LIFE III

focus

Alien species and nature conservation in the EU

The role of the LIFE program

European Commission

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Alien species and nature conservation in the EU

The role of the LIFE program

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summary

Second only to habitats deterioration, invasive alien species are one of the major threats to biodiversity. Facing this threat represents one of the most ambitious challenges for the start of the new millennium. Considering the dimension of the threat posed by alien species the Commission decided to collect information on actions being carried out to face the problem within the LIFE program, the main EU fund directed at nature conservation.

More than 100 LIFE projects have either partially or exclusively addressed this threat mobilising significant human and financial resources. Eradication and control activities are examples of a varied palette of actions. Wide reaching information campaigns and networks have been implemented to raise public awareness on a problem frequently underestimated. It is surprising to note the richness of the experience gained through these projects and the outstanding results achieved by some of them.

Once more LIFE has proved to be a tool well adapted to the needs of nature conservation. It has also shown that it is possible to control or even eradicate alien species when well-defined areas, such as NATURA 2000 sites, are targeted. This document adds, therefore, a valuable "brick" to the LIFE "house." The snapshot given in the report confirms that the task is immense and that guidance is needed. Yet, LIFE proved it is possible to reach sizable results.

The achievements in this sector further strengthen the image of LIFE as an essential element for the successful implementation of one of the most ambitious projects of the European Union – that of creating and managing the NATURA 2000 network, our common natural heritage.

Introduction

Invasion by alien species represents one of the greatest biological threats to biodiversity, second only to habitat destruction. In addition to affecting ecosystems and contributing to the extinction of native species, invasive alien species (IAS) also cause major socio-economic damage.

*The rose-ringed parakeet (*Psittacula krameri), *native to Africa and Asia, has been introduced into several European urban parks.*

A well-known example of the impact IAS can have on both the environment and the economy is the 1954 introduction of the Nile perch (*Lates niloticus*) to Lake Victoria, in Eastern Africa (Goldschmidt, 1996). The introduction of the perch was brought about to reduce the drop in fishery due to over fishing. The result was the disappearance of about 300 out of 500 endemic fish species. The commercial exploitation of the Nile perch triggered a chain reaction, harming a wider variety of components of the ecosystem.

The use of wood to smoke the fish lead to the deforestation of the surrounding area, and the consequential increase in soil erosion caused the eutrophication of Lake Victoria. These factors in turn fostered the invasion of the South American water hyacinth (*Eichornia crassipes*), an exotic plant characterized by a rapid rate of respiration (high consumption of oxygen and water).

This plant competes with native organisms causing asphyxiation and massive die off and reduces the lake's water level. The damage was not only ecological but also economic, as the traditional source of income for thousands of local fishermen decreased dramatically, leading to the malnutrition of the inhabitants around the lake (WRI, 2000).

The growing number of cases similar to the Nile perch around the world has prompted, in the last few decades, an increasing attention to the issue of alien species by the international community. The problem has been addressed by more than thirty international conventions, agreements and treaties dealing with nature conservation. The two most important of these are the Bern Convention (1979) and the Convention on Biological Diversity (1992), which establish that member parties

should implement measures to control and eradicate existing harmful alien species as well as prevent further introductions.

Despite the course of action suggested by these treaties, specific national legislation to address harmful alien species has been developed by only a few governments, among which Australia, New Zealand, the United Kingdom and Denmark. Other countries, like the United States, have adopted management plans or other specific tools. Most countries however have not yet begun to develop legal instruments to tackle the issue, probably due to an underestimation of the dimensions of the threats posed by IAS. Guidelines, which could aid in the elaboration of national legislation, have recently been provided by IUCN (Shine et al., 2000).

In the European Union specific legislation on IAS has not yet been proposed, although discussion has begun. At the March 2002 meeting of the European Council of Ministers of Environment, it was recognized that "the introduction of IAS is one of the main recorded causes of biodiversity loss and is also the cause of serious damage to economy and health."

The problem of alien species has however been dealt with concretely within numerous areas of special conservation of Natura 2000, the network being established by the EU Commission and Member States.

The aim of Natura 2000 is to reduce the loss of biodiversity in the EU, by establishing a network of areas where conservation of wild flora and fauna is given a special priority and harmful impacts on natural and semi-natural habitats of Community importance are reduced or eliminated.

Since 1992 the EU has supported, through the LIFE financial instrument, projects aimed at the development of Natura 2000. Out of a total of 715 LIFE Nature projects financed from 1992 to 2002, 14% included actions addressed at alien species. This figure shows that, notwithstanding the underestimation by the general public and by policy makers, exotic species are perceived as a major concern by wildlife managers.

A considerable experience has therefore been acquired in managing exotics and in reducing their impact on native species and ecosystems. Lessons learnt provide a contribution to future actions and strategies.

*The false acacia (*Robinia pseudoacacia*) was introduced from North America into a private French garden during the 18th century. It remained within the perimeter of the garden until the early 1900s when the blight of chestnut woods fostered its diffusion throughout Europe. Now the removal of this plant is carried out within several LIFE Nature projects.*

Key terms

What is an invasive alien species? What is an introduction? A proper use of the terms in this specific context is crucial to understand the topic of invasive alien species, so as to avoid misunderstandings arising from an incorrect interpretation of the terms.

Some words are used as synonyms although they should not be; the common meaning of some terms is quite different from the technical meaning. The terms listed below agree with the definitions reported by IUCN (1995 and 2000), as well as those recommended by Lever (1996) and Richardson et al. (2000). A revision of the definitions and terminology is being carried out by the European Council of Environment Ministers, within the framework of the works of the Convention on Biodiversity.

Term	Definition	Example
Alien Species	A species, subspecies or lower taxon occurring outside of the historically known range it occupies naturally and outside its dispersal potential as a result of direct or indirect introduction or care by humans. Includes any part, gametes or propagule that might survive and subsequently reproduce. Synonyms are non-native, non-indigenous, foreign, and exotic.	Monk parakeets, wallabies, coypus (animals), eucalyptus, Jerusalem artichoke and false acacia, (plants) are well known cases of species introduced to Europe from other continents.
Acclimatized Species	A species living in the wild in an alien environment or climate with the support (i.e. for food and shelter) of humans.	Grass carp has been released in several rivers, but they are unable to reproduce since their pelagic eggs need long course rivers for their development.
Naturalized Species	An introduced or feral population of species established in the wild with free-living, self-maintaining and self-perpetuating populations unsupported by and independent of humans.	The false acacia, introduced during the eighteenth century in a private French garden from the north America, began spreading in the early 1900s all over Europe, establishing viable (self-sustaining in the wild) populations.
Invasive Species	A species that is able to establish stable populations, colonizing irreversibly and spreading rapidly in entire natural or semi-natural ecosystems. Biological invasions may also be a natural phenomenon, determining natural range expansions or contractions, without direct interventions by humans, although sometimes they may be fostered by possible human related environmental changes.	Muskrats, once introduced for the fur industry, have rapidly expanded their range towards the western side of Eastern European countries. On the other hand, collared doves are not exotic species, although they colonised Western European countries only recently. Their spread in such a region is recognizable as a natural process of dispersion.
Pest Species	A species which may spread and cause serious environmental changes so as to threaten the conservation of indigenous habitats and species or cause severe economic losses to human activities.	Coypus were introduced to many European countries at the beginning of the twentieth century for the fur industry, and now represent a serious threat both to nature conservation and to human activities and infrastructures.
Feral Population	An animal species that has reverted to the wild from domestication. The mere keeping in captivity does not mean domestication, and therefore the term should never be referred to wild, non-domesticated, species (i.e. which did not undergo some change in phenotype, genotype and behaviour as a result of artificial selection in captivity).	Dogs, cats, goats and ferrets are all domesticated animals which, once released in the wild, may establish self sustaining populations, independent of human support.

Introduction	The process by which a species, subspecies, or lower taxon (including any part, gametes or propagule that might survive and subsequently reproduce) is transported by humans outside its historically known natural range, either intentionally or accidentally, by humans outside its historically known natural range, either intentionally or accidentally.	Humans have introduced marmots, which are native to the Alps, to the Pyrenees and the Apennines. Introduction may also refer to species native to one area and introduced elsewhere in the same geographic area, beyond their natural range. Such introductions are called “translocations”.
Reintroduction	An attempt to establish a species in a geographic area where it was once indigenous, but where it has become extinct in historical times as a result of human activities or natural events.	The wild population of golden eagles in Ireland, once extinguished, mainly as a consequence of human persecution, is being re-established through a LIFE Nature project.
Re-stocking	The release of individuals belonging to a certain plant or animal species with the intention of increasing the existing population in an area where it already occurs naturally.	The native brown bear population living in the Italian Alps has been reinforced through the release of individuals coming from Slovenia. This activity was carried out in the framework of two LIFE Nature projects.

© Photo Stefano Picchi

Eucalyptus sp.

© Photo Parco Naturale Adamello-Brenta

*Release of the brown bear (*Ursus arctos*).*

Unintentional introductions	The result of the use of a species by humans or human delivery systems as vectors for dispersal outside its natural range. Such introductions may be a consequence of a number of commercial activities, such as trade and tourism.	Transported by ship, mice and rats have been accidentally introduced onto dozens of islands.
Intentional introductions	Species deliberately released by humans for a number of activities such as agriculture, forestry, aquaculture and biological control.	Game species, such as pheasants, partridges and a number of ungulates, have been deliberately introduced for hunting purposes in many European countries.
Benign inroductions	A particular type of intentional introduction aimed at establishing a new population of an endangered species outside its recorded historical range to favour its conservation without causing ecological damage.	The Guam rail, a flightless bird on the brink of extinction in its natural range, the Guam island, due to the introduction of the brown tree snake, has been introduced to the Hawaii islands.

1. Alien species within the European Union

The loss of biodiversity due to invasive alien species represents a major problem in Europe as in the rest of the world. Facing the problem, in an era characterized by an increasing global movement of people and goods, is not an easy task.

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Alien species have been introduced to Europe throughout history. There are regions, such as the Mediterranean, where for thousands of years people have been responsible for the spread of ever-increasing numbers of plants and animals. The movement of alien species has mainly been due to the needs for food and trade for the survival of human communities. The improvement in the efficiency of transportation and the growing frequency of travel has facilitated, over time, the spread of imported species. For example, during the Roman Empire, thanks to the establishment of an efficient and well-managed road network and an increase in movement of troops and goods overseas, the opportunities for alien species to arrive in new areas, accidentally or intentionally, rose significantly. The Romans were responsible for the introduction of several species of mammals and birds, usually as a source of food, in several Mediterranean countries and islands.

During the 18th century, the increasing interest of Europeans in exotic species from all over the world resulted in intensive efforts to establish new viable populations. This new "fashion", linked to both socio-economic and ornamental factors, led to the foundation of specialized "acclimatization" societies, such as the Société Impériale d'Acclimatisation founded in Paris in 1854 (Lever, 1996) or the Acclimatisation Society of the United Kingdom.

Above. *Narrow-leaved ragwort* (Senecio inaequidens).
Below. *Sand dune area on Anholt Island in Denmark, five years after being cleared of plantations of the mountain pine* (Pinus mugo). *In order to assure the long-term success of the activity, continuous removal (by hand) of seedlings over a period of 15-20 years is essential.*

Crosby (1986) described this process in great detail in "Ecological imperialism."

Today, with the exceptional ease and speed with which people and goods move, the intentional and unintentional introductions of IAS, related to various economic sectors – trade, tourism, agriculture, forestry and fisheries – has increased dramatically. Introductions are also connected with attempts to create new sporting opportunities, pet trade, biological control and aesthetic values.

Even wars can facilitate the spread of alien species. One hypothesis on the introduction of the South African narrow-leaved ragwort (*Senecio inaequidens*) is that the plant arrived in Europe during the Second World War, together with the soil carried through the military equipment. The plant is now spreading all over the continent along the road and the railroad systems.

The high number of non-native species present today in Europe is therefore not surprising: tens of thousands of plants and animals have been added to native biological communities. It has been calculated that about 12,000 plants have been introduced to

© Photo Mats Eriksson

central Europe both intentionally and unintentionally (Sukopp, 1980). Out of this number, about 228 (1.9 percent) are now permanently established in semi-natural ecosystems (Kowarik, 1996).

The successful introduction of an exotic species is, nevertheless, not a common event. Out of all of the species introduced outside their natural range only a few species manage to establish viable populations. According to the "tens rule" identified by Williamson (1996), the chance that an introduced species becomes a pest is about 1 out of 100. Out of the number of species introduced to a given area, only 10 percent are likely to become naturalized and only 10 percent of these are likely to become invasive.

It is not yet clear which species are more likely to become naturalized or to become invasive. Many scientists have tried unsuccessfully to establish *a priori* if a plant or animal species is prone to become invasive in a given region. As stated by Lever (1994), when dealing with IAS, "the only element in species introduction that can be forecast with certainty is that of unpredictability."

In order to comprehensively study the problems related to IAS, it is important to take into account the two different ways that exotic species in Europe are introduced: from outside the European Union and from one region to another. Whereas species introduced from abroad are immediately recognized as exotic and potentially harmful to local habitats and species, those coming from other parts of Europe are often not recognized as such.

Some species are transported to other countries to solve a problem, often bringing about even more serious ones and, in some cases, causing significant modifications to the landscape. The mountain pine (*Pinus mugo*), for instance, a conifer indigenous to central Europe and the western Alps, was introduced to Denmark and south Sweden in the mid 1800s in order to consolidate the dune system. This pine is now threatening the natural dynamics of the dune system, causing the dis-

Feral populations

Feral populations of domestic animals are a major threat to biodiversity all over the world. Some of them, particularly dogs, cats, pigs, may act as predators threatening the survival of rare and endemic species, while others, such as rabbits, goats and sheep, are voracious herbivorous which may destroy the vegetation of entire territories, turning dense vegetated areas into a desolated desert.

Domestic animals are often also a dangerous source of genetic "pollution" of wild species. Most of them, when released into the wild, interbreed with their wild ancestors, provided that specific environmental conditions are met. This is of particular concern in the case of dogs and cats, which may hybridise respectively with wolves and wild cats, but also in the case of other domesticated species, such as the ferret (*Mustela furo*), which may interbreed with the polecat (*Mustela putorius*).

One of the main problems related to feral dogs is the damage they cause to farm livestock, which often is erroneously ascribed to wolves or bears. Actions to reduce the impact of stray dogs on wildlife and livestock were implemented in a LIFE Nature project carried out in central Italy, "Conservation of the wolf and the bear in the new parks in the central Apennines" (LIFE97 NAT/IT/4141) which included a program for the capture of stray dogs, in collaboration with the competent authorities.

© Photo Riccardo Scalera

The wolf (Canis lupus) *may suffer from competition with feral dogs.*

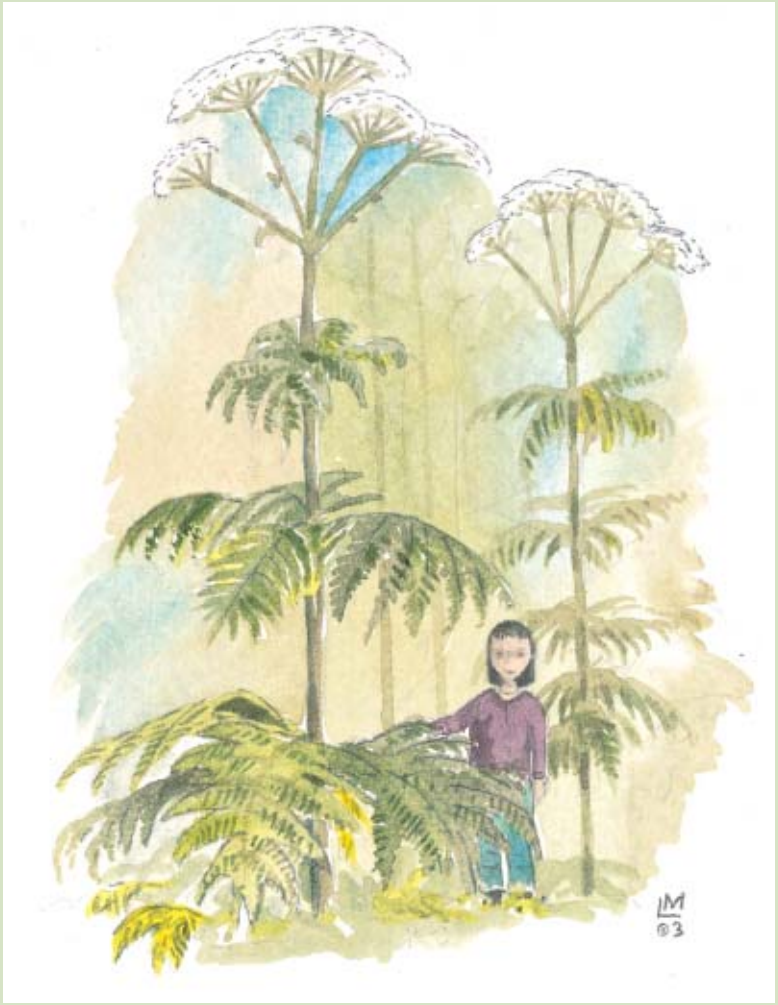
© Photo Paolo Forconi

When dogs become feral, they can be dangerous predators of indigenous wildlife.

appearance of wild vegetation and changes to the landscape. The European Commission has funded three LIFE Nature projects ("Re-establilshing lichen an coastal heaths in the Anholt Desert", LIFE 94NAT/DK/492, "Protection of grey dunes and other habitats on Hulsig Hede/Hulsig Heath", LIFE96 NAT/DK/ 3000, and "Restoration of dune habitats along the Danish West Coast", LIFE02 NAT/DK/8584) tackling these problems in a strategic way across a whole series of Danish Natura 2000 sites. These projects were aimed specifically at the restoration of the threatened dune habitats, "fixed grey dunes" and "decalcified fixed dunes with crowberry (*Empetrum nigrum*)," both listed in the Habitats directive.

