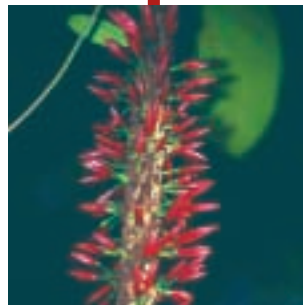
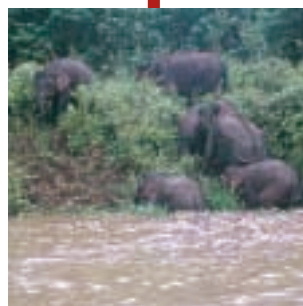
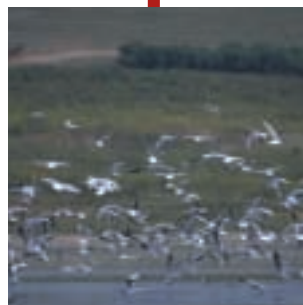


Forest Landscape Restoration

working examples from 5 ecoregions



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Lafarge and WWF, have become partners in an effort to preserve biodiversity and restore forest landscapes. Through this partnership Lafarge is supporting WWF's Forest Landscape Restoration project which is part of WWF's Forest for Life Programme.

“In order to succeed, Forest Landscape Restoration must take a long term vision of forest conservation. It must benefit both people and biodiversity while restoring broader forest functions and processes in the overall landscape. This means involving people rather than excluding them.”

(Chris Elliott, Director, Forests for Life, WWF International)

Forest Landscape Restoration – A Wider View of Ecosystem Management

History has shown that conservation does not work when it is focussed exclusively on small areas. WWF, like many conservation organisations, is now scaling up its approach and interventions. For WWF this means realigning its global programme towards ecoregion based conservation. An ecoregion is a large area with similar biophysical characteristics which corresponds to major ecological and evolutionary processes that create and maintain biodiversity. By using the ecoregion scale we can achieve conservation results that are ecologically viable, conserving networks of key sites, migration corridors, and the ecological processes that maintain healthy ecosystems.

In practice, conservation efforts often focus on a number of landscapes nested within ecoregions; these are still relatively large priority units for intervention and usually represent the areas with the highest remaining biodiversity and the best opportunities for conservation. It is at this scale that ecological integrity can be assessed, that needs, uses and functions can be considered and trade-offs negotiated. Forest Landscape Restoration (FLR) aims to restore the key functions and processes of those landscapes that have already undergone serious degradation.

A landscape can in varying circumstances be defined by a number of factors – cultural, biological, social etc – and within ecoregion planning a “conservation landscape” is often equivalent to a priority conservation area.



Problem: Forest loss and Degradation

The world is losing about 14.6 million hectares (an area the size of Nepal) of forests annually. Coupled with that, many forests are being severely degraded. This means that the remaining forests are not able to fulfil their role within the larger mosaic in landscapes. The role of healthy forests includes protecting soils, contributing to local hydrological systems and providing an incredible range of goods (medicinal plants, food products, raw materials) as well as, habitat for forest-dwelling species. Forests also have aesthetic and cultural value. Degraded forests no longer provide many of these roles and may therefore disturb the subtle balance of landscapes with results that can include biodiversity loss, inequitable distribution of remaining goods and services and resulting social conflict.

Forests are being degraded by a vast range of factors, including:

- Poor fire management
- Climate change
- Poor logging practices
- Conversion to agriculture

Very often the root cause of such threats lies far away: for example demand for palm oil in Europe causing massive conversion to oil palm plantations in South-east Asia.

WWF and forest conservation: Protect, Manage, Restore

In the face of these continuing threats, protecting and managing existing forests is simply not enough. The pressure on remaining forests continues to grow. Furthermore, the value of an isolated protected area or patch of well-managed forest can be greatly reduced if there is no remaining forest around it. It is now known for instance that in China over 50% of pandas do not remain within the boundaries of protected areas, but roam outside their “panda reserves” in forests that are severely fragmented. If we only protect the reserves the pandas will not survive. Equally, if the only trees in a landscape are those remaining in protected areas, and local communities have no energy alternative, they may have little choice but to seek fuelwood from within the protected area.

It is clear that the threat to protected areas and sustainably used forests, is likely to remain high unless the gaps in between are also addressed in the context of a “forested landscape”. This does not necessarily mean filling all of those gaps with forests. Rather, it signifies considering what should be in those gaps (and in some cases this *will* mean forests) to expand the benefits of the landscape. For instance, the presence or absence of a few scattered trees in the landscape can greatly affect migratory bird species.

WWF believes that to undertake successful forest conservation, we need to look at protection, management and also restoration. Often, restoration will mean not restoring entire forests, but rather restoring the benefits that trees provide to people and biodiversity in the context of a landscape, and beyond that, a whole ecoregion. Forest Landscape Restoration on these principles provides a more realistic means of achieving results that are acceptable to a wide range of stakeholders and will therefore be durable. It moves the focus away from the trees to the goods, services and processes that healthy forested landscapes can provide. In practice what this means is that it is not the total number of trees that matters, but rather where they are in the landscape, where they fit within the mosaic of land uses, how they are contributing to the needs of people and to biodiversity and what process is used to restore the landscape.

Restoration is often equated to tree planting. Yet tree planting is only one of a range of interventions, (others include enrichment planting, natural regeneration, fencing) that can restore forests at a site. When we widen our approach to the landscape scale, it is usually unrealistic to restore total forest cover, if nothing else because in many cases thousands of years of human intervention have modified the landscape. While some cultural landscapes include forests and woodlands that provide a wide range of benefits to local people and to biodiversity, in other cases forests have virtually disappeared or been replaced by tree cover that only benefits a minority, such as often happens when natural forests are replaced by intensive monocultural tree plantations. Forest Landscape Restoration starts from the existing landscape and seeks to restore those functions that have been degraded or lost.

