Invasives experts and IUCN Invasives Species Specialist Group members worldwide are seeing some of their work and ideas being communicated on a global scale, in the form of the 21-page draft document "Guidelines for the Prevention of Biodiversity Loss due to Biological Invasion".

This document was compiled after extensive consultation with members, and also with those who attended the Norway/United Nations Trondheim Conference on Alien Species in July 1996. The guidelines are designed to help governments meet their obligations under article 8(h) of the Convention on Biological Diversity to reduce the risks of biodiversity loss caused by alien species.

In October 1996, since Issue 4 of Aliens, many of the people involved met at the IUCN World Congress in Montreal, Canada, where the draft guidelines were presented and discussed.

Further peer review is required on the document, before it is submitted to IUCN for final ratification.

The document is available for reading on the IUCN website at: http://www.iucn.org/themes/ssc/index.htm (under "of interest to members") and comment is invited. Please send any comments by fax, e-mail or letter to:

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American mink were introduced to Belarus in 1953 for the first time. More than one hundred animals were released by Lake Palic which is currently part of the 78,000 hectare Berezinsky Reserve. The reserve includes boreal mixed, coniferous and spruce forests, as well as the bogs and bottomlands of the River Berezina. The release of this species had negative consequences for local fauna in the Berezinsky Reserve. American mink have almost forced from the territory of our reserve the less aggressive European mink, which are now seldom seen in Belarus. And recent evidence indicates that the water vole may share the fate of the European mink; vole populations are threatened by American mink, which in turn threaten the nesting places of water birds.

Raccoon dogs were brought to Belarus for the first time in 1936. The first animals were marked on the territory of the Berezinsky Reserve at the end of the 1950s. Today this species is one that is hunted in our republic. It is known to destroy the clutches and nestlings of landbirds. The raccoon dog is the cause of the decrease in numbers of wood grouse, black grouse and hazel grouse in several regions of Belarus and in specific parts of our reserve too. I would be interested to hear opinions on the management of such species for minimisation of their influence on our natural reserve ecosystems. Please contact me for more detail.

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Invading bivalves in South America

Three species of bivalves: *Corbicula fluminea* (Muller, 1774), *C. largilliertie* (Philippi, 1844) and *Limnoperna fortunei* (Dunker, 1857), from the southeast of Asia, have reached the neotropical La Plata basin via the Rio de la Plata river.

*C. fluminea* and *L. fortunei* are named as invaders due to the fact that they are exotic, and characterised by early sexual maturation, a high reproductive capacity and adaptability to the different environments they colonize.

These characteristics have permitted the rapid expansion of *C. fluminea*, not only into the Rio de la Plata zone, but also into the Parana and Uruguay rivers. Darrigran and Pastorino (1995) have reported the presence of the genus *Corbicula* in the central part of Argentina. *Limnoperna fortunei* is a freshwater species found in rivers and streams of China and the southeast of Asia. It was found for the first time in America in 1991, in a locality known as Bagliardio de la Plata river, Argentina. At the end of 1993, *L. fortunei* could only be found in the area from Punta Piedras (35° 26' S - 57° 08' W) up to Punta Lara (34° 48' S - 57° 59' W) on the Rio de la Plata river, but not in any other country or river in America. By the end of 1994 and beginning of 1995, it had spread further along the Rio de la Plata. It was even possible to find it at water inlets in Bernal and Retiro; both part of Buenos Aires port. Likewise, this species was reported along the coastal area of Republica Oriental del Uruguay; all these localities line the Rio de la Plata.

During the last months of 1995, the first collections of *L. fortunei* were made from the Parana river which is one of the four important sub-basins of La Plata. This illustrates the bivalve's quick and continuous expansion, as well as its adaptation to the different basin environments.

*C. fluminea* rather prefers sandy or muddy substrates where it can bury itself. *L. fortunei* populations are found all over hard substrates such as trunks, roots and stones, including artificial coastal walls.

*Corbicula fluminea* has an average density of 170 individuals/m² on the Rio de la Plata littoral. *L. fortunei* was found for the first time in Bagliardi in September 1991, in isolated groups of 5 or 6 individuals. By May 1992 its average density was 31,222 individuals/m². Then, a year later, it had increased to 82,151 individuals/m², representing more than twice the density of the previous year.

