WATER AND CLIMATE, **ACTING FOR THE FUTURE**

APRIL 2015 The French know-how to respond to climate change

PROJET LABELLISÉ
PARIS2015
COP21-CMP11

french water partnership
fwp pfe
partenariat français pour l'eau

Contents

PAGE

Editorial

The world has entered an era of severe climate change due mainly to human activities.

Water is the first resource affected by these changes, notably in the most threatened regions in France and internationally.

These threats question the sustainable management of water resources and our capacity to provide for basic needs including access to drinking water and sanitation, food security, energy, public health, ecosystem protection and social and economic development.

France will have the great honor and responsibility of hosting the 21st Conference of Parties to the United Nations Framework Convention on Climate Change (COP21) in November and December 2015. The aim of the conference will be to reach a fundamental agreement for the future of our planet.

This agreement must include water as a central element in enabling us to adapt to change and water must be one of the areas that is fundamental for the allocation of climate funding.

This document highlights the climate-compatible actions carried out by French water stakeholders in France and internationally to mitigate and adapt to climate change. These initiatives were pre-selected by a multi-stakeholder steering committee consisting mostly of scientists. These actions serve as input to the Agenda of Solutions listing all the good practices supported or implemented by governments and non-state actors.

Actions set out in this document demonstrate the ability of all stakeholders to take action to respond positively to the challenges of the century: the climate is everyone's responsibility! Decision-makers at all levels should get involved in concrete initiatives to ensure that actions to protect the climate also protect water resources and vice versa!

Henri Bégorre,
President of the French Water Partnership

Jean Jouzel,
Research Director at the French Alternative Energies and Atomic Energy Commission (CEA)
Vice chairman of the first IPCCs' Working Group

1 CLIMATE CHANGE: A GLOBAL PHENOMENON WITH LOCAL IMPACTS

Climate change (FOCUS) is a global phenomenon that endangers a "global public good": the atmosphere. By definition, it crosses human boundaries and has a local impact on everyone's way of life.

The challenge today is to address the climate change caused by emissions of greenhouse gases (GHGs) from human activities. According to the Intergovernmental Panel on Climate Change (IPCC) (FOCUS), it manifests itself through a rise in mean atmospheric surface temperatures. The observed impacts of climate change cannot be reduced to this symbolic observation. There are a set of different and complex impacts which vary from one world region to another.

Layers of uncertainty

A number of uncertainties surround climate change. They can be classified in different categories:

- **scientific and technical uncertainties** surrounding the limits of the available knowledge on climate events needed to establish reliable models of climate changes, in particular at the local scale;
- **uncertainties surrounding natural climate variability;**
- **uncertainties surrounding states' future greenhouse gas emissions**, which depend on each state's socioeconomic changes;
- **uncertainties related to retro-actions, meaning the difficulty to assess impacts** of the current emissions which may have consequences 100 years from now (over a long time scale).

These uncertainties must be incorporated into policymaking and should not serve as an excuse for inaction.

FOCUS

Climate change

Climate change is the statistically significant variation in the state of the climate or in its variability, persisting for an extended period of time. Climate change may be attributable to human activities that alter the composition of the atmosphere and to natural causes.

Ministry of Ecology

FOCUS

The IPCC

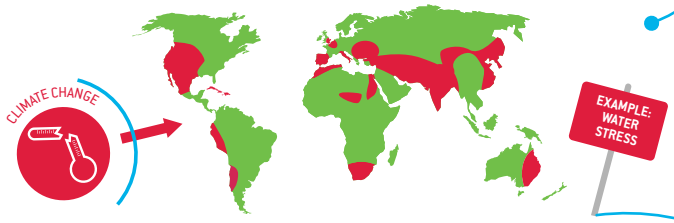
The IPCC (Intergovernmental Panel on Climate Change) was created in 1988 by the 195 Member States of the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP). The IPCC produces reports at regular intervals outlining current climate knowledge. These reports are intended in particular for policymakers through the "Summary for Policymakers" (SPM). The last report (5th report, 2014) essentially reiterates: 1 the responsibility of humans, 2 concerns about a shift away from the global goal of keeping the global temperature rise below 2°C set by the **UNFCCC (United Nations Framework Convention on Climate Change)**, 3 gives more emphasis to adaptation, which has become essential, 4 and stresses that climate change increases the risks to human and environmental safety.

"Better Understanding the IPCC," Ministry of Ecology, Summary Report-Summary for Policymakers, IPCC, 2014

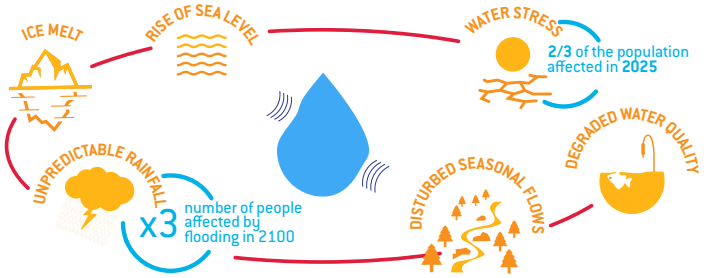
Water and climate: a clear match!

Water is under pressure

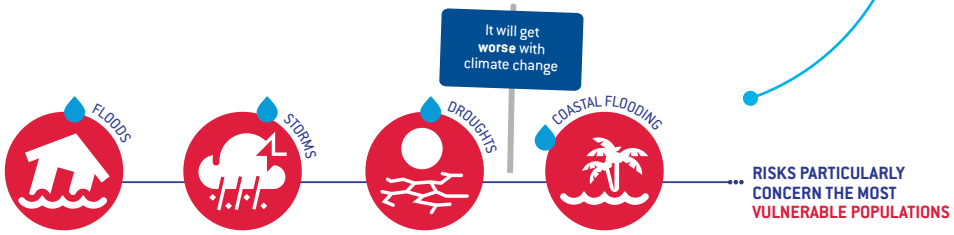
Climate change has local and differentiated impacts



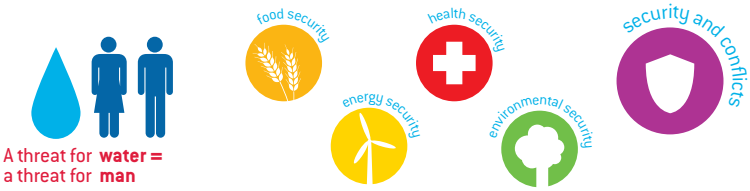
Water ressources are threatened by climate change



90% of all natural hazards are already water related

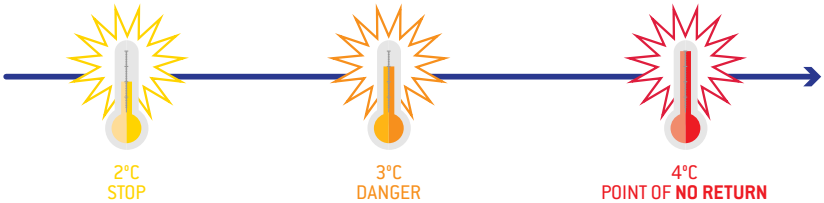


These changes are a threat for mankind



If we do not act, threats of social and political conflicts will arise

A goal for the world : Keep global warming below 2°C



TO GO FURTHER watch the full motion graphic "Water and climate, a clear match !" on our website **www.french-water-partnership.fr**

MITIGATION:
Mitigation refers to our capacity to limit greenhouse gas emissions from human activities that cause climate change.

ADAPTATION:
Initiatives and measures implemented to reduce the vulnerability of natural and human systems to the effects of climate change, whether real or anticipated.

Cascading consequences: water in the context of major global challenges

*Climate change is connected to other **global changes**. Population growth, urbanization and changing lifestyles are primary issues questioning our future development: how will we feed, educate, shelter and provide heating for instance, for a growing population with scarcer resources?*

Water is a key resource in these development challenges, aside from the immediate issues surrounding access to drinking water and sanitation services, it is a fundamental resource notably for food security as well as energy, human health...

90%
of disasters are water-related
WWDR4, 2012

IPCC, 2014

Water, the source of life, is also a source of tragedy. Although the link between changes in the frequency and intensity of natural disasters and climate change is still unclear, **the effects of these natural events and water-related crises in general (conflict, epidemics, etc.) are worsening** and people and property are increasingly affected. Flood-related costs have already increased, largely due to increased exposure of people and property. At the end of the 21st century, the number of people exposed to the risk of flooding could triple, resulting in significant human and economic losses (IPCC, 2014). This means that although climate change does not create new risks, it further aggravates already-known risks. Risk management is therefore not fundamentally transformed by these impacts but must take into account these new uncertainties.

88%
of water used in the world is used for rained and irrigated agriculture
IWMI data, 2007

Agriculture and food security are highly threatened by climate change. "Risk of food insecurity and the breakdown of food systems linked to droughts, and precipitation variability" as well as "risk of loss of rural livelihoods and income due to insufficient access to drinking and irrigation water and reduced agricultural productivity" are two of the six major global risks identified by the IPCC (2014) with "high confidence." Africa and the Middle East are particularly affected but Europe clearly is and will be concerned by these changes as well. Every aspect of food security (access, availability, quality and regularity) will be affected, resulting in **major repercus-**

FOCUS

The land sector

The land sector (agriculture, food security, forests and soils) and contributes to greenhouse gas emissions. This sector, which is directly linked to water, represented 24% of greenhouse gas emissions in 2010 (IPCC, 2014). This sector is also vital for mitigation because it represents a natural carbon sink. Mitigation related to land use may contribute 20 to 60% of the greenhouse gas emissions reduction potential by 2030.

IPCC, 2014

sions for global commodity prices, poverty and economic growth. "Poverty traps" will multiply in vulnerable areas, which will have to face migrations, while generating conflicts and risks for some States' integrity (IPCC, 2014). Food dependency in resource-poor countries will increase, pushing countries with plentiful water resources to produce even more water. Agriculture and rural settings must therefore be given a new priority to enable them to adapt as well as contribute to the mitigation goal (FOCUS).

Globally,
the energy sector is the
2nd
largest water user

The link between water and energy, which are the basis for essential services, works in both directions. First, most energy production methods require significant quantities of water, either directly (agricultural crops for bioenergy, and hydroelectricity) or indirectly (cooling for thermal power plants). However, in some regions, constraints linked to water already affect the reliability of energy production and will impose more and more additional costs (IEA, 2012). Warmer water temperature has an adverse effect on operations for some thermal power plants due to a lack of cooling water. Altered flow rates can make some dams less profitable or even useless, while others will experience enhanced production levels. Energy demand is growing, especially in non-OECD countries, placing further pressure on water resources. Energy is also essential to the whole cycle of human water use, from extraction by pumping to transport, treatment, desalination and various other uses, including for irrigation or industry and wastewater treatment. Impacts on availability and quality risk to increase carbon based energy demand.

By 2025, **1,8**
billion people will live in countries or regions facing absolute water shortages (less than 500 m^3 annually per person)

FAO, 2007

The impacts on health are also extremely significant. Declining water availability in many regions, partially due to climate change, is such that **two thirds of the global population may be exposed to conditions of water stress** (i.e. between 500 and 1,000 m^3 annually per person) according to the FAO (2007). Warmer surface water temperature in certain areas of the planet and seasonal flow perturbations generate **more waterborne and infectious diseases including those related to mosquitoes and ticks.** The quantitative decrease linked to warmer water temperature reduces the dilution phenomenon, causing an increase in the concentration of pathogens and contaminants (medical pollution; micro-contaminants; plant protection products) and direct risks to health. A drop in water quality also poses the risk of making water less rich in nutrients. Consequently, water treatment and purification costs rise in affected regions and access to high-quality, affordable drinking water is compromised. So-called essential water and sanitation services, as different as they may be throughout the world, are thus on the front line of climate change, in particular smaller facilities, which are the most fragile (IPCC, 2014).

Freshwater ecosystems lost

76%

of their species between 1970 and 2010

WWF, 2014

Biodiversity and aquatic ecosystems are deeply affected by water-related issues associated with climate change. **Freshwater systems are adversely impacted by the loss of water quality in some regions** induced by climate change, as well as the construction of certain dams and levees that disturb water flows through the fragmentation and alteration of natural habitats, anthropogenic pollution and overexploitation of species. Wetlands, which are rich in biodiversity as well as a natural infrastructure for storage during dry periods and drainage during wet periods, are especially threatened in dry regions or regions where water resources are subject to extreme pressure. **With these environmental changes, some species take the place of others.** For example, increasing water temperatures in lakes and reservoirs accelerate eutrophication and algae growth, reducing the amount of oxygen available for other species (IPCC, 2014). Salmon and trout are also likely to disappear in favor of French rivers carp and pikeperch (Poulet et al. ONEMA, 2012).

Even if we reduce emissions, adaptation costs would reach 2 to 3 times forcasts, currently estimated around

70-100

billion dollars per year

PNUE, 2014

Although it is difficult to determine the proportion of the funding required specifically for climate adaptation among those required for other global changes such as demography and lifestyle changes, **there is still a great need to adapt to these new contexts, especially in regard to water resources!**

Adaptation is always less expensive than not taking action. The cost of inaction increases over time and eventually may become unsustainable.

IPCC, 2014

In developing countries, anticipated adaptation costs are highest in coastal areas as well as for water supply services and flood management according to the data cited in the "Adaptation Gap Report 2014" from the United Nations Environment Program (UNEP):

ADAPTATION COST ESTIMATES FOR DEVELOPING COUNTRY REGIONS AND SECTORS (OVER TIME PERIOD 2010-2050)

RÉGION	US$ BILLION	SECTOR	US$ BILLION
East Asia and Pacific	17,9	Infrastructures	13,0
Central Asia	6,9	Coastal zones	27,6
Latin America and Caribbean	14,8	Water supply and flood protection	19,7
MiddleEast/North Africa	2,5	Agriculture, forestry, fisheries	3,0
South Asia	15,0	Human health	1,5
Sub-Saharan Africa	14,1	Extreme weather events	6,4
TOTAL	71,2	TOTAL	71,2

World Bank (2010) in "Adaptation Gap Report", PNUE, 2014

2 AN INTERNATIONAL RESPONSE TO A GLOBAL CHALLENGE ? CLIMATE NEGOTIATIONS

*Climate change is a **global challenge** that knows no boundaries but which has **varying impacts on water at the local level**. Initiatives must be developed at ALL levels - international, regional and local-to address climate change.*

Climate negotiations

The 195 Parties to the UNFCCC have been committed to a common response to climate change since the Earth Summit in 1992. A number of tensions have emerged in the negotiation process (FOCUS). Indeed, although the problem is global, there are almost as many perceptions of the issues surrounding climate change as there are Parties to the Climate Convention. Reaching an agreement among 195 countries in an increasingly multipolar world on a subject that directly affects the quality of life of all is a monumental task, despite the growing awareness of the urgency of these issues over the past few years, made possible essentially by the efforts of the IPCC.

1992 Rio
Rio Earth Summit
United Nations Framework Convention on Climate Change (UNFCCC)

1997 Kyoto Protocol
Binding targets for reducing the greenhouse gas emissions of 37 developed countries
Ratified by 193 countries but not the United States…

2005 Montreal
Entry into force of the Kyoto Protocol
Adaptation Fund
Clean Development Mechanism
Nairobi work programme

2007 Bali
Continued negociations and roadmap

2009 Copenhaguen
Agreement on a target for holding the increase in global temperature to no more than 2°C above pre-industrial levels

2010 Cancun
REDD+ mechanism
Transparency of actions, through the measuring, reporting and verification (MRV) system gain in importance

2011 Durban
1st roadmap for a post-Kyoto Protocol agreement in 2015
Canada withdraws from Kyoto Protocol

2012 Doha
Launch of the 2nd period of the Kyoto Protocol

2013 Warsaw
Mechanism for loss and damage
Promise to establish Intended Nationally Determined Contributions (INDCs)

2014 Lima
Roadmap is clarified and timetable is determined
INDCs envisioned

2015 Paris
Projected signature of a global agreement for the post-2020 period (end of the Kyoto cycle)

Paris: a COP unlike any other

*COP21 will be held from November 30 to December 11, 2015, in Le Bourget near Paris under French chairmanship. It should result in the signing of an ambitious global agreement that was prepared at COP20 in Lima, Peru, in December 2014. This agreement will be the first of its kind since the Kyoto Protocol was signed and is known as the **Paris Alliance for Climate.***

COP21 in Paris is an especially decisive event because it is part of the end of a cycle and lays the groundwork for a successor to the Kyoto Protocol in the post-2020 period. The context has changed profoundly since the Kyoto Protocol was signed in 1997 and now requires defining new forms of global solidarity that increase the involvement of emerging countries in strategies to reduce their greenhouse gas emissions and address the concerns of many poor countries regarding their capacity to cope with the essential adaptations that will need to be made.

