca.eu/sites/default/files/soraya.khosravi/gcca2013-eng-pdf.pdf>

²⁰ World Bank Data – GDP per capita, PPP. <http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD>

²¹ World Population Review – Benin, <http://worldpopulationreview.com/countries/benin-population/>

²² UNDESA (2017): *World Population Prospects: The 2017 Revision, Key Findings and Advance Tables*. Working Paper No. ESA/P/WP/248. https://esa.un.org/unpd/wpp/Publications/Files/WPP2017_KeyFindings.pdf

²³ World Bank Data – Population density, <https://data.worldbank.org/indicator/EN.POP.DNST>

²⁴ UNDP (2017) Human Development Report 2016: Human Development for Everyone. Table 1. <http://hdr.undp.org/en/content/human-development-index-hdi>

²⁵ Transparency International (2017) Corruption Perceptions Index. https://www.transparency.org/whatwedo/publication/corruption_perceptions_index_2016

²⁶ UNDP (2017) Human Development Report 2016. Table 5. <http://hdr.undp.org/en/content/human-development-index-hdi>

²⁷ Index Mundi (2014) <http://www.indexmundi.com/benin/literacy.html>; World Factbook (CIA, 2015): <https://www.cia.gov/library/publications/the-world-factbook/geos/bn.html>

²⁸ Programme Alimentaire Mondial (2009): *Analyse Globale de la Vulnérabilité, de la Sécurité Alimentaire et de la Nutrition au Bénin* (AGVSN); World Factbook (CIA, 2015): <https://www.cia.gov/library/publications/the-world-factbook/geos/bn.html> and http://reliefweb.int/sites/reliefweb.int/files/resources/43DA51077604F6EAC12575CC004CE9Bo-Rapport_Complet.pdf

²⁹ Jalloh et al. (2013)

vulnerable to external shocks and changes in trade policies, especially with Nigeria³⁰. Since agriculture is especially vulnerable to the consequences of climate change, it will disproportionately affect the poor, who depend on agriculture for their livelihoods and who have less capacity to adapt³¹. Without adaptive measures such as enhanced crops and improved irrigation³², agricultural production is expected to decrease by 3 to 18% in 2025. However, the high percentage of households in poverty (in 2011, 36.2% of the population estimated at or below the national poverty line³³) may limit investment and hinder adoption of adaptive measures. The most vulnerable socio-economic groups are small-scale cattle herders, smallholder farmers and fishermen; smallholder farmers and small-scale cattle herders are to some extent interdependent since herders may depend on farms for the feed for their cattle, partly covered by post-harvest grazing. There is also a gender dimension to climate change: a study focusing on dry grains found that only 28% of the households surveyed that are headed by women were able to cover the basic annual needs of their families compared to 43% of male-headed households. As a result of the consequences of climatic changes, the self-sufficiency of rural households headed by women will be even lower³⁴.

Some climate change scenarios show that parts of the most productive zones for staple crops (north, north-west, and centre) could experience reduced precipitation as well as an average increase of 2°C in temperature, with substantial negative effects on staple yields (e.g. a decline of 5–25% for maize)³⁵. The lengthening of the dry season has an overall effect on agricultural production. Net exports of maize are shown to increase due to favourable changes in climate for large-scale maize production in combination with economic developments. For tubers and root crops (yams, sweet potatoes, cassava, and others), imports will grow. Cassava production and yields are shown to improve until 2030 and then stagnate, at between 3 and 4 million metric tons and at just over 15 tons per hectare, respectively³⁶. For yams and sweet potatoes, results of studies and climate models vary: some models project an increase, others a decrease of yield.

Most likely is that yam yield will decline significantly during the period 2041–2050 ranging from 18 to 33%³⁷. Reduction in yam yield is not explainable by the change in temperature but due to a decline in precipitation. Net imports of crops are expected to increase slightly³⁸ which could compensate the food availability. Concerning the impact of climate change on cotton cultivation, it is expected that yield will decrease due to insufficient and unequal rainfall, diminishing income in the short-term but potentially leading to crop diversification.

As for the other sectors: a rising sea level and increased coastal erosion are threatening communities, particularly the poor, living along the urbanised coast and the sensitive coastal ecosystems. In the future, this is expected to lead to population migration, disease outbreaks, and to contribute to food shortages. Overall, the coastal, north-western, and far northern zones of Benin are considered to be particularly vulnerable to the impacts of climate change³⁹.

National government strategies and policies

The Ministry of Environment (MoE) is responsible for national climate change policies and activities related to adaptation, mitigation and capacity development. These responsibilities include providing oversight of the National Fund Environment and Climate Change (FNEC), the implementation of the National Program for the Management of Climate Change (PNGCC), and working closely with other ministries (agriculture, health, etc) in the formulation of climate related activities. The MoE is also the National Focal Point for the United Nations Framework Convention on Climate Change (UNFCCC) and is responsible, in collaboration with the sectoral ministries, for the monitoring and evaluation of the implementation of the NDC and institutional capacity building (see below)⁴⁰.

Numerous action plans and policy documents have been formulated by the Government of Benin, including Agenda 21, Benin 2025, the Agreement on Sustainable Development, and several reforestation programmes, as well as an Initial and Second National Communication document on climate change that are currently under implementation. Benin also

³⁰ World Bank. Benin Dashboard, Climate Change Knowledge Portal. http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCCode=BFN downloaded December 10, 2017.

