

# Nature-based solutions

to address climate change





## What is the current situation?

**T**he natural environment worldwide is increasingly affected by climate change, including disruption of vegetative growth cycle and rainfall, changes in species range or loss of species and natural habitats, desertification, rising sea levels, ocean acidification, and coral bleaching. According to recent scientific studies, one species out of four is at risk of extinction by 2050 due to climate change.

Climate change combines with other stressors that impact biodiversity, such as degradation and fragmentation of natural habitats, overexploitation, pollution, and invasive alien species. It also increases the frequency and severity of natural hazards such as floods, droughts, heat waves, and storms, with significant negative impacts on human populations.

To address climate change, we urgently need to curb the emission of greenhouse gases produced by human activities. Given the inertia of the climate system, it is also necessary to engage in adaptation measures to anticipate and better prepare for the consequences of climate imbalance.

Among the range of proposed solutions (energy savings, technology improvements, development of renewable energies, public transport, circular economy/recycling, etc.), those provided by nature are often overlooked or underestimated. Yet, they are natural solutions for carbon capture and storage, and they provide real and beneficial opportunities to mitigate the impacts of climate change and reduce exposure of human populations to natural hazards.



**One species out of four is at risk of extinction by 2050 due to climate change**

Nature-based solutions, as defined by IUCN, help to address climate change while providing benefits for biodiversity conservation. They constitute positive, “no regret” actions, as they bring about combined benefits at environmental, economic and social level.

The role of natural ecosystems in absorbing carbon emissions and helping countries adapt to climate change was clearly recognized at COP21 and in the framework of the new Paris Agreement adopted on the 12<sup>th</sup> of December 2015. This agreement reflects the willingness of the international community to mobilize all sectors and parties concerned in order to keep the increase in global average temperature below 2°C above pre-industrial levels, and to pursue the efforts to limit it to 1.5 °C.

The Paris Agreement also emphasizes the importance of ensuring the integrity of all ecosystems and the protection of biodiversity when taking action to address climate change.



## Why invest in the preservation of ecosystems to address climate change?

**N**atural habitats in good conservation status contribute both to mitigation and adaptation to climate change:

### Mitigation

Terrestrial and marine ecosystems play an important role in the global carbon cycle: when adequately preserved, they act as carbon sinks and stores. Worldwide, natural ecosystems absorb about half of the CO<sub>2</sub> emissions generated by human activities each year. Protected areas host at least 15% of global terrestrial carbon reserves, and oceans are the largest carbon reservoirs. By capturing and storing carbon, they contribute to climate change mitigation. Their loss and degradation result in an increase in greenhouse gases. Deforestation and soil artificialization are the source of nearly 20% of greenhouse gas emissions.

### Adaptation

Adequately preserved ecosystems have a buffer effect on climate and reduce the risks and impacts of extreme events such as storms, landslides and floods, whose frequency and intensity will be exacerbated by climate change. Mountain forests, for example, contribute to soil stabilization and reduce the risk of landslides; wetlands regulate flooding and protect water resources during droughts, and mangroves and dunes act as natural barriers against winds and coastal erosion. In urban areas and cities, green areas play an important role: they mitigate heat waves by cooling the air while improving its quality. If protected and sustainably managed, ecosystems provide a wide range of services to human communities.

Furthermore, protected natural areas are prime test sites for the monitoring and understanding of climate change impacts on biodiversity, as other anthropogenic stressors are limited. Observation networks have thus been set up, such as the national parks network, the “sentinel lakes” of the Natural Areas Conservation Agency in Haute-Savoie or the network of the Nature Reserve of the French Southern and Antarctic Lands. In this way, data sets that may cover several decades are used to assess the vulnerabilities of certain ecosystems and help to define response strategies.



**By protecting ecosystems, we preserve carbon reservoirs and reduce the risks and impacts of climate change**





## What are nature-based solutions?

**N**ature-based solutions are solutions that build upon ecosystems in order to meet global challenges, such as addressing climate change. The response to these challenges depends indeed, in one way or another, on ecosystem health and proper functioning, in land, coastal or marine environments. Thus, healthy, resilient, functional and diverse ecosystems will enable us to develop solutions for the benefit of our societies and overall biodiversity in the face of global change.



