REGIONSADAPT

RegionsAdapt 2016 Report: An assessment of risks and actions

CDP
DRIVING SUSTAINABLE ECONOMIES

nrg4SD
Network of Regional Governments for Sustainable Development

Index

Foreword

"In the early years of the Convention, adaptation received less attention than mitigation, as Parties wanted more certainty on impacts of and vulnerability to climate change. When IPCC's Third Assessment Report was released, adaptation gained traction, and Parties agreed on a process to address adverse effects and to establish funding arrangements for adaptation." [1]

The Third Assessment Report of the International Panel on Climate Change (IPCC) was published in 2001, seven years after the United Nations Framework Convention on Climate Change (UNFCCC) first entered into force. Although adaptation has become a mainstream topic within the global regime on climate change, there still remains a gap between mitigation and adaptation that has yet to be fully surmounted. This is why the UNFCCC has continuously called for improved action on adaptation, highlighting the fact that "adaptation must be addressed with the same level of priority as mitigation." [2]

In 2015, on the run-up to COP21, some regional governments expressed a shared concern that, by favoring mitigation actions over adaptation actions, they were somehow replicating a pre-existing imbalance between the two. This finding is especially problematic when taking into account the fact that regional governments are frequently assigned with legal responsibilities and policy tools that are pivotal to adaptation. Another common observation was that, although several treaties continued to reiterate that adaptation is a global effort requiring the engagement of multi-stakeholders from all levels, the role of regional governments in this area seemed notably undervalued. Based on these realizations, a collective understanding has emerged – indicating that regional governments needed to take a global action on climate adaptation.

In December 2015, thanks to the initiation of the governments of Catalonia and Rio de Janeiro, ***RegionsAdapt*** was launched in Paris, alongside COP21, by 27 founding members – and with the Network of Regional Governments for Sustainable Development (nrg4SD) serving as its Secretariat.

By fulfilling the aforementioned gap, ***RegionsAdapt*** became the first global initiative designed to inspire and support regional governments to take concrete action, collaborate and report efforts on climate change adaptation. This global partnership is open to all governments from across the world, situated between the local and the national level, regardless of their size or stage of their climate policy's implementation. The literature has identified three ways in which regional partnerships catalyze innovations in climate adaptation policies. First, innovation is sparked internally with collaboration among partners in common projects and joint working groups. Second, regional partnerships can help by scaling up the regions' activities, then diffusing knowledge and policy innovations externally to decision makers beyond the partnerships. Finally, regional partnerships support national adaptation politics by providing inputs to national adaptation policy formulation.[3] ***RegionsAdapt*** aims to serve as a catalyst for all these objectives.

As an international cooperation initiative, it encourages members to interact and exchange experiences and best practices, report efforts, as well as seek joint projects and new ways to foster concrete actions. By raising the visibility of regional governments on the international stage, RegionsAdapt can highlight their fundamental role in bridging gaps for the local implementation of national and global decisions. Moreover, taking into account the lessons of regional governments on the ground, initiatives such as ***RegionsAdapt*** can provide the Parties to the UNFCCC with thoughtful recommendations on innovative solutions for adaptation policy design. Altogether, these potential benefits ultimately favor the ability of regional governments in delivering adaptation measures – and enhance the adaptability of the communities within their jurisdictions.

Once joining ***RegionsAdapt***, governments are essentially agreeing to three commitments:

- **Commitment 1** – To adopt (or review) a strategic approach to adaptation and prioritize adaptation actions within two years of joining the initiative;
- **Commitment 2** – To take concrete action on adaptation in at least one of the seven key priority areas that the founding regional governments have mapped;
- **Commitment 3** – To report data on the progress of the adaptation actions on an annual basis through the "risks and adaptation" section of CDP's (formerly the Carbon Disclosure Project) states and regions platform.

The seven key priority areas of the initiative are the following:

- Water resources and management;
- Resilience and disaster risk reduction;
- Agriculture and zootechnics;
- Forestry, protected areas, and biodiversity;
- Infrastructure (including transport and the energy sectors) and territorial planning;
- Economic impacts and opportunities;
- Social adaptation and impacts.

1. United Nations Framework Convention On Climate Change. Status of Ratification of the Convention. Available at: <http://unfccc.int/essential_background/convention/status_of_ratification/items/2631.php>. Accessed on: 3 May 2016.

2. United Nations Framework Convention On Climate Change. Cancun Adaptation Framework. Available at: <http://unfccc.int/adaptation/items/5852.php>. Accessed on: 3 May 2016.

3. BAUER, A.; STEURER, R. Innovation in climate adaptation policy: are regional partnerships catalysts or talking shops? In: Environmental Politics, vol. 23, No. 5, p.818–838, 2014.

List of founding regions

Australian Capital Territory (Australia)
Azuay (Ecuador)
Basque Country (Spain)
British Columbia (Canada)
California (USA)
Catalonia (Spain)
Ceara (Brazil)
Fatick (Senegal)
Goias (Brazil)
Gossas (Senegal)
Jalisco (Mexico)
KwaZulu-Natal (South Africa)
Lombardia (Italy)
Parana (Brazil)
Prince Edward Island (Canada)
Quebec (Canada)
Rio de Janeiro (Brazil)
Rio Grande do Sul (Brazil)
Saint-Louis (Senegal)
Sao Paulo (Brazil)
South Australia (Australia)
Sud Comoe (Ivory Coast)
Tocantins (Brazil)
Tombouctou (Mali)
Vermont (Canada)
Wales (UK)
Western Province (Sri Lanka)

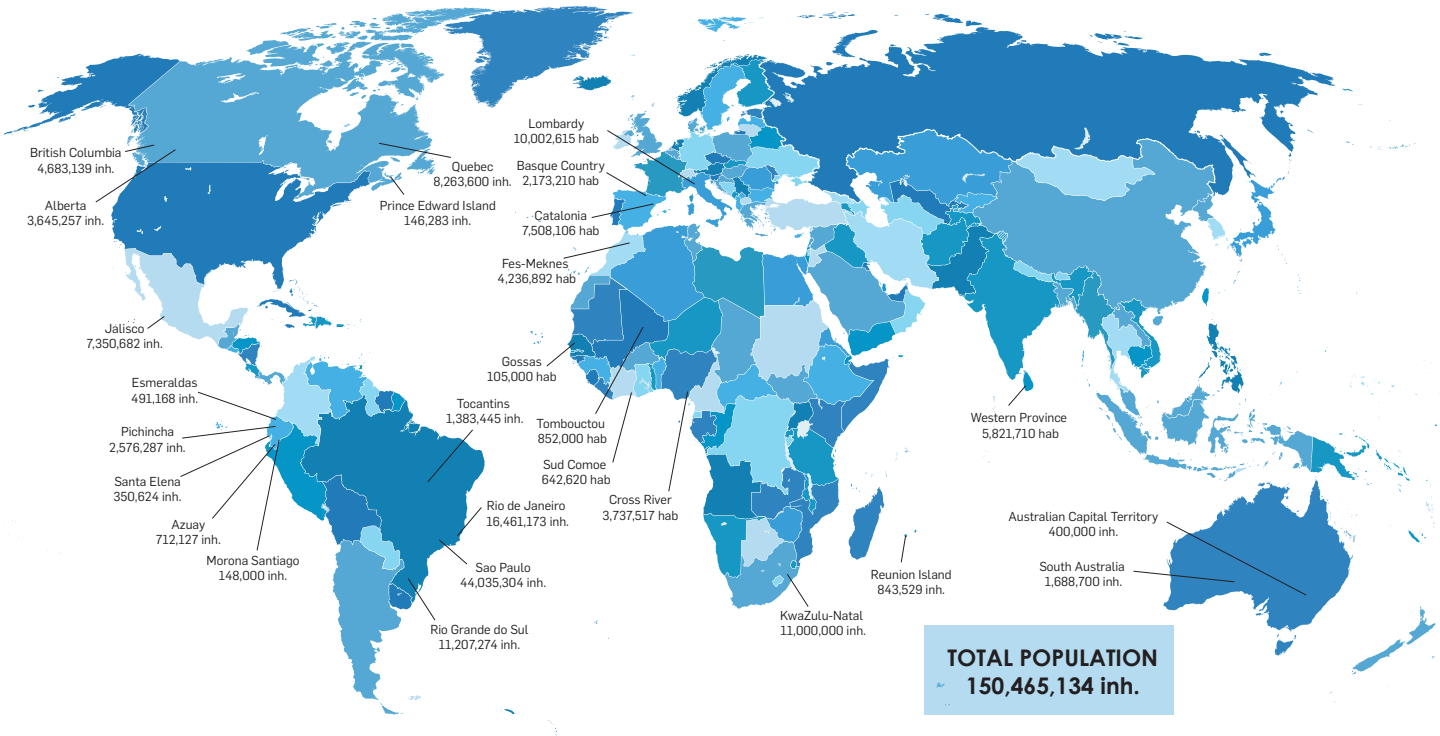
The online reporting procedure is operated through the CDP´s states and regions platform, where the members of the initiative must fill out sections 1 "Introduction" and 5 "Risks and Adaptation." By reporting to ***RegionsAdapt***, members are able to take part in a community of regional government practitioners publicly disclosing the progress of their adaptation efforts for the first time on a global scale.

In January 2017, ***RegionsAdapt*** launches its first data report. This document portrays the risk assessment and adaptation responses of 27 regional governments that have fulfilled their commitments and successfully disclosed their adaptive pathways. This group is comprised of 14 governments from the Americas (10 of which are Latin American), 7 from Africa, 3 from Asia and Oceania, and 3 from Europe.

Additionally, this report provides ten recommendations for the future and encourages their implementation as soon as possible before 2020 to build on the momentum of the Paris Agreement's entry into force.