PARIS ALLIANCE FOR CLIMATE

1st Pillar THE AGREEMENT

The agreement planned for December 2015 is the "first pillar" of the Paris Alliance for Climate.

2nd Pillar THE INDCS

All the Parties, and not only developed countries as in the Kyoto Protocol, are encouraged to publicly outline their Intended Nationally Determined Contributions (INDCs) under the agreement. The INDCs are detailed national action plans aimed at reducing greenhouse gas emissions and supporting adaptation from 2020 onwards. These INDCs will be outlined by each country before March 31, 2015, "for those who are able" and no later than May 31 for all countries. A report summarizing the 195 INDCs will be published in October or November. They will serve as a crucial step for measuring each country's commitment and building trust.

3rd pillar FUNDING

The Green Climate Fund (GCF) will be the main financing mechanism to support climate action by 2020. 10 billion USD were mobilized for this Fund during the COP held in Lima, but the conditions for raising the 100 USD per year that the Green Climate Fund will need in order to fund adaptation (50% of the funds) and mitigation initiatives are not yet clearly established.

4th pillar AGENDA OF SOLUTIONS

The Agenda of Solutions was set out by the United Nations and has France's full support. It represents a true innovation for COP21. This Agenda of Solutions contains all the initiatives involving governments and non-government actors that will be proposed in addition to the international agreement that is expected to be adopted in Paris. These initiatives aim to support and expand governments' commitments by implementing concrete initiatives to reduce greenhouse gas emissions, adapt to the impacts of climate change and fund these initiatives. These climate-compatible initiatives will be sustained by all non-governmental actors including cities, regions, regional authorities, companies, financial institutions, NGOs, associations, etc.

The French government is chairing this COP and will strive to be exemplary in this regard while also acting as a neutral facilitator for negotiations. For example, the government adheres to the ambitious climate goals set by the European Union and began implementing an energy transition reform in 2014. France committed 1 billion USD to the Green Climate Fund out of the 10 billion USD required for the Fund's launch.

FOCUS

What is a COP?

The Conference of the Parties (COP) was established when the United Nations Framework Convention on Climate Change (UNFCCC) was adopted at the Earth Summit held in 1992 in Rio de Janeiro, Brazil. It is the Convention's supreme governing body and serves as the meeting of the Parties to the Convention (the 195 states that ratified the Convention). It meets every year to follow up the application of the Convention, make decisions that further expansion of the rules already laid down and negotiate new commitments. The main negotiation aspects since the conference in Bali (2007) include **mitigation, adaptation, financing, technology transfers and transparency.**

The principle of "**common but differentiated responsibility**" recognizes historical differences in the contributions of developed and developing countries to climate change. This is a cross-cutting issue that applies to every aspect of the negociations.

French Ministry of Ecology

FOCUS

The Kyoto Protocol

The Kyoto Protocol, an agreement made within the UNFCCC but not signed by all the Parties, targets climate change by requiring developed countries that are signatories to the Protocol to reduce greenhouse gas emissions. Since 2005, the time period of entry into force of the Kyoto Protocol, the annual Conference of the Parties to the Kyoto Protocol (CMP) takes place at the same time as the COP.

French Ministry of Ecology

2015: a strategic year for water!

Mr. Ban Ki-moon, Secretary-General of the United Nations, has said a number of times that "Never before has the world had to face such a complex agenda in a single year. And this unique opportunity will not come again in our generation."

March 2015

The UNISDR (United Nations International Strategy for Disaster Reduction) defines its new "post-Hyōgo" framework for action for 2015-2015.

April 2015

World Water Forum in Daegu-Gyeongbuk. Civil society initiatives on water and climate will be presented.

September 2015

The UN General Assembly adopts the Sustainable Development Goals (SDGs) for 2015-2030.

Décember 2015

Signature of a legally binding agreement to figh climate change for the post-2020 period at COP21 in Paris.

Water is a common factor between these different major conferences and stands at a critical juncture between risk management, development and adaptation.

What role will water play in the negotiations?

195 parties, a number of subsidiary bodies, complex processes… What room is left for water in international climate negotiations?

Negotiations will focus mainly on greenhouse gas emissions, but water has a rightful role to play.

None of the thematic work programs focus on water and yet water-related issues can be found throughout the UNFCCC's operational framework for **adaptation**. As requested by many countries which generate low levels of greenhouse gases but remain concerned about their ability to handle the effects of climate change, the issue of **adaptation** plays an increasingly important role at each COP:

- The REDD+ Program on reducing emissions from deforestation and forest degradation in developing countries involves water, as a central ressource for nourishing forests.

- The mechanism on loss and damage that was adopted to "address loss and damage associated with climate change impacts in developing countries that are particularly vulnerable to the adverse effects of these changes, in particular extreme weather events and slow onset events" integrates water-related issues such as droughts, extreme rainfall, flooding, rising sea levels and coastal erosion.

- One of the main issues addressed by the work program on agriculture developed since the Durban Conference is adaptation to climate change to avoid water deficits. Other impacts include issues related to increasing soil carbon storage, which requires far-reaching changes in cultural practices and the reduction of methane emissions into the atmosphere from agricultural waste and farm livestock, which also involves water.

- Water earned a special mention as part of the Nairobi Work Program to support adaptation. The program aims to help countries better understand the impacts of climate change and vulnerability as well as to strengthen their capacity to make informed decisions about adaptation. Among other things, this program supports the National Adaptation Programs of Action (NAPAs) for least developed countries and provides a database on local adaptation strategies containing an index of local strategies and knowledge relevant to specific risks or climate conditions.

- The water sector has significant potential for mitigation and adaptation and therefore has a full role to play in the initiatives set out in the INDCs.

- Finally, water has a strong role to play in the adaptation and mitigation projects funded by the Adaptation Fund and the Green Climate Fund (with the gradual operationalization of the latter).

UNFCCC, FAO

Water can serve as a link between the (primarily UN) processes being implemented in 2015.

1 THE FRENCH WATER ACTORS' CONTRIBUTIONS TO THE AGENDA OF SOLUTIONS

The members of the French Water Partnership think that water should be the driving force behind international talks and policies at all levels, as well as an impetus of action.

Highlighting positive experiences from the water sector will contribute to this political mobilization and will help advance responses to climate change.

These experiences will be used to develop the Agenda of Solutions that will be presented at COP21.

Using water wisely can help mitigate CO_2 emissions in our atmosphere. The water sector also addresses the challenges of adapting to an already changing climate!

Adaptation is an increasingly common subject of international talks, as reflected in the Agenda of Solutions, but should not be seen as an admission of defeat in relation to mitigation. Faced with the threat of irreversible changes, both of these actions must be treated as two parts of the same issue, both in words and in action.
With this in mind, the French Water Partnership worked to identify climate-compatible initiatives carried out by French stakeholders in France and internationally. This inventory is non-exhaustive and new initiatives will continue to be added up to COP21.

To facilitate adaptation, we must continue to support mitigation efforts

IDENTIFICATION OF CLIMATE-COMPATIBLE INITIATIVES IN THE WATER SECTOR CARRIED OUT BY FRENCH STAKEHOLDERS

The climate-compatible initiatives included in this work meet the following principles:

- In line with the French Water Partnership's principles, priority was given to initiatives that highlight the benefits of combining the efforts of **several types of stakeholders;**
- The initiatives focus on **adaptation or mitigation** and special emphasis was placed on initiatives that take these two aspects into account;
- The initiatives address a **variety of water-related risks** relating to quantitative management (drought or surplus) of water, water quality, deterioration of biodiversity and ecosystems, coastal risks, greenhouse gas emissions, and more;
- These initiatives are more far-reaching than technological solutions and attempt to cover the **wide range of climate-compatible expertise**, from local programming to improving knowledge, engineering, information, awareness-raising, etc.

25 *initiatives set out in this publication and the full list in the following databases:*

Water Expertise France **http://business.ubifrance.com/water-expertise-france**

Hub des Solutions COP21 **http://www.solutionscop21.org/**

Portail de l'ONERC Wkhydro **http://wikhydro.developpement-durable.gouv.fr/index.php/Portail:Wikhydro**

Portail de l'ONERC Wiklimat **http://wiklimat.developpement-durable.gouv.fr/index.php/Catégorie:Ressources_en_eau**

My Positive Impact **http://www.mypositiveimpact.org/**

A more comprehensive list of initiatives is available in the appendix to this publication

2 DEFINITION OF CLIMATE-COMPATIBLE MEASURES FOR THE WATER SECTOR

One matter remains unsettled: how to develop relevant criterias for identifying and implementing climate-compatible water initiatives.

The current mechanisms and criterias used by decision makers and practitioners essentially concern greenhouse gas emissions, but they could-and should-also concern adaptation initiatives relating to water management.

The developed criterias could help decision-makers at all levels to take action. They could facilitate decision-making for funders, in particular under the Green Climate Fund and the Adaptation Fund. The criteria could also be used to enhance the MRV (measurement, reporting and verification) system adopted in the Bali Roadmap in 2007 by the UNFCCC. This consists in introducing measures for monitoring mitigation commitments or initiatives. The MRV system mainly concerns greenhouse gas emissions but should also cover adaptation.

These criteria should be linked to the United Nations Sustainable Development Goals (SDGs). The French Water Partnership and its partners have called for the inclusion of a Water Goal in these SDGs. The monitoring and progress indicators for this Water Goal cover sustainable development issues that are inseparable from adaptation issues and provide suggested topics of discussion for defining an approach for sustainable water management in shifting contexts.

In light of this need, the scientific steering committee of the French Water Partnership has launched initial discussions on the matter and will expand on these discussions in the future.

An analysis of identified actions reaffirms the need to base these criteria on resilience (FOCUS).

FOCUS

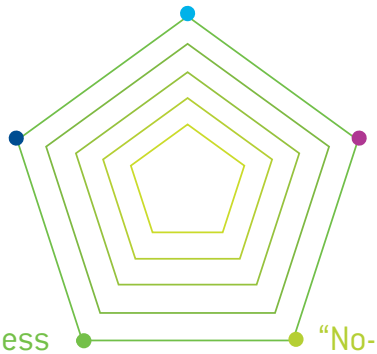
Resilience

Resilience is defined by the IPCC as the "capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation" .

IPCC, 2014

A RESILIENT ACTION TAKES INTO ACCOUNT THE FOLLOWING ASPECTS:

Flexibility and Sustainability
Addressing uncertainty, anticipating and ensuring the sustainability of the action.



Coherence
Strive to avoid maladaptation and counter-productive measures.

Win-Win
Generate positive social, environmental and economic externalities.

Legitimacy and Fairness
Encourage participation, set targets with stakeholders, pay attention to who wins and who loses in order to ensure acceptability.

"No-Regret" measures
Activities that yield benefits even in the absence of climate change.

FOCUS

Developing criterias at the international level for water and climate initiatives

In its publication "Guidance on Water and Adaptation to Climate Change" (2009), **the United Nations Economic Commission for Europe (UNECE)** provides concrete guidelines for analyzing vulnerabilities and identifying suitable and integrated measures for adapting to climate change. In particular, this guide highlights the "Climate Vulnerability Index" approach, which sets out important criterias for analysis at the local level.

The analysis of actions identified by the French Water Partnership highlights the importance of developing "**no-regret**" measures.

"No-regret" measures pose little risk, whatever the scale of global warming, and even in the absence of climate change. Water savings are one of many examples of "no-regret" measures.

The criteria to take into account should be based on an extensive analysis of the vulnerability of a population or region to given risks that covers more than just climate factors. This analysis must consider the reduction of greenhouse gas emissions (mitigation) as well as adaptation. This adaptation should take into account issues relating to social and economic development (Human Development Index, social, employment and gender inequalities) as well as environmental concerns (notably water footprints).

The concept of resilience represents a link between **risk management** (prevention and anticipation, responses to the crisis and reconstruction planning) and **sustainable development** (planning and sustainability) while also integrating the notion of **uncertainty** (flexibility).

PROPOSED STEPS FOR ASSESSING CLIMATE-COMPATIBLE PROJECTS FOCUSING ON SUSTAINABLE MANAGEMENT OF WATER RESOURCES

1 Identification
- Identification of components related to exposure to a climate risk
- Identification of the impact of the project/plan on natural or human systems' vulnerability to climate change

2 Detailed analysis of impacts
- Analysis of climate projections
- Analysis of current and future vulnerabilities

3 Develop and prioritize measures
- Identification of links between activities
- Assessment of risk management capacities
- Identification of options for responding to climate change (mitigation and adaptation)

4 Integration and assessment
- Integration of measures for responding to climate change
- Identification of additional needs
- Assessment of options with regard to climate change

J. Duvernoy, ONERC, 2015

3 WATER AND CLIMATE: LESSONS-LEARNT AND FRENCH EXPERTISE

When analyzing the expertise and experience of different French water stakeholders (local authorities and parliamentarians; governments and public institutions; economic stakeholders; NGOs, foundations and associations; scientific and technical research and training institutions), major guidelines for actions emerge, although they are not exhaustive and are tied to their local context. They have the advantage of serving as initial ideas for developing measures and guidelines.

Strengthen knowledge

Strengthening knowledge is crucial. This will require 1 a better understanding of the vulnerabilities of regions and populations, modeling of climate hazards at different scales (especially local scales) and a greater awareness of the links between climate change and global changes. These efforts will be carried out in keeping with the priorities established at the World Water Forum 2012 in Marseille (FOCUS).

French stakeholders, including the Simon La Place Research Institute, Météo France, French National Center for Space Studies-CNRS (COPERNICUS program), National Research Institute of Science and Technology for Environment and Agriculture-Irstea, The French geological survey-BRGM, Institute of Research for Development-IRD, National Institute of Agronomic Research-INRA, National Center for Scientific Research-CNRS and the partners of research programs such as Explore 2070, PIREN-Seine and Garonne 2050, have conducted cutting-edge research on improving knowledge, modeling climate hazards at the local and territorial scale and concerning the various water-linked sectors.

See actions: Municipality of Hyères-les-Palmiers sheet no. 2, Adour-Garonne Water Agency sheet no. 4, DEAL Martinique sheet no. 7, BRGM sheet no. 21, Météo France sheet no. 25

FOCUS

The priorities for water and climate of the 6th World Water Forum (Marseille 2012)

1 Climate change generates new uncertainties that should lead us to revise our planning and IWRM models.

2 Resilience must become a new factor in the assessment of water-related activities.

3 Climate change and global changes are closely linked.

4 Finding ways to improve dialogue between scientists and decision-makers.

EXPERTISE

The PIREN-Seine (interdisciplinary environmental research program) was developed by **the CNRS and Seine-Normandy Water Agency, the Climate Change Management and Impacts program (GICC) program and the Ministry of Ecology in partnership with Irstea, Météo France, BRGM and the design firm Sogreah.** The aim of the PIREN-Seine program is to highlight the sensitivity of water resources in the Seine basin to climate change and to assess the possible changes in various climate scenarios on river flows and groundwater levels throughout the entire basin. These results were used to draft the **Water Development and Management Master Plans (SDAGE) 2016-2021 for the Seine-Normandy basin**. The aim of the SDAGE is to adapt the basin's management of new and emerging issues caused by climate change. **This is a direct implementation of the IWRM+ .**

2 The strengthening of dialogue between science and policymaking is especially important in a context of climate change. This allows for addressing uncertainties, which feeds into policymaking. **See action: ONEMA sheet no. 9**

The French National Agency for Water and Aquatic Environments (ONEMA), the Water Agencies as well as the French National Observatory on the Effects of Global Warming (ONERC), the Natural Spaces Conservatory of Haute-Savoie (Asters) and the French Research Institute for the Exploitation of the Sea (Ifremer) play an important role (among other stakeholders) in helping decision-makers make informed decisions.

3 **In France, these approaches have been used to take into account climate change in the Water Development and Management Master Plans (SDAGEs) at the basin scale and at a more local scale in the Water Development and Management Plans (SAGEs).**

See actions: Adour-Garonne Water Agency sheets no. 4, Rhône-Mediterranean-Corsica Water Agency no. 5, Ministry of Ecology sheet no. 8, Asters sheet no. 18, Ecoles des Mines de Douai-Artois-Picardie Water Agency sheet no. 22 and Ifremer sheet no. 23

IWRM+

The development of knowledge on climate and its impacts on water resources makes it possible to take these issues into account in the Integrated Management of Water Resources (IWRM).