In many cases, a landscape's forests will have been so severely degraded that the benefits they can provide are severely impaired. This degradation frequently encourages a further cycle of destruction. In contrast FLR identifies the right balance of goods, services and processes that can be sustained in the landscape to provide a broad range of benefits to people and biodiversity. Indeed, increasingly sophisticated methods for evaluating these goods and services – such as medicinal plants and, soil stabilisation – are available and are being used by development agencies, governments and even commercial enterprises.

Forest Landscape Restoration need not be a high cost, high maintenance operation. The key is to get the right sorts of interventions that complement and reinforce each other in order to produce a sustainable landscape that provides increased benefits to many more people and biodiversity.

Such a restored landscape might combine protected areas, plantations for fuelwood, well managed plantations for timber, scattered trees in the landscape providing stepping stones for biodiversity and trees alongside rivers protecting water quality. Trees on local farms can protect crops from the sun and help to improve soil quality. Finally, a sufficiently diverse and healthy amount of forests can harbour medicinal plants for local people, as well as a range of other non timber forest products that can sustain a local economy.

The five case studies illustrated in this brochure demonstrate some examples of FLR.

Bulgaria: Supporting a government-endorsed strategy to restore natural forests on the Bulgarian Danube islands, an important habitat for many bird species including the rare Dalmatian pelican.

China: Finding the right balance between the needs of the endangered panda and those of local communities and implementing in a sustainable manner a government policy to plant trees.

Malaysia: Creating wildlife migration corridors along the Kinabatangan River which will benefit local fishing communities, while also improving plantation practices among oil palm growers.

Brazil: Preserving the remaining fragments of Atlantic Forest and restoring connectivity among them so as to ensure the survival of endangered species (eg: the Golden Lion Tamarin) and the provision of forest goods and services that help meet human needs.

New Caledonia: Working with landowners and cattle ranchers, with the support of scientists and local authorities, to ensure the survival of the tropical dry forest – one of the world's most threatened and fragile ecosystems.

Forest Landscape Restoration and other WWF priorities

In addition to operating in a range of ecoregions, WWF has six priority themes by which it focusses its conservation efforts: Forests, Species, Freshwater, Marine, Climate Change and Toxics. Forest Landscape Restoration is at the interface of many, if not all, of these themes. Healthy forests affect water quality and in some cases, quantity too. WWF is working in key watersheds, such as the Danube in Bulgaria and the Kinabatangan river in Malaysia to restore the functions of the watershed. FLR also has a key role to play in improving the resilience of ecosystems to threats such as climate change. A number of threatened species remain on the brink of extinction unless a sustainable solution can be found to restore their habitat. In Brazil for example, WWF is working together with other partners to restore the severely degraded Atlantic forest along the Atlantic coast which is the habitat of the endangered golden lion tamarin.

How Forest Landscape Restoration works

Forest Landscape Restoration requires flexible and multiple approaches. Once the agreed long term vision for the landscape is established, a series of actions can be identified. These will range from ensuring the “environment” is right (ie: institutions are in place, economic incentives are positive, market pressures are addressed etc.) to working with local stakeholders to agree a common way forward and on the ground activities such as fencing, enrichment planting etc. At the international level, pressures on forests will also have to be addressed. Unless the root causes of forest degradation and loss are addressed, any intervention effort will probably be in vain. The policy and institutional framework at national level must also provide the right context for FLR – sometimes such institutional frameworks will need to be altered e.g. by abandoning unsustainable incentives which promote industrial plantations. In some cases the legislative framework (eg: land tenure) may need to be addressed.

At the landscape level, negotiations with key stakeholders will have to take place to identify the different goods, services and processes that are important and that need to be restored. Trade-offs may be inevitable as different stakeholders will approach the landscape from different angles. It is important that FLR should also maintain options for future generations, and restore key ecosystem functions in order to minimise future risks. Finally, at the local level, a range of direct actions will have to take place, based on the agreed priorities for the landscape.

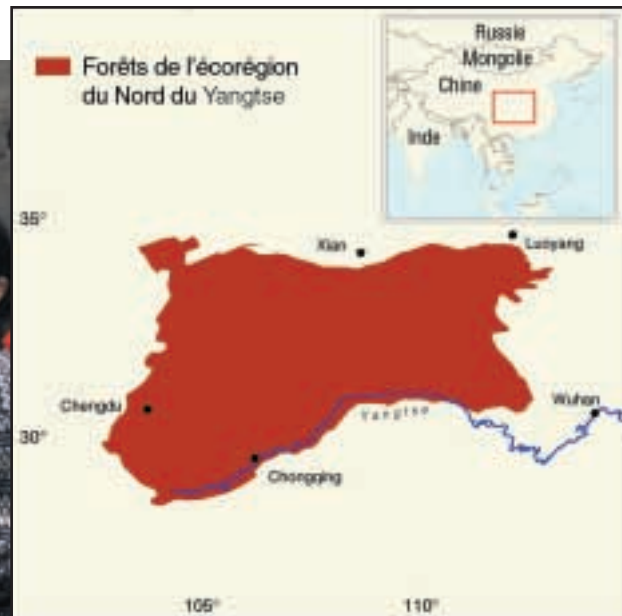
WWF’s target for Forest Landscape Restoration

“By 2005, to undertake at least twenty forest landscape restoration initiatives in the world’s threatened, deforested or degraded forest regions to enhance ecological integrity and human well-being”

The way we do restoration, where and with whom we choose to do it will not only affect biodiversity but also people. The World Bank has indicated that “Forest resources directly contribute to the livelihood of 90 percent of the 1.2 billion people living in extreme poverty and indirectly support the natural environment that nourishes agriculture and the food supplies of nearly half the population of the developing world.”