**Nature-based solutions for the benefit of human societies and biodiversity**

**Nature-based solutions involve three types of actions, which may be combined at regional and local level:**

- 1 | Preserving the integrity and good ecological status of ecosystems;**
- 2 | Improving sustainable management of ecosystems used by human activities;**
- 3 | Restoring degraded ecosystems or creating ecosystems.**

Nature-based solutions are an essential part of the required strategy in order to address climate change. They constitute a sustainable and economically viable alternative, often more cost effective in the long term than technology investments or the construction and maintenance of infrastructures.

They also contribute to preserve biodiversity, particularly by preventing soil artificialization, which is a major cause of soil erosion and greenhouse gas emissions. Finally, through ecosystem services, they provide significant benefits to human well-being.

To be effective and to provide meaningful results, these solutions must be implemented at a landscape scale and on a long term basis.



## Experiences

### at regional and local level

#### Solutions for climate regulation



**H**ealthy ecosystems such as forests, wetlands and oceans, play an essential role in the carbon cycle by capturing and storing it in the long term. They thus contribute to climate regulation, through photosynthesis, for instance. Other natural processes, including the gradual transformation of plants into peat, are also important. Peat bogs, which cover only 3% of the land surface, contain globally twice as much carbon as forests. Their current degradation accounts for about 6% of anthropogenic carbon emissions each year. The PEATBOG research project has shown that peatlands in good condition sequester significant amounts of carbon, but also that their storage function can be reversed as a result of nitrogen pollution and drought.



#### Improving sustainable management of the natural environment

##### Focus on **forests**

In France, forests play a fundamental role in biodiversity conservation and climate regulation, as they cover about one third of the country's territory. In metropolitan France, about 1147 MtC are stored in above and below ground parts of trees, and 1074 MtC in the soil. Trees also capture annually, through photosynthesis, the equivalent of one third of the total CO<sub>2</sub> emissions in the country, i.e. 32 MtC / year.

Older and mature forests, composed of large trees, can store greater amounts of carbon in their aerial (trunk, branches) and underground parts (roots). Sustainable forest management should encourage older stages and biodiversity; this maximizes the diverse carbon stocks and biodiversity reservoirs that are essential for the adaptation of forests to climate change. In addition, the choice of species is important; while softwoods store carbon more rapidly during the first years of life of forest stands, later the trend is reversed and hardwoods are more efficient in terms of carbon storage on the medium to long term. A multilayered stand will also improve carbon storage, as lower layers recapture carbon released by the soil. This complexity enhances both the stability and resilience of the stands, as well as biodiversity. The "FRENE" (ash) project in the Rhône-Alps Region is already engaged on this path, and promotes the free evolution of at least 10% of the Rhône-Alps Region forests. Biodiversity issues are also taken into consideration in the Aquitaine Region, through the establishment of a "biodiversity" clause in reforestation operations carried out in the framework of the "Aquitaine Carbon" project following the Klaus and Xynthia storms.



## Solutions for climate regulation

**H**alting ecosystem loss and degradation and ensuring the preservation of natural habitats are strategies that contribute to mitigate climate change: IPCC experts indicate that these strategies would account for one third of the total carbon captures required by 2030. In order to achieve this goal, it is necessary to improve sustainable management of natural environments and expand the protected areas network.

When effectively managed, protected areas are a key tool enabling biodiversity conservation against major anthropogenic threats; they also contribute to the preservation of ecosystem potential for resilience and adaptation. This is why they are increasingly recognized as effective, economic and sustainable tools when addressing climate change. They help to mitigate its impacts by safeguarding ecosystem function as carbon sinks, particularly in marine and forest areas. Conservation and restoration of these ecosystems worldwide could contribute to prevent 0.5 °C of warming.



### Developing an efficiently-managed network of protected areas

#### Focus on marine protected areas

The ocean, which covers 70% of the earth's surface, is the main climate regulator. It absorbs 93% of the additional heat generated by human activities and over a quarter of CO<sub>2</sub> emissions, while generating more than half of the oxygen we breathe.

The marine protected area networks help maintain a healthy ocean. They preserve marine biodiversity, enable marine ecosystems to act as heat and carbon pumps, strengthen their resilience to global warming and help to combat acidification. The feedback from large marine protected areas shows that they result in an increase in

the number of species (+ 20 to 30%), biomass (+450%) and the size of fish, compared to unprotected areas. To be effective, these networks must be connected and representative, including the high seas. They should also implement adaptive management, incorporating protection, ecological restoration and sustainable management action.