A number of studies carried out at the national and local level show that all countries are seriously affected by alien species. However, specific and comprehensive studies on the current status of IAS in the European Union, including a species checklist with data on their ecological and socio-economical impact, are not yet available and the current knowledge on IAS in Europe is far from being exhaustive. While a number of studies are being produced as isolated initiatives by scientific institutes or public administrations, there is no coordination at the international level.

The project being carried out by the European Topic Center on Nature Protection and Biodiversity of the European Environment Agency (www.eea.int) is one example of how this gap is being addressed. This project aims to collate national data on introduced fish species and provide a regional statistical overview. In the future, this research could be extended to other taxonomic groups and all data on IAS could be integrated into the European Nature Information System (EUNIS database), which includes information on species, habitats and their sites present in Europe (European Commission, 2003).



The case of the giant hogweed

"Fashionable country gentlemen had some cultivated wild gardens,
In which they innocently planted the Giant Hogweed throughout the land.
Botanical creature stirs, seeking revenge.
Royal beast did not forget.
Soon they escaped, spreading their seed,
Preparing for an onslaught, threatening the human race."

Return of the Giant Hogweed from the Genesis album *Nursery Cryme* (1971).

Many European freshwater ecosystems, made vulnerable by unsustainable management practices, are colonized by exotic species that are seriously damaging the ecosystems and, in some cases, represent a potential damage to human health. The giant hogweed (*Heracleum mantegazzianum*) is recognized as an invasive weed in almost all European countries (Waage, 2000). It was introduced from western Asia during the 18th century for ornamental purposes. It competes with native riparian species, and has a shallow root system that increases soil erosion along riverbanks. The invasion of this species in urban and suburban areas is considered an increasing public health hazard because of its toxic sap containing a substance that causes painful blister.

1.1 The ecological impact of invasive alien species

All ecosystems are characterized by strict relationships between their biotic and abiotic components and by a typical spatial structure. IAS may alter these features, modifying both the number and composition of species, the relation between the food chains and the balance of the resources in the ecosystems. This may result in a negative impact on biodiversity, affecting native species by means of changes in ecological dynamics, in morphological and genetic features, and in the transmission of diseases and parasites. All of these factors may act at different levels simultaneously, and may interfere with the ecological balance of single habitats or entire ecosystems.

Impacts on species

The introduction of exotic species can alter the relations between species living in a particular area, establishing new dynamics of competition and predation, and possibly displacing native species (Gause principle[1]).

Competition refers to the behaviour of two or more species that interact for the exploitation of the same resources (i.e. food, water, shelter, light, etc.), which reach a natural dynamic balance. The introduction of the grey squirrel (*Sciurus carolinensis*) in the UK is a well-known case of a species of North American origin introduced outside its natural range for ornamental purposes. It has almost completely displaced the native red squirrel (*Sciurus vulgaris*), now seriously threatened with extinction throughout the entire country.

In the wild, populations of prey and predator live together in balance, and the prey-predator relationship is extremely important for the dynamics of ecosystems. When an exotic species is introduced in new territories it may become a predator of indigenous species which do not have adequate defensive behaviour. In this case the ecological balance will be disturbed. A dramatic example of exotic predator is the American mink (*Mustela vison*) on native water voles (*Arvicola terrestris*) in the UK. The American mink was imported in several European countries for the fur industry at the beginning of the twentieth century. This voracious carnivore has a major impact on wildlife, especially mammals, birds and fish. Studies carried out in Belarus show that the American mink has severely reduced and fragmented water vole populations (see Macdonald et al., 2002). The only redeeming feature of the species is that its diet may include other exotic species such as rats and rabbits (Lever, 1994).

The ecological impacts of IAS may also be genetic. When IAS appear in a new ecosystem they can interbreed with closely related native species.

This genetic exchange may result in a loss of the genetic integrity of the native species and in the formation of hybrids. A well-known case is the North American ruddy duck (*Oxyura jamaicensis*). This American species

The grey squirrel (Sciurus carolinensis) *is a North American species introduced into Italy and the United Kingdom, where it competes with the native red squirrel (*Sciurus vulgaris*) and causes damage to forestry and agriculture.*

© Photo Riccardo Scalera

[1] The Gause principle, or competitive exclusion principle, states that two species with identical ecological needs cannot coexist in the same area.

© Photo Riccardo Scalera

*White-headed duck (*Oxyura leucocephala*).*

was introduced to the UK in 1949, and is now present in several European countries. The American ruddy duck is a major concern for the conservation of the white-headed duck (*Oxyura leucocephala*), a native endangered species of the Mediterranean basin with fragmented breeding populations. The ruddy duck is known to interbreed with the native white-headed duck, generating fertile hybrid individuals. Moreover it may be responsible for anomalous dynamics of sexual competition among the males and females of the two species. All of these factors are thought to represent a serious threat for the long-term survival of the white-headed duck and are therefore being taken into consideration by a number of management initiatives, including two LIFE Nature projects, namely the "*Oxyura leucocephala*'s reintroduction on Biguglia's pond" carried out in Corsica, France (LIFE97 NAT/F/4226), and the "Conservation plan for the white-headed duck in the Community of Valencia" in Spain (LIFE00 NAT/E/7311). This last one includes the production of a specific recovery plan for the native species.

Impact on habitats/ecosystems

The presence of IAS not only affects individual species, but can also influence the ecological balance of entire habitats or ecosystems.

The European Union hosts several vulnerable ecosystems, ranging from freshwater to marine, forests to grasslands and cultivated land. IAS may affect these ecosystems in a number of ways, modifying their species richness, community structure and physiognomy. In Europe the ecosystems most vulnerable to IAS are islands, lakes, rivers and in-shore marine areas (Heywood, 1995). Factors such as land use and habitat fragmentation have also demonstrated to increase the vulnerability of ecosystems to invasion of harmful alien species (Williamson, 1999).

Competition resulting from the introduction of IAS may alter the structure of an ecosystem both directly and indirectly. The invasion of a forest by a plant species may result in an imbalance within the original vegetation layers (herbaceous, shrubs and arboreal), which in turn may change the environmental conditions for indigenous species, for instance modifying the availability of light or space, or the incidence of fires.

The impact of IAS is not limited to the structure of an ecosystem. At the beginning of the twentieth century, a few acacia species (*Acacia longifolia, A. saligna, A. melanoxylon, A. cyclops*) native to Australia were introduced to Portugal to stabilize dunes. These species not only caused structural change to ecosystems, changing local habitats into monospecific communities, but also established symbiosis with nitrogen-fixing bacteria. This resulted in an increase in availability of soil nitrogen and carbon, impairing the success of native species and favouring the invasion by acacia itself and other exotic species (Marchante et al., 2001). The LIFE Environment project "Recovery, Conservation and Management of Species and Natural Habitats in the Coastal Area of the Central Portugal" (LIFE95 ENV/P/0119) contributed to the removal of the trees of acacia from the Quiaios-Mira coastal zone.

Dynamics of change can be surprisingly similar on land and in the sea. An example is *Caulerpa taxifolia*, a green alga native to tropical waters, cultivated as ornamental plant in some European aquaria. Around 1984, this species was accidentally released into the Mediterranean Sea below the Monaco Aquarium and spread quickly along the coasts of France, Spain, Italy, Croatia and Greece. *Caulerpa* alters the biodiversity of the ecosystem through the formation of monoculture stands, affecting, among other submarine habitats, the Posidonia beds, a habitat of Community importance under the EU Habitats directive. The *Caulerpa* carpet causes ecological and economic damage, eliminating native seaweeds and their biological communities and impairing their function as food and shelter for a complex

Islands

Invasive alien species are one the main causes of biodiversity loss on islands and the damage they cause on isolated ecosystems has been known for centuries. Pliny the Elder wrote in his *Natural History* that the invasion of rabbits on the Balearic Islands was such a severe problem that the help of Caesar and the Roman troops was sought to control them (see also Clutton-Brock, 1999).

Within the European Union, there are thousands of islands: about 5,000 islands are scattered throughout the Mediterranean Sea alone, a globally important biodiversity hot spot. These islands, along with those in the Macaronesian region (Canary islands, Madeira and Azores) and the French islands scattered in the Indian and Atlantic oceans, host typical habitats and endemic species that have always suffered from introductions of alien species. Rabbits and goats, if introduced, for example, are able to turn these lush islands into deserts, due to their voracious feeding habits. In addition, dogs, cats and rats kill chicks and the adults of several gregarious seabird and other species which have evolved free of predators and therefore have not developed any effective protection against newly arrived predators.

Because IAS are a major concern for the conservation of nature on islands, LIFE Nature has supported a number of projects since 1992 dealing with control and eradication of invasive alien vertebrates, especially on the islands of Spain, Portugal and Western Isles of Scotland.

Several projects implemented and/or carried out in the islands and islets of Spain and Portugal have addressed exotic predators (such as cats, rats and mice) or herbivores (such as rabbits, goats and wild sheep) and their threat to the survival of rare and endemic species (in particular seabirds, giant lizards and small mammals).

On the Western Isles of Scotland the LIFE projects aimed at the reduction of the spread of the American mink (*Mustela vison*), an exotic predator threatening the population of ground-nesting birds: species of special conservation concern, which makes these islands internationally important.

© Photo Riccardo Scalera

Right. *Rabbit (*Oryctolagus cuniculus*).*
Centre. *A view of Lanzarote, Canary Islands.*
Below. *Steep cliff in the Balearics.*

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web of marine life and, eventually, reducing fishing resources. Eradication is no longer feasible but actions to contain this invasion are being carried out. Since 1992, the European Community supported four LIFE Environment and two LIFE Nature projects to monitor and control the expansion of this alien species along the Mediterranean coasts of Spain, France and Northern Italy.

Invasions have the potential of causing loss of ecosystem resilience[2] if they lead to a habitat simplification. A simplified habitat is more vulnerable to external disturbances (meteorological events, fires, etc) and takes longer to recover. Agro-ecosystems are most sensitive to invasions, due to their simple structure, which makes them more vulnerable to loss in resilience. Apart from ecological considerations, the loss of resilience in these systems can also have an economic cost: the cost of herbicides, pesticides, fertilizers, irrigation and other inputs needed to maintain these systems can greatly affect the economy.

[2] The term resilience indicates the capacity of a community or ecosystem to recover after a disturbance (Westman, 1978).

© Photo Maria Teresa Manfredi

Above. *Male crayfish* Austropotamobius pallipes.
Left. *Close-up of crayfish abdomen infected by pathogens.*

Health impacts

New diseases are often spread by the introduction of IAS, which can act as vectors for pathogens or can cause disease themselves directly. This can threaten not only native species of plants and animals, but also humans. Pathogens and pests may attack wildlife, livestock and crops, causing the destruction of large areas of natural habitats, disappearance of indigenous species, epidemics and even famine.

Carriers of plant diseases, including exotic variants of viruses, bacteria and fungi, are introduced through the movement of plants or parts of them. Cases of major infestations due to imported species have been documented for centuries and are the best known examples of damage produced by alien species. For instance, *Phylloxera vastatrix* is an aphid native to North America that lives on local vine *Vitis labruscana*, which has a natural tolerance to the species. *Phylloxera* was accidentally transported to Europe's grape growing regions in the mid 1800s on American rootstocks. In a few decades it nearly destroyed the European wine industry, which was dependent on *Vitis vinifera*, a species vulnerable to *Phylloxera*. The epidemic was brought under control by grafting *V. vinifera* scions onto resistant American *Vitis labruscana* rootstocks, but the effects of the biological invasion were devastating. The economic loss was enormous; the landscape of many European regions changed rapidly and a great part of the European heritage of viniculture disappeared.

Above. *Red swamp crayfish (*Procambarus clarkii*).*
Below. *Black rat* (Rattus rattus) *(from Scalera, 2001).*

Animals may also be vectors of diseases and parasites. One of the main examples in Europe is the spread of a new strain of the fungus *Aphanomyces astac*i, imported with stocks of farmed red swamp crayfish (*Procambarus clarkii*) from North America to Britain (Williamson, 1996). This fungus may be lethal to non-American species of crayfish. For this reason it may have been responsible for the contraction of the distribution range of the native freshwater crayfish (*Austropotamobius pallipes*) in Europe and in Britain in particular. In Italy the European Commission has funded a project "Conservation of *Austropotamobius pallipes* in two pSCIs of Lombardy" (LIFE00 NAT/IT/ 7159) aimed at the reintroduction of this crayfish. The project includes sanitary check-ups on both wild and captive-bred individuals, now living together with other exotic species, such as the red swamp crayfish (*Procambarus clarkii*) and the Turkish crayfish (*Astacus leptodactylus*), which may be a vector of new pathologies threatening the native species.

Examples of epidemics affecting humans during the centuries are numerous. For instance, the black rat (*Rattus rattus*), native to Indian subcontinent, is not only one of the naturalized species that have had the worst ecological and economic impacts, but is also agent of deadly human diseases. The history of the bubonic plague, which recurrently infested Europe during the Middle Ages, is a tragic example of an epidemic caused by an introduced species. Between 1346 and 1352 this disease wiped out one quarter of the European human population, killing up to 70% of the inhabitants in some towns (Diamond, 1997).

Some invasive alien plants are also considered a health hazard. The European Plant Protection Organisation (EPPO) signals the common ragweed (Ambrosia artemisifolia), a North American invasive plant strongly allergenic to man, as an "introduced exotic pest." This plant is widespread in Europe (Belgium, France, Germany, Luxembourg, Portugal, Sweden, Italy,) and could become a serious problem both for public health and for agriculture. Control and eradication programs have already started in Italy and France.

1.2 The socio-economic impact of invasive alien species

In the European Union comprehensive data on the economic costs associated to the impact and the management of IAS are not available, excluding assessments elaborated at local level and on single taxa. However, data relative to other countries can contribute to provide a picture of the relevance of the problem.

Invasive alien species can have severe economic impacts, in particular in agriculture, aquaculture and forestry sectors. An estimate made by the Weed Society of America, in 1992, shows that annual damage due to IAS, including crop losses and the cost of herbicides, was between 4.5 and 6.3 billion USD. A significant example is the case of the golden apple snail (*Pomacea canaliculata*), intentionally introduced from Argentina to Taiwan in 1981 as a potential food source. The snail rapidly invaded rice fields in all of eastern Asia, devastating crops and creating serious problems for the local population. It has been calculated that in 1990 in the Philippines the cost of controlling the golden apple snail and replanting rice, and the loss of yields amounted to 48 million USD. Moreover, the huge cost of replanting greatly reduced farmers' incomes. The golden apple snail has also had a direct impact on human health. It is an intermediate host of the lungworm (*Angiostrongylus cantonensis*), which causes a deadly form of meningitis in humans.

The horse-chestnut leafminer (*Cameraria ohridella*), a moth of unknown origin, has infested trees of this species in Austria and the Czech Republic and is spreading at more than 100 km per year across Europe. The insect now threatens rare endemic forests in the Balkans. The European Commission is currently funding, under the 5th Framework Program for Research (www.eca.eu.int) , a multidisciplinary research project, "CONTROCAM: Sustainable control of the horse chestnut leafminer, Cameraria ohridella (*Lepidoptera, Gracillariidae*), a new invasive pest of *Aesculus hippocastanum* in Europe" (QLK5-CT-2000-01684), involving several Central and Eastern European countries, aimed at the control of this exotic pest.

Exotic animal species with known relevant economic impacts include the grey squirrel (*Sciurus carolinensis*), which affects forestry and agriculture in the UK, Ireland and Italy, and the coypu (*Myocastor coypus*), which affects the same sectors in a number of countries. LIFE Nature projects addressing coypus are ongoing in France, Italy and Spain.

The introduction of alien species can at times bring also benefits, as when they are used for agriculture, animal farming, wood production, hunting or trade of ornamental plants. However, in most cases introduction of an exotic species benefits only a limited number of people.

Of the few estimates of the cost of alien species invasion at the national level, a study realized by Pimentel et al. (2000) showed that annual damage in the United States amounted to 137 billion USD and to 12 billion USD in the United Kingdom.

A number of studies have been realized at the local level to assess the direct costs of prevention, control and mitigation measures against alien plant and animal species. Estimates exist for *Rhododendron ponticum*, a plant native to the Iberian Peninsula, Turkey, Bulgaria and the Balkans (Rotherham, 2001), which is a highly invasive exotic in forests and semi-natural woodlands of the British Isles. In Ireland, it has a negative impact on "transition mires" and "quaking bogs," habitats to be protected according to the Habitats directive. In the UK, control of this species in a single protected area (Snowdonia National Park, Wales) has costed 45 million GBP to date (European Commission, 2003). Since 1997 the EU has co-financed five LIFE Nature projects in order to face the problem of invasion by the rhododendron in several Natura 2000 sites in the UK.