See all IWRM actions: Adour-Garonne Water Agency sheet no. 4, Rhône-Mediterranean-Corsica Water Agency sheet no. 5, AFD sheet no.6, DEAL Martinique sheet no. 7, SCP sheet no.13, Etc Terra sheet no. 20, BRGM sheet no. 21 and Ifremer sheet no°23

France : 60 years of IWRM's practical experience !

THIS IWRM+ APPROACH

is adapted to climate-related issues and based on broad principles of sustainable management of water resources as an integrated whole

It is developed at the relevant geographic scale for water resources: the catchment area scale. It is used to generate solidarity and consistency between upstream and downstream areas, in various forms (sharing of expertise, levying of charges, etc.). This means addressing climate change in a consistent way at the level of regions and water resources.

Coordination among actors ensures consistency between the sectors represented by these various stakeholders and their ownership of actions to be taken at the catchment scale.

It is based on the development of a balanced approach between water savings and the mobilization of resources (conventional and non conventional).

Financing mechanisms at the appropriate scale (catchment areas) and in line with the local political organizational structure.

It requires increasing consistency between water policies and major structural policies (energy, food security, environment and health) by quantifying current resources and anticipating future needs for every use.

EXPERTISE

The International Network of Basin Organizations (INBO) is specifically concerned with the management of basin water, in particular transboundary basins, a major water-related issue. It worked with the United Nations Economic Commission for Europe (UNECE) to produce the "**Collection of good practices and lessons learned on water and adaptation to climate change in transboundary basins of rivers, lakes and aquifers** " (April 2015-7th World Water Forum). "Aquifers: Basin and Financial Redistribution in Action," a project developed under the **WATERCLIMA LAC program** (Watershed and Coastal Management in the context of Climate Change in Latin America and Caribbean), supported by the **International Office for Water (IOWater)**, is an example of good practice.

Guidelines for mitigation

Water stakeholders have developed ways of helping to mitigate climate change, in particular with regard to three fundamental issues. Water can play an important role in the ***energy transition.***

Reducing energy needs

Reducing the emissions of greenhouse gases generated by water treatment and transport for all uses is a complex challenge given the considerable energy needs associated with these activities. These needs are meant to increase with time. French water stakeholders have therefore developed technological solutions that reduce their energy demand. One example is optimizing the energy efficiency of drinking water and wastewater treatments and transport processes.

See actions: SIAAP sheet no. 3, Société des Eaux de Marseille sheet no. 13

Water as a renewable source of energy

Hydroelectricity is an interesting source of energy (if it is adapted to local demand and appropriated locally). Other potential sources such as **tidal current turbines** can also contribute to mitigation. They use the natural potential of water resources by emitting far fewer greenhouse gases in comparison to carbon energy. However, hydroelectric plants are affected by flow changes caused by climate change and infrastructure must be adapted over the long term.

See action: EDF sheet no. 11

Recycled wastewater and livestock manure are also a genuine source of energy. The biomethane produced can be reinjected into the natural gas distribution system. The combustion of biogas used in sanitation processes can produce heat, which is a source of energy. The calories recovered from domestic wastewater during transport can be reused for district heating.

See action: VEOLIA sheet no. 16

Waterway transport, which is more energy-efficient than road transport and is equivalent to rail transport (ADEME), is a historic means of transport and way of strengthening intermodal transport between regions.

See action: Douai Ecole des Mines/Artois-Picardie Water Agency sheet no. 22

EXPERTISE

The dual pressure of energy on water and water on energy increases with climate change. At the "**Preserving the Flow of Life" Conference organized in Lyon from October 29 to 31, 2014, by the Greater Lyon Urban Community, EDF, the World Water Council, the Rhône-Mediterranean-Corsica Water Agency, SHF, Graie and the French Water Partnership**, the Chair of the World Energy Council, Ms. Marie-José Nadeau, stated that "the more we try to improve CO_2 management, the more the pressure on water intensifies". It is therefore essential to understand the link between water and energy in order to mitigate the impacts of climate change. Find the results of the talks on the Conference website:

http://www.preserving-the-flow.com/

Water: essential to the land sector which is a boon to mitigation efforts

The IPCC has emphasized that the land sector (agriculture, food security, forests and soils) provides an excellent opportunity for mitigation and, if managed properly, could contribute 20 to 60% of the potential for mitigation of greenhouse gas emissions by 2030! This "good management" of land, which is so essential to mitigation, is directly linked to the "good management" of water. Agroecology is one of the four major aspects mentioned by the IPCC toward "good management" in order to support mitigation and adaptation to climate change.

FOCUS

Agroecology

Agroecology helps to conserve water and revitalize soils, prevent erosion and desertification, produce with more or fewer external resources and reduce pollution and waste while taking into account local specificities. It includes various cross-cutting sectors through a wide range of actions from farmer training to public and private research, reducing the use of pesticides and other inputs, promoting organic farming, selecting seeds suitable for specific climate conditions and soils as well as promoting agroforestry. Today agroecology is considered one of the most effective channels for enabling the agriculture sector in France and internationally to meet the food and non-food needs of the future by reconciling competitiveness with job creation and environmental sustainability. Water resources are a key factor to the success of this agroecological transition.

FAO, French Ministry of Agriculture

Water lies at the heart of adaptation strategies

The majority of adaptation initiatives focus on water resources.

The challenge for water resources in vulnerable regions is to "merge a decreasing offer with demand that, in places, is already unsatisfied and that will increase with the impacts of climate change and other factors" (French Climate Change Adaptation Plan).

The guidelines for adaptation focus on several pillars for action:

Water as an integral part of risk management

Faced with increasing impacts of natural water-related events such as flooding or drought on humans and property, sustainable management of these resources also contributes to risk management. Coastal areas are especially affected by the risks of erosion, flooding and saltwater intrusion. These risks have an impact on structural policies (urban policies, food security policies, etc.) and must now take into account the uncertainties surrounding climate change.

Increasing cities' infiltration capacities through soil desealing is one way to adapt "without regrets" given the risk of increases in extreme, sudden and unexpected rainfall in certain areas.

See actions: EPTB Seine Grands Lacs sheet no. 1, Water and Climate Cluster sheet no. 19, Municipality of Hyères-les-Palmiers sheet no. 2 and Rhône-Mediterranean-Corsica Water Agency sheet no. 5

EXPERTISE

According to the IPCC, this risk is determined by the occurrence of natural hazards, exposure and vulnerability. France has developed tools to take into account the risk of **flooding** at these three levels:

- **occurrence of hazards:** The Central Service of Hydrometeorology and Support for Flood Forecasting (**SCHAPI** Toulouse) studies flood early warning systems;
- **exposure:** The purpose of the **Flood Prevention Action Programs (PAPIs)** is to promote the integrated management of flood risks to reduce their harmful impacts on human health, property, economic activities and the environment;
- **vulnerability: State recognition of natural disasters** allows flood victims with a property damage insurance policy to be compensated.

EXPERTISE

Reducing water leaks in systems is a line of attack that is easy to identify but costly. The guide to developing a plan of action **on the reduction of water losses from drinking water distribution systems** by Eddy Renaud (Irstea) et al., developed in partnership with ONEMA and the Scientific and Technical Association for Water and the Environment (ASTEE), provides an overview of French expertise on this subject and offers some interesting directions for further study.

EXPERTISE

In 2015 the members of **EpE (Entreprises pour l'Environnement)** published "**Measuring and managing water**". The water footprint is defined as the total volume of freshwater used to produce goods and services consumed by an individual, region, company or sector (WWF France). Growing pressure on water, heightened by climate change, pushes companies increasingly to incorporate their water footprint into their risk management policies as well as to develop and implement solutions.

FOCUS

At the European level, **the Water Framework Directive (WFD) of 2000**, implemented in the context of the Water Development and Management Master Plans, places emphasis on natural environments in European water policies and introduces **obligations regarding results, methods and timetables** for achieving **good physico-chemical and ecological status of bodies of water**. A proactive policy for maintaining green areas and restoring the original aspect of waterways is required for the quality of aquatic environments. A plan for actions called "**Blueprint**" was launched in 2012 to support the target set by the WFD for sustainable use of water resources to the needs of the population, the economy and the environment in the context of climate change.

French Ministry of Ecology

Water saving

Water saving is a pillar of the measures for adapting water resources to climate change and other global changes. This involves the sustainable and sound management of resources through preventing wastage, improving the quality and yield of drinking water systems, agroecology, bucket drip irrigation and developing crops that consume less water in regions suffering from water stress, etc.

Creating water savings is one way to limit greenhouse gas emissions. The less water that is used or wasted (e.g. through leakage control), the less water will need to be transported and treated and thus the less energy will be consumed.

See actions: Rhône-Mediterranean-Corsica Water Agency sheet no. 5, CARI sheet no. 18, Société des Eaux de Marseille sheet no. 13 and NATAÏS sheet no. 12

Mobilizing water resources

The mobilization and storage of new "conventional" and "non-conventional" resources together with water storage is one means of adapting. In some cases, depending on the local context and projections, mobilizing new water resources to meet demand is a feasible option as part of a vision of sustainable resource management and local ownership.

See action: Languedoc Roussillon Prefect-Regional Agriculture Department sheet no. 10

The use of "non-conventional" resources (reuse of wastewater, use of rainwater, aquifer replenishment anddesalination, where appropriate) are also interesting solutions.

See action: VEOLIA sheet no. 16

Water quality

Preserving the quality of water is a serious challenge in the face of climate change and the anthropogenic pressures (domestic, agricultural and industrial pollution) threatening it from all sides. This will be achieved by monitoring water status and reducing urban, industrial and agricultural pollution.

See action: SUEZ environnement sheet no. 15

Preserving ecosystems

Aquatic ecosystems (environments and biodiversity) are a part of adaptation (FOCUS). For example, wetlands not only shelter a wealth of biodiversity but also contribute to risk management by reducing pollution. They act as a sponge in the event of flooding and a supply of water in drought conditions.

See actions: ONEMA sheet no. 9, SUEZ environnement sheet no. 15

Funding

Climate change adaptation efforts are linked primarily to water, whether directly or indirectly, and require substantial funding.

The impacts of climate change are, above all, local impacts. Local authorities therefore play an important role in funding adaptation initiatives. Funding urban planning and development efforts is essential to address the risks of flooding and erosion, especially in developing areas exposed to these risks such as Southeast Asia.

By taking increasingly into account climate issues, IWRM funding mechanisms (FOCUS) can be good sources of funding for climate-compatible initiatives to protect water resources.

International transfers also have a role to play, in particular through contributions to the Green Climate Fund and the Adaptation Fund to support developing countries in their adaptation and attenuation efforts.

FOCUS

In France, water policies implementing the IWRM framework are funded respecting the following principles : "**subsidiarity**", "**solidarity**" between users at the catchment scale and "**polluter pays**".

EXPERTISE

Two French players involved in funding international adaptation efforts

The French Agency for Development (AFD) is involved in funding water-related initiatives that take into account climate change.

The AFD has a CLIMATE CHANGE STRATEGY based on three pillars:

1. **FINANCIAL COMMITMENTS:** 50% of AFD's allocations should be earmarked for climate initiatives;
2. **PROJECT IMPACT ASSESSMENT:** systematic carbon footprint and assessment;
3. **SELECTIVITY OF OPERATIONS:** a policy of determining eligibility for funding according to the AFD's mandate, taking into account the level of development of the countries in question, their climate policies and the carbon footprint of each project.

The AFD's method of ACCOUNTING for the amounts it pledges to development projects that contribute to the fight against climate change is based on a methodology for determining whether a project has one or more of the following types of co-benefits:

- mitigation of emissions or carbon sequestration;
- adaptation by limiting vulnerability to the consequences of climate change;
- support for the implementation of policies to respond to climate change.

For example, in 2013 the AFD pledged 110 million euros to fund an ambitious storm drainage project in Gabon, where heavy rainfall is projected to become increasingly intense. The funds for this project were counted as having a co-benefit in terms of adaptation to climate change.

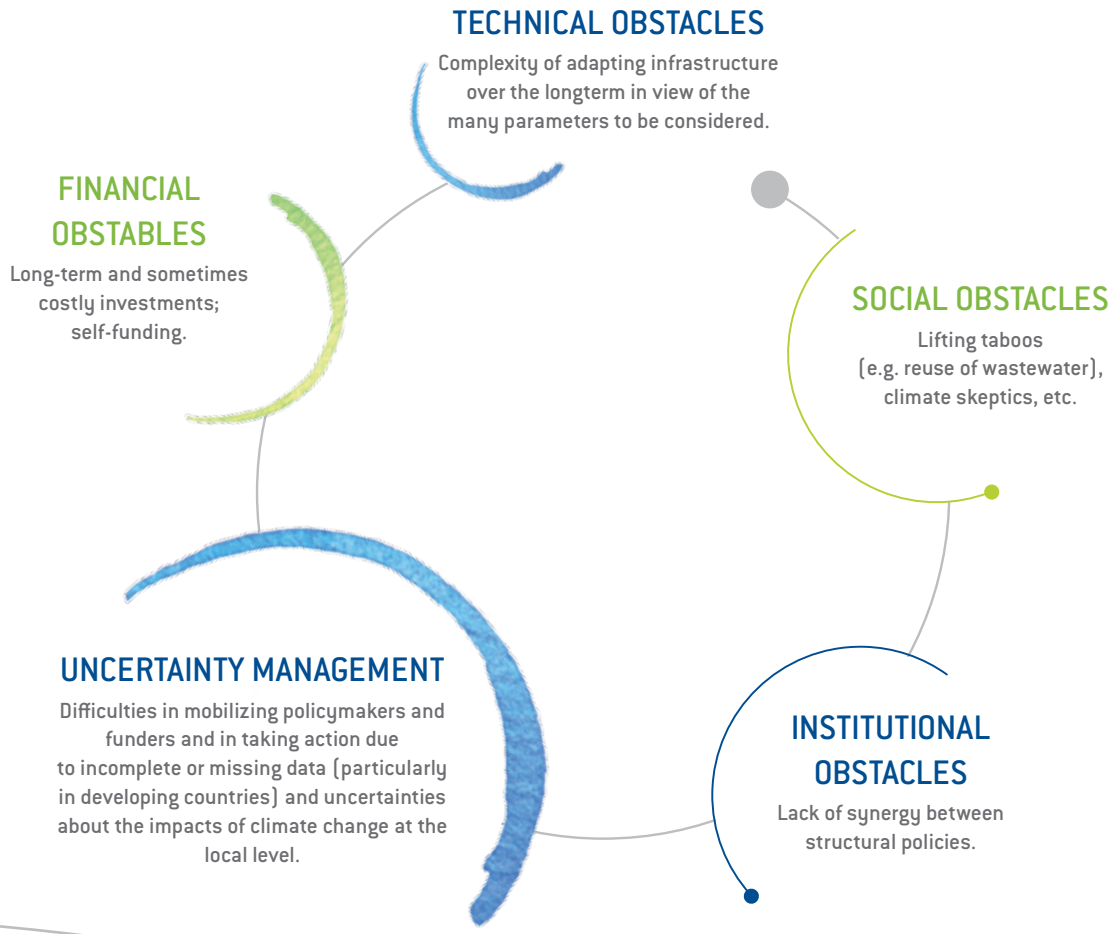
In 2014 the AFD counted 14 water-related projects (public water and sanitation services, flood risk management and irrigation), representing commitments of approximately 251 million euros, as having climate co-benefits.

See action: AFD sheet no. 6

The French Global Environment Facility (FFEM) is a public fund whose aim is to promote environmental protection worldwide. The FFEM plays an important role in supporting adaptation measures concerning water management (especially international initiatives) in a context of climate change in developing countries.

The difficulties and risks of maladaptation

The analysis of climate-compatible initiatives reveals a certain number of difficulties associated with these types of initiatives. With further experience and the sharing of know-how, these actions can be improved in the future. Some of these difficulties included:



FOCUS

Beware of maladaptation!

In its most recent Assessment Report (AR5), the IPCC warns of the risk of maladaptation. Maladaptation means any measures that, directly or indirectly, are counter-productive or do not succeed in reducing vulnerability to climate change but increase it instead. The IPCC (2014) cited the examples of the development of crops for bioenergy that increase the demand for water or the increase in energy consumption caused by electrical irrigation pumps in India.

Messages from the French Water Partnership ahead of COP21

Based on this analysis, the French Water Partnership launches a strong advocacy to mobilize decision-makers at all level, in particular for the COP21.