In this context it becomes urgent to reverse the trend of forest loss and degradation.

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Case Study: Upper Yangtze Forests, China

Extending and improving the quality of forest in the Minshan landscape

The forest trail winds along the mountainside covered in birch and pine trees. Under the trees, tall thickly sprouting bamboo presses in on the two rangers who move slowly across the steep slopes. It is cold, more than two thousand metres above sea-level and there is snow on the higher peaks above. A pheasant runs through the trees alarmed by the approaching men. They scan the forest floor carefully, hoping to find signs of their quest, the shy and secretive giant panda. Incredibly, the black and white bear, the very symbol of WWF, is almost never seen, a master of stealth leaving only the signs of its passing – some broken bamboo shoots or some droppings on the forest floor. The rangers know the pandas are near, somewhere among the thickets of bamboo, listening and waiting for the humans to pass by.

The female panda needs a mate, but she will have to move out of the reserve to find him leaving the shelter of the forest close to where the humans make their home. She moves at night, and the rangers will not see her go.

The ecosystem

The Minshan conservation area in southwest China covers 33,000 km² of high mountains and temperate forests in Sichuan Province. Located within the Forests of the Upper Yangtze Ecoregion this mountainous landscape is home to a quarter of all the world's giant pandas (*Ailuropoda melanoleuca*). Beautiful snow leopards (*Panthera uncia*), Asiatic black bears (*Ursus thibetanus*) and golden monkeys (*Pygathris roxellana*) also live here. Rare species of pheasant and the noble crested ibis (*Nipponia nipponia*) are present, and the temperate forests contain half of China's known plant species and at least one thousand species of trees. The richness of the forests allows local people to make use of over 150 medicinal plants.



Nigel DUDLEY



The problem

A growing human population of around one million Chinese, Tibetan, Qiang, Baima and Han people live in the Minshan area. Consequently, large areas of natural forest have been cleared for agriculture and timber. In Sichuan the panda habitat shrank by 50% between 1974 and 1989 (to a total area of approximately 10,000² kms. Although the Minshan area is still heavily forested, population pressures have led to increased demand for fuelwood and the conversion of mountain slopes to orchards.

Severe flooding in 1998 (exacerbated by clear cutting of mountain forests) has been a prime motivating factor in the government's decision to enforce conservation of the steep mountain slopes in the region.

A Chinese government policy of providing support for reforestation (known as 'Grain for Green') has been put in place to encourage the conversion of steep slopes into forests and orchards. According to the government this will return all land with a slope greater than 25° to forest within 30-50 years. However, planting is restricted to commercially viable species such as prickly ash (*Zanthoxylum L.*) rather than encouraging the use of more suitable species or allowing natural regeneration.

In Sichuan the 'Grain for Green' policy affects over 800,000 hectares. Logging bans have also been introduced to prevent flooding and landslides. Some 2000 local people were employed by the logging industry before it was banned. In some cases they have found new jobs with a mining company but the majority of these workers are now unemployed and some have taken to poaching wildlife or illegal logging.

Forest Landscape Restoration: Balancing the needs of people and wildlife

The goal for Forest Landscape Restoration in Minshan is to increase the extent and quality of the panda habitat while at the same time enhancing the livelihood security of local communities. The government is also committed to increasing the number of protected areas in Minshan, especially where they affect panda populations. As well as

the 'Grain for Green' policy, China also has a National Forest Conservation Programme (NFCP) which aims to increase forest cover in the Upper Yangtze, Yellow and Songhuajiang river basins.

WWF is working with the Forestry Department of Sichuan and other key stakeholders to develop a shared vision of forest management strategies that will leave space for wildlife and ensure ecological health for the area. One of the main priorities is to assess the impact and suitability of certain government led policies. Issues to be assessed include the logging ban which affects local people's income and welfare, diversification into mining and ecotourism projects as well as the suitability of the crops and tree species being used in the 'Grain for Green' programme on the steep slopes.

A key component of FLR in Minshan for WWF is to work with local stakeholders to assess their perceptions and aspirations for the forest landscape in which they live. For example, the Qiang community is known to depend to a large extent on medicines obtained from plants in the forests. Community forestry and restoration strategies will therefore have to be linked to not only improving the quality of forests in which pandas can live but to addressing how local people gain their livelihood.

In Sichuan, local scientists will assess the impact of different forest regeneration policies in the watershed. The results will provide local communities with advice about how to best apply the grants received under the "Grain for Green" scheme. This work is being undertaken in cooperation with the region's seven county forest departments, all of whom worked with WWF to draw up a project proposal in 2001.

One key priority within the landscape is to identify gaps in the existing protected area network. Improved connectivity between panda habitats will allow isolated populations to interbreed, and thereby improve their genetic diversity. FLR in the Minshan landscape aims to regenerate 1200 hectares of native forest between key panda habitats by 2004, which will also allow these charismatic animals to move safely between the high slopes. Regeneration will also allow greater sustainable use of the forests by local people.

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Case Study: Bulgaria

Protection and restoration of the floodplain forests of the Bulgarian Danube Islands

High above the forest floor cormorants shift on their nests, dark bonnets of twig and reed decorating the tall white willows. In the quiet reedbeds beside the ancient river a frog slips from the water to rest upon the broad-leaved water lily. A Grey heron, motionless against the reeds stabs swiftly from above, swallowing the frog with its arched neck outstretched, supple and strong. Dragonflies hover over the floodplain pools while large carp rise cautiously from the muddy depths casting gentle ripples on the surface. A pair of Dalmatian pelicans descends from the sky, noisy wings and ungainly bodies hitting the water in a rush. Soon, the fishermen will come, casting their nets across the water hoping to find the giant sturgeon rich with eggs. High in a tall oak tree a white-tailed eagle scans the river, waiting and watching for its mate to return with food for their chick. This is the eagle's last refuge on the mighty Danube, and like the fishermen the birds must travel further and further each season to fill their stomachs.