Along the Rio de la Plata littoral, *L. fortunei* presents an average density of 14,284 individuals/m².

Ituarte (1981) reported for the first time the presence of two bivalve species from the southeast of Asia in the Rio de la Plata river: *C. fluminea* and *C. largilliertie*. The link between the countries is the shipping trade. Ituarte also reported that *Corbicula* was introduced to Argentina between 1965 and 1975, perhaps for consumption by crews since it is edible.

Continuous sampling in the above described area showed that *L. fortunei* arrived at the Rio de la Plata river in 1991. The Argentine imports from places where this species is primarily found – Hong Kong, Vietnam, Thailand and Korea – have boosted the increase in numbers. Since this is not a food species, it possibly arrived in tanks containing fresh water with no biological treatment. Thus overseas trade should be subjected to a strict biological control.

All over the world the control of plague molluscs is effected by means of electric discharge, chlorination, poisons (very toxic), electromagnetism, high temperature, ultrasound, etc. There is often a high economic cost and residual toxicity.

Among all the problems caused by invading bivalve species in the northern hemisphere, we may cite:

1) Blockage of important water pipes, either in houses and/or industry, which means:
   a) light reduction in the tubing;
   b) decrease of flux velocity in the pipes due to friction (turbulent instead of laminar flux);
   c) accumulation of empty shells in water tanks;

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The mollusc fauna of the Rio de la Plata river has been threatened with extinction due to alterations particularly in the water beds and, in general, in the natural habitats. This situation has worsened due to the invasion of exotic bivalve species: a shifting of and density decrease in the existing malacofauna are evident.

Corbicula fluminea has caused serious problems in the United States since its arrival in 1938. No damage has been detected in the neotropical region, but it must be pointed out that its ingress occurred 30 years after that in the northern region.

Limnoperna fortunei has become extremely dangerous due to the following factors:
1. Its byssate epifaunal habit has no competitive interaction with any other organism living in La Plata basin littoral.
2. This species evidences a high biotic potential. Its invasion involves biofouling processes that affect the running water systems for either human consumption or industrial use, such as those described by Morton (1973) in Hong Kong, or the ones produced at the water-supply plant of La Plata city in 1994.

Animal welfare groups took the case to court, citing inhuman methods and comparing the method to that of Nazi gas chambers. This will put a stop to the programme, and Dr Genovesi is concerned that there is even debate among NGOs: “The eradication of the grey squirrel from Italy is urgent, and we decided to use anaesthetisers as the technique was requested by NGOs”.

Grey squirrel in Italy

The potentially successful programme to eradicate grey squirrels from the Piedmont area of Italy has been called to a halt by animal welfare groups. Dr Genovesi Piero reports that the project had been working very well: in a first trial, more than 50% of the estimated population (190 out of 360) were trapped in live traps and euthanised with the anaesthetiser alothane.

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The Hawaiian Ecosystems at Risk (HEAR) Project

U.S. Geological Survey, Biological Resources Division and
University of Hawaii, Department of Botany

The Hawaiian Ecosystems at Risk (HEAR) project was established in 1995 to provide information and infrastructure to the natural resource management community (federal, state, and private) in Hawaii, regarding harmful alien species there. Prime considerations in the design of databases produced by the HEAR project have been good relational structure, data integrity checks, and compatibility of data structures with local and international standards (including IUCN standards).

Databases designed by HEAR which deal directly with alien species include a Harmful Non-Indigenous Species (HNIS) database (including information about invasive/disruptive alien species), an island matrix database containing island-by-island distribution information for selected alien species, as well as a database of more detailed information about selected species (to be used to develop an experimental “screening” protocol). Other databases—dealing with species and systems impacted by alien species—include a monitoring database (for collection of alien and native species data; with flexible design for any plot-based data), a species of concern tracking database (information about endangered/threatened/candidate species), and others. These databases all use standard “taxon codes,” which in turn are based on standard nomenclature of Hawaiian organisms as maintained by the Hawaii Biological Survey (Bernice P. Bishop Museum).