The main message of the members of the French Water Partnership is:

The agreement reached during COP21 must incorporate water as a central component of adaptation and water must be treated as fundamental to the allocation of climate funding.

In order to do this, the following are required:
The COP21 must result in a universal, ambitious, legally binding agreement on reducing greenhouse gas emissions to a level that will hold down the global rise in average temperature to less than 2°C compared to pre-industrial levels;

adaptation strategies must be given equal priority to mitigation strategies. Water must therefore be integrated into climate change adaptation and mitigation strategies at all levels, especially at the national level: National Adaptation Plans (NAPs) and Nationally Appropriate Mitigation Actions (NAMAs), as well as in the adaptation section of the COP21 agreement;

the various water stakeholders possess extensive experiences in adaptation and mitigation. These stakeholders have seen their experience replicated in the context of resilient actions taking the climate into account in the integrated management of water resources at the regional scale and at the appropriate geographical scale (catchment area), based on an approach that balances supply and demand. This requires increased consistency among major structural policies (energy, food security, environment and health);

significant international funding, in particular via the Green Climate Fund and the Adaptation Fund, must be earmarked for the water sector by the international community, in order to support the poorest, most threatened regions of the planet;

water must be included in plans and measures for preventing risks and responding to natural hazards in order to protect the most at-risk populations (follow-up to the Conference in Sendai, Japan);

non-state stakeholders representing civil society as a whole, in particular those of the water sector, must be involved in climate negotiations.

ACTIONS SUMMARY

PROJECT LEADER	ACTION	MITIGATION ADAPTATION	KEY WORDS *Risks, sectors, type of action*	N°
Local public basin institution of Seine Grands Lacs (EPTB)	*Making Paris more resilient to extreme hydrological events*	Adaptation	*Floods, Flow variability* *Multi-sectors* *IWRM and planning, Knowledge, Technologies*	1
Muncipality of Hyères-les-Palmiers	*Assessing the threats of submersion and erosion of the Var coastline*	Adaptation	*Coastal risks* *Water and urban development* *Knowledge, Information*	2
Greater Paris Sanitation Authority (SIAAP)	*Involving water and sanitation services in the response to climate change with the Greater Paris Sanitation Authority (SIAAP)*	Adaptation Mitigation	*GHG emissions, Quality* *Water and sanitation services, Water and energy* *Knowledge, Technologies*	3
Adour-Garonne Water Agency	*Improving knowledge and planning at the basin level with the Garonne 2050 project*	Adaptation	*Quality, Drought, Ecosystems* *Multi-sectors* *IWRM and planning, Knowledge, Information*	4
Rhône-Mediterranean-Corsica Water Agency	*Developing a climate change adaptation plan for the Rhône-Mediterranean-Corsica basin*	Adaptation	*Multi-risks* *Multi-sectors* *IWRM and planning, Financing, Knowledge, Raising awareness*	5
French Agency for Development (AFD)	*Managing water resources in the Mekong Basin*	Adaptation	*Multi-risks* *Multi-sectors* *IWRM and planning, Financing*	6
Regional Department of the Environment, Development and Housing (DEAL) for Martinique	*Assessing the vulnerability of water resources for better adaptation in Martinique island*	Adaptation	*Multi-risks* *Multi-sectors* *IWRM and planning, Knowledge, Raising awareness*	7
Ministry of Ecology, Sustainable Development and Energy	*Exploring the future of water in France with Explore 2070*	Adaptation	*Multi-risks* *Multi-sectors* *Knowledge*	8
French National Agency for Water and Aquatic Environments (ONEMA)	*Strengthening the science-policy nexus to address the impacts of climate change*	Adaptation Mitigation	*Ecosystems* *Multi-sectors* *Knowledge, Information, Raising awareness*	9
Prefect of Languedoc Roussillon, Regional direction of agriculture and forestry	*Adapting agriculture in Languedoc Roussillon through the Regional Project for Sustainable Agriculture (PRAD)*	Adaptation	*Drought* *Water and food security* *Engineering, Government policy*	10
Electricité de France (EDF)	*Adapting a hydropower plant in response to glacier melt*	Adaptation Mitigation	*Ice melt* *Water and energy* *Engineering*	11

NATAÏS	*Managing and optimizing irrigation for corn production*	Adaptation Mitigation	*Drought* *Water and food security* *Engineering*	12
Société du Canal de Provence (SCP)	*Cooperating to tackle climate change in Africa-the Water Development and Management Master Plan for the transboundary Senegal River*	Adaptation	*Multi-risks* *Multi-sectors* *IWRM and planning*	13
Société des Eaux de Marseille (SEM)	*Mitigating greenhouse gas emissions connected with drinking water provision in Marseille*	Adaptation Mitigation	*GHG emissions , Drought* *Water and sanitation services* *Engineering, Technologies*	14
SUEZ environnement	*Restoring wetlands and preserving biodiversity-Zone Libellule®*	Adaptation	*Quality, Flow variability, Ecosystems* *Water and sanitation services* *Engineering, Raising awareness*	15
VEOLIA	*Wastewater treatment as a green energy source in China*	Adaptation Mitigation	*GHG emissions , Drought* *Water and sanitation services* *Engineering, Technologie*	16
Asters (Conservatory of Natural Areas in Haute-Savoie)	*Water in mountains: sharing and reconciling uses of an endangered resource*	Adaptation	*Floods, Drought* *Multi-sectors* *Technologies, Knowledge*	17
Center for international Actions and realizations (CARI)	*Managing oasis resources through agroecology - Example of the CARI pilot farm in Morocco*	Adaptation Mitigation	*Drought* *Water and food security* *Raising awareness, Engineering*	18
Water and Climate Cluster	*Limiting urban heat islands by re-vegetating towns and nearby areas*	Adaptation Mitigation	*Drought* *Water and urban development* *Knowledge, Engineering*	19
Etc Terra, Grand Lyon Metropole	*Integrated Management of Water Resources (IWRM) in Madagascar*	Adaptation	*Floods, Drought, Ecosystems* *Water and food security* *IWRM and planning*	20
the French geological survey (BRGM)	*Ensuring the existence of groundwater for the supply of drinking water to Montpellier city*	Adaptation	*Drought, Floods, Quality* *Water and sanitation services* *IWRM and planning, Knowledge*	21
Ecole des Mines de Douais and Artois-Picardie Water Agency	*Adapting inland navigation with GEPET-Eau*	Adaptation Mitigation	*Flow variability* *Water and transportation* *Knowledge, Information*	22
French Research Institute for Exploitation of the Sea (Ifremer)	*Better anticipating change in estuary waters with the C3E2 Project-the example of the Loire River*	Adaptation	*Floods, Flow variability* *Multi-sectors* *IWRM and planning, Knowledge*	23
The national Research Institute of Science and Technology for Environment and Agriculture (Irstea)	*Combining open and participatory tools to help water management stakeholders adapt their practices: Wat-A-Game*	Adaptation	*Multi-risks* *Multi-sectors* *Raising awareness*	24
Météo France	*Offering climate services for the sustainable management of water resources*	Adaptation Mitigation	*Multi-risks* *Multi-sectors* *Knowledge, Information, Raising awareness*	25

Action

Making Paris more resilient to extreme hydrological events

Adaptation 1

TIME PERIOD
2014
2020

LOCATION
SEINE GRANDS LACS WATER BASIN

Project leader:
Local public basin institution (EPTB) of Seine Grands Lacs

Context and aims

Paris is exposed to a major flood risk due to the flood potential of the Seine and Marne rivers. Memories of the last major flood, which occurred in 1910, have faded and most inhabitants and local authorities do not imagine that such a disaster could reoccur in the near future. Since this last major flood, adjustments have been made and steps taken to reduce flood risk; however, at the same time massive urban development in flood-prone areas has meant that the foreseeable damages of a flood of comparable intensity have continually increased. According to some scenarios, in such an event, direct damages alone could amount to 30 billion euros (OECD, 2014). Moreover, climate change has heightened this threat by increasing the variability of extreme phenomena.

Project description

Faced with such a situation, the EPTB, in partnership with the government, is leading and coordinating a comprehensive 130-million-euro flood prevention program for implementation by 2020. The program has three main objectives: 1 to develop a risk culture, 2 to stabilize the cost of potential damages in the short term 3 to strengthen the resilience of the area. The program intends to make use of technical and societal innovation as a priority, either in the implementation of a pilot project at the Bassée site or the use of information technology (smartphone applications, social networks, etc.). The EPTB is also preparing an action program focusing both on a better understanding and innovative and collaborative management of low-flow periods and the implementation of measures to mitigate the impact of they can have in the context of climate change. This program of measures is based on two instruments - the Seine plan and the European Interreg program. The detailed content of these actions will be defined through consultation with basin partners, i.e. Government and the Seine - Normandy Water Agency.

Project strengths

- Given the complexity of the Paris region and the multitude of stakeholders involved, special emphasis is being given to collaboration. This is materialized by raising awareness on hydrological risks, disseminating a "river culture" and by generating solidarity at basin level which is also one of the keys of this success.
- Indicators assessing the effectiveness of public measures are currently being developed in conjunction with the French National Observatory of Natural Hazards (ONRN).

PARTNERS:
Paris city authorities and departmental councils of the inner suburbs of Paris, EPTB Members, Government and the Seine-Normandy Water Agency

KEYWORDS
Floods,
Flow variability
Multi-sectors
Knowledge,
IWRM and planning,
Technologies

MORE INFORMATION AT
www.seinegrandslacs.fr

CONTACT
regis.thepot@seinegrandslacs.fr

Action

Assessing the threats of submersion and erosion to the Var coastline

Adaptation 2

TIME PERIOD
january 2014
june 2015

LOCATION
HYÈRES-LES-PALMIERS

Project leader:
Muncipality of Hyères-les-Palmiers

Context and aims

The sea level rise that is characteristic of climate change is a reality in Mediterranean regions and is accentuating coastal erosion which is already substantial in places. In the town of Hyères, harbor work between Giens and the Gapeau river have divided up the coastal tombolo (a narrow piece of land, or bar, composed of sand or pebbles by which an island is attached to the mainland) and interrupted the dominant littoral drift, resulting in large sediment deposits, or accretion, to the north of structures and erosion to the south, due to uncompensated sediment losses.

In 2012, as part of the National Integrated Coastline Management Strategy, the French Ministry of Ecology, Sustainable Development and Energy (MEDDE) launched a call to local authorities for projects aiming to relocate activities and assets and the spatial recomposition of territories threatened by coastal risks. One of the projects selected for implementation is coordinated by the town of Hyères-les-Palmiers.

PARTNERS:
The French Geological Survey (BRGM- Technical center and regional department for PACA), Government

Project description

The purpose of the project was to develop knowledge on current and future coastal flooding. Firstly, multivariate statistical analysis of extreme values for wave height, sea level, river water level, etc. helped to establish various scenarios. In a second step, modeling was used to show the flooding that would occur under these different scenarios, for the current sea level, as well as for two scenarios with higher sea levels.
This data will help to better anticipate the impact of a rise in sea level on the coast near the town of Hyères. "Hard" measures involving structural works (groins, rockfill, rip-raps, etc.) have already been implemented, primarily between 1950 and 1980, with contrasting effectiveness in terms of their impact on coastal stability. Other "soft" measures, such as geotextile submerged breakwaters and sedimentary inventory management have also been implemented by the municipality.
Currently, the project being carried out by the town of Hyères-les-Palmiers is adressing the spatial recomposition of the Ceinturon coastal plain area and its coastline from Port Saint-Pierre to the mouth of Gapeau, in light of scenarios generated by modeling produced in partnership with the BRGM.

KEYWORDS
Coastal risks
Water and urban development
Knowledge, Information

Project strengths

• The hydrodynamic modeling tools developed by BRGM for this study were found to be particularly innovative and are ready to be used for other future projects.

MORE INFORMATION AT
http://www.hyeres.fr
CONTACT
g.lecozannet@brgm.fr
a.stepanian@brgm.fr

Action

Involving water and sanitation services in the response to climate change with the Greater Paris Sanitation Authority (SIAAP)

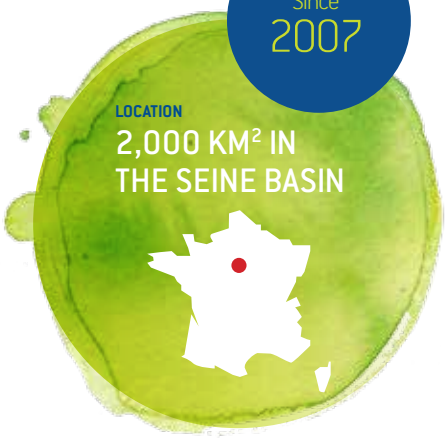
Adaptation

Mitigation

3

TIME PERIOD
Since
2007

LOCATION
2,000 KM² IN
THE SEINE BASIN



Project leader:
Greater Paris Sanitation Authority (SIAAP)

Context and aims

The SIAAP is the only interdepartmental water and sanitation authority in Europe. Each day it transports and treats 2.5 million m^3 of wastewater, rainwater and industrial water from the greater Paris area.
The urban, demographic and economic growth of the greater Paris area experienced by all political and institutional players will inevitably have environmental consequences, including on water quality. Repercussions on water treatment costs are expected in response to the deterioration of its quality and these treatment processes are energy-intensive and emit greenhouses gases.

Project description

The SIAAP has developed a sustainable development policy structured around a five-fold strategy: 1 contributing to the sustainable management of the greater Paris area, 2 helping to improve the living environment and health, 3 paying careful attention to social and societal expectations, 4 preserving natural resources and 5 responding global warming. As part of this strategy, the SIAAP implements a variety of initiatives every year, from water-saving programs to adapt to rain variability to mitigation through improving the energy efficiency of its processes and infrastructure.
For example, in order to identify areas for improvement and to assess its mitigation efforts within the framework of its sustainable development strategy, the SIAAP developed its own measuring tool for greenhouse gas emissions. This tool is used in its six wastewater treatment plants. The SIAAP is now capable of conducting its own overall assessment of GHGs and identifying the stages of its operations that emit the most pollution. This tool is also a decision support tool for the investment projects selected by the SIAAP.
The SIAAP also developsways to improve the energy efficiency of its wastewater treatment plants, which is a key driver for mitigating the effects of climate change in water and sanitation services. Over time, its motors will be replaced with more efficient motors and variable speed drives will be added to optimize energy consumption according to real-time needs. The SIAAP takes advantage of regulatory incentives in the form of energy savings certificates offering financial benefits in order to invest in more efficient equipment. Using the GHG measurement tool it developed, the SIAAP is able to monitor non-negligible impacts that affect nine million users in the Ile-de-France region. As a result of the energy efficiency retrofits carried out on its plants in 2013, their emissions have dropped by more than 25%.

Project strengths

• The sustainable development strategy focuses on the long term, it concerns all SIAAP activities and forms part of the concept of promoting urban ecology by implementing local synergy aimed at developing the thermal potential of effluents or generating power from non-fossil fuels.

KEYWORDS

GHG emissions ,
Quality,
Drought
Water and sanitation services
Knowledge,
Technologies

MORE INFORMATION AT
www.siaap.fr
http://www.siaap.fr/le-siaap/missions-du-siaap/presentation/

CONTACT
cleo.lossouarn@siaap.fr

Action

Improving knowledge and planning at the basin level with the Garonne 2050 project

Adaptation 4

TIME PERIOD
2010
2015

LOCATION
ADOUR GARONNE BASIN

Project leader:
Agence de l'eau Adour-Garonne

Context and aims

The Adour-Garonne Water Agency is a public body, which was set up following the introduction of the French Water Act in 1964. Its role includes the prevention of pollution and protection of water and aquatic environments.
The Adour-Garonne Basin Committee, a participatory decision-making body, today faces strong changes and uncertainties when establishing policy guidelines. Climate change, demographics, energy issues and changes to agricultural policy are variables which influence and render difficult decision-making in the field of water, particularly where priorities for action and the implementation of clear governance are concerned.
Today, it seems that water is already a fragile resource- figures estimate the water deficit for the entire basin at 250 million m^3- and this fragility is expected to increase in coming years.