The ecosystem

Bulgaria's stretch of the River Danube is 478 km long and contains 75 islands covering approximately 11,000 hectares. For thousands of years the wetlands alongside the Danube and the islands themselves have been subject to constant erosion and sedimentation along with periodic flooding. This ebb and flow along the river banks has given rise to their unique vegetation and rich wildlife diversity. The Lower Danube and its delta now represent a rare and outstanding freshwater ecoregion containing over 50 different habitats which are vital for many plant and animal species. The floodplain itself contains forests of mixed oak, elm and ash as well as marshes and river channels essential for preserving biodiversity in the region.

Over 300 species of higher plants have been identified on the Bulgarian Danube islands more than half of them dependent on the water table. Insects and amphibians depend on the cover provided by duckweed (*Lemna minor*), salvinia (*Salvinia natans*), white water lily (*Nymphaea alba*) and yellow water lily beds (*Nuphar luteum*), almond and willow-osier scrub and Balkan purple willow forests (*Salix purpurea*). Tree species include the common oak (*Quercus longipes* Stev.), black poplar (*Populus nigra*), elms (*Ulmus campestris* and *U. effusa*) and mulberry trees (*Morus nigra*). The forests are home to mammals such as deer, wild cat, foxes and wild boars. Numerous endangered bird species like the rare White-tailed eagle (*Haliaeetus albicila*) also rely on the floodplain forests for nesting sites. In total, some 160 bird species are known to use the Danube islands for nesting, migration and wintering. Rare visitors include the Dalmatian pelican (*Pelecanus crispus*) and the pygmy cormorant (*Phalacrocorax pygmaeus*). The river itself has 65 fish species as well as 11 amphibians, and is the last known habitat of the Danube newt (*Triturus cristatus dobrogicus*) in Bulgaria. The floodplain is also an essential spawning area for wild carp (*Cyprinus carpio*) – catches of which have declined to 1/20th of their size in the last century. Even so, the carp remain an important food resource for local people and there are over 2000 fishing boats still plying the waters.

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The problem

Approximately 30% of the original floodplain forests on the Bulgarian Danube islands remain in a close to natural state but for over forty years the Danube Islands in Bulgaria have been part of the State owned timber industry. The single biggest threat to the remaining natural floodplain forests on the islands is conversion to hybrid poplar forests. Poplar forestry is the main economic activity on the Danube islands due to the favourable natural conditions, high productivity and the relatively short return period (average 15-20 years). Until the year 2000, existing plans entailed conversion of native forests and would have led to them covering less than 7% of the islands.

Forest Landscape Restoration: The Economic case

As a natural resource, the floodplains have clear value as a recreational area for local people, and are part of a landscape that Bulgarians regard as part of their heritage.

All 75 Danube Islands are state owned, and managed by the National Forestry Board. In response to plans which threatened to continue large scale conversion, an economic analysis was undertaken to look at the costs and benefits of further conversion versus protecting and restoring part of this rich landscape. Exclusive State ownership of these islands has made the analysis of economic costs and benefits of protecting and restoring the floodplain forests possible. Areas of natural forest which have not yet been converted to poplar plantations are areas with marginal economic value. The analysis showed that financial losses from suspending timber production on

certain islands can be offset by intensifying production in areas already converted to poplar plantations. Additional 'economic gains' to the community include the potential use of original forest for recreational purposes, improved fishing (by creating more spawning grounds), the harvest of non-timber forest products and possible eco-tourism development.

This economic analysis has shown that profits for the State from further conversion of previously unexploited floodplains to poplar plantations would be low. This 'loss' is small in relation to supporting their return to healthier natural forest status.

In 2001, the National Forestry Board agreed to halt any further conversion and to set aside 30% of the plantation area that would have been logged within the next five years for floodplain forest restoration.

Based on the results of the economic analysis, the Government of Bulgaria has adopted a Strategy for the Protection and Restoration of Floodplain Forests on the Bulgarian Danube Islands, which sets goals for the preservation of the remaining

floodplain forests and the restoration of further areas, currently under poplar plantations. At the time of writing this document, an Action Plan for the implementation of the strategy is being finalised. This strategy requires a compromise between economic interests and conservation goals. Further benefits in the form of sustainable forest resources being made available for hunting and fishing have added to the perceived 'gains' of leaving the natural forest undisturbed.

Forest Landscape Restoration under the new action plan for the Danube islands has resulted in a compromise between economic, social and environmental interests. It is dependent upon political goodwill from the stakeholders. The proposed restoration of significant areas of floodplain forests includes the removal of dykes, restoration of internal channels and other measures to restore the natural hydrological regime of the islands, as well as replanting of native vegetation.

The commitment to protect the floodplain forests has been driven by the Ministry of Agriculture and Forests, and Ministry of Environment and Water with the support of Bulgarian experts, NGOs and WWF International (Danube-Carpathian Programme). At national level the Forestry Board is itself committed to developing a balanced and sustainable forestry policy. The FLR strategy for the Bulgarian Danube Islands will also help Bulgaria meet its commitments under various international conventions such as the Convention on Biological Diversity (CBD).

At an international level the Republic of Bulgaria has joined Romania, Ukraine and Moldova as signatory to the creation of a Lower Danube Green Corridor – some 900,000 hectares of protected and restored areas – consisting largely of wetlands and floodplains.