³¹ Jalloh et al. (2013)

³² République du Bénin, Ministère de l'Environnement, de l'Habitat et de l'Urbanisme, Direction de l'Environnement (2001): *Communication Nationale Initiale du Bénin sur les Changements Climatiques* <http://unfccc.int/resource/docs/natc/bennclf.pdf>

³³ World Bank data (2014): http://data.worldbank.org/country/benin#cp_wdi

³⁴ Rochat, A.; Guenat, D. (2013): *Agriculture + Food Security Network Brief No 3 Climate change: farmers' perceptions and strategies*. Bern University of Applied Sciences. https://www.hafl.bfh.ch/fileadmin/docs/Studium/B5CAgronomie/Majors/afs_brief_no3_en.pdf

³⁵ Lawin et al. (2012)

³⁶ Lawin et al. (2012)

³⁷ Kumar Srivastava, A.; Gaisera, T.; Paethb, H.; Ewert, F. (2012): *The impact of climate change on Yam (Dioscorea alata) yield in the savanna zone of West Africa*, Elsevier, <http://www.ukm.my/ipi/wp-content/uploads/2013/07/10.2012The-impact-of-climate-change-on-Yam-Dioscorea-alata-yield-in-the-savanna-zone.pdf>

³⁸ Jalloh et al. (2013)

³⁹ BMEHU (2001), in: De Vit, C.; Parry, J-O., (2011): *Review of Current and Planned Adaptation Action: West Africa, Ghana*. Adaptation Partnership. https://www.iisd.org/pdf/2011/West_Africa_Adaptation_Action.pdf

⁴⁰ http://www4.unfccc.int/ndcregistry/PublishedDocuments/Benin%20First/CDN_BENIN_VERSION%20FINALE.pdf

ratified the UN Convention on Biological Diversity (CBD) in 1994 for which it had a National Biodiversity Strategy and Action Plan approved in 2002⁴¹, the Convention to Combat Desertification (CCD) in 1996 for which it developed a National Action Programme in 2000⁴², and the Framework Convention on Climate Change (UNFCCC) in 1994⁴³. Benin signed the Paris Agreement in April 2016 and ratified the agreement in October 2016 with it entering into force in November 2016 (see Nationally Determined Contributions below).

In line with its development priorities, Benin emphasizes the need in its climate change actions to alleviate extreme poverty and promote economic growth⁴⁴. These priorities are reflected in its Initial National Communication (2002) and its National Adaptation Programme of Action (NAPA, 2008). The first phase is called 'Integrated adaptation programme for the fight against the damaging effects of climate change for the agricultural production and food security in Benin'. This phase started in January 2010 and is still under implementation. Its focus is on the four most climate vulnerable agro-ecological zones of Benin: zone 1: Extreme Nord (Malanville), zone 4: West Atacora-Donga (Ouaké, Matéri), zone 5: Central coastal zone (Savalou, Aplahoué), zone 8: fisheries zone (Ouinhi, Bopa, Adjohoun, and Sô-Ava), see [Map 5](#). The general objective is to strengthen the capacity of agricultural communities to make them adaptive to climate change. Anticipated results are the establishment of nine executive Community Committees for Technical Coordination, cultivation of short cycle crops, studies, and validation workshops. Achieved performance so far is between 77% (physical annual measures) and 93% (annual financial execution)⁴⁵. The Adaptation Partnership, a USAID supported platform on climate adaptation, identified the gaps in current adaptation action: they appear to be in coastal zone management, maintenance of freshwater resources, forestry, and energy. Gender does not constitute a significant component of any current or proposed adaptation projects⁴⁶.

The priority projects as submitted to the UNFCCC⁴⁷ have a slightly different focus than the options formulated in the initial NAPA⁴⁸ in which agricultural production systems and climate-related diseases protection were priorities. In the projects submitted to the UNFCCC, these are less explicitly mentioned. Submitted projects are:

- implementation of a forecasting system for early warning and climatic risks for food security in four vulnerable agro-ecological regions;
- climate change adaptation of households through awareness-raising and capacity building on solar energy and efficient stoves in areas vulnerable to climate change and with degraded soils;
- exploitation of surface water to adapt to climate change in the most vulnerable areas in the Centre and North Provinces;
- malaria protection for children and pregnant women in areas most vulnerable to climate change;
- protection of coastal areas against sea level rise.

Benin received support from UNDP to move its National Adaptation Plan (NAP) forward. A team of UNDP consultants held several meetings with Benin's government. An inception workshop took place in the first quarter of 2015 and the GCF readiness programme was launched⁴⁹. There has been little progress in the interim period.

In 2014 Benin communicated three potential Nationally Appropriate Mitigation Actions (NAMAs) to the UNFCCC. However, the proposed actions (below) have not been formally submitted to the UNFCCC for assistance in the development into concrete projects:

- the development of an urban transport system in greater Cotonou to reduce GHG emissions;
- the sustainable development of natural forests and forest planting to strengthen carbon sinks;
- recovery of CH₄ (methane) emitted by landfills in local communities with a special status (Cotonou and greater Cotonou, Porto-Novo and Parakou)⁵⁰.

In 2011, Benin joined the UN Climate Change Learning Partnership (UN CC: learn). In 2013, Benin finalized a National Climate Change Learning Strategy⁵¹. Other milestones, mainly focusing on capacity building, are trainings on climate negotiations (2014) and climate finance (2013 and 2016)⁵².

⁴¹ Convention on Biological Diversity. Clearing House Mechanism Benin. <http://bj.chm-cbd.net/implementation/documents>

⁴² Programme d'Action National de Lutte Contre la Désertification. <http://www.unccd.int/ActionProgrammes/benin-fre2000.pdf>

⁴³ https://unfccc.int/essential_background/convention/status_of_ratification/items/2631.php

⁴⁴ BMEHU (2001)

⁴⁵ Loconon, D.Z. (2013): Integrated adaptation programme for the fight against the damaging effects of climate change for the agricultural production and food security in Benin, Quelques acquis du PANAI

⁴⁶ De Vit, C.; Parry, J.E. (Adaptation Partnership) (2011)

⁴⁷ UNFCCC (2012): NAPA Priorities Database, Benin, http://unfccc.int/adaptation/workstreams/national_adaptation_programmes_of_action/items/4583.php