Even though the negative effect on indigenous natural and agricultural ecosystems is indisputable (Parker et al, 1999), there are currently few reliable estimates of the indirect impact, reduction of the value of the agricultural land, increase of water con-

*The coypu (*Myocastor coypus*) was introduced in Europe from North America at the beginning of the twentieth century for the fur industry. Once escaped in the wild, coypus caused severe damages to antrophic structures along canals and rivers, to agriculture and to autochthonous wildlife in general.*

Irish Famine

In order to increase the production during the nineteenth century, a hybrid potato was introduced to Europe and widely cultivated. In 1844 a shipment of seed potatoes infected with the potato blight (*Phytophthora infestans*), a fungus native to Mexico, arrived from the United States and was offloaded at Ostende in Belgium.

In a short time the fungus reached Ireland where potato crops were rapidly infected. In 1845 and again in 1848 a third of the potato crop was destroyed by blight. Even more disastrously, three-quarters of the crop failed in 1846.

One million people died of famine-related diseases (Clarkson, 1989) and up to 1.5 million more emigrated to avoid starvation (Alexopoulos *et al.*, 1996). Potato blight was a huge shock, which had a long-term impact on European agriculture, reducing the returns on potato growing. Consequently, prices of potatoes relative to those of cereals – for the equivalent food value - were, on average, 50-100 percent higher in the late 1850s than in the 1830s (Solar, 1997).

sumes, loss of ecological "services", economic loss, of alien species (Perrings et al, 2002). The Japanese knotweed (*Fallopia japonica*) for instance, was introduced in South Wales gardens in the 19th century and started to have a negative economic impact since the 1930's, reducing with its mere presence the price of the land. The Japanese knotweed moreover reduces plant and animal populations and alters significantly ecosystem structure and function. During winter dormancy, the species standing biomass may represent a fire hazard. From 1992 to 2002, the county of Swansea spent more than 240,000 GBP to contain this plant. At present, the invasion of the Japanese knotweed is such that the county cannot afford its control and is currently identifying possible funding opportunities for a biological control research program (Renals et al., 2001).

1.3 How to reduce the impact: managing invasive alien species

According to the Convention on Biological Diversity (see following chapter) "once the establishment of an invasive alien species has been detected, States, individually and cooperatively, should take appropriate steps such as eradication, containment and control, to mitigate adverse effects. Techniques used for eradication, containment or control should be safe to humans, the environment and agriculture as well as ethically acceptable to stakeholders in the areas affected by the invasive alien species. Consistent with national policy or legislation, an individual or entity responsible for the introduction of invasive alien species should bear the costs of control measures and biological diversity restoration where it is established that they failed to comply with the national laws and regulations. Hence, early detection of new introductions of potentially or known invasive alien species is important, and needs to be combined with the capacity to take rapid follow-up action" (Decision VI/23).

The most environmentally desirable and cost-effective strategy is of course prevention, which eliminates the problem at its very origin. Surveillance, as field activities to identify new alien species in a given region, is a fundamental measure to guarantee, through an efficient early warning system, prevention. According to the Council of Europe Strategy on IAS (Genovesi and Shine, 2003), surveillance should target all taxonomic groups and focus on high-risk sites, such as:

> main entry points for commercial tourist arrivals (airports, ports, harbours and open moorings, train stations, etc.);
> entry points of natural dispersal pathways (coasts, border crossings of water systems shared with neighbouring countries, etc.);
> areas adjacent to facilities where alien species are kept in captivity or containment (botanical gardens, zoological gardens, fish farms, nurseries, game parks, etc.);
> areas where severe disturbance has occurred (land clearance, storm damage, etc.).

When prevention has failed, if the spread of an introduced species has been detected on time, eradication is the best management option, aiming at the complete removal of the alien species. Usually, it is possible to eliminate an exotic species only soon after its introduction, before it becomes invasive. Therefore, a rapid action is needed. The type of intervention to be implemented in the field depends on several factors, biological, social and economic.

To provide competent authorities basic tools for the implementation of a rapid response to introductions, specific contingency eradication plans should be developed. Their elaboration should be standardised on the basis of an agreed framework and should foresee consultation with relevant agencies and involved communities.

If eradication is no longer feasible, it is still possible to restrict the spread of the exotic species, through its containment beyond a geographical boundary and/or its long-term control, by reducing the population density under an acceptable threshold.

When all the above measures are not feasible, the last option left is to learn to "live with" such species and to mitigate their impact on native species and ecosystems.

Whatever the strategy adopted (for additional information see Wittenberg and Cock, 2001), it is important to remember that managing invasive alien species is only a phase in the process to achieve a higher goal, the conservation of native habitats and species.

2. Policy context

Over 40 international and regional instruments contain provisions and programs related to alien invasive species. An exhaustive and comprehensive review of the global legal framework related to IAS has been recently published by Shine et al. (2000).
The EU has developed a number of regulations and directives dealing directly or indirectly with IAS. The most important are the "Birds" and "Habitats" directives and the wildlife trade regulations.

2.1 Legal and institutional background at the international level

2.1.1 The Convention on Biological Diversity

In 1992 more than 100 world leaders attended the "Earth Summit" organised in Rio de Janeiro by the United Nations, approving the Convention on Biological Diversity (CBD), the first major global agreement on the conservation and sustainable use of biodiversity, now ratified by 181 Parties. Article 8(h) of this comprehensive strategy recommends that "each Contracting Party shall, as far as possible and appropriate, prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species."

The Convention on Biological Diversity urges the contracting parties, among which the European Community, to undertake measures addressing the problem of IAS.

During the VI Conference of the Parties, held in October 2002, a number of Guiding Principles to develop "effective strategies to minimise the spread and impact of invasive alien species" was identified. These principles are intended to assist governments and relevant bodies in the implementation of Article 8(h) of CBD (Decision VI/23) and in the elaboration of strategies and action plans to manage IAS at the national and regional levels.

The European Commission (2003) has described the situation within the European Union in a specific report to the Convention on Biological Diversity, the "Thematic Report on Alien Invasive Species", which describes legal, administrative and policy measures adopted by the Community in sectors concerned directly or indirectly to IAS, which outlines how the Community contributes to relevant international and European processes.

The European biodiversity strategy

The Convention on Biological Diversity provides that all parties develop a biodiversity strategy. As a party to the CBD, the European Community developed and adopted, in 1998, the European Community biodiversity strategy (COM(1998)42 final). This document includes the following specific reference to IAS: "The presence or introduction of alien species or sub-species can potentially cause imbalances and changes to ecosystems. It can have potentially irreversible impacts, by hybridisation or competition, on native components of biodiversity. Applying the precautionary principle, the Community should take measures pursuing to prevent that alien species cause detrimental effects on ecosystems, priority species or the habitats they depend on and establish measures to control, manage and, wherever possible remove the risks that they pose".

The EC strategy is to be implemented through four sectoral action plans:
1) Conservation of natural resources.
2) Agriculture.
3) Fisheries.
4) Economic and development co-operation.

The plans also refer to the development of the Natura 2000 network and to the overall efficacy of the LIFE program.

*White-headed duck (*Oxyura leucocephala*).*

The IUCN/SSC Invasive Species Specialist Group

In 1993, in order to increase awareness of IAS and to create ways to prevent, control or eradicate them, a highly qualified group of more than 140 scientific and policy experts from 41 countries, the "Invasive Species Specialist Group" (ISSG), was established as a part of the Species Survival Commission of The World Conservation Union (IUCN/SSC). The activities of the group focus primarily on IAS that cause biodiversity loss, with particular attention to those that threaten oceanic islands, and its recommendations are directed especially at IUCN members, conservation practitioners, and policy-makers.

In collaboration with the IUCN Commission on Environmental Law, the ISSG prepared a document entitled "IUCN Guidelines for the Prevention of Biodiversity Loss caused by Alien Invasive Species".

Additional information on the activities of the ISSG and a number of relevant documents on IAS are available on the website www.issg.org.

The Global Invasive Species Program (GISP)

This innovative program was established in 1997.

The GISP mission is to conserve biodiversity and sustain human livelihood by minimizing the spread and impact of IAS through a "Partnership Network" that includes scientific and technical experts on IAS issues from around the world. GISP services are primarily intended to benefit developing countries and institutions that support sustainable development.

During GISP Phase I, the European Community supported the development of "A Guide to Designing Legal and Institutional Frameworks on Alien Invasive Species" (Shine et al., 2000).

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*The cottontail rabbit (*Sylvilagus floridanus*) is an American species introduced into northern Italy. It is the object of specific recommendations of the Bern Convention.*

The actions dealing with invasive alien species recommended in the "Conservation of natural resources" plan, include:

> updating of the list of alien invasive species that are known to pose an ecological threat to native flora and fauna, habitats and ecosystems within the EU;
> promotion of exchange of information regarding existing legislation, guidelines and experience, including measures to control or eradicate alien invasive species or prevent their introduction;
> development of international guidelines to address the problem of alien invasive species under the CBD.

2.1.2 The Bern Convention and the Council of Europe strategy

The "Convention on the Conservation of European Wildlife and Natural Habitats," was signed in Bern in 1979 by 45 contracting parties, among which the European Community. This agreement, managed by the Council of Europe, includes important provisions and recommendations dealing with alien species. In particular, according to article 11.2b, each Contracting Party undertakes "to strictly control the introduction of non-native species."

The Bern Convention has already adopted a wide range of provisions to help member states identify adequate management and control measures against IAS.

In recent years other recommendations have been adopted, especially those addressing native species threatened by IAS or IAS themselves and those on the eradication of non-native terrestrial vertebrates and on IAS threats to biological diversity on islands and other isolated ecosystems.

Under the Bern Convention, specialized groups of experts have prepared a number of technical documents and

*Tree of heaven (*Ailanthus altissima*).*

papers for the Council of Europe in order to promote sound implementation of provisions dealing with IAS (see for example deKlemm, 1996; Lambinon, 1997). Most significant documents are "Guidelines for eradication of terrestrial vertebrates: a European contribution to the invasive alien species issue" (T-PVS (2000) 65) and "Identification of non-native freshwater fish established in Europe, assessing their potential threat to native biological diversity" (T-PVS(2001) 6).

The document "Bern Convention action on invasive alien species in Europe" (T-PVS (2001) 10) underlines the importance of greater synergy between institutions, especially between the Convention and the European Commission, to harmonise legislation and programs on invasive alien species.

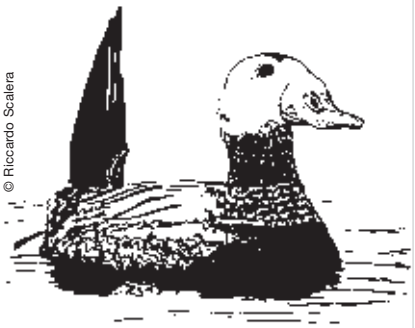
In 2003 the Council of Europe approved the "European strategy on invasive alien species" (T-PVS (2003) 7), which promotes the development and implementation of coordinated measures and efforts throughout the region to minimise the adverse impact of IAS on Europe's biodiversity, economy and human health and well being (Genovesi and Shine, 2003).

2.1.3 Other relevant international instruments

In addition to the Convention on Biological Diversity and the Bern Convention, the EU has ratified a number of other important international conventions aimed at nature conservation, which refer to alien species. These are:

> the Helsinki Convention on the Baltic Sea (1974),
> the Ramsar Convention on the Conservation of Wetlands (1971),
> the Barcelona Convention on the Mediterranean (1976),
> the Bonn Convention on Migratory Species (1979),
> the Convention on the Protection of the Alps (1991).

*The American ruddy duck (*Oxyura jamaicensis*) (from Scalera, 2001).*



The European Union and its Member States collaborate with a number of international bodies concerned with IAS issues. They include the following:

> European and Mediterranean Plant Protection Organisation (EPPO),
> Organisation International des Epizooties (for animal health),
> World Trade Organisation,
> International Civil Aviation Organisation,
> International Maritime Organisation.

Cooperation with these bodies is aimed at reducing risks associated with certain pathways as well as prevention and management of species. For example, the EU is actively cooperating with the International Maritime Organisation, to develop legal measures for ballast water management, and with the IPPC/EPPO (European Commission, 2003) to develop a work program on IAS, in particular plants, with the following objectives:

> definition of terms,
> collection of data,
> collection of information on existing control measures,
> preparation of pilot studies on recommendations to EPPO members on the eradication and containment,
> development of a common approach to weeds as quarantine pests or regulated non-quarantine pests, where appropriate,
> information services.

The EU is also engaged sub-regionally, for instance through regional seas instruments for the North-East Atlantic (OSPAR), Baltic Sea and the Mediterranean, which mandate prevention and management measures for marine introductions.

The UN Food and Agriculture Organization (FAO) has also elaborated specific document taking into account matters related to IAS, such as the "Code of Conduct for Responsible Fisheries" and the "Code of Conduct for the Import and Release of Exotic Biological Control Agents" both adopted in 1995.

2.2 EU legislation related to exotic species

In the European Union there is no specific legislation dealing with IAS. This might be also due to the consideration that, as reported by the European Commission (2003), such cross-cutting issues as IAS involve several sectors. They include nature conservation, trade, agriculture, fisheries, health and research.

Moreover up to now IAS issues have had relatively low visibility in the Community, especially outside specialist circles. Only in the last years, problems and risks associated to IAS have received greater attention. For instance, in 2001 the Commission has officially recognised IAS as an emerging issue (COM(2001)162 final). Alien species have been also taken into account by the March 2002 European Council of Environment Ministers as one of the main causes of biodiversity loss and serious damage to economy and health.

Even though there is no EU specific legislation addressing IAS, the wildlife trade regulations and the "Birds" and "Habitats" directives include provisions which address the risks of introduced species to native fauna and flora.

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*Introduced goats (*Capra hircus*) can turn green islands into desolated deserts, due to their voracious feeding habits. The species has been targeted by the Portuguese project "Measures for the recovery of the terrestrial habitat of Deserta Grande" (LIFE95 NAT/P/0125).*

The Convention on International Trade in Endangered Species of Wild Fauna and Flora

In 1973 a number of countries signed the Convention on International Trade in Endangered Species of Wild Fauna and Flora, also known as CITES. CITES is a complex and a continually evolving treaty, with a number of resolutions relating to its interpretation, definitions and application.

The enforcement of CITES is based on a complex administrative system which all parties must implement to regulate and control movement of species at international level. This system depends on the issue of import and export certificates provided that specific conditions are met, for example, after execution of adequate monitoring of trade both at entry points and in the wild.

This convention does not include any provision directly related to IAS. However CITES has recognized the importance of cooperation with the CBD on this topic and has shown increasing interest in IAS issues. For instance, Decision 11.64 on trade in alien species calls for the recognition that non-indigenous species can pose significant threats to biodiversity, and that fauna and flora in commerce are likely to be introduced into new habitats as a result of international trade. It urges Parties to consider the problem of invasive species when developing national legislation that deal with trade in live animals or plants (see for instance decision 11.100 and the minutes of the meetings of the Animal Committee).

2.2.1 The Regulation (EC) 338/97 on international wildlife trade

In order to protect endangered wildlife from unsustainable trade exploitation, the European Union has adopted a number of laws, generally known as wildlife trade regulations. These are mainly aimed at a sound implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), signed in Washington in 1973. Although not yet a party to the Washington convention, the EU has implemented the convention since 1984 through Council Reg-

*The American bullfrog (*Rana catesbeiana*), a species introduced in Europe as a pet species and for food. (from Scalera, 2001).*

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© Photo Riccardo Scalera

*Red–eared slider (*Trachemys scripta elegans*).*

ulation (EEC) No. 3626/82. Following the adoption of the single market in January 1993, which abolished trade controls between Member States, this regulation has been amended and updated by Council Regulation (EC) No. 338/97, currently amended by Commission Regulation (EC) No. 1579/2001 (Magel, 2002).

Wildlife trade regulations deal with imports and exports of wild animals and plants and their products to and from the EU, as well as commerce between and within Member States. All CITES provisions are incorporated in these regulations, in addition to other measures (for instance, inclusion of non-CITES listed species). These regulations also take into account the provisions of other EU directives, such as the "Birds" and "Habitats" directives, in order to be consistent with the EU nature conservation policy.

The wildlife trade regulations not only provide a basis for the implementation of CITES within the Community, but represents also the most effective legal tool for controlling imports of species that may become invasive. Specifically, Regulation 338/97 provides that the Commission may establish restrictions on the import of "live specimens of species for which it has been established that their introduction into the natural environment of the Community present an ecological threat to wild species of fauna and flora indigenous to the Community."

The American bullfrog (*Rana catesbeiana*) and the red-eared slider (*Trachemys scripta elegans*), are the only species for which import has been suspended (according to Commission Regulation (EC) No. 349/2003).

2.2.2 The EU Birds and Habitats directives

In 1979, the Council of the European Community adopted Directive 79/409/EC on the conservation of wild birds (also known has the "Birds" directive), which requires Member States to protect all bird species naturally occurring in the wild on their territory.

Article 11 of the directive states that "Member States shall see that any introduction of species of bird which do not occur naturally in the wild state in the European territory of the Member States does not prejudice the local flora and fauna."

In 1992, the European Union adopted the Council Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora, also known as the "Habitats" directive, with the aim of realising a network of protected areas, called Natura 2000, and maintaining habitats and species in a favourable conservation status.

Article 22 of the Habitats directive establishes that, for Member States, "the deliberate introduction into the wild of any species which is not native to their territory is regulated so as not to prejudice natural habitats within their natural range or the wild native fauna and flora and, if they consider it necessary, prohibit such introduction."