Restoring the Danube islands will allow the natural forests to regenerate, providing wildlife habitats for endangered species and an essential resource for residents and visitors to the region. FLR ultimately aims to improve water quality, provide alternative sources of income for local people and to preserve biodiversity in this unique ecosystem, a strategy which is the first of its kind in Bulgaria.

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Case Study: The Atlantic Forest, Brazil

Increasing the extent and quality of Brazil's fragmented Atlantic Forest

The sun is hot and the small creatures shelter from its rays beneath the treetops. Tiny fingers dig into the tree's moist bark searching for insects burrowing beneath the wood. The male monkey is looking for food for its twin babies, clinging to the long soft fur on its back. High pitched whistles, gentle as birdsong criss-cross the forest as other golden lion tamarins speak to each other among the thick foliage. Somewhere close-by his mate is feeding herself.

A harsh scream cuts through the air. The golden tamarin freezes, eyes wide with fear. Above the forest canopy an eagle circles the treetops, sharp eyes taking advantage of the bright light. The monkey leaps from the branch spanning the dizzy drop to the next tree, its babies holding tight against the shock of the fall. A golden tail, longer than his body gives him balance as he throws himself into space. He must hide from the eagle before he can find his mate. Later, she will have milk for the twins, but for now he must keep them safe in the forest.

The ecosystem

The Atlantic forest stretches for several thousand kilometres along the east coast of Brazil, and continues inland to parts of Paraguay and Argentina. The area includes dry forests, tropical and subtropical forests and important mangrove areas. In terms of biodiversity, over half of the tree species found here are endemic and it is home to 19 species of primate and over 160 bird species including the red-necked tanager (*Tangara cyanocephala*) and the red-billed curassow (*Crax blumenbachii*). Almost all (92%) of the Atlantic forest's amphibians are endemic. The Atlantic forest is also where most Brazilians



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now live, some 70% of the population in some of the world's largest cities including Rio de Janeiro and São Paulo. Golden lion tamarins (*Leontopithecus rosalia*) make their home in one tiny area here, small squirrel-sized monkeys with long tails and exuberant coats which form a mane around their tiny face.

The problem

The scale of past deforestation and fragmentation in Brazil's Atlantic forest is enormous. Brazil's Atlantic forest once covered over 1 million square kilometres but now covers less than 100,000 km² (about 7% of its original size). Today, only small patches of this forest remain. They are isolated from one another and surrounded by increasing urban development. So seriously has the integrity of the original forest been disrupted that almost all of the endemic species within the Atlantic Forest can now be considered endangered.

The Atlantic forest faces several sorts of threat in different areas of Brazil, ranging from timber extraction, to hunting and the conversion to agricultural usage. The harvesting of palm hearts as well as the collecting of ornamental and medicinal plants by large numbers of people living in and near the forest is a constant problem. Conversion to sugar cane plantations and cattle ranching has destroyed many areas of natural forest. Fragmentation of the forest has disrupted the migration and habitat distribution of many species and in the case of the golden lion tamarins has reduced them to precariously low numbers.

The lion tamarins now inhabit an area covering less than 2% of their original habitat. Little more than twenty years ago there were fewer than 200 golden lion tamarins left in the wild. In 2001, a newborn male brought the number of individuals of this species back to 1000. However, at least double this number is thought necessary to ensure a viable and healthy breeding population if the species is to survive in the wild.

The fate of the golden lion tamarin and the future of the Atlantic forest go hand in hand.

WWF Brazil, in partnership with the Golden Lion Tamarin Association has focussed much of its efforts on two protected areas of Atlantic forest using the tamarin as a spearhead of its public awareness campaign. As such, the tamarin



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symbolises all of the endangered species within the forest and its recovery from a catastrophically small population is a source of pride within Brazil.

Weighing just about one kilogram and with a body the size of a squirrel this tiny charismatic animal is now very widely recognised inside and outside Brazil. As a result of the high profile publicity attracted to the golden lion tamarin WWF has been able to convince several private landowners to create protected areas on their own land. These private protected areas have legal status and limit the use to which the land can be put. The golden lion tamarin project concentrates on two principle conservation areas – the Poço das Antas Biological Reserve in Rio de Janeiro State, and União Biological Reserve in nearby Rio das Ostras county.

Forest Landscape Restoration: preserving endemic species

Golden lion tamarins and countless other species have an uncertain future unless more of the Atlantic forest can be protected and restored. By 2025 the aim is to increase the habitat available to the monkeys to at least 25,000 hectares and to double their numbers to 2000.

Forest Landscape Restoration in this case involves linking the idea of conservation with the fate of an especially well known species – and thereby linking the idea of habitat, ecosystem and landscape in people's imagination.

A key part of FLR is the creation of forest corridors to connect biological reserves with each other and allow breeding populations to intermingle. Near to the Poço das Antas reserve settlers are being encouraged to plant seedlings so as to promote

regeneration of tree species. To a certain extent the forest regenerates itself if it is left untouched, but a succession of large forest fires in recent years has caused significant damage. Local people, tourists and farmers have to be shown that protecting the forest has important consequences for the protection of the watershed on which everyone relies. Outside the Poço das Antas and União reserves, WWF is working with a tri-national network (Brazil, Paraguay and Argentina) to connect and restore tracts of the Atlantic forest. This southern border area is the last refuge of the jaguar in the Atlantic forest.

WWF also promotes needed legislation and supports the creation of new public protected areas and better protection of those that already exist. With its partners, WWF works to advance economic incentives, including tax breaks and ecotourism, that encourage private landowners to protect their forestland.