RegionsAdapt members who reported through CDP´s platform in 2016

Regional Government (Country)	Head of Government	Land area (km²)	Population
Alberta (Canada)	Premier Rachel Notley	661,848	3,645,257
Australian Capital Territory (Australia)	Chief Minister Andrew Barr	2,358	400,000
Azuay (Ecuador)	Prefect Paul Carrasco Carpio	832,862	712,127
Basque Country (Spain)	Governor Iñigo Urkullu	7,235	2,173,210
British Columbia (Canada)	Premier Christy Clark	944,735	4,683,139
Catalonia (Spain)	President Carles Puigdemont i Casamajó	32,108	7,508,106
Cross River State (Nigeria)	Governor Benedic Ayade	20,156	3,737,517
Esmeraldas (Ecuador)	Prefect Lucia de Lourdes Sosa Robinzon	15,825	491,168
Fes-Meknes (Morocco)	President Mohand Laenser	38,880	4,236,892
Gossas (Senegal)	President Adama Diallo	2,500	105,000
Jalisco (Mexico)	Governor Jorge Aristóteles Sandoval Díaz	126,497	7,350,682
KwaZulu-Natal (South Africa)	Premier T.W. Mchunu	94,361	11,000,000
Lombardy (Italy)	Governor Roberto Maroni	23,864	10,002,615
Morona Santiago (Ecuador)	Prefect Felipe Marcelino Chumpi Jimpikit	24,059	148,000
Pichincha (Ecuador)	Prefect Gustavo Baroja Narváez	9,467	2,576,287
Prince Edward Island (Canada)	Premier Wade MacLauchlan	5,656	146,283
Quebec (Canada)	Premier Philippe Couillard	1,667,712	8,263,600
Reunion Island (France)	President Didier Robert	2,504	843,529
Rio de Janeiro (Brazil)	Governor Luiz Fernando de Souza	43,777	16,461,173
Rio Grande do Sul (Brazil)	Governor José Ivo Sartori	281,748	11,207,274
Santa Elena (Ecuador)	Prefect Patricio Cisneros Granizo	3,695	350,624
Sao Paulo (Brazil)	Governor Geraldo Alckmin Filho	248,222	44,035,304
South Australia (Australia)	Premier Jay Weatherill	983,482	1,688,700
Sud Comoe (Ivory Coast)	President Aka Aouele	7,627	642,620
Tocantins (Brazil)	Governor Marcelo de Carvalho Miranda	277,721	1,383,445
Tombouctou (Mali)	President Mohamed Ibrahim	496,611	852,000
Western Province (Sri Lanka)	Governor K. C. Logeswaran	3,684	5,821,710



Introduction

Global climate change can be addressed in two ways: mitigation and adaptation. While mitigation aims at reducing greenhouse gas emissions and enhancing carbon sinks, adaptation is defined as the "*initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects.*"[4] For some time, the majority of climate actions were concentrated on mitigation. But climate change can already be felt in many parts of the world: extreme weather events like droughts, floods and storms are increasing. Therefore, adaptation has become a more pressing issue in recent years. Territories need to be prepared for the impacts of climate change through both adaptation policies, like risk reduction and prevention strategies, as well as activities to strengthen their resilience. The adoption and early entry into force of the Paris Agreement marks a historic step in this direction. In addition to its goal for mitigation, Article 7 of the Agreement establishes a long-term adaptation goal:

"Parties hereby establish the global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the temperature goal referred to in Article 2." [5]

The Paris Agreement also reaffirms the important role of non-Party stakeholders in climate action. Climate change is a global issue, but its impacts are felt mostly on a regional and local scale. The challenge of addressing these impacts through adaptation requires not only the commitment of nation states, but a multi-stakeholder approach. Because adaptation is typically described as location-specific, adaptation strategies need to take into account the territories where adaptation challenges should be tackled. Regional governments play a significant role in this regard. They are key players on the ground to limit and efficiently tackle climate change, since 50% to 80% of adaptation and mitigation actions are or will be implemented at the regional or local level. Regional governments are a crucial nexus between national and local governments and can therefore be quite helpful when translating national strategies and policies to the local level. The ***RegionsAdapt*** initiative aims to inspire and support these governments to take action, collaborate and report efforts on climate change adaptation. By joining the initiative, regional governments commit to reporting data on the progress of the adaptation actions on an annual basis through the "risks and adaptation" section of CDP's states and regions platform. Within the first year of the initiative, 27 regional governments reported on the climate change impacts within their territories and on their adaptation efforts aimed at tackling these impacts. This constitutes an important source for the assessment of adaptation actions and it is, at the same time, a useful learning tool in itself for regional governments.

This report is the first to reflect on the commitment of the different regional governments that joined the ***RegionsAdapt*** initiative. It shows not only how diverse the impacts of climate change can be, but also how territories around the world frequently face similar problems. Moreover, it illustrates how ambitious these regional governments are in their adaptation strategies.

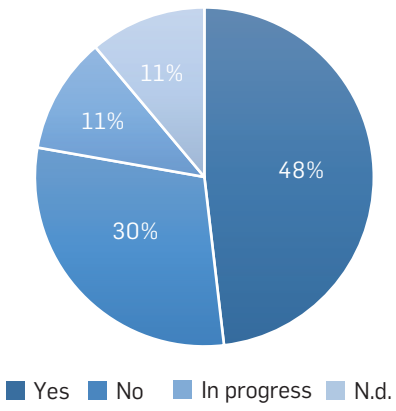
4. Metz, B., Davidson, O.R., Bosch, P.R., Dave, R., Meyer, L.A. (eds.) (2007): Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

5. UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (2015): Paris Agreement, Paris.

Physical risks from the impacts of climate change

All of the regional governments that reported through the platform said that the impacts of climate change present significant physical risks to their territories. This chapter offers an overview of the different physical risks they are facing from climate change and how they are taking action to anticipate these impacts. As shown in **Figure 1**, the majority of the disclosing governments has already carried out a vulnerability assessment, or has one in progress. This indicates that regional governments are well aware of the need to prepare for the impacts of climate change, and this kind of assessment is the first step to identify their needs.

Figure 1: Vulnerability assessments carried out



Climate change impacts are assessed according to their level of risk and their anticipated timescale (in years). The level of risk is described by estimating the potential impact from the anticipated effect of climate change along with the likelihood of that effect occurring. Four options are available using this metric (i) Extremely serious; (ii) Serious; (iii) Less serious; and (iv) other. Similarly, there are four options to describe the expected timescales:

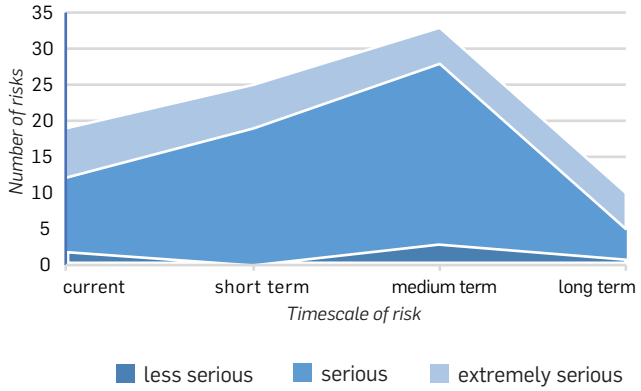
- Current: the region is already experiencing the identified effect from climate change;
- Short-term: the region will experience the identified effect from climate change by 2025;

• Medium-term: if the region will experience the identified effect from climate change between 2026 and 2050; and
• Long-term: if the region will experience the identified effect from climate change after 2051.
Additionally, we included the expression of "not defined" (n.d.) where governments did not make any specifications on the issue.
The 27 participating governments that said climate change presents a physical risk to their regions, in total, reported 128 physical risks from climate change – separated into 17 categories. These categories were the following:

- More intense rainfall
- More frequent rainfall
- Change in seasonality of rainfall
- Increased average annual rainfall
- Reduced average annual rainfall
- Reduced average annual snowfall
- Greater temperature variability
- More hot days
- Hotter summers
- More intense heat waves
- More frequent heat waves
- More intense droughts
- More frequent droughts
- Warmer water temperatures
- Increased frequency of large storms
- Sea level rise
- Other

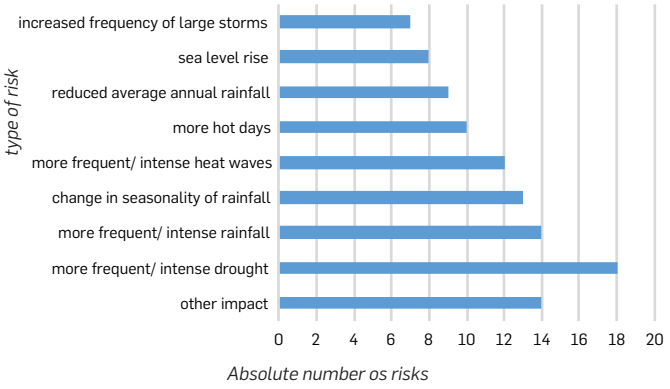
Figure 2 shows the distribution of climate change impacts according to their risk level and the anticipated timescales. While governments could not evaluate the level of risk of a significant amount of impacts (31%), most risks reported are considered as either serious (46%) or extremely serious (18%). An indication that climate change is a relatively immediate threat is the fact that 20% of the reported risks are already experienced by the regions and 23% will occur within the next ten years. The majority of the risks (30%) are reported to occur in the medium term, a timescale of one generation.

Figure 2: Physical risks from climate change (absolute numbers)



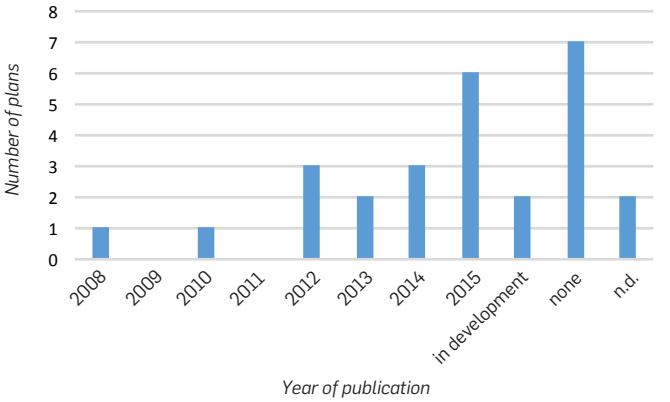
The main concerns for the reporting governments, as indicated in **Figure 3**, relate to more frequent and/or more intense droughts, as 72% of the governments mentioning this as a physical risk resulting from climate change. 56% of the reporting governments included more frequent and/or more intense rainfall as a physical risk, and more than half of the respondents included the change in seasonality of rainfall. Nearly half of them mentioned more frequent and/or more intense heat waves and 40% considered more hot days to be one of the physical risks from climate change. Reduced average annual rainfall and sea level rise were mentioned by more than one-third of the governments, and the increased frequency of large storms was also among the risks mentioned most by the participating governments.

Figure 3: Most commonly reported physical risks from climate change



Some of these risks are considered to pose similar threats to the regions. More frequent and/ or intense rainfall, for example, is seen by 64% of governments as a serious threat to their territories. For other impacts, the level of risk is evaluated differently by the reporting governments. Sea level rise, to give an example, is considered less serious by 13%, serious by 50% and extremely serious by 25% of the reporting governments.
In order to anticipate these impacts of climate change, adaptation strategies are clearly needed – especially considering the fact that some regions will face or are already facing a wide range of climate change effects. Already confronted with these impacts, the accompanying planning process to identify medium-term and long-term needs, develop strategies and implement them, usually results in an adaptation plan.[6] Among the disclosing governments, the one who first established an adaptation plan did it eight years ago – in 2008. Since then, 2015 has been a landmark year for the adoption of adaptation plans, which possibly indicates how much momentum the Paris Agreement negotiations have generated. While more and more regional governments are working on their own adaptation plans, **Figure 4** also shows there are governments that still need to develop their plans to effectively respond to the challenges resulting from climate change.

Figure 4: Publication of adaptation plans

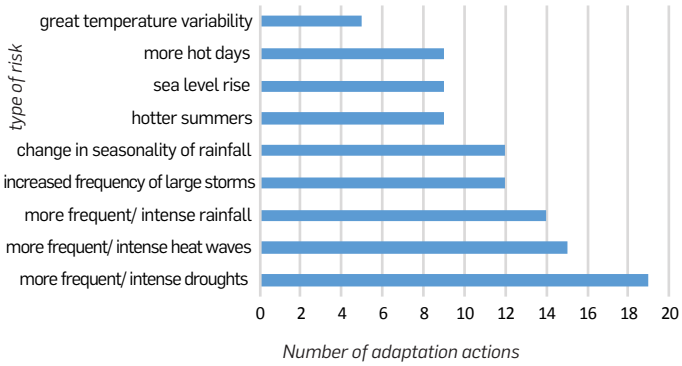


6. Georgetown Climate Center (n.d.), "State and Local Adaptation Plans", available at: <www.georgetownclimate.org/adaptation/plans.html> Accessed on: Dec. 22nd 2016.