Project description

Faced with such challenges, the Agency and Basin Committee sought to further analyze the dominant trends and provide a full picture of the situation to water authorities and operators:
• in spatial terms: by more accurately establishing changes to the water supply and demand balance;
• in terms of the future: by looking forward over the next 40 years up to 2050.
It was in this context and to meet requirements of the Water Development and Management Master Plans that the Agency launched the project: "Garonne 2050 - Prospective study of water needs and resources at the Garonne basin level".
The findings of the study were used to develop proposals for the 2016-2021 Water Development and Management Master Plans of the basin, for which consultation is currently underway. The findings suggested that climate change issues should be taken into account in water planning and management by:
• improving knowledge on the impact of climate change on the resources and vulnerability of areas and evaluating the effects of various possible adaptation scenarios;
• acquiring effective tools for monitoring phenomena which cause structural imbalance, water scarcity and drought;
• developing water-saving approaches and ensuring a more efficient use of water;
• supporting strategies for development and land use that are consistent with the resources available locally.

Project strengths

• The Garonne 2050 project is particularly useful because it takes into account future scenarios for climate change, demographics, consumption, and behavior at the basin level. It is by fully analyzing these risks, in a process combining stakeholder involvement and modeling, that the most accurate estimation of the needs of a given area can be obtained.

PARTNERS:
Regional councils of Midi-Pyrénées and Aquitaine, Regional Department of the Environment, Development and Housing for the basin, ONEMA, Department of Food Agriculture and Forestry of the Midi-Pyrénées region (DRAAF), Departmental Council of Haute-Garonne, SMEAG and EDF.

KEYWORDS
Quality,
Drought,
Ecosystems
Multi-sectors
IWRM and planning,
Knowledge,
Information

MORE INFORMATION AT
http://www.eau-adour-garonne.fr

CONTACT
francoise.goulard@eau-adour-garonne.fr

Action

Adaptation 5

Developing a climate change adaptation plan for the Rhône-Mediterranean-Corsica basin

TIME PERIOD 2013 2018

LOCATION RHÔNE-MEDITERRANEAN-CORSICA BASIN

Project leader:

Rhône-Mediterranean-Corsica Water Agency

Context and aims

The Rhône-Mediterranean-Corsica Water Agency is the main public water body in the large southeastern quarter of France and is fully dedicated to implementing water policy within the region. The Agency collects water taxes paid by households, local authorities, large companies, farmers, etc. Every euro collected is reinvested in services for local authorities, large companies, farmers and associations. The Agency therefore helps to implement projects aimed at rationalizing water use and tackling pollution and degradation of rivers, lakes and the Mediterranean Sea. It has developed unrivaled knowledge of water issues and the associated challenges through constant monitoring of water quality and the study of emerging phenomena that will impact the future.

The latest scientific findings of the IPCC confirm that climate change is becoming more severe. This is especially true on the shores of the Mediterranean Sea, which is one of the world's hotspots, and in mountainous areas. The facts speak for themselves. For example, the wine harvesting season takes place a month later than half a century ago and this is just the start of the process of change.

Project description

On 28 May 2014, the governing prefect of the basin area, the president of the Basin Committee and the presidents of the five regional councils of Franche Comté, Burgundy, Rhône-Alpes, Provence-Alpes-Côte d'Azur and Languedoc Roussillon adopted a basin-wide plan for climate change adaptation in the field of water. This plan is based on a review of scientific knowledge on climate change impacts. It proposes practical measures for adaptation with three key focuses:

- **Encouraging ground permeability:** This includes, for example: for every square meter of sealed soil in an urban area, creating an infiltration area of one and a half square meters. Benefits of such a system include less violent floods and greater groundwater levels, a reduction of urban sprawl and better control over urban heat islands.
- **Stopping water waste:** This includes, for example: i) a water yield objective of 85% for the whole drinking water network by 2030, to be achieved by reducing leakage, and ii) an effort to reduce irrigation water by 20% by 2030.

In this context, the Agency has also launched an open call for projects to local authorities, businesses and managers of collective dwellings. This call targets projects concerning leakage reduction in the drinking water network and all projects to reduce water consumption for public uses such as the watering of gardens and parks, in industrial processes and shared buildings.

- **Making room for rivers:** This involves for example: rethinking land use strategies in order to restore flood plains along 20% of a river's length by 2020 or to preserve wetlands, which have a natural sponge effect and thus encourage groundwater retention.

Investment of the 260 million euros, allocated by the Rhône-Mediterranean Water Agency for the implementation of measures under the plan, has been underway since 2013 and will continue until 2018.

Project strengths

- In 2014, water savings made in the Rhône-Mediterranean basin amounted to 68.6 million m^3 (all activities included), which is equivalent to the annual consumption of a town of one million inhabitants.

PARTNERS:
Regional authorities of Franche-Comté, Burgundy, Rhône-Alpes, Provence-Alpes-Côte-d'Azur and Languedoc-Roussillon

KEYWORDS

Multi-risks
Multi-sectors
IWRM and planning,
Financing,
Knowledge,
Raising awareness

MORE INFORMATION AT
http://www.eaurmc.fr/climat.html

CONTACT
yannick.prebay@eaurmc.fr

Action

Managing water resources in the Mekong Basin

Adaptation 6

TIME PERIOD
Since
2005

LOCATION
MEKONG BASIN, THAILAND, LAOS, CAMBODIA AND VIETNAM

Project leader:
French Agency for Development (AFD)

Context and aims

The French Agency for Development (AFD) is a public institution and the main operator for France's development cooperation system. The French Agency for Development has worked for more than seventy years to combat poverty and foster development in developing countries. They also promote the economic and social vibrancy of France's overseas departments and territories.
The Mekong Basin, which is shared by China, Burma, Laos and Thailand, feeds 80 million inhabitants through fishing and agriculture.
Economic and demographic growth, the resulting increase in energy demand (hydroelectricity) and climate change raise concerns about the impacts on biodiversity, fishing and coastal erosion.

PARTNERS:
French Global Environment Facility (FFEM)
World Meteorological Organization (WMO)

Project description

The Mekong-HYCOS (Hydrological Cycle Observation System) project, developed with the support of the World Meteorological Organization, is designed to improve knowledge of the water regime in the lower Mekong Basin and the management of related resources and risks.
The AFD and the FFEM helped to set up a reliable system for collecting and transmitting hydrometeorological data in real time in order to predict the risk of flooding. The dissemination of hydrological information to users and national data treatment and archiving systems has improved.
• 32 stations have been built and 17 have been retrofitted to prevent flood risk.
• A 1.5 million euro grant from the AFD and a one million euro grant from the FFEM were used to fund this project.
Member countries have strengthened their capacities on these issues to ensure the sustainable, long-term use of the network. Better decision-making regarding large-scale hydropower facilities will make it possible to cover the projected demand for electricity while preserving the balance of the river's ecosystem.

KEYWORDS
Multi-risks
Multi-sectors
IWRM and planning,
Financing

Project strengths

• The Mekong-HYCOS project helps to ensure ownership of hydrological issues and to ensure the sustainable development of the basin and water resources while promoting better cooperation among the countries of the region.

MORE INFORMATION AT
http://www.afd.fr/home/projets_afd/AFD-et-environnement/changement_climatique

CONTACT
pacoudl@afd.fr
mevellecm@afd.fr

Action

Assessing the vulnerability of water resources for better adaptation in Martinique island

Adaptation 7

TIME PERIOD 2011 2013

LOCATION MARTINIQUE

Project leader:

Regional Department of the Environment, Development and Housing (DEAL) for Martinique

Context and aims

Social housing policies, sustainable development, biodiversity and risk prevention commitments taken at the Grenelle Environmental Forum, come under the authority of Regional Departments of the Environment, Development and Housing (DEAL).
The Caribbean region is already deeply affected by climate change. Impacts include rising temperatures, a rise in sea level resulting in saline seepage, risks to infrastructure and tourism and extreme climate variability. Caribbean islands, including Martinique, have already begun to develop adaptation measures to cope with the various challenges as they emerge, particularly those related to water resources. In Martinique, 90% of drinking water production comes from rivers. This gives rise to repeated difficulties in low-water periods when the instream flow downstream of water intakes is not respected.

PARTNERS:
BRGM, Météo France

Project description

To assess the impact of climate change, modeling was conducted by means of a comprehensive hydrological model, developed by BRGM (the French geological survey) based on Météo France climate projections. In keeping with the IPCC Fifth Assessment Report of 2014, two climate scenarios were studied for the 2081-2100 period - the RCP 4.5 scenario (average emissions trajectory) and RCP 8.5 (high emissions trajectory). The principal findings were as follows:

- During the dry season, the quantity of available water is expected to reduce significantly;
- During the rainy season, the changes expected vary according to the chosen climate scenario - under scenario RCP 4.5, effective rainfall (share of rainfall remaining after evaporation) increases moderately while for scenario RCP 8.5 the situation remains stable;
- In low-water periods, the northern part of Martinique, where all of the drinking water supply intakes are located, is expected to be especially affected. Some river intakes would no longer be sustainable in the 2081-2100 period. Consequently, it is thought that climate change will lead to growing pressure on quantities of water resources;
- Groundwater, however, is expected to be less severely affected due to the greater replenishment of aquifers during the rainy season. In the future, volumes of potentially exploitable groundwater could even increase in central Martinique.

The results of the study have been used to produce trend projections which public authorities will be able to use to adapt water resource management to climate change.

KEYWORDS

Multi-risks
Multi-sectors
IWRM and planning,
Knowledge,
Raising awareness

Project strengths

- The DEAL Martinique, in partnership with BRGM, developed innovative modeling, unprecedented in the Caribbean region, to adapt a specific environment.

MORE INFORMATION AT
http://www.brgm.fr/projets/impact-quantitatif-changement-climatique-sur-ressources-eau-martinique

CONTACT
l.arnaud@brgm.fr

Action

Exploring the future of water in France with Explore 2070

Adaptation 8

Project leader:
Ministry of Ecology, Sustainable Development and Energy (MEDDE)

TIME PERIOD
2010
2012

LOCATION
NATIONAL - MAINLAND FRANCE AND FRENCH OVERSEAS DEPARTMENTS

Context and aims

The Ministry of Ecology, Sustainable Development and Energy works on climate-related issues among others.
The aim of this program is to assess the impact of climate change on water resources in France for the 2050-2070 period and to draw up and evaluate adaptation strategies.
This consists of understanding the social, economic and environmental impact of climate change in the water sector based on a systemic analysis integrating the results of the five topics studied: surface water hydrology, groundwater hydrology, aquatic ecosystems, coastal water and forecasting.

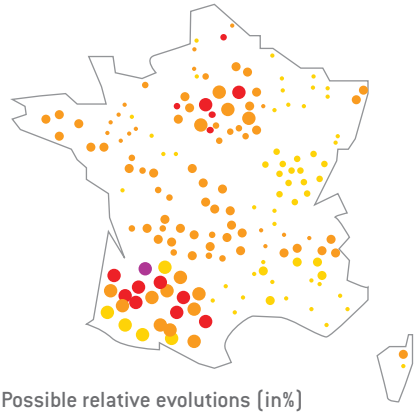
Project description

A systemic integrative model was developed at the national scale in order to match water supply (aquifer flow and replenishment rates) with water demand (various user sectors; aquatic environments) for the 2050-2070 period. This model takes into account the impacts of climate change as well as demographic changes and developments in the various sectors that use water, while opening up discussions on the adaptation of these sectors.
This highly innovative program centered on four major concrete issues for water resources:
- matching supply and demand for water;
- vulnerability of aquatic ecosystems;
- risk to coastal water;
- extreme events.

It is a comprehensive program that covers everything from assessment to forecasting and plays a role in supporting discussions on adaptation:
For the purposes of **assessment**, "**water balances**" are developed for each basin at the scale of more than a hundred catchment areas, taking stock of water abstraction and resources.
For the purposes of **forecasting**, three major adaptation strategies were assessed by varying parameters such as network efficiency or cultivated areas: 1 water savings, 2 intermediate adaptation strategy and 3 increased water needs.

Project strengths

- Explore 2070 is the result of multi-actor, multi-topic, collaborative efforts to share scientific results with decision-makers. These results make it possible, among other things, for water Agencies to incorporate the impacts of climate change in the future Water Development and Management Master Plans (SDAGEs) and, more broadly, in the basins' initiatives and discussions on adaptation to climate change.
- These long-term, integrated forecasting efforts are highly innovative and conducted on a national scale.



Possible relative evolutions (in%) of the mean annual flow between 1961-90 and 2046-65.

-20 to -10%	< 0,37
-30 to -20%	0,45
-50 to -40%	0,53
-70 to -60%	> 0,53

PARTNERS:
BRGM, BIOTOPE, Irstea, Météo France, KPMG, Actéon, IOWater, BRL Ingénierie, BIPE, ARMINES, Asconit, Sogreha, Metroeconomica, Water Agencies and ONEMA

KEYWORDS
Multi-risks ,
Multi-sectors
Knowledge

MORE INFORMATION AT
http://www.developpement-durable.gouv.fr/Evaluation-des-strategies-d.html

CONTACT
aurelie.carroget@developpement-durable.gouv.fr

Action

Strengthening the science-policy nexus to address the impacts of climate change

Adaptation 9

Mitigation

TIME PERIOD
Since
2010

LOCATION
FRANCE AND THE EUROPEAN UNION

Project leader:
French National Agency for Water and Aquatic Environments (ONEMA)

Context and aims

ONEMA is France's premier technical organization specialized in knowledge and monitoring of water status and the ecological functioning of aquatic environments. By virtue of its responsibilities, ONEMA serves as the interface between science and management of water and aquatic environments.

Project description

In order to improve sensitivity to climate change in water and aquatic environments management, it operates at multiple levels, as reflected in the following examples:

Strengthening the science-policy nexus on water and climate change at national, European and international levels

• At the national level, it worked with the water Agencies and the Ministry of Ecology to organize a national seminar on February 3, 2015, in preparation for COP21, which welcomed 170 participants, decision-makers and top-level interdisciplinary scientists. This seminar made it possible, in particular, to draw up concrete recommendations on strengthening dialogue between scientists and policy-makers in order to take into account climate change in water and aquatic environments management policies.

• From 2010 to 2012, ONEMA worked with the European Commission to develop an interface between science and policy for implementing the Water Framework Directive.

• Finally, ONEMA and UNESCO followed up a recommendation from the 6th World Water Forum for initiating a platform for interfacing between science and water managers to improve the way they include science with regard to the IPCC and other United Nations conventions.

These experiences made it possible to isolate several major principles for an interface between science and policy in the field of water and climate change, including implementing a community of practice, identifying and appointing "knowledge brokers" that bring life to the interface and support its main activities and enhancing communication and dissemination of knowledge tools.

Support for the production of scientific and technical knowledge for management of water and aquatic environments.

It recently published a study on the impact of climate change on freshwater fish in the "Comprendre Pour Agir"[1] collection.

Project strengths

• ONEMA has seven years of experience in science-policy interface for the management of water and aquatic environments. It has resources for evaluating requirements in terms of knowledge on science, technology, production, capitalization, communication and diffusion of knowledge as well as facilitation of information exchange. These resources are an inspiration to all actors interested in fostering the development of science-based public policies on water, particularly in the specific context of climate change.

PARTNERS:
The Water Agencies, Ministry of Ecology, Sustainable Development and Energy, , European Commission (DG RTD), UNESCO IHP, International Water Resources Association (IWRA), International Office for Water, Biotope

KEYWORDS
Ecosystems
Multi-sectors
Knowledge, Information, Raising awareness

MORE INFORMATION AT
www.onema.fr

CONTACT
frederique.martini@onema.fr

[1] This work provides an overview of current knowledge of climate change's effect on water resources in France and fish biodiversity. This overview presents various forecasting tools and the applicability of these tools, which are used to provide quantitative responses to the scale of expected changes.

Action

Adaptation 10

Adapting agriculture in Languedoc Roussillon through the Regional Project for Sustainable Agriculture

TIME PERIOD
Since
2012

LOCATION
LANGUEDOC ROUSSILLON REGION

Project leader:
Egional Direction of Agriculture and Forestry

Context and aims

The Prefect of the Languedoc Roussillon region is responsible for applying national and European policies within the region. He is at the head of the decentralized services of the state at the regional level.
Regional Projects for Sustainable Agriculture (PRADs) aim to establish the main guidelines for the application of national agricultural policy at regional level, taking into account regional specificities and any economic, social and environmental issues.
The PRAD for Languedoc Roussillon, approved in March 2012, highlights the specificity of the Mediterranean climate which warrants action in the field of water resource management, among other things to sustain the agricultural potential of the region.
The document notes, in particular, that over the last thirty years, in summer, the average temperature of Montpellier has risen by 2.3°C - the region is now a "semi-arid" zone - and that lowland evapotranspiration has increased by 20% to 30% to 240 mm, equivalent to an 11% decline in agricultural production.