In the face of widespread disruption to the original ecosystem, the goal of FLR in Brazil's Atlantic Forest may seem small-scale. At the protected areas level however, a small amount of conservation has been shown to produce remarkable results. In the case of the golden lion tamarin the restoration of just 20 hectares of forest corridors between patches of isolated forest will bring at least a further 3,500 ha of forest within reach of the currently available habitat. WWF and the Golden Lion Tamarin Association have been working with some 40 conservation organisations on the tamarin project – a unique worldwide partnership of zoos, NGOs, research programmes and the Brazilian government to save the species.

On a wider scale the restoration of the forest landscape in the Poço das Antas and União reserves involves recuperation programmes for degraded forests, environmental education programmes and new techniques for species reintroduction from captive breeding programmes. It also brings with it capacity building for local conservationists, development of ecotourism as a source of project funding and such innovations as fauna corridors on private land.

Through FLR, WWF hopes that habitats for endangered and endemic species such as the golden lion tamarin can be restored successfully and that such results will encourage similar projects elsewhere.



Case Study: Lower Kinabatangan River, Malaysia

Protecting and restoring habitat along the Kinabatangan River

An early morning mist lies along the mighty Kinabatangan. The shrill cry of the hornbill comes from the forest and shy proboscis monkeys forage high in the treetops. As the morning sun strengthens in the sky wild gibbons hoot to each other across the river as they feed on ripe figs. From somewhere close by there is the sound of mighty elephants pushing unseen through the foliage in search of food.

For hundreds of years the Kinabatangan has been the main highway to the interior of Sabah with its impenetrable forest cover. Local people, the Orang Sungai, hunt and fish along the banks of the river in their longboats.

Tourists come here now to witness the profusion of life along the river bank, to photograph the monkeys in one of only two places in all of Asia where ten primate species make their home. Here, the seemingly human appearance of the gentle orangutan captivates ecotourists, while tree snakes dangle from the branches as visitors move quietly beneath. On the Kinabatangan visitors may glimpse elephants moving along the river's edge and marvel at the variety of habitats along its course, lowland forest, limestone outcrops, swamps and mangroves bursting with life.

The elephants move slowly, a mature female guiding the small herd through the bush. Human beings make her nervous, and she has scars on her shoulder, old wounds caused by bullets fired at her when she strayed into the oil palm crops. Now, she has taught the herd to use the Kinabatangan to avoid the open ground where the trees have been cut down around the plantations. They step cautiously into the river, staying shallow and feeling their way carefully along the bottom. In the water they are safe, and it is their only route to the next patch of forest where they can hide again.

The ecosystem

The Kinabatangan River in the Malaysian state of Sabah (northern Borneo) is an exceptional wildlife resource. The lowland section of the river stretches for 560km and its catchment area represents a quarter of the land area of Sabah state. Natural forest cover along the river bank includes a 27,000 hectare strip recently designated as Kinabatangan Wildlife Sanctuary and the river corridor includes dipterocarp forest, riparian forest, freshwater swamp forests, limestone forests, oxbow lakes and mangroves.

Wildlife along the river includes more than 50 mammal species such as orangutans (*Pongo pygmaeus*), Asian elephants (*Elephas maximus*), Sumatran rhinoceros (*Dicerorhinus sumatrensis*) and 10 primates including proboscis monkeys (*Nasalis larvatus*), famous for their long flaccid nose. The orangutan population of around 800 individuals is one of the largest in Sabah while the elephant herd numbers approximately 100 individuals. Over 200 bird species have been recorded, several of them severely threatened – such as the Storm's stork (*Ciconia stormi*).

The problem

At present the landscape of the Lower Kinabatangan is a patchwork of differing land uses, some of which are conflicting. At least 85% of the floodplain has already been converted from natural forest to agriculture. The rapid conversion (in the past 25 years) of natural forest to oil-palm plantations has severely reduced the natural habitat along the river banks and at certain points the riparian forest cover is non-existent. The forest corridor is now broken up and this presents critical problems for wildlife migration, especially to the elephant population who at times are forced to wade through the river to avoid entering farmland and plantations where they face being shot at. Conflicts between elephants and oil-palm planters has been a significant feature of the conversion of riverine forest.

Many of the species found along the Kinabatangan floodplain have now been exterminated in other parts of Sabah. Meanwhile, development inland in the upper watershed of the river has altered the flood regime of the Kinabatangan. This has resulted in increased annual flooding of the lower

reaches – a factor which has driven elephants onto higher ground closer to human habitation and plantations. Damage to the oil palm trees caused by the elephants has led to further conflict with the farmers. At the same time, the floods have also made it increasingly difficult for planters to grow oil palm along certain stretches of the river, as the excessive water kills the young plants. These problems have made oil palm producers more sympathetic to the idea of landscape restoration in these areas.

Forest Landscape Restoration: a life-line for the freshwater ecosystem

The floodplain ecosystem and its crucial dependence on the waters of the Kinabatangan unites all of the local stakeholders, whether planters, fishermen, those working in ecotourism or in conservation.

WWF is working towards restoring a forest corridor along the Kinabatangan which will connect the coastal mangroves with the upland forests. This will allow local people, wildlife, nature-based tourism and local forest industries to thrive and support each other. There are also local communities – the

Nigel DUDLEY



Nigel DUDLEY



Stewart MAGINNIS

Orang Sungai (river people) – who rely upon the floodplain for fishing. Restoring and maintaining the forest along the river will bring clear benefits for the local people – the protection of riverbanks from floodwaters, a sustained water supply for local towns and an improvement in the quality of local fisheries.

On the Kinabatangan, FLR aims to promote good environmental management of the area's natural capital. By encouraging relatively small-scale tree planting it may be possible to restore vital forest corridors to the landscape allowing the large mammals of Kinabatangan to coexist with the human population.

