French National Climate Change

Impact Adaptation Plan

2011 – 2015

ANNEXE II

Detailed action sheets

Contents

CROSS-CUTTING action sheet

Some adaptation actions to be undertaken cover several themes or sectors and therefore call for cross-cutting actions. This introductory chapter presents the three cross-cutting actions identified for this first National Adaptation Plan. These actions highlight the need to mainstream climate change adaptation in all sectors of activity and to make adjustments if required in order to prepare for climate change.

Illustration. The Fourth IPCC Assessment Report recalls that change will affect a number of sectors and that there will be several cross-cutting impacts.

Overall lead: DGEC

Action n°1: Define climate change reference scenarios

Description:
The executive summary of the preparatory consultation report issued a call for the government to set reference values for climate change. Many sectors of the economy actually require references, very often in the form of precise values, so that they can take them into account in scoping their long-term actions and decisions effectively.
From a scientific point of view, the uncertainty inherent in climate projections, as well as the range of climate projection models, means that it is not possible to supply "unique" values for a given time horizon. In fact, in climatology terms, climate references are interpreted according to the climate model used and according to a confidence interval calculated on the basis of future projected values.
This approach, which involves a probable range and a confidence interval, is required to inform technical or political decision-making, but it is often too broad to provide a basis for certain types of technical planning.
Faced with this situation, public authorities have been asked to provide "simplified" future climate values so that stakeholders who require them can understand them. These values, by their very nature, will be scientific data, but will not be scientific quality values.
Lead: DGEC
Partners: Environment Alliance[1]
Tools:
Climate reference values produced by the scientific community
Drafting of an official directive by the authorities presenting the "simplified" reference values
Timetable: 2011-2012
Indicators: Reference publications
Number of climate models considered
Availability of the report providing scientific reference values
Availability of the report providing "simplified" values

Action n°2: Systematically mainstream climate change in delegated public service contracts let by the government

Description:
Climate change could increase the frequency of certain types of disruption affecting the delivery of public services. Although no urgent phenomenon has been identified to date, it is necessary to take this aspect into account when reviewing contracts for delegated public services and public service contracts in order to identify existing vulnerabilities, on the one hand, and to prepare the measures required to ensure continuity of quality in delivery of these public services, on the other hand.
Therefore, when delegated public service contracts are let or reviewed by the government during the National Climate Change Adaption Plan implementation period, issues relating to the vulnerability of a service to climate change and any potential service disruption will be mainstreamed in the provisions of the contract. Delegated service providers will be required to carry out a climate change vulnerability

[1] The composition of the Alliance is given on the Research action sheet

study for the service and to inform the government, if required, of actions which will be taken to guarantee service delivery.
Vulnerability and adaptation studies will be based on reference climate projections provided by the government.
In the case of current delegated public service contracts and public service contracts, the government will evaluate those services which could be affected by climate change and inform the delegated service provider or supervisory authority, if required.
Lead: DGEC
Partners: Departments responsible for drafting delegated public service contracts let by the government
Tools:
Reference scenarios for projected climate change
Drafting of reporting framework documents for delegated service providers
Regulatory circular for government departments setting out the mechanisms to be introduced for producing vulnerability studies, and adaptation methods, where required, if a risk of public service disruption emerges
Timetable: 2011-2012 (reference publication and circular)
2012-2015 (amendments to new delegated public service contracts and examination of current contracts)
Indicators:
% of new delegated public service contracts let by the government whose provisions mainstream climate change (2011-2015)
% of delegated service providers who have submitted vulnerability studies and the adaptation actions undertaken to ensure continuous service delivery (2013-2015)
% of current delegated public service contracts in which vulnerability to climate change has been identified

Action n°3: Mainstream climate change projections in risk assessments over the life expectancy of classified installations

Description:
It is necessary to ensure that Classified Installations for Environmental Protection (CIEP) and those covered by the SEVESO directive mainstream climate change within the framework of their mandatory risk assessments, if this is appropriate to their projected life expectancy. Risk management procedures must remain operational irrespective of climate change. This provision will only apply to administrative procedures which commence during the implementation period covered by the National Climate Change Adaptation Strategy.
Climate change projection reference data to be taken into account will be published by the government.
The extension of this measure to all basic nuclear installations will also be examined.
Leads: DGEC and DGPR
Partners: Decentralised government departments
Tools: Publication of reference climate data (from departmental to municipal level) to be taken into account when carrying out risk assessments.
Circular notifying administrative departments and industry.
Timetable:
2012: Publication of reference data
2012 - 2015: Mainstreaming in risk assessment directives
Indicators: Number of risk assessments which have already mainstreamed climate change

Action n°4: Facilitate thinking in order to define the notion of acceptable risk

Description:
The national consultation carried out in 2010 called for "the rapid facilitation of joint thinking to define the notion of acceptable risk which is crucial when choosing, for example, between coastal protection or withdrawal strategies".[2]
Following this recommendation, the Prevention and Precaution Committee (CCP) was tasked in the summer of 2010 with examining the notion of acceptable risk in the context of governance of the risks

[2] National consultation working groups, report, 30 June 2010, p.9

associated with climate change and, more specifically, with considering the role of cooperation mechanisms.
The Committee delivered its initial scoping information in spring 2011, which will form the basis for further work, culminating in the presentation of a full report in late 2011.
Preliminary scoping already indicates that the notion of acceptable risk raises opposition, notably concerning the calculation of the value of human life in monetary terms. Although the definition officially falls within the domain of risk managers (i.e. the public authorities) it also raises a number of technical, moral and political difficulties, which explains why there is no unified procedure. Ultimately, it would be easier to operate within the optic of an "unacceptable threshold" rather than an acceptable level of risk.
The establishment of a type of governance which refers to the notion of acceptability implies that several conditions are all being met, notably:

- availability of risk assessment tools and management measures which make it genuinely possible to achieve the level of acceptable risk set;
- rules for decision-making;
- respect for best practice in governance: credible expertise (skills, independence and transparency), information, stakeholder participation.

This diverse array of dangers and hazards is specific to risks associated with climate change. Risks combine, overlap and potentially amplify each other. Dangers associated with damage caused by the technological environment can combine with dangers associated with damage caused to the natural environment, thus creating a domino effect.

The fact that these changes are evolving will probably mean that reviews of acceptable risks will be required and anticipating risks will involve adjustments. The fact that climate change takes place over time means that it is necessary to define the timeframe(s) to be taken into account (effects on future generations, and the development of ethical thought).

A further difficulty when defining acceptable risk stems from the difference between the perceptions and attitudes of individuals or social groups when it comes to climate change. Stakeholders defining acceptable risk in the climate change adaptation field can be divided into four main groups similar to those involved in defining acceptable risk in other fields: experts, public authorities, civil society and economic partners, and individuals.
There is now a clear understanding that cooperation is required between stakeholders to achieve good environmental management and governance of transitions. A structure dedicated to organising this cooperation is required to manage the approach defined for expertise, also taking responsibility for training and informing stakeholders in civil society, promoting transparency in relationships with insurers and clearly acknowledging lobbying activities. The structure should also promote access to information for individuals.
If this is to be a national structure, it must be based on a network at a municipal level rooted in the local area, with a regional network.
Lead: CPP
Partners: CGDD
Tools: Referral to the CPP
Timetable:
Mid-2011: publication of a scoping paper relating to methodology and issues
Late 2011: Publication of the CPP report
Indicator: Availability of the CPP report to the public

Action n°5: Increase research into adaptation in the context of Future Investments

The creation of a "**Future Investments**" programme (*Investissements d'avenir*) is "a historic event for French research". Of the €35 billion mobilised as part of this major stimulus package, €22 billion has already been allocated for higher education and research.
Climate change adaptation research, be it in the field of health, biodiversity, agriculture, etc., will benefit from this significant investment which will mean that all centres of excellence in France pursuing ambitious projects on every scale, ranging from excellence seedbeds to world-class excellence initiatives (former centre of excellence campuses), can be given further support.

The ANR has been designated as the main organiser for the programme and for the implementation of calls for proposals as projects receive funding. These large-scale actions will build France's innovative capability and act as driving force for growth in the future.
Lead: MESR
Timetable: 2011-2015

HEALTH action sheet

It is now recognised that climate change will affect human health through direct or indirect mechanisms. Since the IPCC First Assessment Report, observations and modelling have provided a better understanding of observed and projected climate change and its impact on the environment and society. These changes occur against the general backdrop of environmental, demographic, social and economic disruption as well as globalisation of communications and transport.
Several classic health hazards and environmental events likely to be exacerbated by climate change have been identified in French, European and international reports: the emergence or re-emergence of infectious diseases, an increase in the frequency and intensity of extreme events, and profound changes in the environment.

Illustration. Example of a climate change index for health: the number of days in the year on which the maximum daily temperature is abnormally high[3]. This index is set to rise sharply in the coming decades.

Action n°1: Consolidate "Health-Climate" research

Description of the action:
Within the framework of the National Strategy for Research and Innovation (SNRI), interministerial groups for "Life sciences and technologies", "Environmental sciences and technologies, global ecology" and "Human and social sciences" will create a "Health-Climate" working group as part of the collaboration between the interministerial groups for research and innovation concerned.

This group will comprise representatives from ministries responsible for research, sustainable development and agriculture, alliances for life sciences and health (Aviesan), the environment "Food, Water, Climate, Regions" (AllEnvi), human and social sciences (ATHENA) and agencies providing funding and technical expertise.

This group will be responsible for preparing recommendations in the "Health-Climate" field and for identifying appropriate implementation mechanisms. It can draw on research areas identified during the climate change consultation (see list in text box).
Lead for the action: MESR
Partners: Interest group members
Indicators: Creation of the group by GIMRIs

Text box
Research areas identified during the consultation exercise prior to the National Adaptation Plan

- Pollens, moulds and pollutants: the potential modifying effects of temperature on the relationship between exposure to pollutants, exposure to pollen, exposure to mould and various health indicators.
- The impact of temperature changes, atmospheric CO_2 and water resources on the development of plants, notably on their pollen production and on modifications in their allergenic potential;
- The respective contributions of moulds, grass pollen and ozone peaks to the increase in frequency of the onset of allergic symptoms in the early summer.
- The development of microorganisms producing natural toxins and climate change: incidences of the development of this phenomenon worldwide, the potential existence of contributory factors common to these three types of toxin, the possibility of evaluating and predicting the risk for humans and animals. This involves promoting environmentally-friendly methods as quickly as possible to reduce the risk of mycotoxins. Furthermore, measures to regulate them based on existing data will facilitate the reduction of the risk of exposure in the first instance, if required.
- Potential modifying effects of environmental factors such as temperature, humidity, UV radiation, etc., on the relationship between exposure to pollutants and various health indicators (incidence or prevalence of diseases, etc.).

[3] J. Jouzel, climate scenario assignment, report, January 2011

Action n°2: Introduce or increase monitoring of risk factors likely to be influenced by climate hazards (extreme events)

Measure 2.1: Monitor pollens and moulds

Description:

This involves developing or reinforcing monitoring of pollens and moulds and their health impacts, in particular allergies, and their potentiation by chemical pollution in the external atmosphere in continental France and French overseas territories.

Reinforcement of pollen monitoring:

- monitor plants, airborne pollens and the health impacts associated with exposure to these biological particles, with particular focus on "climate boundary" areas (transitional sectors between clearly defined climate regions).
- reinforce and professionalise phenological observation networks

Development of monitoring of moulds:

Increase the number of monitoring sites and explore the inclusion of other moulds, in addition to the two moulds which are currently the focus of research (*Cladosporium and Alternaria*). However, this latter point requires a prior bibliographical review relating to the potential correlations existing between allergic symptoms and the airborne presence of a given mould. If there is insufficient data in the literature, clinical studies establishing these correlations will need to be carried out.

Development of monitoring for pollen and mould allergies:

Establish a network of "patient-observers", who can keep accurate diaries of their allergic symptoms.

Lead: DGS, RNSA

Partners: ARS / MEDDTL / CNRS / INRA / CHU Strasbourg / ANSES / FNLON / associations of allergy specialists

Timetable: 2011, follow-up in 2012.

Indicators: Bibliographical review, RNSA reports and annual balance sheet comprising components relating to the climate/health correlation.

Measure 2.2: Monitor vectors and reservoir hosts

Description:

Mapping and surveillance of human and animal disease vectors; structuring of expertise relating to vectors and reservoir hosts for infectious diseases. (cf also Action 3 of the Agriculture action sheet).

Actions in this domain will benefit directly from the creation of a National Centre for Vector Expertise and Vector Risk (CNEV), a multidisciplinary network of experts specialising in issues relating to entomology and the fight against vector-borne diseases: "a multidisciplinary structure facilitating rapid and effective mobilisation of all skills in operational and strategic domains, in addition to analysis and proposals relating to the fight against vector-borne diseases in France".

Within the framework of the National Climate Change Adaptation Plan, CNEV will compile and analyse information and studies relating to vectors and the fight against vector-borne diseases. It will ensure monitoring and alerts for new vector-borne hazards and will reinforce technical expertise to support risk assessments and the authorities.

Furthermore, CNEV will provide technical support to improve and evaluate monitoring tools for arthropod vectors and the implantation of certain species of vector or reservoir hosts responsible for infectious or parasitic diseases. It will consolidate the structure of expertise relating to vector insects within the general framework of monitoring and control of infectious diseases in animals and humans.

The programme of work for this measure will include:

- monitoring the geographic range of distribution for sand flies and their density, as well as monitoring of the incidence of the main diseases transmitted by these vectors, in particular canine and human leishmaniasis;
- study of the impact of climate change on certain vector-borne diseases;
- - monitoring of the geographical range of distribution for other types of vector, in particular ticks (vectors for human and animal diseases) and changes in their density;
- monitoring of the incidence of the main diseases transmitted by these vectors, especially Lyme disease.

The Inter-*département* Mosquito Control Agreement (EID), will continue its mapping and monitoring projects for certain species of vector and reservoir host responsible for infectious diseases, with methodological input from CNEV.

Leads: DGS/DGAL

Partners: CNEV / French Natural History Museum / IRD/ InVS / ANSES, EID

Timetable: 2011, with follow-up in 2012. Three-year study (2012-2014) on ticks and Lyme disease.
From 2013, continuous monitoring of sand flies and the incidence of leishmaniasis.
Specific monitoring, output and method indicators: registration for the CNEV programme relating to this action, CNEV annual report and statement.
In 2015, evaluation of the conclusions of various studies and the introduction of preventive measures if required.

Measure 2.3: Monitor the development of toxin-producing microorganisms
Description:
Monitor the development of microorganisms producing natural toxins (cyanotoxins, phycotoxins, mycotoxins) in order to predict their development.
Climate change (temperature, rainfall) associated with an increase in agricultural production and the trend towards lower fungicide use are crucial factors in the development of toxigenic moulds.
Furthermore, monitoring of the proliferation of potentially toxigenic microalgae, which could pose a threat to the consumption of shellfish and fish, needs to be reinforced and their geographic distribution must also be identified for forecasting purposes and in order to target prevention in areas at risk, including French overseas territories.
Phytoplankton and phycotoxins are already being monitored:

- routine monitoring (regulated toxins) within the framework of Ifremer's REPHY network;
- vigilance relating to emerging toxins (unregulated or unidentified). This vigilance has been underway since early 2010.

Monitoring of new, recently discovered species, including in French overseas territories, needs to be extended to marine cyanobacteria, benthic microalgae (*Ostreopsis, Gambierdiscus,* etc.) which produce various types of toxin such as ciguatoxins, for example.

For several years now, the rise in average seas temperatures and ocean acidification have been contributing on a global scale to changes in the distribution of toxic microalgae. This is probably the case for species of *Ostreopsis*, which have previously been inventoried in tropical areas. Since 2006, they have been proliferating regularly in the Mediterranean and toxins are accumulating in sea food making it unfit for consumption. In addition to the health risk associated with ingestion, these toxins also present an inhalation hazard (marine aerosols).
Changes in the composition of populations of phytoplankton in relation to climate change require studies to be carried out into the modification of algae species and the toxins produced in order to pre-empt and evaluate the health risk posed by certain species. According to the European Food Safety Authority (EFSA) this is the case for *Ostreopsis* (which produces palytoxin-like compounds). A risk assessment is also required for the development of *Vulcanodinium spp*, which produces pinnatoxins (neurotoxic cyclic imines) which were identified in France in 2010.

It is also necessary to exercise vigilance regarding tropical fish acting as vectors for ciguatera poisoning (e.g. barracudas, etc.), which are beginning to be detected on European coasts.
Leads: Ifremer (emerging toxic plant plankton and trophic networks); Anses (monitoring of moulds producing mycotoxins)
Partners: DGS/DGAL
Timetable
Ifremer: Studies relating to the influence of environmental parameters on toxin production (2012/13); design of techniques for collecting samples of benthic algae and analytical methods for dosage of Ostreopsis toxins in aerosols (2012-2014).
Anses: 2011, inventory of microorganisms to be monitored and setting of priorities. From 2012, establishment of a progressive monitoring process.
Indicators: Annual Ifremer and Anses report and balance sheet, if required.

Action n° 3: Evaluate the risks to human health associated with extreme events and assess the health impacts of adaptation measures, notably by creating a "Health-Climate" monitoring group

Measure 3.1: Create a "Health-Climate" monitoring group within the HCsp
Description:
Creation of a multidisciplinary monitoring and alert body which provides risk management recommendations within the High Committee for Public Health, dealing with all issues relating to the impact of climate change on health. A permanent multidisciplinary team comprising experts in climate

change science and health, as well as expert social economists, teachers and researchers – notably in the biodiversity and ecotoxicology fields – will be set up within the High Committee for Public Health. This "Health-Climate" group will carry out periodic reviews of climate change literature, assess data, alert the authorities and produce various management recommendations such as research, studies, training, monitoring measures, or in-depth risk analysis by health agencies, for example. Its priority will be to suggest a methodology for evaluating choices and strategies for remedying or adapting to climate change and associated new technologies in relation to personal health, the health of the population and the living environment.
Leads: HCsp
Partners: DGS/DGEC/DGPR/DGAL/ANSeS
Timetable: 2011, implementation; 2012 studies begin.
Specific indicators: Number of referrals. Number of recommendations provided. Actions taken on the basis of recommendations. Publication in 2013 of recommendations for a methodology for assessing the health impact of adaptation measures.

Measure 3.2: Evaluate the health risks associated with quantitative conservation of water resources
Description:
Evaluate the health risks and make recommendations for mainstreaming these issues in measures to preserve water resources quantitatively. Anses will be asked to establish recommendations for the water quality required for domestic non-drinking water (notably "grey" water) according to type of use. Furthermore, Anses will be required to define a framework for the potential to "replace groundwater by artificial means using treated wastewater or surface water", notably as regards setting preconditions for absorbed or injected water, in order to preserve the quality of usable water resources for human consumption.
Lead: ANSES
Partners: DGS/DEB
Timetable: 2012-2013
Specific monitoring, output and resource indicators: Referrals in 2012 and the publication of recommendations in 2013 and 2014; status report on the implementation of recommendations in 2015.

Measure 3.3: Reinforce food safety
Description:
The target is to improve refrigeration technologies whilst ensuring food quality and safety for professional refrigeration management in an emergency or in the case of an extreme event. Recommendations for adaptation measures will be made based on the results of this project. This will be achieved via involvement in the European **FRISBEE** project (Food Refrigeration Innovation for Safety, consumers' Benefit, Environmental impact and Energy optimisation): www.frisbee-project.eu

- Develop a European cold chain database (existing technologies, consumer requirements and expectations, product storage data);
- Develop new tools to evaluate the performance of refrigeration technologies, combining food safety and food hygiene, energy consumption and environmental and economic aspects;
- Improve existing refrigeration technologies (food quality, energy consumption, environmental impact) and develop new processes.

Lead: Cemagref
Partners: 26 partners including INRA, AgroParisTech, ACTIA, 13 companies, 11 research institutes or universities and two non-governmental organisations, DGAL, DGS, Anses, Ania,
Timetable: 2011 - 2014
Indicators: Publication of recommendations in 2015

Action n° 4: Develop preventive health actions taking into account the consequences of extreme events and adapt vigilance and alert mechanisms

Measure 4.1: Extend the calculation of UV indices to French overseas territories
Description:
Extend UV index forecasts so that they can be adapted for local use as an information resource. These areas are not actually covered by Météo-France.
Lead: Météo-France

Partners: DGS/INPES/ARS/DGEC
Method: Public information resource
Timetable: 2012
Indicators: Frequency of publication of indices, and public warning messages.

Measure 4.2: Reinforce management of occupational risks caused by climate change
Description:
Identify and prevent occupational risks caused by climate change. The following parameters should be considered: cold spells, heatwaves, ionising radiation, flooding.
Lead: ANSES
Partners: DGS/DGT/Météo-France / INRS / ANACT / OPPBTP / MSA / InVS / RNV3P
Implementation methods: Creation of a working group coordinated by Anses linked to the "Physical Agents" Specialist Expert Committee
Resources:
1) Internal resources: establishment of a partnership to link internal occupational health expertise to expertise in physical agents
2) Working group
3) "Physical Agents" Specialist Expert Committee (CES Agents physiques)
4) Reference to outsourced studies (Research and Documentation Centre or contract) (e.g. Anact, to identify professions at particularly high risk etc.)
Timetable: 15 months for the Anses collective appraisal
Indicators: Referral to Anses, collective expert report and Anses recommendations, prevention campaign in place, number of recommendations implemented.

Measure 4.3: Analyse and adapt tools relating to the built environment and technical facilities in health, social care and community health centres
Description:
Create a multidisciplinary working group to analyse and adapt existing tools relating to the built environment and technical facilities in health, social care and community health centres, and in homes for the elderly not requiring nursing care in order to reduce the impact of more frequent and severe extreme events.

- Develop the HEQ standard;
- Adapt existing circulars and produce further circulars relating to buildings and climate change adaptation;
- HFDS to produce a guide relating to urgent restoration or provision of electrical supply, telecommunications, drinking water, oil and gas, etc.;
- Define the obligations of health, social care and community health centres in the event of the failure of power supplies.

Lead: DGOS
Partners: DGS / DUS / DGOS / DGCS
Methods: Vulnerability studies for existing buildings, review of existing circulars on living conditions which could be affected by climate change, the development of HEQ standards if required, decrees/circulars relating to legal obligations in the event of a failure of power supplies.
Indicators: Report and conclusions of the working group on the vulnerability of health sector buildings; status report on the implementation of recommended actions for a 2015 horizon, number of circulars/bulletins modified, publication of a document on electrical power failures.

Measure 4.4: Mainstream climate change in national preventive and care plans
Description:
Development of national preventive and care plans to respond to the health impacts of extreme events and adaptation of national plans for extremes of temperature - Heatwave Plan (*Plan canicule*) and Cold Spell Plan (*Plan grand froid*).
Lead: DGS/DUS
Partners: ARS/InVS, Ministry of the Interior (DSC), DGPR, INPES/DGCS
Methods: Vulnerability study for existing mechanisms, updating of decrees/circulars
Timetable: 2012 and 2013
Indicators: Effective evaluation and updating of plans and online publications, number of regulatory instruments modified.

Measure 4.5: Map bodies of surface water at risk of degradation in quality in the event of extreme temperatures

Description:

Map areas where bodies of surface water are at the greatest risk of degradation in quality in the event of extreme temperatures. This applies to both continental France and French overseas territories.

- Inventory of measures for reducing the health risks associated with swimming in water whose quality is likely to be degraded. Awareness of the proliferation of organisms or microorganisms such as amoeba or leptospira not mentioned in the European Bathing Water Directive;
- Proposal of measures to limit health impacts according to the risks detected and areas affected.

The aim is to support local authorities responsible for producing (and updating on a regular basis) a profile for bathing water, by providing them with information relating to this risk for inclusion in the profile (in compliance with the European Bathing Water Directive 2006/7/EC relating to water quality, according to which "profiles" or studies describing the vulnerability of bathing water to potential pollution and specifying appropriate measures to reduce this pollution and protect bathers must be implemented for the first time by February 2011).

Lead: DGS

Partners: DGS / ANSES / IGN / DEB /ONEMA / water agencies / Météo-France

Timetable: 2013

Indicators: Number of high-risk areas mapped

Action n° 5: Raise awareness among all stakeholders and provide education via targeted training, information and communications initiatives

Measure 5.1: Provide information about protection against UV rays in French overseas territories

Description:

Specific support for the population to prevent exposure to UV radiation by adapting communication tools in partnership with ARS and local health authorities.

Leads: ARS/local health authorities

Partners: INPES, DGS

Methods: Campaigns to raise awareness

Timetable: 2013 for the French West Indies

Indicators: Dependent on the publication of UV indices (Measure 1 of action 4), messages to the population, brochures, information campaigns.

Measure 5.2: Mobilise professional stakeholders, raise awareness and provide education about the health impacts of climate change

Description:

Mobilise and educate professional stakeholders and raise awareness of the health impacts of climate change by:

- Providing specially adapted basic training similar to that currently provided by the EHESP, or further education provided by bodies for the relevant professional groups (Universities, higher education institutes, specialist colleges for paramedical and social welfare training, CNAM, the Occupational Health Institute, etc.);
- Creating a working group on training for health professionals (doctors) relating to tropical diseases which could develop in France. The working group is made up of tropical disease experts: SFSE, SFSP, the French Defence Medical Service, etc.

Lead: DGS

Partners: DGOS / EHESP /InVS / ANSES / SFSE

Timetable: 2012

Indicators: Number of training courses which have included a climate change impact component, number of training courses delivered, working group output, status report on the implementation of the working group recommendations.

Measure 5.3: Mobilise the public, raise awareness and provide education about the health impacts of climate change

Description:

Mobilise the public, raise awareness and provide education about the impact of climate change by developing health education messages relating to exceptional climate events

Lead: INPES

Partners: DGS, Anses, DGCL, local elected representatives (including the AMF), MAEE, tourism

Methods: Implementation of a communications action plan

Timetable: 2012

Specific monitoring, output and resource indicators: Number of information and communications campaigns, existence of a web platform, monitoring of web hits

Measure 5.4: Make consumers and their representatives aware of food safety

Description:

Develop and disseminate an information tool based on recommendations provided by ANSES **by bringing together representatives and consumers**. There will be a special focus on recommendations associated with gaps in the cold chain. Several studies have in fact been carried out by Anses on this subject. A ruling on a proposal for an action sheet by the DGS on food storage in the event of an emergency (power cuts, flooding, storms, earthquakes, etc.) aimed at the general public, as well as on a proposal for a "Food Safety Guide" proposal was delivered in 2010. Lastly, a "Hygiene in the Home" factsheet was published in 2006.

Lead: ANSES

Partner: DGS/DGAL,

Timetable: 2013 (finalisation of the tool); 2014 (online availability and publication)

Indicators: Availability of an online information leaflet on the Ministry of Health website

WATER RESOURCES action sheet

A. Overview of the pressures and issues

Water resources are a crucial issue in any analysis of climate change impacts and the appropriate adaption measures to be provided. Climate change is directly reflected in a change in the dynamic of the water cycle on spatial and temporal levels. Furthermore, as well as being a crucial resource for man and ecosystems, water is a key issue in many other areas (agriculture, energy, tourism, etc.). The drought of spring 2011 could prefigure future events.
Climate change will have numerous impacts on water resources, both in terms of supply (quantity and quality) and demand. Scientific projections indicate a drop in surface run-off in almost all catchment basins. Studies by Boé (2007) suggest:

- a moderate drop in flow in certain regions in winter;
- no noticeable change in spring;
- a sharp reduction in flow in summer and autumn;
- a greater number of days in the low water period.

The drop in flow would be sharper in particular in **areas which are currently already affected by structural deficits**. The main challenge, or perhaps the greatest challenge, is therefore to try to match dwindling supplies to a demand which is already not being met in some areas and which is set to increase as a result of climate change. Work carried out within the framework of the ONERC report, "The cost of impacts and adaptation strategies", indicates that even assuming stable demand, there will be **an additional deficit of 2 billion m^3** when it comes to meeting demand for current industrial, agricultural (irrigation) and drinking water requirements for a 2050 horizon. All of these developments will place pressure on users and pose new challenges in terms of avoiding water resource degradation.

Drinking water pressures
Drinking water accounts for 18% of water abstracted. Although there are currently no major drinking water supply issues, some catchment basins could experience more frequent water shortages as a result of climate change, even if there is no increase in demand. Degradation of resource quality caused by climate change due to reduced waste dilution capability reduces the supply of good quality fresh water for domestic use. These developments could have the knock-on effect of increasing production costs for drinking water (mobilisation issues, treatment costs).

Agricultural pressures
The agricultural sector is the main water resource user, accounting for 48% of overall consumption. It will be particularly affected by the impact of climate change on this resource. The initial results of the INRA Climator programme (Brisson and Itier, 2009) relating to wheat and maize show that the decline in rainfall will be reflected mostly in hydrological drought and partially in edaphic drought in rain-fed crops (wheat) and irrigated crops (maize). The availability of water during the productive phase will decrease generally, **with increased demand for water** if current production conditions remain unchanged. The **decrease in the availability of water** will actually create more significant abstraction pressures.

Industrial and energy generation pressures
Climate change impacts will affect energy generation in two ways:

- by reducing cooling efficiency in the event of combined heating of water and air temperatures associated with poor flow;
- by influencing the management of hydroelectric dams.

Waste water treatment pressures
In the event of a drop in the rate of water flow, **increased waste water treatment will be required and hence increased cost incurred** in order to maintain environmental standards. Some impacts of climate change will have a positive effect on water treatment (accelerated biological reactions) and others will have a negative impact (increased energy consumption, problems relating to bad odour, acceleration of corrosion, higher concentrations of micropollutants).

Rainwater drainage pressures
Given the likelihood of increased urban runoff (violent rainstorms, blocked drains) it will be a necessary to reintroduce natural infiltration methods as a "no regrets" measure and, as a consequence, to review the regulations for designing rainwater drainage systems.

Quality pressure
A quantitative reduction in water resources, coupled with a potential increase in anthropic pressure due to demographic growth could have significant impacts on water quality.

Integrated water resource management by catchment basin must involve overall management which takes into account various water requirements, including the environment and the current aim to achieve the targets of the European Framework Water Directive within the framework of the SDAGE programmes approved in 2009 for the period 2010-2015. Although the scientific community does not currently foresee an actual national water shortage in the medium term, its pronouncements are much more qualified on a regional level. The predicted impacts of climate change involving a decrease in available resources would affect first and foremost those regions which are already experiencing pressures on water resources. Therefore it would seem to be necessary to prevent water shortages immediately and thus to promote a strategy to save water and optimise its use which aims to reduce pressure on the resource and prevent conflicts, by means of appropriate governance, and to protect aquatic environments.

Illustration. Sample climate change impact index for water.[4] The increase in the duration of summer droughts is significant in all regions.

