(GISP) The Global Invasive Species Programme: Toolkit for Early Warning and Management

The Global Invasive Species Programme (GISP) [See Aliens 7], in which IUCN is a partner, held a workshop in Kuala Lumpur, Malaysia, from 22 - 27 March 1999. This meeting, which was funded primarily by the Global Environment -Facility, was a collaborative effort by two sections of GISP: the Management section (chaired by Jeff Waage of CABI Bioscience) and the Early Warning Systems section (chaired by Mick Clout). The meeting had 29 participants (including several ISSG members), from 13 countries.

Our two sections of GISP decided last year that we would cooperate closely in preparing tools to help developing countries (especially small island developing states) to deal with the threats to their biodiversity which are posed by invasive species. The Kuala Lumpur workshop therefore had as its major aim the drafting of toolkit for early warning and management of invasive species problems in such developing countries.

In order to do this, participants first presented the particular problems faced by their home countries, such as poor telecommunications infrastructures, or lack of awareness of the invasive species problem. They then discussed what the "toolkit" might consist of; or which is the best way to reverse the increasing numbers of invasions experienced.

_Early warning_ of incipient invasions can only be achieved if people are aware of both the potential extent of damage, and the likelihood that it will occur. _Management_ (not merely to prevent single species invasions, but also to restore entire systems) will probably only be effective, firstly if early warning systems evolve and people use them, and secondly if contingency plans for rapid response to new invasions are designed and set in motion. Much of the discussion centred around making the document _PRACTICAL_ and _REALISTIC._

Consensus was reached on the format and content of the toolkit, which will include a manual on prevention and management of invasive species and a supporting international database on their characteristics. Both could be tailored to meet regional needs. By the end of the meeting the first draft of a generic manual had been completed and there was endorsement of the design for an international invasive species database. The pilot version of this (being prepared by Sarah Lowe and Philip Thomas of ISSG) will be the database of the _World's 100 Worst Invasive Species_, supported by the TOTAL Foundation.

_Mick Clout (ISSG Chair) and Sarah Lowe (ISSG)"

_GISP_  
Christmas Island  
Asian ants  
Mauritius  
Réunion Island  
Nordic Initiative  
White-headed duck  
_Ligustrum robustum_  
US Executive Order  
Working for Water  
Pacific Website  
SAPIA  
DOC weed plan  
SPREP  
Marine Bioinvasions

_Sponsored by:_

_Manaaki Whenua_  
_Landcare Research_
Alien ant invasion and ecosystem collapse on Christmas Island, Indian Ocean.

The dramatic and rapid loss of native biodiversity following the introduction of the brown tree snake to Guam, *Miconia calvescens* in Tahiti, and avian malaria in Hawaii are unhappy legacies illustrating the devastating impact that single alien invaders can wreak on island life. These and other catastrophes have reinforced the notion that isolated islands are especially vulnerable to invasion by exotic species, but we have always regarded Christmas Island (Indian Ocean) as an exception to the rule. Perhaps best known for the hordes of bright red land crabs that march to the sea each year, rain forest on the island has remained remarkably free of alien invaders even after a century of human occupation and accompanying species introductions. Christmas Island has been a rare jewel among oceanic islands – maybe, that is, until now.

Trouble has come to yet another island paradise. Populations of the introduced crazy ant *Anoplolepis gracilipes* have now exploded in undisturbed rain forest on Christmas Island, with disastrous consequences. Also known as the long-legged ant, *Anoplolepis* is a well-known “tramp” species, and has now achieved an almost pan-tropical distribution. It is a stowaway, traveling the world as concealed cargo; one rumour is that *Anoplolepis* reached the island of Mahé in the Seychelles hidden in a bag of rice. This invasive alien ant has wreaked untold (and usually undocumented) environmental damage on many tropical oceanic islands, most notably Hawaii and the Seychelles, through direct impacts on...
both native vertebrates and invertebrates.

On Christmas Island, four key characteristics make it a particularly significant threat. First, like many other tramp ants, Anoplolepis forms supercolonies, with multiple queens and little, if any, territoriality between colonies. Supercolonies can extend over hectares and maintain densities of foraging workers on the forest floor in the order of 1000 ants per square metre. Second, they construct nests virtually anywhere, including the soil, tree hollows, beneath rocks and under thick leaf litter. Third, crazy ants are generalist consumers and forage widely, being predators of a wide range of invertebrates and small vertebrates both on the forest floor and in the canopies of large trees. Fourth, this ant tends, protects and encourages the establishment of a variety of sap-sucking scale-insects, which can be debilitating to their host plants.

Although the crazy ant was first reported from the island some 55 years ago, it wasn’t until 1989 that supercolony formation was first detected. In December 1998 we located supercolonies in at least eight locations across the island, ranging in area from several hectares to over 1 km² and totalling 2-3% of the forested area on the island. The impact of the crazy ant within areas of supercolony formation is extraordinary. These effects can be divided into three categories: those associated with impacts on the dominant red land crab, those associated with the probable mutualism between crazy ants and scale insects, and those related to effects on island species of special conservation value.

First, crazy ants annihilate resident populations of the endemic red land crab, Gecarcoidea natalis, which is found in rain forest all over the island. At this stage it is unclear how crazy ants (5 mm long and 2 mg live weight) can kill such large crabs with heavily calcified exoskeletons (to 120 mm carapace width and >500 g live weight), but our observations suggest that death occurs within 24-36 h of exposure to the ants. Normally, these crabs are extremely abundant, reaching a mean density and biomass of 1.3 crabs per square meter and 1400 kg per hectare. By excluding red crabs from fenced experimental plots, and comparing them to unfenced controls, we have established that this crab is the dominant consumer on the forest floor, controlling critical aspects of ecosystem function on the island. By consuming leaf litter, seeds and seedlings in a broad diet, this one species almost single-handedly controls the dynamics of seedling recruitment, litter accumulation and decay, and nutrient cycling on the island. Red crabs are largely responsible for the very open understory and mostly bare ground in the rain forest, unique structural features for which the island is noted.