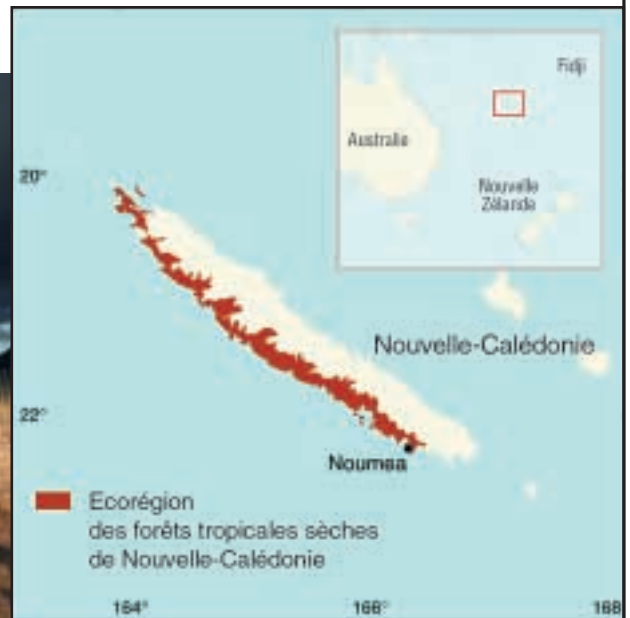
FLR along the river would involve ensuring a strip of natural forest at least 500 metres wide on each side of the Kinabatangan. Economically, it can be shown that planters could set aside between 10% and 30% of their estates along the river for forest regeneration without suffering appreciable financial losses. This would in turn bring benefits to ecotourism along the river, an industry which is attracting increasing participation among local people.

WWF is working to promote better practices in oil palm plantations, thereby tackling the problem of forest degradation at its source. This means creating awareness and raising standards among buyers of palm oil products, a process in which WWF is actively involved.

In 1999, the lower Kinabatangan was declared as Malaysia's first Gift to the Earth, WWF's highest accolade for good conservation work. It is also one of eight focal priorities for WWF's Asian Rhino and Elephant Action Strategy (AREAS) as well as being one of three 'partners for wetlands' projects funded by WWF-Netherlands.

As part of the FLR process, WWF will act as facilitator, communicator and intermediary between stakeholders including government officials, businessmen and local fishermen in the area. The result will be that the Kinabatangan elephants will be able to migrate safely along the river, local communities will be able to ensure their subsistence from fisheries and ecotourism, and oil palm plantations will be improved and contained.

Bernard SUPRIN



Case Study: New Caledonia

Protecting and restoring the Dry Tropical Forests

A giant land snail moves across the leaf litter on the forest floor sensing the sweet smell of nearby gardenia blossoms. Something swifter scuttles beneath the leaves, and a gecko emerges to climb the trunk of the margareta tree. It shelters beneath the bright pink blossoms, tasting the air with its tiny tongue. Higher still there are wattled bats roosting in the old growth forest, chattering to one another as they shelter from the midday sun. They stir nervously, scenting the smoke which begins to drift among the trees.

The forest burns fast. Small reptiles and insects scramble for safety slithering, hopping, climbing in their attempts to escape the flames. Old growth, tall trees and shrubs fall into the fire. Deer move quickly away, fast enough to escape the heat, hiding in the thick scrub where they cannot be seen by the hunters. Later, the blackened earth will come to life again, green shoots breaking through where the thick roots and trunks once covered the forest floor. Then deer will come quietly from the forest to feed on the succulent young plants which will sprout from the scarred earth. But the men with guns will be waiting, sure of their targets on the open ground. After the hunters the cattle will come, trampling the new shoots and clearing the ground with their hooves and mouths. The forest is rubbed away, bare ground without shelter or life.

The ecosystem

Dry forests are the most threatened tropical forest type worldwide. New Caledonia's dry forest is one of the WWF Global 200 Ecoregions, a priority area in terms of both species diversity and endemism. This forest houses numerous endemic invertebrates including two newly discovered species – a gecko (*Bavaya exsuccida*) and a skink (*Caledoniscincus* sp.). While New Caledonia's dry forest does not contain many

charismatic species, its plant life is remarkable – genetically unique endemic wild rice (*Oryza neocaledonica*) grows here along with the remarkable and colourful *Captaincookia margaretae* (*Rubiaceae*), the only member of its genus. In all, this ecoregion has 379 native plant species. Of 117 dry forest plant species evaluated for IUCN (The World Conservation Union) classification more than half are threatened, and it is likely that several species within New Caledonia became extinct before they were even described.

Today, essentially all of New Caledonia's highly restricted micro-endemics are vulnerable to local disturbance, regardless of the vegetation type or the substrate on which they grow.

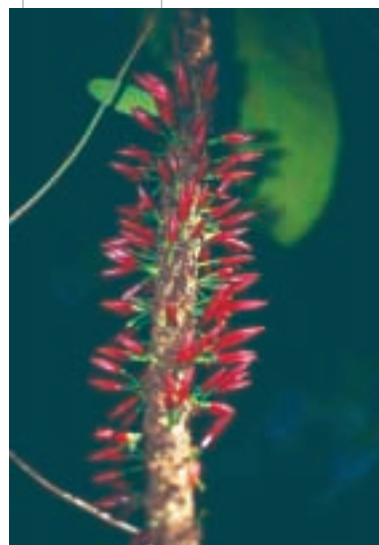
The problem

New Caledonia's dry tropical forest (sometimes called sclerophyllous forest) once covered at least 4,500 km² along the western slope of Grande Terre island. Human settlement, fire and the conversion of forest to cattle pasture has led to large scale deforestation. Today, just 2% of its original extent remains – less than 100 km² (smaller than Manhattan island). When the forest disappears so do its endemic plants, depriving us of possible medicinal uses or other agricultural opportunities. For example, New Caledonia's unique wild rice species *Oryza neocaledonica*, may have genes that could improve domestic rice production worldwide.