PARTNERS:
Regional Commission on the Agricultural Economy

Project description

The PRAD plan comprises five strategic focuses:

Supporting a dynamic agricultural sector that attracts young people and that is competitive and respectful of the environment

Building on the extraordinary agronomics research and development potential of the region to prepare the agriculture of the future today

Conserving agricultural land to ensure well maintained and lively areas

Ensuring high quality food through recognised local produce guaranteeing consumers' confidence in producers

Ensuring readily available water resources for agriculture, preserving water quality and anticipating climate change

In particular, the plan highlights the specificity of the Mediterranean climate which warrants the storage of excess winter rainfall for agricultural uses in spring. Indeed, climate change has significantly increased the need for such carry-over of resources.

As part of the strategic focuses for successful adaptation, the PRAD gives priority to integrating the aridity index in the natural handicaps zoning criteria - in particular by identifying disadvantaged areas in danger of abandonment - and to supporting efforts to adapt plant material and make water resources readily available. In addition to promoting water-efficient farming practices, this means supplementing water supply and 50 reservoirs per year, through the realization of the Aqua Domitia project, which involves the transfer of water from the Rhône.

KEYWORDS
Drought
Water and food security
Engineering,
Government policy

Project strengths

- The project vision takes into account the specificities of the area and the inter-related challenges of food and water security and climate change.
- Its actions seek to move towards sustainable management of water resources by addressing supply and demand issues.

MORE INFORMATION AT
http://draaf.languedoc-roussillon.agriculture.gouv.fr/Le-Plan-Regional-de-l-Agriculture

CONTACT
guillaume.benoit@agriculture.gouv.fr

Action

Adapting a hydropower plant in response to glacier melt

Adaptation

Mitigation

11

TIME PERIOD
2008
2011

LOCATION
CHAMONIX

Project leader:
EDF

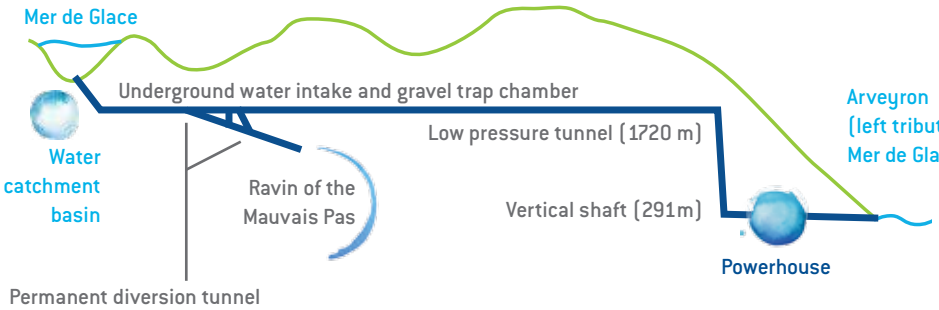
Context and aims

Electricité de France (EDF) is an integrated energy company and a global leader for electricity production. In 2013, it had an installed base of 140 GW.
The Les Bois hydropower plant, built in 1973, produces electricity using water collected under the Mer de Glace glacier (Sea of Ice) in Chamonix, in the French Alps. The Mer de Glace began to shrink in 1940 and the phenomenon has gradually accelerated in recent years as a result of global warming. In 2005, the ice over the water intake was still 50m thick and the terminus, or end, of the glacier was situated approximately 120m downstream of the intake.
In 2008, the intake was uncovered and positioned at the glacier terminus. Over the years, the glacier has transported and deposited a large quantity of moraine (boulders, gravel, etc.) on the right bank of the glacier. With the retreat of the glacier, this moraine has fallen to the valley bottom covering the water intake with boulders. It therefore became vital to move the subglacial water intake. Following a storm on 11 June 2009, the original intake became blocked after 36 years of uninterrupted operation.

Project description

With the rapid retreat of the Sea of Ice, the subglacial water intake for the Les Bois hydropower plant was positioned at the glacier terminus and buried under alluvium.
Climate change adaptation led EDF to undertake the construction of a new intake 800 meters upstream to allow the hydropower plant to continue operating. Design and engineering studies were carried out from 2005 to 2008 by EDF's Hydraulic Engineering Center. The main works were launched in late 2008, with a view to commissioning a temporary water intake in April 2009 and a new permanent intake in April 2011. The plant has operated with the new water intake since 2011.
Hydropower, which is a renewable energy, has an important role to play in decarbonizing electricity and therefore mitigating climate change.

LES BOIS HYDROPOWER SCHEME - LONGITUDINAL PROFIL



Project strengths

• This project opened up a course of reflection on the need to renew and adapt infrastructure to climate change and the means to achieve this.

PARTNERS:
Laboratory of Glaciology a nd Environmental Geophysics (LGGE) and the Department for the Rehabilitation of Mountain Land (RTM) of the National Forests Office.

KEYWORDS
Ice melt
Water and energy
Engineering

MORE INFORMATION AT
http://webtv.edf.com/chamonix-une-centrale-hydroelectrique-sous-la-mer-de-glace-vid-eo4047.html

CONTACT
laurent.bellet@edf.fr

Action

Managing and optimizing irrigation for corn production

Adaptation

Mitigation

12

TIME PERIOD
Since
2013

Project leader:
NATAÏS

Context and aims

NATAÏS, a company based in Bézéril in the Gers region, specializes in the popping corn production for the European popcorn industry. Corn growing is contracted out directly to 220 local farmers; in 2011 these partners cultivated a total area of 4,750 hectares. For many years now, NATAÏS has actively pursued a sustainable development approach to agriculture. Since 2010, as part of this approach, the company has placed special emphasis on the management and optimization of the irrigation of popping corn.
The Gers region is particularly susceptible to drought and the phenomenon is being accentuated by climate change. NATAÏS has set itself the goal of reducing irrigation water by 20% across its entire network of farmers, without reducing yield or quality.
Agriculture accounts for approximately 70% of global water consumption. Corn, or maize, is a cereal of exotic origin and is one of the most commonly grown crops in France. Its production requires large amounts of water. Balanced management of water resources is essential in order to meet the needs of agriculture, food safety and other uses, particularly in light of climate change.

PARTNERS:
Adour-Garonne Water Agency

Project description

The Adour-Garonne Water Agency is supporting the project led by NATAÏS. The project aims to decrease the amount of irrigation water of all producers of the company's 4,300-hectare growing area, by 20%. By directly funding capacitive probes for some twenty producers (data from probes can be viewed on the Web) and by providing 9,000 euros of grants per year to NATAÏS for the development of consulting services, the Agency and the company have helped to reduce water quantities by 20%, in a region concerned by regular drought, while maintaining the yield and quality levels of popcorn producers.
Costs are:
The average water consumption of the producers who took part in the project decreased 24% from 1,880 m³ per hectare to 1 430 m³ per hectare in 2011, and 12% to 1,660 m³ per hectare in 2012. Financial costs, which were 220 euros per hectare on average, decreased by 10% to 25% depending on the producer.

KEYWORDS
Drought
Water and food security
Engineering

Project strengths

• The project encourages farmers at their scale to develop more efficient practices in a region at risk from water shortages. Following a review of the water savings, there are plans to improve the process and deploy it across all of the producers in contract with NATAÏS. There are also plans to develop support to reduce nitrogen fertilization.

MORE INFORMATION AT
http://www.popcorn.fr/

CONTACT
Joel.Marty@eau-adour-garonne.fr

Action

Adaptation

13

Cooperating to tackle climate change in Africa - the Water Development and Management Master Plans for the transboundary Senegal River

Project leader:
Société du Canal de Provence (SCP)

Context and aims

SCP (Société du Canal de Provence) is a semi-public company with the special status of Regional Development Company (RDC). It provides public services with respect to irrigation and water supply for domestic, agricultural and industrial uses and provides engineering expertise, particularly in the field of integrated water resources management.
The IPCC, in its report of 2014, outlined that Africa is the most vulnerable continent in terms of water-related risks (drought, quality, etc.), despite gaps in studies of the region's climate and hydrology.
Consequently, the Senegal River will have to cope with changes in the future, in terms of rainfall inputs, temperature, evapotranspiration, flow etc. and these changes are still poorly understood. In parallel, anthropogenic pressures on the river are destined to increase due to demographic and economic growth of countries in the river basin.
In 1972, the Senegal River Basin Development Authority, known as OMVS, was set up by nations that share the river - Mali, Mauritania, Senegal, then Guinea - to introduce joint river governance, based on cooperation.

Project description

Faced with the challenges of development - to which the river is key - and climate, the member nations of OMVS selected SCP, in association with the CSE (French Center for Ecological Monitoring), and CACG (Gascony Development Company), to draft the Water Development and Management Master Plans (known in French by the acronym SDAGE) for the Senegal River, with full consideration of the above issues for the period up to 2025.

The SDAGE outlines key guidelines and a detailed action plan to establish a consistent framework for development activities while protecting water resources and the environment, looking ahead to 2025. Climate change dominated discussions at several stages of the master planning process.

Modeling used to produce the SDAGE included forecasts for withdrawals (water demand) and inputs (potential supply), thus making it possible to test various water development scenarios and the impact of these on uses of the resource.

Based on this process, two alternative options were decided:

- If low water inputs are expected in the basin, as a precautionary measure, the allocation of water to non-priority uses will be limited.
- If greater water inputs are expected, more water can be withdrawn (via infrastructure) to satisfy water demand.

Climate change, although still poorly understood, can thus be applied in hypotheses predicting basin inputs and used to influence decisions on how water is managed.

Project strengths

- The integration of climate issues in the Senegal River SDAGE project is particularly innovative in the region and its importance is heightened by the cross-border nature of the basin. The work of the SCP has helped to build a regional approach to integrated water resource management by disseminating a forward-looking approach to the basin and making this a basis for strong cooperation, which is a vector of stability.

PARTNERS:
OMVS (Organization for the enhancement of the Senegal River), AFD (French Agency for Development), European Union, CSE CACG

KEYWORDS
Multi-risks ,
Multi-sectors
IWRM and planning

MORE INFORMATION AT
http://www.portail-omvs.org/gestion-ressource-et-environnement/sdage/schema-directeur-damenagement-sdage

CONTACT
jean-luc.trouvat@canal-de-provence.com

Action

Mitigating greenhouse gas emissions connected with drinking water provision in Marseille

Adaptation

Mitigation

14

Project leader:
Société des Eaux de Marseille (SEM)

Context and aims

Société des Eaux de Marseille (SEM) is responsible for providing water and sanitation services on behalf of local authorities. It also provides engineering services for industry, business and public establishments within the region principally with a view to controlling water consumption and preserving the natural environment.

Project description

To help mitigate climate disruption, Société des Eaux de Marseille has set a goal to reduce greenhouse gas emissions resulting from the provision of drinking water by 20%. It also plans to propose integrated management tools to major clients in the manufacturing and tertiary sectors to enable them to achieve similar reductions.

To achieve this target, SEM is seeking to optimize operations and save water by increasing hydraulic efficiency in the water supply, treatment and distribution processes. It is also implementing remote meter reading for customers throughout the entire Marseille Urban Community enabling over one million inhabitants to control their consumption. In addition to these actions, SEM is implementing energy management measures as part of the ISO 50 001 certification process and through investments in renewable energy production. Focuses include small hydro and solar power projects and increasing the use of these green energies for power and fuel supply.

In providing its services, SEM also carried out excavation work which generates greenhouse gas emissions. It reduces these emissions by using recycled fill materials and trenchless work methods.

It is also focusing on the activities of large customers in the manufacturing sector by deploying an integrated system (comprising metering and management indicators) for multi fluids management (compressed air, steam, etc.).

This already broad set of actions will be supplemented by the creation of an action plan aimed at reducing energy consumption by 10% within 15 years and reducing hydraulic losses linked to water supply and distribution by over 20%, across Marseille Urban Community. Lower losses means increasing energy efficiency for processed water while limiting waste.

Project strengths

• SEM, through the measures it has developed and by involving a range of sectors and actors, is taking an integrated approach to its GHG emissions reduction targets while also contributing to saving water.

KEYWORDS
GHG emissions ,
Drought
Water and sanitation services
Engineering,
Technologies

MORE INFORMATION AT
www.eauxdemarseille.fr

CONTACT
marc.gervasi@eauxdemarseille.fr

Action

Restoring wetlands and preserving biodiversity - Zone Libellule®

Adaptation

15

Project leader:
SUEZ environnement

TIME PERIOD
2009
2012

LOCATION
SAINT JUST AND SAINT NAZAIRE DE PÉZAN

Context and aims

SUEZ environnement is a global leader in the water and waste management fields.
In coming years, climate change could increase river temperatures and cause low-water periods to occur more frequently, thus accentuating the additional impact of human activities, such as the discharge of wastewater to the natural environment.
Climate change also contributes to the decline of biodiversity in aquatic environments, consequently reducing their self-purifying ability.

Project description

Zone Libellule® (the Dragonfly Zone) is a dual solution - it provides a buffer, downstream of a wastewater treatment plant, to facilitate the return of treated water to the natural environment (by controlling pollution, temperature, etc.), and uses the said water to re-generate local biodiversity.
Zone Libellule® is an area adjacent to the local wastewater treatment plant which is being piloted in a project led by the local authorities of La Palus in Hérault. Wastewater transits via the zone before being discharged into the Dardaillon river. Developing the zone consisted in assembling several aquatic ecosystems with differing hydromorphological characteristics (a deep pond, meanders, wet meadow, etc.) with a selection of aquatic plants for vegetation.
The treated wastewater follows a route that eliminates macro-pollutants and some phytosanitary products (through the reed bed), breaks down pollutants (which are absorbed by roots) and eliminates certain metals such as zinc (through species such as water mint and watercress), as well as bacteria and molecules through UV exposure in buffer zones.
There is minimum human involvement, thus allowing local biodiversity to regenerate itself naturally.
This full-scale research lab is one of a kind for the observation of environmental rehabilitation through the use of local fauna or flora.

PARTNERS:
Local council of Saint Just in Hérault

1 Phytoplankton basin
2 Reedbed
3 Meanders
4 Braided stream
5 Free zone
6 Wet meadow
7 Floodplain
8 Live fence
10 Natural watercourse

KEYWORDS
Quality,
Flow variability,
Ecosystems
Water and sanitation services
Engineering,
Raising awareness

Project strengths

- Zone Libellule® is also an exceptional educational site for teaching people about the value and preservation of aquatic environments.
- A storage area adjacent to the pond can act as a storm basin, controlling floods and dry periods.

MORE INFORMATION AT
http://www.emag.suez-environnement.com/zone-libellule-innovation-biodiversite-2192

CONTACT
eric.blin@lyonnaise-des-eaux.fr

Action

Wastewater treatment as a green energy source. VEOLIA expertise in China

Adaptation

Mitigation

16

TIME PERIOD
2015
2008

Project leader:
VEOLIA

Context and aims

The VEOLIA Group supports cities and industries globally in the management, optimization and re-use of water resources, energy and materials, especially from waste, by providing them with solutions based on a circular economy.
China, the world's most populous country, is the largest producer of greenhouse gases - although its per capita emissions remain far behind the United States or Canada - and its emissions are only set to fall after 2030. This means that there is significant potential for mitigation and that all sectors can have an impact. The sanitation sector produces greenhouse gases in varying degrees, depending on the processes used and the age of infrastructure. There is therefore a real opportunity for developing countries like China, which have a growing need for such infrastructure, to invest in low-emission and energy-efficient processes. Ürümqi, a city in northwest China which has undergone rapid economic development since the 1990s, opted to take this route. In 2005, in anticipation of the impact of its growth on demand for water and wastewater treatment, the city chose VEOLIA to upgrade and operate its wastewater treatment plant.

Project description

The Ürümqi plant is designed to process the wastewater of 1.5 million inhabitants, following a program of extension and modernization implemented in 2010, which increased the plant's capacity from 200,000 m^3 to 400,000 m^3 per day. Today, biogas from the digestion of sewage sludge provides an important source of renewable energy. Six sludge digesters built by VEOLIA offer a processing capacity of 2,700 m^3 per day; in 2014, they produced 985,000 m^3 of biogas per month.
The biogas produced is re-used at the plant for three purposes:
- to supply heat through biogas-fired boilers;
- to generate power, through three biogas-fueled generators;
- to power fans, which generally use fossil-based energy.

Biogas is used differently according to seasons, in order to obtain the highest possible energy efficiency. In winter, biogas is allocated to boilers as a priority to ensure an uninterrupted service in spite of harsh conditions.
Overall, the green energy generated from the sewerage sludge treatment process implemented in Ürümqi covers 50% of the plant's energy needs and considerably reduces its carbon footprint - 80% of greenhouse gas emissions were avoided in 2014 compared with 70% in 2011.