In areas of supercolony formation, large tracts of forest have taken on characteristics which we had previously only seen on our small experimental plots—the accumulation and persistence of a deep litter layer, and the establishment of an incredibly abundant and diverse seedling community. Similar impacts may even become apparent in areas remote from crazy ant supercolonies. Red crabs make annual breeding migrations, moving en masse from the forest interior to the coast to breed. Most crazy ant supercolonies are at lower elevations near the coast, so in several places, migrating red crabs have had to traverse the supercolonies to reach the coast. It seems they never make it. We have seen entire migrations, involving tens of thousands of red crabs, completely wiped out by crazy ants—in one supercolony we counted an average of six crab carcasses per square meter. Presumably, the density of red crabs in source areas will eventually decrease, with the result that seedling, litter, and nutrient dynamics could change dramatically even in areas far removed from crazy ant supercolonies.

Second, without exception, ant supercolony formation has been associated with massive outbreaks of several different scale insects, the most common and widespread of which is the lac scale Tachardina aurantica. Within supercolonies, hordes of worker ants ascend the trunks of most large canopy trees to gather honeydew from dense infestations of scale insects, which they then return to their nests and distribute to other members of the colony. In several areas, scale outbreaks have been severe enough to cause extensive canopy die-back, with a far greater proportion of dead and dying trees than in nearby areas free of crazy ants. We also think that trees infested with scale insects and their attendant crazy ants may be so stressed, that rates of growth and fecundity may be significantly lower than in trees free of infestation.

Third, crazy ants directly threaten numerous other species with high conservation value on Christmas
Island, particularly sea birds. For example, the Island is the only known nesting location for the endangered Abbott's booby (Papua alba) and vulnerable Andrew's frigatebird (Fregata andrewsi), both of which nest in the canopies of rain forest trees. Given that crazy ants in the Seychelles are known to attack domestic dogs, chickens and pigs, it is not unreasonable to speculate that these and other birds (both tree and ground-nesters) are directly threatened by foraging crazy ants. In fact, Anoplolepis supercolonies already overlap Abbott's booby nesting areas at several locations around the island.

Christmas Island is also home to the world's largest and most intact population of the coconut crab Birgus latro, which like the red crab, is found throughout rain forest on the island. We have seen coconut crabs killed in large numbers by crazy ants in most supercolonies. In addition, several endemic skinks and geckos, and innumerable litter invertebrates, are probably all vulnerable to extirpation in areas of crazy ant infestation. Recent reports from Bird Island in the Seychelles confirm our worst fears about the potential impact of crazy ants on Christmas Island's biota, especially vertebrates. Anoplolepis was first noticed there in 1991, and infested about half of this small (80 ha) island by 1998. Where the ants are abundant, they have caused the deaths of white tern Gygis alba chicks, caused the disappearance of the endemic skink Mabuya seychellensis, and displaced some 60,000 breeding pairs of the sooty tern Sterna fuscata.

We are concerned that if left unchecked on Christmas Island, Anoplolepis will have a catastrophic impact on a rather unique, and until now, relatively pristine oceanic island. Our initial observations indicate that supercolonies can advance at a frightening rate, in the order of 1-3 m per day in some locations. At that rate, it is inconceivable that crazy ants may completely over-run the forested areas on Christmas Island (ca. 100 km²) within a few short years, with the devastating consequences we have outlined above. Even if Anoplolepis supercolonies dissipate behind the advancing front of invasion, structural changes in the forest precipitated by the decimation of local land crab populations will persist for decades.

Despite this presage of doom, we close on a note of optimism. Elsewhere, many biological invasions have proceeded swiftly and silently. As a result, government agencies often find themselves trying to manage an already massive problem about which they know very little, either in terms of the dynamics of the invader, or its impact on native biota. However in this case, we have picked up on the spread of the crazy ant very early, and by virtue of our long association with the island, have been able to appreciate the formidable and manifold threats these ants pose to ecosystem integrity on the island. At this stage we estimate that just a few percent of the island's forested area may be affected, so there is still time to act before crazy ant supercolonies become so widespread that managing their invasion will be all but impossible. However, action needs to be taken now. Together with Environment Australia, we are developing a plan that in the first instance will initiate an island-wide survey of established and incipient ant supercolonies. Protocols for controlling Anoplolepis will also be assessed, incorporating the use of baits laced with the stomach toxicant hydra-methylnon. This is a slow acting poison, so worker ants have time to ingest the bait, return it to their colonies and distribute it to conspecifics through trophallaxis, before the bait eventually kills them. Baiting entire supercolonies will be all but impossible, and at this stage, we favour a strategy of limiting the spread of existing infestations by baiting along their boundaries. The impact of the baits on non-target species will also have to be evaluated. However, to optimize the allocation of limited human and financial resources to combating this invasion, we need to know much more about the population dynamics of Anoplolepis, the role of the putative ant-scale mutualism in the formation of ant supercolonies, and the wider impacts of the invasion on the island's native biota. Watch this space.

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Exotic ants in Asia: is the mainland at risk?
The case of Hong Kong

In Issue No. 6 of Aliens, James Wetterer discussed the ecological impacts of exotic ant species in the islands of the Pacific. Such impacts have been documented for other islands in the Pacific, Caribbean and Indian Ocean, in North and South America and in Australia (e.g. Williams, 1994). However, very little has been written on the impact of exotic ants in continental Asia or Africa, even though these continents contain vast tropical areas, in which the (mostly tropical or subtropical) invasive ants might prosper. This may be primarily due to the shortage of active ant specialists in the region, but perhaps also to the assumption that the continental tropics, with their rich native fauna, are invulnerable to invasion. Is this the case? I will consider an example from tropical South China.