Overall lead: DGALN/DEB
Overall indicators:
- Changes in the quantity and quality of water resources (notably via monitoring of runoff, piezometric levels and untreated water). Estimation of the contribution of adaptation measures to these changes
- Changes in water demand for various usages (cf notably Indicator n°21 'volumes declared in the basin for abstractions in the year n-1 by sector' in the water agency contract of agreed objectives)

B. Les Actions

Action n°1: Improve understanding of the impacts of climate change on water resources and the impacts of various potential adaptation scenarios

Measure 1.1: Identify, via a national study in continental France and French overseas départements – Explore 2070 – the costs and risks associated with various climate, demographic and sociological scenarios for a 2070 horizon and evaluate the ability of different adaptation strategies to minimise them
Lead: MEDDTL/DGALN/DEB
Partners: DGPR, CGDD, ONEMA
Tools: Provision of a decision-support tool for public stakeholders based on the development of a systemic integrative model
Timetable: 2011-2012
Output indicators: Systemic integrative functional model, operational decision-support tool available to public stakeholders

Measure 1.2: Evaluate the impact of climate change variability on low-flow regimes based on past observations
Lead: ONEMA
Partners: Cemagref, DEB, catchment area DREAL, water agencies
Tools: Statistical tools for various low-flow characteristics and the investigation of possible links with climate variability
Timetable: 2011
Output indicators: Report presenting the tools and links with climate variability

[4] J. Jouzel, climate scenario assignment, report, January 2011

Measure 1.3: Map the vulnerability of bodies of groundwater to climate change
Lead: ONEMA
Partners: BRGM, DEB, catchment area DREAL, water agencies
Tools: Mapping tools
Timetable: 2010 – 2011
Output indicators: Finalised maps and associated report

Measure 1.4: Evaluate the conditions for implementing active groundwater resource management
Leads: ONEMA / Seine-Normandy basin delegation (DBSN) / MTES
Partner: BRGM
Tools: Proposal for an ONEMA study on the environmental, health and economic impacts of active groundwater management – DBSN study on the ability of certain areas of captive groundwater to overstock water reserves – referral by the MTES to ANSES in relation to recharging groundwater with treated waste water or surface water notably with respect to water quality requirements
Timetable: 2011 - 2015
Output indicators: ONEMA study: final report / DBSN study: final report with an instrumentation proposal / ANSES final report

Measure 1.5: Acquire new knowledge on the scale of major hydrographic basins, notably by modelling hydrosystems integrating climate change impacts
Leads: Water agencies
Tools: AESN: involvement in the GICC-RexHySS project within the framework of PIREN Seine studies and collective expertise on the effects of climate change on the Seine estuary and Normandy coast (ongoing lower Seine public interest group)
AELB: modelling the middle reaches of the Loire, modelling groundwater and rivers in the Poitou Charentes and the Marais Poitevin; updating of the AERM&C Cenomanian model: a risk study on water resources and sustainable management of the Durance in 2050, backed by Lyon Cemagref; a study of the thermal and hydrological impact of electricity generation on the environment, funded by EDF
AERM: Studies aimed at improving understanding of climate change impacts on the Rhine-Meuse basin: AMICE project (impact of climate change on the hydrology of the Meuse basin and adaptation scenarios) and the FLOW-MS project (INTERREG Ivb programme – climate change studies, International Commission for the Protection of the Moselle and Saar)
AEAG: Forward study on water requirements and resources in the Garonne basin, 2011-2012, AEAG (MO) – inventory of knowledge on climate change and groundwater, 2011, AEAG – research project to model the response of the Gironde estuary to variability in types of climate change, 2011-2012, – studies and actions to raise awareness carried out by the Midi-Pyrénées regional environment agency
Timetable: 2011 – 2015

Measure 1.6: Disseminate the knowledge acquired via a portal
Lead: DGALN/DEB
Partner: ONEMA
Tools: Knowledge-sharing portal
Timetable: 2011 - 2015
Output indicators: National portal available to the general public

Action n°2: Provide effective tools for monitoring structural imbalance phenomena, resource scarcity and drought within the context of climate change

Measure 2.1: Implement a piezometric reference network for monitoring the impact of climate change on groundwater
Lead: ONEMA
Partners: BRGM
Tools: Feasibility study for a piezometric reference network based on existing piezometric measurements selected according to the quality of records and low influence criteria
Timetable: 2011 - 2012
*Output indicators: Proposal for a reference network based on existing piezometric measurements (2011) and a programme to create an optimal network (*to be reviewed in *2012)*

Measure 2.2: Optimise existing meteorological, hydrological and water temperature monitoring networks to build vigilance and alert capability regarding the status of aquatic environments and adapt usage to the available resources, including in French overseas *départements*
Leads: DGALN/DEB, DGPR
Partners: ONEMA, Météo-France, BRGM, catchment area DREAL, water agencies
Tools: Operational monitoring networks
Timetable: 2011 - 2015
Output indicators: Selection of criteria for defining target networks

Measure 2.3: Create a National Low Water Observatory (ONDE) coordinated at a national level
Lead: ONEMA
Partners: DEB, catchment area DREAL
Tools: Dry pond observation network to be activated in all continental French départements
Timetable: 2011 - 2015
Monitoring indicators: Implementation of ONDE in all continental French départements, compared to 9 pilot départements currently.
Output indicators: Observation network established and results in use

Measure 2.4: Track changes in demand for water by setting up a national abstraction database
Leads: ONEMA – DEB - AEAG
Partners: DGPR, government departments, water agencies, Chambers of Agriculture, BRGM, IOWater, Sandre (national French service for water data)
Tools: Water abstraction database
Timetable: 2011 - 2015
Output indicators: Water abstraction database and incorporation of historic data

Action n°3: Develop water saving and ensure more efficient use of water - reduce water abstraction by 20%, excluding winter water stocks by 2020

Lead: MEDDTL
Partners: Water agencies, MAAPRAT, MTES
Tools: existing regulations and assistance from water agencies in situ. The target is to achieve water savings of 20% by 2020 applied to annual water abstraction calculated as an average over the period 2015-2020
Timetable: 2011 - 2020
Monitoring indicators: Changes in water abstraction in various sectors each year/in the period from June to September of each year
Method indicators: Financial assistance from water companies, communications actions, new surveys

Measure 3.1: Promote water-saving across all sectors and uses, particularly in regions experiencing shortages. Support treated rainwater recycling, especially in areas experiencing shortages
Leads: Water agencies
Partners: Local authorities
Tools: Communications actions relating to the benefits associated with water-saving and funding for water-saving (water-saving in all sectors including the fight against leaks in networks) and rainwater recycling by local authorities
Timetable: 2011 - 2015
Monitoring indicators: Annual or biennial survey on the status of developments in rainwater recycling (CERTU)
Output indicators: Estimation, insofar as possible, of water savings achieved via communications operations and funding – results of surveys on rainwater recycling
Resource indicators: Type of communications action and financial assistance introduced:
AELB: fight against wastage, leak detection in networks, recycling in industry, "irri-mieux" agricultural irrigation warnings, etc.
AESN: studies into the national provision of drinking water based on a minimal network yield, rainwater recycling
AERM&C: inventories of drinking water network assets, sectorisation; in priority areas: modernisation or leak repairs, modernisation of irrigation techniques, changes to processes in the industrial sector

AERM: improvement of drinking water network performance, leak detection facilities, metering, network renovations
AEAG: network diagnostic studies, assistance with all investments to reduce water consumption, communication and raising awareness.
+ Indicator (n°20) 'water savings' in water agencies' contracts of agreed objectives: total financial assistance committed over the course of the year to leak detection and to reduction of leaks in drinking water networks and to a reduction in abstraction for irrigation.

Measure 3.2: Support treated waste water recycling for crop or green space irrigation, particularly in regions experiencing shortages. This should be carried out in accordance with strict precautionary measures and various forms of monitoring at environmental, agronomic and health levels
Leads: MEDDTL - MTES
Partners: Water agencies
Tools: Regulatory framework and financial assistance from water agencies in situ
Timetable: 2011 - 2015
Monitoring indicators: Annual or biennial survey into the status of progress or developments in treated waste water recycling
Output indicators: Survey results, including the surface covered by treated waste water recycling and the annual volume recycled
Resource indicators: Financial assistance from water agencies

Measure 3.3: Improve efficiency in the energy sector in terms of abstraction and water consumption for existing and future power stations
Lead: EDF
Tools: Renovation and monitoring action plan for water cooling towers (thermal efficiency monitoring measures, maintenance and renovation work to fight scale formation, research into more efficient materials which create less scale)
Timetable: 2011 – 2019 with partial or total renovation of 15 water cooling towers
Method indicators: Action plan measures applied

Measure 3.4: Optimise existing water storage in the agricultural sector and implement the creation of artificial reservoirs in compliance with environmental constraints, in addition to efficiency optimisation measures for water use
(linked to Measure 4.2)

Action n°4: Support the development of activities and land use which are compatible with locally available water resources

Measure 4.1: Identify potential adaptation scenarios for activities which use water in regions already experiencing shortages
Leads: MEDDTL – MAAPRAT – DATAR – water agencies and regional authorities
Partners: Water agencies
Tools: Surveys and studies launched in 2011 as part of the agriculture component: study of water-efficient activities, AEAG study on the impacts of the reform of abstractable volumes, CGAAER project on the impacts of the reform and potential adaptation measures.
Project to carry out studies and develop inter-regional and European cooperation (MEDCIE) led by DATAR: evaluation of the cost of various potential adaptation scenarios, alignment with existing public policy, definition of adaptation strategies and recommendations for action for the government and local authorities. A thematic approach, including a water component.
Rhône, Mediterranean and Corsica (RM&C): strategic programmes focusing on priority regions to manage resource availability, especially the SOURSE project (Provence, Alps, Côte d'Azur region) and the AQUA 2020 project (Languedoc-Roussillon region)
Timetable: 2011 - 2015
Output indicators: Finalised surveys and assignments, implementation of recommendations in partnership with the relevant professions and technical institutes, as well as local authorities.
Resource indicators: Total cost of the AEAG study, number of equivalent full-time staff involved in the CGAAER-CGEDD assignments

Measure 4.2: Based on a multi-use rationale and in compliance with SDAGE programmes, optimise existing water storage and create water storage if required, notably by replacing abstraction during low-flow periods with winter abstraction. The use of water storage must be conditional on the implementation of measures to optimise efficient water use
Leads: MEDDTL - MAAPRAT
Partners: Water agencies
Tools: Funding from water agencies and EAFRD
Timetable: 2011 - 2015
Output indicators: Number of operations, volumes replaced in millions of cubic metres
Resource indicators: Indicator (n°22) 'resource development' in water agencies' contract of agreed objectives (total funding committed in millions of euros for works to create storage to support low water and artificial reservoirs)

Measure 4.3: Develop water-efficient activities within the agricultural sector
Leads: MAAPRAT – MEDDTL – INRA – Environment Alliance
Tools: Study of enablers and blockers to the development of activities for diversifying into crops using water-efficient systems
Timetable: 2011 - 2012
Output indicators: Definition of recommendations for public decision-makers and identification of potential opportunities for development in France

Measure 4.4: Reduce the impermeability of soil, thus promoting rainwater infiltration
Lead: DGALN
Partners: Water agencies
Tools: Draft decree for a "rainwater tax" to allow municipalities or groups of municipalities to levy a tax on urban rainwater management (Grenelle 2)
OPUR research programme into urban rainwater management (AESN)
Research project into urban rainwater pollution to identify and quantify rainwater pollution sources, analyse the effect of maintenance and use of urban surfaces on rainwater, study the feasibility of treating rainwater pollution, make recommendations for defining rainwater pollution management strategies (DEB, CERTU)
Timetable: Publication of the implementation decree scheduled for 2011
Output indicators: Published decree

Action n°5: Reinforce the integration of climate change issues into water planning and management, in particular in the next water agency intervention programmes (2013-2018) and programmes for development and water management (2016-2021)

Leads: MEDDTL, water agencies
Tools: Guide for water agencies planned for 2011, national scoping exercise to improve understanding of low water flow values at key nodes
Timetable: 2011 - 2015
Output indicators: Finalised guide distributed to water catchment basins by late 2011 – implementation of the guide by water catchment basins over the period 2012 – 2015 in preparation for the next SDAGE programmes.

BIODIVERSITY action sheet

By virtue of its history and geography, France is privileged to have an exceptionally biodiverse heritage. In continental France, 133 types of habitat were recorded in the Fauna and Flora component of the European Habitats Directive. Over 14,800 species of terrestrial floral, of which 66 are endemic, were also recorded, as were 44,250 animal species, of which 1,850 are endemic, and 13,300 species of mushroom, excluding species which have been introduced. French overseas territories as a whole are home to an even greater variety of species, since there are over 100 times more freshwater fish species, 60 times as many bird species and 26 times more plant species then in continental France. This biodiversity, which has been significantly transformed by man, also includes a large genetic heritage comprising domestic and cultivated species with several million plant and animal varieties.

The reactions of certain species to climate change can already be observed over the last few decades: bird ranges are shifting northward, alpine plants are found at higher altitudes and there is an increase in certain alien invasive species, etc.

Since changes in biodiversity are based on extremely complex interactions between species, habitats and anthropic pressures, human choices to combat climate change notably in agriculture, forestry, urban development and risk management must take into account the need to maintain the adaptive capacity of ecosystems.

Therefore, in accordance with the targets and guidelines set out in the National Biodiversity Strategy 2011-2020 (SNB), the proposed actions aim to preserve or restore nature's adaptive potential by reducing human pressure on species and habitats where necessary, and by promoting ecological variety and continuity at a local level.

In order to guide decision-making as scientific knowledge improves, understanding of the impacts of climate change on biodiversity, reversible and "no regret" measures have been selected.

Illustration. Sample climate change index for biodiversity: average daily temperatures.5 The predicted increase by 2100 is approximately 2.5° to 3.5°C for scenario A2.

Leads: MEDDTL/DGALN/DEB

Action n°1: Integrate biodiversity issues associated with climate change into research and experimentation

Research into the causes and mechanisms of the induced effects of global change (including climate change) on biodiversity are already incorporated to a large degree into the priorities of most major relevant research bodies. Moreover, this research topic lies at the heart of the National Research and Innovation Strategy (SNRI). Two of its three main themes focus in particular on global change: "environmental emergencies and ecotechnologies" and "health, well-being, food and biotechnologies". These priority areas provide a benchmark for defining state funding allocation and programming thematic French research.

This research requires integrated observation, experimentation and modelling and simultaneous support for these three major areas. French research focusing on experimentation already has effective tools. This research must be supported through increased networking, notably by programmes organised by the Ministry for Ecology, and biodiversity research resources. The expertise created by this research must be actively encouraged and exploited. The creation of an Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem services (IPBES) will provide an international mechanism.
Furthermore, policy relating to biodiversity interacts with other climate change adaptation themes: water, agriculture, forests, coastlines, mountains, the city, transport, etc.
Lead: MESR/DGRI
Partners: ANR, Environment Alliance[6], Cemagref, CIRAD, CNRS, FRB, IFREMER, INRA, IRD, MEDDTL, MNHN, universities

[5] J. Jouzel, climate change scenario assignment, report, January 2011
[6] The composition of the Alliance is given on the Research action sheet

Measure 1.1: Include in the contracts of agreed objectives for major research organisations research into the interaction between climate change, change of use and research into biodiversity, the impacts of climate change on ecosystem services and the adaptation issues they raise.
Leads: MESR, MAAPRAT (for bodies which it supervises)
Partners: BRGM, Cemagref, CIRAD, CNRS, IFREMER, INRA, IRD
Tools: SNRI / contracts of agreed objectives for major research organisations
Timetable: Drafting of contracts of agreed objectives for major research organisations 2011-2013 (INRA 2011, IRD 2011, CIRAD 2012, IFREMER 2013, BRGM 2013, Cemagref 2013, CNRS 2013)
Monitoring/output indicators: At least one research topic including this theme in the signed contracts of agreed objectives

Measure 1.2: Promote research into biodiversity and climate change within the framework of calls for tender in relation to Future Investments (*Investissements d'Avenir*)
Leads: MESR
Partners: Environment Alliance
Tools: Future Investments
Timetable: 2011 – 2021 (Labex) / 2011-2022 (Equipex), etc.
Monitoring/output indicators: Budgetary investment

Measure 1.3: Improve understanding of biological adaptation processes via co-funded international programmes, such as ERA-Net, dealing notably with biodiversity in relation to climate change
Leads: ANR, MEDDTL, MESR
Partners: FRB, Verseau développement
Tools: Funding for ERA-Net Biome, ERA-Net Biodiversa and ERA-net CIRCLE2 calls for research proposals
Timetable: 2011 -2013
Monitoring/output indicators: Number of international proposals on this topic selected

Measure 1.4: Improve understanding of the viability and adaptation of ecosystems, territories and resources to global change via calls for national research proposals led by the ANR and MEDDTL
Leads: MESR, MEDDTL
Tools: ANR calls for research proposals
- Agrobiosphère: Viability and adaptation of productive ecosystems, regions and resources to global change.
- IPCC: climate change impacts and management
- BGF: biodiversity and forest management and public policy
- ADAPT: viability and adaptation of productive ecosystems, territories and resources in the face of global changes
Timetable: 2011-2013
Monitoring/output indicators: Number of applications funded relating to this topic

Measure 1.5: Reinforce research via modelling and scenario-setting for biodiversity, notably in relation to the effect of environmental changes, by incorporating the socio-economic aspect
Lead: FRB
Partners: DIVERSITAS, TOTAL, GDF Suez, Fondation Total
Tools: Key Programme "Modelling and biodiversity scenarios" launched in 2010 and a call for proposals issued in 2011
Timetable: 2010 – 2013
Monitoring/output indicators: Scientific output (number of publications, theses, etc.).

Measure 1.6: Create a permanent Centre for Biodiversity Synthesis and Analysis (CESAB) where biodiversity experts can pool their data sets and ideas
Lead: FRB
Partners: A regional authority and private partners
Tools: Call for proposals for scientific proposals launched in 2010 and 2011
Timetable: 2010 – 2013
Monitoring/output indicators: Scientific output (number of publications, theses, etc.).

Measure 1.7: Set up permanent Major Research Infrastructures (including TGIRs) for biodiversity and its interactions with climate change.
Lead: MESR
Partners: Cemagref, CIRAD, CNRS, IFREMER, INRA, IRD, MNHN, universities
Timetable: 2011 2021
Indicateurs de suivi/résultats : Number of labels awarded to TGIRs for projects whose targets involve or include issues relating to the interaction between biodiversity and climate change.

Measure 1.8: Support and contribute to the establishment of the Intergovernmental Science-policy Platform for Biodiversity and Ecosystem Services (IPBES) to provide the crucial scientific expertise required for policy-making relating to biodiversity within the framework of global change.
Leads: MESR, MEDDTL, MAEE
Partner: FRB, Diversitas, IDDRI, Environment Alliance
Tools: Develop French proposals for the creation of a mechanism to mobilise expertise at the science-society interface, in preparation for the setting up of IPBES and associated issues.
Timetable: 2011
Monitoring/output indicators: A French proposal for a mechanism to mobilise expertise, approval or adoption of French proposals when IPBES is established.

Action n°2: Reinforce existing monitoring tools to take into account the effects of climate change on biodiversity

Climate change has an impact on the distribution of species and natural habitats, phenology and even the adaptation of living things to a changing environment. It is therefore necessary to have a biodiversity monitoring network available to detect changes, understand the underlying causes and act accordingly. Based on data collected in this way, indicators can be drawn up collating changes in biodiversity with observed climate change in order to inform debate involving decision-makers and citizens. Furthermore, protected areas can perform an important role as observation sites for climate change over the long term. In fact, protected areas are privileged sites for observation because of their relatively low levels of anthropisation, the availability of resources (notably human), existing monitoring mechanisms and their geographic distribution across the whole of France (notably along coastlines, in mountain areas and in French overseas territories). It is necessary to extend funding for biodiversity in the long term to provide a basis for these actions as a whole.
Lead: MEDDTL/DGALN/DEB
Partners: National Botanical Conservatoires (CBN) and their federation (FCBN), ONCFS, ONF, Non-profit nature associations, FNC, FNPF, Protected Areas Network, IGN-IFN, MEDDTL/CGDD/SOeS MAAPRAT/DGPAAT, ONERC, ONEMA, Environment Alliance

Measure 2.1: Reinforce mechanisms for monitoring species
Within the framework of the Nature and Landscapes Information System, and in order to contribute to the evaluation of the conservation status of species and habitats and the connection with climate change, standard protocols will be defined for drawing up inventories. Based on these protocols, a monitoring mechanism for species and habitats of European Community interest (Habitat, Fauna and Flora, and Bird Directives; Marine Strategy Framework Directive), alien invasive species and species vulnerable to climate change will be defined and implemented.
Lead: MEDDTL/DGALN/DEB
Partners: CBN, FCBN, MAAPRAT/DGPAAT, MNHN, ONCFS, ONEMA, non-profit nature associations and learned societies, experts from public research institutes, FNC, FNPF
Implementation tools: introduction of standard inventory protocols within the SINP framework.
Definition of a monitoring mechanism. Implementation of inventories by public institutes, non-profit nature associations and other authorised bodies.
Timetable: 2013
Specific monitoring/output indicators: Number of stable continuous biodiversity monitoring protocols and the number of these protocols implemented

Measure 2.2: Create a structured network of volunteer observers of the impact of climate change on biodiversity and changes in biodiversity
There are many mechanisms for public participation in science. Some, such as the Observatory for the Seasons, already enable links to be made with climate change. Support for public participation in science must be pursued and stakeholders encouraged to grasp the issues of climate change.
Lead: MEDDTL/DGALN/DEB

Partners: CBN, FCBN, MAAPRAT/DGPAAT, MNHN, non-profit nature associations and learned societies, experts from public research institutes
Timetable: 2012
Specific monitoring/output indicators: Number of voluntary observers registered with the Observatory for the Seasons or other Observatories for the impacts of climate change on biodiversity.

Measure 2.3: Improve understanding of land use and plant life
Lead: MEDDTL/CGDD/SOeS
Partners: MAAPRAT/DGPAAT
Implementation tools: Construction and updating of an environmental quality indicator for land use, based on the method used in Ile-de-France
Timetable: 2012
Specific monitoring/output indicators: % of the country for which the land use indicator is available

Measure 2.4: Map habitats in continental France and French overseas territories on a 1/25 000 scale with regular updates so that changes in the distribution and size of habitats can be monitored
France does not currently have any maps of natural or semi-natural environments. These are crucial tools for improving evaluations of the conservation status of species and habitats in order to analyse ecological continuities and the impact of various pressures on biodiversity, including climate change. The target is to produce a map of natural habitats on 1/25 000 scale by 2018, similar to the geological map, on a partnership basis.
Lead: MEDDTL/DGALN/DEB
Partners: CBN, FCBN, IGN-IFN, MEDDTL/CGDD/SoeS, MAAPRAT/DGPAAT, MNHN,
Implementation timeframe: 2011 : launch of habitat mapping, first national map available in 2018, with regular updates
Specific monitoring/output indicators: % of the country covered by habitat maps

Measure 2.5: Set up a permanent network for monitoring the environmental status of continental French watercourses based on the Water Framework Directive (WFD)
This action falls within the scope of ongoing studies at a national and European level to define terms of reference for good environmental status in compliance with the European Water Framework Directive (WFD). It is crucial to establish monitoring for environmental status of a network of reference sites for the main types of continental French watercourse in order to mainstream the impacts of climate change in the WFD standard for good environmental status as these effects are observed.
Lead: MEDDTL/DGALN/DEB
Partners: Cemagref, water agencies, DREAL, ONEMA.
Timetable: 2010-2011: definition of a permanent reference network / 2012: measures begin in the field
Specific monitoring/output indicators: Amount of reference data collected

Measure 2.6: Pursue and promote existing approaches in protected areas networks relating to the study of current and potential future consequences of climate change on biodiversity.
This action forms part of the ongoing process of monitoring the effect of climate change on glaciers. Between 2011 and 2015, this approach must be enhanced by:
- identifying particularly vulnerable species and habitats which would provide good indicators for monitoring climate change. Explorations are currently taking place in the Pyrenees National Park with the French National Natural History Museum.
- inventorying all climate change impact observation sites in protected areas (funded by the Ministry for Ecology) so that an assessment came be made for establishing common parameters and a representative spread of natural environments.

Lead: MEDDTL/DGALN/DEB
Partners: National parks
Implementation tools:
- Inventory of indicator species, habitats and current observation sites in protected areas
- Reinforcement of actions by harmonising monitoring activities and the representativeness of sites
Timetable: 2012
Specific monitoring/output indicators: % of protected areas where the inventory has been carried out

Measure 2.7: Provide robust and regularly updated indicators for the effects of climate change on biodiversity

This involves permanently and effectively aligning the activities of the National Observatory for Biodiversity (ONB) and the National Observatory for the Effects of Global Warming (ONERC).
Lead: MEDDTL/DGALN/DEB
Partners: Environment Alliance
Timetable: 2012
Specific monitoring/output indicators: Definition of at least one robust indicator of the impact of climate change on biodiversity within the framework of the ONB.

Action n°3: Promote integrated land management, mainstreaming the effects of climate change on biodiversity

The aim is to promote integrated land management ensuring that biodiversity is preserved and restored. The measures outlined below are based on decisions, initiatives and plans supported elsewhere, independently of the National Climate Change Adaptation Plan, but which could make an active contribution to it. Integrated land management mainstreaming the effects of climate change on biodiversity must preserve or restore the basic potential for nature to adapt, notably by:
- allowing the dynamics of movement and colonisation to take place, particularly on range boundaries;
- supporting specific changes in biodiversity in a given location;
- preserving the services delivered by ecosystems.

This implies, inter alia:
- ensuring continuity of services delivered by ecosystems in the face of climate change through sustainable resource management;
- promoting the variety, quality and functionality of natural habitats, including restoring degraded natural habitats;
- safeguarding viable populations of the largest possible number of species;
- managing natural resources sustainably.

Lead for the action: MEDDTL/DGALN/DEB

Measure 3.1: Implement and preserve the Blue and Green Infrastructure (TVB) and identify and preserve an ecological network in French overseas territories (REDOM - BEST) in order to improve the adaptation to climate change of the environmental structure, as set out in the Grenelle laws.
Lead: MEDDTL/DGALN/DEB
Partners: MEDDTL (DHUP, DGITM, DGEC, CGDD, RST), MAAPRAT, DATAR, Cemagref, MNHN, ONEMA, ATEN, FPNRF and regional authorities
Implementation tools: National guidelines for the preservation and restoration to good environmental status of ecological continuities/National Ecological Coherence Programmes/urban planning documents/Green and Blue Infrastructure resource centre
Implementation timetable: 2012 for regional programmes
Specific monitoring/output indicators: % of regional schemes set up

NB: Action 2 on the Urban Planning and the Built Environment action sheet supports the promotion of nature in cities.

Measure 3.2. Mainstream climate change in the strategy for creating protected areas and in terms and conditions governing the management of existing and future protected areas
Lead: MEDDTL/DGALN/DEB
Partners: ATEN, MEDDTL, MAAPRAT, MNHN, ONF, PNF, RNF
Implementation tools: Strategy for the Creation of Terrestrial and Continental French Protected Areas (SCAP) which aims to place 2% of continental French territory under high-level protection / training and methodological guides
Implementation timetable: 2019 (for SCAP)
Specific monitoring indicators/results: % of continental terrestrial France which is under high-level protection (1.23% in 2010)

Measure 3.3: In compliance with the Grenelle laws, standardise planning documents which relate to integrating sustainable development within a region and aim to preserve biodiversity in the context of climate change.
Leads: All government departments responsible for developing and/or approving planning documents

Implementation tools: Cohesion[7] between SDAGE, SRCAE, SRCE, SCOT, PLU, PCET, SAGE, etc.
Implementation timetable: Recurring
Specific monitoring/output indicators: % of the country covered by "Scot-Grenelle"

NB:
- Measure 1.1 of the Urban Planning and the Built Environment action sheet covers mainstreaming of biodiversity in spatial planning documents.
- Measure 1.1 of the Funding and Insurance action sheet suggests revising methodological guides relating to sustainable development integration tools to improve mainstreaming of climate change and promote biodiversity adaptation.

Action n°4: Integrate climate change adaptation into strategies and plans implemented by the government to preserve biodiversity

Species distribution is the result of a series of historic factors and complex interactions, of which the current climate is just one component. In the case of France, given its diverse biogeographical areas, it is even more difficult to obtain robust scenarios from which to evaluate the future status of the environment and potential regional changes in the distribution of species and habitats.
The approach adopted to mainstreaming climate change impacts in government conservation policy is based on the following points:
- organising scientific expertise in order to accumulate and pool existing information and to strengthen cooperation between different political and conservation stakeholders
- developing an approach prioritising flexibility, reversibility and adaptability to specific local circumstances
- integrating appropriate measures into regulations, strategies and government plans on a step-by-step basis

Preservation of the main ecosystem functions and ecosystem services is included in the National Biodiversity Strategy guidelines. These are taken into account notably in Targets 6 and 7.

Measure 4.1: Establish scientific monitoring relating to the current state of available knowledge on the impacts of climate change
Lead: MEDDTL/DGALN/DEB
Partners: ECOFOR, FRB
Implementation tools: Development of the Ccbio database / Dissemination of information to stakeholders and relevant government departments
Timetable: 2011/ 2015
Monitoring/output indicators: Regular inventories of the impacts of climate change on biodiversity.

Measure 4.2: Mainstream climate change in regulations, strategies and national action plans for species protection and the fight against alien invasive species
Lead: MEDDTL/DGALN/DEB
Partners: MNHN / FCBN / ONCFS / ONEMA/ MAAPRAT / DGPAAT
Tools: Ministerial decrees setting out the list of protected species and alien invasive species / National action plans
Timetable: 2011/ 2015
Monitoring/output indicators: Number of revisions of the regulations/number of species involved/number of plans involved

Measure 4.3: Mainstream the effects of climate change in assessments of the environmental impacts of plans submitted which infringe stringent protection of species
Lead: MEDDTL/DGALN/DEB
Partners: Decentralised government departments/CNPN, MAAPRAT/DGPAAT
Methods: Legal proceedings for infringement
Timetable: 2011/ 2015
Monitoring/output indicators: % of evaluations mainstreaming climate change impacts

Measure 4.4: Carry out collegiate studies mainstreaming climate change with stakeholders affected by ex situ conservation policies relating to plant species
Lead: MEDDTL/DGALN/DEB, MESR

[7] A term which, for the purposes of this action sheet, covers notions of compatibility and mainstreaming

Partners: FCBN, MNHN, botanical gardens, museums, MAAPRAT/DGPAAT
Timetable: 2011/ 2015
Monitoring/output indicators: Number of proposals made/number of actions carried out
There is also provision for a measure in the Agriculture action sheet (cf. Measure 4.2) and in the Forest action sheet relating to tree species (cf. Measure 3.3).

NATURAL HAZARDS action sheet

Where natural hazards are concerned, climate change will mainly be reflected in widespread pressure on low-lying coasts, coastal erosion or submersion due to the predicted rise in sea levels associated with a potential change in wave regimens. The forecastable rise in temperatures will increase, extending the risk associated with forest fires, and more frequent heatwaves will exacerbate the damage linked to shrinkage-swelling of clay soils. By contrast, in the current state of knowledge, there is no clear trend towards a sharp increase in the risk of flooding by overbank flow and there is still insufficient data relating to gravitational landslide hazards. However, mountain environments, by virtue of the increased sensitivity of some of their components to changes in temperature and precipitation rates, are already being affected by changes, with varying degrees of speed and localisation, which are likely to alter the natural phenomena which create hazards.

In order to respond to these issues, current policy for natural hazard prevention and management provides an appropriate framework for adaptation, providing: (1) certain aspects of this policy are strengthened, notably by improving understanding of the risks and lessons learned and by mainstreaming climate change as soon as possible; (2) new a priori evaluation methods relating to economic, social and environmental impacts, and the effectiveness of preventive measures are incorporated ; (3) new methods and tools are developed to anticipate the imminent break with some of our traditional ways of thinking and acting

By way of a preamble, it is appropriate to recall the significance of making data and changes available in real time to enable all stakeholders to adapt their behaviour, hence the need to carry out a periodic review of measures to be taken as knowledge improves.

It is also important to stress the specific characteristics of French overseas territories. Most of these overseas territories are extremely vulnerable and are very exposed to occasionally violent hydrometeorological hazards (cyclones, storms, rapid rises in water levels), depending on the region and also on climate variations. These specific characteristics are taken into account wherever possible below.

Illustration. Sample climate change index for natural hazards: extreme daily precipitation values.8 Maps of extreme changes in precipitation values appear to display regional contrasts.

Action n°1: Develop knowledge (hazards, issues, methods) in the various vulnerable zones

The measures proposed involve improving understanding of the current natural hazard situation, which requires prior consolidation in certain areas, the use of available data and the development of methods and knowledge relating to climate change.

Coastline:

Measure 1.1: Consolidate understanding of extreme sea flooding and evaluate the impact of climate change on coastal hazards

Under Measure 1.1.1, the Rapid Flooding Plan (PSR) makes provision for the gradual development and operational implementation of coastal oceanographic models based on the same principle as the PREVIMER demonstrator, with the aim of refining forecasts for coastal sea levels. Within the more specific framework of climate change adaptation, coastal oceanographic forecasting partners will study the feasibility of developing specific models for evaluating the impact of climate change on coastal hazards (flooding and erosion) on a local scale.

Sub-measure 1.1.2: The impact of climate change on extreme sea flooding cannot be considered without an initial consolidated baseline reference. In order to achieve this, an estimate of extreme levels and unusually high sea surges in the English Channel, Atlantic, and Mediterranean will be carried out following two lines of enquiry in order to study the conditions for separability and intercorrelation of the physical phenomena measured, using modelling, if required.

Lead: DGPR

[8] J.Jouzel, climate scenario assignment, report, January 2011

Partners: SHOM – CETMEF – BRGM – LNHE – IFREMER –Météo-France - Universities
Tools: Statistical methods, numerical modelling
Timetable: 2012-2015
Indicators: Publication of an estimate of extreme sea levels, availability of data via ANEMOC

Understanding of swell climates and their development along the French coastline as a whole (continental France and French overseas territories) will be reinforced by several measures (cf. Coastline action sheet, Measure 2-2).

Zones subject to landslides:
Measure 1.2: Improve understanding of shrinkage-swelling phenomena in clay soils and landslides in relation to climate conditions
Sub-measure 1.2.1: Regarding the shrinkage-swelling phenomenon in clay, an improved understanding of the link between climate conditions, moisture and deformation of clay soils is crucial given the probable increase in the frequency of heatwaves and hence in damage related to shrinkage-swelling of clay soil.

Sub measure 1.2.2: Regarding gravitational landslides, awareness of the hazards and their development will be improved through analysis of existing data (slopes, instrumented cavities, etc.) and their correlation in order to study the significance and relevance of the parameters measured to research objectives on the one hand and to the development of phenomena and associated mechanisms on the other hand.

Sub-measure 1.2.3: A structure will be set up for exchanges on a national or international level, notably to share available knowledge.
Lead: to be determined
Partners: BRGM, CERMES, CSTB, IFSTTAR, INERIS, ISTERRE, Météo-France
Tools: Acquisition and analysis of chronological series, hydromechanical modelling
Timetable: 2012-2015
Indicators: Scientific publications and partnerships at a national and European level

Flood zones:
Measure 1.3: Consolidate understanding of flood risks and evaluate the impact of climate change on the scale of large hydrographic basins
Sub-measure 1.3.1: Within the framework of the implementation of the Floods Directive and following the publication of the IPCC's Fifth Assessment Report, a study into the impacts of climate change on rises in water levels and flooding in major catchment basins will be launched. This is a response to the need to understand potential changes in watercourse regimens on the scale required to manage flood risk.

Sub-measure 1.3.2: Since the detection of changes should be based on a consolidated baseline, methods which provide for an improvement in our current knowledge of flood hazards must be developed and implemented. Some research activities currently underway will make it possible to specify the most appropriate methods, which could notably be based on the historic information which has been made available (cf. Measure 2-6), as well as information relating to recent extreme events (cf. Measure 3-3).

Sub-measure 1.3.3: A study will be launched into methods for mainstreaming the uncertainties inherent in assessments of rises in water levels and flooding associated with climate change in spatial development.
The construction of the largest possible flood envelope and methods for taking it into account will be studied within this framework in particular.

Lead: DGPR
Partners: Cemagref, IFFSTAR, Météo-France, universities
Tools: Numerical modelling
Timetable: 2012-2015

Measure 1.4: Inventory flood prevention measures and develop a decision-support tool

Sub measure 1.4.1: A new decision-support tool will be developed to analyse the advantages and disadvantages of flood prevention measures and thus to compare them. This new tool will be based on a multi-criteria analysis (MCA) extending to issues which cannot be evaluated in monetary terms and tending to consider hazards which have experienced a climate change impact.

Sub-measure 1.4.2: Technical and economic inventories of preventive flood measures and associated costs will be compiled simultaneously for three categories of flooding (overbank flooding, sea flooding, storm water flooding). *Lead: MEDDTL*
Partners: CGDD, DGPR, DGALN, CERTU, Cemagref, CETMEF and RTM
Timetable: 2010-2012
Indicators: Delivery of a specification and methodology; number of multi-criteria analyses (MCA) carried out; delivery of three inventories

Mountain areas
Measure 1.5: Improve understanding of avalanche activity and its development
In addition to studies focusing on slope instability (cf. 1-4) which also relate to mountain regions, and in order to develop understanding of avalanche activity and its development, a climatology of major natural avalanche events in the Alps over the last 50 years will be drawn up and the correlation between changes in avalanche activity indicators and average nivo-meteorological indicators will be studied..
Lead: DGPR
Partners: Cemagref, ONF, Mountain Landscape Restoration (RTM), Météo-France, Snow Study Centre
Tools: Long-term observation data sets acquired during the permanent avalanche study, nivo-meteorological observations

Cyclone Zones
Measure 1.6: Improve understanding of cyclone activity and its development
Several studies have already shown a change in the trajectory of cyclones, particularly in the North Atlantic. Further studies will be carried out to provide a more accurate understanding of the development of cyclone activity (trajectories, force, frequency) and hence cyclone risk and associated coastal hazards (cf. 1-3) in La Réunion (work scheduled) and the French West Indies (work in progress).
Partner: Météo-France

Cross-cutting measures
Measure 1.7: Develop methodological tools to analyse and evaluate potential domino effects and adverse configurations associated with natural hazards
There are plans to develop methodological reference tools for analysis and evaluation, on a relevant regional scale, of potential domino effects and adverse configurations associated with natural hazards, in order to suggest strategies in areas which are vulnerable to this type of event. Whether the work carried out is applicable to accidental risk and, in particular, to very infrequently occurring events may also be studied.
Partners: INERIS, CERTU, etc.
Timetable: 2012-2015

Action n°2: Extend observation and make data available

Observations are an integral aspect of research, but are also required in order to manage risk. The measures proposed aim to create a reference baseline for natural hazards on which a number of proposals will be based, notably relating to measurement of the evolution of risks associated with climate change. They will attempt to organise monitoring and make data available.