HEAR databases are currently in use by the U.S. Fish & Wildlife Service, National Park Service, Natural Area Reserve System (State of Hawaii, Department of Land and Natural Resources, Division of Forestry & Wildlife), University of Hawaii (Department of Botany), The Nature Conservancy of Hawaii, and Maui Pineapple Company (a local private organization protecting watershed). Final versions of information contained in the HNIS database are posted on the web as HNIS reports.

In conjunction with these databases, HEAR provides a web-based clearinghouse for information about selected alien species of concern to land managers in Hawaii, including distribution maps for selected alien species in Hawaii.

The internet provides an unparalleled mechanism for collecting and disseminating up-to-date data; HEAR is taking full advantage of this technology. HEAR project information and data are available online; the HEAR website is updated frequently. Further information is available at:

http://www2.hawaii.edu/~halesci/HEAR/

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(Opinions expressed are my own and do not necessarily represent the views of USGS/BRD, RCUH, CPSU, UH, or anyone besides just me!)
Workshop on alien crayfish in Europe
University of Florence, September 24-27 1997

The Department of Animal Biology and Genetics at the University of Florence (Italy) is organizing an International Workshop entitled "The introduction of alien species of crayfish in Europe: how to make the best of a bad situation?" to be held at the Zoological Museum "La Specola".

The workshop will develop in 13 invited lectures, and space will be left to other participants for poster displays and a roundtable discussion, which will deal with: the role of legislation and education to prevent both disappearance of native species and the introduction of alien ones; and programmes of inland water restoration for reintroduction of native species.

For a detailed programme and further information, please, contact:

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4th International Conference on the Ecology of Invasive Alien Plants
Technische Universität Berlin, 1-4 October 1997

This conference will be the next in a series of meetings that started in 1992 in Loughborough, UK, and was continued in Kostelec, Czech Republic, in 1993 and in Tempe, Arizona, USA, in 1995. It will offer the chance to concentrate on issues identified as important during preceding meetings.

Topics will include:

- What makes a plant invasive?
- How can the effects (e.g. economic) of plant invasions be assessed?
- Control: blind actionism or cost efficient nature management?
- Cost/effect analyses of control measures.
- Early warning, risk analyses.
- Policies.

There will also be room for reports on individual case studies.

Intending participants, please contact me for more details.

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This meeting aimed at producing a policy statement relating to invasive mammals and birds. It was organised for the OECD by the Department of Animal Ecology, Swedish University of Agricultural Sciences, Umeå, in conjunction with the Department of Applied Zoology, University of Helsinki. Professor Heikki Hokkanen (University of Helsinki) acted as scientific co-ordinator.

Most papers discussed positive and negative effects of vertebrate introductions, two dealt with the attributes of invasive species and two concerned policy.

During the years in which I have worked on the effects of invasive mammals, I have come to regard these effects as primarily an island problem, leaving aside the Australian continent. This meeting showed me this is far from the truth. Of 17 mammal and bird species introduced to the Nordic countries, for example, 14 have established a population in at least one country. Mink and beaver introduced from North America have displaced their European counterparts in most countries where these related species pairs have come into contact. As pointed out by Nummi, the biota of the Nordic countries is relatively youthful, owing to the short time elapsed since the last great ice sheet wiped out most life in the area.

Some effects of invasive invertebrates are much more widespread than I had realised, hybridisation being one such effect. Dan Simberloff gave the meeting numerous examples of hybridisation between introduced and native species from many different parts of the world, including all continents.

Perhaps my strongest feeling with respect to understanding the effects of invasive species is that almost all our knowledge is based on studies of the most obvious direct effects of invasives. Reality is more complex. Chris Dickman, in discussing the impact of introduced dingoes, red foxes and cats on the Australian native fauna, pointed out that these predators also affect each other’s numbers, even though the mechanisms are not always clear. If we really understood the arrays of flow-on effects associated with each introduction, let alone several introduced species interacting together, we would begin to realise just how all-pervading a problem we have when we wish to protect indigenous biotas from invasives.

Major recommendations arising from the workshop were:

- All introductions of non-indigenous vertebrates, for whatever purpose, should be regulated, and this according to principles outlined for Australia by Bomford in a 1991
OECD Workshop on Invasive Mammals (continued)

Bureau of Rural Resources Bulletin.
- Any species whose introduction is allowed should:
  1) carry a substantial economic or social benefit,
  2) not be harmful to humans,
  3) not be likely to establish in the wild,
  4) not have an adverse ecological impact,
  5) be possible to eradicate.
- A black list would include species not allowed into the country under any conditions.