Hong Kong Special Administrative Region has a land area of some 1,100 km², including a section of the China mainland and several hundred islands up to 140 km² in size. The land has had centuries of heavy human impact, and none of its primary forest remains. The deforested land has proven amenable to the spread of many exotic species, including some 150 to 300 vascular plants, birds such as the abundant red-whiskered bulbul Pycnonotus jocosus, and invertebrates such as the giant African land snail Achatina fulica (Dudgeon & Corlett, 1994). Of some 160 ant species recorded in Hong Kong (Fellowes, 1996 and unpublished) only a few are known to be exotic in origin: these include the fire ant Solenopsis geminata from South America; the big-headed ant Pheidole megacephala, the dacetonine Quadrirstruma emmae and crazy ant Paratrechina longicornis from Africa; the pharaoh’s ants Monomorium pharaonis and Monomorium destructor from India. None of these are very widespread outside urban areas. A number of other species are possibly exotic, but have uncertain natural distributions, belonging either to genera centered elsewhere (e.g. the long-legged ant Anoplolepis gracilipes, formerly longipes), or to wide-ranging species groups which have not been adequately studied (e.g. Plagiolepis “alluadi”, Paratrechina “sauteri”, P. “bourbonica”, Tapinoma “melanocephalum”, Technomyrmex “albipes”, Lepisiota “rothneyi” and Monomorium “floricola”). Still other ants cannot be named to species, due to incomplete species descriptions, lost type material and a lack of recent study, but might include lesser-known exotics.

There is currently no evidence that any of these potentially invasive ant species are spreading unchecked in natural (or semi-natural) ecosystems in Hong Kong. Outside urban areas, most are known from only a handful of sites in Hong Kong. Only P. longicornis, A. gracilipes, P. “bourbonica” and T. “albipes” are both widespread and locally abundant. Of these P. longicornis is largely commensal with human habitations. A. gracilipes has successfully colonised many fringe habitats, where frequent human disturbance (including fire) prevents succession of vegetation (and ants). P. “bourbonica” and T. “albipes” occur in both open and forest habitats, but only T. “albipes” achieves very high local densities, and this only at a few tiny forest fragments or forest edges. In short, where potentially invasive ants in Hong Kong thrive, it appears to be in ecosystems whose paucity of ant species is more likely due to habitat disturbance than to the invasives themselves. This could be because they have not yet reached the more “natural” habitats, yet for some of the species at least, with their proven dispersal abilities, this seems an unlikely explanation. The implication is that the native community of ants (and perhaps other fauna) has, where intact, provided a measure of resistance to invasion.

However, habitat disturbance cannot be overlooked in considering the impact of exotic species. Much of the land in South China, and indeed tropical Asia, has been heavily modified by human activities such as agriculture, for-
estry and urban development, resulting in drastically impoverished native insect communities. These are likely to be more vulnerable to invasion than Hong Kong's semi-natural terrestrial ecosystems. Even where agricultural activity has been abandoned, the recovery of the native community is not guaranteed. During a recent field visit to an area of Lantau Island (Hong Kong's largest island, less than 2 km from the mainland), ecologists found only two ant species, *P. megacephala* and *A. gracilipes*. The former, renowned as a threat to native invertebrate communities elsewhere (e.g. Hoffmann, 1998), occurred in particularly high numbers, and had penetrated a small forest as well as the abandoned farmland surrounding it. Local resistance was not, it would seem, insuperable.

Is this the shape of things to come in South China? Or is it an aberration, a momentary insurgence to be crushed by native species and their superior adaptations to local conditions? To make such predictions, we need an improved knowledge of the interactions between species, as well as their climate tolerances. It is crucial to find out what, if anything, limits the success of exotic ants in 'intact' ecosystems; such an understanding might even enable their effective control in agricultural landscapes, by modifying fringe habitats to the advantage of their enemies. Where agriculture surrounds and even encroaches into nature reserves, as in South China, such habitat management may prove important in the conservation of forest biodiversity.

Traditional Chinese medicine puts great emphasis on maintaining the natural balance of the body, rather than treating the symptoms of extreme deviations. This principle could usefully be applied to ecosystems; a basic step is to ensure that the presence and prevalence of exotic species is being monitored. Thus to James Wetterer's concern for island faunas, I would add a plea for information on their continental counterparts. They may be able to take care of themselves, but we can't be sure of it!

Thanks to Barry Bolton (British Natural History Museum, UK) for information on ant distributions, and Graham Reels (Kadoorie Farm & Botanic Garden, Hong Kong) for specimen collection and comments.

**The good and bad news from Mauritius**

In Aliens 5 the successful eradications of mice from Cocos and Sables Islands (Rodrigues), black rat from Gabriel Island, and brown rat and black-naped hares from Gunners Quoin were reported. All these eradications were successful; however, on Gunners Quoin some irresponsible person has released rabbits. It is hoped that these can be removed using bait left over from an eradication programme on Flat Island.

Flat Island was the focus of a rodent and feral cat eradication programme during September and October 1998. This island, 253 ha, had a population of black rats (*Rattus rattus*), mouse (*Mus musculus*) and feral cat. The island is covered mainly with introduced weed, scrub and grass. The work was carried out by a team from Wildlife Management International Limited (New Zealand) and was assisted throughout by National Parks and Conservation Service and Mauritius Wildlife Appeal Fund staff.

The island had to have grid lines cut every 25 metres and the bait laid out every 25 metres along these. The bait used was Pestoff (active ingredient 0.2% brodifacoum) produced by Animal Control Products, New Zealand. This accounted for all the rodents and at least one cat by secondary poisoning. Another cat was trapped and killed. The cat population was thought to have been only a few stray animals left behind by visitors.