The approaches presented will then be linked to the development of an observatory for natural hazard prevention (Lead: DGPR), whose main role will be to collect data to allow assessments to be carried out relating to vulnerability and the effectiveness of actions implemented.

Coastlines

Measure 2.1: Establish an infrastructure designed to collect, process, archive and distribute sea level data in order to observe and understand long-term sea level variations
There are plans to reinforce the national network for swell measurement in situ (cf. Coastline action sheet, Measure 2.2).

Observing and understanding long-term variations in sea levels involves establishing an infrastructure to collect, process, archive and distribute in situ meteorological quality sea-level data (tidal observatories in coastal areas). Setting up this infrastructure involves support for the Observation System For Long-term Sea Level Variations project (SONEL) and a major French contribution to the GLOSS programme (Global Sea Level Observing System).
Lead: SHOM
Partners: LEGOS, LIENSs
Tools: Tidal observatories, data-sharing portals
Timetable: 2011-2015
Indicators: Availability of REFMAR and SONEL data

Forests
Measure 2.2: Maintain and develop the interministerial French forest fire database and improve public access to it
Ongoing development of the French forest fire database (BDIFF) is a response to the need to collect data about forest fires and, in a more general and ambitious sense, about plant cover affected by fires and requirements for long and medium-term observation of the development of annual pressure from fires in France.
Lead: MAAPRAT
Partners: MIOMCTI, IFN.

Measure 2.3: Consolidate mapping of areas which are potentially vulnerable to summer forest fires in the medium term
An initial national project to map areas which will potentially be vulnerable to summer forest fires circa 2040 was carried out in 2010 (Météo-France, ONF, IFN). Further studies linked to the IPCC Fifth Assessment Report and using its simulations, in association with the European Commission (DG Environment, JCR) and certain member states will strengthen methodology and make it possibly to refine this first inventory of zones which are potentially vulnerable to forest fires for a horizon as yet to be determined.
Lead: MEDDTL / DGPR.
Partners: MAAPRAT, ONF, IFN, METEO-FRANCE and CCR

Mountain areas
Measure 2.4: Carry out a feasibility study for introducing long-term monitoring of the evolution of natural hazards in mountain areas based on existing networks
Mainstreaming changes in mountain environments and natural phenomena in risk management requires continuous updating of knowledge and pooling of data produced. The measure proposed involves studying the feasibility and optimal coordination conditions for harmonising existing networks for long-term monitoring of the development of natural hazards in mountain areas.
Lead: DGPR
Partners: Alpine Cluster for Study and Research into the Prevention of Natural Hazards, INERIS

Zones subject to land movement
Measure 2.5: - Set up an observation network for shrinkage-swelling of clay soils and gravitational landslides based on existing experimental sites (global monitoring, data-sharing, making information available to the research community)
Research sites are crucial to a proper understanding of shrinkage-swelling phenomena in clay soils and mapping due to the observations and data which they provide. An observation network for shrinkage-swelling phenomena in clay soils will be set up based on existing experimental sites (global monitoring, data-sharing, availability of data for research purposes).
In order to measure the effects of climate change on gravitational movements, a baseline reference for instruments at sites will be developed and an observation and data-sharing network will be established.
Lead: to be determined.
Partners: BRGM-CERMES-CSTB-IFSTTAR-INERIS

Indicators: Number of instrumented sites with data-sharing

Flood zones

Measure 2.6: Map flood risks for territories at significant risk of flooding within the framework for implementing the European Floods Directive

Topographic data relating to flood zones as a whole is currently being collected within the framework for implementing the European Floods Directive (EFD). Flood risks will be mapped for regions at major risk and included in all Flood Risk Management Plans (FRMP) approved in 2015. The Floods Directive makes mainstreaming climate change in management approaches mandatory, in addition to a six-yearly review of all documents. Within this framework, historic data relating to rises in water level and flooding will be made available to the public via the Database of Historic Flood Data (BDHI) which can be accessed online.

Measure 2.7: Explore the idea of long-term monitoring of the development of hazards associated with rises in water levels and flooding

Lead: DGPR
Partner: Cemagref, BRGM, SHOM, IFFSTAR, IGN
Timetable: 2011-2015

Action n°3: Standardise the concept of vigilance, alerts and associated mechanisms and make systematic provision for lessons learned feedback

This action focuses on crucial components of risk management. Vigilance and alerts reduce exposure to hazards, and lessons learned feedback improves understanding and facilitates assessment of the relevance of measures implemented and ultimately improves hazard prevention and management.

Forests

Measure 3.1: Monitor changes in the forest fire weather index

Météo-France provides dedicated forest fire assistance in defence and security zones in southern and south-western France. A website provides forest fire protection services with an automatic national map forecasting fire risk, which is updated twice daily. Continuous monitoring of these indices will be developed to produce a statement of how they are developing in relation to climate change and to reinforce existing mechanisms, for projection purposes, so that changes in the danger status can be taken into account. The same approach will be extended to relevant French overseas *départements* and territories (mainly La Réunion and New Caledonia).
Lead: MIOMCTI / DSC
Partners: MAAPRAT, ONF, IFN, Météo-France.

Cross-cutting measures

Measure 3.2: - Make provisions to extend the weather watch system to cover "tidal wave and flooding" hazards

Vigilance measures relating to weather and rising water levels, warning systems and decision-support tools further up the alert chain and mechanisms to warn the public have existed for several years and are now mostly operational. They are regularly assessed and improved. There are plans to extend the weather watch to wave/flooding hazards for all continental French coastlines in 2011. Most of the current measures relating to the standardisation of mechanisms for forecasting, vigilance and alerts fall within part 2 of the of the Rapid Flooding Plan.
Partners: Météo-France, SHOM, MIOMCTI/DSC, DGPR

Measure 3.3: Establish a global and reliable lessons learned feedback process after major events

The educational value of feedback about a sequence of events for an understanding of phenomena and how they evolve makes lessons learned an important element of hazard management (especially when these hazards are evolving) and this must be reinforced. A study will be carried out to define a reliable process for sharing lessons learned after a major event, methods for capitalising on results and information shared with stakeholders in the field and medium-term monitoring.
A pilot project relating to diagnosis of extreme events observed (Research lessons learned, *REX "recherche"*) is also planned (cf. Measure 3.4 on the Research action sheet).
Lead: DGPR

Partners: MIOMCTI / DSC, CGDD, CGEDD, CETMEF, IFFSTAR, MAAPRAT / DGPAAT, CERTU
Timetable: 2011-2013
Indicators: Production of a methodological guide

Action n°4: Mainstream the impact of climate change on natural hazards in urban development management

The proposed measures involve defining terms for mainstreaming potential hazards related to climate change in urban planning documents on the one hand, and mainstreaming climate change in specific natural hazard prevention documents, on the other hand: major hazards information document, natural hazard prevention plans (PPRN) Flood Risk Management Plans (FRMP), local strategies.

Cross-cutting measures

Measure 4.1: Mainstream the potential impacts of climate change in urban planning documents such as the SCOT and PLU.

Preventing urban development in natural or rural zones which will potentially become dangerous and avoiding greater population density in zones which have already been urbanised where hazards will increase are the best strategies for curbing the increasing vulnerability of these zones and avoiding subsequent relocation. New buildings are intended to last at least 50 to 100 years, and spatial planning studies must take this into consideration, especially in relation to the potential risks associated with climate change.

Mainstreaming the potential impacts of climate change in planning documents such as the SCOT and PLU will be based on a definition provided by the government of the various regional scenarios for the impact of climate change on natural hazards. This information will be made available to the relevant departments in order, ultimately, to include a prospective "climate change adaptation" component systematically into the strategic element of the government's information disclosure obligation where relevant.

Measure 4.2: Integrate climate change into information documents produced by the government to enable mayors to develop municipal information documentation relating to major hazards (DICRIM)

Climate change adaptation also falls within the sphere of preventive information. In this respect, information documents produced by the government (for which provision is made in the Environment Code) will include this topic so that mayors can produce municipal information documentation relating to major hazards (DICRIM), providing all the relevant information.

Measure 4.3: Specify the terms and conditions for reviewing natural hazard prevention plans (PPRN) in order to mainstream the impacts of climate change when statutory reference hazards are defined

Thinking will focus on methods for reviewing the National Climate Change Adaptation Plan as knowledge about the impacts of climate change evolves, as part of ongoing work relating to the regulatory definition of reference hazards.
Lead: DGPR
Partner: DGALN, DGEC/ONERC

Coastlines

Measure 4.4: Mainstream the impact of climate change on sea levels in reviews of policy relating to coastal hazard prevention plans

The current review of policy relating to Coastal Risk Prevention Plans (PPRL), makes provision for rises in sea level as a result of climate change to be taken into consideration. The Rapid Flooding Plan (PSR) makes provision for a list of priority Coastal Risk Prevention Plans in sea flooding zones which present a danger to be drawn up in 2011.
Lead: DGPR
Timetable: 2011-2013

Flood zones

Measure 4.5: Make provision for a strategic "climate change adaptation" component in local strategies within the framework for implementing the European Floods Directive

Within the framework for implementing the Floods Directive, a strategic “climate change adaptation” component is planned for local strategies.

Lead: DGPR
Partner: DGALN, DGEC/ONERC, MIOMCT
Timetable: 2011-2013
Indicators: Directives issued to departments

Action n°5: Reduce vulnerability, improve resilience and climate change adaptation

This mainly involves methodological studies culminating in the production of reference guides on adapting coastal defences, forest stands, construction measures to combat shrinkage-swelling of clay soils and sustainable development tools.

Coastlines
Measure 5.1: Suggest adaptation measures for existing coastal defences
Sub-measure 5.1.1: Potentially dangerous built-up areas will be identified to establish a vulnerability reduction programme for these areas, as provided for in the Rapid flooding Plan (*Plan submersion rapide*, PSR), which could, in the absence of any other alternative, include relocation plans.
Sub-measure 5.1.2: Methods to diagnose the status of existing coastal defences are currently being prepared. Methods to assess the functioning of these defences will also be required by contractors in order to manage them and assess their future effectiveness. Lastly, adaptation methods will be proposed incorporating the results of the SAO POLO research programme. A national guide on the subject will be published.
Partners: CETMEF, DGPR, DGALN

Forests
Measure 5.2: Explore the potential for natural regeneration of various types of forest stand following a forest fire
A study into the natural ability of various types of forest stand to regenerate after forest fires, (according to their provenance and hybrid character) will be carried out on the Mediterranean rim with the aim of defining planting strategies to achieve mixed forest formations which are more resilient to climate variability, whilst ensuring actions to combat natural hazards (survival and adaptation to events and extreme conditions).
Lead: MEDDTL
Partner: MAAPRAT, INRA, Cemagref

Zones subject to shrinkage-swelling of clay soils
Measure 5.3: Evaluate construction recommendations and current professional practice and quantify their degree of adaptation to the anticipated impacts of climate change in areas subject to shrinkage-swelling of clay soil
Based on an initial assessment of the behaviour of various types of soil using different climate scenarios for shrinkage-swelling of clay soils (cf. 1-5), the impact on the structure of individual dwellings will be evaluated and the preventive construction measures required to avoid disasters will be scoped. This will verify that the preventive measures currently advocated by the authorities and construction professionals will be adequate to withstand future droughts. An experimental test programme will be carried out on detached homes threatened by shrinkage-swelling of clay soils. The end result will be to evaluate building advice and current professional practice and to assess their level of adaptation to the expected impacts of climate change.

Measure 5.4: Produce an inventory of second-generation damage to structures affected by shrinkage-swelling of clay soils with regard to practical remedies for this damage
An inventory will be produced of second-generation damage and practical remedies relating to shrinkage-swelling of clay soils in order to pre-empt future damage associated with the projected increase in shrinkage-swelling phenomena.

Measure 5.5: Produce technical guides relating to clay soil characteristics, foundation design and repairs to structures affected by shrinkage-swelling of clay, in addition to summary information documents for professionals

As a “no regrets” measure, there are plans to produce technical guides relating to the characteristics of clay soils, foundation design, and repairs to structures affected by differential settlement and to use them as a basis for summary documents for professionals.
Partners: DGALN- DGPR-BRGM-CERMES-CSTB-IFSTTAR-INERIS-AQC-CETE Med
Tools: Instrumentation and monitoring of experimental sites, full-scale ground and house movement simulator.
Timetable: (5-3) 2011-2015 (5-4) 2011-2015 (5-5) 2012

Cross-cutting measures
Measure 5.6: Develop a methodological tool to assess the robustness (resilience) of regions to natural hazards
The robustness or resilience of regions in relation to natural hazards is a subject which has still not been analysed in any depth by regional authorities, notably in regional forward studies. The development of a methodological tool would enable local authorities to understand how robust their region is in relation to forecastable hazards and to develop the policies required to ensure the sustainable development of the region, its activities and population..
This methodological instrument, consistent with the frame of reference for Local Agenda 21, developed with associations of elected representatives and trialled in certain regions, would supplement the toolkit available to local authorities committed to sustainable development.
Lead: DGPR
Partner: CGDD, associations of elected representatives

AGRICULTURE action sheet

The agricultural sector is particularly vulnerable to the effects of climate change. Changes in temperature (especially maximum and minimum values), seasonal distribution of precipitation, increased variability, and extreme events (heatwaves, droughts) can have major direct impacts on agricultural production as a whole. Moreover, these climate modifications can also cause significant disturbance to ecosystems which also affect production: the development of pathogens and alien invasive species, an imbalance between scavengers and natural predators, desynchronisation between the lifecycles of pollinators and the plants with which they are associated and a reduction in biodiversity.
In the context of climate change adaptation, agriculture will retain its primary function of providing human nourishment. In order to be effective, adaptation of the agricultural sector must form part of a strategic vision and include environmental, social and economic issues at a French and European level. The Common Agricultural Policy (CAP), through its existing measures,[9] supports adaptation to climate change. The reform of the CAP in 2013 will provide an opportunity to mainstream issues more fully. These requirements are all the more pressing because approaching the issue via production systems seems to be the most appropriate way to address adaptation issues in agriculture. Adaptation must also include not just the basic needs of the population, but also the impact of climate change on economic sectors and regions. These changes must also respond to consumer needs.

It is also important to stress certain inertial factors specific to the agricultural sector. Changing one element in a production system, such as the availability of water, for example, can have consequence for the whole chain (upstream and downstream). Moreover, the multitude and diversity of stakeholders to be mobilised is in itself a significant inertial factor, especially in situations characterised by uncertainty.

Illustration. Sample climate change index for agriculture: soil moisture index.10. This index is falling for a 2100 horizon, irrespective of the scenario.

Action n°1: Pursue innovation via research and lessons learned and facilitate transfer to professionals and teachers

The prime objective is to develop, in conjunction with agricultural technical institutes, development organisations and research bodies, means of adapting facilities, technical itineraries and cultural practices and to facilitate their dissemination. This work will incorporate the specific local characteristics of agricultural regions and biodiversity issues (landscape-based approach, etc.). Technical solutions and agronomic itineraries identified should guarantee the socio-economic viability of farms, the safety of crops produced and yields. A formal lessons learned process will make it easier for agricultural consultants to mainstream climate change impacts and adaptation.

Issues relating to climate change must be taken into account when reference standards for qualifications are reviewed. This subject is not specifically addressed in the measures listed here as it is described in the "Education and Training" action sheet, which looks at all stakeholders and prioritises a career-based approach in association with the plan to mobilise growth in the green careers sector.
Leads for this action and all the measures given below: Directorate General for Education and Research (DGER - SESRI/SDI/BFR, DGRI)
Other aspects of this theme are covered in the "Research" and "Mountains" action sheets, in particular.

Measure 1.1: Create and make available online annually updated summaries of agricultural research programmes on a European, national and regional scale) relating to climate change impacts and adaptation
Partners: Directorate General for Agricultural Policy, Agri-food and Regions (DGPAAT), the National Observatory for the Effects of Global Warming (ONERC), Ministry for Higher Education and Research

[9] Agri-Environmental Measures (AEM), Regionalised Agri-environmental Measures, Less Favoured Areas Compensatory Allowances (LFACA)
[10] J. Jouzel, climate scenario assignment, report, January 2011

(MESR), National Research Agency (ANR), National Institute for Agronomic Research (INRA), National Centre for Agronomic Research and Development (CIRAD), Research and Development Institute (IRD), Association for Agricultural Technical Coordination (ACTA), National Organisations for Agriculture and Rural Affairs (ONVAR), Institute for Research in Environmental Science and Technologies (Cemagref), Universities, Regional Directorate for Food, Agriculture and Forests (DRAAF), Interministerial department directorates (DDI), etc.
Tool: A database which is accessible to stakeholders devoted to agronomic development research projects (compatible with studies carried out by ONERC)
Timetable: 2011-2015
Indicator: Number of studies available on the database relating to agricultural adaptation to climate change.

Measure 1.2: Integrate climate change adaptation into contracts of agreed objectives and research programmes undertaken in the period 2011-2015
Partners: INRA, ACTA, ONVAR, Cemagref, APCA, ANR, MESR, MEDDTL
Tools: Introduction of an adaptation component into contracts of agreed objectives between the government, ACTA, the Permanent Assembly of Chambers of Agriculture (APCA) and ONVARs, divided into multi-year programmes and resulting in framework conventions.
Timetable:
2011: new INRA contract of agreed objectives and a collaboration agreement which is currently being renegotiated with CIRAD
2012- 2013: new ACTA and Cemagref contracts of agreed objectives
2014: review of the Cemagref associated framework agreement
Indicators:
- Number of contracts of agreed objectives signed during the period 2011-2015 which include a climate change adaptation element
- Number of studies/publications relating to adaptation of agriculture to climate change produced within the framework of contracts of agreed objectives with a 2015 deadline.

Measure 1.3: Facilitate innovation and knowledge transfer (including lessons learned) by promoting cooperation between farmers, all agricultural development stakeholders and the basic and applied research community
Partners: ACTA, APCA, ONVAR, Cemagref, DGPAAT, MEDDTL (including the General Commissariat for Sustainable Development of the Ministry for Sustainable Development, the lead in the national plan to mobilise green economy jobs and careers), agricultural training colleges and higher agricultural training institutes, Agricultural Vocational Training and Promotion Centres (CFPPA), national parks, etc.
Implementation tools:
- Support for organising information days for professionals (the current state of knowledge relating to climate change adaptation in agriculture; lessons learned provided by farmers)
- Writing and publishing of books and summary articles for professionals
- Technical, agronomic or economic support for farms and regions to facilitate their adaptation to climate pressures
- Publication of resources for technology transfer/lessons learned
Timetable: 2011-2015
Indicators:
- Number of publications on this specific topic aimed at farmers and technical consultants
- % of funding from Programme 776 allocated to climate change adaptation (applied research activity and innovation in agriculture)

Action n°2: Promote spatial planning relating to local vulnerabilities and the new opportunities available

In order to allow agricultural systems and associated areas of activity to adapt to climate change, Regional Sustainable Agriculture Plans (PRAD) will incorporate this issue into government agricultural policies at a regional level, by taking into account guidelines set at a regional level in various planning

and strategy documents[11], specific local characteristics,[12] and economic, social and environmental issues as a whole.
Preservation of agricultural land, particularly in greater urban areas and coastal areas, contributes to climate change adaptation (by promoting adaptation to biodiversity, reducing heat islands in cities and risk prevention: reducing erosion on plant-covered slopes, flood expansion areas, etc.). It is therefore necessary to introduce a voluntary policy to protect land assets and to provide robust data on the absorption of agriculture land to this end.
Lead for this action: DGPAAT
Measure 3.3 in the Biodiversity action sheet addresses this aspect from a more cross-cutting perspective.

Measure 2.1: Integrate climate change adaptation into regional agricultural policy
Leads: Prefects
Partners: Regional Committee for Agriculture and Rural Affairs (COREAMR), relevant government departments, including, the Massif Commissioner, if required, regional authorities, Chambers of Agriculture, representative agricultural union organisations, authorised environmental protection associations, etc.
Tool: Regional Sustainable Agriculture Plans (PRAD)
Timetable: 2011-2012 (established for seven years)
Indicator: Number of effective PRADs mainstreaming climate change adaptation
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Measure 2.2: - **Improve the implementation of targets for reduced absorption of agricultural land in urban planning policy**
Lead: DGPAAT
Partners: Departmental Committee for Changes in Agricultural Land Use, MEDDTL, Delegation for Spatial Planning and Regional Action (DATAR)
Tool: The Observatory for Agricultural Land Absorption publishes an annual report on the absorption of agricultural land (measuring flows, but not land resources). It will also track changes in land use caused by climate change, if possible.
Timetable: to be established in the second half of 2011, becoming operational in 2012
Indicator: Changes in the absorption of agricultural land

Action n°3: Adapt monitoring and alert systems to new health risks

In order to understand and monitor the impact of climate change, it is necessary to be able to anticipate emerging threats. Alert and monitoring systems must be designed as flexible tools which can be adapted quickly to new circumstances. The action is divided into four components.
Lead for this action and all of the following measures: Directorate General for Food (DGAL)

Measure 3.1: Increase expertise relating to vectors
This action is linked to an action in the Health action sheet (cf. Measure 2.3)
Co-Lead: Directorate General for Health (DGS)
Partners: French National Natural History Museum, IRD, Health Monitoring Institute (InVS), National Agency for Food, Environmental and Occupational Safety (ANSES)
Tool: National Centre for Vector and Vector Risk Expertise (CNEV). This public centre for expertise created by the agriculture and health ministries is devoted to vectorial aspects of diseases, working closely with ANSES. CNEV will provide vectorial expertise for mapping disease emergence risks associated with climate change.
Timetable: 2011 – 2012 (definition of the scheme of work)
Indicator: Evaluation of monitoring tools for vector arthropods and the implantation of vector species and/or host reservoirs for infectious or parasitic diseases.
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[11] This notably involves taking into account Regional Development Programmes for French overseas *départements* and regions (DROM), Regional Coherence Programmes, local urban development plans, Regional Climate, Air, Energy Programmes (SRCAE), Regional Climate-Energy Plans (PCET), etc.
[12] There will be a specific focus on mountain, coastal and Mediterranean environments and on French overseas territories. (cf Coastlines and Mountains action sheets).

Measure 3.2: Increase studies on interactions between climate change, plant biology and health
Partners: DGS, Directorate General for Risk Prevention (DGPR), ANSES, DGPAAT, Research and higher education stakeholders, private laboratories and local authorities
Tool: The Plant Health Laboratory (LSV), a public institution comprising 6 national sites attached to ANSES since 2011, will also extend cooperation relating to potentially harmful organisms emerging as a result of climate change to partners in the European Euphresco programme.[13]
Timetable: From 2011
Indicators: Number of partnerships and collaborative projects created and the number of national programmes set up
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Measure 3.3: Reinforce the structure of animal disease monitoring mechanisms
Partners: DGS, DGPR, ANSES, DGPAAT
Tool: French animal health epidemiology monitoring platform (status not currently defined), availability of animal disease monitoring information to various partners and gradual mainstreaming of issues relating to climate change, notably by pooling information from international health risk monitoring activities.
Timetable: to be established in the second half of 2011, becoming operational in 2012
Indicator: Number of animal health epidemiology bulletins addressing the link between disease in animals and climate change.

Measure 3.4: - **Reinforce the structure of plant disease monitoring mechanisms**
Partners: Chambers of Agriculture, technical institutes, agricultural cooperatives, traders
Tools: Monitoring networks for bio-aggressors will be asked to integrate climate change adaptation into their organisational mechanisms
Timetable: From 2011
Indicator: Number of plant health bulletins relating to the link between plant disease and climate change

Action n°4: Manage natural resources sustainably and in an integrated manner to reduce the pressures caused by climate change and prepare ecosystems for adaptation

A properly sited, selected and managed **field tree** in any of its various forms (hedge, alignment, spinney, agro forestry, meadow woodland, meadow orchard, etc.) contributes to reducing temperature differences and provides protection against high winds. It also improves biodiversity (through the presence of auxiliaries) and water infiltration (by reducing run-off and soil erosion).

Soil is a true biodiversity reservoir for facing future challenges and must preserve its productive potential (food safety) and its role in the food cycle. Carbon sequestration in organic matter in soil is therefore a measure to be encouraged as it promotes biodiversity, water regulation and purification and the productive capacity of soils, whilst fighting the greenhouse effect.

Biodiversity is a crucial factor in ecosystem resilience. Maintaining and increasing biodiversity in agricultural ecosystems will build their capacity to adapt to climate change. This action falls within the scope of the National Biodiversity Strategy (SNB) 2011. Genetic diversity safeguards improved ecosystem resilience. Furthermore it offers the opportunity to produce new species and varieties adapted to future climate conditions. It is crucial to ensure that important groups of genes and alleles which could confer tolerances on these stress factors do not disappear. This action is divided into two approaches - safeguarding the conservation of genetic resources on the one hand and guaranteeing sustainable use of genetic resources on the other hand.

Water management is a crucial issue in view of the likelihood of a reduction in rainfall and changes in its temporal and geographical distribution. Adaptation of agriculture to climate change is divided into two components: the impact on the resource of growing competition between uses on the one hand, and the dependence of plant cover on this resource for hydric functioning, on the other hand. There are two possible responses, which act on supply and demand simultaneously. A multi-use approach,

[13] The aim is to increase cooperation and improve coordination of national research activities relating to plant health and legislative programmes (17 countries are involved at EU level) via research networks and by mutual sharing of national programmes

which also complies with SDAGE programmes, is to optimise existing water storage and create water reserves wherever indicated, notably by replacing abstraction during low water periods with winter abstraction. Adaptation to scarce water resources can take two forms: reducing water requirements for crops or improving water resource utilisation efficiency. This involves:

- identifying and implementing methods to reduce crop requirements during the summer
- optimising water management in catchment basins, notably by designing more water-efficient irrigation techniques delivering water closer to crops and restricting abstraction during low water periods
- more generally, promoting agricultural practices which allow shared water and soil management to be optimised. In French overseas *départements* in particular, this involves developing monitoring and alert mechanisms for water resources and also preserving the resource by improving rainwater management.

Lead for this action and all subsequent measures: DGPAAT

Action 3.1 on the Biodiversity action sheet also addresses these issues from a cross-cutting perspective.

Measure 4.1: In public policy, promote natural resource management aimed at limiting the effects of climate change

Partners: Farmers, Chambers of Agriculture, unions, MEDDTL, civil society, National Forestry Service (ONF), Coastal conservatories (especially in the case of French overseas territories), nature parks

Tools:

1- Mobilisation of measures in Rural Development Programmes (PDRH, Corsica and French overseas territories) which play a role in preserving biodiversity and managing soils and water sustainably, notably via measures for the protection of endangered species (PRM), preservation of plants threatened with extinction (PRV), regionalised Agri-Environmental Measures supporting water efficient practices which protect hedgerows and Measure 222 of the PDRH relating to agroforestry.

2- Mainstreaming of climate change adaptation in national and European Community policy (negotiations for the post-2013 CAP, French regulatory framework, etc.)

Timetable: From 2011

Indicators:

- Number of regions which have initiated a "Measure 222" and the number of hectares planted

- Number of farms benefitting and utilised agricultural areas covered by Agri-Environmental Measures

- Number of farms benefitting and utilised agricultural areas covered by Biodiversity Agri-Environmental Measures

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Measure 4.2: Preserve genetic resources for future adaptation

Co-Leads: DGAL

Partners: MEDDTL, research institutes, public and private stakeholders

Tools:

1- Construction of an appropriate system to conserve food and agricultural genetic resources in which the roles, status, responsibilities and resources of each stakeholder are identified and the creation of a body to ensure this conservation and also define the genetic resources preserved.

2- Review of methods for recording plant varieties on the national register, within the framework of the "sowing and sustainable agriculture" plan, in order to include environmental criteria in national evaluation criteria for varieties prior to commercialisation (new Environmental, Agronomic, Technological and Environmental Value (VATE)

3- Inclusion in European networks of experts in genetic resources

Timetable: 2012 - 2015

Indicators:

- Number of species recorded in the inventories of various collections (and the number of accessions in these collections[14]) / number of French collections integrated into the United Nations Food and Agriculture Organisation international system

[14] This is a "virtual" genetic entity. Every time genetic material (a species, variety, or clone) coming from a given site (natural site, gene bank, etc.) enters a collection on a specific date, this constitutes an accession. A "lot" is the physical entity represented by the accession.

- Number of recorded varieties whose agronomic performance has been examined in sub-optimal conditions[15]
- Number of networks of which France is a member (comparison in 2015 with 2010)

Measure 4.3: Promote water-efficient agriculture

Since water-saving must be promoted in all sectors and among all users, this theme is also developed in the "Water Resources" action sheet (cf. action 3 and Measure 4.3).
Partners: MEDDTL, INRA, water agencies, farmers, ACTA, Chambers of Agriculture
Tools: Provision of monitoring and support for studies helping to define adaptation strategies: e.g. Collective Scientific Expertise (ESCo) "diversification of areas of activity to reduce inputs".
Timetable: 2011 - 2012
Indicator: Number of recommendations made to relevant stakeholders, including public decision-makers; number of studies published during the period 2011-2015.

Measure 4.4: Optimise water storage

This measure is developed in the Water resources action sheet (cf. Measure 4.2)
Co-Lead: MEDDTL
Partners: Water agencies
Tools: Funding from water agencies and EAFRD
Timetable: 2011 - 2015
Indicators:
- Number of operations
- Volumes in millions of cubic metres replaced
- Indicator (n°22) "Resource development" in the water agencies' contract of agreed objectives Total amount of funding committed in millions of euros for work on water stocks to support low water and artificial reservoirs

Action n°5: Manage the risks inherent in variability and climate change in agriculture

Upstream, it would appear to be crucial to structure references for optimal adaptation of crops and livestock breeding around climate change and to make them available to producers, consultants, and different types of farmer. This implies an ability to create a corpus of clear technical messages informed by the information available, which must take into account specific regional characteristics (assets and constraints) in order to be useful and functional. A methodological study on the evaluation and benefits of seasonal forecasting models is undoubtedly worthy of consideration in this action (cf. Action n°1). Moreover, providing farmers with efficient genetic material which is multi-tolerant to abiotic stress, would enable them to choose species to grow based on the geographical conditions on their farms (cf. Action 4). Climate change can also have impacts on the nature and function of agricultural buildings and their use. The adaptation strategy required will vary according to meteorological conditions, type of building and facilities and the production system and practices adopted.

The aid mechanism for harvest insurance consists of paying a proportion of the premiums for innovative insurance contracts covering harvests against most climate risks faced by farmers. Since 2010, this incentive mechanism has formed part of the first pillar of the Common Agricultural Policy (CAP). These insurance policies allow farmers to benefit from broader cover than is available from public agricultural disaster compensation funds or traditional hail insurance. By showing farmers the level of exposure to risk of their crops through their insurance premium, this mechanism encourages them to pursue their adaptation initiatives and to give greater consideration to this risk factor in decisions relating to practices employed, area cultivated, etc.

Mutual funds fall within the sphere of health and environmental risks, for which there are virtually no insurance products, even though climate change can manifest itself by the arrival of disease previously restricted to warmer areas, for example.

Lead for this action: DGPAAT
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[15] This term refers to "producing and testing more varieties which are more resistant to biotic and abiotic stress".

Measure 5.1: Improve farmers' cover against climate hazards by developing insurance mechanisms (both in quantity and quality)
This measure is to be pursued with action n°6 on the "Funding and Insurance" action sheet.
Lead: DGPAAT
Partner in the action: Ministry for the Economy, Finance and Industry (MinEFI)
Tools:
1- In continental France, a mechanism to encourage insurance based on the Common Agricultural Policy health check from 2010 to 2013. The extension or development of community policy beyond 2010 depends on current CAP negotiations.
2- Plan to implement a public reinsurance mechanism as a last resort.
3- Study by the General Council for Agriculture, Food and Rural Areas (CGAAER) of possible approaches to insurance for farmers in French overseas territories.[16]
Timetable: 2011 – 2013 (for harvest insurance)
Indicator: Proportion of the total surface area insured by crop type
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Measure 5.2: Create a new tool, in the form of a mutual fund, to enable farmers to qualify for compensation in the event of an outbreak of animal or plant disease or of an environmental disaster
Lead: DGPAAT
Partners: MINEFI, MEDDTL, professional agricultural organisations
Tool: Mutual fund in continental France grouping areas of agricultural activity as a whole for greater economic effectiveness
Timetable: 2011 (end of the first half-year for the publication of the implementing decree and actual implementation in the second half of the year).
Indicator: Number of beneficiaries of the fund

[16] Assistance with crop insurance could, in theory apply to French overseas *départements.* In practice, the absence of any provision for harvest insurance on the part of insurers mean that there is no assistance available for these farmers. Furthermore, the community framework is different for French overseas territories as regards agricultural insurance.

FOREST action sheet

The forestry sector has faced severe crises in the last decade: storms in 1999 and 2009, a drought and heatwave in 2003 and recurring forest fires. Climate change would seem to be an additional and aggravating risk factor, which must be examined very closely. In addition to these exceptional events, there are fundamental changes which, given the length of forest cycles, must be taken into account immediately. These events and changes can present both favourable aspects (an increase in productivity in certain areas) or more problematic aspects (modification in ranges of species, increased risk), both of which need to be managed.