The reasons for not having an adaptation plan are mainly a lack of economic and human resources. In some cases, a lack of cooperation between government and civil society was also mentioned; in others, necessary institutional structures are not in place yet. However, with more than 150 adaptation actions reported, it is clear that regional governments are focused on the need to mitigate the risks of climate change in order to protect their territories and populations. **Figure 5** indicates that a number of physical risks reported by the governments are already being addressed by their adaptation actions and the number of actions per risks correlates, for the most part, with the type of physical risk most reported by the governments. More hot days and greater temperature variability were not among those risks most mentioned but are already being addressed by a number of adaptation actions also because of their impact on human health.

The next section will further illustrate the physical risks for the regions resulting from climate change. A full description of these risks can be found in the appendix. The following part will also highlight what specific impacts these risks have in the territories and what adaptation actions the regions are carrying out to increase resilience.

Figure 5: Most addressed physical risks from climate change



Droughts: More frequent and more intense

As the physical risk most mentioned by governments, more frequent and/ or more intense droughts pose a serious threat to regions worldwide. Droughts are environmental disasters that occur when the amount of precipitation is reduced over an extended time period, and can persist for months or even years.[7] Different factors influence their occurrence: temperatures, high winds, low relative humidity, timing and characteristics of precipitation, like distribution and intensity of rainfall. Droughts are not immediate hazards, like hurricanes or earthquakes, but graduate onsets –which is what makes them difficult to identify and adequately address. The impacts of droughts are diverse and have severe consequences for human beings and the environment.[8]

The impacts droughts have on regions are as varied as the adaptation actions taken to reduce the regions' vulnerabilities to them. Almost twenty different adaptation actions were mentioned by the disclosing governments. Additional reservoirs and wells for water storage are the most prominent ones. The Australian Capital Territory, for example, has mitigated short-term to medium-term water supply security risks by recently completing two major construction projects, the construction of the enlarged Cotter Dam and the construction of the Murrumbidgee to Googong Water Transfer Pipeline, which allows the transfer of up to 100 megaliters of water per day through a 12 km underground pipeline. Santa Elena already considered the construction of the reservoir "Sube y Baja" in its Aqueduct Hydraulic Plan from the 1980s. In the last two years, the construction of this reservoir was finally carried out together with the construction of the reservoirs "El Suspiro", "Pedregalito" and "Ciénega."

Promoting and incentivizing water efficiency is also an important way to reduce the vulnerability to droughts, which can be done through public awareness campaigns, as carried out in Quebec. Community engagement and education, like São Paulo is doing, is also an effective tool to reduce the impacts of droughts, especially related to water supply. Water butts and rainwater capture are another way to make regions more resilient. Rio Grande do Sul, for example, implemented an incentive policy in 2015 for farmers to adopt water storage practices in their properties, and Tocantins is currently realizing the "Barraginhas Project," which aims to capture rainwater and thereby promote its infiltration into the soil in order to perpetuate the bodies of water in the region. In the province of Pichincha, the construction of reservoirs is focused on reducing drought at the local level. The government here not only considers the requirements of rainwater to produce agro-foods, but also integrates people's opinions and desires. To adapt agriculture to climate change, Gossas diversified its water supply. The use of solar energy should ensure the availability of water for farmers in the region. The government also promotes bio-agriculture with

Table 1: Regions affected by more frequent and/or intense droughts

Region	Timescale	Level of risk
Australian Capital Territory	medium-term	serious
Azuay	medium-term	extremely serious
British Columbia	medium-term	serious
Catalonia	short-term	extremely serious
Gossas	short-term	serious
Pichincha	n.d.	n.d.
Prince Edward Island	current	serious
Quebec	medium-term	n.d.
Rio de Janeiro	medium-term	extremely serious
Rio Grande do Sul	current	serious
Santa Elena	long-term	extremely serious
South Australia		
- more frequent droughts	long-term	extremely serious
- more intense droughts	medium-term	extremely serious
Tocantins	short-term	extremely serious

Kwa Zulu-Natal: Increasing the resilience of water supply through wastewater reuse

Kwa Zulu-Natal is making a great effort on sustainable use of water resources and, at the same time, increasing the resilience of its water supply towards the risk of drought through reuse of wastewater. The wastewater recycling plant treats domestic sewage to near potable standards for industrial use. The plant has the capacity to treat approx. 40m³/day of wastewater.

7. Mishra, A.K. and Singh, V.P. (2010), "A review of drought concepts", Journal of Hydrology, No. 391, pp. 202–216.
8. Ibid.

compost and bio-digesters to produce biogas. Rio de Janeiro is taking various actions to decrease vulnerability to droughts. With 1,440ha of riparian forest and springs protected or restored and 1,280ha of reforested areas, the state is not only addressing adaptation but also contributing to the reduction of greenhouse gas emissions. Real-time risk monitoring, with monthly hydrologic reports, and improvements in the water supply distribution method in the Paraíba do Sul watershed are also among the adaptation actions being taken by Rio de Janeiro.

Image 1: Solar system for wells in Gossas

More extreme rainfall events

Climate change will increase extreme weather events around the globe. On the one hand, droughts will occur more often, but on the other hand, rainfall will be more frequent and/or more intense.[9] This can lead to increased runoff, because soils or pavements cannot absorb the increased amounts of water. Floods can be a major consequence with devastating impacts on people, infrastructure and the economy. More than half of the disclosing regional governments face the risk of more frequent and/or intense rainfall as a result of climate change.

Governments are taking different actions in order to increase resilience to extreme rainfall in their territories. By generally incorporating climate change into various long-term planning documents, British Columbia is addressing the issue from the ground. Climate change is a cross-cutting issue affecting all sectors, but it is still not fully integrated into the public planning processes of administrations worldwide. Nevertheless, it should be considered in all governmental policies. Concretely, the province of British Columbia is using improved weather forecasting and warning dissemination to better prepare itself for extreme rainfall events. Catalonia is using stormwater capture systems to avoid flooding in its territory. The network of metropolitan collectors and municipal networks are the main infrastructure in cities to drain off rainwater, regulate flow and reduce the risk of floods. Unified anti-flooding system tanks built in a number of cities in the Barcelona Metropolitan Area also reduce the risk of flooding and guarantee the quality of bathing water as well as regulating water treatment plants. Rio de Janeiro is engaging the community through training, social networks, and the website of the State Environmental Institute (INEA). All flash flood alerts to the population and to the Emergency Agency (Defesa Civil) are associated with publicity actions using these channels. The region of Lombardy is pursuing a more holistic approach to adaptation to the risk of extreme rainfall events. The first step is the revaluation of the "hydro-geological hazard mitigation plan," by explicitly considering the variability of future climate. There are adequate policies and protection systems in place to respond to the anticipated increase in flood risk. Safeguarding the necessary space for water streams and limiting the extension of sealed areas help to ensure the natural soil capability of water retention and flood control. The region is also adapting its current early warning system and emergency management plans to the possible increase of flash floods as a consequence of extreme rainfall events. Special local protection activities close to rivers, creeks and the sea, as reported by Jalisco, also contribute significantly to reduce the vulnerability of the population. The government of Alberta is addressing infrastructure needs in relation to extreme rainfall events with $9 billion in funding (2016-17 budget) primarily through Municipal Sustainability Initiatives grants. In addition, the province has allocated $700 million in the 2016-17 budget for recovery and protection. Other noteworthy strategies developed by the disclosing governments are soil retention initiatives, stormwater capture systems, extreme events management projects and more resilient infrastructure, like bridges and culverts.

Table 2: Regions affected by more extreme rainfall events

Region	Timescale	Level of risk
British Columbia	current	serious
Catalonia	short-term	serious
Jalisco	short-term	serious
KwaZulu-Natal		
- more frequent rainfall	medium-term	serious
- more intense rainfall	long-term	extremely serious
Lombardy	short-term	serious
Prince Edward Island	medium-term	serious
Quebec		
- more frequent rainfall	current	n.d.
- more intense rainfall	short-term	n.d.
Rio de Janeiro	n.d.	n.d.
Rio Grande do Sul	medium-term	serious
South Australia	medium-term	serious

Image 2: Flood of river Ticino in Pavia, Lombardy

Rio de Janeiro: Supporting risk management on five pillars

INEA has developed projects aimed at mitigating and remediating, as well as disaster prevention and risk reduction associated with intense rainfall. Risk management in Rio de Janeiro is supported on five pillars: 1) Diagnosis: Preliminary assessment, risk analysis, vulnerability studies; 2) Preparation: Formulation and implementation of a contingency plan or other actions to mitigate economic and human damages; 3) Prevention, mitigation and adaptation: Structural and non-structural interventions that reduce risks; 4) Adverse events management: Floods response; and 5) Recovery: Rehabilitation and Reconstruction

9. IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Change in the seasonality of rainfall

Climate change not only modifies the overall amount of rainfall, but also its seasonal distribution. This change in the seasonality of rainfall mostly affects the agricultural sector and, thereby, food security.[10]
The Basque Country is tackling the issue of changing seasonality of rainfall by incorporating water stress estimation into hydrologic plans, and by promoting and incentivizing efficient water use. More specifically, water supply infrastructure is being renovated, water supply agents are being combined, taxes are being reviewed and awareness campaigns are being carried out. Grants for climate actions of municipalities are also provided, together with planning for Special Areas of Conservation (SAC). Following the end of the Millennium Drought, the Australian Capital Territory reverted its approach to water management from implementing water restrictions to using permanent water conservation measures. Since 2010, water consumption across the Australian Capital Territory and Queanbeyan has been guided by permanent water conservation measures.

> "Greater variability in rainfall throughout the year, combined with warmer temperatures, will impact agriculture across the region with reduced productivity and with need to change to different product types and land management practices" The State of South Australia, Australia

These measures ensure that, even though water restrictions are no longer being applied, good day-to-day judgment from government and the water utility is being applied to water use. The private installation of rainwater tanks remains a popular means to reduce water bills throughout the Australian Capital Territory, which also provides ongoing benefits to water security and stormwater quantity and quality. The installation of rainwater tanks will also enable those landowners with tanks to maintain healthy, more resilient gardens during extended dry periods in the future. Since changing rainfall patterns will affect the hydroelectric production of Quebec, the province is keen to gain knowledge on vulnerabilities and adaptation strategies related to energy production and reservoirs management. The government is also consolidating its water monitoring network and producing a hydroclimatic atlas that evaluates the impact of climate change on river flooding and low-flow periods. KwaZulu-Natal, in turn, is restricting development in risk areas. Its Municipal System Act and Disaster Management Act require that disaster management practitioners identify areas of risk, which involves monitoring investments or developments under construction, since they should not be built on floodplains. Morona Santiago is taking a more technical approach through meteorological stations and monitoring water resources with hydrological stations. The province is also implementing agricultural drainage systems and reforestation initiatives, together with the creation of environmental regulations and basic biodiversity studies. The Province of Pichincha uses risk maps that were designed to prevent the effects of five types of natural hazards. One of these maps is used to increase resilience to landslides caused by the accumulation of water in saturated soils.