⁴⁸ UNDP; Beninese Ministry of Environment and Nature Protection (2008)

⁴⁹ <http://adaptation-undp.org/projects/benin-nap-process>

⁵⁰ UNFCCC (2014): Pre-2020 action by countries, Benin, http://unfccc.int/focus/mitigation/pre_2020_ambition/items/8167.php

⁵¹ UN Climate Change Learn (2013) : http://www.unccllearn.org/sites/default/files/benin_national_strategy_final.pdf

⁵² UN Climate Change Learning Partnership: <http://www.unccllearn.org/node>

Nationally Determined Contributions (NDC) ⁵³

In its first Nationally Determined Contributions (NDC) submitted to the UNFCCC in November 2017, Benin presents itself as being highly vulnerable to the effects of climate change. Benin plans to reduce its emissions (excluding the forestry sector) by approximately 21.4 % during the period 2021-2030 compared to the Business-as-Usual (BAU) scenario. Of 21.4 % decrease in emissions, 3.5 % is unconditional (through national efforts) and 17.9 % is conditional (requiring international finance). Reducing the annual rate of deforestation, for example, will make an additional contribution to lowering emissions, but will heavily depend on conditional funding⁵⁴. Benin estimates that to achieve its ambitious emissions targets and adapt to the adverse effects of climate change, it would need an overall budget of about USD 30.13 billion (2021-2030) of which the government would be able to contribute USD 2.32 billion (unconditional) and additional international funds providing the remaining USD 27.81 billion (conditional).

Of the USD 30.13 billion, an estimated USD 12.13 billion would be needed for mitigation and USD 18 billion for adaptation. The NDC highlights that for implementation Benin will require financial support, technology transfer (especially in agriculture/forestry, energy, waste and transport) and capacity building. The NDC presents objectives for the energy sector (e.g. use of renewables (hydro and solar), dual-fuel power plants) and for agriculture (e.g. improved crop cultivation techniques, crop management, agro-forestry and conservation of national forests).

Benin is not a member country of the NDC-Partnership or of the UNDP Support Program both of which assist countries in preparing the implementation plan for the NDC.

Climate finance

In the last decade, there have been numerous projects and programmes financed by donors aimed at improving Benin's climate preparedness, including tree plantations, capacity building of national and local governmental institutes, and agricultural strategy development. Donors include international organisations such as UNDP, World Bank, DFID, IDRC, French/German/Danish/Dutch Ministries of Foreign Affairs, Least Developed Countries Fund (LDCF),

and GIZ. Overall, the majority of bilateral climate change related projects in Benin are financed by French institutions (ministries, research institutes NGOs etc.) that are in some cases also involved in the implementation⁵⁵. The largest donor for overall development in Benin is the European Union (372 million Euros in the 11th European Development Fund) investing mainly in sustainable agriculture and energy and good governance⁵⁶. As for climate funds utilization: according to the Overseas Development Institute (ODI), Benin received USD 22,850,000 in climate funds between 2004 and 2014 – placing it at number 51 of the climate finance approved ranking list of 135 countries⁵⁷. With support of UN CC: learn, Benin works to strengthen its capacity to access climate funds⁵⁸.

Benin is a pilot country for the inception phase of the Green Climate Fund (GCF) Readiness Programme that aims to strengthen the institutional capacity of countries for the preparation of projects for submission to the GCF for funding. It is expected that on-stream investment from the private sector in climate change adaptation will occur after the pipeline of vital and viable national projects drawn from national climate change strategies, plans and policies has been developed⁵⁹. This access programme is coordinated through UNDP and the World Resources Institute (WRI). The National Adaptation Plan Global Support Programme (NAP-GSP) is linking with the GCF Readiness Programme to maximize opportunities to coordinate adaptation actions in Benin.

Benin joined the GEF in April 1994 and completed GEF enabling activities (to qualify for funding from GEF), including a NAPA, National Biodiversity Strategy and Action Plan (NBSAP) and country self-assessment. In total, it has been allocated USD 13,600,270 for biodiversity projects USD 34,782,091 for climate change, and USD 15,658,158 for multi focal area projects⁶⁰.

Currently, an investment plan for funding from the Scaling Up Renewable Energy in Low Income Countries Program (SREP, a funding window of the Climate Investment Funds) programme, is under development⁶¹.

⁵³ NDC Benin, available at http://www4.unfccc.int/ndcregistry/PublishedDocuments/Benin%20First/CDN_BENIN_VERSION%20FINALE.pdf

⁵⁴ Measures proposed in the INDC for LULUCF include reducing the rate of deforestation and implementing a reforestation plan with the goal of creating 15,000 ha forest plantation annually.

⁵⁵ De Vit, C. ; Parry, J.E. (2011)

⁵⁶ Union Européenne : *Les relations de l'Union Européenne avec le Bénin* http://eeas.europa.eu/benin/index_fr.htm downloaded December 11, 2017.

⁵⁷ Nakhooda, S.; Norman, M. (2014): *Climate Finance: Is it making a difference? A review of the effectiveness of Multilateral Climate Funds*. ODI. <http://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/9359.pdf>

⁵⁸ <http://www.unclearn.org/news/benin-government-builds-capacities-access-climate-finance>

⁵⁹ UNDP Adaptation Learning Mechanism (2013): *Supporting Benin to advance their NAP Process*, <http://www.undp-alm.org/benin-advancing-adaptation-agenda>

⁶⁰ GEF – *Country profile Benin*. https://www.thegef.org/gef/country_profile/BJ

⁶¹ Climate Investment Funds (2016): <https://www.cif.climateinvestmentfunds.org/country/benin/benin-srep-programming>

Climate change projects

Projects in Benin that are involved in climate change adaptation and mitigation in relation to water and food security are numerous. Below follows a selection of the main programmes currently under implementation:

- a number of projects in the energy sector to reduce the use of coal and promote climate-friendly energy sources, financed by the World Bank⁶²;
- '2SCALE'⁶³ funded by the Netherlands Ministry of Foreign Affairs (2012-2017), aiming to improve rural livelihoods and food and nutrition security in Africa by creating partnerships to enable farmers and entrepreneurs to grow together in their agribusiness⁶⁴;
- several food security and disaster risk reduction projects supported by the World Food Programme (WFP)⁶⁵;
- several climate relevant programmes executed by GIZ, including: 1) 'Adapting agriculture to climate change' (PACC) (2014-2019), a project aimed at sustainable management of natural resources, in particular of water and soil, to help those agricultural areas of northern Benin most affected by climate change better adapt to these changes; 2) 'Transboundary Biosphere Reserve in the Mono Delta' (2013-2019), a project that aims to protect natural resources, particularly biodiversity, and promotes natural resources use in a sustainable manner; and 3) 'Integrated management of water resources and water supply' (2014-2017), aiming at ensuring water access by intervening in the interrelationship between water, climate change and food security⁶⁶;
- a Global Climate Change Alliance (GCCA) programme, financed under the European Development Fund (EDF), for reduction of flood impacts (2012-2017), notably by promoting the conservation and sustainable use of gallery forests in the lower valley of the Ouémé River and by equipping Benin with basic geographic information systems (GIS) and cartographic equipment in support of improved forest and land management.⁶⁷

The following regional programmes with a focus on food security and/or water are also being implemented in Benin:

- the 'Adaptation Learning Programme for Africa' (2010-2017), executed by CARE, is aiming to increase the capacity of vulnerable households in Sub-Saharan Africa to adapt to climate variability and change and supported by the

United Kingdom's Department for International Development (DFID), The Ministry of Foreign Affairs of Denmark, The Ministry of Foreign Affairs of Finland and the Austrian Development Cooperation⁶⁸;

- 'Great Green Wall' financed by Multi Trust Fund (GEF), Special Climate Change Fund (GEF), World Bank and AfDB. The concept was approved of in 2011. However, the implementation phase has not started yet⁶⁹;
- 'Programme to Build Resilience to Food and Nutrition Insecurity in the Sahel' (P2RS) (2014-2019) funded by the African Development Bank in a move aimed at ending the frequent cycles of drought and famine in the Sahel region⁷⁰;
- regional programmes executed by GIZ, including 'Energising Development (EnDev) which is also supported by the Netherlands – Programme for Energy Access' (2005-2019), aiming at the development of commercial markets for the diffusion of renewable energies and energy-efficient technologies for households, public and social institutions, and small and medium-sized enterprises⁷¹.

For a list of international and multilateral climate projects in Benin, see the Annex.

| 8 |

Climate contribution of the Netherlands

The Netherlands supports climate-relevant projects in Benin through a variety of channels and in cooperation with range of actors with a focus on integrated water management, WASH, food security and renewable energy:

- **Omi-Delta water program:** a water and sanitation programme that will be implemented over the period 2017-2021 and consists of three funding instruments: (i) A fund for the development of government projects; (ii) A fund for civil society and private sector projects, and (iii) a technical assistance instrument.
- **integrated water resources management (IWRM) and Delta Plan:** disaster risk reduction in urban areas along the coast will be enhanced through the introduction of the Delta approach in the Ouémé Basin. Support to a National Water Institute (INE Benin) will help the country to deal with the uncertain effects of climate change; INE Benin aims to build national capacity concerning data

⁶² World Bank – Benin (2015). <http://www.worldbank.org/en/country/benin>

⁶³ 2SCALE is a consortium of the International Fertilizer Development Center (IFDC), BoP Innovation Center (BoPInc.), and the International Centre for development oriented Research in Agriculture (ICRA)

⁶⁴ 2SCALE consortium (2013): *Business as unusual, the 2SCALE project – highlights 2013*, <http://ifdc.org/benin>

⁶⁵ World Food Programme (WFP) (2015) <http://www.wfp.org/countries/benin>

⁶⁶ GIZ (2015): Benin. <https://www.giz.de/en/worldwide/342.html>

⁶⁷ GCCA (2013)

⁶⁸ CARE Climate Change Information Centre (2014): *Adaptation Learning Programme for Africa*, <http://www.careclimatechange.org/adaptation-initiatives/alp>

⁶⁹ GEF (2016) <https://www.thegef.org/project/ggw-sahel-and-west-africa-program-support-great-green-wall-initiative>

⁷⁰ African Development Bank (2014): *AfDB approves US \$231 million for building resilience to food and nutrition insecurity in the Sahel*, <http://www.afdb.org/en/news-and-events/article/afdb-approves-us-231-million-for-building-resilience-to-food-and-nutrition-insecurity-in-the-sahel-13625/>

⁷¹ GIZ (2015)

collection, hydraulic modelling and advisory services, as a sustainable response to climate change challenges.