The actions presented in his first climate change adaptation plan reflect recommendations made during the consultation exercise, with supplementary input from existing reports on adaptation of forests to climate change. They aim to offer information relating to the following five requirements:

- Improve understanding of climate change impacts on forest ecosystems and increase research and development into all aspects of forest adaptation;
- Promote long-term monitoring mechanisms for forest ecosystems and provide managers with the ecological data required to develop adaptation strategies;
- Promote adaptation of tree stands by appropriate forest management to maximise forest potential and make the necessary genetic resources available. Involve all stakeholders from the forest/timber field in this approach;
- Preserve biodiversity and consolidate the protective role of forests in relation to certain natural hazards;
- Provide protection against exceptional climate events using measures which are appropriate to the various types of risk.

The various actions presented are applicable to all types of environments found on French territory (including French overseas *départements*). However, the impacts of climate change will not be the same in French overseas *départements* as in continental France. Moreover, the highly complex nature of tropical ecosystems means that we only have a partial understanding of how they work. Therefore priorities linked to adaptation in forests in French overseas *départements* are somewhat different. The main requirement is to improve understanding of the functioning of ecosystems and their response to climate changes (action n°1). This involves developing tools to describe these environments which are often difficult to access (actions 2.1 and 2.3). However, whilst waiting for knowledge which is more firmly supported, “no regret” measures could be put in place to conserve the extraordinary genetic diversity of these environments (action 3.3). The various Rural Development Programmes (RDR 2014/2015) in French Overseas *départements* could provide useful *tools for* implementing these actions (action 3.4). Lastly, the actions planned in French overseas *départements* could be integrated into a scientific and technical cooperation programme with other countries in the region (Amazonia, the French West Indies, the Mascarene Islands).

This plan is specifically focused on climate change adaptation and not on mitigation. However, forests occupy a special position because the majority of adaptation actions also contribute to mitigating the effects of climate change. Measures designed to adapt forests in response to the impacts of climate change aim to perpetuate the various services delivered by forests (including timber production) through appropriate management. By maintaining healthy forests, these actions simultaneously safeguard the role they play in carbon storage.

Illustration. Sample climate change index for a forest: soil moisture.17 This index is falling for a 2100 horizon, irrespective of the scenario. It should be noted that the trend for strong winds cannot be determined for France.

Overall lead for the action sheet: MAAPRAT/DGPAAT (Forest and Woodland Division)

Action n°1: Pursue and increase research and development on adaptation of forests to climate change

[17] J. Jouzel, climate change scenario assignment, report, January 2011.

The breadth of subjects to be tackled and the funding to be mobilised mean that coordinated research activities are required to promote synergies between stakeholders. This coordination is based on a prior summary of existing studies and proposals relating to subjects which require consolidation. Current priorities relating to adaptation of forests to climate change relate to the following themes:

- characterisation of the vulnerability and plasticity of forest trees according to conditions in their forest sites;
- identification of genetic characteristics and life traits which confer relative benefits on species in a changing climate context;
- the significance of intra- and inter-population variability for the vulnerability of forests to climate change;
- the response of ecosystems (temperate and tropical) to disruptions and hence their resilience on different temporal and spatial scales;
- interactions between species, functions and components of an ecosystem (temperate or tropical), in particular those involving bio-aggressor/host pairings;
- modelling of climate change impacts on a regional scale for large ecological regions (GRECO) and silvo-environmental regions (SER);
- understanding water flow in forests and its role in water and soil conservation;
- evaluating the cost of adaptation measures and the cost of inactivity, estimation of the cost to society of the loss of wooded areas, economic modelling of management pathways by incorporating an analysis of risks linked to climate change;
- the perception and behaviour of stakeholders in the forest/timber field regarding climate, acceptance of corresponding risks, the decision-making process and uncertainty.

In a changing climate context, managers have many questions and all research and development stakeholders must be mobilised to design new management techniques and effective decision-support tools. The development needs currently identified and which will be taken forward in the next five years are:

- development of advice on the use of tree species (in association with Action 3.3);
- development of vulnerability maps for tree stands on a regional scale (SER);
- development of measurement/mapping tools for the useful water reserve and water balance;
- optimisation of technical approaches to combating hazards (drought, destructive storms, fires)
- creation of appropriate technical approaches using innovative tools (planting, soil cultivation, low impact machinery, etc.);
- identification of examples of consistency or potential conflicts of advice associated with adaptation in order to identify the optimal comprise, taking the various issues into account (Example: conservation of dead wood - health risk/fire prevention);
- estimate of the cost of investments with or without payment from ecosystem services, including or excluding game;
- tools for representing and providing information about forest health and mainstreaming natural hazards and uncertainty in decision-making.

Finally, if advances in research are to yield useful tools for managers rapidly, then it is crucial to consolidate existing mechanisms to allow for the transfer of knowledge and methodologies to development stakeholders.
Action lead: MAAPRAT (DGPAAT and DGER)

Measure 1.1: Mobilise resources to fund completed research on priority topics
Lead: MAAPRAT/DGPAAT
Partners: DGER, ANR, MEDDTL
Tools: French research programmes (CEP&S, Agrobiosphère, GICC, etc.), European research programmes (COST, ERA-Net, etc.)
Output indicators: Number of forest projects financed by national or European programmes and the sums allocated
Deadline: 2015

Measure 1.2: Integrate a strategic component devoted to research and development on adaptation to climate change into forestry institute[18] contracts of agreed objectives
Leads: MAAPRAT, MEDDTL (for establishments under its auspices)
Partners: Cemagref, CNPF/IDF, IFN/IGN, FCBA, INRA, ONF
Tools: Contracts of agreed objectives
Output indicators: Number of scientific or technical publications relating to the implementation of contracts of agreed objectives; number of recommendations guides prepared; number of contracts of agreed objectives incorporating climate change adaptation in 2015
Deadline: 2015

Measure 1.3: Establish, update annually and disseminate a summary of research activities carried out into the impacts of climate change and adaptation of forests to climate change
Lead: MAAPRAT, GIP ECOFOR
Partners: INRA, Cemagref, CNRS, ONF, CNPF/IDF, AgroParisTech, FCBA
Tools: CREAFOR project
Output indicators: Number of online studies, date for the database update
Deadline: 2012

Measure 1.4: Provide RMT AFORCE with funding to extend and reinforce its actions
Lead: MAAPRAT, CNPF/IDF
Partners: 12 RMT partner organisations
Tools: Renewal of labelling and consolidation of funding
Output indicators: Total number of projects generated, number of tools produced
Deadline: 2015

Action n°2: Collect environmental data, promote it and make it accessible and ensure monitoring of impacts on ecosystems
Action lead: MAAPRAT

In order for all stakeholders to grasp the relevance of adapting their activity to climate change at their own level, and thereby promote the emergence of initiatives adapted to regions, it is crucial to promote essential environmental and climate data and make it available and accessible:
- regionalised climate change scenarios;
- topographic and pedoclimatic data;
- data relating to ecosystems and biodiversity, land use, soils and their evolution (statistical field inventories, remote sensing data);
- data relating to the health status of forests;
- data relating to remote anthropic impacts liable to interfere with climate effects.

Measure 2.1: Develop geomatic tools to improve data gathering and processing
Lead: MAAPRAT
Partners: Cemagref, IFN/IGN, ONF, CNPF/IDF, INRA, DSF, FCBA, CNRS
Tools: Cemagref contract of agreed objectives, Equipex GEOSUD project
Output indicators: Creation of a national forest geomatics platform
Deadline: 2015

Measure 2.2: Draw up and make available a standardised description of forest data sources, particularly those containing data relevant to climate change, prioritising freely accessible data
Lead: MAAPRAT
Partners: GIP ECOFOR, IFN/IGN, Research and development institutes, RMT AFORCE, MEDDTL (via SINP)
Tools: Ca-SIF project
Output indicators: Number of online links created to basic data sources within the framework of adaptation of forests to climate change
Deadline: 2014

[18] The term forestry institutes is used to avoid listing all the forestry organisations involved. It covers the following organisations: INRA, Cemag[18] J. Jouzel, climate scenario assignment, report, January 2011

Measure 2.3: Make climate change impact indicators for forests available online
Leads: GIP ECOFOR, ONERC
Partners: IFN/IGN, DSF, ONF, research institutes, local observatories
Tools: ONERC website
Output indicators: Number of indicators defined, number of indicators placed online
Deadline: 2012

Measure 2.4: Promote and adapt forest monitoring to track the way in which ecosystems respond to climate change
Leads: MAAPRAT, MEDDTL
Partners: IFN/IGN, DSF, ONF, CNPF/IDF, GIP ECOFOR
Tools: IFN inventory, Network of DSF correspondents and observers, systematic monitoring network for damage to forests, Renecofor network
Output indicators:
Deadline: 2015

Action n°3: Promote the adaptive capacity of forest stands and prepare the timber sector for climate change

Action lead: MAAPRAT

Given the scope of climate changes expected by the end of the century, existing forest tree species are highly likely to experience increasing difficulty in adapting to climatic conditions as these changes are evolving faster than the spontaneous rate of adaptation by migration of forest cover.
Forest management must therefore promote the adaptation of forest stands in order to preserve as much forest potential as possible, make forest genetic resources available (action 3.3), and safeguard the different goods and services associated with forests (including timber production). Implementing this management involves, first and foremost, achieving a better understanding and a more accurate diagnosis of the vulnerability of existing forest stands (cf research and development priorities in action 1).
It will then be necessary to:

- gradually mainstream adaptation issues into management documents (action 3.1);
- study different adaptation approaches by exploring all the associated risks and benefits (action 3.2);
- support forestry workers' actions in the field (action 3.4);
- assess the risks and opportunities associated with these changes in the forestry field as a whole in order to adapt activities accordingly (action 3.5).

Measure 3.1: Integrate the theme of climate change adaptation into reviews of regional forest strategies (*Orientations Régionales Forestières,* ORF)
Lead: DRAAF
Partners: Forest managers, scientific partners, NGOs
Tools: CRFPF
Output indicators: Number of regional forest strategies (ORFs) initiated/ongoing/completed
Deadline: 2015

Measure 3.2: Evaluate existing experiments in order to provide accurate guidance for establishing new mechanisms aimed at studying various management options
Lead: INRA
Partners: ONF, CNPF/IDF, Cemagref, FCBA, GIP ECOFOR, DRAAF
Tools: Forestry institute databases relating to inventories of experiments (including RBI)
Output indicators: Balance sheet of facilities for each organisation. Drafting of a facilities evaluation report
Deadline: 2015

Measure 3.3: Conserve, adapt and diversify forest genetic resources
Lead: MAAPRAT
Partners: CRGF, DRAAF, INRA, ONF, GIE SFA, Cemagref, FCBA, CTPS, state nurseries, AgroParisTech, national botanical conservatories

Tools: Network of tree conservation areas (UC), network of selected forest stands, state seed orchards, arboreta
Output indicators: Balance sheet per species of existing conservation mechanisms (in situ and ex situ),
number of updated "Forest Advice" factsheets by forest species, quantities of seeds marketed which comply with the charter
Deadline: 2015

Measure 3.4: Support foresters' actions by initiating measures in the forthcoming Rural Development Regulation (RDR 2014/2015) to provide funding for actions to help forest stands to adapt
Lead: MAAPRAT
Partners: DRAAF, regional authorities, RMT AFORCE partners
Tools: Information disclosure obligations post 2013, PDR, LEADER
Output indicators: Number of provisions in the forthcoming PDRs relating to the adaptation of forests to climate change, corresponding EAFRD total under the new programme
Deadline: 2014

Measure 3.5: Pre-empt quantitative and qualitative changes in timber industry supplies
Lead: MAAPRAT
Partners: FCBA, professional organisations, research and development institutes, DRAAF, CRFPF, IFN/IGN
Tools: CSFPFTB, CPF, PPRDF
Output indicators: Number of massifs examined
Deadline: 2015

Action n°4: Preserve biodiversity and services delivered by forests in relation to natural hazards

There are cross-cutting action sheets relating to the themes of biodiversity and natural hazards. There are also two further action sheets, "Coastlines" and "Mountains", relating to environments which are deemed to be particularly vulnerable to climate change. The forest is the focus of measures in these four action sheets which should be consulted.

Action leads: MAAPRAT, MEDDTL

Biodiversity
Forest environments represent major biodiversity reservoirs, notably in tropical forests. Some of the actions on the Biodiversity action sheet apply to forest ecosystems. One specific measure is proposed here in addition to these measures.

Measure 4.1: Produce a diagnostic report of Natura 2000 forest sites in France
Lead: MEDDTL
Partners: French National Natural History Museum, ONF, CNPF/IDF, MAAPRAT
Tools: Evaluation of the conservation status of the sites
Output indicators: Number of diagnostic assessments and best practice guides for conserving sites, Proportion of sites for which long-term proposals have been made
Deadline: 2015

Fire hazard
An increase in average annual temperature combined with a fall in precipitation will have the effect of extending the zone which is vulnerable to forest fires.[19].
The measures relating to this risk are detailed on the "Natural Hazards" action sheet. They deal with:
- improving understanding **(Natural Hazards action sheet - action 1);**
- consolidating the forest fire database and refining the mapping of areas which are potentially vulnerable to forest fires **(Natural Hazards action sheet – action 2)**;
- monitoring of changes in vigilance indices **(Natural Hazards action sheet – action 3)**;
- mainstreaming of changes in vulnerable areas in urban planning documents **(Natural Hazards action sheet – action 4)**.

Hazards associated with mountain terrains
In mountain areas, forests reduce the incidence of soil erosion, rock falls and landslides. They also help to stabilise steep slopes and to prevent storm flooding by reducing runoff. In order to achieve optimum prevention of various natural hazards, forest cover must be preserved for the long term against the backdrop of a changing climate. One of the major issues in the future will be avoidance of excessive ageing of forest stands by taking priority action in areas where the issues are the most significant (cf. Mountain action sheet - action 1).

Coastal hazards
Along the Atlantic coastline, sand dune forests provide protection against wind erosion. Planting on dune belts can also stabilise the dunes and reduce the advance of the coastal margin. Here too, plant cover must be maintained through the implementation of appropriate silviculture. This action must be prioritised, beginning with forests which provide the most significant protection (cf. Coastline action sheet - Measure 2.6).

Action n°5: Anticipate and manage extreme climate events

Climate change heralds increasingly frequent, powerful or protracted climate events. Such events give rise to exceptional circumstances requiring new management techniques which deviate from standard practice. Within the framework of climate change there are three types of emergency likely to affect forests: drought, fire (cf. action 4) and storms.
It is therefore necessary to adapt to this new situation and to prepare upstream to manage these events
Lead: MAAPRAT

Measure 5.1: Improve cover for foresters against climate hazards by developing insurance systems (both in terms of quantity and quality)
Lead: MAAPRAT
Partners: MEDDTL, MEFI, Ministry for the Budget, FPF, Sysso, federations of insurers, reinsurers and banks
Tools: National Committee for Forest Risk Management, Compte d'Épargne Assurance pour la Forêt (savings and insurance scheme for the forest), DEFI-assurance
Output indicators: Forest area insured as a proportion of the insurable forest area
Deadline: 2015

Measure 5.2: Develop crisis management plans for various extreme events (storms, health crises)
Lead: MAAPRAT
Partners: Ministry of the Interior (DSC), MEDDTL (DGPR), forest managers, scientific partners, DSF, GIP Ecofor
Tools: Expert reports produced after the storms of 1999 and 2009, expert reports produced after the drought in 2003, interministerial report on the extension of fire risks published in 2010, guide to forest management during health emergencies
Output indicators: Publication of crisis management plans
Deadline: 2015

FISHERIES AND AQUACULTURE action sheet

General background:
Climate change impacts on fisheries and aquaculture through an increase in water temperatures and sea levels, melting of glaciers, changes in ocean salinity and acidity, the increased force of cyclones in some regions and a drop in rainfall in others, and changes in the distribution and size of fish stocks. Climate change jeopardises the sustainability and productivity of this basic economic and environmental resource, but it can also present opportunities, especially in aquaculture.
The response to climate change of the sea fisheries sector and marine or freshwater aquaculture depends to a large extent on the adaptation strategies introduced. Fisheries policy is based on an eco-systemic approach taking into account all ecological changes, evaluating the whole range of consequences and developing appropriate management responses. Drawing on this approach, study of climate change phenomena and their impact on the fisheries ecosystem will be crucial and will help to consolidate it.
Resources used by fisheries will be affected by the consequences of climate change on the oceans. However, this impact on the oceans and their biodiversity has yet to be determined. Firstly, work must be carried out to define the potential consequences more accurately, notably for commercially fished species.
In the light of these results, the issue of the impacts to be taken into account by fisheries management tools must be analysed (possible adjustments to fishing zones, an increase in occupational risks associated with extreme events, possible modifications relating to the availability of stocks, etc.).

Illustration. Sample climate change index for fisheries: there are no conclusive French indices for this maritime activity.

Action n°1: Adapt the French shellfish sector to climate change issues

Background:
Climate change is likely to impact on the shellfish sector by bringing about changes in techniques or breeding methods. New collection areas for oyster spats are already appearing, concentrated initially in the Arcachon basins and to a lesser extent in the Marennes-Oléron area. The implementation of studies on the ability of oysters and mussels (the main French shellfish harvest) to adapt to higher temperatures, and increased vigilance regarding emerging diseases are the first issues to which the sector must respond in order to adapt to the impacts of climate change.
Targets:
- Health monitoring relating to the emergence of diseases affecting different areas of activity in the shellfish sector;
- Evaluation of the genetic potential of oysters and mussels to adapt to a rise in temperature.

Description of the action:
a) Health monitoring:
- evaluate the methods to be implemented to ensure a health monitoring system that can detect the emergence of new diseases affecting shellfish;
- define a monitoring network (stakeholders, monitoring protocols, etc.).

b) Introduce a health monitoring system:
- optimise the data collection system (grids of measures, frequency, costs)

c) Health monitoring balance sheet:
- summary of the changes in monitoring data on the French coastline;
- analysis of the results against ecosystem changes over the same period, with change data to be compared against climate change (regional or global indicators);
- integrated monitoring proposal.

d) Genetic potential for adaptation to a rise in temperature :
- implementation of laboratory experiments to determine the genetic potential of oysters and mussels to adapt to a rise in temperature;
- production of a publication to disseminate the results.

Lead for this action: DPMA/SDAEP/BCEL - DGAL
Partners: DGAL, Ifremer, SYSAAF, other public and private institutes, collaborative projects with institutes abroad

Tools:

Models developed
2D and 3D mapping
Readings of regular average observations of diseases affecting shellfish and a summary
Indicators for monitoring different aspects of the status and dynamics of the system (physico-chemical environment, biological productivity, health status, etc.)

Monitoring indicators: *establishment of sets of historic data*
Availability to the public
Health monitoring report and scientific publication

Implementation timetable:
2012-2013: inventory of the current situation
2013-2014: information required for monitoring purposes established and monitoring introduced
2014-2015: balance sheet of observations and dissemination of the publication

ENERGY AND INDUSTRY action sheet

Energy generation, transport and consumption are influenced by the climate and will therefore have to adapt to climate change. Some energy infrastructures have long lifespans and will thus eventually be exposed to a climate which differs from the current climate. In addition, climate change adaptation in the energy sector must be viewed within the general context of greenhouse gas emissions and the fight against insecurity in domestic energy supply.

Studies carried out to quantify impacts in this sector would suggest that global warming will reduce annual energy requirements for buildings (an increase in demand for cooling will be fully offset by the decrease in demand for heating).

The consultation exercise which paved the way for the National Plan produced a series of recommendations to respond to the issues identified in this area. Recommendations relating to mainstreaming climate change in regulations for comfort and energy consumption in the home, as well as research programmes into the housing environment, have been incorporated into the "Urban Planning and the Built Environment" component of the plan. Similarly, recommendations dealing with raising public awareness of best practice have been incorporated into the communications component of this plan.

The provision of scenarios relating to future changes in natural renewable energy sources associated with climate change was proposed. Currently, analysis of the relationship between climate change and local changes in potential NREs is still in the research stage and is surrounded by much uncertainty, as was stated notably in the latest IPCC special report on renewable energies (May 2011). Work using research currently underway could possibly yield information to support decision-making in the next phase of the National Climate Change Adaptation Plan.

The issue of cooling energy plants in hot weather was addressed by mainstreaming climate change in the water quality monitoring data of the European Water Framework Directive (WFD): this recommendation is covered in action 4. It is also appropriate to remember that since the heatwave in 2003, cooling systems for power plants have received significant additional funding to improve efficiency, notably in hot weather (Electricité de France has allocated multiyear investment totalling €200 million), and research into the effects of thermal discharge on biodiversity has been launched in the form of a partnership between industry and research organisations. Moreover, a mixed government/industry group dealing specifically with heat discharge is already operational.

In compliance with the recommendations produced by the consultation exercise, the actions proposed on the theme of energy will focus on managing the issue of peaks of electricity consumption in hot weather which could be caused by increased demand for cooling, in addition to methods to promote more energy-efficient cooling methods.

Lastly, climate change could potentially affect the industrial sector in some industries at a production level (manufacturing processes, supplies of raw materials, etc.) and at a marketing level (changes in markets, etc.). The importance of this theme, which has not been the focus of in-depth study in France, was highlighted during the preliminary consultation exercise for the Plan. Although these are very long-term considerations in terms of decision-making in industry (looking ahead 20 years or more), it would seem appropriate to carry out forward studies now on the macro-level changes which the French industrial sector might expect. An action is therefore proposed at the end of this action sheet.

Illustration. Sample climate change index for energy: heating degree days or cooling degree days.[20] *There is a clear downward trend for heating degree days and an upward trend in the number of cooling degree days.*

Action n°1: Manage the emergence of peaks in summer energy consumption via an electrical capacity obligation mechanism

Description

Electricity consumption in France today is at its highest during cold spells, generating peaks of consumption which must be managed in order to safeguard supply.

[20] J. Jouzel, climate scenario assignment, report, January 2011.

Serge Poignant, Deputy for Loire-Atlantique, and Bruno Sido, Senator for Haute-Marne, submitted a report to the Minister for Ecology and Energy in April 2010 relating to the management of this peak and making some twenty recommendations to manage demand, decrease consumption and ensure that investment is made in state-of-the-art methods for both generation and reduction. One of the recommendations involves imposing a capacity obligation on suppliers and introducing a secondary market for capacity trading, which was adopted in law n°2010-1488 of 7 December 2010 relating to the New Organisation of the Electricity Market (NOME).
A summer consumption peak could emerge in the long term due to the combined effects of global warming and increased use of cooling equipment. This is why studies carried out by the peak electricity working group should be transferrable to the issue of summer consumption, which could occur in approximately fifteen years from now.
Regulations relating to the NOME law capacity obligation are due to be introduced and to come into force in 2012. The government will ensure that they can be adapted to changes in the profile of peak electricity consumption in France.
Lead: DGEC
Tools: Decree setting a capacity obligation, annual capacity obligation levels set by the government.
Timetable: 2012
Output indicators: Publication of the decree relating to capacity obligation and incorporating the option of taking peaks during hot weather into consideration

Action n°2: Promote the use of more efficient cooling equipment (air conditioning) or equipment using renewable or recoverable energy

Description
Existing mechanisms to promote energy efficiency call for a gradual renewal of the most energy-intensive equipment and the promotion of renewable energies (e.g. geothermal energy).
Mechanisms for the award of Energy Saving Certificates (ESC) encourage the installation of more energy-efficient equipment, including cooling equipment. The second phase of ESCs began in January 2011 for a three-year period with the aim of increasing energy efficiency by a factor of 6.4, which will contribute notably to improvements in electrical equipment. A third phase will enable gradual improvements in the efficiency of cooling equipment to be pursued.
Moreover, the Heat Fund (*Fonds chaleur*) can finance cooling equipment using renewable or recoverable energy and, in the longer term, collective cooling networks supplied by these energy sources. Collective cooling networks also reduce the pressure on cooling equipment electricity consumption. Projects for cooling which are sparing in their use of electrical energy or fossil fuels are supported by this fund (renewable energy adsorption/absorption heat pumps, thermo-refrigeration pumps, geothermic pumps with a free cooling mode in the summer, etc.).
Lastly, whilst the Sustainable Development Tax Credit and zero-rated Eco Loan, do not directly support efficient cooling, they can indirectly reduce cooling demand by improving the thermal inertia of buildings.
Lead: DGEC
Partner: ADEME
Tools: Provisions of ESC 2011-2013 and 2014-2016; Heat Fund
Timetable: 2011-2015
Indicators: Annual monitoring of the proportion of cooling equipment in validated ESCs in continental France and French overseas territories; number of renewable cooling projects financed by the Heat Fund

Action n°3: Make all hydrogeological and climate data available

Description
The availability of reliable hydrology and climate data was deemed to be a crucial issue within the energy framework of the consultation exercise. Dynamics have been initiated or reinforced since the consultation in 2010 to provide access to reliable data.

At a national level, Onema is coordinating the Water Information System *(*SIE) whose millions of elements of hydrological data from a wide range of contributors (government, public agencies, research organisations, etc.) are freely accessible via an online platform.[21] The publication in August

[21] www.eaufrance.fr

2010 of the decree relating to the National Water Data Programme (SNDE) will improve the quality of available data and the reliability of SIE outputs accessible online. French overseas *départements* are also involved in this work.

As regards climate data, the DRIAS project for providing access to regionalised French climate impact scenarios for adaptation by societies and environments will make the two French models and other international models used in the Fourth IPCC Assessment Report, with descending scales of 50 to 8km depending on the model, available online in early 2012. The research component of the Plan is also based on DRIAS for issues which go beyond the field of pure energy.
Leads: ONEMA (hydrology) and Météo-France (DRIAS)
Partners: DGALN, DGEC
Tools: Eau France portal; DRIAS portal
Timetable: 2011-2015
Indicators: Volume of Water Information System data available; annual % of data which has had a quality update; accessibility to the DRIAS web platform

Action n°4: Integrate climate change into the monitoring indicators of the Framework Water Directive so that the effects of thermal discharge can be isolated from those associated with global warming

Description
The general belief is that it is crucial, within the framework of the study of the environmental status of surface water recommended by the WFD, to be able to differentiate between the impacts of industry and those of climate change in heating of watercourses. Watercourses are actually used for cooling in industrial operations, but global warming will also affect the temperature of surface water, with or without the influence of industry.
A network of measures will be established in 2012 within the framework of the WFD. The WFD will require them to evaluate long-term changes in natural conditions (article 8, annexe V-1.3.1), notably climate change. The monitoring mechanism will therefore have to isolate the climate change parameter. The network established already provides for thermal instrumentation. Moreover, research studies relating to thermal discharge are underway in order to achieve a more accurate evaluation of the impacts of these discharges on aquatic biodiversity.
Lead: DGALN
Partners: Water agencies, ONEMA, Cemagref, government departments
Tools: Network of measures associated with the implementation of the WFD
Timetable: 2012-2015
Indicators: Heating data collected by the network; ability to attribute heating to a source

Action n°5: Identify French industrial sectors which are vulnerable to climate change and potential opportunities (2030-2050)

Description
Several sectors of the economy are sensitive to changes in the climate (agriculture, forestry, energy generation, tourism, transport, etc.), in a positive or negative way, depending on the case. The industrial sector is crucial to the national economy and the balance of trade, but there is currently little evidence available on its future vulnerability to climate change, the potential opportunities for French industry and the sectors which could be adversely affected.

This action proposes evaluating the vulnerability of this sector to climate change and the implications for economic intelligence on a national level for 2030 and 2050 horizons.
Lead: DGCIS
Partner: DGEC
Tools: Industry/Climate 2030-2050 forward study
Timetable: 2012-2013
Indicators: Publication of the vulnerabilities/opportunities study; % of industrial GDP potentially vulnerable to climate change in 2030 and 2050

INFRASTRUCTURES AND TRANSPORT SYSTEMS

The impacts of climate change on transport networks, irrespective of mode, could increase over the course of the century. The long lifespan of these networks means that it is necessary for them to adapt. Transport infrastructures, which are public facilities, are crucial to the country's economy. They have a long-term role and provide a permanent structure for regions by revitalising them on an economic and social level. Transport systems serve regions on a variety of scales (district, wider urban area, rural space, globalised space).

Various measures have been identified which make it possible to analyse the impact of climate, predict transport system vulnerabilities and prepare improvements in the resistance and resilience of existing and future infrastructures in order to ensure continuity and safety of services for the transport of people and goods. In order to complete this programme, it is crucial for the government to make shared, regionally or locally defined baseline climate reference data available (sea levels, swell, rainfall, temperatures, snow, flow rates for streams and rivers, etc.). It is actually difficult to adapt technical regulations and implementation strategies to the fairly broad range of uncertainties usually provided in climate projections. Setting baseline reference values will make it possible to study the vulnerability of transport systems. Without set reference values or projections, it is impossible to study vulnerabilities and therefore to take positive adaptive action.

The various actions are defined below:

Review and adapt technical standards for the construction, maintenance and operation of transport networks (infrastructures and equipment) in continental France and overseas territories

This involves ensuring that infrastructures built several decades ago to last for a long time (up to a century or more) according to technical standards developed between thirty and fifty years ago (or even more in the case of some structures, even if they have been revised notably with regards safety) can respond to the potentially moderate and extreme conditions expected as a result of climate change. For new transport projects, it is of course essential that standards are adequate for the revised set of hazards.

Maintenance cycles for transport infrastructures must be evaluated and optimised (cost-benefit analysis) by each infrastructure manager, integrating the combined effects of traffic and climate change in transport network maintenance programmes.

The same should apply to the programme for renewing equipment and installations associated with transport services.

Study the impact of climate change on transport demand and the consequences for reshaping transport provision

Climate change could modify travel needs, mobility in general (changes to departure points-destinations linked notably to the temporal distribution of flows and the geographic distribution of populations and activities (agricultural, industrial, etc.) and the appeal of tourist destinations). It is necessary to clarify potential changes in mobility for passengers and freight in relation both to prospects for transport demand and its impact for reshaping transport provision. The impact of changes in urban morphologies will also be studied. A multidisciplinary approach must be adopted (including geography, economics and sociology, in particular), making it possible to address all three aspects of sustainable development as fully as possible.

Define a harmonised methodology to diagnose the vulnerability of infrastructures and land, sea and airport transport systems.

Methods for assessing the vulnerability of transport networks to climate change are not well developed since climate change is still a recent issue. Methods analysing risks associated with certain types of extreme event have been developed, but they are specific to the networks studied.

The scientific and technical research community, in liaison with network managers, needs to produce methodology resources to facilitate local studies on an individual network scale in order to draw up a vulnerability statement for the various networks, enabling comparisons to be made based on criticality indices.

Establish a statement of vulnerability for land, sea and air transport networks in continental France and in French overseas territories and prepare appropriate and phased response strategies to global and regional climate change issues

The background to climate change points to the need for an analysis of the extent to which transport infrastructures, engineering structures, carriageways or railway lines, river port and airport engineering structures could resist the impact of natural forces for their allotted lifespan (i.e. their lifespan without regeneration work, heavy maintenance or removal). Local road networks and all decentralised infrastructures are also affected by these analyses relating to climate hazards.

French regions in which there is only one major high-capacity transport service should be the focus of particular attention. In these cases, the vulnerability of the infrastructure in question (airport, port, bridge, etc.) is in fact critical. This is mainly an issue in French overseas territories, but also potentially in isolated regions in continental France (islands, valley bottoms in mountainous areas, etc.).

Changes in average conditions caused by climate change and a rise in the number of extreme events, with an increase in the frequency and duration of undesirable events and the size of the areas affected by them, raise questions about responsibility, concerning, first and foremost, the integrity of the structures themselves (which can fulfil functions for various contracting authorities simultaneously), priorities in the choice of a response strategy (withdrawal inland, reinforcement, acceptance of temporary loss of service with a transfer to the means of transport, etc.), as well as acceptable levels of risk (to be established or reviewed) and the timing of investment in adaptation strategies and their implementation. What level of resistance or resilience should we adapt to?

Should we integrate all extreme events into adaptation measures, and if so, how should this be achieved? Given the variety of legal and contractual contexts, these strategic issues relating to the responses required for adaptation for each category of network will be addressed within the framework of the domain of each infrastructure manager (including regional authorities) and each transport operator, in accordance with the provisions of the law. In the case of franchises or public-private partnerships, these issues will be regulated within the framework of contractual relationships. In every case, strategic transport themes will be selected on a regional scale, with priority being given to vulnerable areas.

Illustration. Sample climate change index for transport infrastructures: number of days with abnormally high temperatures[22]*. The increase is significantly higher in the summer than in other seasons.*

Leads: DGITM, DGAC
Global output indicators for the action sheet:

- *Review of the various technical standards and adaptation, if required.*
- *Production of studies and research on the impact of climate change on mobility.*
- *Production and publication of methodologies for carrying out climate change hazard vulnerability studies.*
- *Production of vulnerability studies including an analysis of the risk to the various infrastructures and transport networks based on defined methodologies.*
- *Drafting of climate change adaptation strategies for infrastructures and transport networks.*

Action n°1: Review and adapt technical standards for construction, maintenance and operation of transport networks (infrastructures and equipment) in continental France and French overseas territories

Description of the action: Technical standards relating to transport networks are, by definition, very different. They can be:

- European standards (notably Eurocodes relating to buildings and highways, motorway, port, rail and river engineering structures) which may have supplementary national annexes, some of which specify that national climate conditions be taken into account;
- international standards such as those set by the ICAO relating to airport design;
- international standards such as those set by the ICAO relating to airport design (e.g. the decree of 10 July 2006 relating to the technical characteristics of certain land airports, with accompanying technical annexes);

[22] J. Jouzel, climate scenario assignment, report, January 2011

- ministerial circulars (e.g. modified circular 76-38 relating to the characteristics of inland waterways);
- reference standards and technical documents relating to each sector (especially the railways) or contracting authorities (as is the case, for example, for standards relating to maintenance and monitoring of infrastructures).

Eurocodes relating to engineering structures can in some instances comprise elements common to road, rail, port and river infrastructures and can contain specific provisions relevant to them. Many other reference standards are specific to a given mode of transport.

The possible updating of technical standards, after verification, will require the following services to be mobilised:
- Ministry of Transport specialist technical departments: CERTU, CETMEF, IFSTTAR, Cemagref, CETU, SETRA, STRMTG, STAC, which are responsible for organising technical thinking on updating technical reference standards, usually working in association with AFNOR and the ICAO, notably:
- relevant contracting authorities which apply and contribute to the definition of these reference standards based on lessons learned: the government (road network and airports), motorway network concession holders (SCA), local authorities (road networks), RFF for rail infrastructures and SNCF for rail rolling stock, VNF for French waterways, major sea ports, and local authorities for port infrastructures
- For urban transport, the Paris public transport system (RATP), network operators and authorities responsible for organising public transport.