While we believe total eradication has been achieved, we will have to wait for the results of two years monitoring before we can be absolutely sure. If the programme was successful, it will be one of the largest islands from which the black rat has been removed. The removal of these animals opens the way for further restoration of the habitat by weed control and planting of indigenous species. Later the island could be used for translocation of some of the endemic bird and reptile species.

**Brian D. Bell**
Managing Director
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XIX Pacific Science Congress July 4-9, 1999 Sydney, Australia

Symposium  Introduced and invasive biota

Introduced and invasive biota are a major symposium topic of the XIX Pacific Science Congress, to be held July 4 – 9, 1999 at UNSW, Sydney. The symposium will be divided into four sections:

- marine organisms and ballast water
- invasive terrestrial plants
- terrestrial invertebrates
- vertebrates

Registration details and instructions for abstracts are available on the web: http://www.icmsaust.com.au/PacificScience/ or from

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Workshop: Methods to control and eradicate non-native terrestrial vertebrates, Malta, 3-5 June 1999

A workshop on "Methods to control and eradicate non-native terrestrial vertebrates" will be held in Malta on 3-5 June 1999. For more information, contact the organiser:

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Proceedings of the Workshop on Databases for Nonindigenous Plants [USA]

Gainesville, Florida
September 24-25, 1997

By Colette C. Jacono and Charles P. Boydstun.
U.S. Geological Survey in Cooperation with Federal Interagency Committee for the Management of Noxious and Exotic Weeds and National Biological Information Infrastructure

The Greater New England Symposium on the Ecology of Invasive Species

The Greater New England Symposium on the Ecology of Invasive Species took place on February 27, 1999 at Yale University. Titles and authors are posted, and abstracts from this meeting are now available on the Web in the form of a downloadable PDF file. The abstracts will also be posted in html format shortly.

At the present time, we are being hosted by the Yale Forest Forum Web page and so our page does not have a direct URL. To reach the page go to: http://www.yale.edu/yff/html/home.html and scroll down to ‘Education and Outreach’, click on forums, and then on The Greater New England Symposium on the Ecology of Invasive Species.

Scientific papers from the Symposium will also appear in a special issue of the journal Biological Invasions, with publication expected late 1999.

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Alien Invading Plants and Water Resources in South Africa

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Invasive Alien Species: A Summary of Public Dialogue Exploring New Solutions to an Old Persistent Problem

A symposium, “Invasive Alien Species: A Summary of Public Dialogue Exploring New Solutions to an Old Persistent Problem” was held at Yale on May 6, 1998 hosted and coordinated by the Yale Forest Forum, to foster discussion and feedback in the lead up to the Executive Order [USA].

A summary of is available on the Web at http://www.yale.edu/yff/html/body_invasive.html. The complete summary must be downloaded. A hard copy is also available.

Contact: Keri Gibson at yff@yale.edu.
5th International Conference on the Ecology of Invasive Alien Plants
13-16 October, 1999
La Maddalena, Sardinia - ITALY

Invasions of plant species have for a long time drawn the attention of botanists, agronomist and ecologists. Although this resulted in an ever-increasing body of scientific literature on "invasion biology" we still do not completely understand all aspects of this process and its impact on ecosystems. This Conference will be the continuation of a series of meetings that started in 1992 in Loughborough, GB, and was continued in Kostelec, Czech Republic, in 1993, in Tempe, AZ, USA in 1995 and in Berlin, Germany, in October 1997. It will offer the chance to continue discussions of its predecessors and concentrate on issues identified as important during preceding meetings.

CONFERENCE TOPICS
You are invited to make an active contribution; please, share your experience, problems, ideas and proposition with other participants. We propose the following topics:

(a) What makes a plant invasive?
(b) How can the effects (e.g. economic) of plant invasions be assessed?
(c) Cost-effect analyses of control measures
(d) Early warning, risk analyses
(e) Habitats management and trophic interactions
(f) Policies
(g) Invasive Plants and National Parks, Nature Reserves, Protected Areas, Botanical Gardens, Historical Gardens, Parks in Town
(h) Invasive Plants in Mediterranean Agro-Ecosystems
(i) Modeling plant invasions, computer simulations, Geographical Information Systems and other mechanisms for compiling information: their uses and misuses.

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

PAPERS
We are looking forward to your presentation. Papers, Posters, Video Presentations or any other new technologies in sharing your experiences are welcome, on the topics indicated and others falling within the scope of the Conference.

See also: http://www.botany.org/bsa/announce/iceiap.html

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Terrestrial Ecosystem Research Initiative (TERI)

The Terrestrial Ecosystem Research Initiative (TERI) was set up under the European Union (EU) Fourth Framework Research Programme as an umbrella organisation for EU funded ecosystem research. TERI (http://www.nbu.ac.uk/terica/) is currently addressing the issue of areas of ecosystem research neglected under Framework Four (the most recent five year rolling programme of EU research) and identifying priorities for research under the forthcoming Framework Five Research Programme. One area that has been identified is the issue of Aliens and Outbreak Species in Europe.

A small workgroup to address this issue in its European context was planned for the 17th and 18th February 1999 at the University of Durham, UK.

More information

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Plant invaders in Réunion Island (French Overseas Territory, Indian Ocean)

Several waves of plant importation have upset the landscapes of Réunion Island in less than 350 years. In 1989, one could count 1,052 introduced flowering plants in the natural or semi-natural environment of Réunion Island, compared to 675 indigenous ones. Of the total number, 620 (36%) are non-naturalized introductions, 432 (25%) are naturalized and the 675 indigenous ones make up only 39%. Some of the naturalized plants have rapidly revealed themselves to be invading, some sixty of them upsetting the structure of the natural surroundings and disturbing the ecological process involved.