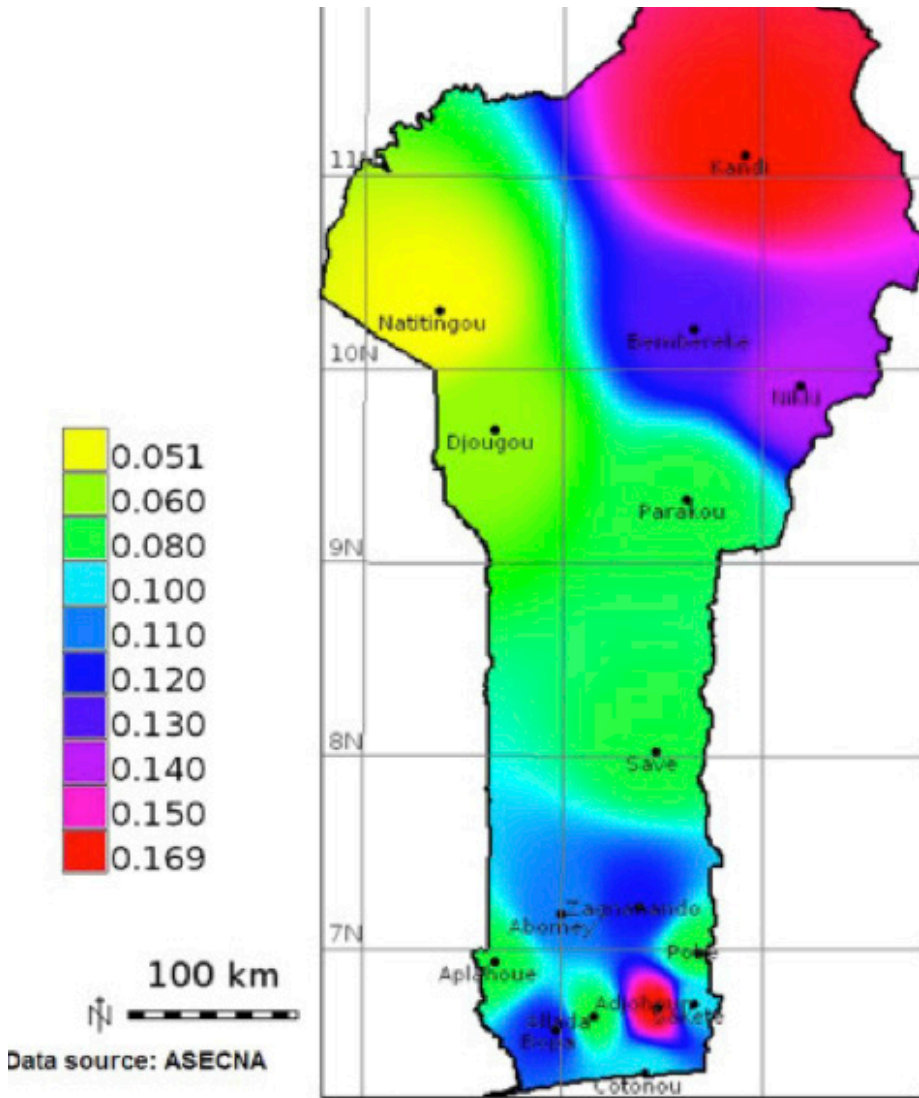
- **new water and energy sources:** a change from ground water to surface water as a source for drinking water will contribute to climate change adaptation, while a shift from fossil fuels to solar energy by financing the use of solar technology to secure production, contributes to mitigation;
- **rural infrastructure:** remote rural areas that are often isolated during rainy spells will have better access to markets, production areas and health facilities through improved road and water infrastructure;
- **innovative adaptation for food security and businesses:** innovative practices that improve both food security and business development options will be

researched and supported, e.g. the production of biofuels on an experimental basis to generate revenue at a local level while producing a clean source of energy.

- **Youth entrepreneurship development:** A climate change SME risk assessment will be developed that will strengthen SMEs and other stakeholders' vulnerability to climate change. Legend: The clearer colours (upper half of legend) indicate a high number of 'bad' years where the pluvial-metric deficit is higher than or equal to 30%. Years: 1951 – 2010.