The main climate hazards considered in reference standards are wind, temperature, snow and rainfall (on the scale of a catchment basin or engineering structure), erosion and also swell climates and sea levels associated with climate change. The requirement for information in relation to these hazards mainly applies to extreme events.

This action is divided into two measures:
- an inventory of technical reference standards referring to climate variables affected by climate change scenarios and the identification of requirements for climate hazard information
- a proposal to modify reference standards documents and review them if required.

In order to review reference standards, it will be necessary for the government Directorate General for Energy and Climate (DGEC) to make climate reference values and parameters available for consideration when adapting reference standards for specialist technical departments and contracting authorities (cf. Cross-cutting Actions sheet, Action n°1).

Given the large number of documents, a list of priorities will have to be drawn up. Priority must be given to modifications with the greatest medium and long-term impact.

Measure n°1.1: Inventory technical standards referring to climate change variables affected by climate change scenarios and identify the information required about climate hazards
Leads: Relevant contracting authorities: DGITM, DGAC
Technical support: Specialist Ministry departments (CERTU, CETMEF, IFSTTAR, Cemagref, CETU, SETRA, STRMTG, STAC) in association with infrastructure managers RFF, VNF.
Partners: Public transport network operators, SNCF, RATP, infrastructure managers, SCA and ASFA, major sea ports, regional authorities, authorities responsible for organising public transport.
Implementation tools: Working groups for each mode of transport led, under the aegis of the DGITM and DGAC, by the scientific and technical network (specialist technical departments) bringing together contracting authorities and partners, and cross-cutting working groups for documents relating to several modes of transport in order to identify requirements.
Implementation timetable: completion of inventory by late 2011; identification of information required by June 2012
Indicators: List of relevant reference standards, percentage of reference standards examined in order to identify requirements; list of information required relating to climate parameters and values.

Measure 1.2: Make specific information relating to climate parameters and values available via the government (DGEC) to technical departments and contracting authorities so that reference standards can be adapted.

Lead: DGEC (Co-leads: CGDD-DRI, DGPR)
Partners: Météo France, IPSL, SHOM, CETMEF, BRGM.
Implementation tools: Supplementary studies to specify hazards using models
Implementation timetable: The deadline for specifying hazards will be very variable; this sub-action will be achieved in stages and will extend, where required, for the entire duration of the plan.
Indicators: List of completed studies specifying hazards for the reference review. Verification of the response to the list of parameters and climate values requested.

Measure n°1.3: Propose modifications to reference standards documents and review them
Leads: DGITM and DGAC
Technical support: Ministry for Ecology, Sustainable Development, Transport and Housing specialists departments (CERTU, CETMEF, IFSTTAR, Cemagref, CETU, SETRA, STRMTG, STAC) in association with infrastructure managers RFF, VNF, etc., with government input for regulatory documentation and ministerial circulars.
Partners: Regional authorities, major sea ports, airports, authorities responsible for public transport, SNCF, RATP, urban transport network operators, ASFA.
Implementation tools: Technical studies to examine the proposed modifications, proposals for documents within the standards framework, preparation of regulatory documents and circulars.
Implementation timetable: Deadlines will vary according to the type of reference standard.
Indicators: % of reference standards identified which are vulnerable and where changes are proposed; % of reference standards which have actually been modified (modified document).

Action n°2: Study the impact of climate change on transport demand and the consequences for reshaping transport provision

Description of the action: The problem of the impact of climate change on supply and demand in transport can be divided into four components:

- impact on interurban passenger land transport services;
- impact on passenger transport services in an urban environment (changes in urban morphology);
- impact on demand and the air transport economy;
- impact on the transport of goods.

Studies will be informed in advance by forward research relating to overall and regional economic and demographic changes in France. A multidisciplinary approach will be required (including geography, economics, and sociology in particular) so that all three aspects of sustainable development can be properly addressed.

Measure n°2.1: For interurban travellers, initiate research into changes in population location choices and tourist destinations
For interurban land transport, the study could focus on the influence of climate change on the choice of locations for population and activities, changes in tourist destinations and the long-term impact of transport distribution by mode, period, etc. A balance sheet for reshaping transport provision can then be drawn up.

Measure n°2.2: For urban travellers, study the link between urban development policy and transport
For urban transport, the link between urban development policy and transport and the impacts in terms of the distribution between modes of transport will be studied and established. Any existing adaptation measures mentioned in local regional planning documents which could have consequences for transport demand will be taken into consideration.

Measure n°2.3: In the aviation sector, follow up the analysis carried out within the ICAO framework into developments in air transport
In relation to climate change in the aviation sector, an initial analysis was carried out within the framework of the ICAO committee for aviation and the environment in consultation with the World Tourism Organisation. It is proposed to pursue this work on the impact of adaptation on the development of air traffic.

Measure n°2.4: For goods, study changes in the location of economic activities and major freight corridors

A goods component will also be developed notably to study the impact of climate change on the location of economic activities and the activities of major rail, road and river freight corridors and on sea routes and port traffic.

For each of these components, one of the difficulties will lie in identifying the impact of climate change amongst the various hypotheses under consideration, some of which can have significant impacts (e.g. the price of oil). There will be a particular focus on analysing the effect associated solely with the adaptation phenomenon. The hypotheses and scenarios selected in each measure must be mutually consistent.
Leads: DGITM (land and sea transport)
Co-leads: CGDD - DRI and SEEIDD (demographic forward study, interurban land component, urban component and goods component), DGAC (air transport)
Technical support: CGDD, research organisations linked to the Ministerial scientific and technical network
Partners: DGITM, SETRA, CERTU, CETMEF, regions and climate change skills and innovations clusters (PCI), DATAR, Tourism Directorate, DGALN, DREAL, VNF, RFF, ICAO.
Implementation tools: Funding for research and studies
Implementation timetable: Intermediary reports in late 2013, final reports in late 2014
Indicators: Research reports and studies for each component

Action n°3: Define a methodology to diagnose the vulnerability of infrastructures and land, sea and airport transport systems, which will be made available to all the relevant local authorities, network managers and transport operators in continental France and French overseas territories

Description of the action: The vulnerability diagnosis can be carried out at different levels, such as a whole transport network, or the components of the network. It is important for the method to be consistent with overall approaches developed in regions elsewhere by the DGPR.

The two priority measures identified are to make available:

- a framework analysis methodology which offers approaches common to different modes, types of network or particular components of a network;
- methodologies which are more particularly adapted to:
    - a network vulnerability analysis which takes multimodal aspects into account;
    - specific points: road, port and river engineering structures and airport infrastructures, taking into account the strategic and financial significance of these structures and infrastructures.

Measure n°3.1: - Develop an appropriate vulnerability analysis framework methodology for transport networks
A methodology relating to methods for diagnosing vulnerability on a transport network scale, including multimodal networks, will be established and then made available to contracting authorities and managers of land, sea and airport networks and transport systems. The aim is to be able to assess loss of functionality and transport use following extreme events leading to localised or widespread damage to physical infrastructures or operational systems. This methodology must connect approaches on different geographical scales (networks, sub-networks, specific points) and address the multimodal nature of vulnerability and the domino effect (energy, water, forest fires, etc.).

This action will be carried out iteratively in collaboration with infrastructure managers to ensure that the methodologies proposed are applicable.
Initially, an inventory will be produced of existing methodological studies and a compendium of practices and network and transport system managers' requirements in terms of network vulnerability analyses. A methodological guide will then be developed based on pilot studies relating, for example, to a meshed road network, a corridor (intermodal approach), a port platform or an airport and access to it.
Leads: DGITM and DGAC with the support of DGPR
Technical support: specialist technical departments at the Ministry (CERTU, CETMEF, Cemagref, CETU, SETRA, STRMTG, STAC) in association with infrastructure managers RFF, VNF.

Partners: Public transport network operators, SNCF, RATP, infrastructure managers, major sea ports, representatives of local authorities and authorities responsible for organising public transport, ASFA, DREAL.
Implementation tools: Studies
Implementation timetable: First deliverables mid-2012 (inventory and compendium of managers' practices and requirements) followed by methodological documents (late 2013)
Indicators: production of methodological guides (urban, air, interurban rail and road and publication of intermediary reports).

Measure n°3.2: Develop a vulnerability analysis methodology designed for networks and specific points (highway, port, river and rail engineering structures, etc.)
This involves developing applied risk analysis methodologies for highway, rail and inland waterway engineering structures. These methodologies could be based on methodologies already rolled out on particular types of structures on the state-owned national highway network or on port and coastal defences.

Methodological guides for analysing vulnerability applied to the various types of network (possibly as part of a local or regional approach), and to specific points (highway and port civil engineering structures, specific points on linear infrastructures – including railways and inland waterways, etc.) will be developed, taking into account the strategic and financial significance of these structures. These could be based on methodologies already rolled out on particular types of civil engineering structure.

Methodological guides for analysing vulnerability will be distributed to transport infrastructure managers. These documents will be prepared by central technical departments in liaison with infrastructure managers led by the DGITM and DGAC with support from the DGPR. The leads will establish priorities for producing methodological documents in liaison with specialist technical departments (by modes, type of network or specific point) according to the specific requirements for each mode and the current state of knowledge.

This action will be carried out iteratively in collaboration with infrastructure managers (RFF and VNF in particular), in order to ensure that the methodologies proposed will be applicable.
Leads: DGITM and DGAC, with support from the DGPR
Technical support: Specialist technical departments at the Ministry (CERTU, CETMEF, Cemagref, CETU, SETRA, STRMTG, STAC) in association with the infrastructure managers RFF, VNF.
Partners: Network operators representing regional authorities and authorities responsible for organising public transport, ASFA, SNCF, RATP, sea ports, airports, DREAL.
Implementation tools: documents or methodological guides
Implementation timetable: 1st half 2012 for the guide relating to airport infrastructures; late 2013 for guides relating to special points and road, rail, river and sea port engineering structures
Indicators: Availability of methodological guides

Action n°4: Establish a statement of vulnerability for land, sea and air transport networks in continental France and in French overseas territories and prepare appropriate and phased response strategies to local and global climate change issues

Description of the action:
Every contracting authority and transport network manager (i.e. the government for infrastructures for which it is the direct contracting authority, local authorities, and public bodies responsible for managing transport infrastructures, concession holders) must carry out a diagnostic assessment of the vulnerability of infrastructures or equipment. An important aspect of these vulnerability assessments is identifying priority geographic areas, themes or elements of infrastructure. Initially, these studies can target the main risks identified and then be extended, taking the domino effect into account as part of a progressive approach.

For some transport infrastructure managers, initial work is scheduled to start in 2011 and 2012. RFF will carry out a pilot study in 2011 for the French national rail network on part of the network, which can then be extended in the light of the results. VNF is planning a vulnerability study in 2012. For airport infrastructures, the DGAC will task STAC with a systematic analysis of the vulnerability of airports in continental France and French overseas territories.

Des premiers travaux sont prévus par certains gestionnaires d'infrastructure de transport dès 2011 et 2012. RFF réalisera en 2011 pour le réseau ferré national une étude pilote sur une partie de son réseau qui pourra, en fonction des résultats, être généralisée. VNF prévoit la réalisation d'une étude de vulnérabilité en 2012. En matière d'infrastructures aéroportuaires, la DGAC va confier au STAC une analyse systématique de la vulnérabilité des aérodromes en métropole et Outre-mer.

Adaptation of references scheduled in action 1 will not have been completed by these deadlines and the methodological guides planned in action n°3 will not be available in their final form. Our understanding of climate hazards will also improve gradually over the duration of the plan and beyond.

To facilitate the development of vulnerability assessments for contracting authorities and managers, MEDDTL will organise a network of contacts to provide methodological support and allow various partners to share their experience.

Measure n°4.1: Carry out vulnerability studies
Leads: Contracting authorities and transport network managers: the government with RST (SETRA, CETE and STAC) and DREALs for infrastructures for which it is the direct contracting authority, motorway operators, regional authorities, public bodies managing transport infrastructures (RFF, VNF), infrastructure managers or operators RATP, SNCF for the network, rolling stock and notably the stations.
Partners: According to the circumstances RST (SETRA, CETE, STAC), DREAL, infrastructure managers and operators
Implementation tools: Completion of studies, integration of the issue of climate change adaptation into projects commissioned by the government from infrastructure managers and public transport network operators (public bodies, concession holders, etc.)
Implementation timetable: Progressively over the entire duration of the plan until 2015, with the first studies due in late 2012.
Indicators: Number of vulnerability studies carried out by type of network

Measure n°4.2: Set up a network of contacts in order to share experiences and provide methodological support to infrastructure managers and transport operators
The aim is to prepare to develop adaptation strategies for transport infrastructures and systems by exchanging knowledge and sharing lessons learned.
Leads: DGITM and DGAC
Partners: Ministry scientific and technical network (CERTU, CETMEF, SETRA, Cemagref, CETU, STRMTG, STAC), infrastructure managers (RFF, VNF) and network operators SNCF and RATP, regional authorities, motorway concession holders, sea ports, airports, DGEC, DGPR, DGALN, CGDD.
Implementation tools: Creation of a collaborative website, number of meetings of the contacts network
Implementation timetable: 2011-2015
Indicators: Creation of a collaborative website, meetings of the contacts network, involvement in climate change adaptation seminars.

URBAN PLANNING AND THE BUILT ENVIRONMENT action sheet

Buildings currently represent 42% of energy consumption and 25% of greenhouse gas emissions. However, buildings are also the place where we spend more than 80% of our time. This means that buildings must be viewed globally in terms of their multitude of interactions with their inhabitants and the environment.
Urban planning attempts to implement coherent urban and development projects. Urban planning and the building industry are disciplines which interact very closely on the successive levels of a region (block, island, district, city and wider urban area, etc.), and since they both represent multidisciplinary and synthetic approaches, they are characterised by systemic functioning which requires a global approach.

However, until recently, activities in the urban planning and built environment field have focused more on mitigation than adaptation.

Our cities are, or will be, exposed to several types of climate change hazard[23]:

- a rise in temperatures and heatwaves: episodes of extreme hot weather and the rise in summer temperatures will increase as the heat generated by the urban metabolism and human activities produces a heat island phenomenon;
- flood risk: the risk of flooding and rising urban water levels could increase with more precipitation and violent storms against the backdrop of rising sea levels, leaving coastal areas much more exposed;
- the effects of drought on the built environment: the increased incidence of drought could have repercussions, mainly on buildings with inadequate foundations, caused by the geotechnical behaviour of the ground (swelling and shrinkage of clay soils).

The main problem with adapting buildings to climate changes is associated with the fact that the annual rate of construction of new buildings only accounts for approximately 1% of the existing building stock. The sector will only evolve very slowly if it acts on this single aspect, especially since the spread of urban development (urban sprawl) is sometimes more rapid than the recurrence interval of a natural hazard or the geographic spread of a hazard. Therefore it necessary to take action in relation to the urban built environment and the existing urban environment, however action in this sphere is characterised by significant uncertainty about the future on the one hand, and by significant inertia in achieving results on the other hand.
Educational work is now required to enable stakeholders to gain a better understanding of this notion of climate change adaptation. The measures proposed in this first plan aim to consolidate this educational work.
This action sheet does not cover urban research, which is addressed in the Research action sheet, nor does it take a sectorised approach by type of hazard, given the systemic nature of the city.

Four measures are proposed:

- integrate climate change adaptation into urban planning documents;
- promote nature in the city and green space management;
- combat extreme heat in cities and reduce the effect of heat islands;
- act to improve comfortable temperatures in buildings in the context of global warming.

Illustration. Sample index for climate change in urban planning: maximum daily temperatures[24]*. For indices relating to extremes of heat, scenarios A2 and B2 show a rising trend for the frequency and intensity of these extremes.*

Action n°1: Incorporate climate change into urban planning documents

Measure 1.1: Mainstream biodiversity in urban planning documents

[23] A summary review on the theme “Cities and Climate Change Adaptation” was produced in the 2010 ONERC report.
[24] J. Jouzel, climate scenario assignment, report, January 2011

Description: The Grenelle II law made provision for regional ecological coherence programmes by the end of 2012, co-produced at a regional level by the government and the region. The law states that urban planning documents must take these schemes, which normally include the Green and Blue Infrastructure, into account. By preserving biodiversity, this continuity will improve resilience to climate change and facilitate adaptation by natural systems. The more biodiversity is preserved (zones, continuity, etc.), the better equipped it will be to resist the impacts of climate change.

- the first project in 2012 will develop indicators for use in urban planning documents to measure the level of preservation of biodiversity and ecological continuities
- Moreover, once these plans have been developed, and in the light of exemplary cases identified, a guide for departments will be produced illustrating and explaining how to take these documents into account when developing or revising urban planning documents.

Lead: DGALN/DHUP
Partner: DGALN/DEB
Tools:

- *development of biodiversity indicators for urban planning documents*
- *creation of a technical instruction guide*

Timetable: 2012: indicators
2013-2014: guide
Output indicator: Availability of indicators; availability of the guide

Measure 1.2: Mainstream the risks and effects associated with climate change in planning documents

Description of the action: the Grenelle II law made provision for the production of Regional Climate-Energy Plans for all regional authorities with at least 50,000 inhabitants. The law states that urban planning documents must take these plans into account.

- When the decree is published and the first plans have been produced, a guide for departments will be developed illustrating and explaining how it is possible to take these climate plans into account when drafting or revising urban planning documents, based on exemplary cases which have been identified.
- Furthermore, an assessment diagnosing vulnerability to climate change will be trialled on several SCOT programmes.

Lead: DGALN/DHUP
Partner: DGEC, ADEME
Tools:

- production of a technical instruction guide;
- trialling of vulnerability diagnostic assessments for climate change on SCOTs.

Timetable: 2012-2013: technical guide; 2012-2013: trial climate vulnerability diagnoses
Output indicators: Availability of the guide; summary of the trial

Action n°2: Adapt nature management and green space management in cities

Several of the actions listed in the “Nature in the City” plan presented on 9 November 2010 fall within the sphere of the Ministry for Ecology, Sustainable Development, Transport and Housing and will make a positive contribution to adaptation. It is recognised that the presence of nature in the city, and plant cover in particular, can have a beneficial effect on reducing the adverse effects of global warming in cities (reduction of the heat island effect, shade, infiltration, retention of runoff water, etc.).

Measure 2.1: Set up a cycle of national biodiversity conferences on mainstreaming nature in planning, urban planning and development practices

Papers will include a plan for local species adapted to climate change to be prioritised in development projects.
Tool: Three-yearly cycle of conferences
Lead: DGALN/DHUP
Partner: DGALN/DEB
Timetable: 2011-2012
Indicators: - organisation of the conferences; an initial conference was held in September 2010 (on the subject of the link between SCOT programmes and Nature in the City) and a second conference is scheduled for October 2011(Integration of Nature in the City into PLU programmes)
- inclusion of the promotion of local species adapted to climate change in the conference proceedings (synergy with water-saving and the fight against alien invasive species)

Measure 2.2: Establish a "Nature in the City" prize as part of the EcoQuartiers 2011 awards for Eco-districts, following requests for the incorporation of issues relating to Nature in the City into the call for EcoQuartiers projects

Within context of the changes in the EcoQuartiers 2011 framework for the new call for EcoQuartier 2011 projects, a group of approximately 80 sustainable development stakeholders was formed to preserve and enrich the new EcoQuartiers framework. One of the objectives for projects is "To preserve biodiversity and restore and promote nature in the city". It explicitly incorporates the aspect of "resource preservation and adaptation to climate change", and is divided into three objectives:

- develop understanding of local biodiversity and associated ecological functions;
- preserve, promote and manage ordinary and remarkable biodiversity;
- develop nature areas on the project site, focusing on quality and quantity, by establishing a Green and Blue Infrastructure.

Lead: DHUP
Tool: Call for EcoQuartiers projects
Timetable: 2011
Indicators: Number of projects received prioritising the adaptation of a Nature in the City component as the main focus of their EcoQuartier project; the number of projects awarded this title in the 2011 awards list.

Measure 2.3: Produce methodology components for mainstreaming biodiversity in the project engineering for EcoQuartiers

Within the framework of the EcoQuartiers 2011 club, and in order to mainstream this action from the Nature in the City Plan, a development group specifically devoted to integrating biodiversity into EcoQuartiers has been set up. It will produce methodologies and recommendations for the project engineering required (aims, skills required and timing of their deployment, etc.) and the ecological management of private green spaces. The group will meet four times in 2011. Considerations relating to climate change adaptation will be incorporated into the framework for this action.
Lead: DHUP
Tool: Terms of reference
Timetable: 2011
Indicators: Production of methodologies for mainstreaming biodiversity in EcoQuartiers project engineering

Action n°3: Combat heatwaves in cities and reduce the heat island effect

Measure 3.1: Produce a balance sheet of adaptation best practice within the framework of the "Sustainable Cities" plan

Scrutiny of submissions for new EcoQuartiers 2011 projects will highlight best practice in French initiatives to combat heat islands. As part of the "Preservation of resources and climate change adaptation" aspect, one of the stated aims of EcoQuartiers is specifically to "reduce greenhouse gas emissions and adapt to climate change".
The objectives considered as part of this aim are notably establishing a diagnosis and taking steps to minimise forecastable and emerging risks (reinforcement of resilience), specific actions to reduce the urban heat island phenomenon, studies on porosity, shapes, colours, materials, air flow and on planting and water loss which will contribute to reducing the urban heat island effect, improve comfort levels in indoor areas and reduce exchanges with outside areas.

Several proposals for EcoCités (eco housing developments), notably in the south of France, have a mandatory requirement to adapt buildings to local climatic conditions. Familiarity with the area and the way in which contractors will focus on reducing the harmful effects of development are crucial. This is combined with investigations at a district level into the energy-efficiency of the built environment and the energy strategies which must be implemented (integrated renewable energy generation) in order to make the connection between climate, comfortable summer and winter temperatures and a reduction in the greenhouse gas effect.
Within the framework of funding from the Future Investments programme (*Investissements d'avenir*) dedicated to the EcoCités initiative, actions associated with reducing the impact of heat islands as part of construction projects could be eligible for co-financing. Applications were submitted by regional authorities on 15 March 2011.
Lead: DGALN/DHUP

Tool: Inventory of practices contributing to climate change adaptation in EcoQuartier and EcoCité projects
Timetable: 2012
Monitoring indicators: Dissemination of lessons learned and best practice

Measure 3.2: Make diagnosis of vulnerability to climate change an assessment criterion for the award of the EcoQuartier 2012 label
Lead: DGALN/DHUP
Timetable: 2012
Monitoring indicators: Definition of criteria
Output indicators: Award of the label

Action n°4: Take steps to improve comfortable temperature levels in the built environment in the context of the global rise in temperatures

Measure 4.1: - Reinforce comfortable summer temperature requirements in heating regulations
Description of the action: : The 2012 heating regulations are based on three efficiency requirements and several requirements relating to method, which have been reduced to a minimum to allow greater flexibility in building design and to focus requirements on overall efficiency. The three efficiency requirements relate to: bioclimatic needs, primary energy consumption and comfortable summer temperatures. The requirements relating to bioclimatic needs and primary energy consumption are expressed in absolute terms, i.e. a maximum value which must not be exceeded. Maximum values are adjusted according to building use (housing, office space, etc.), geographical location, altitude, surface area for residential buildings and greenhouse gas emissions from wood-burning systems and from low-emission heating and cooling networks solely for consumption. The comfortable summer temperature requirement consists of comparing a standard indoor temperature with a reference temperature taken over a series of five hot days. The aim of this action is to develop criteria for a more accurate indicator which takes into account the intensity and duration of an excessively hot period and also a homogenous requirement calculated under the same conditions as other heating regulation requirements, i.e. as an absolute value. This approach aims notably to avoid the use of air conditioning to achieve a comfortable summer temperature.
Lead: DGALN/DHUP
Partners: DGEC, ADEME, CSTB
Tools: Creation of a working group
Timetable: 2012-2014
Monitoring indicators:
- *conclusions of the special working group*
- *changes in the comfortable summer temperature component in regulatory documents on heat regulations.*

Measure 4.2: Carry out research and experimentation work on comfortable summer temperatures
Description of the action: The Platform for Research and Experimentation in the Building Industry (PREBAT2), which is currently launching its second 2011-2015 phase, will mobilise its funding partners (ADEME, ANR, PUCA, etc.) to carry out research and experimentation work on extremely energy-efficient materials and systems to improve comfortable temperature levels in the summer, their integration and internal and external benefits, as well as behavioural and social issues, in order to address comfortable temperatures in buildings. Research on this topic focusing on and/or requiring monitoring and lessons learned feedback (e.g. demonstrators) will be launched during this period, relating to both new and existing buildings. The projects will include a component dealing with the dissemination of results.
Lead: DGALN/PUCA/ PREBAT2 Secretariat
Partners: DGALN/PUCA, DGALN/DHUP/QC, CGDD/DRI, DGEC, ADEME, CSTB, ANR, OSEO, Anah, ANRU
Tools: Calls for proposals as part of the funded research programme
Timetable: 2011-2015
Indicators:
- *Integration of the issue of comfortable summer temperature into various calls for papers;*
- *Number of research and experimentation applications selected in the course of various calls for proposals which include the comfortable summer temperature aspect.*

Measure 4.3: Improve understanding of the status of air quality inside existing buildings in order to mainstream health constraints in measures designed to improve energy efficiency in existing buildings

Description of the action: The national "Housing" campaign (2003-2005) undertaken by the Observatory for Interior Air Quality facilitated the creation of an inventory of the typical quality of interior air in continental French housing stock as a whole. The data collected during this campaign is currently being processed. This study by the OQAI is continuing in 2011 and involves launching two campaigns of measures in schools and office buildings respectively. In offices, this involves collecting data relating in particular to interior air quality, comfort and safety as perceived by the occupants, as well as to the energy efficiency of the buildings.

Moreover, seven energy-efficient homes were monitored for interior air quality, occupant comfort, and actual energy efficiency.

These studies should make it possible to set a reference baseline for air quality in buildings. This reference level will facilitate monitoring of the impact of climate change and adaptation actions on changes in air quality.

Lead: DHUP

Partners: OQAI, DGS, ADEME, CSTB

Tools: Studies

Timetable: 2011 – 2015

Indicators: Status report on the studies (number of buildings surveyed, etc.); publication of results

TOURISM action sheet

Illustration. Sample climate change index for tourism: number of days of snowfall. There will be an overall drop in the number of days with snowfall[25] in 2100, although it will not have disappeared altogether.

Climate change will have an influence on competition between tourist regions, their production factors (water resources), business activity and the secondary economy. Although we can expect significant changes for tourism as a market, understanding the implications of climate change is a very complex process due to the nature of tourist demand which has a large number of parameters.

Action n° 1: Promote and develop cycle tourism provision

Description:

Cycle tourism entails significant rail travel to gain access to trip destinations (in approximately one third of cases), over an extended season (April to October) and generates above average economic returns. This market can reinforce the activities pursued by tourism professionals and tourist destinations against a backdrop of pressures on energy resources and climate change: an earlier start to the seasons, redevelopment of mountain tourism with cycle routes in the valleys, competitiveness with the introduction of carbon neutral tourism provision, relocation of better-off customers to rural areas, etc.

The DGCIS is organising the France Vélo Tourisme initiative to promote sustainable tourism to French customers and geographically proximate European markets, whilst pursuing the development of a national cycleway and green route networks to support this activity.

The main activity is to set up a shop window website: francevelotourisme.com, which will go live in 2012. Developing provision will include setting and disseminating new reference standards for service providers (accommodation providers, tourist offices, etc.) and supporting the development of structured major itineraries (Paris - le Mont Saint-Michel, the Vélodyssée cycle route, London - Paris, etc.).
Lead: DGCIS
Partners: Regional authority networks, economic stakeholders, user associations, ministries (Ecology, Sports)
Tools: francevelotourisme.com shop window website, reference standards for national services (accommodation, tourist offices, cycle hire, visitor attractions), market analysis
Timetable: 2009-2015
Indicators:: - monitoring of tourist demand in France: the target is to exceed the 3% to 6% mark for cycling holidays in France ;
- annual overview of cycling holidays organised by specialist tour operators

Action n°2: Study climate change adaptation measures for developments and tourist activities in mountain areas

Measure 2.2 Refresh the brand image of cross-country skiing and trekking by mainstreaming sustainable development in ski resorts

Cross-country skiing in France is receiving a major image makeover, backed by the Ministry for Sport and for which the DGCIS provided an exceptional subsidy of 10,000 euros in 2011 (with DATAR at an institutional level) to the National Cross Country Skiing and Mid-Altitude Mountain Council (CNSNMM). Cross-country skiing creates an even greater feeling of well-being than Alpine skiing. It allows skiers to discover natural environments and open spaces which responds to a basic sociological trend to

[25] J.Jouzel, climate scenario assignment, report, January 2011

combine sporting, economic and tourist activities with greater respect for the environment (and biodiversity) in relation to climate change.

This forms part of the cross-cutting project to promote regional attractions by the Tourism Division which is also supported by a variety of operators (e.g. Grandes Traversées du Jura, which also involves the activities of the CNSNMM in a networking capacity).

Associated leads: DGCIS – Ministry for Sport
Partners: DATAR - National Cross Country Skiing and Mid-Altitude Mountain Council *(CNSNMM)*
Tools: Campaign to raise awareness / posters and a guide
Timetable: From autumn 2011
Indicators: Implementation of an advertising campaign
Change in the number of cross-country skiers and trekkers.

INFORMATION action sheet

In recent years, France has become more sensitive to the issue of climate change due to extreme meteorological events such as the storms of December 1999 and January 2009, the heatwave in 2003, and a number of tragic events such as the Xynthia gales in February 2010 or the floods in the Var *département* on 15 June 2010, which, although they cannot be directly attributed to climate change, nevertheless served to highlight the vulnerability of contemporary society to these hazards.

However, raising public awareness must be addressed as part of a structured approach, based on rigorous information criteria so that France can avoid piecemeal decisions and adapt to a global phenomenon in interaction with all 21st century biological, water, social and economic phenomena.

This approach is all the more crucial today as the complexity of national and international scientific and political debate and its translation into public opinion, involves giving citizens an informed and coherent, overview of the issues and options for action.

Moreover, public authorities and citizens must be able fully to grasp the new issues associated with the effects and the collective and individual risks of climate change. Recommendation no.10 in the National Adaptation Strategy, validated by the Interministerial Sustainable Development Committee on 13 November 2006, stated the requirement that "actions aimed at promoting exchanges between the scientific community and the public, which provide the latter with scientifically reliable information, should be reinforced". The consultation carried out prior to the development of the National Plan raised awareness among a large number of stakeholders, elected representatives and local authorities, businesses, unions, non-profit associations and government departments, which had been one of its main objectives. Informing the public about the general issue of climate change was highlighted by Groups 1 and 2 in the consultation, who requested targeted information about the expected impacts in the sectors affected, with a special focus on populations living in particularly vulnerable areas where the information currently being disseminated in relating to natural hazards must be improved.

Almost 1,000 people took part in the various meetings organised in continental France and French overseas territories. The online public consultation carried out in September and October 2010 received almost 4,000 online responses.

A successful climate change adaptation policy depends on an informed commitment by decision-makers who are aware of the complexities and new forms of vulnerability caused by climate change, and also on the adoption of measures by the population as result of their involvement in democratic debate, education, awareness raising, training, information and via a critical approach. Information is a major issue in all forms of adaptation policy and it will be even better received if citizens are given the means to understand it.

Illustration. A survey published in March 2011 shows that more than 6 out of 10 French people (63%) expressed concern about the impacts of global warming on their lifestyles.

Leads: MEDDTL/DICOM and ONERC
Partner: MAAPRAT/DICOM
Global output indicators for the action sheet: Number of communications initiatives

Action n°1: Increase communications aimed at the general public, elected representatives and business, using as many methods as possible

Leads: ONERC and MEDDTL DICOM

Measure 1.1: Define a communications strategy
Communications relating to climate change must be organised and structured around clear shared targets. A communications strategy will be defined and implemented. This strategy will involve all relevant ministerial departments.
Lead: DICOM
Partner: ONERC

Timetable: Definition of annual plans over the period 2011-2015
Output indicators: Number of communications initiatives carried out, number of people reached
The communications strategy will be organised as follows:

- Phase 1: actions to raise awareness and educational actions to inform the general public, elected representatives and business about the issue of climate change adaptation
  - from September 2011 to June 2012
  - disseminate messages using existing tools, adapt them or create new resources
- Phase 2: actions to influence behaviours and to present adaptation best practice which can be implemented
  - from September 2012
  - for elected representatives (cf details in action 4)
  - to communicate practical actions at a regional level based on the adaptation component of Regional Climate-Air-Energy Programmes

Measure 1.2: Develop the Ministry's adaptation website
The Internet has become one of the most important methods for communicating and disseminating information. However, the proliferation of websites can also lead to mixed messages or incorrect information. The *MEDDTL* website must be developed so that it becomes a reference site for information on the impacts of climate change and the adaptation required and can act as a portal for all validated information fora.
Leads: ONERC / DICOM
Partners: DGPR, DGITM, DGALN, ADEME
Timetable: Action over the whole period of the plan
Output indicators: Number of visitors to the website

Measure 1.3: Set up a climate change and adaptation touring exhibition
Taking information out into the public remains an essential communications method. A touring climate change exhibition would provide stakeholders in the field with a turnkey tool comprising a package of coherent, validated messages which will facilitate local actions and reinforce acceptance of policies dealing with every aspect of climate change.
Lead: ONERC
Associated departments: DICOM
Output indicators: Number of days on which the exhibition is presented

Measure 1.4: - Produce or update communications resources, especially audiovisual materials
Lead: DICOM
Partner: DICOM MAAPRAT
Output indicators: Number of resources produced

Measure 1.5: Ensure representation at climate change and adaptation events which are open to the public
Although communications are now largely paperless due to the Internet and audiovisual media, direct contact with the public still has significant potential to win over citizens to the fight against climate change and its effects. It is therefore necessary to ensure that there is a more frequent representation at climate change and adaptation events which are open to the public.
Leads: DICOM, ONERC
Partners: DREAL
Output indicators: Number of speeches

Action n°2: Organise the dissemination of sectoral impacts to prepare the public for adaptation measures

Not all actions relating to disseminating information or to communication in different sectors are shown here. In some cases they are more relevant to other thematic action sheets.