Project strengths

- The measures implemented have resulted in major savings of fossil-based fuels and significant reductions in greenhouse gas emission. They also save water through the re-use of wastewater for irrigation.

PARTNERS:
Ürümqi Water Bureau, Ürümqi KUNLUN Environment Protection Group Co Limited in a joint venture with VEOLIA Water Company Limited

KEYWORDS
GHG emissions ,
Drought
Water and sanitation services
Engineering,
Technologies

MORE INFORMATION AT
www.veolia.com

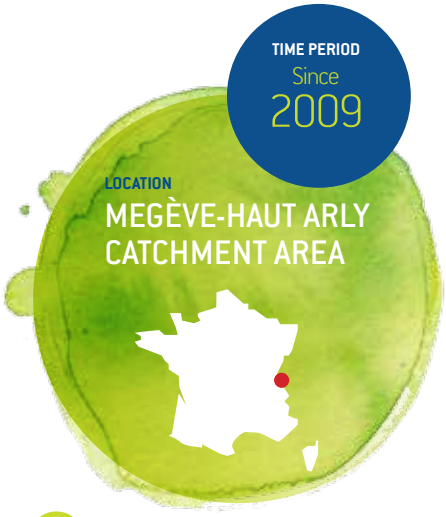
CONTACT
nina.cambadelis@veolia.com

Action

Adaptation 17

Water in mountains: sharing and reconciling uses of an endangered resource

Project leader:
Asters (Conservatory of Natural Areas in Haute-Savoie)



Context and aims

The Mountain Water Observatory, led by the Conservatory of Natural Areas in Haute-Savoie, Asters, in connection with the Montagne Vivante endowment fund, works closely with scientists, water operators and local officials to improve knowledge on the availability of water in mountain areas, in light of ongoing climate change.
The mountain environment is particular in that it conjures up a strong or harsh image, and yet it is fragile. Water is a key element of this very unique environment and provides a perfect example of the fragility of mountain areas.
In European mountain ranges, impacts include an increase in extreme flood events in the autumn-to-spring period and, above all, increasingly frequent and marked periods of low water, resulting in seasonal water shortages. It is therefore necessary to adapt and focus on sharing this increasingly scarce resource between some very specific uses (tourism, farming, forestry, etc.).

Project description

Today's challenge is to reconcile uses to ensure the sustainable management of water in mountain regions. For this purpose, the Mountain Water Observatory seeks to:
• fully understand the functioning of catchment areas in order to anticipate difficulties connected with water shortages or, inversely, abnormal rainfall;
• study and anticipate the effects of climate change and anthropogenic changes on water resource availability;
• help water operators to measure the medium- and long-term impact of their modes of operation on water resource availability.
To achieve this, a measuring network that uses observation to collect data on certain phenomena has been set up. This process is supported by hydraulic modeling, which makes it possible to interpret datasets and simulate the future state of water resources while taking into account both future climate change and the development of human activities. The Observatory seeks to give its work an operational focus and is currently developing decision-making tools consisting of an interface for data providers and local water operators, to enable them to make informed management choices.

Project strengths

• This study of water focuses on a multi-stakeholder approach in order to best address cross-functional issues while taking into account the specific characteristics of the mountain environment.

FOCUS

The International Congress of Integrated Management in High Watersheds (held in Megève, France, from 8-10 October 2014) provided an opportunity for the many diverse stakeholders concerned by the future of mountain water resources to come together and reflect on related issues. Discover avenues for adaptation arising from the congress's many constructive debates on the EGEM website: **http://www.egem2014.org/**

PARTNERS:
Montagne Vivante endowment fund, EDYTEM/CNRS (research institutes), TENEVIA (environmental monitoring company), RDA74, Conservatory of Natural Areas in Haute-Savoie, Megève council

KEYWORDS
Floods, Drought
Multi-sectors
Knowledge, Technologies

MORE INFORMATION AT
http://observatoire-eau-montagne.org/

CONTACT
aude.soureillat@asters.asso.fr

Action

Managing oasis resources through agroecology - Example of the CARI pilot farm in Morocco

Adaptation

Mitigation

18

TIME PERIOD
2015
2016

LOCATION
THE JORF OASIS, MOROCCO

Project leader:
Centre d'Actions et Réalisations Internationales (CARI)

Context and aims

CARI is a non-government organization which strives to empower local producers by promoting local agriculture.
Oasis are agri-systems which are built and maintained by man. A combination of water and vegetation must be carefully managed to create the oasis effect which generates a form of hot, humid micro climate that is particularly suited to farming a wide variety of agricultural production. However, the gradual disappearance of conditions enabling oasis farming, due among other factors to climate change, has led to reduced revenues for oasis people and the pauperization of their communities. The Moroccan oasis town Jorf is a classic example. Jorf is situated in the expansive, semi-arid valley of Tafilalet, south of the town of Errachidia, in a dryland where droughts occur several times a year.

Project description

The aim of the project developed by CARI and supported by the Itancia Foundation is to assist the creation of a farm to demonstrate and disseminate agro-ecological practices. The five-hectare pilot farm, owned by a partner farmer, will also promote the sustainable use of natural resources of the oasis. The farm provides a place for:
• agricultural production;
• applying the principles of ecological agriculture;
• training and dissemination of practices;
CARI has provided support on agro-ecology methods, including:
• Soil fertility management (compost, crop rotations and associations, etc.), early sowing and seed saving;
• A more rational application of treatments and use of natural treatments;
• Limitation of submersion techniques on some plots through the implementation of a more efficient drip system, which halves the amount of irrigation water required.
This project also contributes to mitigation through the implementation of a solar pumping system (wells) and the elimination of fuel-driven motors - fuel savings enabled the farmer to achieve a return on investment after the first year.

Project strengths

• This project focuses on harnessing sustainable development and adaptation potential and developing awareness among stakeholders resulting in co-benefits in the long run.

PARTNERS:
The Itancia Foundation, Centre d'Etude et de Développement des Territoires Oasiens et Désertiques (Center for Study and Development of Oasis and Dessert Areas), The Ferkla Oasis Association for Environment and Heritage

KEYWORDS
Drought
Water and food security
Raising awareness, Engineering

MORE INFORMATION AT
www.cariassociation.org

CONTACT
oasis@cariassociation.org

Action

Limiting urban heat islands by re-vegetating towns and nearby areas

Adaptation

Mitigation

19

TIME PERIOD
2007
2015

LOCATION
AGEN URBAN COMMUNITY

Project leader:
Water and Climate Cluster

Context and aims

The Water and Climate Cluster brings together research centers, businesses and local authorities, mainly through the ACMG (Climate Association for Mid Garonne and Southwest France) to explore links between water and climate, in particular in the Agen region, and with a view to exporting expertise.
One of the major consequences of the increase in temperatures, connected with other factors, is the emergence of urban heat islands i.e. concentrated areas of warmer temperatures within the urban area. The warming of the urban area of Agen, acknowledged by ACMG, results in a less comfortable living environment, implications for health and a need to rethink urban policies.

Project description

The Water and Climate Cluster has explored this issue by leveraging and extending various projects focusing on climate effects on the Southwest of France (Adaptaclima and Telerieg in particular) and has proved the existence of an urban heat island phenomenon using thermal satellite technology and ground sensors.
To address this issue, the Cluster proposes to give nature a central place in the urban area and to strengthen links with the countryside as a means of cooling urban areas during heat waves, which are occurring more and more frequently in the region. It is possible to mitigate the urban heat island effect or even cool air near business or residential areas by encouraging the creation of cool areas. This can be achieved by increasing vegetation in towns along urban footpaths or cycle paths. Vegetation provides shade and above all transfers water, which it pumps naturally from the ground, to the atmosphere, through evapotranspiration. The Water and Climate Cluster also recommends better coordination with the neighboring farming community whose crop types and growing methods influence soil and atmospheric humidity and could thus help reduce local summer heat. Water is therefore a critical resource for offsetting the impact of climate change, particularly in summer when requirements are greater. In the Agen region, there are plans to store water in new-generation lakes encouraging biodiversity and in surface water bodies, such as old meanders of the Garonne river. If such plans gain social acceptance, they will ensure the functioning of this sustainable form of "air-conditioning" based on water and plants.

Project strengths

• The action led by the Cluster involves a sociological dimension. Through field studies, the cluster has shown that re-vegetating urban areas helps to improve comfort and reduce stress, leading to positive implications for health. The Cluster seeks to find the most effective way to raise awareness around these topics.

PARTNERS:
Institut Polytechnique de Bordeaux, CEA Tech Aquitaine, the IMS research lab, ACMG, IFTS (Institute for Filtration and Separation Techniques), the VEOLIA Water Research and Development Center

KEYWORDS
Drought
Water and urban development
Knowledge, Engineering

MORE INFORMATION AT
http://www.acmg.asso.fr/pdf/Article_Adptaclimall_ACMG_01122014_web.pdf

CONTACT
jfberthoumieu@agralis.fr

Action

Integrated Management of Water Resources (IWRM) in Madagascar

Adaptation

Mitigation

20

TIME PERIOD
mars 2014
à fev. 2017

LOCATION
ZAMBAZAMBA CATCHMENT AREA, FIANARANTSOA, NASANDRATRONY, HAUTE-MATSIATRA REGION, MADAGASCAR

Project leader:
Etc Terra, Grand Lyon Metropole

Context and aims

Etc Terra, an association founded in 2012, works in partnership with Agrisud International in various African countries. Its mission is to show that it is possible and beneficial to reconcile economic development and conservation of natural capital in rural regions of developing countries.

According to the FAO, agricultural production should more than double in developing countries by 2050. This necessary increase in production will inevitably have consequences on water resources which, in some regions of the world, have already been significantly impacted by climate change effects. Madagascar is highly exposed to such issues given the prevalence of irrigated rice-growing, which is performed by two million households. Consequently, there are frequent conflicts of interest between drinking water and agricultural uses.

In March 2014, an integrated management of water resources project was launched for the Zambazamba catchment area, which supplies drinking water to the town of Nasandratrony to prevent conflicts of use and to reconcile water and food security.

Project description

A development plan was developed following a participatory process involving local stakeholders. Within this framework, three areas of work were identified:

• Protection and increase of water resources upstream of the catchment: establishment of 60 hectares of agro-forestry developments on contour lines, especially close to the water intake to promote infiltration of rainwater rather than runoff;

• Improvement of water productivity downstream of the intake through the dissemination of water-efficient practices and most importantly Systems of Rice Intensification (SRI), which have the double advantage of reducing water consumption and improving yields. Some fifty farmers are receiving individual support to implement this process;

• Impact measurement: the system implemented is designed to measure the expected improvement in the rainfall-runoff ratio, both at the intake and outlet of the Zambazamba catchment area. The climate impact of the project will also be evaluated at the end of the project, including the CO2 sequestration achieved through agro-forestry developments.

This project is closely connected with the drinking water supply program project CAP'EAU which is being implemented by Lyon City Council and its partners and which will benefit 4,500 persons in Nasandratrony alone.

Ultimately, the aim of this pilot project is to be replicated 1 in other municipalities in the Haute-Matsiatra region 2 and within larger catchment areas, similar to the sites involved in the Holistic Forest Conservation Program - a REDD+ program (Reducing Emissions from Deforestation and Forest Degradation) which Etc Terra and Agrisud International are also implementing in Madagascar.

Project strengths

• Through this project, Etc Terra is helping to disseminate practices with multiple benefits, including the conservation and efficient use of water resources, the diversification and increase of farmers' incomes and climate change adaptation and mitigation.

PARTNERS:
Agrisud International, Lyon City Council, Water Agency for the Rhône Mediterranean Corsica region, Regional authorities of Haute Matsiatra (Madagascar)

KEYWORDS

Floods,
Drought,
Ecosystems,
Water and food security
IWRM and planning

MORE INFORMATION AT
http://www.etcterra.org/fr

CONTACT
m.tiberghien@etcterra.org
r.vaudry@etcterra.org

Action

Ensuring the existence of groundwater for the supply of drinking water to Montpellier

Adaptation 21

TIME PERIOD
2011
2014

LOCATION
THE LEZ RIVER SPRING, MONTPELLIER REGION

Project leader:
The French geological survey (BRGM)

Context and aims

BRGM is the leading public institution in the application of earth sciences for the management of resources and risks above and beneath ground, including groundwater.
Water from the Lez spring is collected to supply drinking water to the 340,000 inhabitants of the Montpellier Urban Community, just as it has been for over 150 years. Using groundwater rather than surface water from the Lez is less complex and costly in terms of the treatments required.
Under climate change, lower rainfall and a rise in temperatures are expected. Such phenomena affect the very large groundwater reservoir of the Lez by decreasing the amount of water that can infiltrate the ground to replenish the quantities stored in the aquifer.
Moreover, future increases in the population of this fast-growing urban area will mean greater drinking water needs.

Project description

A study of the aquifer and digital modeling of groundwater flow was undertaken. Eight geological sections and the data from 635 boreholes were used to visualize in a precise manner the complex geological structure that is the Lez karstic aquifer. New drilling highlighted the likely presence of groundwater deep in the ground.
The digital model developed simulates the impacts of climate and anthropogenic changes on water resources, based on IPCC scenarios, and helps to anticipate future crises that could occur in the period up to 2050. These models were also used to develop a flood prevention system.
The results of modeling make it possible to determine a sustainable level of water withdrawal for the future - incorporating seasonality into withdrawal strategies - and to propose alternative resource management strategies than those currently used; increasing withdrawals would make it possible to supply at least 390,000 inhabitants by 2030 without jeopardizing aquatic ecosystems.
The simulation of different types of scenarios also opens up discussions sufficiently early to enable changes to be made to regulatory aspects relating to withdrawal, such as declarations of public utility for the exploitation of resources.

Project strengths

• This comprehensive local study, ranging from the assessment stage to recommendations, addresses multi-use issues and highlights links between socio-economic and climatic factors.

The findings of this operational study provide water operators of the city of Montpellier with information on the future of water resources.

PARTNERS:
Tetis, Rhône-Mediterranean-Corsica Water Agency, Departmental Council of Hérault, Regional health Authority, Departmental Division of territories and sea of Hérault, Hydrosciences, G-Eau, Biotope, Tetis

KEYWORDS
Drought,
Floods,
Quality
Water and sanitation services
Knowledge,
IWRM and planning

MORE INFORMATION AT
http://www.brgm.fr/projets/lez-exemple-gestion-multiusage-eau-ressources-qualite-risque

CONTACT
jc.marechal@brgm.fr

Action

Adapting inland navigation with GEPET-Eau

Adaptation

Mitigation

22

TIME PERIOD
2012
2015

LOCATION
CUINCHY-FONTINETTES

Project leader:
École des Mines de Douai
and Artois-Picardie Water Agency

Context and aims

The Artois-Picardie Water Agency is one of the six water agencies. It is based in Douai, France, and has competence over the Artois-Picardie basin. It provides support to the ARMINES joint research center at the Douai Ecole des Mines for the GEPET-Eau project.
The anticipated impacts of climate change in terms of extreme events and flows (probable drop in summer flows; possible increase in winter flooding, etc.) will disrupt ship transport.
The GEPET-Eau project contributes to meeting the goals of the French plan of action for adapting to climate change (PNACC) by proposing predictive and adaptive strategies for managing waterways and water resources in general within different catchment areas.

Project description

The aim of the GEPET-Eau project is to better understand how the Dunkerque-Escaut channel structures operate on a specific portion (Cuinchy-Fontinettes reach) in order to propose management strategies that can ensure the sustainability of navigation in a context of climate change.
The GEPET-Eau project has developed an initiative that consists of collecting data in order to identify the simplifying assumptions necessary for defining the usual modeling approaches used to assess the critical events and consequences of climate change. The aim is to increase the resilience of the Cuinchy-Fontinettes reach. These models are used to develop predictive strategies that serve as a valuable decision support tool. This tool will be used within the operational management units of Voies Navigables de France (VNF) with economic and service-related benefits expected for VNF and the affected regional authorities.
These efforts are especially positive in a context of climate change because inland navigation is more energy efficient than road transportation. It thus offers considerable potential for mitigation, provided that waterways are adapted suitably.

Project strengths

• The GEPET-Eau project produces multi-actor work that seeks to strengthen the link between science and water managers as well as the link between knowledge and policy-making.