With 11 million km<sup>2</sup>, France has the second largest maritime domain in the world and is directly concerned by these issues. It contributes in particular to the establishment of large marine protected areas in the Pacific region, which hosts the largest portion of its exclusive economic zone, such as the nature park of the Coral Sea in New Caledonia (1.3 million km<sup>2</sup>), and the projects of large marine reserves in French Polynesia.





## Experiences

### at regional and local level

#### Solutions to reduce natural risks



#### Solutions to reduce flooding risks

Locally, climate change leads to an increase in extreme weather events such as flooding. Preservation and restoration of wetlands mitigate the intensity of floods and reduce the associated damage. Protection or restoration of floodplains has proved in many cases more effective against flooding than dikes.

These “natural infrastructures” can sometimes replace, or be combined with, artificial infrastructures. They represent cheaper and more sustainable flood management solutions, while providing natural habitats for aquatic wildlife.



#### Focus on **Seine-Saint-Denis**

The Department of Seine-Saint-Denis, once dotted with watercourses and wetlands, is now very highly urbanized (93%). Initially, flood risk management relied mainly on the construction of infrastructure such as retention basins, coupled with automated control systems. In the 1990s, new upstream management approaches took shape, aiming at anticipating and preventing flooding. Currently, there is a shift toward natural solutions, using ecosystems to control flooding. Various initiatives have been implemented to restore nature in the city and allow ecosystems to play their regulating role in flood control by fostering water infiltration. This avoids the overflow of drainage systems that are saturated during heavy rains or runoff on waterproofed surfaces. Furthermore, restoring nature in the urban areas improves biodiversity, landscapes and the living environment through the preservation of rivers. The Department is thus investing in the development of multifunctional urban spaces through open water management, both to control flood risks and to safeguard biodiversity.





## Solutions to reduce natural risks

### Solutions to reduce coastal erosion risks

Coastal areas suffer increased rates of erosion due to rising sea levels, higher storm frequency, and limited sediment availability associated with the artificialization of the coastline. Projections for 2050 estimate the loss of land due to coastal erosion in Europe between 3700 and 5000 km<sup>2</sup>; it would mainly affect coastal wetlands. In the context of climate change, protection of coastal ecosystems is a natural risk management tool, with a potential to provide innovative solutions to the stakeholders involved.



### Focus on Aquitaine

In the Aquitaine Region, this issue is particularly important, since the coastline has lost 5 to 20 meters in 2014 (against 1 to 3 meters on average), even up to 40 meters at some places, following the successive storms events of 2013 and 2014. Meanwhile, the sea level continues to rise (20 cm since 1870), thus extending further inland.

During the 2013-2014 winter, the 240 km of sandy coast that constitute most of the Atlantic shoreline, have been heavily eroded. One of the tasks of the National Forest Office is to manage coastal forests and dune environments. Dune conservation can not only fix the soil and dissipate sea swell, but it also helps to maintain the sediment balance and protects low areas from flooding. Since the 1980s, management approaches have evolved and shifted from the prevalence of structure engineering to an increasing development of ecological engineering. Therefore, management of coastal dunes currently addresses three key issues: erosion control, protection of the hinterland, conservation of biodiversity. Storm events in the Aquitaine Region have highlighted the protective role of dunes. Recent studies have indeed found that the diversity of natural habitats (mosaic) is in correlation with the degree of protection they afford.





## Experiences

### at regional and local level



#### Focus on **New Caledonia**

In New Caledonia, the increased frequency of extreme weather events such as tropical storms and cyclones generates significant coastal erosion. In the Loyalty Islands, Ouvea in particular, the shoreline has receded in recent years. The local government has decided to implement a climate change adaptation strategy that incorporates several components: erosion monitoring (establishment of a participatory monitoring system, analysis of aerial photographs), maintaining a natural coastline area, moving tribe living areas further inland, and integrated participatory management of the coastal zone in order to maintain coastal ecosystems in good conservation status.

Integrated Coastal Zone Management is a management approach aimed at maintaining a balance between land planning, usage and preservation of natural areas on the coastal areas. This implies an adequate mode of governance, involving all stakeholders and users of the coastal zone. This is the intended purpose of the "INTEGRE" project (Territorial initiative for regional environmental management). This issue is critical in islands such as New Caledonia, where space is limited and there is strong pressure on the coastline.

According to the French Initiative for Coral Reefs, benefits from reefs and mangroves, which prevent damage to the coastal zone, generate yearly savings amounting to 115 to 220 million Euros in New Caledonia.