Table 3: Regions affected by change in the seasonality of rainfall

Region	Timescale	Level of risk
Australian Capital Territory	medium-term	serious
Basque Country	short-term	serious
British Columbia	medium-term	less serious
Catalonia	current	serious
KwaZulu-Natal	long-term	extremely serious
Lombardy	short-term	serious
Morona Santiago	short-term	serious
Pichincha	n.d.	n.d.
Prince Edward Island	medium-term	serious
Quebec	current	n.d.
Rio de Janeiro	current	extremely serious
Santa Elena	medium-term	serious
South Australia	medium-term	extremely serious

Image 3: Rainwater conservation tanks on new house in Australia

10. Calzadilla, A., Rehdanz, K., Betts, R., Falloon, P., Wiltshire, A., Tol, R. S. J., 2013: Climate change impacts on global agriculture, Climatic Change Vol. 120, Iss. 1, pp 357-374..

Warmer conditions: Heat waves, more hot days and hotter summers

In some parts of the world, heat waves will become more frequent and more intense. They will last longer and have higher temperatures. Summers will tend to be hotter and hot days will occur more often. This will not only affect the environment, but will also pose a threat to local populations, particularly those vulnerable to heat stress.
British Columbia incorporates climate change into long-term planning documents and has developed a new heat wave alert system to warn the public and trigger municipal heat wave response plans. These plans include educational messages to the public and vulnerable populations, advice about cooling centers and water stations, or considerations for outdoor events – including water availability and schedule changes. The Basque Country is executing some pilot projects related to heat mapping and thermal imaging to increase its resilience to heat waves, and

Catalonia is also addressing the heat wave issue through its "Action Plan to Prevent the Effects of Heat Waves on Health" (POCS), which is revised annually. Promoted by the Catalan Ministry of Health, the POCS establishes a series of measures and recommendations for the most vulnerable to prevent the impacts of heat waves. The Plan is divided into six scenarios, depending on the severity of the heat wave, which propose different actions accordingly. Catalonia also promotes water efficiency through the MEDACC-Life project, which developed a system for crop irrigation optimization that takes into account weather forecasts, evapotranspiration data and field measurements to estimate weekly irrigation requirements in corn crops. These are sent to farmers, who can benefit from water and energy savings. The energy increase resulting from hotter summers in Catalonia leads to the establishment of several measures to deal with energy and water poverty among the population. These should prevent cut-offs of water, electricity and gas services to people at risk of poverty or social exclusion. Lombardy is putting its efforts toward the reinforcement of the healthcare sector and the reduction of urban heat islands through expanding green spaces and urban parks, as well as bio-climatization in new buildings – among other measures. Ensuring the adequate supply of energy for air conditioning during periods of high demand will also help increase resilience to heat waves. Quebec is taking various measures in order to adapt to warmer conditions in its territory. Disease prevention measures include a pollen reduction strategy and the creation of a multidisciplinary observatory for evaluating, monitoring and preventing zoonotic diseases. The government is also elaborating and implementing an air quality policy, as well as monitoring air contaminants. Additionally, public health and outreach activities are being carried out together with the testing of a telephone alert system aimed at vulnerable groups. To reduce existing heat islands, the government is supporting municipalities' implementation of projects like tree planting, constructing shaded areas and using reflective material to preserve existing cool zones. Biodiversity monitoring, mapping and monitoring of permafrost distribution and thickness, as well as other monitoring and surveillance systems, are other actions that address the impacts of warmer conditions in the province. Warmer conditions do not only have severe impacts on urban areas. Rio Grande do Sul, for instance, approved a soil and water strategy in 2015 meant to reduce the impacts of extreme events on a rural property level, which illustrates the importance regional governments see in managing issues that cross-cut urban and rural areas. The government of Alberta is working together with the forest industry and other federal and provincial agencies to implement a strategy for rejuvenating Alberta's forests, in order to create healthy, vigorous forests that can withstand catastrophic pest outbreaks and future wildfires.

Image 4: Forest fire in Catalonia

Table 4: Regions affected by warmer conditions (heat waves, more hot days and hotter summers)

Region	Timescale	Level of risk
Alberta		
- more hot days	n.d.	n.d.
Australian Capital Territory		
- more frequent heat waves	short-term	serious
Basque Country		
- more frequent heat waves	medium-term	serious
- more intense heat waves	n.d.	n.d.
British Columbia		
- more frequent heat waves	medium-term	serious
- more intense heat waves	medium-term	serious
- more hot days	medium-term	less serious
- hotter summers	short-term	serious
Catalonia		
- more intense heat waves	short-term	serious
- more hot days	current	serious
- hotter summers	n.d.	n.d.
Jalisco		
- more frequent heat waves	n.d.	n.d.
- more hot days	medium-term	serious
- hotter summers	medium-term	serious
KwaZulu-Natal		
- more hot days	medium-term	medium-term
Lombardy		
- more frequent heat waves	short-term	serious
- more intense heat waves	short-term	serious
- more hot days	short-term	extremely serious
- hotter summers	short-term	extremely serious
Quebec		
- more frequent heat waves	short-term	n.d.
- more intense heat waves	n.d.	n.d.
- more hot days	short-term	n.d.
- hotter summers	short-term	n.d
Rio Grande do Sul		
- more hot days	current	serious
South Australia		
- more frequent heat waves	current	extremely serious
- more intense heat waves	current	extremely serious
- more hot days	n.d.	n.d.
- hotter summers	n.d.	n.d.
Tocantins		
- more hot days	medium-term	serious

Australian Capital Territory: Addressing the issue of bushfires through community engagement

The goal of the bushfire management in the territory, outlined under the Strategic Bushfire Management Plan, is to suppress bushfires and reduce their consequences on human life, property and the environment through the Government and the community working together. The Emergency Services Agency (ESA) currently informs and engages the community through public awareness and information campaigns, and the implementation of the Community Fire Unit Program. Each year the ESA prepares a Community Education Plan. The Community Engagement Strategy on Climate Change also works to build an ongoing dialogue with the community on climate change, including preparing and responding to extreme weather events.

Warmer water temperatures and sea level rise

From 1901 to 2010, the mean global sea level rose by around 19 cm and the global sea level has risen at a higher rate since the mid-19th century than it did during the previous two thousand years. About 75% of the sea level rise is attributed to glacier mass loss and oceanic thermal expansion due to warming. Since global temperature increase will exceed 1.5°C for all but one scenario, oceans will warm further and ice melt will continue, causing global sea level to rise 24-30 cm by 2065 and 40-63 cm by 2100. [11] [12] While these are global average estimates, they can be significantly higher or lower over broad regions around the globe. Prince Edward Island, for example, is low lying and anticipates 1m of sea level rise by the end of the century, and Jalisco forecasts the sea level in its territory will rise by 1m to 2m.

Image 5: Coastal erosion

One third of the reporting governments named sea level rise as a physical risk resulting from climate change. To adapt to this particular effect of climate change, sea level rise modeling, flood mapping and flood defense systems are being developed by a number of governments. The Basque Country uses GIS mapping of the coast with 2100 level increase estimations to model sea level rise in its territory, and Prince Edward Island has been mapping flood risks in many locations within its territory. In British Columbia, new engineering and planning guidance on sea dike design and coastal development will enable local governments and qualified professionals to protect people, buildings and infrastructure from sea level rise. Catalonia is conducting its so-called "Life-Pletera" project, which consists of demolishing old roads near the coastline and restoring the area to create new wetlands. In the Llobregat aquifer, the Catalan Water Agency suggested a water barrier to prevent it from being overused, together with recharge ponds and an extraction regulatory plan. Sea level rise, combined with the slower recharge of groundwater, will increase the salinization of coastal aquifers. The water barrier project is, therefore, not only addressing the recharging problem but also saltwater intrusion. In the Ebro Delta, which is also in Catalonia, pilot actions on mitigation and adaptation to climate change should reduce coastal erosion, increase carbon sequestering in the soil, reduce GHG emissions and improve water quality. In KwaZulu-Natal, a vulnerability assessment examines the risks areas, infrastructures and communities that will be affected by sea level rise. The government also defined a coastal setback line. It is prohibited - or in some cases even restricted - to erect, alternate or extend structures that are wholly or partly seaward of the line.

Table 5: Regions affected by warmer water temperatures and sea level rise

Region	Timescale	Level of risk
Basque Country		
- sea level rise	short-term	serious
British Columbia		
- warmer water temperatures	long-term	serious
- sea level rise	long-term	serious
Catalonia		
- warmer water temperatures	current	serious
- sea level rise	current	less serious
Jalisco		
- sea level rise	long-term	serious
KwaZulu-Natal		
- sea level rise	short-term	extremely serious
Prince Edward Island		
- sea level rise	medium-term	serious
Quebec		
- sea level rise	current	n.d.
South Australia		
- warmer water temperatures	long-term	extremely serious
- sea level rise	current	extremely serious

11. IPCC (2014), Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)], IPCC, Geneva, Switzerland, 151 pp.

12. UNFCCC (2014), Feeling the Heat: Climate Science and the Basis of the Convention, available at: http://unfccc.int/essential_background/the_-science/items/6064.php (16.12.2016).

Reduced average annual rainfall

As an increase in extreme weather events is one of the consequences of climate change, not only will rainfall patterns change and rainfall events become more frequent and more intense, but overall annual rainfall may also be reduced. Nine regional governments reported already facing this impact, or will face it in the short and medium term. The impacts of reduced rainfall are especially felt in the agricultural sector, since it is highly dependent on water availability. Farmers in KwaZulu-Natal, therefore, switch to more water-efficient crops, such as sorghum or millet. Tombouctou uses dune fixation and deepening of lakes and ponds to soften the impacts of reduced

Table 6: Regions affected by reduced average annual rainfall

Region	Timescale	Level of risk
Alberta	n.d.	serious
Catalonia	medium-term	serious
Esmeraldas	current	serious
Fes-Meknes	medium-term	serious
KwaZulu-Natal	n.d.	n.d.
South Australia	current	extremely serious
Sud-Comoé	n.d.	n.d.
Tocantins	short-term	extremely serious
Tombouctou	n.d.	n.d.

rainfall, whereas in Esmeraldas the government arranged the construction of small stone walls, as well as reforestation projects and the protection of water sources. Tocantins has several policies that address the water sector in order to increase resilience, among them are the "State Policy on Water Resources," the "State Plan for Hydrographic Basins," as well as the "Hydrographic Basin Plans," which is for water basins with greater conflict over water use, and Basin Committees. The government, together with the National Water Agency (ANA), also monitors hydro-meteorological data in several regions of the state.

Image 6: Reforestation in Gossas

Increased frequency of large storms

Large storms have a wide range of effects. Seven governments that reported through the platform said that they are already suffering or will suffer, in the short to medium term, from the consequences of an increased frequency of large storms.
The disclosing regional governments use different actions to increase their resilience to large storms. While British Columbia enhances preparedness ahead of major storms through improved weather forecasts, Prince Edward Island has mapped province-wide erosion risk and storm surge risk in many locations, to help guide development decisions. In this location, land use planning policies are being developed to address flood risk concerns.

> "Prince Edward Island is low lying with many coastal wetlands, beaches, dunes and soft cliffs made of sandstone. Coastal infrastructure, including roads, bridges, homes, businesses, wharves, health care facilities and energy infrastructure, is at risk from both, storm-mediated erosion and storm surge." The Province of Prince Edward Island, Canada.