Moreover, according to article 6(3), "Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives." This provision should be applied also to activities involving the release, translocation or any other improper use of exotics affecting the conservation status of native species within a Natura 2000 site.

European case law on restricting movement of alien species (reported from the European Commission, 2003)

The European Court of Justice (ECJ) has considered the application of Art.8(h) of the Convention of Biological Diversity in the context of free movement of goods within the Community. Case C-67/97 concerned the keeping of a non-indigenous bee species on the island of Læsø (Denmark) and the protection of the brown bee subspecies *Apis mellifera mellifera* native to the island.

The European Court of Justice ruled on 3 December 1998 that a legislative measure prohibiting the keeping of any species of bee other than the native subspecies *Apis mellifera mellifera* on the island must be regarded as justified, under Article 30 of the EC Treaty (ex Article 36), with a view to protecting the health and survival of animals. It considered that measures to preserve an indigenous animal population with distinct characteristics contribute to the maintenance of biodiversity by ensuring the survival of the population concerned and are thus aimed at the protection of animal life.

From the point of view of such conservation of biodiversity, it is immaterial whether the object of protection is a separate subspecies, a distinct strain within any given species or merely a local colony, so long as the populations in question have characteristics distinguishing them from others and are therefore judged worthy of protection.

This case creates a precedent – at least in specific circumstances – for limiting the operation of the Single Market for reasons related to the protection of wild species and genetic diversity.

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*The European bee (*Apis mellifera mellifera*).*

The European Commission (2003) considers that this case law might, under certain conditions, also apply to territories larger than small islands such as Læsø, and is currently examining whether the principles established by the ECJ for small islands could be applied to all Member States.

There may be scope to apply this precedent to other alien species or subspecies that, once introduced to a given territory, are extremely difficult to contain and may have irreversible effects at the species or other genetic level. Such risks may come from, for instance, the introduction of alien crayfish, the use of live baitfish in wild or semi-wild fisheries without prior screening for suitability, and large-scale landscaping and replanting with non-native genotypes of plants.

2.2.3 Other relevant EU directives and regulations

Other EU directives and regulations exist concerning invasive alien species. For instance, having regard of the role of zoological gardens as a major pathway for the spread of exotics worldwide, a relevant measure is included in Council Directive 1999/-22/EC on the keeping of wild animals in zoos, which requires Member States to "prevent the escape of animals in order to avoid possible ecological threats to indigenous species and preventing intrusion of outside pests and vermin" (art.3).

As reported by the European Commission (2003), there are also a number of legal instruments which, although not directly addressed to nature conservation, prohibit or restrict imports of alien plant and animal species particularly in relation to agricultural pests and diseases affecting livestock and farmed fish. For these two categories, the Community has a comprehensive framework of laws and procedures that are harmonised with international phytosanitary and zoo sanitary rules.

© Photo Riccardo Scalera

*The grey squirrel (*Sciurus carolinensis*).*

3. LIFE contribution to the implementation of the CBD guiding principles

The LIFE program, which has been a testing ground for pilot actions aimed at the eradication and control of alien species, demonstrates that the threats posed by exotics can be addressed successfully within the Natura 2000 network, obtaining considerable results, particularly in isolated ecosystems and at the early stage of invasion.

3.1 The Natura 2000 network

The Birds and Habitats directives are among the main legal instruments for the conservation of wild threatened species and habitats in the EU. The main objective of the Habitats directive is the creation of a network of protected areas, called Natura 2000, aimed at ensuring that all fauna, flora and habitats listed in the two directives receive sufficient protection to guarantee their long-term conservation. Natura 2000 will include Special Areas of Conservation, classified under the Habitats directive, and Special Protection Areas, designated by the Member States pursuant to the Birds directive.

One innovation introduced with the Habitats directive is that the selection of sites is not linked to States boundaries, but to biogeographical regions: Alpine, Atlantic, Boreal, Continental, Macaronesian, Mediterranean and Pannonian (this last introduced in "The treaty to the accession to the European Union 2003"). A second innovative approach is that socio-economic realities within the sites are taken into consideration together with conservation values. The sites will not be nature sanctuaries: the preservation of biodiversity may require human activities compatible with the conservation aims of Natura 2000.

The realization of the Natura 2000 network is structured in three phases. During the first phase the Member

States identify a number of sites on the basis of the presence of habitats/species listed in the Habitats directive, to be proposed to the Commission as Sites of Community Importance (pSCIs).

In the following phase the Member States and the Commission, with the support of the European Topic Center on Nature Protection and Biodiversity of the European Environment Agency, verify the information and consolidate the national lists. After the Council of Ministers approval of all the biogeographical lists of sites, the Member States have six years to designate the pSCIs as Special Areas of Conservation and to gradually introduce the measures to conserve and manage the sites.

The Special Protection Areas, designated under the Birds directive, are incorporated into the Natura 2000 network from the time of their designation by the competent national authority.

Up to October 2003, 15,557 Sites of Community Importance have been proposed by Member States for inclusion in the Natura 2000 network and 3,200 Special Protection Areas have been designated.

Map showing the biogeographical regions of the European Union. It also includes those regions relative to the Accession Countries and the Candidate Countries (from European Environment Agency, 2003).

Regions
- Arctic
- Boreal
- Atlantic
- Continental
- Alpine
- Pannonian
- Mediterranean
- Macaronesian
- Steppic
- Black Sea
- Anatolian

3.2 The LIFE program

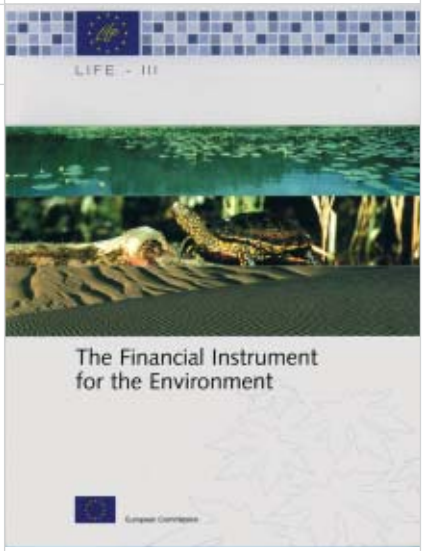
In 1992 the European Union established the Financial Instrument for the Environment, LIFE (Council Regulation (EEC) No. 1973/92) to contribute to the implementation and development of environmental policy and legislation.

This instrument, which consists of three branches, LIFE Nature, LIFE Environment and LIFE Third Countries, started its third phase (2000-2004) under Regulation (EC) No. 1655/2000, with a budget of 640 million Euros.

The three branches are very different from each other. The specific objective of LIFE Nature is to contribute to the implementation of the Birds and Habitats directives, and in particular, to the creation of the Natura 2000 network. It finances nature conservation projects to maintain or restore natural habitats and/or species populations to a favourable conservation status. LIFE also finances Co-op projects, aimed at effective co-operation and networking among LIFE Nature projects targeting similar nature conservation subjects or themes, and Starter projects in order to contribute to the preparation of international LIFE Nature proposals.

LIFE Environment finances demonstrative projects, which contribute to the development of innovative techniques for the protection of the environment.

LIFE Third Countries contributes to the creation of capacity building and



Brochure of the European Commission on the LIFE program.

to the development of environmental legislation in neighbouring countries of the EU and countries bordering on the Mediterranean and Baltic Sea.

A total of 1992 LIFE projects have been financed from 1992 to 2002: 665 LIFE Nature, including 4 Co-op and 12 Starter projects, 1,166 LIFE Environment and 161 LIFE Third Countries projects.

3.3 The LIFE projects dealing with invasive alien species

Many LIFE projects include actions dealing with the management of exotic species, although LIFE does not specifically address the problem.

Most of them are LIFE Nature projects: out of a total of 715 projects, funded since the start of the program, 102 include measures dealing with IAS (about 14 % of the total, Annexes 1 and 2). Alien species were also addressed by one LIFE Third Countries and six LIFE Environment projects (Annexes 3 and 4).

Of these 109 LIFE projects, 66 deal with plants, 31 with animal species and 12 address both (Fig.1). In total over 27 million Euros have been dedicated to reducing or eliminating the threats posed by exotics.

The high number of LIFE projects dealing with IAS in Italy and Spain (see fig.2) is related to the high number of projects proposed each year by the two countries anddoes not imply a greater perception of the problem. As shown in fig.3, the number of projects does not reflect the budget financed for actions aimed at IAS in each country, because the cost of projects and measures varies considerably from country to country.

Twenty-four projects deal almost exclusively with the eradication or control of alien species, including 20 financed by LIFE Nature and 4 by LIFE Environment (Fig.2, Annexes 1 and 3). The total budget of these projects amounts to 23.3 million Euros, with an EC contribution of almost 11.9 million Euros.

The other 83 projects aimed, at least in part, at alien species (see Fig.2) include various types of measures, often connected with restoration of habitats or recovery of species of EU interest. The minimum budget spent on actions dealing with exotics, which amounts to more than 4.3 million Euros, has been calculated for only 44 projects, due to the impossibility to extrapolate the expenses dedicated specifically to manage IAS, from figures related to actions aimed to other objectives.

The following pages review the main outcomes of LIFE projects dealing with IAS, in accordance with the Guiding Principles developed by the CBD.

The CBD guiding principles for the prevention, introduction and mitigation of impacts of alien species that threaten ecosystems, habitats or species are subdivided into four groups: general, prevention, introduction of species and mitigation of impacts.

Among the themes included in the general group of the guiding principles, developed in various degrees by

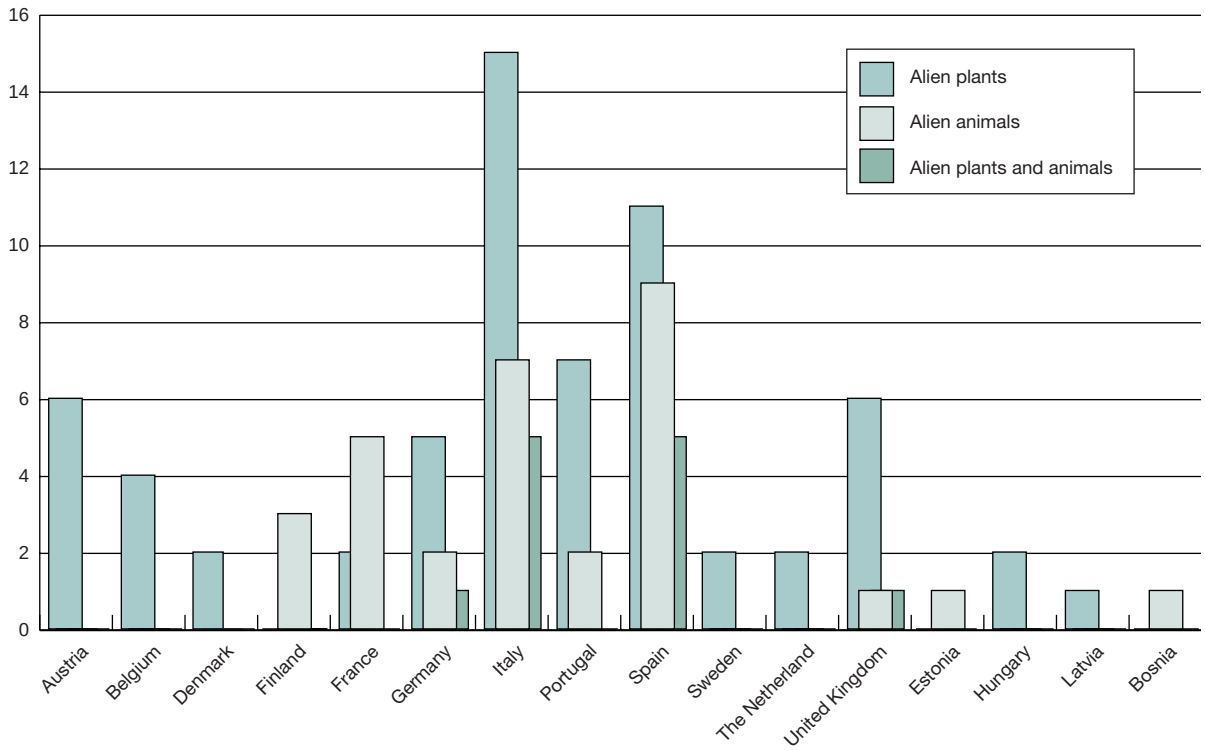


Fig.1 – *Number of LIFE projects addressing alien plants/animals in each European country from 1992 to 2002*

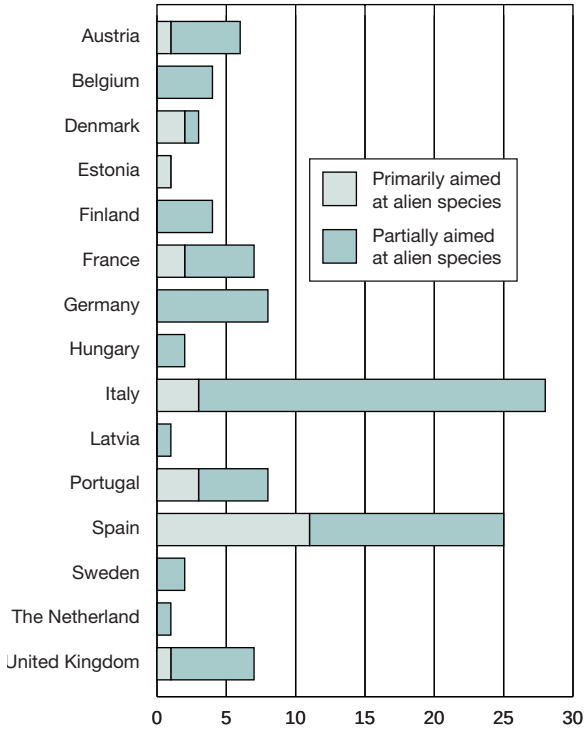


Fig.2 – *Number of LIFE projects addressing alien species from 1992 to 2002*

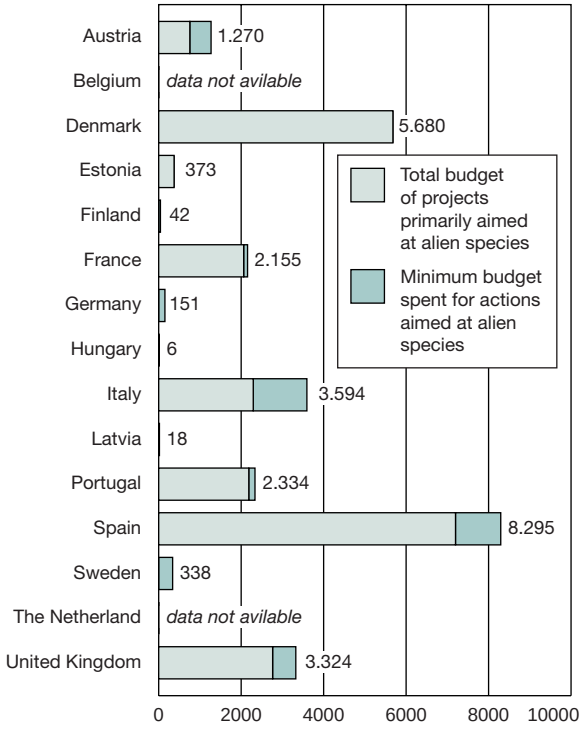


Fig.3 – *Budget dedicated to LIFE projects addressing alien species from 1992 to 2002 (thousands of Euro)*

LIFE projects, there are the ecosystem approach, the role of states, research and monitoring, education and public awareness.

LIFE gives a specific contribution to the principles concerning prevention and mitigation of impacts, the latter including provisions for eradication, containment and control.

The "lessons learnt" in implementing these projects (Annexes 1 and 4) represent an important contribution to:
> plan the actions to be envisaged within future projects dealing with alien species;
> support, the need be, the development of a EU strategy based on the Convention on Biological Diversity (CBD) guiding principles.

In addition to "lessons learnt" in relation to the CBD Guiding Principles, experiences from some LIFE projects dealing with measures accompanying the management of exotics are also taken into consideration.

3.3.1 General principles

Ecosystem approach

Article 2 of the CBD defines the ecosystem as a "dynamic complex of plant, animal, and micro-organism communities and their non-living environment interacting as a functional unit." An efficient approach to IAS cannot limit itself to an intervention on the single species but involves an integrated management of all components of the ecosystem, based on the most appropriate scientific methodologies and promoting, in parallel, conservation and sustainable use.

The ecosystem approach is implied in the spirit of LIFE Nature, the objective of which is "to maintain or restore the natural habitats and the population of species of wild fauna and flora at a favourable status."

All LIFE Nature projects are based on the ecosystem approach, the only one that can guarantee the long-term maintenance of natural biodiversity, favouring a greater resistance against the invasion by exotic species and/or a greater capacity of the ecosystem to recover after a biological invasion.

The ecosystem approach implies a strict co-operation between neighbouring administrative regions, as ecological boundaries rarely coincide with administrative ones.

This approach can help the application of a single strategy in managing IAS in the same ecological units. For example, between 2000 and 2002, four LIFE Nature projects were submitted for funding by four different Spanish public administrations. Their objective was to develop a collaborative framework to protect the only relatively healthy population of the native European mink (*Mustela lutreola*) in Western Europe. The main threat for this species is the spread of its (competitive) American relative (*Mustela vison*) in its distribution area, the medium and lower Ebro basin. The four projects (LIFE00 NAT/E/

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7331, LIFE00 NAT/E/7335, LIFE00 NAT/E/7299, LIFE02 NAT/E/8604) were financed and are today being managed in strict coordination to apply a common conservation strategy in the Ebro basin.