As with our new Biosecurity Act in New Zealand, these recommendations focus on intentional introductions. Little is said about accidental introductions, which are the hardest to prevent and include some of the most damaging to native species. This is why, in my paper at the workshop, I suggested that all countries should spend more time in systematically analysing invasion risks with a view to identifying those problem species most likely to be introduced accidentally. If this were done it would enable each country to develop contingency plans for rapid response to invasions of those species should they happen in the future.

Full proceedings of this meeting have been published in the Scandinavian journal Wildlife Biology 2(3): 129-228, 1996.

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Eradications in Mauritius

The management plan for Round Island, prepared following eradications there, recommended that other islands in the group be surveyed and that a management regime be established for them. In 1993 the Overseas Development Administration (UK) financed Wildlife Management International Limited (NZ), the National Parks and Conservation Services (NP&CS) of Mauritius, as well as the Jersey Wildlife Preservation Trust, to undertake the survey of the outer islands of Mauritius and Rodrigues and to prepare a management strategy. This plan recommended a number of alien animal eradications.

As finance from the ODA was limited, some priorities were made, and in 1995 WMIL, NP&CS (Mauritius) and the Mauritius Wildlife Appeal Fund tackled the problems on Gunners Quoin, Cocos and Sables and Gabriel Islands. On Gunners Quoin (67 hectares) the target animal was Rattus norvegicus. The bait, a grain-based pellet containing 0.02% Brodifacoum, was laid by hand at 25 metre intervals. It was necessary to cut tracks through the thorn scrub, and the Special Mobile Force (Mauritius) assisted with this. Results were almost immediate and dead rats could be found throughout the island. It was noted that the other alien mammal, the black-collared hare Lepus nigricollis was also taking some of the bait, so this species was targeted by laying bait where hare sign was prominent.

At Cocos (15 ha.) and Sables (8 ha.), mice Mus musculus were the target. Because of the smaller home range of mice, the bait was placed at 10 metre intervals. Very little cutting was required as most of the ground cover was grass, but this was cleared away from the actual bait station. The final island treated was Gabriel (42 ha.). Here the rat was Rattus rattus. Again, little cutting was involved because the 25 metre grid could be laid out by working between thickets. Some bait was broadcast into thickets.

Monitoring has been carried out at least twice by NP&CS and there has been no sign of any mammals. Already there are signs of the vegetation recovering on both Gunners Quoin and Gabriel Island, with Latania palms and Pandanus regenerating. On Gunners Quoin, the lizard fauna has become a lot more visible. Even the night gecko, Nactus coindemirensis, has been seen on at least two occasions whereas it had only previously been seen by the expedition which described it.

The eradications and recovery follow the pattern established on Round Island. However all have quite major weed problems which need to be addressed and this is likely to become a significant part of future management. The success of the eradications does however indicate that the larger islands – Flat (Mauritius) and Crab (Rodrigues) – could have their problem animals removed through committed programmes.

Brian D Bell,
Wildlife Management International Limited, New Zealand

Ashok Khadun,
National Parks and Conservation Service, Mauritius
The Fynbos "Working for Water" Program
An environmental project that combines social and environmental benefits

The "Fynbos Working for Water Program" is a sub-program of the South African Department of Water Affairs and Forestry's "Working for Water" Program. This name refers to the jobs being created to clear water catchment areas and river courses of invasive alien plants. The program is of enormous benefit to the environment but also has clear socio-economic benefits. The short-term social benefits contribute towards the realization of long-term environmental goals.

A major problem in the young democracy of South Africa is unemployment and related social problems such as crime. The social aims of the program are the empowerment and upliftment of rural communities. As an example of how successful this has been in the short term, the level of unemployment in the small town of Villiersdorp in the Western Cape Province dropped to 5% from much higher levels before the implementation of the program in the town.