The last relics of the semi-dry forest are nowadays the most threatened by several invading plants. Among these is Hypage benghalensis, which invades by literally smothering the indigenous trees under an inextricable green fleece. At a higher altitude, the underwoods are locally affected by a profusion of Ligustrum robustum ssp. walkeri, which endangers regeneration of indigenous plants. Leucaena leucocephala, which was already considered as invading at the end of the last century, only grows well in the most degraded areas.

The littoral zones are equally very affected by these invasions. Recently, Schinus terebinthifolius has upset the vegetative areas of humid zones. Just up from the beach, the shore is disfigured by Prosopis juliflora, which stretches over the whole of the littoral, in the North and West of the island, causing problems for seaside resort tourism.

The most disturbed mountain rainforests like the forests of Acacia heterophylla on the western slopes are locally threatened by the competition of Acacia meamsii. In various places, the ericoid vegetation of high altitudes is itself supplanted little by little by the development of Ulex europaeus. In addition, all of the formations at high altitude are jeopardized by the spreading of graminacea (Holcus lanatus, Anthoxanthum odoratum) which encourage outbreaks of fire.

The agricultural areas that are very disturbed are the scene of invasions by undesirable plants as well. Some woody mimosacea can’t be mastered without the assistance of heavy engines and at very high costs. This is the case of Dichrostachys cinerea, which covers the herbaceous savannahs subject to salted spindrifts, with impenetrable thorny thickets. It is also the case of Acacia meamsii, which, 600 m up, invades the fallow lands of the West and the South. At medium altitude, the gullies and the valley-bottoms which have been severely cleared in the past, sometimes shelter real oceans of Lantana camara or Rubus alceifolius.

University studies are starting which will provide the means to evaluate and grade the ecological impact of the invading plants. Moreover, since 1997, two research programmes have been financed by the local collectivities (Région-Réunion) in order to identify methods of biological control against Rubus alceifolius and Ligustrum robustum ssp. walkeri. As with any biological control method, it will be necessary to find biocontrol agents that are very specific to the targeted species.

For the future, we have to further promote public awareness, more particularly to check imports. In addition, programmes of regional cooperation with the other islands of the Occidental Indian Ocean would be desirable.

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[Also see page 13]
Introduced Species in the Nordic Countries
Nordic Council of Ministers (NMR) project

The Nordic Council of Ministers (NMR) has funded a project “Introduced Species in the Nordic Countries”. The countries participating in this project are Iceland, Sweden, Finland, Norway and Denmark. The project aim is to make an inventory of the effects of introduced species in the Nordic countries (including ecological and economic effects). The project includes only introduced species that could potentially damage the natural/semi natural ecosystems/habitats, not those species that are agricultural or forestry pests.

We now have our first version of this Internet based list of researchers and administrators in the field of introduced species. The short name of the list is NNIS and its location is: http://www.sns.dk/natur/nnis/indexuk.htm

It is our hope that the list will be of use for you and your colleagues in the field of introduced species. For further information about the project please contact myself:

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On 1 February 1999 UK Environment Minister Michael Meacher announced that he has accepted the recommendation of the White-headed Duck Task Force that there should be a trial to establish whether it is feasible to reduce the numbers of the introduced North American Ruddy Duck (Oxyura jamaicensis) in the United Kingdom.

The trial will establish whether it is feasible to move on to a larger control strategy, to find out what the cost of this would be, and to assess the implications for landowners; it will be carried out by the Central Science Laboratory under contract in three areas of Great Britain - the West Midlands, Anglesey and Fife.

Background

The Ruddy Duck was introduced into the UK in the 1950s. Some Ruddy Ducks brought there as captive birds escaped to the wild, and experienced a rapid population growth, with a tenfold increase between 1975 and 1990. The UK population now numbers around 4,000 birds.

The White-headed Duck Task Force was announced by Michael Meacher on 6 July 1998. It was set up to recommend the best scientific and cost effective method of carrying out a controlled reduction in numbers of the Ruddy Duck in order to assess whether it is necessary and practicable to move to a larger control strategy.

In the late 1970s, the Western European population of the White-headed Duck (Oxyura leucocephala), located in Spain, had declined to a number of only 22 birds. Action by the Spanish authorities through the protection of sites and the banning of hunting has helped to increase the total number of birds to around 1,000.

The problem caused by the migration of the Ruddy Ducks and their expansion into Europe is that they are aggressive and mate with the White-headed Ducks, producing a fertile hybrid. The greatest threat to the White-headed Duck comes from hybridisation and competition with the Ruddy Duck.

Research into the population change of Ruddy Ducks following their introduction to the UK shows how numbers have increased and the range widened over the years. The pattern of continental occurrence correlates with the UK increase and did not begin until they were well established in the UK. A study of Ruddy Ducks in mainland Europe shows there is no other source that could account for the number of birds occurring in the wild on the continent.

Apart from protecting the remaining Western European population of the White-headed Duck, if no action to control Ruddy Ducks is taken soon, the Ruddy Duck is likely to reach the key White-headed Duck breeding sites further east. Individual Ruddy Ducks have already been sighted in Turkey.

Source:
Press release from the UK Department of the Environment, Transport, and the Regions, Issued Monday 1 February 1999

[Also see: Aliens I, March 1995, page 10]
The invasive behaviour and the biological control of *Ligustrum robustum* subsp. *walkeri* on the Mascarene island of La Réunion

The native ecosystems of the Indian Ocean Mascarene Islands are characterised by high levels of endemicity (72% of the Angiosperm flora can be found nowhere else) and habitat destruction due to human activities as well as biological invasions.