Maps

Map 1 Frequency of years of extreme rainfall deficiency in Benin

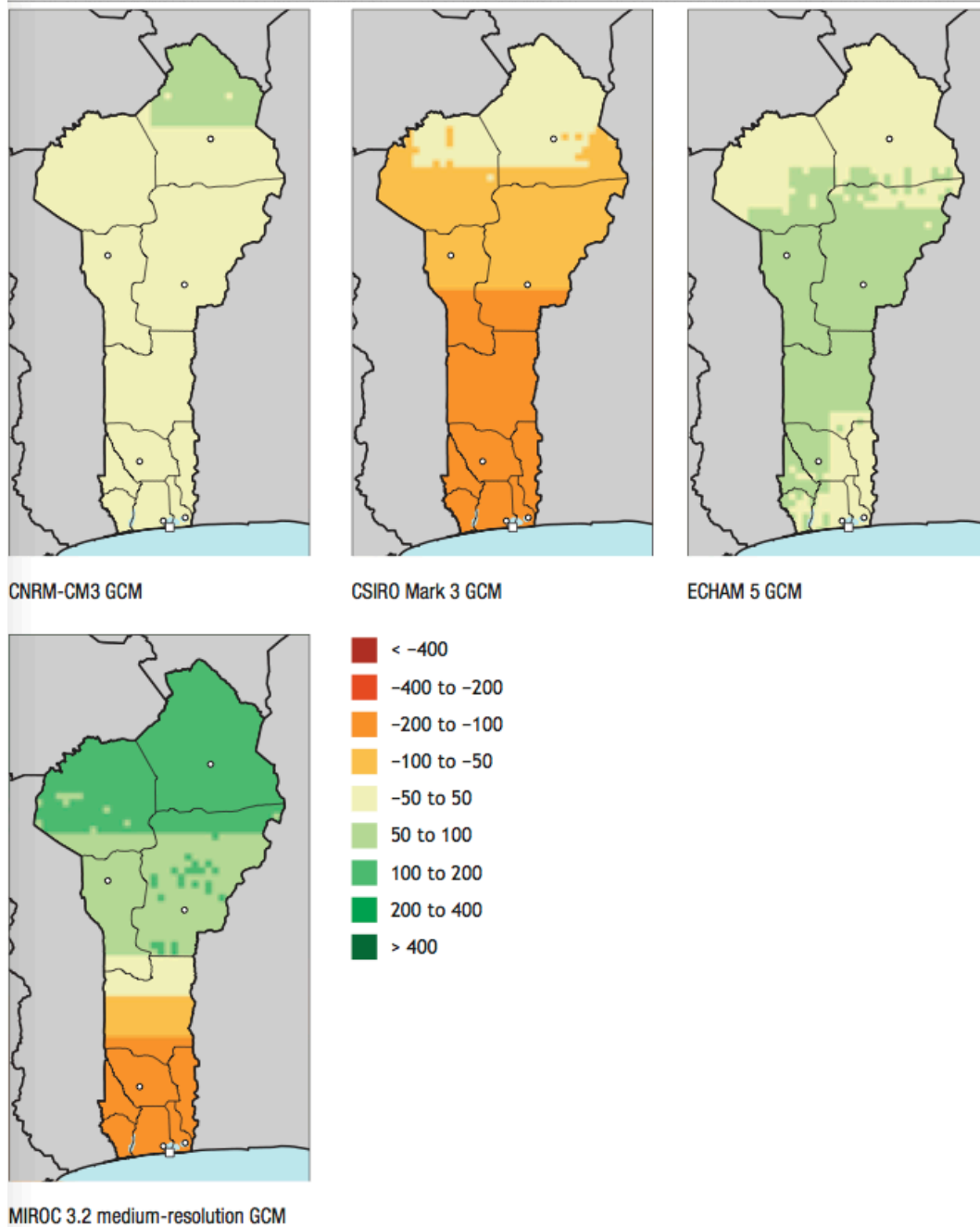


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Source: Yabi and Afouda (2011), retrieved from Konrad Adenauer Stiftung, Les Enjeux du Changement Climatique au Bénin

Legend: The clearer colours (upper half of legend) indicate a high number of 'bad' years where the pluviometric deficit is higher than or equal to 30%. Years: 1951 – 2010.

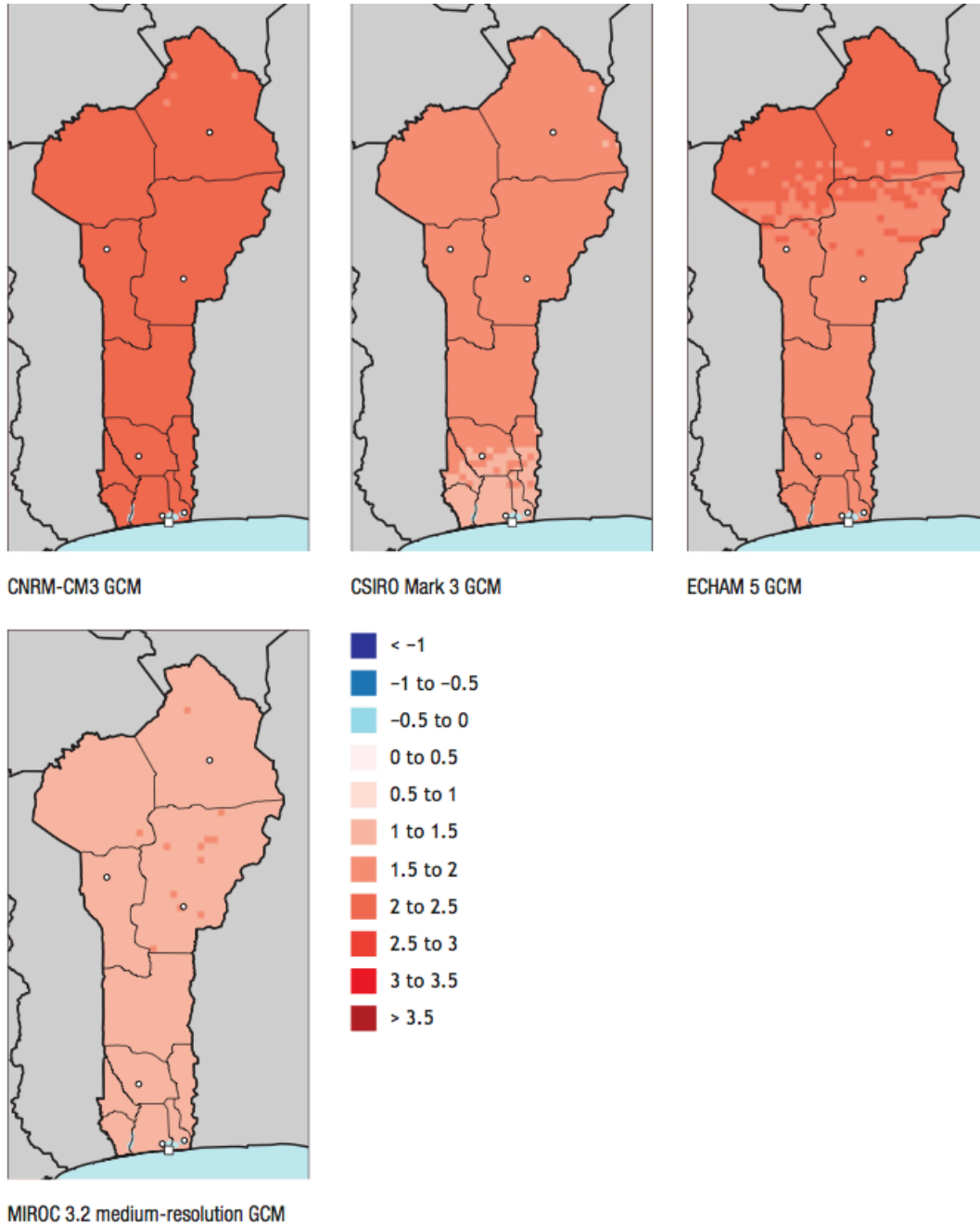
Map 2 Changes in mean annual precipitation in Benin, 2000–2050, A1B scenario (millimeters)



Source: Authors' calculations based on Jones, Thornton, and Heinke (2009).