APPUI :
Artois-Picardie Water Agency

PARTNERS:
ARMINES research center (Douai School of Mining), Voies Navigables de France (VNF), Irstea, DREAL Nord-Pas de Calais, Polytechnic University of Catalonia, Ministry of Ecology, Sustainable Development and Energy (GICC)

KEYWORDS

Flow variability
Water and transportation
Knowledge, Information

MORE INFORMATION AT
https://gepeteau.wordpress.com/

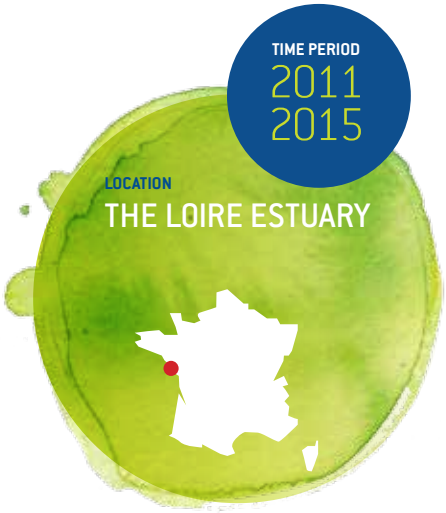
CONTACT
eric.duviella@mines-douai.fr
a.courtecuisse@eau-artois-picardie.fr

Action

Adaptation

23

Better anticipating change in estuary waters with the "C3E2" Project - the example of the Loire River



Project leader:
French Research Institute for Exploitation of the Sea (Ifremer)

Context and aims

The French Research Institute for Exploitation of the Sea, Ifremer, contributes, through its work and expertise, to enhancing knowledge on oceans and ocean resources, monitoring the marine and coastal environment and the sustainable development of maritime activities.

Estuaries are fragile areas of sea and land. They are impacted by climate change, which manifests itself especially in a rise in sea level downstream and changes in river deposits upstream. More specifically, in mainland France, these impacts translate to a decrease in flows, especially during the low-water period, which is likely to become longer. The main expected consequences are thus higher flood risks, greater saltwater intrusion into upstream waters, the progression upstream of areas of high turbidity, or silt blockages (large accumulations of fine sediment), and changes to the morphology and sediment deposits of estuary systems.

PARTNERS:
ARTELIA, Institute of Geo-architecture UBO, The Loire-estuaire public interest grouping, French Ministry of Ecology, Sustainable Development and Energy

Project description

Ifremer and its partners have developed the "C3E2" project, supported by the Climate Change Management and Impacts program (GICC) being led by the French Ministry of Ecology, to provide crucial data for the management of estuarine areas, economies and communities.

Under "C3E2", tests were developed through hydromorphological modeling of estuaries, based on various climate scenarios. According to the results of these tests, the way the estuary responds to climate scenarios varies greatly according to its "initial" geometry, the space available in the flood plain beyond the currently floodable area, the possibilities of interaction with the riverbed and changes in solid deposits upstream, which, according to the experts, must be urgently categorized in relation to climate change and uses.

Through "C3E2", it was possible to simulate the future of the salt marshes bordering the Loire according to climate change scenarios. This provided a useful base for testing alternative ways of managing these marshes which are currently used for extensive grazing or hunting activities. The results of the study will be communicated to management authorities during 2015 and could lead to the identification of alternative floodplain management scenarios.

KEYWORDS
Floods,
Flow variability
Multi-sectors
Knowledge,
IWRM and planning

Project strengths

• The project is designed to be a repository for various estuaries and initiates links with management authorities.

MORE INFORMATION AT
http://wwz.ifremer.fr

CONTACT
plehir@ifremer.fr

Action

Adaptation 24

Combining open and participatory tools to help water management stakeholders adapt their practices: Wat-A-Game

Project leader:
National Research Institute of Science and Technology for Environment and Agriculture (Irstea)

Context and aims

The National Research Institute of Science and Technology for Environment and Agriculture (Irstea) conducts multidisciplinary scientific research to produce concrete solutions to support action-oriented policymaking.
Various actors and uses are involved in the management of water resources, which has been weakened by climate change. Multiple models are available for managing resources, each of which is adapted to the circumstances and risks surrounding water resources. A common thread across these models is the need for informed managers that are familiar with the risks and uses related to these resources.
In the face of current and future climate risks and hazards, strengthening the capacities of water managers at all levels is a crucial issue for developing sustainable, rigorous responses.

PARTNERS:
Cirad, ComMod, Lisode, Oxyo Water, Casden and LEGTA Théza

Project description

Irstea worked alongside its partners to develop a training and teaching method to help water managers to manage water resources sustainably at the level of their own region in a context of global and climate changes through the COOPLAAGE (Combining Open and Participatory Tools to Enable Water Management Stakeholders to Adapt) Wat-A-Game.
The goal of this method is to incite stakeholders to take action by providing a set of easy-to-use, simple, rigorous tools and methods to set up participatory workshops focused on modeling, simulation, planning, monitoring and assessment. The COOPLAAGE pack also includes a Wat-A-Game kit containing material and methodological components for creating an analogical model (with cards and marbles) of a play version of a catchment area as well as COOPLAN processes for participatory planning and Just-A-Grid, which is designed to introduce and foster discussions on water-related principles of justice.
The added value of this methodology is that it formalizes knowledge from a variety of sources in a physical, easily transportable format that makes it easy to define and exchange values and viewpoints. COOPLAAGE can be used to build scenarios including climate events (drought or heavy rain) and socioeconomic events (changes in price or demographics).

KEYWORDS
Multi-risks
Multi-sectors
Raising awareness

Project strengths

• COOPLAGE is a cross-functional tool that can be used to assess a range of challenges at very large scales and with a wide variety of audiences in order to strengthen the knowledge needed to address these challenges.

MORE INFORMATION AT
www.watagame.info

CONTACT
geraldine.abrami@Irstea.fr

Action

Offering climate services for the sustainable management of water resources

Adaptation

Mitigation

25

TIME PERIOD
Since
2008

LOCATION
FRANCE

Project leader:
Météo France

Context and aims

Météo France is the leading French public institution for meteorology and climate studies. Changes in soil water resources and drought risks represent major challenges related to climate change in France, which were explored as part of the ClimSec (2008-2011) project. This project received the Norbert Gerbier-MUMM International Award for scientific quality from the World Meteorological Organization in 2010.

The link between the repetition of droughts since the 1990s and the effects of global warming is now a fact. It has been demonstrated that this risk will worsen by the middle of the 21st century, regardless of uncertainty concerning precipitation changes in all seasons and all regions of France. At the end of the 21st century, France may be faced with unprecedented extreme climate events such as drought, for which adaptation measures are essential and need to be developed quickly.

PARTNERS:
MAIF Foundation,
CNRS, CERFACS, ARMINES, Irstea

Project description

The ClimSec project has created new data sets on soil moisture in France at a very high spatial resolution both in terms of the present climate (since 1959) and future climates (several socioeconomic models and scenarios are taken into account). This data is processed to produce indicators. The relevance of these indicators was tested in the context of national operational hydrological monitoring and crisis management at the regional scale. The data was prepared to be made available to a wider audience (engineering firms, regional authorities and the general public) through the DRIAS platform, a national climate service in France providing access to regional climate projections for France.

This data was also used by regional climate change observatories such as the ORACLE platform to assess the impact of climate change on agricultural practices in the Poitou Charentes region.

Through the sharing of methodologies and approaches, this data contributes to the Global Framework for Climate Services overseen by the World Meteorological Organization. This initiative seeks to strengthen knowledge on a global level of climate hazards, in particular those related to agriculture and food insecurity, risks, health and water resources.

KEYWORDS

Multi-risks
Multi-sectors
Knowledge, Information, Raising awareness

Project strengths

• The ClimSec site produced by DRIAS provides a wide user audience with user-friendly, assisted access to knowledge on changes in soil drought in France and full access to downloadable data on specific regions over a given period of time. The site incorporates various services offered through the DRIAS platform, including a hotline, a user forum, training, and more.

MORE INFORMATION AT
www.meteofrance.com
www.drias-climat.fr

CONTACT
jean-michel.soubeyroux@meteo.fr

Appendix

List of other climate-compatible actions identified by the French Water Partnership

Comité intersyndical pour l'assainissement du Lac du Bourget (CISALB)	*Integrated management of the Bourget Lake in a climate change context*	*Multi-risks Multi-sectors* *IWRM and planning*
Provence-Alpes-Côte d'Azur Region and SCP	*Verdon hydraulic connection*	*Multi-risks Multi-sectors* *IWRM and planning, Engineering*
Artois-Picardie Water Agency	*Cooperate in planing water resources management in order to reduce impacts of climate change in the Chile basin*	*Multi-risks Multi-sectors* *IWRM and planning*
Rhine-Meuse Water Agency	*Designing sustainable systems related to water and sanitation services with low environmental impact and energy efficient*	*GHG emissions* *Water and sanitation services* *Knowledge, Engineering*
Seine-Normandy Water Agency	*Managing climate change impacts with the Water Resources Management Master Plan (SDAGE)*	*Multi-risks Multi-sectors* *IWRM and planning*
French Agency for Development (AFD)	*Conserving water whilde reducing leakage and rehabilitating drinking water services in 30 midsize cities in Morocco*	*Drought* *Water and sanitation services* *Engineering, Financingment*
Ministry of Ecology, Sustainable Development and Energy	*RESSOURCE : for integrated management of migratory waterbirds and wetlands in Africa*	*Ecosystems Multi-sectors* *Knowledge*
Asconit	*Monitoring water quality in the Dong Nai Basin : pre-feasibility study*	*Quality Multi-sectors* *Engineering, Knowledge*
Cimeo, Agence pour l'eau en montagne	*Limiting water withdrawals in the mountains by revaluation of the works and natural heritage*	*Drought Multi-sectors* *Engineering, Knowledge*
Société du Canal de Provence SCP	*Canalsol - refreshing a solar plant through the natural freshness of a canal*	*GHG emissions, Ecosystems* *Water and energy* *Engineering, Technologies*
SUEZ environnement	*BIOVALSAN : producing "green" gas from wastewater and reinjecting it in the natural gas distribution network*	*Hausse des GES* *Water and sanitation services* *Engineering, Technologies*
SUEZ environnement	*Implementing circular economy on the Schanghaï Chemical Industrial Park (SCIP) (China)*	*Hausse des GES* *Water and sanitation services, water and industries* *Engineering, Technologies*
SUEZ environnement	*AQUADVANCED: a "smart grid" solution in the service of water resources preservation*	*Drought* *Water and sanitation services* *Engineering, Technologies*
SUEZ environnement	*West Basin, a treatment and wastewater recycling plant to fight against water stress in the Los Angeles area (California)*	*Drought, Quality* *Water and sanitation services* *Engineering, Technologies*
VEOLIA	*Adapting urban drainage systems to the risk of extreme rainfalls in Copenhagen*	*Floods* *Water and urban planning* *Engineering*
Agronomists and Veterinarians without Borders - AVSF	*Saving water and create a sustainable economic branch based drip irrigation with SCAMPIS project in Madagascar*	*Drought* *Water and food security* *Engineering, Technologies*

European Center for Flood risk Prevention (CEPRI)	*Guide to raising awareness of flooding from rainwater runoff*	*Floods Multi-sectors Knowledge, Raising awareness*
Islamic Relief France	*Community dike for protection from floods in Pakistan*	*Floods Multi-sectors Engineering*
Islamic Relief France	*Harvesting rainwater for desert inhabitants in Pakistan*	*Drought Water and food security, Water and health Engineering*
Syndicat du Sud-Est Valentinois (SISEV)	*Increasing water reserves available in the Mediterranean region with the Juanon storage basin*	*Drought Water and food security Engineering*
French National Centre for Scientific Research (CNRS) - Seine-Normandy Water Agency	*Anticiper les futurs de la Seine avec PIREN*	*Multi-risks Multi-sectors Knowledge*
International Office for Water (IOWater)	*Improving resilience to climate change in Latin America through cross-border cooperation: WATERCLIMA LAC Program*	*Multi-risks Multi-sectors IWRM and planning*
International Office for Water (IOWater)	*Collection of good practices and lessons learned on water and adaptation to climate change in transboundary basins of rivers, lakes and aquifers*	*Multi-risks Multi-sectors Knowledge, Raising awareness*
International Office for Water (IOWater)	*Creating a global network of basin organizations to test adaptation measures to climate change at the basin scale*	*Multi-risks Multi-sectors IWRM and planning, Information*
National Center for Space Studies (CNES)	*COPERNICUS Observing water from space*	*Multi-risks Multi-sectors Knowledge, Technologies*
National Center for Space Studies (CNES)	*SWOT (Surface Water Ocean Topography Mission)*	*Multi-risks Multi-sectors Knowledge, Technologies*
National research Institute of Science and Technology for Environment and Agriculture (Irstea)	*Guide to developing a plan of action on the reduction of water losses from drinking water distribution systems*	*Drought Water and sanitation services Raising awareness*
Université Lille-1	*Smart grids for water networks efficiency : SunRise Project*	*Drought Multi-sectors Knowledge, Technologies*

All the actions are available on the following databases :

Water Expertise France **http://business.ubifrance.com/water-expertise-france**
Hub des Solutions COP21 **http://www.solutionscop21.org/**
Portail de l'ONERC Wkhydro **http://wikhydro.developpement-durable.gouv.fr/index.php/Portail:Wikhydro**
Portail de l'ONERC Wiklimat **http://wiklimat.developpement-durable.gouv.fr/index.php/Catégorie:Ressources_en_eau**
My Positive Impact **http://www.mypositiveimpact.org/**

Aknowledgment

Editorial Board:
ELÉONORE LEBOUVIER, HÉLOÏSE CHICOU, PHILIPPE GUETTIER, with the participation of JEAN-LUC REDAUD, chairman of the French Water Partnerships' working group on "Water and global and climate changes".
The French Water Partnership wishes to thank the Grand Lyon Metropole, Jean Jouzel, the CGAAER and all the member of its steering committee: the french Agency for Development (AFD), the French geological survey (BRGM), the french National Centre for Scientific Research (CNRS), the national Research Institute of Science and Technology for Environment and Agriculture (Irstea), the French Research Institute for Exploitation of the Sea (Ifremer), Philosophy Research Institute of Jean Moulin University-Lyon 3, the french Ministry of Foreign Affairs, the french Ministry of Ecology, Sustainable Development and Energy, the french National Observatory on the Effects of Global Warming (ONERC), the french National Agency for Water and Aquatic Environments (ONEMA), the french Institute of Research for Development (IRD), Allenvi.

Glossary of the FWP

Pictogram of our Colleges


Government and Public Institutions


NGOs, non-profit Organizations and Foundations


Local Authorities and Parliamentarians


Economic Stakeholders


Technical, Scientific, Research and Training Organizations


French and International Individuals

Pictogram of our themes


Access to drinking water


Sanitation


Water basin management


Food Security


Energy


Emergency, Reconstruction and Development


Biodiversity


Global and Climate Change


Sustainable Cities


Solidarity Mechanisms


Innovations and French Know-how


Governance


Financing


Training

Glossary water and climate


Adaptation


Mitigation

APRIL 2015

Graphic design:
SÍLABA VISUAL / www.silabavisual.com
ANNE-CHARLOTTE DE LAVERGNE / ELISE MARTY / MARIANA CASTILLO
contact@silabavisual.com / + 52 1 55 22 40 33 56

Printing coordination:
MILLENNIUM DESTINATIONS / www.millennium-destinations.com

Printing:
PS PRINTING SERVICE-PARK JIYOON / bat82@hanmail.net / 010 4482 4978

PRESENTATION OF THE FRENCH WATER PARTNERSHIP

The French Water Partnership (FWP) is a non-profit organization. It was founded in 2007 on World Water Day.
It is a French platform for discussing and exchanging ideas that helps to place water at the top of the global political agenda. It also helps to share the collective know-how of French players throughout the world. The FWP now counts more than 120 members from the public and private water sectors.
The FWP consists of six panels made up of representatives from 1) the government and its public institutions; 2) NGOs, organizations and foundations; 3) regional authorities and parliamentarians; 4) economic players; 5) research and training establishments and 6) French and foreign private individuals. It carries out its activities in a collaborative manner, without any category of members taking priority over the others. Together they develop common, consensus-based messages and communicate them in European and international bodies and networks such as the United Nations, the European Union, the Union for the Mediterranean and at events such as the World Water Forum and the World Water Week in Stockholm.

51 rue Salvador Allende
92027 Nanterre / France

+33 (0) 1 41 20 19 49
+33 (0) 1 41 20 16 09

www.french-water-partnership.fr
www.partenariat-francais-eau.fr

COMMITTED TO WATER FOR THE WORLD ENGAGÉS POUR L'EAU DU MONDE