The international meeting "Vertebrados invasores en islas de España y Portugal," held in Santa Cruz de Tenerife on February 12-14, 2003.
Below. *Female American striped crayfish (*Orconectes limosus*) with eggs.*

The role of States

The management of IAS is a transboundary problem. This is particularly true within Europe, with its shared coastline, mountain chains and watercourses, where species introduced within the boundaries of one State can easily spread to neighbouring countries, without any respect of national administrative boundaries.

A prompt collaboration and exchange of information among States is therefore particularly important to identify pathways that enable exotics to spread over new territories and invade new areas within the European Union.

In 2003, following a symposium organised within the framework of the LIFE Nature Co-op project "Control of exotic vertebrates in Islands of Portugal and Spain" (LIFE02 NAT/CP/E/14), presidents of the governments of the autonomous regions of Madeira, Azores, Canary islands and Balearic islands signed a declaration for the development of a common adequate

The CBD guiding principles for the prevention, introduction and mitigation of impacts of alien species that threaten ecosystems, habitats or species

A General
1 Precautionary approach
2 Three-stage hierarchical approach
3 Ecosystem approach
4 The role of States
5 Research and monitoring
6 Education and public awareness

B Prevention
7 Border control and quarantine measures
8 Exchange of information
9 Cooperation, including capacity-building

C Introduction of species
10 Intentional introductions
11 Unintentional introductions

D Mitigation of impact
12 Eradication
13 Mitigation of impact
14 Containment
15 Control

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legislation to prevent further undesired introductions and to facilitate eradication and control actions.

Research and monitoring

The Habitats and Birds directives specifically require for research and monitoring of conservation status of native habitats and species. According to article 11 of the Habitats directive "Member States shall undertake surveillance of the conservation status of the natural habitats and species referred to in Article 2 with particular regard to priority natural habitat types and priority species." Moreover Article 18 foresees that: "Member States and the Commission shall encourage the necessary research and scientific work […] They shall exchange information for the purposes of proper co-ordination of research carried out at Member State and at Community level."
Research and monitoring are particularly important to tackle exotics. Their management requires a base of updated and comprehensive scientific and technical knowledge. Current knowledge is often inadequate to allow decision makers to adopt measures on invasive alien species.

LIFE does not finance projects based only on research. However, research activities are financed when connected with interventions in the field. In some cases important results on invasive alien species have been obtained. One of these is the LIFE Environment project "Expansion of the tropical green algae *Caulerpa taxifolia* in the Mediterranean Sea" (LIFE92 ENV/F/0066, LIFE92 ENV/E/0067 and LIFE92 ENV/IT/0068), directed at algae that represent one of the main threats for the *Posidonia oceanica* beds, a Community important habitat. The area of distribution of the seaweed in the Mediterranean Sea was determined and secondary metabolites that play an important role in the competitiveness of the Caulerpa to indigenous species have been identified. The main conclusion of the project was that the eradication of the seaweed is no longer feasible in the Mediterranean basin.

Above. *Removal of exotic crayfish from a tributary of the Ticino River in Northern Italy.*
Below. *Exotic crayfish captured with a trap.*

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The project "Control of the *Caulerpa taxifolia* extension in the Mediterranean Sea" (LIFE95 ENV/F/782), involved eighteen partners, including national and regional governments. In this project methodologies of description and identification of *Caulerpa* were standardised. Various techniques for the control of the seaweed were developed, tested and proposed at the local, regional and international level. On the basis of surveys of sensitive areas and Natura 2000 sites, realised to monitor the spread of the so dubbed "killer alga" and to discover new populations, a mathematical model of the spread of *Caulerpa* and a strategy for its control in the entire Mediterranean Sea were developed.

Monitoring, which is carried out by a great number of LIFE Nature projects, is a key tool for a prompt detection of the presence of new exotic species. Today discovery of new species often depends on occasional reporting by specialists (naturalists, birdwatchers, botanists, etc…) or non-specialists connected with other fields of activity (agriculture, forestry, fishing, etc.).

A project that achieved significant results on exotic species, as a consequence of monitoring activity, is "Conservation of *Austropotamobius pallipes* in two pSCIs of Lombardy"

12/LOCAL

Martes, 4 de noviembre de 2003 / Ultima Hora Menorca

130 voluntarios participan en las tareas de erradicación del 'carpobrotus edulis'

La iniciativa, en el marco del Programa Life, limpia una zona de 10.000 m² invadida por la 'patata frita'

La buena respuesta a la iniciativa del Consell de Menorca en el marco del Programa Life tendrá continuidad con próximas jornadas

Las plantas recogidas fueron trasladadas a la planta de Milà para su transformación en compost

Erradicación de la planta invasora en la costa menorquina

(LIFE00 NAT/IT/7159). A map showing the distribution of all crayfish species found on a wide geographic area is being realised. Surveys already carried out lead to the discovery of at least three exotic species, namely the red-swamp crayfish (*Procambarus clarkii*), the American striped crayfish (*Orconectes limosus*) and the Turkish crayfish (*Astacus leptodactylus*), together with a number of sites hosting remnant populations of the native white-clawed crayfish (*Austropotamobius pallipes*). The data collected are being used to establish the best management option for a proper conservation strategy for the native species, to be reintroduced in two protected areas.

Education and public awareness

According to the European Community (2003), the threats posed by invasive alien species "have low visibility outside the specialist circles" and citizens, key sectors groups and decision makers have only a limited perception of the problem. Education and public awareness campaigns are therefore extremely important for a successful management of the problems associated to the introduction of exotic species. In this context, LIFE offers the best opportunities to raise public awareness, since all projects include a specific section on public awareness and dissemination of results.

Awareness raising campaigns may be essential activities not only for preventing new invasions of exotic species but also for ensuring public support on eradication and control programs. Spread of information addressing stakeholders and other involved targets (i.e. traders, farmers, gardeners, tourist associations, etc.), could give an important contribution stimulating, for example, voluntary collaboration.

Leaflets and brochures are among the most popular products realised for this purpose. A relevant example is the Spanish project "Conservation of the threatened freshwater mussel (*Margaritifera auricularia*) in the River Ebro (Catalunya)" (LIFE00 NAT/E/7328). During its implementation, a new population of the alien zebra mussel (*Dreissena polymorpha*), a famous invader, was discovered accidentally. Although the project did not include any action aimed at exotics, this discovery led to the realisation of a leaflet on the threat posed by *Dreissena*, produced as a contribution to the prevention of its spread. The leaflet furnishes indications on boat maintenance to avoid the spread of the exotic mussel.

Consensus and cooperation are important in particular when the species

Above. *The eradication of the fig marigold (*Carpobrotus edulis*) was carried out during the LIFE Nature project "Conservation of areas with threatened flora on the island of Minorca" (LIFE2000 NAT/E/7355). Numerous volunteers were involved in the project as a result of the intensive awareness campaign.*
Right. *The leaflet published to stop the spread of the zebra mussel (*Dreissena polymorpha*) in the Ebro river basin.*

The leaflet on the need to control rodents and cats in the Canary Islands produced during the project "Restoration of the islets and cliffs of Famara (Lanzarote Island)" (LIFE99 NAT/E/6392).

is present in more than one country. The LIFE Environment project "Control of the *Caulerpa taxifolia* extension in the Mediterranean Sea" (LIFE95 ENV/-F/782), included an even wider information campaign. One of the aims of the project was to inform governments and all involved sectors (i.e. fishermen, divers, pleasure craft crews) on the need to contrast the invasion of *Caulerpa*. A video, multilanguage leaflets and posters have been produced and distributed in eight Mediterranean countries (Spain, France, Italy, Malta, Croatia, Tunisia, Algeria and Turkey). The effectiveness of this campaign was remarkable: tourists and residents contributed to the discovery of new colonies of Caulerpa, which were removed, slowing-down the spread of the "killer algae" in the Mediterranean sea, now recognised as a pest to be eliminated.

Awareness raising campaigns may also be useful in changing public perception of exotic species. Public consultation with local communities and stakeholders, so as to solve in advance potential misunderstandings and disagreements, is strongly

General principles: lessons learnt

> To overcome possible disputes and conflicts between States or subnational regions, inter-jurisdictional management agreements and other measures to operate cross-sectorial integration should be encouraged, as in the case of the four Spanish projects aimed at saving the European mink (*Mustela lutreola*) and the LIFE Nature Co-op project "Control of exotic vertebrates in Islands of Portugal and Spain".

> Research on IAS ecology and biology, including status, distribution, history and population trends, should be supported. Research should include assessment of the impacts of IAS on the ecosystems and on the socio-economic sectors. Information exchange and consultation among specialists on alien species should be promoted.

> Regular monitoring of areas vulnerable to invasion (Natura 2000 sites, islands, isolated ecosystems, protected areas) should be implemented. In the project "Conservation of the threatened freshwater mussel (*Margaritifera auricularia*) in the River Ebro (Catalunya)" it allowed the unexpected discovery of a new harmful exotic species.

> Regular updating of scientific data and local knowledge should be promoted in order to raise public awareness and to support decision-makers in adopting prompt actions in response to IAS emergencies.

> The involvement of stakeholders on containment and control programs should be envisaged in order to enhance the possibility to afford the high and recurrent costs of these management options and to reach effective results.

> Awareness raising programs and regular information for the public should always be considered an integral part of any eradication or control project. Public awareness, even though an essential part of the LIFE projects, often does not specifically cover the IAS issue. The need to raise awareness on exotic species should be taken into account within all projects aimed at the development of the Natura 2000 network. Due to the importance and the generalized lack of knowledge on alien species, projects should also be encouraged to include a more detailed analysis of the sites interested by the project. The LIFE Environment project "Control of the *Caulerpa taxifolia* extension in the Mediterranean Sea" (LIFE95 ENV/F/782), furnishes a good example of the usefulness of a well managed public awareness campaign.

> Information campaigns on IAS issues should be promoted for different target audiences (general public, students, stakeholders, local authorities, government agencies). Information materials to assist farmers, gardeners, birdwatchers, foresters, fishermen, hunters, divers, hikers and photographers in detecting the establishment of new alien species, should be prepared.

© Photo Daniela Zaghi

Silene hicesiae *is a small flower endemic of the Aeolian Islands, which is threatened by intentionally introduced exotic plants.*

recommended to allow for a rapid and effective implementation of the management actions. Public opposition could cause significant delays in the management of undesirable IAS. A well-known case study is the block of the eradication of the grey squirrel in Italy due to strong local opposition (Genovesi and Bertolino, 2001). As a result the species can no longer be removed from the area.

3.3.2 Prevention

"An ounce of prevention is worth a pound of cure".

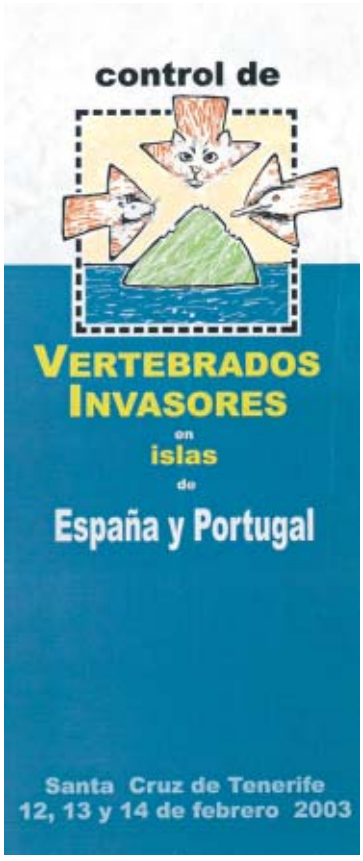
The protection of the environment is best achieved by preventing environmental harm rather than by attempting to remedy or compensate for the damages (McNeely, et al., 2001). Prevention is therefore the first line of defence, as suggested by all international instruments dealing with IAS.

Prevention, as referred to in the CBD guiding principles, includes:

a) Border control and quarantine measures.
b) Exchange of information.
c) Cooperation, including capacity-building.

LIFE, which is aimed at containing and eliminating actual and not potential threats to habitats/species, has not funded projects addressed specifically at the prevention of invasive alien introductions. However, there are prevention measures, other than those dealing with awareness raising (see previous paragraph), which have been included in a number of LIFE projects. A major example of the implementation of the CBD principles is found in the Spanish LIFE Nature Co-op project "Control of exotic vertebrates in Islands of Portugal and Spain" (LIFE02 NAT/CP/E/14), which includes actions aimed at promoting exchange of information through the organisation of an international symposium, the realisation of a guide on management techniques for invasive vertebrates, and the establishment of a network to share updated information on exotics and their management.

One of the outcomes of the Italian LIFE Nature project "EOLIFE99 – Conservation of priority plant species in Aeolian Islands" (LIFE99 NAT/IT/6217), aimed at four endemic plant species of Community interest, was the inclusion of specific measures to avoid intentional introductions of exotics in the species management plans. The Lipari municipality, beneficiary of the project, issued an ordinance to ban the introduction of exotic animals and plants in the entire archipelago.



The invitation to the meeting organised within the Spanish Co-op project.

Similar results were obtained with the LIFE Third Countries project "Development of a new management policy for the Hutovo Blato wetlands, Bosnia-Herzegovina" (LIFE99 THC/BIH/0035). Its main objective was the drafting of a new Cantonal and State law, including specific indications for the control and elimination of non-native, invasive fish species, within protected areas.

© Photo Riccardo Scalera

Strombolicchio, the islet close to Stromboli, in the Eolian Archipelago, where the introduction of alien species has been avoided thanks to the LIFE project "Eolife99".

Case study

Measures for the management and conservation of the laurel forest of Madeira (LIFE97 NAT/P/4082)

One cannot blame the Madeiran people for having been seduced by the stunning ornamental Kahili ginger (*Hedychium gardnerianum*) with its large, vividly coloured inflorescence, and adopting it in their gardens back in 1934. They are regretting it, though, since it is now running wild in Madeira's forests, choking the native vegetation. The true home of *Hedychium gardnerianum* is the foothills of the Himalaya but this big plant - over 1 m tall – now forms vast, dense colonies across the lower border of the Madeiran mountains, displacing the native species of the macaronesian laurel forest – a priority habitat according to Habitats directive. It propagates by stolons where already established, while fleshy, red seeds are dispersed by frugivorous birds. Even small (1 cm) root fragments will regrow.

In 1997, a LIFE Nature project was funded to the Madeira Natural Park to control this incredibly aggressive species and raise public awareness towards the problem of species introduction into islands. Although the surface covered by the invasive plant increased dramatically between the preparation of the LIFE proposal and the beginning of the project - from 150 ha to more than 200 ha – a total of 165 ha were worked on, meaning 850 tons of plant material removed. The results were incredible as the removal was done manually, the only way to prevent small pieces of rhizome from being left behind and re-growing. Eradication was achieved inside the forest and in key areas near it, forming a kind of "cordon sanitaire". The project hired several rural workers and had the support of the army for the plants' removal. Farmers owning land plots near the cordon sanitaire were encouraged to cultivate them after a first exotics removal by the natural park, under the compromise to fight back any natural re-sprouting. Plant remains were composted and the resulting fertiliser given out to local farmers.

This doesn't mean that when the project ended, in January 2000, the work was to be considered finished. Far from it. With such aggressive species, a continuous monitoring and control is needed. This is being achieved with the integration of three of the LIFE project workers in the Park's staff to form an exotics prevention team and permanent agreements with the army - that guarantees the assignment of a brigade of twelve men to the field work once a week – and the Centro Ocupacional do Funchal, a local institution that organises activities for disabled young people – which assigns ten people to the field work once a week.

Prevention: lessons learnt

> Local and regional rules to prevent introductions in particularly vulnerable areas (e.g. archipelagos, isolated ecosystems, biodiversity hot spots, protected areas) should be developed. Legal base to forbid the entry of IAS should be provided, as in the case of the Aeolian Islands LIFE project.

> Sites management plans and species action plans should include, when appropriate, measures directed at preventing IAS introductions.

> Capacity-building programs should be promoted for training personnel to be used for early detection, following the example of the LIFE project funded in the Madeira Natural Park.

> Exchange of information among administrations, particularly those in similar biogeographical and climatic conditions, should be encouraged to identify and address risks, provide feedback and, as appropriate, support capacity-building for prevention and risk assessment.

3.3.3 Eradication

Eradication is the most effective solution in terms of biodiversity conservation, and when carried out successfully, it is more cost-effective than control, which requires continuous expenditures over a long period of time.

This management option is used in LIFE more for plants than for animals, probably because the definitive removal of plant species is perceived as more feasible and achievable within the average LIFE project time length. One example is the LIFE-Nature project "Restoration of alluvial woods in the Ticino Park", (LIFE97 NAT/IT/4134) which took place in Northern Italy. The American cherry (*Prunus serotina*), the false acacia (*Robinia pseudacacia*), the tree of heaven (*Ailanthus altissima*) and the red oak (*Quercus rubra*) were eradicated from a wide surface of forest habitat of Community interest.

In general, no eradication project should begin unless a specific assessment study has shown its technical and financial feasibility. In the case of the Italian project "Palata Menasciutto – management and conservation of wet woodlands" (LIFE99 NAT/IT/6253), the eradication of black bullhead (*Ictalurus melas*) and pumpkinseed sunfish (*Lepomis gibbosus*), two fish species introduced from North America, was considered no longer feasible after the start of the activities. The eradication was not possible because the water bodies hosting the two species were lying too close to a river course, and floods, which occur periodically in that area, would have brought about a natural re-colonisation. Another constraint was the lack of species-specific eradication techniques to be applied to fish.