Quebec is integrating climate change adaptation in risk prevention and public security policies, and the Australian Capital Territory has a stormwater system with a number of water-sensitive urban design measures – like wetlands and retarding basins. These are designed to mitigate flood risk by temporarily storing runoff and releasing it at a controlled rate. These systems work to reduce the peak flow in downstream drainage systems. A water-sensitive urban design planning requirement for on-site detention functions as temporary storage and controlled release of stormwater runoff generated within a block. This is also promoted for redevelopment sites, ensuring that the capacity of the municipal stormwater system is not exceeded. Rio de Janeiro is addressing the growing frequency of large storms with a multitude of adaptation strategies. In the City of Rio de Janeiro, a total of seven wells for rainwater storage are set to be installed. The smallest of them, a big underground reservoir, was installed with a storage capacity of 18 million liters of rainwater. Landslide risk mapping, flood mapping and real-time risk monitoring are additional measures that can increase resilience to severe storms and crisis management, including warning and evacuation systems – which are also important actions to address the issue in the region. Evacuation training for the population and systems to communicate the danger of landslides and flooding were installed in critical areas. INEA, the State Environmental Institute, has also established a digital radio communication system for use during disasters and the Emergency Agency (Defesa Civil) received equipment to communicate in case of a disaster. Further, INEA created Rio de Janeiro's Flash Flood Warning System, which has a team of meteorologists and technicians analyzing data from hydrological and meteorological networks 24 hours a day, 7 days a week. In the event of heavy rain or overflow forecast, INEA sends alerts via SMS to the registered population and to the Emergency Agency – which receives a call and another communication from INEA's digital radio system. Weather radars are also used to quantify water in the atmosphere with a radius of up to 250km, which makes the State of Rio de Janeiro the first one in Brazil to have all its catchments covered by radar technology. Reunion Island finances dam works through a management plan for flood risk and also subsidizes various research studies to better determine its vulnerability.

Table 7: Regions affected by increased frequency of large storms

Region	Timescale	Level of risk
Australian Capital Territory	short-term	serious
British Columbia	short-term	serious
Fes-Meknes	n.d.	n.d.
La Réunion	n.d.	n.d.
Prince Edward Island	medium-term	serious
Quebec	current	n.d.
Rio de Janeiro	current	extremely serious

Image 7: Disastrous floods and landslides in Nova Friburgo, Rio de Janeiro State in 2011

Greater temperature variability

Among the other physical risks reported by the responding governments is greater temperature variability. Cross River State is planting 5 million trees across its territory, in addition to sustainable management and natural conservation efforts aimed at mitigating the impacts of climate change. British Columbia is incorporating climate change into long-term planning documents. The government is using climate change assessments for key economic sectors to identify climate-related risks and actions that can help these sectors prepare for them. In Quebec, research on infrastructure adaptation to freeze-thaw cycles should reduce vulnerability in the province, and Jalisco is starting to counter the impacts of greater temperature variability by implementing solar power in two governmental buildings.

Table 8: Regions affected by greater temperature variability

Region	Timescale	Level of risk
Alberta	long-term	serious
British Columbia	medium-term	less serious
Cross River State	medium-term	serious
Jalisco	long-term	less serious
La Reunión	n.d.	n.d.
Quebec	current	n.d.

Reduced average annual snowfall

A decrease in average annual snowfall was reported by four governments: Lombardy, Quebec, Catalonia and British Columbia. The government of British Columbia introduced measures that promote and incentivize water efficiency, as well as water use restrictions and standards. The new "Water Sustainability Act" will protect aquatic ecosystems during times of water scarcity, and will only allow water for essential household use during droughts. In Catalonia, some government-owned ski resorts have pioneered the development of tourism offerings outside the snowy season, through new family activities – like canoeing or horse-riding trails. This favors the economic viability of these ski resorts and, at the same time, their adaptation to fewer days with snow. Lombardy carries out a number of adaptation actions to tackle these impacts, like diversifying the touristic offering as an alternative to winter sports and promoting flexibility of existing ski resorts by adapting the opening season to real snow availability. The government is also including climatic considerations in feasibility assessments of future ski areas. Additionally, the regional administration is promoting cost-benefit analyses to evaluate environmental and economic suitability of existing ski areas regarding future scenarios. Risk monitoring, updating hazard cartography and protection systems are additional actions that can be taken to reduce the vulnerability to less annual snowfall in Lombardy.

Table 9: Regions affected by reduced average annual snowfall

Region	Timescale	Level of risk
British Columbia	medium-term	serious
Catalonia	medium-term	serious
Lombardy	short-term	serious
Quebec	short-term	n.d.

Image 8: Snow season without snow

Increased average annual rainfall

In the State of Rio Grande do Sul, precipitation is projected to increase on average in all seasons of the year and the "Disaster Risk Management Project," which is already under way in the state, aims to assess all risks regarding extreme hydrological events in order to design tools for disaster prevention and mitigation. The Basque Country is investing in rural areas and forest conservation to mitigate the effects of increased average annual rainfall in its territory. The government in Alberta is currently investing more than $8.5 million to update flood hazard mapping, accelerating the mapping of new areas and high-risk communities.

Table 10: Regions affected by increased average annual rainfall

Region	Timescale	Level of risk
Alberta	n.d.	n.d.
Basque Country	n.d.	n.d.
British Columbia	current	less serious
Rio Grande do Sul	medium-term	serious

Adaptation actions to other physical risks and additional strategies

Regional governments have already shown great, ambitious work in this direction through more than 150 reported adaptation actions. Although, since 20% of physical risks resulting from climate change are not yet directly addressed by adaptation efforts, there is still a lot to be done. On the other hand, several adaptation actions carried out by the disclosing governments do not specifically address one of the mentioned climate change impacts. Azuay, for example, has a strategy on biodiversity management that includes three integrated projects. These will allow for sustainable management throughout the province, identifying areas for conservation and for economically viable and environmentally sustainable production activities. These projects will be achieved through incentivizing small producers and by guaranteeing spaces for product marketing. The Western Province is using climate change mainstreaming to proactively introduce novel thinking on environmental best practices and bold approaches. The government of Sud Comoe adopted a new vision of development that is compatible with the preservation of biodiversity and the fight against climate change – and preservation of the environment is included as a priority in the development plan for the next four years. Some concrete actions are already being carried out, like the promotion of a zero-deforestation policy for the large oil palm industrial estates found in the region. The government is also working on popularizing solar energy by supporting the creation of a regional training center on solar energy, as well as the setup of a production plant for bio-coal that comes from industrial plantation waste, which will enable the region to reduce deforestation that has been driven by the production of firewood. The government in Tombouctou is carrying out adaptation actions like maintaining forested areas and afforestation, restrictions on hunting, riverbank protection schemes, river drainage, bank fixation work, as well as the introduction of new seed varieties. Growing pressure on Alberta's air, land and water requires the integration of resources management decisions to minimize cumulative environmental effects. This means, among other things, that air quality management is integrated with land, water and biodiversity management in order to ensure ecosystems are sustained.

A global indicator for adaptation developed by Catalonia

The indicator was developed using 29 key indicators grouped into 10 headings: water management, agriculture and livestock farming, forestry, health, the energy sector, industry, services and commerce, tourism, town planning and housing, mobility and transport infrastructures, research, development and innovation. The subsequent statistical analysis of these indicators produced a global adaptation indicator quantifying Catalonia's capacity to adapt to climate change in the future. This global indicator is based on two factors: use of resources and environmental quality. "Effectively, our capacity to adapt to the impact of climate change depends on how we use resources (water and energy, principally) and on the quality of the environment (basically, the air we breathe)"

Risks and Adaptation Actions related to Water Supply

Under the Global Climate Action Agenda at COP22, November 9th was entirely dedicated to action on water issues. This Action Day highlighted water as a pathway to support the implementation of the Paris Agreement. It was the first time a United Nations Climate Change Conference devoted a special day to this theme. Such a spotlight on this topic reflects IPCC's most recent Assessment Report (AR5 – 2014), which indicates growing evidence of human influence in multiple ecological dynamics, including changes in the global water cycle. In this realm, climate-related risks to water supply frequently become a matter of deep concern, taking into account the essentiality of this resource to humankind. [13]

Countless studies repeatedly indicate that water and sustainable development are inextricably intertwined. Water represents an unavoidable input not only to key productive processes, such as food production and manufacturing, but also to basic infrastructure, like power supply and transportation. As an underlying component to sustainable development, water plays its most fundamental role, nonetheless, in household usage. Access to safe drinking water has

Climate change impacts can decisively influence water quality. The IPCC technical paper "Climate Change and Water" explains that some combined events like higher temperatures, increased precipitation intensity and more frequently lower flows could aggravate the extent of many water pollutants, such as dissolved organic carbon, pesticides, and thermal pollution. This situation translates into increased impacts on ecosystems, human health, and the reliability and operating costs of water systems (IPCC, Climate Change and Water, 2008, p.43).

13. IPCC, 2014: Summary for Policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

been recognized as a pivotal factor in eradicating extreme poverty, combating hunger and diseases, reducing child mortality, improving maternal health and promoting gender equality. Being crucial to the entire 2030 Agenda for sustainable development, water issues are well enshrined in SDG6 "Ensure availability and sustainable management of water and sanitation for all.[14]" Also, water and climate change are inextricably interconnected.

Under the ongoing global warming, IPCC's scenarios suggest increasing projections of the share of global population that is expected to experience water scarcity and be affected by major river flooding in the 21st century [15]. Shortages and increasing competition for water affect rural and urban populations throughout the world, especially in developing countries. An estimated 663 million people were using unimproved water sources or surface water in 2015" [16].

In this realm, climate risks associated with water supply systems are manifold. Increased scarcity, higher prices and declining quality can represent a few examples of the challenges ahead. Currently, regions already have deployable adaptation actions to be implemented that involve a wide range of policy options, including complementary alternatives on both the demand and supply sides.

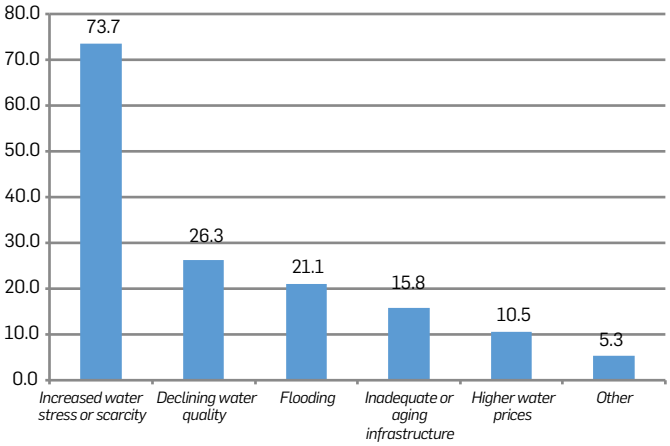
In such a context, this section of the report discloses a variety of challenges and solutions regarding water supply risks in the regions that took part in ***RegionsAdapt***´s 2016 reporting process. Unsurprisingly, Water resources and management figured among the seven key priority areas that were selected when founding members shaped the initiative. In a nutshell, ***RegionsAdapt*** aims to epitomize the former UN Secretary-General´s vision:

> "To address the many challenges related to water, we must work in a spirit of urgent cooperation, open to new ideas and innovation, and prepared to share the solutions that we all need for a sustainable future. If we do so, we can end poverty, promote global prosperity and well-being, protect the environment and withstand the threat of climate change." Ban Ki-moon [17]

The following graphs and tables summarize the information regarding water supply risks and adaptation actions that the regional governments submitted through the reporting process. According to the reported data, most governments confirmed the existence of substantive risks to water supply within their territories, in the short or long term. This was the case for 19 of the 23 governments. The only few exceptions were Gossas, Quebec, Reunion Island, and Tocantins. The graph below displays the most frequent challenges reported by those 19 regional governments foreseeing substantive risks to water supply. Quite remarkably, 14 of these 19 governments (73.7%) predict increased water stress or scarcity in the short or long term. Among these 14, 11 (79%) reported a timescale for this risk ranging from "current" to "short" and "medium-term." Also in relation to water stress or scarcity, 10 governments reported a "serious" level of risk, and 3 mentioned an "extremely serious" level of risk. Together, these two answer categories account for 13 of 14 (93%) surveyed governments foreseeing increased water stress and scarcity in their territories. The 3 governments declaring extremely serious water stress or scarcity were Catalonia, Rio de Janeiro, and Santa Elena.