South Africa, and especially the Western Cape Province with its unique fynbos vegetation (which forms part of the Cape Floral Kingdom), has an enormous problem with invasive alien trees and shrubs. Fynbos is a fire-prone vegetation type that is highly susceptible to invasion by alien plants. Several species from the Mediterranean Basin, North America, and especially Australia, are major problems. Species such as *Pinus pinaster* (Mediterranean Basin), *Pinus radiata* (California) and *Hakea sericea* (Australia) are a major threat to the fynbos in the mountainous areas of the Western Cape Province, whereas Australian *Acacia* species such as *A. mearnsii* and *A. saligna*, and *Eucalyptus* spp. are threatening the lowlands and riparian areas. Because of extensive budget cuts during the political transition of South Africa, the invasive alien plant clearing program came to a virtual halt.

An informal discussion group, the Fynbos Forum, comprising scientists and environmental managers, held a workshop in November 1993 to discuss the effect of invasive alien plants on runoff from fynbos catchments. They adopted a resolution to develop a "road show" presentation, to demonstrate to policy makers the effect of invasive alien plants on both water runoff and biodiversity, and the potential socio-economic consequences of this. The "road show" was presented to Kader Asmal, Minister of Water Affairs and Forestry, in July 1995. The dynamic Minister immediately saw the potential of the project as an ideal tool in the Reconstruction and Development Program of South Africa.

In September 1995, R25 million (US$5.5 million at R4.50 : US$1) was allocated to the national program, with R13.5 million of this going to the fynbos catchments of the Western Cape Province. There are about 1.14 million hectares of protected fynbos water catchment area in this province; these comprise privately-owned land (proclaimed as catchment areas under the Mountain Catchment Areas Act), state-owned land declared as State Forest Land, and Provincial Nature reserves.

Invasive alien plants occur in almost half of the 1.14 million ha. Of the total invaded area, more than 60,000 ha. are covered with alien plant stands having canopy cover of 25 - 100%.

Between the start of the Working for Water Program in October 1995 and the end of August 1996, 39,000 ha. had been treated, including nearly 7,000 ha. of dense stands (having > 25% canopy cover). The Fynbos Working for Water Program employed more than 3000 people at its (first) peak in March 1996. More people are now being employed following the injection of a further R20 million into the project by the Cape Town City Council, R22 million by the National Department of Water Affairs and R0.5 million by the small coastal town of Hermanus on the south coast of the Western Cape Province for 1995/6.

Alien plant control is not a once-off job. For the Fynbos Working for Water Program to be successful it will have to follow up the initial clearing operations at regular intervals for 8-10 years to ensure that the seed banks are depleted. The program is also being complemented by a program of biological control to reduce the source of seed pollution, and to reduce the vigour of existing stands. If the bio-control program succeeds in reducing the rate of spread of the dominant alien species, the labour-intensive mechanical and chemical control programs will succeed in reducing the current stands. A major problem is the lack of funds for alien plant control in the lowlands. Ecologists are currently working on formulating a motivation for the clearing of these areas, based...
on the economic value of biodiversity. There is great potential for very interesting research on the management of natural resources. The program managers are already in contact with several international agencies about launching such international research programs.

Although development and training are not the primary aims of the Fynbos Working for Water Program, training is currently being given to employees in fields such as personal financial management, environmental education, ecotourism development, project management and supervision, first aid and even day-care training for employees who act as day-mothers for the children of their colleagues working in the production teams. The training given, not only to employees of the project, but also to community representatives, will hopefully create an awareness and understanding of the environment among the local communities involved in the program. In the long term this will ensure the wise and sustainable management, of not only the water catchments, but the environment as a whole.

Disclaimer: The views expressed in this message are those of the author, and not necessarily those of WNA and/or its employees.

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"Another prickly nightshade might be poised to take over where its upland cousin leaves off".
near Fort Myers in 1995 are within 50 km of critical wildlife refuges and national preserves, and within 80 km of the Everglades National Park. Such pristine cypress swamps need to be protected from a plant which has completely dominated the understory vegetation at three sites.

With favorable hydrologic conditions, wetland nightshade appears to have displaced native wetland plants in at least one cypress swamp. Within a 10-year period, wetland nightshade has spread along 40 kilometer lengths of two rivers, with local dispersal resulting from the dissipation of seeds or sections of stem. Even pieces of stem shorter than 5 cm are capable of producing shoots and adventitious roots within a few days of placement in water or wet soil.