Eradication is likely to be even more difficult in marine environments, as shown by the international LIFE Environment project "Expansion of the tropical green algae *Caulerpa taxifolia* in the Mediterranean Sea" (LIFE92 ENV/F/0066, LIFE92 ENV/E/0067 and LIFE92 ENV/IT/0068). The main difficulties of eradication were due to the lack of biological barriers in the marine environment and to the difficulty of implementing the physical removal of the *Caulerpa* beds underwater. This kind of eradication is in general only possible in extremely rare conditions that allow the treatment of an extre-

*Removal of the American cherry (*Prunus serotina*) along the Ticino River (*above*), and panel informing on the works being carried out in the project site (*below*).*

mely isolated population in restricted areas.

As a general rule, eradication is considered to be feasible in the early stages of invasion, when populations are small and localized, and only in areas of manageable size, such as small islands or other isolated ecosystems, which should be considered priority areas for this type of intervention. Successful results have been obtained in Italy: black rats (*Rattus rattus*) and trees of heaven (*Ailanthus altissima*) have been eradicated from some islands of the Tuscan archipelago through the LIFE Nature project "Protection of biodiversity in Capraia and other minor islands in Tuscany" (LIFE 97 NAT/IT/4153). The removal of rats had an immediate positive effect on the reproductive performance and on the population size of one important colony of Cory's shearwater (*Calonectris diomedea*), a bird listed in the Birds directive's annexes.

In addition to a sound feasibility study, a successful eradication campaign requires coordination among all administrations with competence on the territory, to avoid that other interventions not coherent with the objectives of the project are carried out in the same area.

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Above. *Scuba diver removing the killer algae (*Caulerpa taxifolia*).*
Below. *A view of Mediterranean maquis in the Capraia Island after the removal of the tree of heaven (*Ailanthus altissima*).*

© Photo Regione Toscana

The Italian project "Protection of biodiversity in the Tuscan Tiber valley" (LIFE98 NAT/IT/5125), to mention one specific example, included actions to remove the maritime pine trees (*Pinus pinaster*) translocated between 1920 and 1970 by the national forestry administration and used for reforestation. The lack of preliminary consultation with the Forestry Corps, at the planning phase of the activities, did not allow for the total removal of the species, since the only measure permitted was selective felling of the trees. However, after negotiations, the Forestry Corp agreed to continue the action also after the end of the project, so as to obtain complete removal.

Also the Austrian project "Pannonian Sanddunes" (LIFE98 NAT/A/5418) shows that the removal of exotic trees, which is the objective of many LIFE Nature projects, is not always an easy task. The project was aimed at the last relict dunes in Austria, which were "blocked" by the pines placed by forestry administration during various reforestation campaigns and by the alien plants, such as the tree of he aven (*Ailanthus altissima*) and the false acacia (*Robinia pseudoacacia*), that invaded the dunes. The national forestry laws were the main constraints to the project, forbidding the removal of exotic trees, especially those used during the twentieth century in reforestation programs.

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Eradication: lessons learnt

> Eradication of invasive alien species is more likely to succeed in islands and isolated ecosystems.

> Total removal of exotics should be taken into consideration only where measures are most likely to be successful.

> Sound feasibility studies should be always carried out before any eradication program. This approach would avoid a project failure due to the impossibility to remove certain species both for ecological and financial reasons. Feasibility studies should take into account the efficacy of the interventions, the possible effects on native species and ecosystems, and the potential risk of re-invasion.

> Contingency plans for the eradication of specific taxa should be elaborated. Specific monitoring actions should be implemented to verify the success of the eradication and the eventual need of corrections.

> Any eradication program should be supported by the authority competent for the management of the area and should be developed according to an appropriate spatial-temporal scale.

> Local and national legislation dealing with the management of alien species should be reviewed, on the basis of experience acquired, to verify if it can be improved.

3.3.4 Containment

Containment, limiting the spread and keeping the IAS within regional barriers, especially when eradication is no longer feasible, is an appropriate strategy where the range of the population is small enough to achieve a significant result.

Spread of IAS in suitable habitats can be avoided through natural or artificial barriers and exclusion fencing can be an effective control measure in some circumstances. One example is that of the project "Conservation of habitats and species of the pSCI Bosco della Mesola" (LIFE00 NAT/IT/7147). In order to protect a lowland forest grown on fossil dunes from the 15th century, the exotic fallow deer (*Dama dama*) population was contained in temporary enclosures. This species inhibits the natural renovation of the forest, threatening the precious native population of Hermann's tortoise (*Testudo hermanni*) occurring in the area and the last native population of red deer (*Cervus elaphus*) of the Italian peninsula. A sound control campaign associated with containment reduced the risk of expansion of the exotic species beyond the containment zone.

Above. *The fallow deer (*Dama dama*) (from Scalera, 2001).*
Below. *The Hermann's tortoise (*Testudo hermanni*).*

© Photo Guido Ceccolini

Rhododendron ponticum is one of the main invasive alien plants in the United Kingdom. It has invaded several environments and habitats protected under the Habitats directive. Total eradication of this species is no longer feasible in the country. However, the LIFE Nature project, "Restoration of Atlantic Oakwoods" (LIFE97 NAT/UK/4244) achieved the total removal of this species from one Natura 2000 site. To maintain this result, the main problem was the massive presence of rhododendron in the area surrounding the Natura 2000 site and the popularity of this plant in local gardens, potential sources of reseeding. To solve these problems the project manager decided to create a buffer zone, a "cordon sanitaire", which proved to be successful to avoid the reinvasion of rhododendron. The same

Case study

Restoration of the islets and cliffs of Famara (Lanzarote Island) (LIFE99 NAT/E/6392)

Island ecosystems are particularly sensitive to the intentional or accidental introduction of exotic species. Feral cats and dogs, rats, mice, rabbits are among the most harmful, since they behave as predators or opportunistic invaders of habitats that have evolved without them.

In the Canary Islands, LIFE Nature has financed one successful experience of alien species' eradication, which can be deemed as exemplar and somehow pioneering. The formerly unspoiled islets of La Graciosa, Alegranza and Montaña Clara hosted vigorous populations of rabbits, native only to southern Spain and probably established since the early arrival of the Spanish people in the XVI century. Also populations of feral cats, rats and the false tobacco (*Nicotiana glauca*, native to South America) remained in the islets as witness to human presence in these pristine environments.

While rabbits were threatening unique plant communities (14 endemic to Lanzarote and 38 to the Canary Islands, and four plant species whose conservation is considered a priority under the Habitats directive), feral cats and rats played their role as the most reputed predators for vertebrate communities. Resident and migratory birds and endemic mammals and reptiles were put at risk of extinction.

Above. *A view of Famara (Canary Islands).* Below. *The brown rat (*Rattus norvegicus*) (from Scalera, 2001).*

The objective of the LIFE Nature project was to improve the conservation status of this archipelago, a marine-terrestrial Natura 2000 site, by controlling invasive alien species in two islets, using "clean" methods. Intensive trapping campaigns were undertaken using only methods aimed at reducing damage to local species and negative effects over the ecosystems. The full eradication of exotic rabbits in "Montaña Clara" islet (1 km^2) meant a pioneer work worldwide for islands of comparable size, and the control carried out in the "Alegranza" islet (12 km^2) showed that, while initially considered impossible, tackling such problem in medium-sized islets is feasible.

After achieving the main objective with the rabbit, further control measures were carried out, aimed at the eradication of feral cats, rats, and the false tobacco. As a result, alien species were virtually removed from the islets and the local habitats and species immediately started to recover. To ensure that the results of these works be long lasting, the beneficiary established a permanent monitoring system, and designed a prototype mechanism to avoid the invasion of rats from boats, which was being tested when the LIFE project finished.

The experience acquired through LIFE shows that new methodologies, improved expertise among wildlife managers and the increased share of information are providing excellent new opportunities to combat alien species.

approach has been used in the Portuguese LIFE Nature project "Measures for the management and conservation of the laurel forest of Madeira" (LIFE97 NAT/P/4082) to safeguard the Macaronesian laurel forest, where local farmers were involved in the cultivation of a cordon sanitaire to keep it free of exotic species.

A special form of containment is the removal of the undesired species from the wild and its control in a dedicated site. Within the Spanish project "Restoration and integrated management of the Island of Buda" (LIFE96 NAT/E/3180) two palm species, *Phoenix* sp. and *Washingtonia* sp., have been removed from a Natura 2000 site and placed in a public garden in a urban area next to the Buda Island. This has brought the support of the local community.

Mechanical removal of flowering Rhododendron ponticum.

Containment: lessons learnt

> LIFE projects have demonstrated that containment in limited areas, such as Natura 2000 sites, is an efficient tool to manage alien species.

> Specific monitoring actions should be implemented to verify the success of the intervention.

> Specific management plans, based on ecological research, regular monitoring, public consultation and careful coordination, should be realised.

Case study

Managing rhododendron in the UK

Rhododendron (mainly *Rhododendron ponticum*) was introduced to many parts of the British Isles in the 18th and 19th centuries to private estates, parks and woodlands (for game cover) mainly from Spanish stock. It was known in the wild by the late 19th century and spread widely in the 20th century. Its distribution is now considered stable. The species regenerates freely from seeds, suckers and rootlets and has spread to native woodland, heaths, bogs and sand dunes on a wide range of damp acid substrates.

One of the problems with rhododendron has been its popularity as a colourful addition to wild places and by the time it has been generally accepted that control is required there is often a huge task to be carried out at a landscape scale. This is where the input from a fund such as LIFE Nature has been particularly useful. It has enabled a number of projects to be carried out in England, Scotland and Wales to tackle the backlog of work and to establish funding mechanisms that can be used for ongoing control.

The focus of the LIFE-funded projects has been to eradicate rhododendron from the core Natura 2000 areas, to provide a cordon sanitaire around these special sites and to work with private landowners and communities to seek their support for a coordinated programme.

The techniques employed involve the whole-scale removal of the plants (by mechanical and manual clearance), burning the material, removing rootmats to expose fresh soil and controlling re-growth with herbicides. Rhododendron is poisonous so grazing animals cannot control it.

The "Restoration of Atlantic Oakwoods" project (LIFE97 NAT/UK/4244) undertook the large-scale removal of rhododendron from woodlands at Loch Sunart on the west of Scotland. Although the LIFE project could mobilise private landowners (by covering 95% of the costs) the necessary ongoing maintenance looked uncertain until, largely through the work of the project, a funding package was included in the Scottish Forestry Grant Scheme. Higher payment rates are also offered for work within Natura 2000 sites. A follow-up project in Loch Sunart notes that whilst the earlier work has been largely successful it would be too early to consider the problem solved. Until all sources of seed are tackled the threat of reinvasion will remain and not all landowners wish to support the eradication programme. The UK project "Safeguarding Natura 2000 rivers in the UK" (LIFE99 NAT/UK/6088) was in a similar situation when trying to persuade landowners to remove rhododendron from riversides in North West Scotland.

In the New Forest National Park over 110 ha of rhododendron were cleared from heaths and woods where it was forming a "rhododendron-forest", thanks to the project "Securing Natura 2000 objectives in the New Forest" (LIFE97 NAT/UK/4242). The completed work will require constant vigilance to ensure that any new growth is tackled in time. Again, the project faced the problem of rhododendron's popularity as a garden plant and even had to replant a section of ornamental rhododendron hedge which was damaged in the clearance work! Rhododendron will remain a problem in and near Natura 2000 sites until there is a general change in attitude and the promotion of, for example, the planting of dwarf sterile *Rhododendron* hybrids.

3.3.5 Control

The aim of control is to reduce density and abundance of an exotic species to keep its impact to an acceptable level (Genovesi and Shine, 2003). Effective control may be achieved through a range of integrated management techniques, including mechanical, chemical and biological control. Control methods should be selected taking into consideration efficiency, selectivity and the undesired effects they may cause and in accordance with Community regulations and codes.

Many LIFE projects include actions to control harmful populations of IAS threatening species listed in the Birds and Habitats directives. Once the exotic species targeted has been weakened, the native species affected can generally regain ground, sometimes even reducing the abundance of the exotic species and leading to its extinction.

LIFE projects relevant in this context are those dedicated to the conservation of the European mink (*Mustela lutreola*) in the La Rioja, Álava and Castilla and León regions in Spain (LIFE00 NAT/E/7331, LIFE00 NAT/E/7335, LIFE00 NAT/E/7299). These projects are making great efforts to save the native populations of the European mink found in the area, from the threat represented by the American mink (*Mustela vison*). Annual control campaigns are being carried out along the Ebro river and its tributaries, significantly reducing the American mink population.

The Italian LIFE Nature project, "Bosco Fontana: urgent conservation actions on relict habitat" (LIFE99 NAT/IT/6245), aimed at the conservation of the residual alluvial forests of *Alnion glutinoso incanae* invaded by the American oak (*Quercus rubra*), used a singular control technique. The exotic plants were not removed but were "killed" through different methods that ranged from the use of explosives to the ring bark-

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Above. *A view of the Ebro river delta, targeted by four LIFE Nature projects.*
Below. *Capture of the American mink (*Mustela vison*) in the Ebro basin.*

© Photo Bosco Fontana Nature Reserve (CNBF)

*The use of explosives to eradicate exotic trees (*above*) created new ecological niches for saproxylic fauna of EU importance, such as the stag beetle (*Lucanus cervus*) (*right*).*
Below. *The placing of traps to eliminate the rats in Tenerife (Canary Islands).*

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ing of trees. The dead trees were then left on site. This methodology differs from the one used normally, which consists in cutting and removing the plant, leaving open gaps in the woodland. The results of the ecosystem approach used in the project were not only the control of the exotic species, but also the improvement of the conservation status of the forest and the increase of dead wood favouring the saproxylic fauna that depends on them.

A good example of how exotic fish species might be controlled, considering that, as specified above, eradication is almost impossible, comes from the Italian LIFE Nature project "Conservation of *Salmo marmoratus* and *Rutilus pigus* in the Ticino river" (LIFE00 NAT/IT/7268). The project was aimed at the reintroduction of the endangered marble trout (*Salmo marmoratus*) and the Danube roach (*Rutilus pigus*), in a stretch of the Ticino river where the exotic Wels catfish (*Silurus glanis*) has been introduced. The reintroduction program would not succeed without prior reduction of the population density of this exotic predator. For this reason periodical removal is being carried out through electro-fishing, particularly in stretches along the river where high density of Wels catfish were observed. The density of this undesired alien species is being controlled with a limited use of financial resources.

Control operations can also be carried out correctly without obtaining significant results. As in the case of the LIFE Nature project, "Increase in the size of *Columba bollii* and *Columba junoniae* populations" (LIFE96 NAT/E/3095), where the elimination of rats from the slopes of Tigaiga Mountain, in Tenerife (Canary islands), did not result, for unknown reasons, in an improvement of the breeding success of pigeons. This should not be considered as a failure of the project. The elimination of rats, with no significant negative impact on other species and on the ecosystem, has removed one of the main known cause of the low breeding success of the pigeons. The poisoning method used in the successful elimination of rats, based on the utilization of security bait-boxes to avoid consumption or extraction by other species, should be promoted and could be used to eradicate rats in particularly sensitive areas.

To be successful the methods applied should be socially, culturally and ethi-

cally acceptable. The Spanish project "Recovery Plan of *Puffinus puffinus mauretanicus* in SPA (Balearic Islands)" (LIFE97 NAT/E/4147), included an action aimed at the control of cats and rats, two of the main threats to the Balearic shearwater. Adverse public opinion affected the elimination of cats. A compromise was negotiated which allowed for the capture of cats and their sterilization. But this did not remove the threat: the shearwater population continued to decrease, due to cat predation. The situation was different for rat control, which did not encounter any opposition.

One-way to obtain consensus and raise awareness on the actions carried out, may be to involve local communities, either creating new employment or on a voluntary basis. Within the project "Management of the most valuable wetlands in SW Finland" (LIFE99 NAT/FIN/6278), the non-native American mink (*Mustela vison*) and raccoon dog (*Nyctereutes procyonoides*) have been hunted systematically with the collaboration of local hunting associations, reconciling the needs of nature conservation, fishing and hunting.

*Wels catfish (*Silurus glanis*), removed from the Ticino River through electro-fishing (*top*), were measured (right) and their stomach contents analyzed (*above*) to study their impact on indigenous fauna.*

Caccia al pesce siluro, killer dei fiumi

Sul Ticino la campagna finanziata dalla Ue per limitare la diffusione del gigante venuto dall'Est

L'ESPERTO

«Pericolo anche dalla trota fario»

Un predone di cinque metri

Left. *Control of the Wels catfish (*Silurus glanis*) in a newspaper.*
Centre. *The American mink (*Mustela vison*).*
Below. *The Balearic shearwater (*Puffinus puffinus*).*

The main constraint of control operations, as opposed to eradication, is that they are to be considered as recurring activities. Since they do not foresee the complete and definitive removal of a species, but only the diminution of the population level to an acceptable threshold, they are reasonable only if there are sufficient financial resources to maintain the results obtained over an extended period of time.