Measure 2.1: Incorporate an "adaptation" element into existing or future communications tools

- communication actions relating to the sustainable city: *EcoQuartiers (*EcoDistricts*)*, *EcoCités* (Eco Housing Developments), *Nature en Ville* (Nature in the City), *Plan bâtiment (*Buildings

Plan), 2012 Heating Regulations, research within the framework of the call for the Urban Development, Construction, Architecture Plan (PUCA)
    - web content could be planned initially for these subjects as a whole
    - a workshop could possibly be planned for *EcoQuartiers*
    - the brochure of winners of the call for *EcoQuartier* projects could have a feature on this subject
    - information could be provided on display boards and action sheets at the Mayors' and Local Authorities Fair.
    - information could be provided at the Solar Decathlon 2014, if it is held in France.
- communications actions relating to water and biodiversity: the National Biodiversity Strategy, climate plans implemented in National parks.
    - web content could initially be planned for these subjects as a whole.
- promote adaptation issues in forthcoming events:
    - IPCC authors' meeting, Durban international climate conference
- promote adaptation issues in MEDDTL tools:
    - provide input to the Ministry's external newsletter *Planète Grenelle*, the Ministry's Facebook page, develop a behavioural application for adapting to climate change and develop quizzes
    - propose a partnership with the Cité des sciences for an exhibition targeting young people
- use ADEME energy information areas to disseminate adaptation information

Lead: DICOM
Partners: DGALN, DGITM, DGEC, DGPR, CGDD, MAAPRAT (DICOM), CSTB, ADEME
Output indicators: Number of actions carried out

Action n°3: Collate and disseminate basic data on climate change, its effects and adaptation required

Measure 3.1: Collect scientific information in summarised form
There is a wealth and variety of scientific research relating to climate change, but the results are complex and often appear in a form which it is difficult for the general public to understand. It is therefore necessary to collate this knowledge in summarised form and possibly produce additional studies in areas where information is scarce. The Wiki proposed in measure 2.3 on the Research action sheet will be one response to this measure.
Lead: ONERC
Partners: Météo-France
Tools: Establishment of a scientific network and the organisation of a network of regional observatories
Output indicators: Reference documentation

Measure 3.2: Develop a reference website to disseminate scientific information
Given the continuous flow of new information emerging from climate change research, the Internet is the most appropriate channel for disseminating knowledge gathered. A reference website is required to disseminate information validated by the scientific community.
Lead: ONERC
Tools: ONERC website, Universcience CLIMOBS website

Action n°4: Raise awareness among decision-makers and provide relevant information to assist in decision-making

It is necessary to inform stakeholders responsible for preparing public and private policies and strategies about adaptation issues. Anticipating the effects of climate change aims to minimise the cost of these impacts and several actions are planned in the Funding and Insurance action sheet to this effect (actions 2.2 and 4.2).

Measure 4.1: Raise awareness amongst political decision-makers
Although research conclusions are shared with the vast majority of researchers in the scientific community, political decision-makers are not fully aware of climate risks and their level of decision-

making is not commensurate with the issues at stake. Awareness must continue to be raised among political decision-makers via the ONERC letter for elected representatives created in 2009.
Lead: ONERC
Partner: DICOM
Timetable: 2011-2015
Output indicators: Number of letters disseminated

Measure 4.2: Define adaptation principles and methodologies and disseminate them to government departments
The government will ensure that stakeholders in decentralised departments with a scoping role, notably those responsible for prior scoping and the information disclosure obligation (environmental assessment procedures, impact studies, etc.), are informed of the main issues relating to strategic guidelines for adaptation and reference climate forecasting data. These stakeholders will have access to regularly updated information, including national and regional guidelines from sectoral studies (the importance for adaptation of services delivered by ecosystems, Nature in the City, etc.). These could be accompanied by methodological recommendations on decision-making in situations characterised by uncertainty.
Leads: ONERC, MEDDTL partners (CGDD/IDDPP, AE-CGEDD, DGEC, DGPR, DGALN, DGITM, DICOM)etc.
Timetable: 2011-2015
Output indicators: Availability of pertinent information to the relevant stakeholders (CPP opinion, for example)

Measure 4.3: - **Disseminate adaptation principles and methodologies to local authorities**
It is necessary to provide decision-makers with methodologies which will help them to define their climate change adaptation policies. ADEME's PCET resources centre should provide the basis for this information.
Lead: ADEME
Partner: ONERC
Output indicators: Number of visitors to the PCET website

Measure 4.4: Share examples of best practice
Trials and first steps towards climate change adaptation can provide examples for decision-makers as a whole. Examples of best practice in adaptation should be collected and disseminated.

An analysis and evaluation of adaptation measures can be carried out from a technical, sociological and economic perspective.
Lead: ADEME through the intermediary of its regional directorates, ONERC
Partners: DGPR, CSTB, ONB
Output indicators: Number of examples disseminated

EDUCATION AND TRAINING action sheet

BACKGROUND[26]

1) Education

Issues relating to climate change fall within the framework of sustainable development education, which involves science teaching in its various forms. This cross-cutting teaching means that areas specific to sustainable development can be addressed in teaching, training and in the life of schools and educational establishments and that teaching resources can be produced by making widespread use of partnerships.

Sustainable development issues are already represented in primary, junior and senior school curricula and in technological and vocational education. Furthermore, sustainable development is also present in core knowledge and skills and in overlapping themes. Sustainable development education is therefore embedded in the teaching process at every stage of pupils' education.

2) Vocational training

The consultation exercise preceding the National Climate Change Adaptation Plan proposed actions ranging from raising awareness to professional training in issues relating to climate change adaptation:

- universal raising of awareness / creation of general modules in all post-baccalaureate training and in sustainable development training programmes eligible for the Personal Training Allowance (DIF)
- in the professions and areas most affected, including health and agriculture
- training for company directors, employees, elected representatives and regional authority staff in order to ensure better governance
- creation of new sectors: climate change adaptation as a business start-up opportunity; creation of new university courses relating specifically to climate change
- training for trainers.

These recommendations would appear to fit easily into the National Mobilisation Plan for Employment and Careers in the Green Economy (henceforth referred to as the "Plan for Careers in the Green Economy").

The Plan for Careers in the Green Economy aims to adapt the employment and training and careers guidance services to the current state or future prospects of the green economy:

- a trained workforce must be available in sufficient numbers and with appropriate qualifications to respond to public contracts (public rail or urban transport, waste, energy, etc.) and to private contracts (building, organic farming, timber for building or heating, etc.) which relate to targets set by the Grenelle Environment Forum
- innovation, design and production in a green economy require new knowledge and skills: we need to produce specialists in integrating sustainable development issues today so that we can influence all professional activities, including at an operational level in the future
- new careers will emerge or scarce skills will become increasingly important
- these changes will not be without negative impacts: some sectors (traditional motor manufacturing, refineries, the chemical industry, etc. or installations (factories or buildings which are energy-intensive or produce greenhouse gases) may shrink and staff may require retraining
- exploring these issues will ease the transition towards a green economy and corporate social responsibility and will make the economy more competitive

With five-way governance (local authorities, professional areas, social partners, non-profit environmental and non-environmental associations, government departments with invited experts) bringing together hundreds of national and local stakeholders, the Plan for Careers in the Green Economy allows various stakeholders to meet and work together, create a structure, and concentrate as many actions as possible with their funding (notably in basic and continuous training).

The Plan for Careers in the Green Economy has already developed diagnostic tools, action plans and implementation measures for the following fields:

- water-sewerage-waste-air
- building trades
- agriculture and forests
- eco-electrical systems
- refining-petroleum-green chemistry
- tourism
- careers involving the sea
- biodiversity-environmental services
- urban heating
- paper-cardboard
- cement
- building materials and downstream pressures
- plant health products.

This also apply to careers in the civil service.

Work is currently underway in the following fields:

- banking – insurance – finance
- trade – distribution.

This plan also takes into account the integration of cross-cutting modules for raising awareness or delivering sustainable development training in all or part of basic and continuing training programmes.

Therefore, climate change adaptation is one of the components in sustainable development issues and impacts and it is already integrated, either explicitly or implicitly, in work relating to the Plan for Careers in the Green Economy.

It would therefore appear to be prudent to plan actions which can be fully integrated into the Plan for Careers in the Green Economy and can benefit from its dynamic.

Illustration. Climate change scenarios for France show that change will already be perceptible for 2030 and 2050[27] horizons, at which points current generations will still be engaged in professional activities.

Overall lead: MEDDTL General Commissariat for Sustainable Development
Overall output indicators for the action sheet: Training programmes incorporating climate change adaptation issues.

1) Education

Action n°1: Make teaching resources available to the educational community

A partnership between the French Ministry for Education and Météo-France has led to the creation of a website about the atmosphere, the climate and climate change relating to primary, junior, secondary and technological and vocational education curriculums. The site will develop as knowledge emerging from climate change research evolves.
Leads: Météo-France and the French Ministry for Education
Tools: Website http://education.meteofrance.com*,*
Output indicator: Changes in website content
Timetable: 2011

2) Vocational training

Action n°2: Gain a more accurate understanding of a the impact of adaptation to climate change in each of the sectors studied within the framework of the Plan for Careers in the Green Economy and disseminate the results

[27] J. Jouzel, climate scenario assignment, report, January 2011

Produce action sheets validated by the Chair of the area committees of the Plan for Careers in the Green Economy, providing fine detail for each area of activity on:

- the impacts of climate change
- issues relating to adaptation to climate change
- training needs to produce researchers capable of driving progress in climate change adaptation in the field and stressing governance, risks, civil safety/safe operation of infrastructures and installations, as part of the cross-cutting nature of climate change adaptation.

These action sheets will be sent to all partners in the Plan for Careers in the Green Economy and will be available on the MEDDTL website at: http://www.developpement-durable.gouv.fr.vpn.i2/-Les-metiers-de-l-economie-verte-.html for use in all initiatives to enhance or develop basic or continuous training programmes within these areas of activity or more generally, and for training trainers.

The Plan for Careers in the Green Economy experiment demonstrates that making this range of benchmarks on sustainable development topics available is useful and is appreciated, notably by vocational areas and training stakeholders.

Lead: MEDDTL/CGDD
Partners: Domain Committees for the Plan for Careers in the Green Economy
Tools: Production of resources – dissemination via new technologies, including a website
Output indicators: Action sheets downloaded
Timetable: 2011

C These action sheets are no substitute for crucial references in professional career paths which entail entry into a career, a reference for certification and a reference for training, but they provide content for preparing a “climate change adaptation” component.

A first draft of these action sheets, which will be updated as knowledge advances, is already available at: http://www.developpement-durable.gouv.fr/adaptation

- Agriculture
- Car industry
- Construction
- Biodiversity
- Green chemistry
- Water, sewerage
- Energies
- Sea
- Tourism
- Transport

Action n°3: Incorporate health, public health, environmental and occupational health professionals into the Plan for Careers in the Green Economy in order to provide them with professional training on issues relating to sustainable development in the broad sense of the term and to climate change in particular

This sector has already undertaken actions to this effect (cf Health action sheet in this plan).

Lead: CGDD
Partners: Ministry of Health and stakeholders from this sector in five-way governance
Tools: Study for/ creation of a Domain Committee similar to the 11 existing Domain Committees
Output indicators: Tools made available to the sector by the study or by the Domain Committee
Timetable: 2011-2012

Action n°4: Provide additional training for business start-up advisors so that climate change is incorporated into analyses of business start-up opportunities

Lead: CGDD
Planned partners: Association of French Chambers of Commerce and Industry (ACFCI), Adult Vocational Training Agency (AFPA), job centres (Pôle Emploi), Association of French Regions (ARF)
Tools: A supplementary topic or module to be integrated into existing training programmes
Output indicators: Integration into existing training programmes
Timetable: 2011-2012

Action n°5: Improve ADEME's climate change adaptation external training resources for Regional Climate-Energy Plans (PCET)

The topics to be reinforced in these training programmes are the mainstreaming of an adaptation component in PCETs, development of a vulnerability diagnosis, new or supplementary methods for collaborative working, etc.
Lead: ADEME
Tools: A supplementary topic or module to be incorporated into existing training
Output indicators: Integration into existing training
Timetable: 2011-2012

RESEARCH action sheet

Time variations in climate change are a new phenomenon and adapting to them will require society to use an array of tools, some of which are not currently available. There will therefore be significant demand for researchers to develop new tools in the various fields affected (climate forecasting, spatial planning, agriculture, the economy, transport, etc.). Climate change adaptation would therefore seem to pose a real challenge for research in the years to come. France has the skills required to meet this demand with a world-class research community, notably in climate modelling. Two international level global climate models have been developed by French teams and contributed to the IPCC report (Météo-France's Arpège and IPSL's LMD-Z, each of which is coupled by CERFACS to the same LOCEAN NEMO ocean model). France is a major climate player in Europe, notably alongside the United Kingdom and Germany. The International Centre for Research into the Environment and Development (CIRED) is also a world-renowned player in the field of interactions between climate change and economic development.
The present plan incorporates basic knowledge in the relevant disciplines produced by research organisations.
The European and French research communities are structured around climate change adaptation founding programmes and projects.
At a European level, research projects forming part of a series of framework programmes funded by the European Commission and coordinated initiatives based on the Era-net model such as CIRCLE (Climate Impact Research Coordination for a Larger Europe) have led to the creation of a Joint At a national level, some research programmes have been exploring this topic for several years, including ANR research programmes such as ADAGE (Adaptation to Climate Change in Agriculture and Anthropised Ecosystems), MEDDTL's GICC climate change impact management programme and GIS Climat programmes.
Lastly, climate change adaptation involves local stakeholders first and foremost and requires collaborative work by scientists, decision-makers and citizens.
The requirements expressed during the consultation focus on four themes:
climate knowledge, research tools, thematic research and promotion of research.
The research recommendations relating to research developed in the thematic action sheets on transport, biodiversity, mountains, the city, water, hazards, coastlines, agriculture, forestry, etc. are not covered in this action sheet. Supplementary information is sometimes provided.
Research bodies have joined forces to pool their expertise in the environmental field. The Environment Alliance (AlllEnvi) comprises the following organisations: BRGM, CEA, Cemagref, CIRAD, CNRS, Conference of University Vice Chancellors, IFREMER, INRA, IRD, IFSTTAR, Météo-France, MNHN, in association with Agreenium, ANDRA, ANSES, CEDEFI, CGE, CNES, FRB, IFP, IGN, NERIS, INRIA, IPEV, IRSN, LNE and SHOM.

Illustration. Sample climate change index: extreme daily precipitation values. For a 2100 horizon, this index shows a slight increase in all regions, but these results still contain a great many uncertainties which need to be confirmed by new studies.[28].

Action n°1: Improve understanding of climate change and its impacts

The series of reports produced by the IPCC inventories the state of knowledge on the potential development of the climate for a deadline of 100 years or more. The available projections refer to timescales in which it is possible to assess the effects of mitigation measures and give a long-term view of the impact of greenhouse gas emissions. This issue of climate change adaptation requires more localised information on a shorter timescale (decadal) and in its new Fifth Assessment Report, the IPCC has asked the international scientific community to create simulations based on a 30-year horizon.

Measure 1.1: Evaluate interannual to decadal predictability based on observations and models
- Complete the EPIDOM feasibility study launched after the GICC programme call for research proposals in 2010
Lead: CERFACS
Partners: Météo-France, CNRS, IPSL, CEPMMT

[28] J. Jouzel, climate scenario assignment, report, January 2011

Timetable: 30 months from December 2010
Indicators: Publications, communications
- Support French involvement in JPI Climate
Launched in April 2010, this joint programming initiative is currently under negotiation with the European Commission.
French lead: MESR
European leads: Germany, Austria and Finland, followed by France, Italy and the Netherlands
Timetable: 2011-2015

Measure 1.2: Regionalise global climate projections

- Study regional projections of global climate change for France, in particular the results of the ongoing ANR SCAMPEI project which focuses on mountain regions. Call for tenders: ANR VMCS 2008
  Projet: ANR-08-VULN-0009-01 Late December 2011.
- Exploit the results of CORDEX and in particular of the MED-CORDEX 10 km resolution project which will mobilise coupling of climate, ocean and regionalisation models in the Mediterranean area.

Lead: Météo-France

Measure 1.3: Disseminate the results widely

- DRIAS1 climate service: Providing access to regionalised French climate impact scenarios for adapting societies and environments

Lead: Météo-France
Partners: CNRS, CEA, CERFACS
Timetable: 24 months from December 2010
Indicators: Publications, communications, annual user committee report, user surveys

- Organise periodic central (interministerial) and inter-DREAL sessions to present current research relating to climate change and its impact on the relevant region.

Lead: CGDD/DRI
Partners: FONDATERRA, CETE, etc.
Timetable: First seminar in 2012
Indicators: Number of seminars

Measure 1.4: Mobilise observation, modelling and analysis resources

- Develop the calculation potential of climate modelling centres

Lead: MESR GENCI (Grand Equipement National de Calcul Intensif), Météo-France
Partners: GENCI member organisations

- Reinforce in situ ocean observation for monitoring and predicting climate change. This will involve developing the French contribution to the international Argo network (following international recommendations) and the Euro-Argo research infrastructure (Euro-Argo ERIC and TGIR).
  - Develop a deep Argo component (depths in excess of 2,000m). It is not possible to study these regions which are crucial to an understanding of the role of the ocean in climate change using the current model.
  - Develop a biogeochemical component for Argo in order to observe the impacts of climate change on biogeochemistry and gain a better understanding of physical/biological feedback.
    Actions to be undertaken: Study the number of floats required, evaluate the cost, draw up an implementation plan.

Lead: Ifremer,
Partners: UMPC, CNRS, UBO/IUEM, SHOM, Coriolis and Mercator Océan
Output indicator: Monitoring of Equipex NAOS

- Preserve meteorological data from old archives. Extract and clean old meteorological data stored in the French National Archives which has been exposed to asbestos, digitize it onto computer media, analyse the data and incorporate it into climate databases.

Lead: Météo-France
Partners: National Archives, BNP Paribas Foundation
Timetable: 2011-2016
Output indicators: Volume of data added to databases, publications

- reinforce and exploit shared capability at a European level within the framework of the GMES-Climat service currently being defined (re-analyses based on the services of GMES-Océan, Atmosphere and Territory; reinforce the in situ component for the climate service, "Essential climate Variables" deduced from satellite observations, projections), support the involvement of French teams in this service.

Leads France: MESR and MEDDTL
Partners: Météo-France, Environment Alliance, CEA, IFREMER
Timetable: 2011 define a French position

Measure 1.5: Develop prospective socio-economic research

- Exploit the balance sheet of knowledge in this area drawn up by the Explore 2070 project (DGALN).
- Launch a forward study process to make it possible to: take into account the impacts of climate change and their social consequences in a developing economic context to include a regional dimension and address the issue of temporality (social adaptation – climate changes) for a 2050 horizon; build public policy scenarios with stakeholders for the medium and long term when there is a large degree of uncertainty.

The aim is to test future political options and evaluate their consequences to ensure that stakeholders adopt this approach effectively.
Lead: CGDD prospective study
Partner: OVSQ (History of Natural Hazards partnership Chair)
Timetable: 2012 drafting of a specification
2013 and 2014 project in progress
2015 evaluation of the results
Indicators: Existence of a specification, project launch, publication of results

- Secondly, supplement the results of this study by developing a multi-sector multi-criteria cost-benefit analysis incorporating intersectoral dependencies, direct and indirect losses and benefits, non-monetary impacts (e.g. health, biodiversity). Support an approach to regionalised economic calculations incorporating specific regional characteristics and their potential development paths, notably in terms of demographic growth, climate change, socio-economic change (e.g. changes in the consumption and size of households). Reformulate new proposals when stakeholders have identified the problems and consequences of policy proposals.
- Study the impact on company accounts.

Timetable: Follow-on measure; beyond the period of the plan

Measure 1.6: Improve understanding of the impacts of climate change and provide information
Lead: CGDD/DRI
Partners: ONERC, ADEME, MAAPRAT, CNRS, ONEMA, FRB, GIS-Climat, Environment Alliance, Météo-France

- **Capitalise on existing programmes** GICC, CIRCLE 2, ANR-CEP and future programmes:
  - monitor the results of ongoing research programmes;
  - organise seminars, conferences and workshops;
  - prepare a definition of climate services;
  - translate research results into public policy issues.

Lead: CGDD/DRI
Partners: CETE Méditerranée, SCHAPI, CETMEF, Cemagref.

- **Make research results available:**
  - link up research portals in France and Europe;
  - set up an associated search engine;
  - evaluate research results for professionals and the general public (provide a link with the climate change adaptation Wiki).

Lead: CGDD/DRI
Partners: CETE Méditerranée, CETMEF, Cemagref, etc.

- **Initiate a 3-year climate change impact research programme**

- by capitalising on the results of the GICC programme, initiate a research programme, proposing an innovative leadership role, as is the case in Northern Europe, involving decision-makers and scientists as a whole in a single decision-making body;
- make projects multidisciplinary;
- introduce evaluation, dissemination and uptake by local authorities and stakeholders; draw up a balance sheet after 3 years.

Lead: CGDD/DRI
Timetable: First call for proposals 2012, second call for proposals 2014

Action n°2: Support research

This action brings together measures to support research.

Measure 2.1: Draw up an inventory of climate change research programmes
Draw up an inventory and set up a database of research projects on climate change impacts and adaptation, and add to it on a continuous basis. This database will make it possible to provide an annual overview of French research in this area based on a research interface. It will be able to interface with existing French and European portals.
Lead: ONERC
Partner: GIS climat
Output indicators: Creation of a database, number of projects inventoried

Measure 2.2: Use satellite observations to monitor the impact of climate change applied to the water cycle (continental component) and its management
The first component of this measure will feed into a number of themes, notably forest monitoring, although the measure is devoted to water.

- Make high-resolution satellite imagery available to the scientific community and to stakeholders involved in monitoring and managing the environment, water resources and aquatic environments.
  - Acquire and make available annual high resolution national coverage for the period 2010-2015 and reconstitute historic coverage
  - make French 2000-2015 medium resolution decadal coverage available (satellite observations).
- Use satellite technology to come closer to an integrated understanding of the development of aquatic environments
  - Define the characteristics of aquatic environments (including wetlands) and their development, define the characteristics of land use and its development (Terruti-Lucas, RPG, Corine Land Cover, satellite imaging) and compare this with changes in climate conditions

Leads: Equipex GEOSUD, Cemagref
Partners: Environment Alliance, IGN, CETE SO, and other partners (LTHE, CESBIO, LGGE, etc.), CNES

Measure 2.3: Set up a "Climate Change Adaptation" Wiki
This involves setting up a tool to store and develop new knowledge relating to the area of climate change adaptation which is enriched by a qualified community and made available to the general public. This tool, which will serve as a benchmark, will provide a means of storing knowledge and bringing it to life. The Wiki will be coupled to the IGN GEOPORTAIL, in order to provide geolocation for contributions, and to DRIAS. It will provide access to e-learning modules for self-study relating to climate change adaptation.
Leads: ONERC – CGDD/DRI
Partners: CETE Nord-Picardie, CETMEF, IGN, ENTE Aix, CVRH network, Météo-France
Timetable: Kick-off 2011-2012, then ongoing
Output indicators: Number of pages written/viewed, number of lessons produced/viewed

Action n° 3: Develop thematic research projects

Some research proposals have been integrated into ad hoc thematic reports to make them more accessible. Measures relating to biodiversity, water, coastlines, the city, mountains, etc. are not

represented here to avoid undue complexity. The proposals made in this action sheet supplement proposals made in the other relevant action sheets.

Measure 3.1: - **Develop research to build or improve facilities/infrastructures which are adaptable**

Requirements analysis identifies the need jointly to address the behaviour of materials in response to climate change, adaptation strategies for facilities, equipment and infrastructures and to consider quality of service and use value.

- Study the behaviour of materials exposed to the effects of climate. Promote research into modelling of actions and their effects on existing materials, facilities and infrastructures in response to more extensive and frequent cyclical environmental demands (cycles of freezing/thawing, soaking/drying, humidity/temperature).
    - Incorporate this issue into the CGDD/DRI C2D2 research programme
    - Include this theme in IFSTTAR and CSTB contracts of agreed objectives

Lead: CGDD/DRI
Partners: DGALN (PUCA), DGITM, SETRA, IFSTTAR, CSTB, CETE, CERTU
Timetable: 2011-2013
Indicators: Launch of the C2D2 call for projects, identification of full-time equivalent staff in public institutes and central technical departments

- adaptation strategies for facilities and infrastructures
    - Support research actions for developing technical, social and economic evaluation tools and decision- support tools for the potential consequences of climate change (life cycle analysis, risk analysis, updating or replacement required, etc.).
    - Initiate the development of measurement and evaluation methodologies for mainstreaming adaptation to the consequences of climate change in investment, maintenance, planning of works and structural concepts, so that additional elements can be retrofitted at the least cost if requirements are potentially made more stringent.
    - Introduce these issues into:
        - the Prebat 2 experimentation and research programme;
        - the C2D2 research programme.
    - Launch the CERTU/CETE study.

Lead: DGTIM
Partners: CGDD (DRI-SR), DGALN (PUCA), DGTIM, SETRA, CETE, CERTU
Timetable: 2011-2015
Indicators: Launch of C2D2, identification of full-time equivalent staff in central technical departments study reports CERTU/CETE

- Take quality and level of service and use value into account.
    - Assess the efficiency of facilities, transport rolling stock and infrastructures from a user perspective (with particular focus on vulnerable people) from an economic, quality, and service level perspective (comfortable summer/winter temperatures, malfunctions, fail-soft and alternative transport modes) in relation to extreme events.
    - Introduce the theme into:
        - the Prebat 2 research and experimentation programme; the C2D2 research programme.

Lead: DGALN (PUCA)
Partners: CGDD (DRI-SR and SEEIDD), DGTIM, SETRA, CETE
Timetable: 2011-2015
Indicators: Launch of the PREBAT 2 call for proposals, launch of the C2D2 call for proposals, identification of full-time equivalent staff in central technical departments

Measure 3.2: Develop research into climate modelling in cities and the role of geometry in urban morphology

Bring together, within the framework of a scientific interest group, all stakeholders working in the field of modelling the city and its interactions with a changing climate (e.g. meteorologists, physicists, urban planners, architects, construction engineers, etc.) to develop an integrated approach to the urban micro-climate. It could potentially involve, inter alia:

- promoting the creation of technology platforms to allow existing models to be coupled

- developing new approaches to parametric modelling taking more account of the heterogeneities of space, buildings, morphologies, surfaces and materials in circumstances where changing boundaries are affected by climate change
- creating larger and more reliable experimental databases relating to the urban micro-climate on a block, district, and city scale, so that the models can be validated

Lead: CGDD/DRI
Partners: Météo-France, IFSTTAR, ENPC, CSTB, PUCA
Monitoring indicator: Organisation of seminars or summer schools, a new call for proposals
Output indicator: Creation of an urban modelling scientific interest group (GIS-MU), delivery of the results of the call for proposals
Timetable: 2011-2015

Measure 3.3: Develop research into mountain areas

- The 4-year ERA-NET CIRCLE 2 group launched on 1 May 2010, following on from CIRCLE (PCRD 6, 2004), comprises 34 institutions in 23 countries. The last call for proposals launched in 2010 relates to "impacts and adaptation to climate change in mountain areas". It is coordinated by UBA (Austria), and involves France, Turkey, Sweden, Hungary and Spain. French teams are coordinating three of the proposals selected.

Lead: CGDD/DRI in France
French partners: Cemagref, BRGM, CNRS, IPSL, Météo-France
Output indicators: Publications
Timetable: 2011-2012

- Exploit the results of the ANR's SCAMPEI project (regional projections in mountain areas).
- Evaluate the results of Climate Change Management (GICC) programmes devoted to mountain areas: "Adaptation of Alpine regions to the increase in droughts" and "Adaptation of forest trees using cross-transplantation".

Lead: CGDD/DRI
Partners: INRA, CNRS, Cemagref
Output indicators: Publications, number of seminars held relating to these projects, number of participants

Measure 3.4: Describe the characteristics of extreme events observed within an adaptation framework

Set up a research programme based around a network of collaborating parties (focusing on *GIS Climat)* which would work on selected major events to produce an analysis covering a 2-year period) and produce a document summarising multidisciplinary knowledge in the field at the end of the study. The final objective in each instance would be:

- **a state of play report**, gathering information and publications relating to the event, including the organisation and level of services (alternative services, etc.) with a summary
- **an analysis of adaptation and vulnerability** and their development compared to other similar cases
- **supplementary studies** specific to each case in each of the areas listed above.

A programme of this type would require research resources to be mobilised after a selected event as well as the coordination, multidisciplinary organisation and maintenance of shared web tools. The project fits into the "multidisciplinary mobilisation" component for research teams and data, supplementing the E3P project planned in the "Climate KIC" and the project to evaluate extreme risks in IEED CLAIRE.
This project will contribute to the transfer of research knowledge to editors drafting lessons learned material and enrich their content.

Un projet pilote sur 2 ans (2011 – 2013) est proposé afin de faire la preuve du concept, nécessitant un financement initial de 550 k euros, incluant la coordination et l'animation, ainsi que les études de cas, sur l'ensemble de cette période pour couvrir les coûts marginaux du projet.
Leads: GIS climat – contracting authority CGDD/DRI and DGPR
Partner: Météo-France.

This programme will also subsequently address:

- the specific problem of managing the risk which extreme events could pose in regions which do not currently face these risks;

- the possibility of new risk scenarios with domino effects, a combination of natural hazards and technological hazards or combinations of several natural hazards (flooding, landslides, etc.) . It will be necessary to bring together various stakeholders to determine priority issues for research.

Action n° 4: Promote research

Measure 4.1: Create a network of experts on themes relating to climate change adaptation
Task an organisation from the scientific and technical network (CETE) with drawing up an inventory of relevant regional experts for studies into adaptation to climate change both in the meteorology sphere and in other technical, environmental and societal fields which might be affected by climate change impacts. This directory could be accessed via the climate change adaptation Wiki (cf. Measure 2.5). A second phase would define which assignments could be entrusted to this network of experts in order to develop expertise and transfer it to local partners.
Lead: CETE (to be defined)
Partners: Météo-France, organisations belonging to scientific and technical networks, RST, IPSL
Timetable: 2011-2012
Output indicators: Directory of experts

Measure 4.2: Provide organisation for competitiveness clusters affected by climate change adaptation
Use the existing sustainable development structure to introduce the theme of climate change adaptation into appropriate competitiveness clusters (the sea, hazard clusters, etc.).
Identify relevant voluntary clusters.
Lead: CGDD/DRI
Partners: Relevant competitiveness clusters

Measure 4.3: Set up local adaptation experiments in the regions
Identify a Lead Partner region or urban community. Share available knowledge on adaptation themes relevant to the region in question. Organise knowledge transfer via seminars and define a shared research-action programme adapted to the region in question. Draw up a balance sheet and define a methodology which could be exported to other regions.
Lead: CGDD/DRI
Partners: Selected region, research laboratories involved in GICC or CIRCLE projects, Climate KIC and other interested partners, FONDATERRA
Timetable: 2012-2014
Output indicators: Choice of candidate; seminars organised
Call for joint proposals launched or joint event organised.

FUNDING and INSURANCE action sheet

As regards funding for adaptation to climate change and insurance, the consultation exercise prior to the National Climate Change Impacts Adaptation Strategy stressed that:

- action to fight climate change through mitigation and adaptation policies is economically justified because it would be more expensive to do nothing
- adopting key principles can minimise the funding required: informed anticipation of climate change right from the planning document stage, choosing "no regrets" measures[29], making up lost ground in terms of adaptation, attaching conditions to public and private investment, phased investment, choosing flexible solutions, etc. These principles, and the methodological tools which will be used to implement them, will be widely disseminated to public and private stakeholders.
- Funding for adaptation comes largely from the private sector, but some aspects merit public intervention. It is a particular priority to mobilise resources to fund or co-fund the production and dissemination of information which is adapted to local and sectoral issues relating to climate change, its impacts and adaptation methods. Training and the use of specialist technical expertise by stakeholders whose budgets are the tightest also deserve support. Broadening the existing mechanisms available (loans at preferential rates or tax credits) can facilitate the adoption of measures by individuals. This support would promote innovation and informed anticipation. Lastly, enhanced insurance cover for individuals in French overseas *départements* could offer benefits.
- Some existing funding programmes, including European programmes, could legitimately contribute towards funding adaptation. Mobilising this funding is a priority. Thought must now be given to mobilising additional funding either by enlisting contributions from activities which generate greenhouse gases or by imposing a levy on activities or people settling in high risk areas.
- Insurance mechanisms and provision can be reinforced to make a greater contribution to risk prevention and pre-empting future investment, whilst ensuring that the financial tools offered to do not incentivise risk-taking.

Les actions suivantes contribueront à mettre en œuvre ces orientations.

Illustration. The Stern Report states that the cost of doing nothing about climate change could amount to between 5 and 20% of GDP, whereas the cost of taking action would be as little as 1 to 2%.

Action n°1: Adapt policies, plans, programmes and corporate strategies using sustainable development implementation tools

An adaptation policy should make it possible to avoid pointless investments (for example, seeking to perpetuate investments which are not viable in the medium to long term because of climate change). Forecastable impacts of climate change should therefore be taken into account upstream in the planning phase of investment programmes where decisions are made. Sustainable development integration tools in public policy and corporate strategy will be mobilised to achieve this.
Access to localised operational information about the impacts of climate change and adaptation issues is a key element so that local or sectoral stakeholders preparing plans, projects and strategies are able adapt them. To this end, the Action sheet contains a provision in action n°4 for making relevant information available to government departments responsible for prior scoping and information disclosure.

Measure 1.1: Revise methodological guides and circulars relating to sustainable development integration tools
As part of the process of reviewing methodological documents, circulars and decrees relating to integration tools for sustainable development in public policy and corporate strategies, the government, in close cooperation with the other relevant stakeholders, will ensure that these tools take full account of climate change adaption.

[29] This involves measures to reduce greenhouse gas emissions whose net cost is negative because the direct and indirect benefits are sufficiently significant to neutralise the cost of implementation.