#### Focus on **the metropolitan French coast**

The Ad'Apto project, developed by The Conservatoire du Littoral (the French coastal protection agency), highlights the management strategies of ten representative sites on the French coast, in order to demonstrate that a flexible management of the coastline is feasible and efficient

regarding adaptation to climate change. Firstly, the coastline must be understood as a land-sea interface, regaining coastline "buffer areas" that are able to withstand temporary flooding periods without suffering damage. On the other hand, it is necessary to address and support the natural mobility of the coastline and the change in ecosystems and their related uses by improving knowledge, acquiring land, experimenting and providing support to local projects.



## Solutions to reduce natural risks

### Solutions to reduce drought

**G**lobal warming of the earth's surface, resulting from climate change, is further increased in the cities by urbanization. Many initiatives demonstrate the benefits of bringing nature back to the cities. Various kinds of initiatives, such as green roofs, development of green areas, maintenance or creation of natural areas on the outskirts, help to combat warming in the urban areas.



#### Focus on Orleans City

Orleans City Council has chosen to innovate in the field of climate and biodiversity through the establishment of "freshness areas". It has launched several sustainable development

initiatives (Agenda 21 in 2006, "Biodiversity Plan" in 2009, Territorial Energy and Climate Plan in 2012, Land use planning scheme in 2013) where Orleans is defined as a "garden city". By investing in a multi-functional and cross-sectoral approach, the local authorities have set ambitious, concrete and positive targets in order to preserve biodiversity, improve air quality and increase ecosystem resilience to natural hazards. These targets include reducing artificial and impermeable soils; preserving green areas; greening of public spaces and buildings to maximize "freshness areas" that contribute to cleaner air by fixing dust and other pollutants; preserving permeable surfaces to optimize water infiltration and reduce soil erosion; creating landscape swales; planting of local species, less water-consuming and/or drought-resistant; management and renewal of the arboreal heritage; strengthening of the garden areas (biotope ratio) in local town-planning; closed loop fountains, etc.



## Experiences

### at regional and local level

Outside urban areas, temperature rise and changes in rainfall resulting from climate change can also lead to increased drought in some areas. This generates in turn a greater exposure to fire hazards and water resource protection issues.



#### Focus on the Alpillés Regional Natural Park

The Alpillés Regional Natural Park, that hosts unique biodiversity and man-made landscapes, has decided to adjust Mediterranean forest management in order to minimize fire hazards. In the 1950s, there has been an increasing dominance of softwoods, accompanied by a severe agricultural decline. Stronger and recurring fires have generated major safety issues for people and property, as well as environmental depletion (environment homogenization, impacts on species, erosion, etc.). When mechanical and prevention interventions (fire protection tracks, tanks) proved no longer sufficient, nature based solutions were envisaged. The Regional Natural Park has thus developed and implemented a LIFE+ Nature and Biodiversity project called "LIFE Alpillés". This project has helped develop traditional open mosaics managed through grazing, whose management modes provide significant and multiple benefits: they reduce fire hazards and address them more efficiently, and they also contribute to maintaining human activities while preserving biodiversity through the development of a rich and diverse wildlife.





## Solutions around the world

A large number of initiatives around the world have highlighted the effectiveness of ecosystem management to address climate change, both for mitigation, and adaptation of ecosystems and human societies.



### Vietnam

In Vietnam, planting and protecting 12,000 hectares of mangroves has resulted in an increase in carbon storage, enhanced biodiversity and improved coastal protection, saving dike maintenance costs which amounted to 7 million dollars each year.



### Thailand

In Thailand, studies based on satellite imagery taken between 1967 and 1998 showed that areas where mangroves have been preserved had coastal erosion rates significantly lower than the areas where they have been degraded. An economic assessment of the benefit provided by mangroves as avoided damage estimates the average benefit as US \$ 187,898 (or € 140,924) per mangrove square kilometer.



### Great Britain and the Netherlands

A significant number of initiatives in Britain and the Netherlands illustrate the effectiveness of ecosystems such as coastal wetlands in coastline protection and adaptation to climate change. In most of the 33 projects analyzed, the presence of wetlands and vegetated dunes has had a positive effect on coastline stabilization compared to non-vegetated areas. These studies have also highlighted the role of coastal wetlands in the protection against marine flooding resulting from storms: a reduction of 15 centimeters in the size of flooding waves per kilometer of wetland was observed.