Notes: A1B = greenhouse gas emissions scenario that assumes fast economic growth, a population that peaks midcentury, and the development of new and efficient technologies, along with a balanced use of energy sources; CNRM-CM3 = National Meteorological Research Center–Climate Model 3; CSIRO = climate model developed at the Australia Commonwealth Scientific and Industrial Research Organisation; ECHAM 5 = fifth-generation climate model developed at the Max Planck Institute for Meteorology (Hamburg); GCM = general circulation model; MIROC = Model for Interdisciplinary Research on Climate, developed by the University of Tokyo Center for Climate System Research.

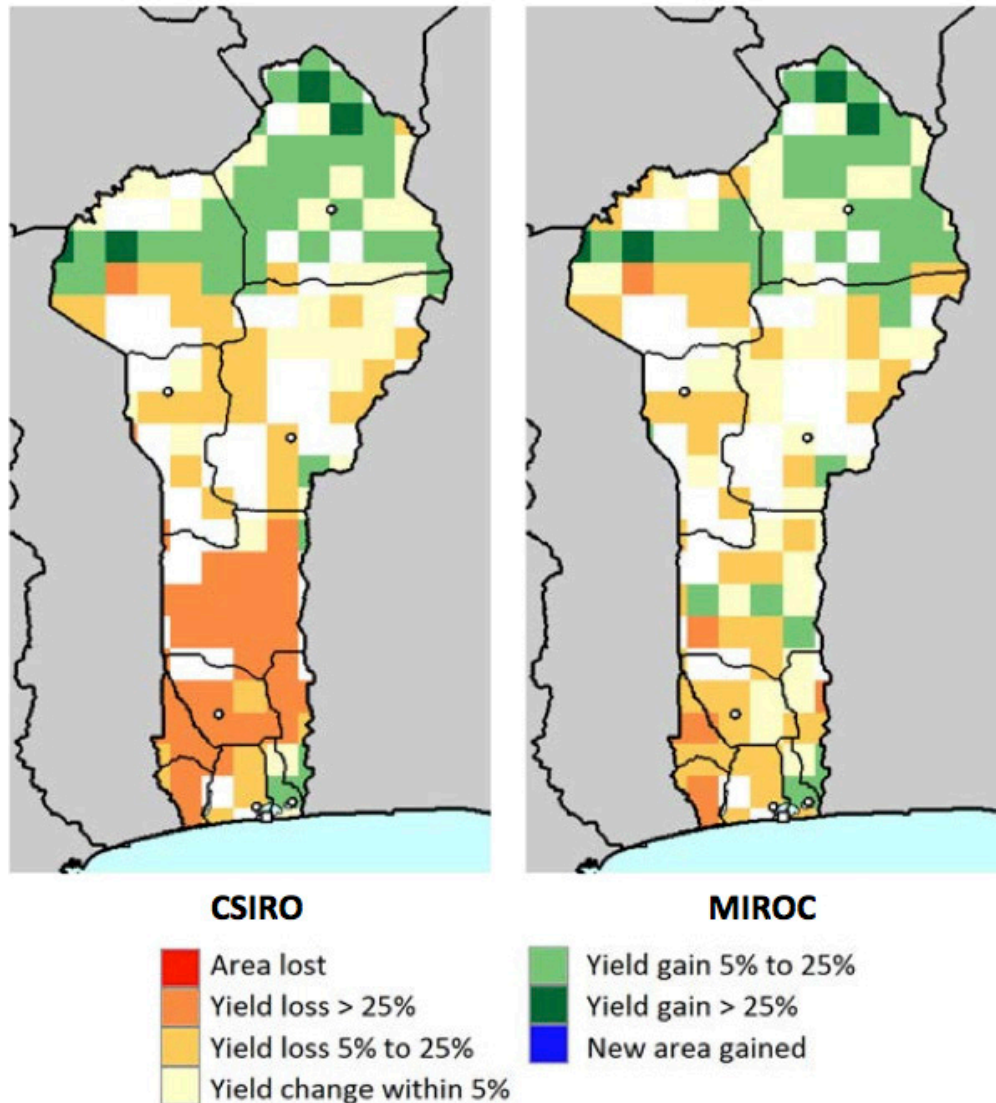
Map 3 Change in monthly mean maximum daily temperature in Benin for the warmest month, 2000–2050, A1B scenario (°C)



Source: Authors' calculations based on Jones, Thornton, and Heinke (2009).

Notes: A1B = greenhouse gas emissions scenario that assumes fast economic growth, a population that peaks midcentury, and the development of new and efficient technologies, along with a balanced use of energy sources; CNRM-CM3 = National Meteorological Research Center–Climate Model 3; CSIRO = climate model developed at the Australia Commonwealth Scientific and Industrial Research Organisation; ECHAM 5 = fifth-generation climate model developed at the Max Planck Institute for Meteorology (Hamburg); GCM = general circulation model; MIROC = Model for Interdisciplinary Research on Climate, developed at the University of Tokyo Center for Climate System Research.

Map 4 Changes in yields under climate change: rain-fed maize



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Source: Emmanuel A. Lawin, P. B. Irénikatché Akponikpè, Abdulai Jalloh, and Timothy S. Thomas, December 2012, *West African agriculture and climate change: A comprehensive analysis - Benin*