More than 98% of the archipelago's primary vegetation remnants are found in La Réunion (French Overseas Department of France), due to the fact that 40% of the island are managed by the National Forest Office (ONF) and most of the native forest areas are protected. *Rubus alceifolius* (Rosaceae) and *Ligustrum robustum* subsp. *walkeri* (Oleaceae) are some of the worst alien invasive plants in the native forests. *R. alceifolius* has invaded Mauritius and La Réunion for a long time whereas *L. robustum* has recently been introduced into La Réunion.

In-depth ecological studies near the first site of introduction in La Réunion have revealed pure stands of *L. robustum* in disturbed forest patches and high seedling-banks in the less disturbed patches (that is to say in the places with no aliens and no human damage). Its characteristic high germination levels, rapid growth rate, shade tolerance and very low mortality, combined with massive fruit production and dispersal by birds contribute to this weed's ability to invade intact forests. Mechanical and chemical control of privet is difficult, especially on steep mountain slopes and it remains a major threat to the indigenous montane forests.

Hence, it was decided that biological control would be the most appropriate option and a classical biological control programme was initiated in late 1997 by the ONF of La Réunion with the work being carried out by CABI Bioscience-UK Centre (formerly the International Institute of Biological Control). This is thought to be the first biocontrol programme against environmental weeds for France and such an approach has never been used against any members of the Oleaceae. This project is funded by the Regional Council of La Réunion with support by the European Union (EEC) and is being run concurrently with that of CIRAD-Montpellier (Fr) against *Rubus alceifolius*. Collaboration with the Post-Graduate Institute of Agriculture (PGIA), University of Peradeniya, Sri Lanka should enable continued detailed surveying for natural enemies and a comparative study of the ecology of the plant in Sri Lanka and La Réunion to be undertaken. The first collaborative research project on the ecological aspect was initiated by a scientist from the University of La Réunion until 1996.

Using dried leaf samples collected during surveys in Sri Lanka, South-West India and North-East India, researchers at St. Andrews University were able to apply molecular techniques to prove that Sri Lanka was the country of origin of the *L. robustum* biotype invading La Réunion and Mauritius. It is thought that the initial introduction in Mauritius was through Botanical Garden exchanges at the beginning of the century. The species group will probably need revision in the light of the DNA taxonomy findings.

Surveys on the Indian subcontinent showed that *Ligustrum* is an innocuous member of the native flora, attacked by a range of natural enemies, and several potential agents, both fungal and arthropod, have been collected and identified. Pathogenicity studies have begun on those plant pathogens collected (mostly hemibiotrophic members of the Dothideales) and host range experiments are underway on two moth species and several chrysomelid beetles. Further surveys are now planned to include the area of origin of the genus *Ligustrum*, believed to be South China and Vietnam, where the greatest diversity of natural enemies are likely to be found. Such surveys may also be of benefit to America and Australasia where other *Ligustrum* species are rapidly becoming serious invasive weeds.

The biological control programme for *L. robustum* in La Réunion will run until the end of 2002 by which time several biological control agents should have been screened for specificity.

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[Also see page 10]
On February 3 1999, the United States President Clinton signed an executive order (EO) to coordinate a Federal strategy to address the growing environmental and economic threat of invasive species, plants and animals that are not native to ecosystems of the United States.

Interior Secretary Bruce Babbitt, Agriculture Secretary Dan Glickman, and Commerce Under Secretary James Baker told a news conference that the order creates an Invasive Species Council. The Council will develop a comprehensive plan to minimize the economic, ecological, and human health impacts of invasive species and determine further steps to prevent the introduction and spread of additional invasive species. The Council, to be chaired by Glickman, Babbitt, and Commerce Secretary William Daley, will work in cooperation with a variety of groups - including states, tribes, scientists, universities, shipping interests, environmental groups and farm organizations - to combat invasive plants and animals.

The Council has seven duties:

(1) overseeing implementation of the EO;
(2) supporting field-level planning;
(3) identifying international recommendations;
(4) creating National Environmental policy Act guidance;
(5) establishing an impact monitoring network;
(6) developing a web-based information network;
(7) preparing a National Invasive Species Management Plan.

President Clinton's budget for fiscal year 2000, proposes an increase of more than $28.8 million in funding to combat invasive species. This includes new funding for combating exotic pests and diseases as well as accelerating research on habitat restoration and biologically-based integrated pest management tactics.

The announcements signal an expanded effort to combat invasive species. The President's order directs federal agencies to use their authority to prevent the introduction of invasive species and to restore native species. It directs the new interagency Council to come up with an invasive species management plan within
18 months.

Federal officials were joined at today’s announcement by eminent Harvard biologist E.O. Wilson. Other scientists who have led calls for stronger federal action to combat invasive species include James T. Carlton of Williams College; Don C. Schmitz of the Florida Department of Environmental Protection; Daniel Simberloff, the Nancy Gore Hunger Professor of Excellence in Environmental Studies at the University of Tennessee; and Phyllis N. Windle, author of a Congressional report on invasive species.

Aggressive federal actions are already underway, including measures to prevent the entry of invasive species, eradicate invasive species before establishment, control invasive species once established, and conduct outreach and education for the general public. These actions include:

- To prevent entry of invasive species, USDA has more than 1,300 inspectors at more than 90 ports of entry inspecting commodities. The inspectors are assisted in some ports by the Beagle Brigade, a group of dogs trained to sniff out prohibited agricultural products.

- USDA has prohibited the importation of untreated wood packing material from China, which has previously carried the Asian long-horned beetle into the United States - and has proposed extending this ban to other countries.

- The U.S. Fish and Wildlife Service will build a barrier in the Chicago Ship Canal, to prevent the spread of invasive species between the Great Lakes and the Mississippi River basins.

- The Interior Department is spending $4.5 million annually to prevent the spread of the brown tree snake from Guam. The Department of Defense is part of this effort. Key elements are an extensive control program on Guam, support for research effort to develop new control measures, and participation in Oahu’s island-wide surveillance and response plan.