The pea-sized fruits of wetland nightshade are small berries, which appear and smell very much like tiny tomatoes. The fruit contains 10-60 seeds, which show over 90% viability. A single stem in full sunlight has been recorded to have 250 berries.

Because of its limited distribution and the threat it poses to wetlands in the southeastern United States, both state and federal agencies are becoming involved in supporting wetland nightshade research, management and publicity.

From the beach head it has established in southwest Florida, it now threatens federal, state, and private wetlands throughout the state. Thus, there is no need for complacency about its potential distribution elsewhere within and outside the “Sunshine State”. Although highly susceptible to damage by frost, larger plants can resprout from protected stem bases, and seeds remain unharmed. Thus, wetland nightshade could at least survive as an annual in more northerly areas.

The ability of wetland nightshade to resprout quickly from the bases of cut or damaged stems and root remnants, combined with its prodigious reproductive capabilities, indicate that it will be difficult to contain the spread of this new wetland invader unless effective management or eradication programs are implemented soon. Fortunately, systemic herbicides registered for wetland use do appear to be effective for controlling stands of wetland nightshade.

Optimal strategies for managing regrowth from the seedbank are also being developed.

Currently, the U.S. Department of Agriculture’s Animal and Plant Health Inspection Service (USDA APHIS), the University of Florida, the Florida Department of Environmental Protection, and the South Florida Water Management District are cooperating to determine the feasibility of eradicating wetland nightshade from one of the smaller infested sites along the Peace River near Arcadia, Florida.

If eradication appears feasible, a cooperative eradication project will be proposed for funding in the near future.

Wetland nightshade may be vastly outshadowed by its upland cousin in terms of area infested and economic impact, but this is definitely a species to worry about. It will probably be much more difficult and costly to control wetland nightshade in a cypress dome in a National Park than tropical soda apple in an open cattle pasture.

By acting to eliminate wetland nightshade at this early stage, we hope to avoid further degradation of Florida’s wetlands by new species capable of the same type of damage as now widespread exotics such as melaleuca Melaleuca quinquenervia, Brazilian pepper Schinus terebinthifolius and scores of other invasive plants.

Alien Fox and Randy Westbrooks rw westbrooks@weblnk.net
Seychelles Wetland Invader

Pistia Stratiotes - water lettuce

Research into freshwater ecosystems in Seychelles turned up another - all too predictable - invader on the main islands. It will come as no surprise to many people that water lettuce *Pistia stratiotes* has established itself in the coastal marshes on Mahé, Praslin and La Digue. It is a recent introduction (some five years ago?) and appears to have been first introduced to the Botanical gardens (in the pools outside the Conservation Department!) and subsequently to have spread as an ornamental.

It was not noticed as a great problem until a study of the largest freshwater marsh, the "Mare Soupape" on La Digue, found that water lettuce had spread from a few small patches in January 1996 to complete coverage of the marsh by July 1996. There had been previous concern that water hyacinth was starting to choke the marsh, but by July 1996 most of the hyacinth had been smothered by the water lettuce. The effect of this invasion was dramatic; in only 6 months the marsh had changed from having a rich fauna, and an important (if species poor) flora, to being completely stagnant. All other plant life has died, with the exception of a few reeds in the process of dying. Animal life is now restricted to small numbers of snails and beetles living in the water film on the water lettuce, and to large numbers of mosquito larvae. All other molluscs and insects have disappeared, as have the fish. The most serious loss has been the endemic terrapin population of the island which has been forced into small overcrowded streams and onto land. There they are being collected for pets or are being attacked by dogs and cats. Until July 1996, La Digue had the largest Seychelles population of terrapins: now they are virtually extinct.

There are other, more indirect effects. La Digue is the only island to retain a population of the critically endangered Seychelles black paradise flycatcher *Terpsiphone corvina* which lives in woodland around the marsh. They feed on insects, many of which used to breed in the marsh. Studies of invertebrate numbers in the woodland show that there has been a population crash of 90% in all invertebrate species following the collapse of the marsh ecosystem. This is a major threat to the flycatcher and also to other insectivorous species that have important populations on La Digue, such as the Seychelles swiftlet *Aerodramus elaphra* and the sheath-tailed bat *Coleura seychellensis*.