Many LIFE projects started control measures which were continued by administrations responsible for the sites or by local stakeholders. As an example, the LIFE Nature project "Rhön Biotope region - Building Block for Natura 2000" (LIFE98 NAT/D/5064) activated actions aimed at the control of non-native pine trees, placed under past reclamation efforts, and the lupine (*Lupinus* sp.), introduced in 1942 for production purpose. At the end of the project, the local forestry administration continued the removal of the pines while local farmers controlled through grazing the spread of the lupine.

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A view of the Harris and Lewis Islands (UK).

Case study

Mink control to protect important birds in SPAs in the Western Isles (LIFE00 NAT/UK/7073)

The remote Western Isles of Scotland (Lewis, Harris, North Uist, Benbecula, South Uist and Barra) are one of the most important bird sites in Europe. The absence of predators has allowed ground-nesting birds (for example, terns, corncrake, dunlin, ringed plover, lapwing and divers) to nest undisturbed on the extensive farmland, coasts, lochs and moors. However there is now a particularly serious threat to the island chain.

Mink (*Mustela vison*) fur farms were set up on the island of Lewis in the 1950s. These farms closed down in the late 1950s and some mink escaped or were released into the wild. By 1969 the first feral mink were spotted in Lewis.

The spread of mink moved southwards down the chain of islands reaching North Uist in 1999 and South Uist in 2001. Not only does the American mink threaten the bird populations but it has a damaging effect on aquaculture, crofting and tourism.

A mink group began a trapping programme in Harris in the early 1990s but could not prevent the animals crossing to South Uist. The mink were able to spread by "island-hopping" and even several kilometres of the Atlantic proved no barrier to colonisation.

The designation of Special Protection Areas gave an impetus and an opportunity to establish "The Hebridean Mink Project". The project, which is supported by national and local interests, has received funding through the LIFE Nature programme to eradicate mink from the southern part of the island chain. To succeed the project must also control the population in the northern islands and establish a 'defensive line'. Whilst the main objective of the project is to protect the internationally important bird populations there will also be a benefit to sport fishing, grouse shooting, fish farming and the keeping of free-range poultry.

The project started in November 2001 and by October 2003 over 350 minks had been caught. There is clear evidence that the numbers being caught are falling; the project is having an impact on the total population. The real strength of the eradication programme lies in the combination of the employment of skilled local trappers, a science-based overview through the UK Central Science Laboratory and applied research running in parallel to the project. The detailed population and behavioural research work has helped to give very precise estimates of populations in each habitat type and has looked at the effect on behaviour as the trapping programme takes effect.

As the population becomes more dispersed, the project will use dogs to locate dens and remains optimistic that eradication, rather than control, is achievable. The project will use its experience to estimate the effort required to eradicate mink from the entire island chain, a long-term goal. The scientific approach adopted by the project is ensuring the best deployment of resources and innovation. Information is collected on each animal, good use is made of GPS and GIS to guide the work, DNA analysis can be used to identify individual animals (important when the project is trying to eradicate the last individuals).

More information can be found on the website www.snh.org.uk.

Control: lessons learnt

> Control programs should be implemented only after a long-term cost/benefit analysis, with defined aims and adequate monitoring arrangements.

> Responsibility should be extended to relevant stakeholders to prevent or control further spread of IAS. Major results were obtained by LIFE projects in Finland, where local hunting associations were actively involved, and in Germany, where local forestry administrations and farmers continued the actions started with the LIFE project.

> Incentive programs should be implemented in order to promote the involvement of local stakeholders in the management of invasive exotic species.

> IAS problems that could be addressed through coordinated control by neighbouring countries/sub regions should be identified (e.g. aquatic plants in shared water system, marine algae along a shared coastline) and appropriate programs developed.

> The management of exotics often involves some sort of "cruelty". Therefore a special effort should be taken to raise awareness and to gain public support. Preventive discussion should be undertaken in projects dealing with control of species which could create public opposition, i.e. when dealing with exotic mammals and birds.

> Control methods should not adversely affect native fauna and flora. Particular attention was given to this aspect by the LIFE project dealing with *Columba bollii* and *Columba junoniae* in Tenerife (Canary islands).

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3.3.6 Accompanying measures

The ultimate goal of managing alien species is to ensure the conservation of native habitats and species. In some cases, removing exotic species from an ecosystem will automatically lead to the return of the indigenous flora and fauna. In other cases, habitat restoration actions and reintroduction of indigenous species are needed. Accompanying measures also help preventing re-invasions.

Re-introductions

Re-introduction of native species after the implementation of eradication or control campaigns of exotic species may have two major benefits:

1) It may mitigate the negative effects caused by the presence of the alien species targeted.

2) It may justify the need to manage the population of alien species, fostering public acceptance of the interventions. For this reason some wildlife managers and policy makers believe that reintroduction programs should always accompany eradication or control programs.

However reintroductions should be carried out only under stringent conditions, strict control and in accordance with best practice guidelines (e.g. IUCN/SSC Guidelines for Re-introductions, IUCN Position Statement on Translocation of Living Organisms). The introduction of non native-subspecies should be avoided due to the risk of genetic contamination.

One LIFE example of a control program planned to prepare the ground for the reintroduction of native species is the project "Reintroduction of El Hierro Giant Lizard (*Gallotia simonyi*

*Reintroduction of the native freshwater crayfish (*Austropotamobius pallipes*) carried out by the Lambro regional park in northern Italy within the project "Conservation of* Austropotamobius pallipes *in two pSCIs of Lombardy" (LIFE00 NAT/IT/7159).*

machadoi) in its former natural habitat" (LIFE97 NAT/E/4190). This project was the continuation of a previous one "Program for the restoration of Hierro Giant Lizard *Gallotia simonyi*" (LIFE94 NAT/E/1238), implemented between 1994 and 1997, during which it resulted that this species, the European reptile most threatened with extinction, disappeared as a consequence of pressure from introduced predators, such as domestic cats. To ensure successful reintroduction, a captive breeding program was implemented and a species management plan was drawn up. Cats were not eradicated in the project's area because it was not possible to stop immigration from neighbouring towns, but a permanent control program, aimed at reducing feral populations of cats preying upon the lizards, is being carried out.

In Estonia, the LIFE Nature project "Recovery of *Mustela lutreola* in Estonia: captive and island populations" (LIFE00 NAT/EE/7081) supports a captive breeding and reintroduction program for the European mink. The animals are reintroduced to two islands, which were the last refuge for the species in northern Europe, after a campaign to remove the American relative.

Habitat restoration

There are cases where the environment recovers naturally, after the removal of exotic species. This is of course easier in simplified or isolated ecosystems. In other cases, restoration needs the support of human intervention.
A relevant number of LIFE Nature projects links measures for the restoration of habitats of EU importance to the eradication of exotic species. One of these, the Swedish project "Restoration of deciduous forests in Söderåsen National Park" (LIFE02 NAT/S/8483) is entirely aimed at the removal of commercial spruce plantations and at the eradication of exotic plants, such as

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Above. *Young individuals of the endemic Hierro giant lizard.*
Centre. *Tomahawk trap use in the scheme for protecting the habitat of* Gallotia gomerana *of the cats coming from a nearby village.*
Below. *Restoration of the priority* Alnion glutinoso incanae *forest habitats, after the removal of the American cherry (*Prunus serotina*) and other exotic trees.*

the common maple (*Acer pseudoplatanus*), the American red oak (*Quercus rubra*) and the American arbor vitae (*Thuja occidentalis*), followed by the restoration of oak and beech forests protected under the Habitats directive. The beneficiary is using environmental friendly techniques, based on traditional forest management methods. For instance horses are used for transporting wood, and pigs to plough the ground and thus help the natural regeneration of the native forests.

One of the main restoration measures carried out when a plant species has been eradicated is the planting of native species. A number of LIFE projects created *ad hoc* plant nurseries to be used for restoration and in order to avoid potential genetic pollution. One of these projects is the Spanish "Recovery of riverine ecosystem in Los Galachos SPA" (LIFE96 NAT/E/3098) during which cuttings and seeds of local plants, common willow (*Salix alba*), red willow (*Salix purpurea*), silver poplar (*Populus alba*), black poplar (*Populus nigra*), narrow-leaved ash (*Fraxinus angustifolia*) and French tamarisk (*Tamarix gallica*), were collected from the Ebro valley, and cultivated in the nursery for reforestation purposes after the removal of the exotic hybrid poplar (*Populus* x *Euroamericana*).

The invasion of exotic species can be a consequence of the deterioration of the conservation status of natural ecosystems. Habitat restoration is therefore also a prevention measure. The objective of LIFE Nature is to improve or maintain habitats and species in a good status of conservation, achieved also through habitat restoration. Even though it is not specifically linked to the prevention of invasion by alien species, restoration often contributes to obtain this goal. It is in fact indisputable that well-balanced ecosystems are less vulnerable to the invasion of exotics. The indirect contribution of LIFE Nature projects is, therefore, relevant considering that they have already involved 10% of the Natura 2000 sites.

Accompanying measures: lessons learnt

> The use of native species in carrying out wildlife management and ecosystem restoration actions should be encouraged. As a general rule for reintroduction/restocking, local individuals should be preferred to individuals coming from other countries, which, although belonging to the same species, can have different ecological needs and may belong to different subspecies.

> Conservation payment schemes and agri-environment measures should be reviewed and, where appropriate, adjusted in order to link incentive payments for the use of native material.

> The need of including restoration programs should be assessed when planning specific measures in eradication, containment and control.

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*The artificial wood of maritime pine trees has been felled in order to allow for the re-colonization of the native habitats of karstic calcareous grasslands (*Alysso-Sedion albi*).*
Above. *Common maple* (Acer pseudoplatanus).

4 Conclusions

The analysis of LIFE projects has shown that:

> LIFE is today the main EU source of funding for field activities aimed at exotics.

> The high number of LIFE projects dedicated to IAS shows that wildlife managers perceive exotics as a major threat to biodiversity conservation.

> LIFE demonstrated that the threats posed by exotics can be addressed successfully within the Natura 2000 network, obtaining considerable results, particularly in isolated ecosystems and at an early stage of invasion.

> LIFE has had a pump priming effect. Measures addressing exotic species started with LIFE are continuing with the support of agro-environmental funds and other financial instruments. This represents a good example of continuity over time: one of the most important factors to guarantee the success of the management of IAS.

> Most of the interventions financed through LIFE aimed at exotics are still too small scale and localized and only seldom adopt a standardized approach. This situation, due to the lack of a comprehensive, large-scale strategy, represents a major limit for a sound management of the problem.

General recommendations

> LIFE should continue to support IAS related projects including preventive projects/actions aimed at reducing the impact of both real and potential threats. In doing so, synergies and co-ordination with other EU financial instruments should be strengthened.

> The impact of IAS related projects funded by LIFE could be enhanced by developing a LIFE strategy on financing actions/projects directed at alien species. The lack of a common EU policy based on the Convention on Biological Diversity guiding principles and on the Council of Europe strategy may, however, partially hinder the long term effects of such projects. The experience gained through LIFE could be a valuable reference in the case such a policy is to be developed in the future.

> Management plans for Natura 2000 sites should devote explicit attention to IAS in terms of prevention and management measures.

> Long term action programs, rather than short term projects, should be given a higher priority, since they are usually more adequate for a successful management on invasive alien species.

> IAS problems that could be addressed through coordinated control by neighboring countries/sub regions should be identified and appropriate programs developed.

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Above. *The biometric measurement of an American mink (*Mustela vison*) captured in the Ebro River (Spain).*
Below. *The house mouse (*Mus domesticus*), a small Asian rodent introduced in Europe in ancient times (from Scalera, 2001).*

> A technical and scientific basis should be developed to identify which species/habitats need most urgent attention, when planning nature conservation projects, in order to establish, in terms of priority and feasibility, and on a case by case basis, which alien species deserve appropriate management for the actual or potential damage caused to the biodiversity.

Specific recommendations for development and implementation of projects/actions aimed at alien species

> Appropriate guidelines on prevention and management of invasive alien species should be taken into account in planning projects. Several bodies, among which IUCN, Council of Europe, FAO, IPPC, etc, have already realized specific guidelines.

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> Before planning a project to address exotics, it is essential to evaluate the human dimension of the problem. For this purpose, a key role in the management of alien species should be recognized to awareness raising. This is a major issue, which deserve a special attention: public consultation with local communities and stakeholders should always be encouraged to solve or accommodate in advance potential misunderstandings and disagreements. Although wildlife managers recognize the growing threat of alien species, decision makers and the general public still seem to underestimate the problem. A sound communication campaign would allow a rapid and effective implementation of the management actions.

> Sound feasibility studies should always be carried out before any eradication program, in order to avoid a project failure due to the impossibility to remove certain species, both for ecological and financial reasons. Feasibility studies should take into account the efficacy of the interventions, the possible effects on native species and ecosystems, and the potential risk of re-invasion.

> Any eradication program should be supported by the authority competent for the management of the area and should be developed according to an appropriate spatial-temporal scale.

> The use of native species in carrying out wildlife management and ecosystem restoration actions should be encouraged. As a general rule for reintroduction/restocking, local individuals should be preferred to individuals coming from other countries, which, although belonging to the same species, can have different ecological needs and may belong to different subspecies.

> The need of including restoration programs should be assessed when planning specific measures in eradication, containment and control.

> Specific monitoring actions should be implemented to verify the success of the intervention.

> Special care should be devoted to ensure project follow-up after its end. This should be done already at the time of project development or, at the latest, in its early stage of implementation.

> Responsibility should be extended to relevant stakeholders to prevent or control further spread of IAS.

Above. *View of a dune invaded by the exotic fig marigold (*Carpobrotus edulis*) on Minorca Island (Spain).*
Below. *Removal of the fig marigold.*

Abstract

Invasion by alien species represents one of the greatest biological threats to biodiversity, second only to habitat destruction. In addition to affecting ecosystems and contributing to the extinction of native species, invasive alien species also cause major socio-economic damage. The European Union has no specific legislation on invasive alien species, but a number of regulations and directives include provisions to deal directly or indirectly with IAS. The most important are the Birds and Habitats directives, and the wildlife trade regulation. The problem of alien species has had tackled within many Natura 2000 sites, the EU network of protected areas aimed at protecting and conserving wild species of flora and fauna, and natural and semi natural habitats considered of Community importance.

From 1992 to 2002, out of a total of 715 projects financed through the LIFE Nature program, the financial instrument aimed at the development of the Natura 2000 network, more than 100 include actions dealing with the management of exotic species. The total budget spent for implementing these projects amounts to more than 27 million Euros. These figures show that, notwithstanding the underestimation by the general public and by policy makers, wildlife managers perceive exotic species are as a major concern. LIFE proved to be a well suited instrument to respond in an efficient way to the precise needs of wildlife managers. LIFE Nature in particular has provided major investment to support activities in this area.

The projects financed provided the opportunity to learn a number of very important lessons directly from the field, so as to contribute to the identification of the actions to be envisaged within future projects dealing with alien species and to develop a EU strategy based on the Convention on Biological Diversity guiding principles.