In Eastern England, the artificial dam of Freiston Shore, built to prevent flooding, was under pressure from increasingly strong waves at high tide. A "managed coastal realignment" project was implemented, creating three 50 meters-wide breaches in the dam and restoring the coastal wetland. The project has strengthened natural coastal protection against flooding and created a site of major interest for biodiversity, which has generated economic benefits for the region through tourism.



## Experiences

### at regional and local level



#### Switzerland and France

The role of ecosystems in flooding risk management has also been highlighted in several initiatives in Europe, including a Franco-Swiss Rhone restoration project. This project has helped replenishing some dried-up Rhone backwaters, installing fishways and changing the structure of tributary streams at strategic points, thereby enhancing river biodiversity (micro and macro fauna, aquatic plants, and riparian forest wildlife), and at the same time reducing exposure to flooding risk for communities downstream from restoration areas.



#### Germany

Finally, the role of ecosystems as solutions to address temperature rise in urban areas, as well as the effectiveness of “freshness islands”, have been highlighted, and many European cities have launched renaturation initiatives. In particular, the city of Stuttgart, in Germany, has enacted binding building regulations to encourage the use of nature based solutions. 60% of the city area is now vegetated, including 39% with nature conservation status.



## Ecosystem preservation and restoration: key solutions to address climate change

IUCN welcomes the adoption of the new climate agreement by world governments at the UN Climate Summit in Paris (COP21), and its recognition of the crucial role of nature in addressing climate change.

Thus, IUCN calls on all concerned parties to mobilize in order to address the climate change challenge, and recommends taking action by:

- reducing the use of fossil fuels, decarbonizing energy systems, improving energy efficiency, enhancing energy savings and developing renewable and low carbon footprint energies, while taking into account biodiversity issues;
- supporting the current and future role of terrestrial, coastal and marine ecosystems as effective and natural sinks and reservoirs of greenhouse gases;
- developing nature-based solutions to mitigate climate change and adapt to its impacts.

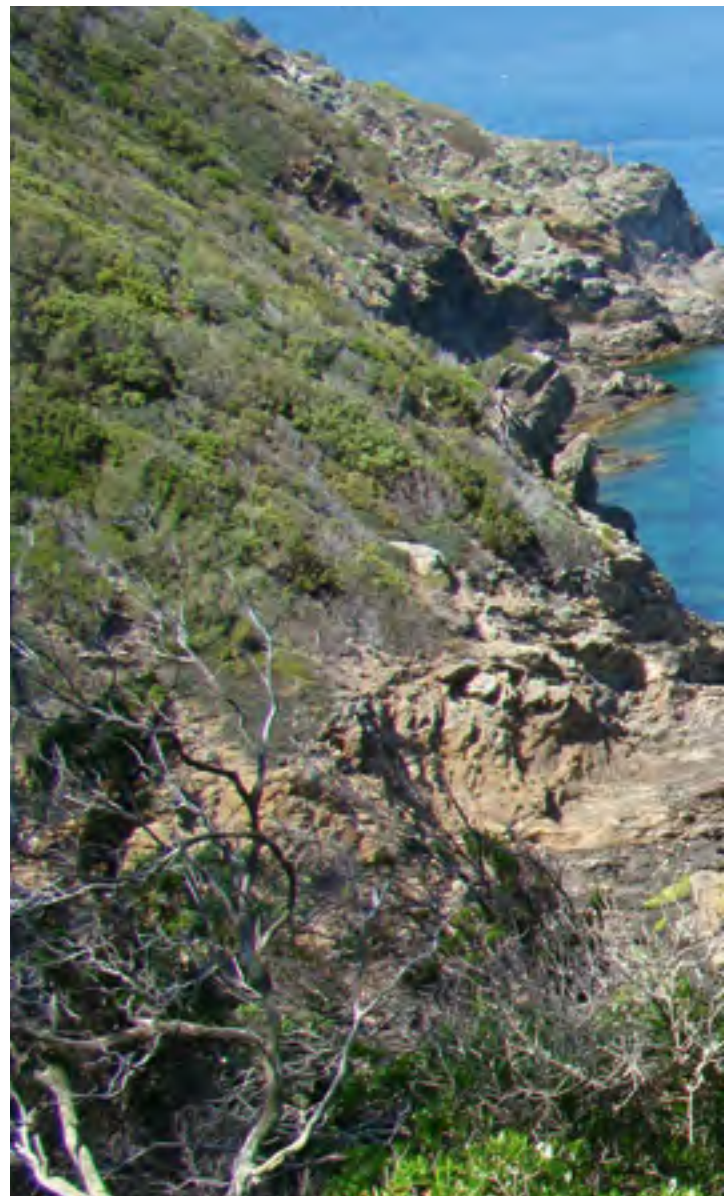
IUCN alerts on current threats to ecosystems resulting from climate change. Associated to other anthropogenic pressures, these threats jeopardize their ability to survive and adapt, while their conservation, restoration and sustainable management provide significant and concrete nature-based solutions to address these changes.