Image 9: Aging water infrastructure

Figure 6: Substantive risks to water supply (% of governments reporting each risk)



The following tables synthesize the risks regional governments reported in relation to water supply:

Table 11: Regions affected by increased water stress or scarcity

Region	Timescale	Level of risk
Australian Capital Territory	long-term	serious
Azuay	medium-term	serious
Basque Country	long-term	serious
British Columbia	medium-term	serious
Catalonia	current	extremely serious
Jalisco	medium-term	serious
KwaZulu-Natal	medium-term	serious
Lombardy	short-term	serious
Pinchicha	short-term	serious
Prince Edward Island	medium-term	less serious
Rio de Janeiro	current	extremely serious
Santa Elena	long-term	extremely serious
São Paulo	current	serious
South Australia	medium-term	serious

Table 12: Regions affected by declining water quality

Region	Timescale	Level of risk
Catalonia	current	serious
KwaZulu-Natal	long-term	serious
Lombardy	short-term	extremely serious
Morona Santiago	medium-term	serious
Western Province	medium-term	serious

14. UN-Water, 2016: Water and Sanitation Interlinkages across the 2030 Agenda for Sustainable Development. Geneva.

15. Ibid

16. SUSTAINABLE DEVELOPMENT KNOWLEDGE PLATFORM (2016), Available at: https://sustainabledevelopment.un.org/sdg6, Accessed on Dec. 20, 2016.

17. CAPACITY DEVELOPMENT IN SUSTAINABLE WATER MANAGEMENT – UNDP CAP-NET (2016), Available at: http://www.cap-net.org/documents/2016/08/cap-net-annual-report-2015.pdf, Accessed on Dec. 20, 2016, p.2

Table 13: Regions affected by flooding

Region	Timescale	Level of risk
Catalonia	medium-term	serious
Cross River State	medium-term	serious
KwaZulu-Natal	medium-term	serious
Prince Edward Island	medium-term	serious

Table 14: Regions affected by inadequate or aging infrastructure

Region	Timescale	Level of risk
Esmeraldas	current	serious
Lombardy	short-term	serious
Rio de Janeiro	short-term	serious

Table 15: Regions affected by higher water prices

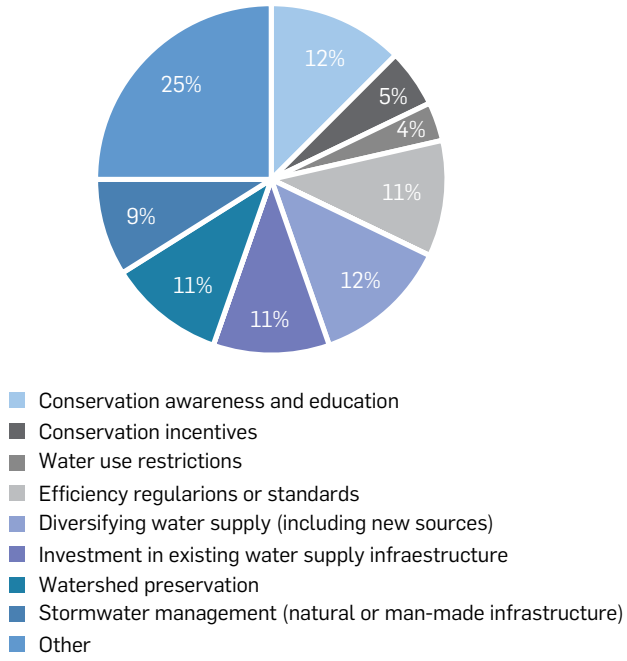
Region	Timescale	Level of risk
KwaZulu-Natal	medium-term	serious
South Australia	medium-term	serious

Table 16: Regions affected by swing between excessive moisture and drought

Region	Timescale	Level of risk
Alberta	medium-term	serious

To address these climate-related risks affecting water supply, regional governments are implementing a plethora of adaptation actions within their territories. The graph below provides a snapshot of these actions.

Figure 7: Adaptation actions to reduce the risk of water supply



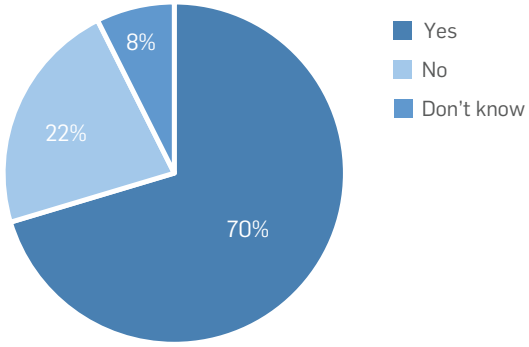
Socio-economic risks from climate change

Climate change does not only physically affect societies, but also their socio-economic sectors. According to the World Economic Forum, the failure of climate change mitigation and adaptation was the biggest risk in 2016, even ranking ahead of weapons of mass destruction.[18] The report also related climate change to other data such as economic, environmental, geopolitical and technological issues, revealing the wide range of climate change impacts. The disclosing regional governments confirm this trend.

The majority of them attested that climate change threatens the ability of businesses to operate successfully in their regions. Structural damages due to extreme events, such as floods and changes in the seasonality of climate – an impact that highly affects the agricultural sector – are widely-reported problems.

This illustrates the wide range of problems that climate change can create, apart from just the natural consequences.

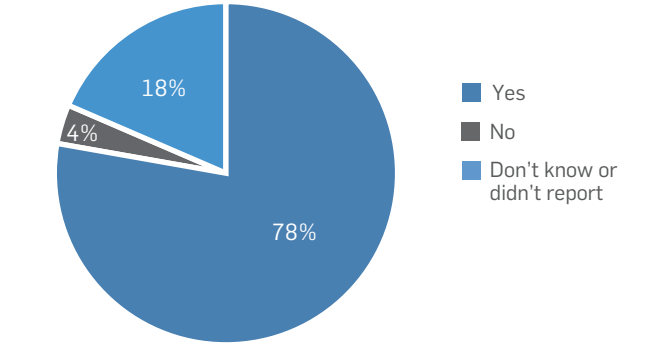
Figure 8: Climate change as a threat to businesses



18. WORLD ECONOMIC FORUM (2016), The Global Risks Report 2016, 11th edition, Geneva.

Social risks as a result of climate change

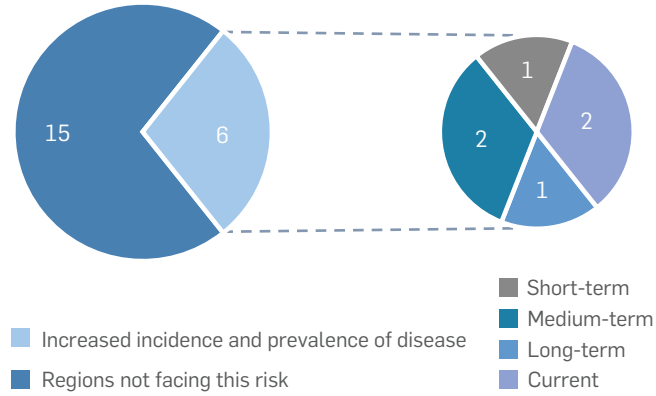
Figure 9: Regions that face social risks from climate change



The social risks related to climate change are undeniable. Some of them can aggravate problems that already exist, like increasing public health system demand. Other problems are consequences of worsened economic conditions, like unemployment resulting from the impact of climate change on the agricultural and industrial sectors. 21 out of the 27 disclosing governments reported that they are already facing or are going to face social risks related to climate change. The following sections will present the different social risks resulting from climate change as reported by the participating governments.

Increased incidence and prevalence of disease

Figure 10 : Increased incidence and prevalence of disease (absolute numbers)

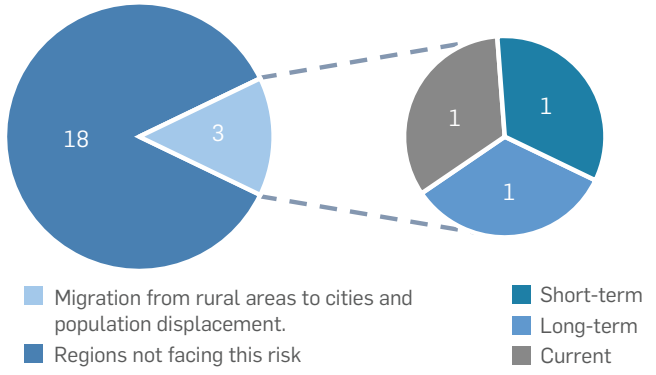


Health problems will be intensified until the end of this century. [19] This will affect human activities by compromising food security, for example. It is important to note that this varies according to the different characteristics and particularities of the regions. In this sense, six regions attested to an increased incidence and prevalence of disease as a social risk from climate change. Also noteworthy, the reported data indicates a considerable preoccupation with food security, respiratory problems, as well as impacts related to heat events.

19. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (2015), Climate Change 2014 Synthesis Report 2014, Geneva.

Migration from rural areas to cities and population displacement

Figure 11: Migration from rural areas to cities



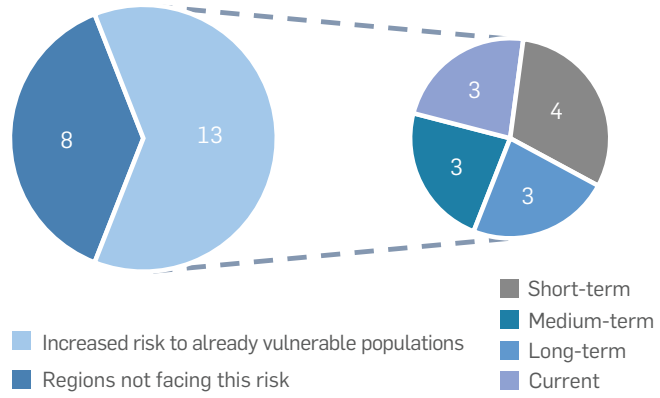
According to the United Nations High Commissioner for Refugees (UNHCR), 22.5 million people have been displaced by climate or weather events since 2008.[20] In this regard, climate change is a growing concern throughout the world – and it is impossible to disassociate the changes in population flow from the impacts of climate change.

In contrast to this trend, only three of the disclosing governments reported that climate change will affect the migration from rural areas to cities. Two regions reported a migration process resulting from changes in the seasonality of rainfall in the agricultural sector. Population displacement problems are connected to people living in risk areas. In this sense, only two governments reported this risk: one of them due to the melting of permafrost that can cause structural accidents, and another one as a consequence of extreme events, making the dislodging of populations living in the so called "red zones" necessary.