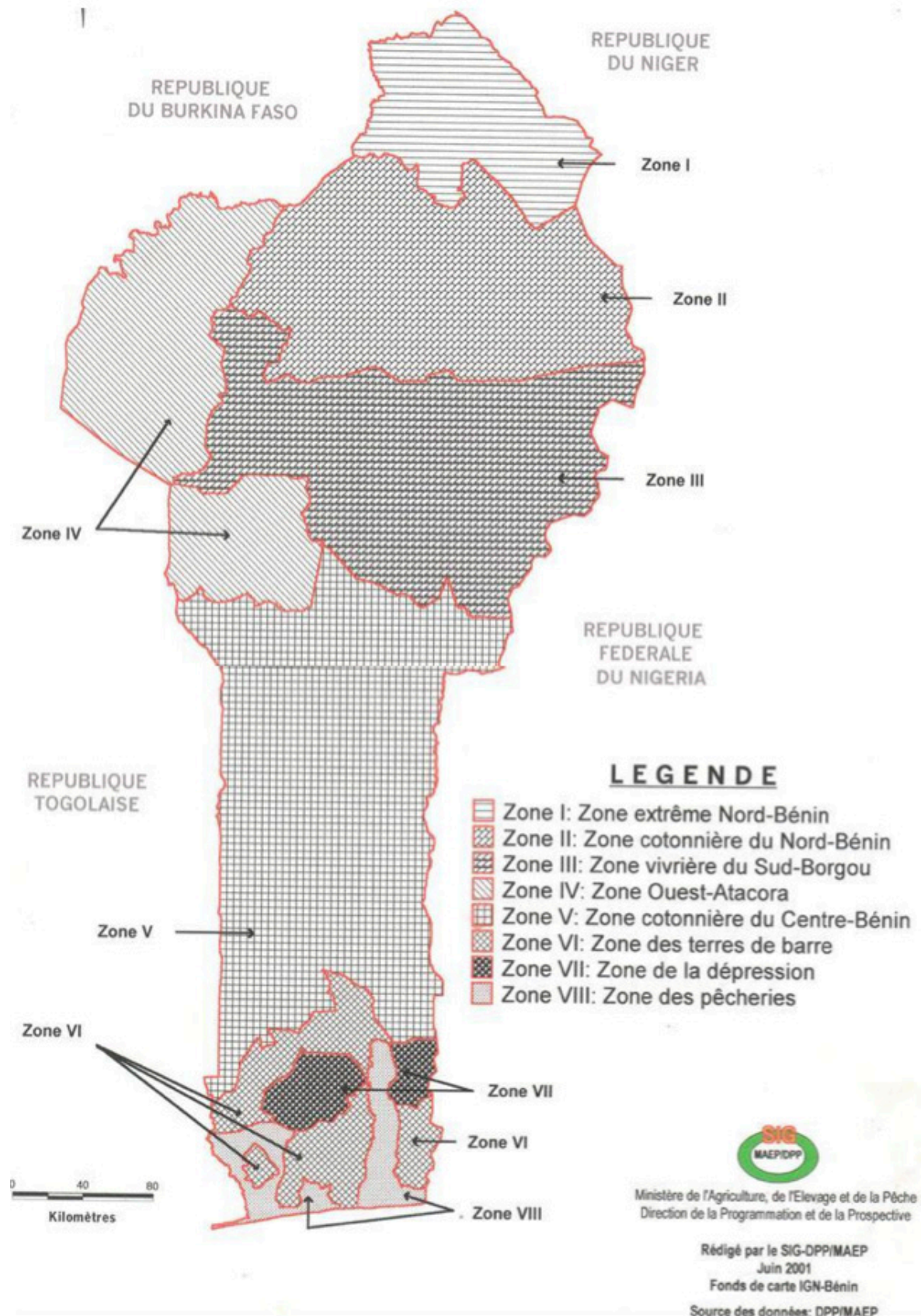
The maps above depict the results of the Decision Support System for Agro technology Transfer (DSSAT) crop modelling software projections for rain-fed maize, comparing crop yields for 2050 with climate change to yields with 2000 climate. The data indicate a slight yield increase of 5–25 percent in the north. For the central and the southern parts of the country (covering the most productive zone of maize), the MIROC⁷² model shows

mostly yield reductions of 5–25 percent. The CSIRO⁷³ model predicts even greater reduction in maize yields, exceeding 25 percent. No area is lost.

⁷² Model for Interdisciplinary Research on Climate (MIROC) is a coupled general circulation model and consists of five component models: atmosphere, land, river, sea ice, and ocean (http://csr.aori.u-tokyo.ac.jp/~hasumi/miroc_description.pdf)

⁷³ Comprehensive climate system model developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) including atmosphere, land surface, ocean, and polar ice (http://www.cawcr.gov.au/publications/technicalreports/CTR_o21.pdf).

Map 5 Agro-ecologic zones in Benin



Annex

International and multilateral climate projects (since 2012)

Sources Climate Funds Update (updated May)⁷⁴ and World Bank (December 2017)⁷⁵: and World Bank (2017)

Name of Project	Fund	Amount of Funding Approved (USD millions)	Disbursed (USD millions)	Dates
Technical Assistance Grant for ESP	Adaptation Fund	0.02	0.02	2016
Strengthening the Resilience of the Energy Sector in Benin to the Impacts of Climate Change	Least Developed Countries Fund (LDCF)	8.0		2014
Strengthening Climate information and Early Warning Systems	Least Developed Countries Fund (LDCF)	4.0	4.1	2012
Strengthening the Resilience of rural Livelihoods and Sub-national Government System	Least Developed Countries Fund (LDCF)	4.45		2016
Flood Control and Climate Resilience of Agricultural Infrastructure	Least Developed Countries Fund (LDCF)	7.2	7.45	2013
Preparation of Benin's First Biennial Update Report (BUR1) to UNFCCC	Global Environment Facility (GEF5)	0.4	0.4	2014
Promotion of Sustainable Biomass-based Electricity Generation in Benin	Global Environment Facility (GEF5)	3.87		2014
Improving Mobility in Parakou	Global Environment Facility (GEF6)	1.8	1.8	2014
Readiness program support	Green Climate Fund (GCF)	0.15		2015
Scaling Up Renewable Energy in Low Income Countries	CIF/SREP	Investment plan under development		2015
Forest and Adjacent Land Management	World Bank	5.6		2013
Additional Financing for Forest and Adjacent Land Management II	World Bank	2		2013
Agricultural Productivity and Diversification	World Bank	45		2017

⁷⁴ <http://www.climatefundsupdate.org/data>

⁷⁵ http://www.worldbank.org/en/country/benin/projects/all?qterm=&lang_exact=English&os=0