- The National Oceanic and Atmospheric Administration (NOAA), the Interior Department, and other federal and state agencies are working to restore the natural ecology of the South Florida and Everglades ecosystems. As this massive replumbing gets underway, NOAA and the Interior Department have made clear that safeguards must be taken to ensure that the new water flows do not become highways for exotic species to be transported through Florida’s fragile environment.

- NOAA is sponsoring research on new technologies for treatment of ballast water to reduce the threat of foreign organisms being discharged into U.S. waters.

- The federal Interagency Committee for the Management of Noxious and Exotic Weeds collaborated on research and publication of a comprehensive fact book on invasive plants.


Editorial Comment: President Clinton’s Executive Order on invasive exotic/alien species caused a great deal of rejoicing by invasive species people, and rightly so. The hundreds of scientists that added their weight to the push for this initiative (several ISSG members amongst them) are all to be congratulated!! MDP.
The Working for Water programme: South Africa

The Working for Water programme was started by the South African government's Department of Water Affairs and Forestry in October 1995. As part of the nation's reconstruction and development project, this invasive alien plant control programme now includes partnerships with other government departments, the private sector, European and American sponsors. The return on investment is high. Benefits include: enhanced water production through clearing invasive alien plants (mainly Eucalyptus, Acacia and Pinus spp.) along rivers, watercourses and wetlands; the mitigation of one of the greatest threats to the conservation of biological diversity and ecological stability; and the alleviation of poverty through the creation of some 40,000 jobs. More than 300,000 hectares have been cleared, 42,059 jobs created and over 120,000 person days of training have been undertaken since October 1995. The training has included the fields of business management skills (8%), work related skills (50%), life skills (19%), environmental management skills (19%), and other (4%). The programme’s 20 year strategy could have the following benefits:

**Empowered people:** Over 40,000 direct and indirect jobs, supporting a further 200,000 people, most of whom are the "poorest of the poor".

**Water:** Preventing the loss of over 4,000 million cubic metres of water from the hydrological cycle every year.

**Land:** Intensive (e.g. crops) and extensive (e.g. wildflowers) use of over one million hectares of land after 20 years.

**Wood:** Use of over one million tonnes of wood per year (e.g. crafts, furniture, charcoal, chips).

**Disaster management:** Fires are the biggest disaster management issue associated with invading alien plants and are capable of causing millions of rands worth of damage. Flooding is also strongly correlated with the aftermath of fires.

For the 20 year strategy to achieve its goal of reducing all key areas to a level where there would only be follow up costs required, some 750,000 hectares need to be cleared annually, which implies a substantial increase to the current level of input.


*Report sent in by Wayne Lotter,
Alien Plant Control Manager
Sappi Forests
South Africa*
New web site on Pacific invasive species

Invasive alien species are a problem world-wide, but are often particularly threatening to island ecosystems. Information about invasive plant species that are present in Micronesia and American Samoa, or have been identified as outside threats, is now available on the Internet. The Pacific Island Ecosystems at Risk (PIER) web site can be accessed at http://www.hear.org/pier/. While the focus of the site is on Micronesia and American Samoa, other Pacific islands face the same threats and can utilize the information. Most of the problem species found in Micronesia or American Samoa are present on other Pacific islands, and identified outside threats would likely be a problem on any tropical island.

For each species, scientific and common names, a botanical description, methods of reproduction and spread, habitat and ecology, native range, presence throughout the Pacific, and options for control are provided. Where available, photos or line drawings are included to aid in identification.

Because not everyone has access to the Internet, future plans include publishing the information in a loose-leaf binder for ready reference. Also planned are information leaflets on some of the major problem species that should be quarantined from further spread. Other activities planned include a workshop on management of invasive species for foresters, park and other land managers, and quarantine officers (requested by resolution at the recent Pacific Heads of Forestry meeting) and the development of a risk-rating scheme to help set priorities for quarantine and, if necessary, eradication or control.

The web site is a work in progress. Comments and suggestions for improvement are welcomed. For a number of species information is incomplete. There are probably species which have been overlooked. If you can provide information, please send it. That way it can be placed on the web site for the benefit of all.

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Southern African plant invaders atlas (SAPIA)

An atlas of alien plant invaders in South Africa, Lesotho and Swaziland was launched in January 1994 for an initial five-year period until December 1998. The aim of the Southern African plant invaders atlas (SAPIA) is to gather basic information such as distribution, abundance and habitat types of plant invaders on a 1/4 degree (15 minute) square basis. There is also provision for more precise grid references. Information is recorded on two standardised atlas sheets, each listing 100 plant taxa, and with a combined total of 161 species. A pocket field guide to all listed species has also been published. The database management system DataEase is used for computerising the data. The database includes 23,000 records, covering 200 species, collected by the author on roadside surveys from 1979-1993. It will also include data on Declared Weeds and Alien Invaders from the Department of Agriculture’s Conservation Audits which started in 1992.


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What is in the weed plan documents?

The Strategic Plan for Managing Invasive Weeds (SPMIW) provides a 10-page overview of weed impacts and trends, but otherwise doesn’t focus on specific weed species or control methods. Rather it concentrates on identifying the critical strategic objectives and needs for properly managing weed threats to public conservation lands in the long term. It includes general principles, objectives and management approaches, targets for DOC’s weed activities to 2002, criteria for evaluating the feasibility of programmes, and detailed ranking systems. The plan also outlines DOC’s priorities for activities that support weed management (e.g. research, surveillance, staff training, and management systems).

A key element in the plan is that it distinguishes between needing to protect those natural areas we value from weed threats, and needing to make strategic attempts to manage emerging weed problems. These two approaches split a complicated issue into two clear objectives, respectively implemented by “site-led” and “weed-led” control programmes. A second key element in the plan is that it highlights the scale and complexity of weed threats, and the need for DOC, regional councils, landowners, Iwi, researchers, and the general public to work together to protect New Zealand’s unique natural heritage.