Once this problem had been discovered on La Digue, other threatened marshes came to light. One degraded marsh on Mahé has also been destroyed in this way and two other sites were noted where water lettuce was present. In July 1996 these were localised, but as La Digue shows, only a few months are needed for this weed to completely destroy these small ecosystems. One of the threatened sites is of especial importance as, since the Mare Soupape has been destroyed, it is now the largest semi-natural marsh area and supports the largest populations of Seychelles terrapins.

Since the Nature Protection Trust of Seychelles publicised the problem in 1996 there has been much interest and concern in Seychelles. There are plans for experimental clearance of the destroyed marsh on Mahé as a first step towards restoring the marsh on La Digue. This has not resulted in practical measures as yet and the threat remains severe on Mahé, Praslin and La Digue. It is to be hoped that we can act to eliminate this introduction before further important sites are lost.

J. Gerlach

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In June 1996 a vegetation survey was carried out on the Indian Ocean Island of Rodrigues (19°25'S, 63°25'E). This was part of a collaborative Biodiversity Restoration project which is being implemented by the Mauritius Wildlife Foundation (MWF) with technical support from the Royal Botanic Gardens, Kew (RBG Kew), Jersey Wildlife Preservation Trust (JWPT) and Flora and Fauna International (FFI). The project is funded by the Global Environment Facility (GEF).

Rodrigues is probably one of the world's most degraded tropical islands, but its biological value is high: a total of 145 indigenous and 49 endemic plant species have been recorded; 8 endemic species are recorded extinct and the remainder are mostly highly threatened. The forests that once clothed the island provided a habitat for a number of endemic birds, vertebrates and insects, including two species of giant land tortoise, two species of giant lizard, and the solitaire - a flightless bird - all now extinct. No pristine forest remains, only relict pockets of extremely modified vegetation. Rapid destruction of the forest has taken place over the last three centuries of colonisation by man, initially for timber extraction, followed by clearance for agriculture, destruction by grazing animals and rats, and introduction of exotic plant species. Currently there are no controls on the introduction of potentially invasive species.

There are currently four reserves on the island. Extensive weed management already takes place at these sites, along with the ongoing re-introduction of native species, however none of the ravines on the island are protected. Cascade St Louis (which was previously recommended as a reserve) has, with funding from the European Development Fund, recently been fenced to protect the watershed. A vegetation survey was carried out at this site with a view to its future protection and management.

Although it is easy to see the extensive damage caused by exotic species on Rodrigues, the survey yielded some alarming results. Based on 20 random samples, within which density counts were made of all woody species, we counted 95% exotic and 5% native plants (Fig 1).

Eighteen exotic species were recorded in Cascade St Louis. Of these, *Acacia nilotica* subsp. *adstringens*, *Furcraea foetida*, *Lantana camara*, *Leucaena leucocephala*, *Litsea glutinosa*, *Pongamia pinnata*, *Psidium guajava* and *Wikstroemia indica* are the most widespread and invasive. All except *L. camara* were found to be regenerating in large quantities from seed, but *L. camara* spreads vegetatively and is now a major invasive of woodland and range lands. In 1938, the plant pathologist P.O. Wiehe found only one plant on the whole island. *A. nilotica* subsp. *adstringens* poses a very serious threat to the site - a plantation was made in 1977 on a hillock at the mouth of the valley - and is spreading rapidly northwards.

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**Figure 1:** Proportion of endemic, non-endemic native and exotic species counted in 20 samples in Cascade St. Louis, Rodrigues. (Values represent total densities counted)
into the heart of the ravine, almost completely outcompeting anything in its way.

A dense thicket of *Pongamia pinnata* grows along the length of the valley in the river basin; the canopy reaches 20 metres in height and the understorey consists of a mass of seedlings and juvenile plants. The site also contains the Critically Endangered (sensu new IUCN categories of threat) endemic species *Psiadia rodriguesiana*, which grows on a sheer cliff face at the head of the valley and is threatened by the spread of *Litsea glutinosa* and *Furcraea foetida*.

The physical problems of tackling infestations such as these are colossal.

An additional threat on Rodrigues is hybridisation with exotic species; for example, the Round Island Bottle Palm *Hyophorbe lagenicaulis* has been introduced for its ornamental value, and could hybridise with the endemic species *H. verschaffeltii*.