The Convention on Biological Diversity (CBD) and the UN Framework Convention on Climate Change (UNFCCC) recognize the importance of incorporating ecosystem-based actions when addressing climate change, and request their integration into local and national strategies to address climate change.

When financing climate-related actions, IUCN calls on countries to allocate ambitious financial means to implement nature-based solutions.



Nature-based solutions have to be included in climate strategies





**N**ature-based solutions must now be fully integrated into climate change and natural hazards action plans, from the global to the local level.

**All stakeholders are concerned.**

- Each State must integrate nature-based solutions in its Intended Nationally Determined Contribution (INDC). Several countries have already taken this course and France may become a leader in this respect, given the importance and diversity of its terrestrial and marine ecosystems. France should incorporate such solutions and deploy them, with quantified and operational targets, in its policy instruments, such as the national climate plan, the national plan of adaptation to climate change and other national programs.
- Local and sub-national governments (e.g. municipalities, cities, regions, provinces...) must also integrate and support nature-based solutions in the framework of regional climate - air quality - energy plans, territorial climate plans and land-use planning documents.
- Businesses are also concerned and should develop nature-based solutions in their projects and innovation work, building on research and development.
- Environmental protection NGOs and managers of natural areas should promote and support nature-based solutions implementation at regional and local level.

Actions to be undertaken include in particular:

- ▶ creation and management of protected areas and ecological corridors;
- ▶ improving ecosystem management and sustainable use of ecosystems;
- ▶ and restoring degraded natural ecosystems.

Nature-based solutions provide significant opportunities to meet the key climate change and biodiversity challenges in which it is crucial to invest today in a targeted and ambitious way.





## IUCN French Committee

International Union for Conservation of Nature.

Established in 1992, the IUCN French Committee is the network of organizations and experts of the International Union for Conservation of Nature in France. It associates, within a unique partnership, two ministries, 13 public agencies, 41 NGOs and more than 250 experts meeting in specialized commissions and thematic working groups. The IUCN French Committee has two main missions: respond to biodiversity issues and promote French expertise internationally. Thanks to its members and experts, the IUCN French Committee provides a unique platform for dialogue, expertise and actions on biodiversity issues, which also involves local authorities and private companies.

With support from:



Région  
Provence  
Alpes  
Côte d'Azur



Comité français de l'IUCN  
Musée de l'Homme  
17, place du Trocadéro - 75016 Paris - France  
Tél. : 01 47 07 78 58  
[uicn@uicn.fr](mailto:uicn@uicn.fr) [www.uicn.fr](http://www.uicn.fr)

Quotation reference: IUCN France (2016). Nature-based solutions to address climate change. Paris, France.

Downloadable document on: [www.uicn.fr/solutions-fondees-sur-la-nature.html](http://www.uicn.fr/solutions-fondees-sur-la-nature.html)

Editorial staff: Pauline Teillac-Deschamps, Florence Clap, Thierry Lefebvre, Aurélie Bocquet, Justine Delangue & Sébastien Moncorps.

ISBN : 978-2-918105-59-6 / Legal deposit: july 2016

Photo credit in order of appearance: © Kasto, © Lars Johansson, © Vladimir Melnikov, © ravo67, © merydolla, © F. Tron, © N. Horrenberger, © N. Poulet, © S. Moncorps, © S. Coste, A. Ducousso, © G. Lemoine, © M. Rossi, © Département de Seine-Saint-Denis/Direction de l'Eau et de l'Assainissement, © A. Persuy, © M. Le Duff, © L. Gouguet, © A. Gigou, © A. Bocquet, © S. Michel, © PHB.cz, © A. Trouillon, © Parc naturel régional des Alpes, © S. Masterson, © V. Neirinck, © C. Moirenc, © J. Delangue.  
Design & creation: Caroline Rampon - [caroline.rampon@laptitfabrikdecom.fr](mailto:caroline.rampon@laptitfabrikdecom.fr) - [www.laptitfabrikdecom.fr](http://www.laptitfabrikdecom.fr)