The remnants of the dry forest are very small (none bigger than 300 hectares), and they are very scattered. Such small stands are more vulnerable to disturbance, and cannot provide useful habitats for species which need more space to forage and nest. The remaining fragments of dry forest are especially vulnerable to overgrazing and forest fires. Another factor affecting the survival of new Caledonia's dry forests is the introduction of invasive and alien species. Since European settlers arrived on the island 150 years ago more than 800 species of alien plants, some 400 invertebrates and 36 vertebrates have invaded the original ecosystem.

Deer and cattle are particular threats to this fragile ecosystem. An introduced species of Indonesian deer (*Cervus timorensis russa*) has proliferated and is widely hunted as game. Forest fires are sometimes set in order to encourage new green

Mike NESBIT



growth which in turn attracts the deer, making them easier to shoot. In addition, they have damaged the forest both by grazing and by creating tracks through the undergrowth – paths which they seek out as shelter from the sun. Cattle ranching is a major economic activity in New Caledonia and as a result some 93% of usable agricultural land is now used for grazing. Other destructive alien species include the ‘electric ant’ (*Wasmannia auropunctata*) from Central America which has spread rapidly through the territory in the past thirty years. The ant is thought to be responsible for the reduction in numbers of several endemic lizard species as well as displacing endemic birds by invading their nesting sites.

Fires, both natural and manmade continue to pose a serious threat to the dry tropical forest and there is a culture of arson among the local population. Fires have been deliberately set in protest at social grievances such as unemployment, or as acts of vandalism motivated by grudges against landowners. Even with conservation projects underway the ability of the tropical dry forest to survive is far from certain.

Forest Landscape Restoration: Economic and social benefits of FLR

An action programme has been launched to protect and restore the tropical dry forest in New Caledonia. Action will include raising awareness of the importance of this ecosystem, addressing some of the root causes of forest loss and degradation (such as fires), identifying priority corridors and restoring together with key stakeholders, 20 km² by 2004-2005.

The overall objective of the programme is to ensure sustainable conservation of New Caledonia’s dry forest both within and outside protected areas. FLR is intended to contribute to the social and economic development of the diverse communities in New Caledonia.

Plans for pest control as well as fire prevention and control need to be drawn up and zones suitable as ecological corridors identified.

Raising awareness at local and international level of the threat to new Caledonia’s dry tropical forest remains a major priority. Cooperation between WWF-France and two local research centres IRD¹, and IAC² have produced assessments of the remaining forest patches and formed a basis from which to launch the action programme. Local institutions and scientists have recognised the need to conserve and restore this fragile ecosystem. Nine partners are now involved³ and have signed a Memorandum of Understanding committing them to the protection and restoration of their natural asset.

This awareness must now be extended to the local population, decision makers and the political representatives of New Caledonia so that everyone concerned will have a better understanding of the cultural value and the economic potential of the dry tropical forest. On a positive note, there is a great deal of goodwill in New Caledonia towards the idea of protecting the dry tropical forest. Eighty percent of the ecosystem under threat is privately owned with approximately sixteen landowners or groups identified as stakeholders. Fourteen of these are individual farmers of European descent, while the remaining two areas of forest belong to indigenous Kanak communities. All of these stakeholders are aware that the disappearance of the dry tropical forest may affect water quality on their land in the long term, and there is a growing understanding that the ecosystem is in a fragile state.

The French Government, while still responsible for the administration of New Caledonia as an overseas territory, is devolving many decision-making powers to the newly instituted Government of New Caledonia.

Working closely with farmers and indigenous people FLR will stabilise and re-establish, in a sustainable manner, a healthy and functional ecosystem able to deliver a range of benefits to those dependent on it.

¹ Development Research Institute – Institut de recherche pour le Développement

² Institut Agronomique néo-Calédonien

³ French Government, Government of New Caledonia, Northern Province, Southern Province, New Caledonia Agronomic Institute, Research Institute for Development, University of New Caledonia, New Caledonia Environmental Awareness and Education Centre and WWF-France



A Call for Action

WWF cannot achieve Forest Landscape Restoration alone.

There are many levels to FLR and many interrelationships which will mean that there is no one recipe for success. The need is there and visible throughout the world. WWF calls on its partners from the conservation world, but also development organizations, governments and business to work together to engage in FLR.

To establish and succeed FLR will mean:

- Creating and encouraging the right policy framework,
- Eliminating economic, financial and/or policy incentives that contribute to forest loss or degradation;
- Allowing key stakeholder participation in determining the balance of goods and services within their landscape and building local capacity;
- Ensuring support for good models and initiatives which can be tested and eventually replicated on a large scale;
- Working with a diverse range of partners;
- Documenting, exchanging and disseminating lessons learnt and experiences;
- Developing and using monitoring tools and techniques to measure progress.

WWF together with its partner, IUCN – The World Conservation Union⁴, will continue to promote FLR as an essential element of their joint forest conservation strategy.

⁴ WWF and IUCN are working jointly on a project called Forests Reborn, which helped develop and promote the concept of FLR



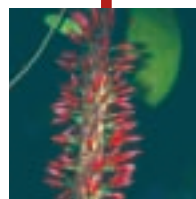
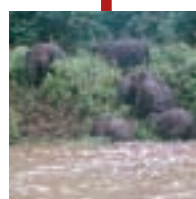
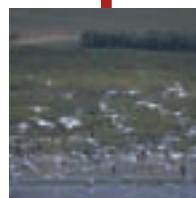
WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by:

- conserving the world's biological diversity
- ensuring that the use of renewable natural resources is sustainable
- promoting the reduction of pollution and wasteful consumption

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