Goats and cattle graze across an area known as the “cattle walk” which covers 55% of the island, but there are no real boundaries and the animals are able to roam freely. Even though the survey site is fenced, goats still gain access causing extensive damage.

Rats (*Rattus norvegicus* and *R. rattus*) are also a major problem. Hundreds of rat-predated seeds of the endemic tree *Pandanus heterocarpus* were found, probably the major cause of its decline at this site. Seed of the only two remaining wild individuals of the endemic tree *Hibiscus liliiflorus* are also eaten by rats; the seed germinates freely *ex situ* but does not stand a chance *in situ*. While it would be impossible to eradicate rats from the island (it covers 109 square kilometres, with a human population of 38,000) some local control is urgently required.

The GEF project has been operating on Rodrigues for one year, and while weed eradication continues at the current reserves, work is underway to improve nursery facilities and propagate material for re-introduction. It is hoped that Cascade St Louis will be given reserve status and a management plan formulated for its protection and restoration. Meanwhile, continued rapid spread of exotic plant species, coupled with the problems of grazing and rat predation may sadly lead to further disruption of this unique and fragmented biota.

This work was carried out as a collaborative project between the Ministry of Rodrigues Forestry Service (headed by Hugot Meunier), the Mauritian Wildlife Foundation Rodrigues Program (led by Colin Parbery), and the Royal Botanic Gardens Kew.

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Seychelles and Rodrigues Islands (Indian Ocean)
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Eucalyptus psyllids

Eucalyptus psyllid, Ctenarytaina eucalypti, is regarded as a pest of Eucalyptus in nurseries in the UK. In 1994, the Australian encrytid parasitoid, Psyllaephagus pilosus, was deliberately introduced into the UK to control the psyllid.

What is interesting about this is the potential conflict of interest between conservation concerns (for which the psyllid might represent inadvertent but welcome biological control) and the nursery industry.

This conflict is not important in the UK where eucalypts are not invasive, but for Spain etc. any potential value of the psyllid as an effective biocontrol agent is probably now lost for good; eventually at least the psyllid and the parasitoid are likely to find their way around Europe wherever the host plants are present. I speculate that this was probably not one of the issues evaluated by the UK Government when deciding to give permission for the release; it is likely that the main considerations were the possibilities of reducing the need for insecticide to protect trees and, obviously, issues of host specificity.

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Thailand appoints invasives group

As a result of the UN Conference on Invasive Species held in Trondheim, Norway, on 15 July 1996, the Office of Environmental Policy and Planning, Ministry of Science, Technology and Environment of the Royal Thai Government has appointed a Working Group on Alien Species, under the subcommittee on the Convention on Biological Diversity, to take responsibility under Article 8(h) of the Convention. The Working Group is chaired by Dr Banpot Napompeth, Executive Director, National Biological Control Research Center, Kasetsart University.

Banpot Napompeth

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Marine invasions: meetings held

A measure of the increasing global interest in combatting established marine invasions is shown by the following list of meetings, held in early 1997:
1. Dynamics of Invasive Marine Species: Application to the Expansion of Caulerpa taxifolia in the Mediterranean.
2. The European Shore Crab (Carcinus maenas) in Australian Waters: Workshop on Impacts and Management Options.
5. Study Group on Ballast Water and Ballast Sediments.

Lu Eldredge (Pacific Science Association) and Ron Thresher (CSIRO CRIMP) are convening a symposium on marine invasions during the VIII Pacific Science Inter-Congress in Fiji from July 13-19 1997.

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Invasions publications

The following collections of papers may be of interest. Both stem from a workshop held at the University of California, Davis.

Advances in Invasion Ecology is a special feature in the September 1996 issue of Ecology (77: 1651-1697).

Invasion Biology is a special issue of the 1996 Biological Conservation (78: 1-214), featuring 18 reviews/papers.

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United States weeds publications

The United States Department of the Interior has produced a document: Preserving Our Natural Heritage - A strategic plan for Managing Invasive Nonnative Plants on National Park System Lands. Further Information from: National Parks Service, P.O.Box 37127, Washington DC 20013-7127, USA.

Also available is: Pulling Together - National Strategy for Invasive Plant Management. Further information on Internet at: http://bluegoose.arw.r9.fws.gov/ficmnewfiles/NatlweedStrategytoc.html

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