The Invasive Weed Threats document provides the details of 306 site-led and 18 weed-led programmes identified as at June 1998. There are probably another few hundred site-led programmes still to be included, but it nevertheless starts to give a real picture of the nature and scale of the weed problem. The site-led programmes are listed by conservancy, and each one has information on the Programme’s location, general community type, important natural values of the place, the weeds present, their threats and the hectares potentially affected, and whether DOC is currently running a control programme there.

Space Invaders provides a brief overview of what is in the SPMIW and Invasive Weed Threats. It does not include the detailed ranking and decision-making systems that are in the main plan. Space Invaders is therefore probably far more digestible for most people. For those who would like more detailed information on weed impacts than Space Invaders provides, the chapter on weed impacts and trends in the SPMIW is available as a separate reprint.
HOW TO ORDER


For overseas orders, there is an additional postage and packaging fee of NZ$10. To order contact:

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[Note provided by Chris Buddenhagen, DOC
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INroducing: SPREP’S INVASIVE SPECIES PROGRAMME PROJECT OFFICER

Introducing Project Officer - Invasive Species and Threatened Avifauna, South Pacific Regional Environment Programme (SPREP), Apia, Samoa.

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"On 10 September 1998 I started as Programme Officer Avifauna Conservation and Invasive Species based in Apia, Samoa. I have worked for the last 12 years in the New Zealand Department of Conservation’s Science and Research Unit based in Head Office, Wellington. There I was primarily a scientist studying pest mammals, threatened birds and invertebrates, herpetofauna, initiating and managing contract research, and managing research staff. The new SPREP position has been funded by New Zealand Overseas Development Aid and AusAid.

My first task will be to set up a Regional Workshop on Invasive Species (involving the 26 member countries of SPREP), and following input from participants, facilitate writing an Action Plan for the Region. I hope that one of the outcomes of the workshop will be a rank-ordered list of projects for which we will seek funding and hence implement the plan. Funding for the workshop has been received from AusAid. Prior to the Workshop, a technical review will be completed. This review will detail what is exactly known about the main groups of invasive species in the South Pacific and the means by which they are being spread. Upon completion the review will be circulated to Workshop participants and published for wider use. The workshop is planned for October 1999.

Another task will be to update the Regional Avifauna Action Plan and hold sub-regional meetings to decide on new species recovery initiatives - hopefully in collaboration with existing projects such as Community Based Conservation Areas.

If you are interested in being kept informed in the above projects or being involved you are invited to make contact with me." web http://www.sprep.org.ws

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Name:
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Report: The first National Conference on Marine Bioinvasions (Massachusetts, USA)

The first National Conference on Marine Bioinvasions, held January 24-27, 1999 at the Massachusetts Institute of Technology brought together 250 scientists, managers and industry representatives from all over the world. Presentations and poster sessions highlighted sources of marine invaders and suggested ways to prevent and control new alien species in sessions on ballast water, patterns of invasions, ecological and evolutionary consequences and technologies for preventing or controlling exotic species. The cross-fertilization of ideas among the participants was as exciting as the presentations and posters.

One of the highlights of the Conference was the keynote address by U.S. Secretary of the Interior, Bruce Babbitt. He opened his remarks by noting that the effects from marine invaders may be more severe than oil spills. The accelerating rate of exotic species transfer reflects global trade routes that have increased in frequency and diversity. The administration supports efforts to minimize and eliminate introductions and called for international cooperation and collaboration. After the Conference, President Clinton released an executive order that (1) requires agency cooperation, (2) proposes a budget of $28 million dollars, and (3) creates an Invasive Species Council to oversee implementation of a plan for coordinated efforts.

During the Conference, several consistent themes emerged — a call for action, identification of prevention and control strategies, the need for education, support for research and management of data. Prevention is usually the most cost-effective approach, but stopping all invasions is not realistic. Five strategies were identified to minimize, reduce or eliminate invading species. The goals are (1) to prevent invasions, (2) to implement an early detection system, (3) to support a rapid response to invasions, (4) to eradicate whenever possible) and (5) to control established species. The potential for any species to become invasive was a recurring theme and one that calls for more aggressive management approaches than are currently in place today. Scientists called for more studies to identify the impacts of invasions — with some invaders becoming commercial successes. Other presenters focused on the importance of eradicating or minimizing the effect of invasions. The eradication of a sabellid worm that was destroying an abalone aquaculture industry was successful. The early response and consistent removal may be applicable to the Rapa whelk invasion in the Chesapeake. The whelk is threatening shellfish beds and is likely to disperse to other regions.

An area not been fully explored is the relative contributions of transfer mechanisms. In addition to ballast water as a transfer vector, other pathways included aquaculture (both intentional and unintentional), bait industry, aquarium trade, fouling, and several other categories such as canals, research, and seafood industry. Efforts to prevent invasions need to address all of the vectors and implement approaches that prevent or minimize introductions. The worldwide distribution of bait is one example of a transfer pathway that is not managed as a source of exotic species.

Education of stakeholders, training of the next generation of scientists and outreach to the public are components that lead to support for legislation, for implementation of action items to prevent eradicate and control invading species, and for early detection. Unfortunately, “politics is sexy” and public support usually rallies around a serious economic or human health threat.

This short discussion does not do justice to the scientific papers describing impacts of invasions, presentations on technologies to minimize or prevent releases of nonindigenous organisms, and approaches to managing invasive species. We are planning to publish proceedings from the conference. There were too any excellent presentations and posters to summarize all of them and readers are urged to review abstracts from the conference at http://massbay.mit.edu/exoticspecies/index.html

Judith Pederson, Ph.D.
Conference Chair

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