Environmental evaluation of plans, programmes and impact studies for works, infrastructure and development projects. The Grenelle Environment Forum is seeking to supplement existing legislation and regulations relating to environmental evaluation, which already includes climate change. A process to update the methodological guides for contracting authorities, engineering and design departments and planning departments will be launched in late 2011, for adoption by 2013. There will be a special focus on addressing new issues, including climate change adaptation policies.
Regional sustainable development policies and Local Agenda 21. Since 1992, over 700 regional authorities have adopted or initiated Local Agenda 21 and regional sustainable development policies, of which 193 fall within the framework of the mechanisms put in place by the Ministry for Sustainable Development. The "Reference framework" developed by the government and local authorities encourages mainstreaming of climate change and suggests approaches to achieve this. In 2011, a new, updated version of "Approaches and guidance for action" and a "Frame of reference for strategic evaluation of Local Agenda 21" will be published. These documents will promote adaptation to climate change within the framework of a coherent, integrated, local sustainable development policy.
Annual local authority sustainable development reports. Article 255 of the National Law for Environmental Commitment (ENE) adopted in July 2010, states that regional authorities and fiscally independent public establishments for inter-municipal cooperation with more than 50,000 inhabitants must produce an annual status report on sustainable development in their region. The implementing decree currently being ratified divides the report into two parts, one relating to actions carried out in relation to asset management and operations and a second part relating to public policies implemented in the region. These two balance sheets are produced in compliance with the five sustainable development goals in Part III of article L.110-1 of the Environment Code. A balance sheet of climate change adaptation actions could be included in these annual reports, whose implementation is scheduled for the 2012 budget.
Corporate social responsibility tools. French provisions relating to the publication of non-financial information requires companies listed on the official market to explain in their annual report how they manage their social and environmental impacts. This mechanism is currently being extended. The government states that mainstreaming of adaptation to climate change is one of the aspects to be addressed in this report. Simultaneously, portfolio management companies are required by French law to provide information about how they take social and environmental effectiveness into account in their investment policies, as well as in their terms of governance. This provision should lead to more sustainable production methods.
Lastly, ISO 26000, published on 1 November 2010, defines and clarifies the concept of corporate social responsibility for all types of organisation. Climate change mitigation and adaptation are two of the issues identified.
Lead: MEDDTL/ CGDD
Partners: MEDDTL / Directorate General for Development, Housing and the Countryside (DGALN) / (DHUP)
Output indicators: Availability of methodological guides, circulars and decrees
Timetable: 2011 – 2013

Measure 1.2: Expand the list of planning documents subject to an environmental assessment
A decree from the Environment Code will supplement the list of plans and programmes subject to environmental evaluation in 2011. This change will make it possible to evaluate climate change adaptation (within the broader framework of environmental evaluation) for new plans and programmes in which it could be a significant issue.
Lead: MEDDTL / CGDD
Output indicators: Publication of the decree specifying the list of plans and programmes subject to an environmental evaluation
Timetable: 2011

Action n°2: Introduce eligibility criteria into relevant public and private funding mechanisms to avoid inappropriate adaptation projects

Adaptation to climate change should constitute an eligibility criterion for funding for investments whose lifespan is of the same order as climate change (infrastructures, buildings, corporate structural investment, etc.), based on the information available. This involves identifying criteria, methods and data sources to allow inappropriate adaption to be detected and to promote the use of these criteria to impose conditionality in the relevant funding mechanisms. In many instances, immediate provision can

be made for a climate change adaptation criterion in order to exclude projects which are obviously inappropriate, and these methodologies can be refined as part of an ongoing improvement process.

Measure 2.1: Identify and disseminate criteria, methods and data sources so that inappropriate adaptation can be detected

Certain forecastable impacts of climate change in France are already known, such as a rise in temperatures, for example. A number of other impacts still need to be specified, such as the extent of local rises in sea level. Depending on the acceptable level of exposure to risk for a project, forecast impacts or potential impacts of climate change should be taken into account. ONERC will suggest criteria, methods and data sources which will allow public and private institutions funding investments with a lifespan of several decades to avoid inappropriate adaptation projects. These recommendations will be set out in a convenient format which is easy for non-specialists to use (guides, checklists) and regularly updated to take advances in knowledge into account. A distinction will be made in particular between forecast and potential impacts. These methodological tools will contain illustrative examples.

Lead: DGEC / ONERC
Partners: MEDDTL Directorates general with possible external input (CIRED)
Timetable: 2012-2013
Output indicators: Publication and updating of recommendations

Measure 2.2: Promote the use of conditionality criteria

Both public and private funding mechanisms could use selection or conditionality criteria (ERDF programmes, State/Region Project Contracts, ESF, EAFRD, corporate investment support programmes including FNADT, OSEO, calls for proposals, notably in urban development, mechanisms for funding housing, local authority subsidy mechanisms, etc.). In order to be effective, the introduction of conditionality criteria must include provisions for checking their implementation and applying sanctions where required. This could involve specific provisions to transfer the responsibility for compliance to the prime contractor. The terms and conditions could also vary depending on whether the funding relates to a call for proposals or is open-ended.

- DATAR produced a compendium of regional conditionality practices in 2008 for ERDF programmes and State/Region Project Contracts (*Contrats de projet Etat-région*). This evolving tool allows stakeholders in a region to develop or reinforce their mechanisms for mainstreaming the environment. Conditionality linked to adaption could be built into the next round of contracts whose content has not yet been fixed (to be produced in 2012-2013).
- These recommendations referring to conditionality linked to adaptation will be disseminated in particular via the ONERC website and the ADME Regional Climate-Energy Plans Resource Centre (PCET) using action sheets. In some cases, disseminating these criteria will involve intermediary stakeholders (professional associations, associations of local authorities, etc.). Specific communications initiatives will be organised, such as meetings to exchange ideas with professional associations in the financial sector.
- Provision is also made for an action to this effect in the Urban Planning and the Built Environment action sheet: “Make diagnosis of vulnerability to climate change an assessment criterion for the award of the EcoQuartier 2012 label” (Measure 3.2).

Leads: DATAR, MAAPRAT, DGCIS, DHUP, etc., depending on the mechanisms
Cross-cutting organisation: DIDD or CGDD
Partners: ONERC, MEDDTL / DGPR, MEDDTL /DGEC, MEDDTL / DICOM, ADEME, DRI
Timetable: 2011-2015
Output indicators: Availability of relevant guidelines and references, number of mechanisms including an adaptation criterion.

Action n°3: Mobilise resources for adaptation

The consultation exercise preceding the development of the National Climate Change Impact Adaptation Plan stressed the need to identify the funding mechanisms which could already be used to fund adaptation, or could do so with minor adjustments, and to publicise the opportunities which they offer. It suggested specifically allocating part of the resources available to adaptation, using funding mechanisms which are already available or by modifying other mechanisms.

Measure 3.1: Inventory existing resources which can be mobilised for adaptation

A study will be undertaken by MEDDTL in 2012, in coordination with DATAR and other relevant ministries, including MAAPRAT, in order to identify existing resources which could be mobilised for

climate change adaptation, possibly with minor modifications. This study will notably cover the following mechanisms: State/Region Project Contracts, ERDF and EAFRD funds, local resources allocated (including a tax on ski lifts, tourism tax, etc.), mechanisms for calls for proposals, assistance for business investment, etc. This work will provide a means of informing potential stakeholders who may be affected of the options offered by existing mechanisms. They will be presented by broad stakeholder type or type of investment.
Lead: MEEDTL/CGDD
Partners: DATAR, MAAPRAT, MINEFI, DGEC and ONERC, etc.
Timetable: 2012-2013
Method indicators: A study is to be carried out
Output indicators: Number of mechanisms identified which could potentially fund adaptation

Measure 3.2: Allocate available resources
During the preparation for the next phase of funding programmes based on models such as ERDF PDRH, PAC post 2013, LEADER, CPER, etc., France is supporting, or will support, mainstreaming of climate change, and notably adaptation, as one of the priorities in the framework for action.
As part of the Common Agricultural Policy reforms (Pillar 2), France recognises that climate change remains one of the environmental challenges facing the CAP in the future and states that the CAP must play a major role in climate change impact mitigation and adaptation. Furthermore, the implementation of the CAP in France recognises the services delivered by extensive grassland systems, Natura 2000 areas and forest environments by supporting investment in these areas or compensating farmers for additional costs and loss of earnings.
Leads: DATAR, MAAPRAT, MEDDTL, MINEFI, etc. according to the mechanisms
Timetable: 2011-2015
Output indicators: Mechanisms explicitly incorporating adaptation, or measures contributing to it, in their targets

Measure 3.3: Undertake studies into additional resources
Additional explorations will be carried out to identify supplementary resources which could potentially be mobilised for adaptation; this could involve contributions from activities generating GHG emissions or by people opting to settle in areas at risk.
Lead: MEDDTL/CGDD
Partners: MEDDTL/DGEC, MINEFI and all relevant ministries and partners, depending on the mechanisms analysed.
Timetable: 2012-2013
Output indicators: Production of collective proposals

Action n°4: Provide funding for specialist expertise for small local authorities and SMEs

In a highly technical area in which the information available is evolving rapidly, decision-makers often need to call on specialist expertise. Some stakeholders may experience difficulty in raising the necessary funding to mobilise this expertise. This is particularly true for small local authorities and SMEs.

Measure 4.1: Support the mobilisation of specialist expertise for small local authorities
The 2011 Finance Bill makes provision for the merger of the General Municipal Facilities Allocation and the Rural Development Allocation into a single allocation – the Rural Regions Facilities Allocation (DETR). The DETR subsidises the cost of providing facilities in municipalities and fiscally independent groups of municipalities located for the most part in rural areas. The criteria selected are based on population and fiscal wealth. The Finance Bill specifies that the purpose of the DETR is to fund investments and projects in the economic, social, environmental and tourism spheres or projects which promote development or maintenance of public services in rural areas. This allocation will be substantially decentralised. The onus is on the prefect, in association with a committee of elected representatives, to establish a list of operations to be subsidised. Broad guidelines can be set at a national level. Thus, for 2011, prefects have been invited to “consider recommendations from the Rural Regions Committees (*Assises des territoires ruraux*), notably in relation to regional engineering and nursing homes”. The action proposed within the framework of the National Climate Change Impact Adaptation Plan consists of modifying the annual DETR circular starting in 2012 in order to invite prefects and committees of elected representatives to include specialist technical assistance

relating to climate change among their priority operations. This action forms part of the general guidelines for supporting regional engineering.
Lead: Directorate General for Local Authorities (DGCL)
Timetable: Implementation in the 2012 edition of the DETR circular
Method indicator: Content of the 2012 circular
Output indicator: Number of subsidies provided for specialist technical operations

Measure 4.2: Support the mobilisation of specialist expertise by SMEs
The issues facing small and medium-sized enterprises relating to climate change adaptation are shared at sectoral and regional levels. The most helpful technical support relating to adaptation for these businesses would be to carry out analyses of issues and priorities at a regional level and to use these as the basis for producing technical reference standards. The first stage would consist of identifying key issues for SMEs on a regional scale, in collaboration with professional federations, if required. From this basis, a second stage would identify relevant support mechanisms, notably by mobilising specialist expertise. For example, this could, after an analytical phase, involve existing mechanisms for calls for proposals, such as competitiveness clusters, which establish a link between research and innovation, rural excellence clusters or "collective actions" funded by DIRECCTE. These actions could be based on measures in the Information action sheet.
Lead: DGCIS
Partners: Professional federations
Output indicators: Identification of priority areas for expertise, mobilisation of expertise

Action n°5: Adapt incentive mechanisms to individuals

The National Adaptation Strategy, adopted in November 2006, recommends planning "an in-depth study to find innovative funding mechanisms to encourage stakeholders to introduce adaptation actions". This involves encouraging preventive actions which go beyond the regulations currently in force, notably to launch a dynamic to disseminate innovative ideas. The consultation exercise preceding the plan mentioned investments in the building industry likely to be targeted: additional work on foundations or the creation of efficient foundations, ventilation systems, passive air conditioning and exterior shutters (this list is not exhaustive). In French overseas territories, the consultation recommended replacing excessively energy-intensive air conditioning units with very efficient air conditioning units, extending the initial experiment to involve replacing old air conditioning units installed by electricity suppliers. The action is intended to support investments compatible with mitigation (i.e. energy-efficient) both in new and refurbished buildings. The initial requirement would seem to be to identify technical solutions to favour adaptation in the building industry, to specify their cost and to carry out a cost benefit analysis if required.

The investments targeted vary in nature and size and probably do not all relate to the same funding mechanism. Several mechanisms support investment in the housing domain including zero-rated eco-loans, sustainable development tax credits, electricity supplier energy-saving certificates, etc. Some investments which favour adaptation are already covered by existing mechanisms, notably if they also relate to mitigation (shutters, more energy-efficient air conditioning in French overseas territories, insulation, etc.), or could easily be integrated into programmes of work (ventilation, etc.). In other cases, funding tools will require specific adaptation or will be the focus of communications initiatives targeting adaptation. The action will consist of identifying adaptations relevant to funding mechanisms and supplying information on the provisions adopted.
Leads: DHUP, DGEC, CGDD
Partners: ADEME, CSTB, MINEFI, Ministry for French Overseas Territories
Timetable: Explorations to be launched in 2012
Output indicators: Tools incorporating adaptation.

Action n°6: Improve insurance cover whilst tying it in effectively to preventive policies

French natural risk management policy aligns prevention and compensation. The compensation system for natural catastrophes incorporates preventive mechanisms which form part of the national climate change adaptation initiative. This action explores options for improvement to this system.

Measure 6.1: Adjust insurance premiums to encourage greater responsibility on the part of stakeholders in relation to risks incurred

Under the current system, protection against the effects of natural disasters is acquired by paying an additional premium fixed by law at 12% of property insurance policies (car, home, comprehensive business policies, etc.). This rate could be adjusted depending on the actual risk incurred and implementing preventive measures would empower insured parties. An adjustment of this type under the current system would only provide a small incentive to individuals, who pay a low premium, but it would certainly have a significant impact on large companies and local authorities who pay substantial insurance premiums and have the resources to implement preventive policies. Exploration is required to ascertain the relevant terms and conditions for a modification of this type, notably the number of insured parties who would be affected, since the buildings insurance system is not affected by this change. If pursued, the adoption of such a change would require a reform of the natural disaster compensation scheme. The government has already begun to explore this idea. A draft law is being studied within an interministerial framework. The effects of a modification of this type will be studied in the impact study accompanying the draft law.
Lead: Treasury Directorate General (DG Trésor)
Partners: MEDDTL/CGDD and DGPR, DHUP, Autorité de Contrôle Prudentiel (insurance supervisory authority)
Tools: Study of the criteria and terms and conditions for modifying the premium
Reform of the compensation scheme for natural disasters
Output indicators: Incorporation of this modification into law

Measure 6.2: - Improve home insurance uptake in French overseas *départements*
In order to be eligible for compensation in the event of a natural disaster, it is necessary to have taken out an insurance policy covering damage to property (for example a comprehensive home insurance policy for buildings). In French overseas *départements*, the take-up rate for this type of insurance is approximately 50%. Some preliminary statistical evidence has been established, but the reasons for this lower uptake than in continental France would merit more detailed study. Supplementary work will therefore be carried out to explore this issue in greater depth and to put forward proposals to improve this situation which could be a cause for concern in several respects (social, budgetary, etc.). At first sight, various approaches could be considered such as financial incentives (as a precondition for receipt of certain types of financial assistance, as is the case with assistance for substandard housing, a rationale which could be extended to other types of housing assistance, etc.), communication, raising awareness, educational work, etc. These must be explored to identify appropriate methods.
This action to increase levels of insurance is supplemented in the agriculture and forestry sectors by plans to develop insurance schemes with the aim of empowering farmers and foresters to manage the risks inherent in their work.
Lead: MEDDTL Commissariat General for Sustainable Development
Partners: Directorate General for French Overseas Territories, DGPR, Treasury Directorate General
Output indicators: Increased insurance uptake in French overseas départements

These policies which feature in the National Climate Change Adaptation Plan under Measure 5.1 “Improve protection for foresters against climate hazards by developing insurance systems (both in terms of quantity and quality)” in the Forest action sheet and Measure 5 “Manage risks inherent in variability and climate change in agriculture” on the Agriculture action sheet, aim to improve farmers’ and foresters’ ability to overcome the consequences of disasters, as well as to develop climate change risk management tools.

Action n°7: Evaluate the costs and benefits of adaptation actions

Although macro-economic studies demonstrate that the fight against climate change and adaptation are justified because it would be more expensive not to take action, not much is known about the details of the cost or even the financial benefits of adaptation actions. Global estimates produced by the World Bank and the United Nations Development Programme provide estimates of between 1 and 6 billion dollars per year for France, but they must be viewed with considerable caution, given the simplicity of the methods used. Sectoral estimates were produced[30], but they do not cover all the sectors and use different methodologies and hypotheses.

[30] cf. report by the Interministerial Group on climate change impacts, adaptation and associated costs, October 2009, http://www.developpement-durable.gouv.fr/IMG/pdf/rapport_onerc_3_FRA_vf.pdf

In-depth cost benefit analysis of actions is required, focusing on several targeted issues, which could include:

- issues relating to the highest fixed costs (cf. changes in coastal margins or coastal hazards, for example in connection with action 4.3 on the Coastline action sheet: “Develop the use of cost-benefit analysis (CBA) to assess the relevance of coastline management options”)
- one or more economic or investment areas will be required for adaptation to take place;
- adaptation in housing (cf. action 5 above);
- specific regional issues (in connection with action 4.2 on the Coastline action sheet: “Produce a multi-criteria analysis (MCA) methodology to evaluate the relevance of coastal margin management options”;
- actions intended to preserve or restore services delivered by ecosystems which contribute to adaptation.

These analyses should identify how costs are likely to be staggered over time and how they will be divided between stakeholders (in connection with action 1.5 on the Research action sheet: “Develop prospective socio-economic research”). This information will feed into thinking about the funding mechanisms and incentive schemes required in the medium to long term. Certain specific actions are scheduled, notably within the framework of the annual interregional studies financed by DATAR. General Secretariats for Regional Affairs (SGAR) are in fact backing a territorial forward study on an interregional scale to ensure a degree of consistency between the National Plan for Climate Change Adaptation and specific regional sectoral issues.

Leads: MAAPRAT, DATAR, MEDDTL, etc. depending on the studies
Timetable: 2012-2014
Output indicators: Number of studies carried out and the number of sectors and regions covered

COASTLINE action sheet

Climate change impacts will not be distributed evenly or fairly on a regional scale. When it comes to natural hazards, climate change for coastlines will manifest itself principally in increased pressure on low-lying coasts, and by the erosion or submersion of coastlines due to the expected rise in sea levels. From a geographical point of view, some coastal regions could therefore be severely affected by projected changes.
Since coastlines lie at the interface of coastal hazards, urban development, tourism and social inclusion, these various areas will have to align their adaptation strategies in a consistent manner. Following the Grenelle Seas Forum, the law relating to the national commitment to the environment has introduced the notion of integrated sea and coastal management, which now provides the new governance structure for these spaces on a coastline scale.

The main principles of adaptation in the coastal sector

1. **Avoid increasing the vulnerability of people, property or economic activities**
2. **Evaluate resilience**, i.e. the capacity to adapt to situations, with the aim of developing this resilience to hazards associated with climate change
3. **Choose between protection, relocation or management of temporary disruptions**. These choices, which will involve citizens, must look beyond a purely socio-economic analysis and take into account acceptance of change, its environmental cost and the financial resources available. The choice between protection and strategic withdrawal requires in-depth local studies of a complex dynamic (local trends for rises in sea level, erosion, sediment discharge and the availability of materials and, in the slightly longer term, an assessment of the cases of extreme tides).
4. **Analyse the vulnerability of regions and their populations.** This involves identifying all of the areas where there is likely to be damage in zones subject to potential hazards, including regions protected by coastal defences and areas marked out for future development. The physical vulnerability and direct and indirect costs must then be evaluated, in addition to their functional vulnerability, to determine what measures should be taken in the light of the various hypotheses selected, social representations and behaviours.
5. **Make modelling tools available** in order to avoid being restricted just to a representation of the rise in sea levels within the framework of temporary or permanent flooding, but also to take into account coastal erosion which can lead to loss of land, sediment movement and affect the behaviour of existing artificial or natural defences.
6. **Develop methods to evaluate economic, social and environmental impacts and the effectiveness of preventive measures.**
7. **Adopt a national coastal margin management strategy and create a national observation network for changes in the coastline.**

The National Strategy for the Sea and Coastlines and future strategic coastline documents must incorporate a coastline component which responds to each of these objectives.

Illustration. Sample climate change index for coastlines: rising sea levels. According to the IPCC, this rise could be between 23 and 51cm by the end of the century, but other studies conclude that the values could be higher.[31].

Overall lead: DGALN
Overall output indicators for the action sheet:
- adoption of a national strategy, creation of a network of coastal margin observatories
- an improved understanding of the coastal environment: coastal hazards, evaluation of the direct and indirect effects of climate change, vulnerability and resilience to extreme events;
- development of a methodology for choosing between the three strategies of protection, relocation or management of temporary disruptions.

[31] J. Jouzel climate scenario assignment, report, January 2011

Action n°1: Adopt a national coastal margin management strategy and develop coastal observation networks

The coastline, which represents the transition between land and sea, is a vulnerable area which is subject to strong natural and anthropic pressures and to their interactions. This causes changes in the coastline which must be predicted, especially in the context of climate change.
Initially, the working group led by French deputy Alain Cousin within the Grenelle Seas Forum will suggest a national coastline management strategy.
Within this framework increased observation via long-term collection of data which is available to all stakeholders and regions is therefore crucial. This will be achieved by the creation of a national observatory for the sea and coastline, and by developing coastal observation networks.
This action aims to develop understanding of natural coastal phenomena for the long term and to ensure coordination between observation networks for monitoring changes in the coastal margin.
Lead: DGALN
Partners: BRGM - CETMEF, DGITM, CGDD
Tools: Adoption of the strategy and setting up of observatories along the entire coastline by perpetuating actions by various operators and ensuring that they are coordinated by defining the different bodies working on the coastline, the type of data to be collected and how they can operate together.
Output indicators: Balance sheet on changes in data sharing and accessibility – delivery of a specification for a methodology for interoperability of data and permanent observatories – implementation timetable – implementation of measures by local authorities – annual reports from observatories detailing problems encountered and expectations – an improvement in the national vision for changes in the coastal margin.

Action n°2: Improve understanding of the coastline: its environment, natural phenomena, physical and anthropic development

This involves first and foremost improving understanding via basic and applied research, notably relating to awareness of hazards, vulnerability reduction and resilience to extreme events.

Issues relating to climate change adaptation are particularly pressing in coastal areas which are heavily built-up and densely populated and are vulnerable to rising water levels, erosion, storms, etc. It is therefore legitimate to speculate about the future this part of the region which is particularly sensitive to climate hazards both from an economic and social point of view and from the point of view of the natural richness of its ecosystems. Moreover, a combination of several factors is often responsible for particularly difficult conditions, hence the need to **develop integrated approaches**.

Issues associated with the coastline will be addressed via calls for proposals by the GICC programme lead by the CGDD.

Measure 2.1: Reinforce the network of measures to deal with swell climates
Understanding of changes in swell climates along the whole of the French coastline (continental France and French overseas territory) will be reinforced by an evaluation of the link between climate variations and wave regimens on the Atlantic coast, the western Mediterranean and in French overseas territories. **Digital atlases of future swells** developed on the basis of climate projections are also planned, as well as an analysis of the sensitivity of the results from the chosen model.
Analysis of average swell climatologies can only be carried out using measurements taken over long periods. An understanding of their long-term evolution and the impact of climate change can only be achieved through even longer continuous observation periods requiring significant maintenance resources.
In order to achieve this, the national in situ swell measurement network could be strengthened by the acquisition and installation of 6 wave recorders (4 wave recorders in continental France [one in Porquerolles, 2 in Corsica, one in La Rochelle], and 2 in La Réunion).
Leads: DGITM – DGPR
Partners: CETMEF, SHOM, BRGM, Météo-France
Tools: Production of a digital atlas of swells.
Output indicators: Number of wave recorders installed, use of data by relevant government departments, availability of the atlas online.
Timetable: 6 months for the acquisition of equipment and 6 to 12 months to install it

Measure 2.2: Obtain data on changes in the coastal margin via an aerial photography operation at low tide
Regular inventories are required to understand the past behaviour of a coastline, to anticipate future changes with greater accuracy and to make a close evaluation of the impacts of climate change. Orthophotographs will be produced very regularly in areas sensitive to rapid change.
Lead: DGALN
Partners: CETE Normandie Centre, IGN
Tools: Production of an orthophotographic record of the continental French coastline
Output indicators: Availability of data on the Geoportail portal and organisation of regular campaigns (every 10 years), utilisation of products.
Timetable: Mediterranean coast and the priority areas of the Vendée and Charente Maritime by 2011 and the English Channel and English Channel/North Sea coast – Atlantic in 2012.

Simultaneously, MEDDTL is providing administrative and financial support to the IGN to produce and update a large-scale reference standard for the whole of the region (basic digital geographic data set, including topographic data), for flood zones in particular.

It is also important to draw attention to the SHOM and IGN Litto3D campaign to carry out a bathymetric survey of the French coasts.

Measure 2.3: Improve understanding of the transit of marine and river sediment.
Little is known about coastal sediment transit. Atlases of sediment transit for continental French and overseas territories coastlines could be produced based on a numerical simulation platform to determine sediment flows over the continental shelf (as is already the case in the English Channel).
A current inventory of these transits is required in order to identify whether changes in forcing could modify these transits and to identify the consequences. These atlases would be produced as part of the process of updating sedimentology catalogues, for which a feasibility study is currently underway: a descriptive summary of the coastline and its hydrosedimentary functioning based on the inventory of knowledge about how the coastline functions, but also on predicted changes.
Lead: DGALN
Partners: DGPR, DGITM, CETMEF, BRGM
Tools: Feasibility study into updating sedimentological catalogues for the French coastline
Output indicators: Possible publication of the catalogues
Timetable: Feasibility study in late 2011

Measure 2.4: Study the physical vulnerability of the French coast to coastal hazards (erosion and flooding) in the context of climate change, with a comparison between current (2010) and future (2070) status
This study implements a multi-criteria mapping approach incorporating expert opinion into a vulnerability index which takes into account erosion and permanent or temporary sea flooding hazards. It aims to classify coastal areas ranging from the most vulnerable to the least vulnerable and to highlight those which are the most exposed. It will then be possible to suggest adaptation measures or to make appropriate recommendations depending on the nature of the zones and their degree of exposure to climate change. It should be noted that this study is part of the Explore 2070 project on adaptation strategies in the water field. Explore 2070 will also take into account areas devoted to agricultural activities, as well as the types of crop impacted by erosion and sea flooding risks.
Lead: DEB
Partners: DGPR, CGDD, Cetmef, MAAPRAT
Tools: Creation of a georeferenced database for the coastline
Output indicators: Production of maps on a national scale for three regions (Seine estuary, Languedoc Roussillon and La Réunion)
Timetable: Mid-2012

Measure 2.5: Evaluate the effectiveness of dune belts against the risk of sea flooding and set up a monitoring and management plan for these dune belts
It is crucial to define the conditions and criteria required to identify geographical sectors in which coastal dune belts, such as the belts which precede low-lying hinterland, are likely to offer protection against flood risks.
Leads: DGPR -ONF

Partners: DGALN, MAAPRAT/DGPAAT, CETMEF, universities, BRGM, DDTM, departmental councils, Communities of Municipalities, CERL
Tools: Mapping of sectors in which dune belts "offer natural protection" from sea flooding, implementation of a monitoring protocol for the status of dunes offering natural protection (breadth, height, level of plant cover, etc.)
Output indicators: Production of identification criteria for dunes offering natural protection, mapping of the status of these dunes, calculation of the total length of dunes along the coastline which offer natural protection and an evaluation of the status of these dunes
Timetable: Specified in the ONF contract of agreed objectives 2012-2016 in July 2011

Measure 2.6: Study the role of coral reefs and mangrove swamps in providing natural defences against coastal erosion

This involves setting up observatories for the impacts of climate change on coral reefs in French overseas territories. Simultaneously, the aim is to prepare to adapt the reefs to future climate conditions by disseminating knowledge on this subject and raising awareness among local stakeholders. This action falls within the scope of the French IFRECOR national plan.
Lead: DGALN, MOM, IFRECOR
Partner: ONERC
Tools: Website bringing together climate change indicators for reefs, raising awareness among local authorities and socio-economic stakeholders in French overseas territories
Output indicators: Number of indicators, documentation disseminated
Timetable: 2011-2015

Measure 2.7: Obtain comprehensive, high-quality information about marine leisure activities on the French coastline.

Improving understanding of the use of the coast for marine sport and leisure activities is an important issue against a background of the proliferation of coastal developments when addressing the consequences of climate change.
The aim of this measure is to obtain comprehensive, quality information about the use of the French coast for leisure activities with a view to producing an economic study applied to marine leisure so that local stakeholders have access to all the information required to make appropriate decisions about environmental, socio-economic or cultural issues. The information/data mobilised will make it possible to evaluate the economic value of the use of the coast for marine leisure activities. The aim is to carry out a cost-benefit analysis:

- Costs associated with positive actions in favour of the marine environment correspond to costs borne by society to avoid degradation of the marine environment, leading to the achievement of good environmental status and the pursuit marine leisure activities in good conditions,
- Economic benefits correspond to benefits for regions of using a coast which is preserved to a satisfactory level (seaside tourism, marine leisure activities and recreational fishing). It is also relevant to address these benefits, at least qualitatively, for economic sectors which suffer from the effects of degradation of the marine environment (principally shellfish farming, professional fisheries, tourism and certain recreational activities).

Lead: DGALN, Surfrider Foundation
Partners: Water agencies, AAMP, Ifremer, DGITM, CGDD
Tools: Set up a steering committee and an evaluation committee
Output indicators: Use of data for CBAs, data uploaded to the site Coastline observatory.
Timetable: 2011-2012

Action n°3: Adapt regulations and forms of governance

Make the inclusion of SMVM elements a standard component in the SCOT and establish a monitoring indicator for SCOTs and SMVMs in coastal municipalities to achieve integrated sea and coastal management

Following the Grenelle Seas Forum, integrated sea and coastline management must be introduced by integrating climate change into Sea Enhancement Programmes (SMVM) along all French coastlines.
SMVMs are a spatial development and information disclosure tool under French law designed to achieve better integration and promotion of the coastline as part of a global sustainable development

approach. This tool must be standardised by encouraging the systematic inclusion of an SMVM component by coastal municipalities and their consortia in SCOTs.
An Indicator action sheet will be produced annually by the Observatory on the role of coastal municipalities affected by these tools and their development. For its part, the regional observatory updates data relating to SCOTs annually by referring to OJEU for the list of municipalities involved in Sea Enhancement Programmes.
Lead: CGDD – SoeS
Partners: DGALN (integrated management and strategic planning office)
Tools: Production of a map of the municipalities in continental France and French overseas territories involved in an SMVM
Output indicators: Production of an annual datasheet on changes in the use of SMVMs in coastal municipalities, and an indicator for monitoring SCOTs and SMVMs.
Timetable: Annually on 1 January for SCOTs

Action n°4: Reinforce coastal strip management methodology and adapt the various management strategies

Measure 4.1: Assess coastal population and housing issues
Studies summarising erosion and issues affected by erosion are currently being published by the SoeS. The SoeS, which is attached to the General Commissariat for Sustainable Development, provides statistical services for the environment, energy, construction, housing and transport spheres.
When local and regional coastal margin monitoring observatories are set up, it is crucial to consolidate the data at a local and national level, to make this layer of information available via the Coastal Observatory mapping tool and to calculate the issues at stake (populations and dwellings) based on the national layer.

In order to calculate the issues, estimate models implemented with INSEE and the DGPR must be run for flooding issues. These models mean that it is possible to produce an accurate estimate of the number of residents and dwellings whatever the zone, provided that it is big enough (more than 10 municipalities).
Leads: CGDD, DGALN
Partners: Cetmef, CETE
Tools: Production of annual action sheets relating to population and housing
Output indicators: Annual input to the coastal observatory and support for coastal margin observatories.
Timetable: Action sheets produced annually

Measure 4.2: Produce a multi-criteria analysis (MCA) methodology to evaluate the relevance of coastal margin management options
The cost-benefit analysis applies to Programmes of Preventive Actions for Flooding (PAPI) in excess of 2 million euros. In addition, the new call for PAPI projects relating to coastal risks also requires a CBA. A new decision-support tool using multi-criteria analysis must be developed in order to achieve an even more relevant analysis of the advantages and disadvantages of structural and non-structural projects than can be provided by CBA. Multi-criteria analysis extends to non-monetary issues and makes it possible to compare various preventive measures.
This methodology could be extended without undue difficulty in 2012 to the specific issue of coastal margin erosion.
This methodology will be accompanied by technical and economic inventories presenting existing risk prevention measures as well as their associated costs (construction and maintenance), including a specific inventory of the coast.
This methodology and the associated guides will be regularly updated in order to extend the list of measures evaluated and to benefit from lessons learned in completed evaluations.
Lead: CGDD
Partner: DEB
Tools: Drafting of a specification for CBAs and MCAs adapted to coastal risks
Output indicators: Delivery of specifications, number of CBAs carried out
Timetable: June 2012 for the Deposit and Consignment Office (CDC)

Measure 4.3: Develop the use of cost-benefit analysis (CBA) to assess the relevance of coastal margin management options within the framework of all coastline development projects
Directive 2007/60/EC of the European Parliament and Council relating to the evaluation and management of flood risk, advocates in Chapter IV on flood risk management plans, that these plans should take into account relevant aspects such as costs and benefits. Moreover, a recommendation was made within the framework of the consultation exercise preceding the National Climate Change Adaption Plan, to develop a socio-economic evaluation method for the costs and benefits of various coastal development options.

These two proposals could result in regulatory advice for the systematic use of cost benefit analysis (CBA) for all coastal management projects, incorporating vulnerability to coastal hazards, in particular for developments located on public maritime land.

This component of the measure will involve defining the content of the CBA template for a coastal management project. The content of the CBA template will refer to themes which must by definition be included (economics, the environment, population, the living environment of populations, health, etc.) as well as points which must form part of the study (methodological approach, presentation of the coastal sector and potential scenarios, an economic evaluation of these scenarios, etc.). These recommendations could then form the technical basis of requirements in a regulatory guide for coastal sector development.
Lead: Mediterranean Coastal division of the EID within the framework of a State/Region 2007-2013 project contract – Sustainable coastal management – Strategic forward studies on changes in coastal risks.
Partners: DGALN, DGPR, Languedoc-Roussillon Region Prefecture, Languedoc-Roussillon DREAL, Languedoc-Roussillon Regional Council
Tools: Production of a bibliographic summary of existing studies and legal documents; adaptation of guides in other development and adaptation fields relating to the coast; definition of a process for creating a CBA template; consideration of the most appropriate regulatory guide in which to include this technical base relating to the CBA in a coastal development project.
Output indicators: Delivery of a content action sheet for a CBA template defining various points including the number of scenarios defined, the number of years for which scenarios are projected, the number of indicators considered in the economic analysis, the degree of accuracy used in the costs and benefits considered, factoring in the uncertainty inherent in some parameters and data.