20. THE OFFICE OF THE HIGH COMMISSIONER FOR REFUGEES (2016), Available at: http://www.unhcr.org/climate-change-and-disasters.html, Accessed on: Dec. 7, 2016.

Increased risk to already vulnerable populations

Figure 12: Increased risk to already vulnerable populations



A core concern for the disclosing regional governments is the increased risk to already vulnerable populations. 13 out of the 21 governments expecting to face social risks expressed their concern about vulnerable people – the group of the population most seriously exposed to extreme events. This group is comprised of elderly people and children, who do not have enough resistance to face some climate events. It also includes disease carriers, a population that could be intensified by climate change. Additionally, societies with lower socio-economic conditions may not have the structure nor the resilience capability to face some climate problems that may repeatedly recur in the future.

Loss of traditional jobs

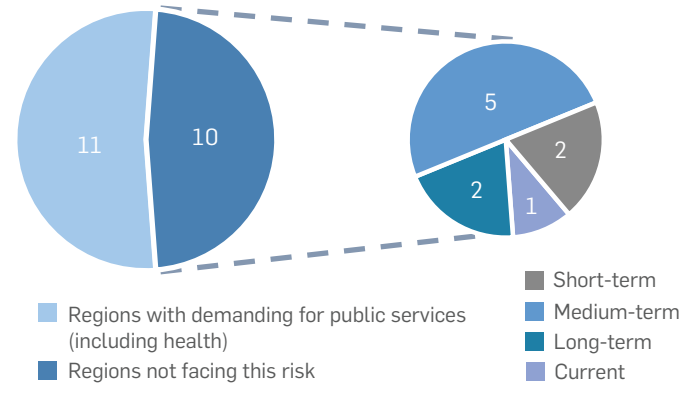
Figure 13: Loss of traditional jobs

Figure 10 : Honey harvest in Santa Elena

Climate events, such as floods and forest fires, cause enormous damage to the infrastructure of the regions. In this sense, they can harm physical and socioeconomic structures, damage industrial plants and agriculture fields, which can ultimately cause the loss of jobs. Among the three regions that reported this social risk, the case of Tocantins illustrates this impact well. There are traditional communities living in a state called Quilombolas, which were created as territories of resistance by slaves who were able to flee from landowners in the 19th century. These communities have a substantial variety of cultural and economic activities, which are currently being threatened by deforestation resulting from forest fires in the state.

Increased demand for public services (including health)

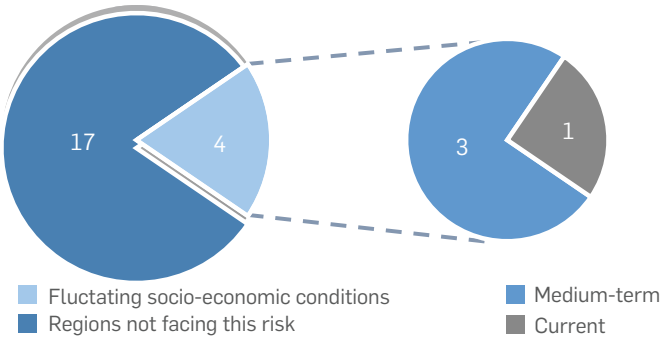
Figure 14: Increased demand for public services



Increased demand for public services, including healthcare services, is a central problem for several disclosing governments. Almost half of the regional governments expecting to face social risks are concerned about their public services. In this realm, the most frequently reported factors are: respiratory diseases, allergies, and the further aggravation of the disadvantaged condition affecting vulnerable populations. In addition, heat waves and heat islands were also mentioned as other factors that can worsen the situation of people with vulnerable health conditions.

Fluctuating socio-economic conditions

Figure 15: Fluctuating socio-economic conditions



Four regional governments reported events related to fluctuating socio-economic conditions. Problems related to the agricultural and industrial sectors are a trend, especially when climate events, such as flooding and loss of seasonality, impact their activities.

A winning path into the future

After one year of the ***RegionsAdapt*** initiative, with this first round of the reporting process on the progress of adaptation actions, it is inspiring to see the commitment that regional governments within the initiative are taking to address the issue of climate change adaptation. Climate change impacts are diverse, but can be felt around the world, and various regions share the same resulting risks. It is, therefore, important to observe that these regions are not facing isolated climate challenges –and that the exchange of different adaptation approaches may offer a great opportunity for reducing vulnerability within regions around the globe. Not only have a large number of risks resulting from climate change been reported, but a significant number of adaptation actions have also been reported – which shows the bold action of the disclosing governments. By sharing their policies and programs, these members encourage other governments to learn from their experiences, exchange ideas on further improvements and create common knowledge on how to adapt to a changing climate. However, not all the reported climate impacts are addressed by adaptation actions, and some governments might need support in order to develop their own adaptation strategies. For instance, only 59% of the disclosing governments have already carried out or are currently developing a vulnerability assessment. Action must be taken quickly, since climate change can be already felt, and in some locations it is being felt with severe consequences. As a matter of fact, 64% of the physical risks that have been reported were considered either serious or extremely serious. More than half of the disclosing governments expect to experience increased water stress or scarcity in the next decades, 70% considered that climate change threatens the ability of businesses to operate successfully in their regions, and 78% expect to face social risks as a result of climate change. Therefore, ***RegionsAdapt*** is seeking to drive the adaptation actions of its member regions further with ten adaptation recommendations for the future, listed below. Regional governments are encouraged to implement these recommendations as soon as possible before 2020 in order to build on the momentum of the Paris Agreement's entry into force. As the data collected through this reporting process also reveal, no doubt remains that regional governments play a crucial role on climate adaptation. The wide array of adaptive actions reported confirms that these actors hold key responsibilities related to the adaptation pathways of the territories under their jurisdictions. Regional governments´ specific scale of action presents a unique perspective to tackle cross-cutting issues that are crucial for climate adaptation, such as water supply, food security, and rural-urban linkages. Moreover, they are well-positioned to integrate local and national levels, coordinate action among municipalities, and offer innovative approaches to national adaptation strategies. Finally, in addition to the clear contributions that these actors may offer to the adaptation goals of their own countries, the data disclosed in this piece of work also underscore a huge underlying potential for regional governments to cooperate among themselves. In fact, since climate impacts are recurrently shared across boundaries, adaptation solutions can also frequently be replicated in different jurisdictions. Among the purposes of ***RegionsAdapt***, lies the attempt to explore this quite untapped potential.

Ten Adaptation recommendations for the future

- Carry out vulnerability assessments to understand physical, social and economic vulnerability to climate change and to identify adaptation measures.
- Develop a strategic approach to adaptation and prioritize adaptation actions.
- Take concrete action on adaptation in at least one of the key priority areas identified through RegionsAdapt.
- Foster citizen and community engagement in your region to develop and implement sustainable adaptation actions.
- Build lasting relationships with your regional industries to learn why adaptation matters to them.
- Engage your national government in dialogue to support the implementation of integrated National Adaptation Plans and policies.
- Integrate climate change and adaptation as a cross-cutting topic in your sectoral policies.
- Exchange and learn from other regions worldwide.
- Mobilize finance for climate change adaptation from public and private sources.
- Report data on your adaptation actions on an annual basis and track your progress.

List of tables

List of figures

List of images

Acknowledgements

Authors:
Felipe Santoro, nrg4SD
Joan França, nrg4SD
Sara Kupka, nrg4SD

Design:
Thais Ferraz, nrg4SD

Special recognition to:
Chris Thorpe, CDP
Joana Setzer
Natalia Vera, nrg4SD
Rodrigo Messias, nrg4SD

About nrg4SD

nrg4SD
Network of Regional Governments for Sustainable Development

The nrg4SD (Network of Regional Governments for Sustainable Development) is a network of regional governments that share common interests in climate change, biodiversity and sustainable development. It was established in 2002 at the World Summit in Johannesburg, and today has over 56 members from 28 countries spanning 4 continents. The nrg4SD is the only international network focused on sustainable development matters that represents solely regional governments. The nrg4SD acts as the voice of regional governments at UN negotiations, European Union initiatives and global discussions on environmental and sustainable development affairs. The nrg4SD facilitates collaboration between its members, promoting sustainable policies and actions in their territories. The nrg4SD also acts as Secretariat of the *RegionsAdapt* initiative.

nrg4sd.org | @nrg4SD | #RegionsAdapt

About CDP

CDP
DRIVING SUSTAINABLE ECONOMIES

CDP, formerly the Carbon Disclosure Project, runs the global disclosure system that enables companies, cities, states and regions to measure and manage their environmental impacts. Over the past 15 years CDP has created a system that has resulted in unparalleled engagement on environmental issues between investors, companies, cities, states and regions worldwide. CDP's data enables its network to link environmental integrity, fiduciary duty and public interest to make better-informed decisions on climate action. CDP is an international organisation, with regional offices and local partners spanning 50 countries. There are now over 5,500 companies, 530 cities, and 100 states and regions from over 90 countries that disclose through CDP.

cdp.net | @CDP

Appendix

Descriptions of physical risks from climate change

Droughts: More frequent and more intense

Decreased water availability - potable, as well as non-potable - is one of the many threats posed by droughts. In the Australian Capital Territory, this might result in increased city heat and a decreasing amenity and livability for the population. In other places, like British Columbia, more incidents of drought may increase the risk of forest fires. The agricultural sector is also highly affected by droughts. In South Australia, food and wine production will be reduced – among other consequences for the state. In Quebec, the likelihood of conflicts over water use for domestic and agricultural purposes will be increased, Pichincha and Tocantins fear negative consequences for family farmers, and the North and Northwest of Rio de Janeiro is facing increased desertification due to past deforestation. In Gossas, agricultural production in rural areas fully relies on the rainy season, a situation implying that droughts will have serious impacts on the life of the population.

More extreme rainfall events

More than half of the disclosing regional governments face the risk of more frequent and/or intense rainfall as a result of climate change. In some parts of British Columbia, intense rainfall may increase the chances of landslides and debris torrent, as well as exceed the capacity of municipal drainage and sewage systems. In Jalisco and Quebec, more frequent and/or more intense rainfall will lead to an increased likelihood of flooding. In South Australia, intense rainfall will also have negative impacts on primary production yields and natural tourist attractions, like the difficult access to Flinders Ranges via unsealed roads. The government of Prince Edward Island sees an additional problem of more intense rainfall in the increased runoff of agrochemicals which has already caused damage to aquatic ecosystems. In Alberta, a significant amount of precipitation can occur in just a few hours, leading to severe flooding, risk to human life, damage to buildings and infrastructure, loss of crops and livestock and disruption to transportation and communication.

Change in the seasonality of rainfall

The province of Prince Edward Island lists regular rainfall as critical during the growing season to ensure viable and marketable crops. Changing rainfall patterns may, therefore, threaten the province's agriculture as a key driver for its economy. In South Australia, changing rainfall patterns also will have impacts on flowering, pollination and fruit set of crops, making changes in agricultural practices and capabilities necessary – including changes in crop types. But changes in seasonality affect not only the agricultural sector. In Quebec, for instance, it also leads to seasonal changes in hydroelectric productivity, impacts on water management practices, e.g. dam regulation, and an increase in the likelihood of forest fires through longer periods without rain. This will damage infrastructure and buildings, and will also decrease air quality. In Lombardy, a change in rainfall patterns means the loss of biodiversity through the extinction of species, habitat modification and shifts in species distribution. KwaZulu-Natal expects to suffer from more flash flooding, increased erosion in the long term and more sediment in streams. Groundwater recharge and water quality may also be affected in the future. Climate change not only alters the shift of dry and wet seasons, which leads to serious consequences for the regions, but its impacts also vary according to the season of the year and the mode of precipitation. In British Columbia, increased precipitation in summer may moderate the risk of forest fires as a positive impact, but changes in precipitation from snow to rain as a result of milder winters may negatively affect the water availability later in the year.