Below. *The coypu (*Myocastor coypus*) is one of the exotic species targeted by the Italian project "Conservation and management of the biotope S. Genuario Wetland" (LIFE00 NAT/IT/7209).*
Left. *A cage trap used during the project.*

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Annexes – LIFE projects dealing with IAS financed from 1992 to 2002

1. LIFE Nature projects primarily aimed at alien species

Project title	Project number	Target alien species*
Pannonian sanddunes	LIFE98 NAT/A/5418	**P** *Robinia pseudoacacia*, *Ailanthus altissima*
Protection of grey dunes and other habitats on Hulsig Hede/ Hulsig Heath	LIFE96 NAT/DK/3000	**P** *Pinus mugo*
Restoration of dune habitats along the Danish West Coast	LIFE02 NAT/DK/8584	**P** *Pinus mugo*, *Pinus contorta*
Restoration of the islets and cliffs of Famara (Lanzarote Island)	LIFE99 NAT/E/6392	**A** *Oryctolagus cuniculus*, *Felis catus, Rattus* sp. **P** *Nicotiana glauca*
Conservation of the European mink (*Mustela lutreola*) in Castilla y León (Spain)	LIFE00 NAT/E/7299	**A** *Mustela vison* **P** *Populus* hybrida
Conservation plan for the white-headed duck in the Community of Valencia	LIFE00 NAT/E/7311	**A** *Oxyura jamaicensis*
SCI Parga-Ladra-Támoga: recovery of bog woodland and dystrophic lake	LIFE00 NAT/E/7330	**P** *Azolla filiculoides*, *Pinus* sp., *Populus* hybrida, *Eucalyptus* sp.
Conservation of the European mink (*Mustela lutreola*) in La Rioja	LIFE00 NAT/E/7331	**A** *Mustela vison* **P** *Populus* hybrida
Conservation of the European mink (*Mustela lutreola*) in Álava (Spain)	LIFE00 NAT/E/7335	**A** *Mustela vison* **P** *Populus* hybrida
Conservation of areas with threatened flora on the island of Minorca	LIFE00 NAT/E/7355	**P** *Carpobrotus edulis*
Conservation of the European mink (*Mustela lutreola*) in Cataluña, Spain	LIFE02 NAT/E/8604	**A** *Mustela vison*
Giant lizard of La Gomera (*Gallotia bravoana* or *Gallotia simonyi gomerana*)	*LIFE02 NAT/E/8614*	**A** *Felis catus, Rattus* sp. and livestock
Control of exotic vertebrates in Islands of Portugal and Spain	LIFE02 NAT/CP/E/14	**A** Exotic vertebrates
Recovery of *Mustela lutreola* in Estonia: Captive and island populations	LIFE00 NAT/EE/7081	**A** *Mustela vison*
Restoration of alluvial woods in the Ticino Park	LIFE97 NAT/IT/4134	**P** *Prunus serotina*, *Ailanthus altissima*, *Quercus rubra*
Bosco Fontana: urgent conservation actions on relict habitat	LIFE99/NAT/IT/6245	**P** *Quercus rubra*, *Platanus* spp.
Measures for the recovery of the terrestrial habitat of Deserta Grande	LIFE95 NAT/P/0125	**A** *Oryctolagus cuniculus*, *Rattus rattus*, *Capra hircus*
Conservation of priority and rare plant species of Madeira	LIFE99 NAT/P/6431	**P** *Pinus radiata*
Gerês valley natural habitats restoration	LIFE99 NAT/P/6439	**P** *Acacia dealbata*
Mink control to protect important birds in SPAs in the Western Isles	LIFE00 NAT/UK/7073	**A** *Mustela vison*

* **A** = animals; **P** = plants

2. LIFE Nature projects only partially aimed at alien species

Project title	Project number	Target alien species*
Water World March-Thaya-Auen	LIFE98 NAT/A/5413	**P** *Robinia pseudoacacia*, *Fraxinus americana*
Management of Natural Forests in the National Park Kalkalpen	LIFE99 NAT/A/5915	**P** *Pinus sylvestris, Picea abies*
The Wengermoor Project	LIFE99 NAT/A/5916	**P** *Pinus* sp.
Flood-plain forests of the Upper Drau river valley	LIFE99 NAT/A/6055	**P** *Solidago* sp., *Impatiens glandulifera*
Management of floodplains on the Tisza	LIFE00 NAT/A/7051	**P** *Amorpha fruticosa, Asclepia* sp., *Acer negundo, Fraxinus pennsylvanica*
Intermediary Atlantic Heathlands in Flanders	LIFE99 NAT/B/6298	**P** pines, *Quercus rubra*
Cross-border recovery and conservation of wet ecosystems	LIFE99 NAT/B/6296	**P** pines
Oligotrophic aquatic habitats in the Kempen	LIFE00 NAT/B/5168	**P** pines, *Prunus serotina*
Fens and heathlands of Zuiderkempen	LIFE02 NAT/B/8595	**P** pines
Re-establilshing lichen an coastal heaths in the Anholt Desert	LIFE94NAT/DK/492	**P** *Pinus mugo*
Management of the most valuable wetlands in SW Finland	LIFE99 NAT/FIN/6278	**A** *Mustela vison*, *Nyctereutes procyonoides*
Protection and management of the valuable wetland Siikalahti	LIFE00 NAT/FIN/7061	**A** *Mustela vison*, *Nyctereutes procyonoides*
Evo Forest - Awareness-raising and protection of Southern Finalnd forest biotopes	LIFE02NAT/FIN/8466	**P** *Larix sibirica, Abies sibirica*
Management of urban Natura 2000 areas in SW Finland	LIFE02 NAT/FIN/8468	**A** *Mustela vison*, *Nyctereutes procyonoides*
Conservation of the Grand-lieu lake	LIFE94 NAT/F/0841	**A** *Myocastor coypus*
Program to safeguard the coastal lakes of Languedoc-Roussillon	LIFE94 NAT/F/0860	**A** *Myocastor coypus*
Oxyura leucocephala's reintroduction on Biguglia's pond	LIFE97 NAT/F/4226	**A** *Oxyura jamaicensis*
Maritime archipelagos and islets of Brittany	LIFE98 NAT/F/5250	**A** *Mustela vison, Rattus norvegicus*
Program for the restoration and management of the habitat used by the bittern in France	LIFE00 NAT/F/7269	**A** *Myocastor coypus*
Preserving great bustard habitats in Brandenburg	LIFE92 NAT/D/4838	**A** *Nyctereutes procyonoides*
Habitat Protection in the Rhön	LIFE93 NAT/D/10200	**P** *Lupinus* sp.
Meadow Habitat Elzwiesen Rheinhausen	LIFE96 NAT/D/3038	**P** *Populus* hybrida
Protection and Development for Benningen Marsh (Benniger Ried)	LIFE96 NAT/D/3043	**P** *Abies* sp.
Rhön Biotope region - Building Block for Natura 2000	LIFE98 NAT/D/5064	**P** *Lupinus* sp.
Restoration of clear water lakes, mires and swamp forests of the Lake Stechlin	LIFE00 NAT/D/7057	**A** *Hyphthalmichthys molitrix*, *tenopharyngodon idella*; *Cyprinus carpio* **P** *Picea* sp.
Regeneration and preservation of dry grassland in Germany	LIFE00 NAT/D/7058	**P** *Robinia pseudoacacia*
Large freshwater mussels Unionoidea in the border area of Bavaria, Saxonia and the Czech Republic	LIFE02 NAT/D/8458	**A** *Ondatra zibethicus*
Increase in the Size of *Columba bollii* and *Columba junoniae* populations.	LIFE96 NAT/E/3095	**A** *Rattus* sp.
Restoration of riparian ecosystem in the natural reserve of Galachos, Spain	LIFE96 NAT/E/3098	**P** *Populus* hybrida

* **A** = animals; **P** = plants

Restoration and integrated management of the island of Buda	LIFE96 NAT/E/3180	**P** *Eucalyptus* sp., *Populus* hybrida, *Phoenix* sp. and *Washingtonia* sp.
Recovery Plan of *Puffinus p. mauretanicus* in SPA) (Balearic Islands)	LIFE97 NAT/E/4147	**A** *Felis catus*, *Rattus* sp. and other mammals
Project of physical and ecological recovery of "Playa del Matorral"	LIFE97 NAT/E/4157	**P** *Washingtonia* sp., *Tamarix sp.*
Reintroduction of El Hierro Giant Lizard in its former natural habitat	LIFE97 NAT/E/4190	**A** *Felis catus*, *Rattus* sp.
Conservation of island SPAs in the Valencian region	LIFE98 NAT/E/5300	**A** Livestock (hens, peacocks) **P** *Opuntia* sp.
Restauration and management of the "Estanys de Sils"	LIFE98 NAT/E/5348	**P** *Phytolacca americana*, *Arundo donax*
Conservation of the Blue Chaffinch of Gran Canaria	LIFE98 NAT/E/5354	**A** *Felis catus*
Biodiversity conservation and recovery in the river basin of Asón	LIFE99 NAT/E/6333	**P** *Eucalyptus globulus*, *Bacharis halimifolia, Cortaderia selloana*
Restoration of an integral reserve zone in the SPA for birds "Riberas de Castronuño"	LIFE99 NAT/E/6343	**P** *Populus* hybrida
Conservation of priority habitats in the Valencian Community	LIFE99 NAT/E/6417	**P** *Carpobrotus edulis*, *Agave americana*
Protection of Posidonia grasses in SCIs of Baleares	LIFE00 NAT/E/7303	**P** *Caulerpa taxifolia*
Conservation of the black vulture in Majorca and other Spanish SPAs	LIFE00 NAT/E/7340	**A** *Felis catus*
Habitat management of Hortobágy eco-region for bird protection	LIFE02 NAT/H/8638	**P** *Amorpha fruticosa*
Conservation program for the Po Delta park geographical area (second phase)	LIFE94 NAT/IT/0538	**A** *Miocastor coypus*, *Silurus glanis*, *Carassius carassius*
Conservation of freshwater habitats in the Siena Province	LIFE95 NAT/IT/0657	**P** *Pinus* sp.
Environmental restoration of the sites of Community interest (Bioitaly) inside the Groane park	LIFE96 NAT/IT/3068	**P** *Prunus serotina*, *Robinia pseudoacacia*, *Solidago gigantea*, *Lonicera japonica*
Active conservation of natural reserve "Valli del Mincio"	LIFE96 NAT/IT/3073	**P** *Nelumbo nucifera*
Conservation of the wolf and the bear in the new parks in the central Apennines	LIFE97 NAT/IT/4141	**A** *Canis lupus familiaris*
Protection of biodiversity in Capraia and other minor islands in Tuscany	LIFE97 NAT/IT/4153	**A** *Rattus rattus* **P** *Ailanthus altissima*
Forest conservation in the Conero Regional Nature Park	LIFE98 NAT/IT/5089	**P** *Pinus halepensis, Robinia pseudoacacia, Ailanthus altissima*
Urgent actions for the conservation of *Pelobates fuscus insubricus**	LIFE98 NAT/IT/5095	**A** *Rana catesbeiana*, *Procambrus clarkii*, *Myocastor coypus*
Protection of biodiversity in the Tuscan Tiber valley	LIFE98 NAT/IT/5125	**P** *Pinus pinaster*
"*Juniper* dunes": rearrangement and conservation of SCI Monte Russu	LIFE99 NAT/IT/6189	**P** *Acacia cianophylla*, *Mesembryanthemum acinaciforme*
Project for the conservation of the wolf in the Pollino National Park	LIFE99 NAT/IT/6209	**A** *Canis lupus familiaris*
Biodiversity in the Iseo peat moss	LIFE99 NAT/IT/6212	**A** *Silurus glanis* **P** *Amorpha fruticosa*, *Ailanthus altissima*, *Phytolacca americana*, *Solidago canadensis*

Monte Labbro and upper Albegna valley, conservation and management	LIFE99 NAT/IT/6229	**P** *Abies cephalonica*, *Pseudotsuga menziesii*, *Cedrus* sp.
Actions of environmental restoration of Alserio Lake	LIFE99 NAT/IT/6235	**P** *Populus* x *canadensis* *Platanus* hybrida
Restore the alluvial forests – Regional Natural Reserve "Naviglio di Melotta"	LIFE99 NAT/IT/6252	**P** *Robinia pseudoacacia*, *Acer negundo*, *Phytolacca americana*
Palata Menasciutto – management and conservation of wet woodlands	LIFE99 NAT/IT/6253	**A** *Ictalurus melas*, *Lepomis gibbosus* **P** *Populus* hybrida, *Robinia pseudoacacia*
Safeguard of marine and coastal areas in the southern Tirreno	LIFE99 NAT/IT/6275	**P** *Caulerpa taxifolia*
Conservation of habitats and species of the pSCI Bosco della Mesola	LIFE00 NAT/IT/7147	**A** *Dama dama*
Conservation of *Austropotamobius pallipes* in two pSCIs of Lombardy	LIFE00 NAT/IT/7159	**A** *Procambarus clarkii*
Urgent action to safeguard the Orbetello Lagoon SCI	LIFE00 NAT/IT/7208	**P** *Eucaliptus* sp.
Conservation and management of the biotope "S. Genuario Wetland"	LIFE00 NAT/IT/7209	**A** *Myocastor coypus, Trachemys scripta*, *Ctenopharyngodon idella* **P** *Robinia pseudoacacia*, *Solidago gigantea*.
Integrated management of Insubric Prealpine habitats	LIFE00 NAT/IT/7258	**P** *Laserpitium niger*
Conservation of *Salmo marmoratus and Rutilus pigus* in the Ticino river	LIFE00 NAT/IT/7268	**A** *Silurus glanis*
Restoration of ecological balance in order to preserve habitats and species of Community interest	LIFE02 NAT/IT/8526	**A** *Myocastor coypus*, *Silurus glanis*, *Procambarus clarkii* **P** *Populus* hybrida
River Toce: conservation of riverbank environments to encourage nesting and migratory birds	LIFE02 NAT/IT/8572	**P** *Robinia pseudoacacia*, *Ailanthus altissima*, etc.
Restoration and demonstration project pSCI "De Wieden and De Weerribben"	LIFE99 NAT/NL/6282	**P** *Aronia melanocarpa*
Conservation of the seabirds communities and habitats of Açores	LIFE94 NAT/P/1034	**A** *Oryctolagus cuniculus*, *Rattus rattus*
Study and Conservation of the Açores Natural Patrimony	LIFE96 NAT/P/3022	**P** *Hedychium gardnerianum*
Measures for the Management and Conservation of the Laurissilva Forest of Madeira (code 45.62*)	LIFE97 NAT/P/4082	**P** *Hedychium gardnerianum*
Conservation of four rare species in pSCI Valongo	LIFE98 NAT/P/5234	**P** *Eucalyptus globules*, *Acacia dealbata*, *Ailanthus altissima*
Restoration of the laurel forest in Funduras	LIFE99 NAT/P/6436	**P** *Eucaliptus globulus*, *Pinus radiata*, *Cupressus macrocarpa*, *Criptomeria japonica*
Restoration of alvar habitats on the island of Stora Karlsö	LIFE00 NAT/S/7118	**P** *Prunus mahaleb*, *Acer pseudoplatanus*
Restoration of deciduous forest in Söderåsen national park.	LIFE02 NAT/S/8483	**P** *Acer pseudoplatanus*, *Quercus rubra*, *Thuja occidentalis*
A conservation strategy for the sand dunes of the Sefton Coast, North West England	LIFE95 NAT/UK/0818	**P** *Hippophae rhamnoides*

Securing Natura 2000 objectives in the New Forest	LIFE97 NAT/UK/4242	**P** *Rhododendron ponticum, Gaulteria shallon*
Restoration of Atlantic Oakwoods	LIFE97 NAT/UK/4244	**P** *Rhododendron ponticum*
Wet Woods Restoration Project	LIFE98 NAT/UK/5431	**P** *Rhododendron ponticum, Physocarpus opulifolia*
Safeguarding Natura 2000 Rivers in the UK	LIFE99 NAT/UK/6088	**A** *Pacifastacus leniusculus* **P** *Rhododendron ponticum*
Woodland Habitat Restoration: Core sites for a forest habitat network	LIFE00 NAT/UK/7074	**P** *Rhododendron ponticum, Fallopia japonica, Synphoricarpus alba*

3. LIFE Environment projects primarily aimed at alien species

Project title	Project number	Target alien species*
Proliferation of the tropical algae *Caulerpa taxifolia* in the Mediterranean	LIFE92 ENV/E/0067	**P** *Caulerpa taxifolia*
Expansion of the tropical green algae *Caulerpa taxifolia* in the Mediterranean Sea	LIFE92 ENV/F/0066	**P** *Caulerpa taxifolia*
Control of the *Caulerpa taxifolia* extention in the Mediterranean Sea	LIFE95 ENV/F/0782	**P** *Caulerpa taxifolia*
Proliferation of the tropical green algae *Caulerpa taxifolia* in the Mediterranean	LIFE92 ENV/IT/0068	**P** *Caulerpa taxifolia*

* **A** = animals; **P** = plants

4. LIFE Environment and LIFE Third Countries projects partially aimed at alien species

Project title	Project number	Target alien species*
Recovery, Conservation and Management of Species and Natural Habitats in the Coastal Area of the Central Portugal	LIFE95 ENV/P/0119	**P** *Acacia* sp.
Sustainable use and management rehabilitation of flood plain in the Middle Tisza District	LIFE03 ENV/H/0280	**P** *Amorpha fruticosa*
Development of a new management policy for the Hutovo Blato wetlands, Bosnia-Herzegovina	LIFE99 TCY/BIH/035	**A** Fish species

* **A** = animals; **P** = plants

identity card

Name LIFE ("L'Instrument Financier pour l'Environnement" / The financing instrument for the environment)

Type of intervention co-financing of actions in favour of the environment in the Community, in the countries of central and eastern Europe that are applicants for accession to the European Union and in certain third countries.

LIFE is made up of three subject headings: **"LIFE-Nature"**, **"LIFE-Environment"** and **"LIFE – Third countries".**

Objectives

> with a view to sustainable development in the European Union, contribute to the drawing up, implementation and up-dating of Community policy and legislation in the area of the environment;
> explore new solutions to environmental problems on a Community scale.

Beneficiaries any natural or legal person, provided that the projects financed meet the following general criteria:

> they match the priorities laid down at Community level and contribute to the objectives listed;
> they are submitted by reliable participants from financial and technical points of view;
> they can be carried out from the technical point of view, in terms of timetable and budget, and offer a good cost-benefit ratio.

Types of project

> Eligible for LIFE-Nature are **nature conservation projects** which contribute to maintaining or restoring natural habitats and/or populations of species in a favourable state of conservation within the meaning of Directive 92/43/EEC.
> Eligible for LIFE-Environment are **demonstration projects** which bring environment-related and sustainable development considerations together in land management, which promote sustainable water and waste management or which minimise the environmental impact of economic activities.
Five areas of intervention are preferred: the management and enhancement of the territory, water management, the effect of economic activities, waste management, integrated product policy.
> Eligible for LIFE – Third countries are **technical assistance projects** which
- Constitute a benefit for the Community, particularly on account of their contribution to the implementation of regional and international policies and agreements;
- Promote sustainable development at international, national or regional level;
- Bring solutions to serious environmental problems in the region and the area concerned.

Implementation the Member States or third countries send the Commission the proposals of projects to be co-financed. The Commission sets the date for sending the proposals annually and reaches a decision on these. It monitors the financing and follow-up of the implementation of the LIFE actions. Accompanying measures enable the projects to be monitored on the ground and, in the case of LIFE-Nature, to encourage certain forms of cooperation between similar projects ("Co-op" measure).

Period of involvement 5 years (2000-2004).

Funds from the Community approximately 638 million EUR distributed as follows: 300 million EUR to LIFE-Nature, 300 million EUR to LIFE-Environment and 38 million EUR to LIFE – Third countries.

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