Measure 4.4: Study the circumstances and issues arising from the implementation of coastal margin management options
Within the framework of the National Coastal Margin Management Plan, there is a recommendation to study options for strategic withdrawal and restoration of natural functioning as an alternative to maintaining the coastal margin with sea defences.
This measure is based on an evolving understanding of hazards, issues and vulnerability, mapping and on national strategies and methodologies for coastal margin management, strategic withdrawal, sea defences, and also the Grenelle Seas Forum.
Lead: DGALN
Partner: CETE Méditerranée
Tools: Production of action sheets on coastal margin management options, planning to support the implementation of these options, public consultation and involvement
Output indicators: Drafting of four 'options' action sheets, included in the National Coastal Margin Management Strategy, for strategic withdrawal and sea defences.
Timetable: September 2011

MOUNTAIN action sheet

For a number of reasons, mountain areas present a very special case with regards climate change. The physical characteristics of mountains are affected by the fragmentation of massifs into different climate zones; mountain systems generate their own climates and their topographic characteristics play a crucial role in determining the local climates. Displacement of air masses in valleys promotes the appearance of microclimates. Furthermore, the location of massifs makes them climate boundaries and they are therefore subject to many influences. These specific characteristics also contribute to the fragmentation of natural habitats and the vulnerability of ecosystems.

Illustration. Sample climate change index for mountains: number of days of snowfall.[32] *There will be an overall drop in snowfall in 2100.*

Action n°1: Mountain agriculture and forests

Action lead: MAAPRAT

In addition to the recommendations set out in thematic action sheets relating to agriculture and forests, a certain number of actions are required to preserve the role played by agriculture and forests in relation to the various issues at stake.

Mountain forests:

Mountain forests represent 25% of the total area of French forests, i.e. 3.9 million hectares. They consist largely of conifers and are characterised by logging conditions which are often difficult.
Furthermore, mountain forests play a key role in providing protection against hazards (avalanches, landslides, soil erosion, rock falls, etc.). One of the major issues with forests is to ensure that they remain stable so that they can continue to carry out their role in preventing these hazards.
In order to achieve this, there must be support for research into the conditions in which forest stands can continue to fulfil this crucial function, whilst delivering essential ecosystem services, notably logging and carbon storage. Activity must focus on:

- Pursuing and increasing research and development on adaptation of forests to climate change, especially in relation to mountain areas (**cf. Forest action sheet– Action n°1**)
- Gradually introducing a national mapping system for mountain forests which play a protective role vis-à-vis natural hazards, in order to highlight priority areas in terms of maintenance and use and to reinforce prevention
- Pursuing actions for conservation and adaptation of mountain forest genetic resources to increase the potential resilience of forests to climate change **(cf. Forest action sheet – Action n°3)**
- Preparing areas of activity which support the development of forest stands by seeking solutions which ensure coherence between supply and demand for wood and maintain mountain activities (**cf. Forest action sheet – Action n°3)**..

Measure 1.1: Extend to local authority forests in mountain areas a diagnostic approach to the protective role played by forests in relation to natural hazards to property and people
Lead: MAAPRAT
Partners: ONF, DRAAF, FNCOFOR, Cemagref, INRA, MEDDTL (DGPR)
Tools: Diagnosis of the protective role of mountain forests as used in state forests
Output indicators: Percentage of municipal mountain forests covered by the diagnosis
Deadline: 2015

Measure 1.2: Identify priority requirements for forest stand renewal under the Mountain Land Restoration scheme (RTM) in state-owned forests in high risk areas
Lead: MAAPRAT
Partners: RTM services, MEDDTL (DGPR), DDT, DRAAF
Tools: ONF contract of agreed objectives
Output indicators: Percentage of forests for which a renewal needs analysis has been produced
Deadline: 2016 (work actually extends beyond the end of the National Climate Change Adaptation Plan: 2025 horizon)

[32] J.Jouzel, climate scenario assignment, report, January 2011

Mountain agriculture:

There must be a particular focus on mountain regions. The main forage area represents on average 90% of the utilised agricultural area, although there are disparities between massifs. In mountain and foothill areas there is an overwhelming proportion of livestock farms:

- 29% of mountain and foothill farms are specialist cattle dairy farms compared to 19% for farms overall
- 29% of mountain and foothill farms specialise in cattle for meat production, compared to 12% for farms overall
- 19 % des exploitations de montagne et piémont sont orientées en ovin-viande contre 6 % au niveau national.

In mountain areas, permanent meadows and alpine meadows are the basic food source for herds of predominantly dairy cattle. These meadows maintained by farmers form the pillar of the mountain agricultural economy. Good meadow management supports sustainable animal husbandry, quality products (with registered designation of origin) and provides employment for agricultural workers.

For mountain livestock rearing, forage autonomy lies at the heart of balanced farming, but with climate change, many livestock breeders are having to adapt their practices regularly, and usually in a piecemeal manner, to try to retain this forage autonomy.

Livestock farmers must ensure a relatively steady supply of food for their herds, despite the lack of vegetation growth in the winter and summer. The drop in grass production and its irregularity has short-term consequences for adaptation and diversification of forage systems. A relatively varied number of types of adaptation have been implemented:

- a structural decrease in the overheads per animal per hectare by increasing surface area;
- turning animals out to pasture earlier and late autumn pasturing;
- adaptation of animal husbandry practices: thus in Mediterranean climates births take place in the early autumn;
- increasing forage stock levels, to provide protection against overly variable yields;
- changing management techniques for seeded meadows: new high winter yield varieties, adjustments to planting and haymaking dates and to fertilisation practices.

In the long-term, these adaptations, which are implemented spontaneously by livestock farmers, could have an impact on the balance of farms, areas of activity or regions.

It is therefore crucial to:

- pursue research and development projects on mountain agriculture adaptation and specify the sustainable nature of the types of adaptation to be implemented at every scale;
- bring regional stakeholders together to consider setting up action plans to improve joint management of regional resources (notably water and land).

In additional to this work to produce reference standards, research and development organisations in the pastoral agriculture sector and pastoral services will have to undertake significant work to disseminate these reference standards and recently acquired knowledge to livestock farmers.

Measure 1-3: Pursue and increase agricultural research and development, especially relating to mountain areas. Ensure the dissemination of reference standards and knowledge acquired.

Lead: MAAPRAT
Partners: CEMAGREF, INRA, Livestock Institute (Institut de l'élevage), APCA
Tools: Contracts of agreed objectives between the government and CEMAGREF, INRA, the Livestock Institute, and APCA, in association with research and development organisations in the pastoral farming sector and pastoral services.

An inventory of sub-actions already carried out must be drawn up for these actions as a whole, in order to specify clearly which sub-actions must be introduced.

Measure 1- 4: Put forward action plans with regional stakeholders to facilitate shared management of regional resources
Lead: MAAPRAT
Partners: Local authorities – relevant bodies responsible for water management, national parks, regional nature parks, research and development organisations in the pastoral farming sector, farmers.
Tools: LEADER - EAFRD funds

Action n°2: Governance

Overall lead: DATAR
Indicators for the action: Mainstreaming of climate change adaptation policy by mountain area governance bodies

Measure 2.1: - Incorporate a climate change adaptation component into Massif Programmes
Massif Programmes, as set out in the provisions of the Rural Regional Development law of 23 February 2005, are developed by Massif Committees and validated by regional councils and departmental councils. These strategic documents set out priorities for each massif. These priorities are divided up by region and by sector.

Given the future impacts of climate change on the general economy of mountain areas, it would seem necessary to integrate this aspect into the thematic priorities for each Massif Programme.
Leads: Prefects responsible for coordinating a massif
Partners: Regional Councils, professional trade unions, representative non-profit associations
Tools: Output indicators: Integration of a climate change adaptation strategy into each Massif Programme.

Measure 2.2: Make the National Mountain Council and Massif Committees a forum for information and analysis of the positive and negative consequences of climate change
Massif Committees provide a forum for local and departmental elected representatives, mountain professionals working in agriculture, tourism, business, arts and crafts and non-profit associations.

Massif Committees are an appropriate forum to explore issues concerning the changes associated with climate change in each massif and also to disseminate analyses and best practice so that populations in different massifs can develop adaptation strategies.

Leads: DATAR and Massif Commissioners
Partners: Regional Councils and representative bodies which are members of the Massif Committee.
Tools: CNM and its permanent commission.
Output indicators: Number of meetings devoted to climate change adaptation policy

Measure 2.3: Raise awareness among mountain populations and provide education
Looking beyond mobilising public and private decision-makers, mountain populations must also be mobilised so that they adopt new behaviours.

Seminars in each massif lead by Massif Committees would be a means of raising awareness. These could be supported by professional organisations and non-profit associations within each massif.
Leads: Massif Commissioners
Partners: Associations of elected representatives and NGOs
Tools: Seminars and information letters, websites
Output indicators: Number of events organised

Action n°3: Natural hazards

Natural hazards in mountain areas have specific characteristics related mainly to relief. This plays a crucial role as gravity accelerates phenomena and creates trajectories which do not vary. This makes these phenomena easier to predict than others.

Lead global: DGPR
Indicators for the action: Number of risk management measures

Measure 3.1: Make mapping of areas exposed to one or more hazards standard practice.
This involves finalising maps of areas exposed to risks across all mountain massifs.
This mapping, which combines all the potential hazards – avalanches, landslides, subsidence, storm flooding – and also factors in forest fires, should facilitate the production of Regional Development Plans and the task of informing the people affected.
Lead: DGPR
Partners: Massif Commissariats, DREAL and DDT
Tools: GIS
Output indicators: Production of maps

Measure 3.2: Trial integrated risk management strategies
Trial a new approach risk and risk management:
A departure is required from a traditional segmented approach (hazard /defence), to an innovative regional approach (vulnerability / organisational approach / project / risk culture).

Decompartmentalise by developing coordination and synergy of stakeholders across the whole management spectrum:
Progress must be made beyond sectoral and one-off approaches (in a crisis management situation) towards developing a synergy across the whole management spectrum (prevention, alerts, crises, repairs) over the long term, focusing on practices at a regional level and developing closer partnerships and improved awareness of risk upstream in development projects.
Leads: Massif Commissioners and DREAL
Partners: Alpine Cluster for Studies and Research into the Prevention of Natural Risks, regional authorities, NGOs.
Tools: Trials on pilot sites and dissemination of lessons learned.
Output indicators: Number of initiatives launched in massifs

Action n°4: Tourism and leisure

Projections relating to future levels of snow cover will soon be available within the framework of the SCAMPEI research project. These studies will document the expected vulnerabilities for snow tourism in the medium and long term.

Data anticipating future snowfall is crucial for this tourist sector which is characterised by very long-term investment (notably in ski-lift facilities) and which governs the dynamics of seasonal employment.

Measure 4.1: Carry out a research programme to model forecastable changes in snow cover
It is difficult to relate a macro-regional analysis to regional areas at a massif level.

It is therefore necessary to construct models to allow analysis of the impacts of climate change to be refined by mountain massif and then later by valley sub-systems.

Leads: Massif commissariats
Partners: Grenoble University and Météo-France
Tools: Research and modelling
Output indicators: Publication of the results of the modelling studies

Measure 4.2: Draw up an accurate inventory of vulnerability to climate change in mountain municipalities
This involves using retrospective meteorological data and IPCC forecasts to produce a vulnerability analysis on a massif or valley scale and to construct a model in order to provide a more accurate understanding of the effects of climate change on mountain areas.
Leads: Météo-France, a university

Measure 4.3: Provide guidance for public actions in a new climate environment
This involves inventorying best practice in various Alpine nations which can be mobilised to manage changes in snow cover in ski resorts.

These studies will be carried out in close collaboration with tourism stakeholders: local authorities, winter sports resort managers, technical departments, etc. and the results will be disseminated to professionals and elected representatives.

Lead: DATAR
Partner: DGCIS
Tools: Study
Timetable: 2012-2013
Indicators: Publication of the results of the study
Number of actions to disseminate results
% of recommendations from the study implemented in 2015.

Measure 4.4: Identify opportunities for summer and low-season tourism
Tourism in mountain areas is not restricted to winter activities and skiing; summer and low-season tourism also offer development opportunities if tourism professionals integrate climate change into their thinking and anticipate changes in the behaviour and expectations of future customers.

An ageing population and increasing life expectancy are contributing to the rise of an independent, solvent population with transferable income. These customers are also more sensitive than average to high temperatures and are therefore more inclined to seek cooler holiday destinations at higher altitude.
Mountain destinations which offer good facilities and service skills, two areas which were developed using tourism as a yardstick, must make arrangements to welcome this customer group and tap into the windfall opportunities which they represent.

This involves conducting surveys and forward studies to equip public and private decision-makers with the tools required to drive strategic developments.

Lead: DATAR
Partners: DGCIS, DGALN, ATOUT FRANCE
Tools: Studies
Output indicators: Number of studies and surveys carried out.

EUROPEAN and INTERNATIONAL ACTION sheet

France is an important player in the adaptation field and intends to reinforce its presence and exchanges on a European and international level.

I) France will achieve this by drawing on its skills and considerable expertise which stem from early intervention, its unique territories, quality services and world-renowned stakeholders such as Météo-France, IPSL and CIRED.

France made an early commitment to defining a national climate change adaptation strategy (adopted on 13 November 2006) which has allowed it to build experience over the long term and make gradual improvements reflecting the diversity of French territory. Continental France has a varied topography and climate which have required it to develop skills in addressing all types of conditions. France is therefore a very important collaborative partner at a European level.
Furthermore, French overseas territories, in three oceans, offer opportunities for unique expertise, which must be continuously reinforced and which make France a much sought-after international partner.

II) Cooperation with countries whose adaptation capabilities are less advanced, is a major element of French foreign policy. It is essential to support their endeavours to address this new need and to develop in a sustainable manner. In addition to bilateral cooperation, notably with the AFD, the Ministry for Foreign and European Affairs (MAEE) and the French Global Environment Fund (FGEF), many stakeholders and agencies are also active in this field: Météo-France, the Institute for Research and Development (IRD), CIRED, the French Institute for Research and Exploitation of the Sea (IFREMER), and the Environment and Energy Management Agency (ADEME), to name but a few.

III) Although France has a great deal to offer, it also benefits from increasingly close contact with its partners.

Adaptation is a relatively new field of activity in which knowledge and expertise are growing worldwide. Topographic and climate diversity in France and the requirements that this creates mean that research being carried in Europe and internationally is of considerable interest to France. France is aware of the challenges presented by adaptation and is keen to develop its skills in cooperation with French overseas territories and neighbouring territories.

IV) Lastly, France is involved at a high level in international and European negotiations such as the United Nations Framework Convention on Climate Change (UNFCC) and the European White paper on adaptation to climate change.

Illustration. Developed countries collectively are involved in mobilising 30 billion dollars over the period 2010-201, reaching 100 billion dollars per year by 2020, to help developing countries fight climate change.

European action

Action n°1: Contribute to developing European adaptation policy and improving regional climate knowledge

France is one of the first European states to address the issue of climate change. The current national adaptation plan is one of the first programme documents of this type to be produced in the European Union.

Measure 1.1: Contribute to European studies within the framework of the White Paper on climate change adaptation
Description: Published in 2009, the White Paper on adaptation recommends that member states should have strategies and a climate change adaptation plan and announces the implementation of a Community strategy in 2013.
France, which already has a strategy and the present adaptation plan, also contributes to European studies initiated by the White Paper through its involvement in European expert review group the

Impact and Adaptation Steering Group, and the European Working Group on climate change adaptation Knowledge Base (WG KB).
Lead: MEDDTL/DGEC (ONERC), MESR, MAAPRAT/DGPAAT
Partner: Environment Alliance
Tools: Representation on and contribution to the two European groups created by the White Paper (IASG and WGKB)
Timetable: 2011-2013

Measure 1.2: Support regional cooperation on hydrological functioning and changes in the Mediterranean Basin – regional cooperation project: HyMeX - Hydrological Cycle in the Mediterranean Experiment
Description: this Mediterranean cooperation action aims in particular to support HyMeX - *Hydrological Cycle in the Mediterranean Experiment* - to improve understanding of the water cycle and increase forecasting capability for the development of extreme events in the Mediterranean Basin. In the long term, this should help nations to evaluate their social and economic vulnerability to extreme events and their adaptive capacity. Awareness of water cycles is essential to anticipating the impacts of climate change.
France is one of the most active members, with Météo-France, CNRS, CNES, Cemagref, INRA, IRD, BRGM.
Lead: Météo-France
Partners: French organisations involved in the international coordination of HyMeX: CNRS, CNES, Cemagref, INRA, IRD, BRGM.
Implementation tools: Data collection and questionnaires, campaigns of measures, regional modelling of the earth system and overall forecasting systems on a fine scale
Timetable: 2010-2020
Indicators: Production of regional climate change scenarios IPCC/AR5, campaigns of measures in 2012, bibliometry of the project

International action:

France is involved in all the fields required to develop and implement adaptation policies, ranging from support for reliable meteorological and climate databases to their creation, and also project implementation.
This section presents adaptation projects on an international level which will be implemented in the period 2011-2015. Other adaptation projects which are drawing to a close or are already completed, as well as projects currently being identified, are not recorded here.
Furthermore, France is a major contributor to multilateral funds such as the Global Environment Fund (French contribution to GEF, 215.5 million euros for the period 2011-2014). GEF funds adaptation actions but it is not possible to specify the exact French contribution to adaptation within the framework of the current functioning of the fund.

Action n°2: Increase international cooperation to improve understanding of climate and meteorological and hydrological events

Given the challenges posed by natural hazards to our societies, an improved understanding of extreme phenomena and better adaptation are appropriate, irrespective of how the climate evolves. Even in the current climate framework the alert and prevention systems in a number of developing countries need to be improved.

Measure 2.1: Contribute to the acquisition of knowledge relating to hydrological and climate systems at a regional level:

- **Développer la connaissance du cycle hydrologique dans la Caraïbe**

Description:
This involves building capacity by providing expertise in technology transfer, training in new hydrometric techniques, and new information technologies to National Departments managing water networks in order to develop a hydrological information system in the Caribbean. Understanding hydrological cycles is a preliminary stage for modelling future climate change impacts.
Lead: IRD

Partners: Météo-France, National Hydrological Services for the 11 Caribbean islands as well as the Caribbean Institute for Meteorology and Hydrology, Barbados (CIMH) and the Instituto de Meteorologia de Cuba (INSMET)
Implementation tools: Collecting and homogenising data on the hydrological cycle in the Caribbean and making it available
Timetable: Operational phase 2009 – 2012
Indicators: Operational availability of data, installation of measuring equipment, technical training sessions

- **Achieve a better understanding of African monsoons**

Description:
After an initial project, phase I (2000-2010), based on research, the AMMA international multidisciplinary initiative is now pursuing phase II (2010-20) which is broader and has applied objectives. It focuses on:
1) improving understanding of the monsoon in West Africa and its influence on the physical and chemical environment and the biosphere on a regional and global scale;
2) producing knowledge which will make it possible to connect climate variability to health, water resources and food security in West African nations and to define appropriate monitoring strategies ;
3) ensuring that the multidisciplinary research carried out receives effective forecasting and decision-making support.
A better understanding of African monsoons will make it possible to define the impacts of climate change on this phenomenon globally.
Leads*: CNRS – National Institute for Sciences of the Universe (INSU),*
Partners: Météo-France / IRD /CNES / CNRS / IFREMER / MAEE + Germany + United Kingdom + United States
Implementation tools: Observation and climate modelling
Timetable: Phase II: 2010-2020
Monitoring indicators: Number of articles and theses, proportion of articles and theses involving African researchers; number of Masters teaching modules in West Africa; number of value-added products supplied.

Measure 2.2: Recover, preserve and disseminate historic French meteorological and climatology data in the Pacific zone which is of international interest
Description: This action comprises the "Pacific" component of the international ACRE (Atmospheric Circulation Reconstructions over the Earth) programme. It will safeguard historic data of value for international climatology and meteorological studies. Understanding fluctuations in climate and meteorological conditions and the types of event which can occur (such as tropical cyclones and drought) in Pacific countries and territories (including the three French collectivities of New Caledonia, French Polynesia and Wallis and Futuna) is crucial to building capacity to respond to these natural hazards in order to reinforce the resilience of populations in Oceania. This information, which is generally collected, analysed and disseminated by regional meteorological services, mitigates the physical impacts on populations and the damage inflicted on civil infrastructures and therefore contributes to protecting the economic interests of countries in the region. Enriching the meteorological database would facilitate climate projection studies notably in this vulnerable region of the world.
Lead: Pacific Fund
Partners: Météo-France, National Institute of Water and Atmospheric Research (NIWA), United Kingdom Meteorological Office, University of East Anglia, National Oceanic and Atmospheric Administration (NOAA),
Implementation tools: Project assistance
Timetable: 2011-20112
Indicators: Availability of the preserved data

Measure 2.3: Provide financial support for the Intergovernmental Panel on Climate Change (IPCC).
Description: IPCC assessment reports are essential to drawing up state of play reports for climate change knowledge, inventorying knowledge and producing a statement of scientific trends and uncertainties to be used ultimately as the basis for defining climate change adaptation policy. Supporting the work of the Panel is a "no regrets" policy as it provides useful reference information for action and international, national and local debate.

This action is further enhanced by the sustained and committed contribution made by French scientists at the highest level to the IPCC's work.
Lead: DGEC, MAEE, MESR
Implementation tools: Contribution to the IPCC operational budget
Timetable: 2011-2015
Indicators: Effectiveness of contributions, publication of IPCC reports in 2013 and 2014

Action n°3: Build the capacity of developing countries to prevent the socio-economic risks and impacts linked to climate variability and climate change

Measure 3.1: Support the creation of vigilance mechanisms for climate change in Africa
Description:
The aim, notably via the VigiRisC project, is to build capacity in African countries to prevent risk and the socio-economic impacts linked to climate change variation, via appropriate products and services relating to vigilance in the sectors of food security, water resources, hydrological regimes of large rivers, health, abnormally high tides and storm surges and also to very high-impact extreme events (droughts, flooding, etc.).
This forms part of the objectives of the Climate for Development in Africa Programme (ClimDev-Africa) initiated by the Economic Commission for Africa, the African Union Commission and the African Development Bank and is based on the conclusions of the IPCC Fourth Assessment Report (2007 Working Group II- Impacts, Adaptation and Vulnerability) which stresses the future effects of climate change in Africa. Climate change is manifested in an increase in climate variability and the development of vigilance systems for meteorological and hydrological hazards can form part of a response to the immediate concerns of decision-makers and perform an adaptation role in sectors which are vulnerable to the climate.
Lead: FGEF
Partners: MAEE, ADB, ACMAD, the Red Cross, LSCE
Implementation tools: Project assistance
Timetable: 2010- 2012
Indicators: Technical status report on the project (via 6-monthly project monitoring reporting, mid-term and final evaluation reports), rate of financial utilisation

Measure 3.2: Support seasonal forecasting in West Africa
Description:
The PRESAO initiative (Seasonal Forecasting in West Africa) was launched in 1998 by a consortium comprising notably the African Centre of Meteorological Applications for Development (ACMAD), with the support of Météo-France), the AGRHYMET centre and the Niger Basin Authority. PRESAO aims to build seasonal forecasting capacity and there are currently plans underway to extend this to the whole year. Within this framework, at the start of each rainy season, PRESAO produces a rainfall forecast for the whole of the sub-region. Seasonal forecasting of the run-off from the main water courses in a region has been added to PRESAO's remit, given the importance of water courses for the population's food security. This is a "no regret" measure in terms of climate change adaptation, as it can reduce uncertainty about climate variability and the resulting agricultural strategies. It means that an adaptation strategy can be developed which anticipates the seasons, a capacity which is particularly useful in the agriculture and food security fields. This initiative means that Red Cross teams can be placed on pre-alert, (in partnership with the International Research Institute for Climate and Society, IRI) and there are plans to extend this to the health field (especially malaria and meningitis).
Lead: Météo-France
Partners: MAEE, ACMAD, AGRHYMET, IRI, UK Met Office
Implementation tools: Project assistance
Timetable: 2011-2012
Monitoring indicator: Operational projects disseminated

Measure 3.3: Support sustainable management of land and climate change adaptation in the Sahel region
Description:
The aim is to create political, strategic and technical conditions in which local stakeholders (NGOs, local authorities) can define and implement sustainable land management actions to improve their income and reduce their vulnerability to climate change. This action will build capacity for resilience to

climate variability in the fields of agriculture, animal husbandry and natural resource management and will enable concrete adaptation actions to be introduced at a local level.
Lead: FGEF
Partners: CILSS, EU, IDRC.
Implementation tools: Project assistance
Timetable: 2011-2015
Indicators: Annual technical status report (via annual monitoring evaluation reports), annual report on financial implementation

Action n°4: Provide support for local and regional institutions to promote the integration of adaptation into development planning

Measure 4.1: Support climate change adaptation in West Africa in the water and agriculture sectors
Description:
Through the actions notably of the AOC (West and Central Africa) project:
- promote a regional approach to adaptation in West Africa;
- promote the integration of adaptation into critical sectors which are vulnerable to climate change;
- make the climate change issue a component of the regional programme of the Economic Community of West African States (ECOWAS) in order to combat climate change.

In order to achieve this, the project aims:
1. to create a sub-regional platform to exchange climate change adaptation information in the agriculture and water sectors and to contribute to the production and dissemination of new knowledge in these areas;
2. evaluate policies and programmes relating to agriculture and water at a sub-regional level (ECOWAS) and a national level (two pilot countries);
3. formulate proposals to improve integration of adaptation into these policies and programmes;
4. produce and disseminate innovative initiatives relating to climate change adaptation (Agriculture and water) in two pilot countries;
5. raise awareness and educate relevant stakeholders about integration and adaptation in these sectors.

Lead: FGEF
Partners: CILSS, EU
Implementation tools: Project assistance
Timetable: 2011-2013
Indicators for the technical status of the project (via 6-monthly monitoring reports on the project, mid-term and final evaluation reports, total rate of financial implementation

Measure 4.2: Contribute to improving water resource monitoring and management tools in the Niger river basin
Description:
The Niger river basin, which covers almost 100,000 km² in nine West African countries is facing a critical water mobilisation challenge, with a significant reduction in surface run-off and a substantial increase in demand and usage by a rapidly growing population. The aim of the project is to equip the Niger Basin Authority (NBA) with the methods required to manage and monitor water resources and major dams efficiently and to ensure that these structures are managed in an integrated and coordinated manner. Building this observation and dam management capacity is an essential initial stage before the implementation of climate change adaptations can be envisaged.
Lead: AFD
Beneficiary: NBA
Implementation tools: Project assistance, capacity building
Timetable: 2010-2012
Indicators: Number of hydrometric stations installed, creation of a water flow database; annual balance sheet of the hydrological functioning of the river.

Measure 4.3: Support mainstreaming of climate change adaptation in the management of protected areas
Description:

This will come notably in the form of support for the Quirimbas National Park (Mozambique) to create conditions for economically, socially and environmentally sustainable management to benefit the population, whilst promoting ecosystem resilience to climate change in a protected area and on its fringes. In order achieve this, there will be support for the implementation of adaptation and mitigation strategies in Quirimbas National Park, which is representative of northern Mozambique marine and land environments, and is an exemplary case study.
Lead: FGEF
Partners: AFD, WWF Mozambique, Government of Mozambique, Quirimbas National Park
Implementation tools: Project assistance
Timetable: 2011-2014
Indicators: Annual technical implementation status report (via 6-monthly monitoring reports, mid-project and end of project evaluations), annual report on financial implementation

Measure 4.4: Support efficient water management actions in urban areas
Description:
This measure will be focused on an initiative launched in the city of Oujda (Morocco). In the context of restricted water resources and increasing demand, water management is a crucial issue which aims to improve economic resilience to the effects of climate change. The programme to improve the yield of the network serving the city of Oujda is an exemplary case of water management by demand implemented by a water board. The target of the programme is to increase distribution yields and thus to achieve significant water savings of 2.5 to 6.8 million m^3/year and reduce pressure on the resource (as well as reducing energy consumption for water pumping, which also contributes to a decrease in the amount of CO_2 emitted). This is a “no regret” adaptation action given the increasing scarcity of water in this geographical area.
Lead: AFD
Partners: Régie Autonome de Distribution d'Eau et d’Électricité.
Implementation tools: Project assistance, funding of investments and facilities
Timetable: 2010-2012
Indicators: Annual volume of water savings and input/output ratio of the network.

GOVERNANCE action sheet

The results of the preparatory work for the Copenhagen summit in December 2009 raised two major topics in the fight against climate change:

- the definition of a management method for mitigation and adaptation actions is just as important as identifying sources of funding. Regional authorities have a role to play in the success of the process in this respect.
- Education and information are two key elements in this success, which are very closely associated with governance and funding.

Simultaneously, the interministerial working group “Impacts of climate change: adaptation and associated costs” highlighted the need for a cross-cutting approach in the regions. This approach to adaptation is notably justified by the need to have operational tools available so that the regions can develop resilience. Stakeholders must be able to become involved in the implementation of a global shared project.

As part of the work carried out during the consultation, Group 3 “Methods” was tasked with identifying the necessary prerequisites for success in sectoral approaches. This referred in particular to setting up a proper evaluation process for public policy. Various stakeholders (economic, social, environmental, etc.) have demonstrated their commitment to this approach, whilst emphasising a shared approach and the need for adjustment. There is a general willingness to act and to accept a share of the responsibility, but resources are limited in the current situation.

In the field of regional governance, the complexity of the system, in particular the distribution of skills, responsibilities and resources, has been identified as a potential source of difficulties for implementing adaptation policies.

For the corporate world, the conflict between self-interest (production, development or survival) and the common interest often entails a strictly economic profitability analysis applied to a relatively short time frame. The system can only change if it does so globally. The main issue which emerged was the need to introduce knowledge about adaptation into the system.

In more general terms, it seems that a number of difficulties were not the preserve of adaption to climate change. They are caused by a general paradigm shift more generally associated with sustainable development. Addressing them does not therefore form part of this exercise. Some actions relating to them have only been retained where there is a specific adaptation approach or major issues as regards implementation of the adaptation plan.

Several issues therefore emerged:

- how should territories be organised to ensure coordinated action and to apply the saying “Think globally, act locally” (scale, skills, complementarity, etc.)?
- how can mainstreaming of climate change issues and sustainable development in decision-making be integrated into the corporate environment?
- how can sectoral approaches actually be aligned in a regional operational situation?

Given the issues identified, intervention modes can be based around the following group of actions:

- organisation of governance (levels and methods);
- consultancy and information relating to decision-making;
- a governance approach based on reduction of vulnerability;
- integration of elements relating to climate change into decision-making.

Some actions relating to these issues are included in the “Funding and Insurance” action sheet. They relate to:

a) Mainstreaming the effects of climate change in impact studies
This action aims to mainstream climate change in project evaluations. This involves actions to improve the management both of public funds and governance.

b) Integration of climate change adaptation into sustainable development policy

c) Introduction of eligibility criteria in relevant public and private funding mechanisms to avoid inappropriate adaptation.

Furthermore, identifying stakeholders involved in research or with regional knowledge is likely to promote multidisciplinarity and knowledge sharing among stakeholders, making it possible to forge strategic alliances between the scientific community and local decision-makers. This action features on the Research action sheet.

Lastly, the issue of shared decision-making in public actions, which is a measure of the success of the policies undertaken, will be addressed through the notion of defining what constitutes acceptable risk, with governance specified by the Prevention and Precaution Committee which has been tasked with this assignment by the Ministry for Ecology, Sustainable Development, Transport and Housing.

Illustration. The Fourth Assessment Report of the IPCC recalls that regional impacts of climate change vary according to the region and actor.

Action n°1: Support the development of regional climate change adaptation strategies

The National Sustainable Development Strategy has demonstrated that the success of a national approach depends on its uptake and implementation in the regions within the framework of extended governance. The Grenelle 2 Law relating to climate change adaptation made provision for Regional Climate, Air and Energy Programmes (SRCAE) and Regional Climate-Energy Programmes (PCET) which must contain an adaptation component.

Drafting these documents requires methodological support, especially in the case of the SRCAE, which entails a new drafting framework with extremely tight deadlines set by the legislative authorities. For PCETs, this methodological support will need to take into account the experiences of local authorities which have already implemented such measures (cf. Action n°2).

Measure 1.1: Facilitate thinking about the alignment between regional strategies
Lead: DATAR
Partners: DGEC, ADEME, CGDD

Measure 1.2: - Integrate adaptation and extended governance into the materials in the PCET resources centre
Lead: ADEME
Partners: DGEC, DATAR
Tools: Website www.pcet-ademe.fr
Output indicators: Number of Grenelle 2 Regional Climate-Energy Plans (PCET) produced with an adaptation component

Measure 1.3: Reinforce the inter-regional coherence framework for adaptation strategies
In order to ensure that regional and subregional strategies are consistent, socio-economic impact analyses must be carried out on an inter-regional scale. They could notably feed into thinking relating to other existing supra-regional frameworks (basins, massifs, etc.). These approaches form part of a broader scheme to avoid inappropriate adaptation.
Lead: DATAR
Partner: DGEC
Tools: Inter-regional studies

Action n°2: Support experience sharing in relation to incorporating climate change into regional development strategies

To date, few regions are as yet actively involved in implementing climate change adaptation measures. However this will change in the next few years, notably due to a legal obligation. Measures to produce a guide based on lessons learned (Local Agenda 21, PCET, etc.) have demonstrated their significance for the uptake of national tools by local authorities.
Furthermore, it is necessary to ensure coherence of regional approaches within the framework of a national approach. Approaches in neighbouring regions must not come into conflict over resource management, especially where water is concerned.

Measure 2.1: Disseminate and update the guide to analysing regional vulnerability
Lead: CGDD
Partners: DGEC, DATAR
Tools: Methodological guide

Output indicators: Date set for an update

Measure 2.2: Evaluate consistency between national approaches (based on the national plan) and regional approaches (SRCAE, PCET)

This evaluation will make it possible in particular to prepare the next version of the National Climate Change Adaptation Plan and SRCAE.

Lead: DGEC
Partner: DATAR
Tools: Analysis of documents
Output indicators: Publication of the balance sheet of the analysis