Warmer conditions: Heat waves, more hot days and hotter summers

In some parts of the world, heat waves will become more frequent and intense. They will last longer and have higher temperatures. Summers will tend to be hotter and hot days will occur more often. This will not only affect the environment but also poses threats to the local population, particularly those vulnerable to heat stress. The elderly (aged over 65 years old) and chronically ill will likely constitute the social group most vulnerable to thermal stress. This can lead to loss of lives, impact on community service organizations that support vulnerable communities exposed to heat stress, higher costs for the healthcare sector and decreased human productivity, as described by Lombardy, the Basque Country, Catalonia, Quebec, the Australian Capital Territory, South Australia and British Columbia. The reduced availability of irrigated outdoor recreation areas and poorer air quality will increase respiratory illness, while increased severity of pollen related allergies may lead to increased morbidity and mortality among at risk population. Catalonia is currently experiencing climate change through an increase in the annual mean temperature of 0,24°C per decade. Additionally, the surface temperature in the territory is likely to increase by 0.8°C in the next decade and by 1.4°C until 2050. These trends may be even larger in the Pyrenean region and in summer. An increase in the number of tropical nights (days with a minimum

temperature of over 20°C) is forecasted for the period 2001-2050, which could be as much as 7% higher than the average for the period of 1971-2000. In Jalisco, this trend is even more alarming. For the metropolitan area of Guadalajara, the average temperature is prone to increase between 3°C to 3.6°C on average by the year 2090, and in the Altos and South regions an increase of up to 85 days of summer is expected. This may lead to a boost in cases of dengue fever on the state's coast. Hotter conditions will also have negative effects on water and energy supply, which will mainly affect the most vulnerable people, as well as the agricultural sector, which will also be negatively affected. KwaZulu-Natal reported that more hot days will lead to increased evaporation and increased water requirements for plants. This may cause a reduction of natural yields and reliability. British Columbia also mentioned the impacts on crops and livestock. Higher recruitment and survival rates of forest insect pests, like the Mountain Pine Beetle, as a result of milder winters and warmers summers have led to the destruction of 50% of the total volume of commercial lodgepole pine in the province since the early 1990s. Quebec also sees a risk in the increase of harmful species and the likelihood of zoonotic diseases because of warmer conditions. The same occurs in Alberta, where the government observes that many forest species are expanding their ranges into more northern regions. The government also mentions the Mountain Pine Beetle as an example, which now occurs further North in Alberta than ever before. In the Australian Capital Territory, heat waves will have negative effects for the ecosystems in the territory and will increase the vulnerability and loss of species. In both the Australian Capital Territory and South Australia, bushfire risk will increase due to warmer conditions and heat waves.

Regions will not be strictly affected by the negative effects of climate change, however. In British Columbia, for example, the change in minimum daily temperatures will be faster than the change of maximum temperatures – especially in winter. This may provide benefits in terms of reduced energy demand for heating during cool seasons. Quebec also mentioned a decrease in the overall electricity demand because of milder winters but, on the other hand, an increase in cooling loads in summer.

Warmer water temperatures and sea level rise

One third of the governments revealed sea level rise as a physical risk resulting from climate change. In some regions, an important amount of people live near the coast and by rivers, like in the Basque Country and British Columbia, and these people could be at risk of flooding. Sea level rise not only poses a threat to human lives but also to what results from the loss of beaches, coastal ecosystems, critical infrastructure and buildings, as well as damage to agricultural land and natural environments. Similar concerns have been mentioned by Quebec and South Australia, for instance. Increased insurance premiums or the inability to obtain property insurance are some economic consequences also resulting from this trend. In British Columbia, sea level rise and increasing ocean acidity pose major threats to coastal habitat and infrastructure. Increased salinization of surface and groundwater (saltwater intrusion) represent another challenge. Additionally, warmer water temperatures may impact commercially and ecologically important fisheries. In Catalonia, the raise in water temperatures, together with a decrease of fresh water and the lack of predators, leads to growth of jellyfish, which pose a threat to people during the bathing season. As a response, the government created a specific program to monitor jellyfish population during the length of the bathing season so as to alert people of that threat thanks to a specific flag.

Reduced average annual rainfall

Nine regional governments reported to face this impact already, or will face it in the short and medium term. The impacts of reduced rainfall are felt especially in the agricultural sector, since it is highly dependent on water availability. In Sud Comoe it reduces agricultural yields and in South Australia, food and wine production are reduced and quality and nutritional value of these products is affected. Farmers in KwaZulu-Natal, therefore, switch to more water efficient crops, such as sorghum or millet. As mentioned by Alberta and South Australia, reduced rainfall also means reduced flow and quality of water into water storages, rivers, wetlands and estuaries, which can result in reduced water supply with economic impacts, if supplies are curtailed significantly. Biodiversity loss, increased risk of soil erosion and reduced forestry growth rates may also result from less average annual rainfall. Droughts and desertification may result from this, as well as drying out of lakes and ponds, like the projected in Esmeraldas and Tombouctou. In Tocantins, where a reduction of rainfall with a shortening rainy season is already observed by the population, losses to the state economy and to the population are predicted.

Increased frequency of large storms

Large storms have a wide range of effects. Seven governments that reported through the platform said that they are already suffering or will suffer, in the short to medium term, from the consequences of an increased frequency of large storms. The Australian Capital Territory, for example, will face this in the next ten years. These storms will bring more intense rainfall with flash flooding and damaging winds. This will damage buildings and infrastructure and will also mean potential loss of lives for the population, loss of productivity, increased living costs and higher insurance premiums, as well as higher costs for the government resulting from repairing and rebuilding existing infrastructure. Coastal communities in British Columbia already face flood risks related to precipitation and river flows with climate change exacerbating these incidents. In Quebec, the increased frequency of large storms will increase the likelihood of damage to the energy production and transport network with disruption of freight and people transport networks. Storm surges, as well as coastal erosion may result in damage to infrastructure and buildings. A decrease in efficiency or damage to electricity transport network is also expected. These impacts

will affect business continuity in the province. The State of Rio de Janeiro has suffered extremely serious natural disasters over the past five years, especially those derived from very large storms. The physical and economic geography of Rio de Janeiro mainly contributes to worsening the effects of climate change. The population is concentrated in coastal and mountainous areas, where rainfall is stronger. Deficiencies in urban infrastructure and drainage systems also contribute to severe flooding and landslides. In April 2010, 270 people died after heavy rains in Bumba, a low-income community in Niteroi, a municipality of the metropolitan region of Rio. In January 2011, a huge tragedy killed a thousand people in the mountainous region of the state and in December 2013, more than 50 people deceased in a heavy rain in Angra dos Reis, a touristic city in Costa Verde region, on the Southern coast of Rio. Thousands of people were left homeless and the financial losses of the companies were more than $200 million due to declining sales and losses of stock and equipment.

Greater temperature variability

Among the other physical risks reported by the governments is the one of greater temperature variability. In Alberta, where this risk is expected to occur in the long term, it will result in an increase in extreme weather events, like drought and fires. In Cross River State, greater temperature variability has come with adverse effects on agriculture, leading to low productivity, flooding, drought and health hazards. In British Columbia, greater temperature variability may not only impact the agricultural sector, but changes in the frequency of freeze-thaw cycles may have important impacts for certain infrastructure in cold regions of the province. More freeze-thaw cycles are also affecting the province of Quebec, where it leads to increased damage to roads, supporting structures and retaining walls. In Jalisco, greater temperature variability will mean up to 27 days on average of frost more than in previous seasons.

Reduced average annual snowfall

A decrease in average annual snowfall was reported by four governments: Lombardy, Quebec, Catalonia and British Columbia. In many parts of British Columbia, snowpacks are projected to decrease, and snow is projected to melt earlier. This means less runoff in summer and less water for agriculture, hydropower, industry, communities and fisheries. In Catalonia, less snow will be available in the mountain areas, where ski tourism is common. Lombardy also sees impacts in the tourism sector due to the rise of the snow cover limit. Additionally, to losses in winter tourism, Quebec views reduced snow cover protection of crops during extreme winter cold events as a risk resulting from climate change. A research on this will be conducted between 2015 and 2018.

Increased average annual rainfall

In the State of Rio Grande do Sul, the precipitation is projected to increase on average in all seasons. On the other hand, British Columbia identifies positive impacts of more rainfall. More water may be available in the province to recharge groundwater aquifers, maintain river flows and replenish soil moisture. Hydroelectric power generation, irrigation and domestic water use may also benefit from that.

Other physical risks from climate change and compounding factors that may worsen its impacts

The reporting governments also identified other physical risks resulting from climate change, often accelerated through other human induced pressures. In Jalisco, loss of endemic species is caused by changes in temperature and urbanization. Quebec mentioned that milder winters will favor the spreading of vector-borne diseases to the North, like Lyme disease and the West Nile Virus. Western Province reported climate change impacts associated with global warming effect by way of rainfall changes (droughts, floods, flash floods), temperature rise, sea level rise and changes to ecosystems, among others. Sud Comoe reported coastal erosion and hinterland desertification as physical risks resulting from the impacts of climate change. In Tombouctou, forest degradation and animal extinction, the degradation of riverbanks, the drying out of lakes, the siltation of farmland, the reduction in cultivable area per family, as well as food insecurity and conflicts are physical risks connected to climate change. In Azuay, several mining projects are planned. If these mining projects are implemented, they will put water sources at risk. Land use change and the loss of plant cover would jeopardize the survival of emblematic and endangered species, like the white-tailed deer, the spectacled bear, the Andean tapir and the condor – among others. Compounding factors that will worsen the impacts of climate change in Morona Santiago are salinization of soil, modification of the topography of river banks and modification of biodiversity patterns. Rio Grande do Sul relies greatly on agriculture and climate change impacts in the state are mainly related to water scarcity or excess events, so that the state is expected to suffer significant economic impacts. Irrigation demand is expected to increase, especially in months that are projected to be most affected by droughts. In addition to that, agricultural malpractices have significantly reduced soil retention capacity, which contributes to the impacts of increased rainfall and more severe droughts. Poorly-planned urbanization, loss of natural areas and growing populations are worsening factors in Jalisco and in Gossas, where the degradation of land and vegetation may worsen the impacts of droughts. The use of wood for kitchen is also another risk factor in Gossas. While this list of worsening factors to climate change is far from complete, it nonetheless illustrates that holistic approaches are needed in order to adapt to climate change and reduce vulnerability.

Contact

regionsadapt@nrg4sd.org
ww.nrg4sd.org/climate-change/regionsadapt
#RegionsAdapt

Network of Regional Governments for Sustainable Development

Chaussée d'Alsemberg 999- B-1180, Brussels, Belgium
www.nrg4sd.org – nrg4sd@nrg4sd.org
twitter: @nrg4sd #Regions4Climate #RegionsAdapt #Regions4Biodiv