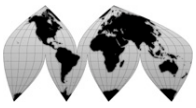

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Prevention and Management of Invasive Alien Species: Proceedings of a Workshop on Forging Cooperation throughout the Austral-Pacific

15-17 October 2002
Bishop Museum, Honolulu, Hawai'i

Edited by Clare Shine, Jamie K. Reaser, and Alexis T. Gutierrez

The workshop was coordinated by the Global Invasive Species Programme and sponsored by the U.S. Agency for International Development, U.S. Fish and Wildlife Service on behalf of the Aquatic Nuisance Species Task Force, U.S. Department of the Interior - Office of Insular Affairs, U.S. Department of State, and The Nature Conservancy. In-kind assistance was provided by the U.S. Environmental Protection Agency. Administrative and logistical assistance was provided by the Bishop Museum, Scientific Committee on Problems of the Environment, and the National Fish and Wildlife Foundation. The Smithsonian Institution National Museum of Natural History provided support during report production.

The Workshop was co-chaired by Drs. Allen Allison and William Brown (Bishop Museum), Mr. Michael Buck (State of Hawai'i, Division of Forestry & Wildlife), and Dr. Jamie K. Reaser (Global Invasive Species Programme; GISP). The members of the Steering Committee included: Dr. Maj de Poorter (ISSG), Ms. Liz Dovey (SPREP), Dr. Lucius Eldredge (Bishop Museum), Ms. Alexis Gutierrez (GISP), Dr. Laura Meyerson (GISP/USEPA), Dr. Jamie K. Reaser (GISP), Dr. Dana Roth (U.S. Department of State), and Dr. Greg Sherley (New Zealand Department of Conservation).

The views expressed in this publication are those of the meeting participants and do not necessarily reflect the positions of any government or other body represented in the meeting, nor its sponsors.

Published by: The Global Invasive Species Programme

Citation: Shine, C., J.K. Reaser, and A.T. Gutierrez. (eds.). 2003. Prevention and Management of Invasive Alien Species: Proceedings of a Workshop on Forging Cooperation throughout the Austral-Pacific. Global Invasive Species Programme, Cape Town, South Africa.

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The Austral-Pacific Region

The Austral-Pacific region has numerous characteristics that make regional coordination on invasive alien species issues particularly important. For example, 98% of its 30 million km^2 is ocean; the remaining 2% contains 7500 islands, of which just 500 are inhabited. Many islands in the three subregions - Polynesia, Micronesia and Melanesia - are small and widely scattered. Whereas the ocean once provided a natural barrier against the spread of pests and diseases, the rapid expansion of trade, travel, and transport now make the region particularly vulnerable to the devastating impacts of IAS. Furthermore, Pacific islands share trading routes, partnerships, and regional infrastructure which can increase opportunities for the introduction of IAS. The inhabitants of the Austral-Pacific region, therefore, have a mutual interest in preventing and managing IAS at the point of export and import.

Map of the Austral Pacific region.

Credit: Courtesy of Perry-Castañeda Library Map Collection, University of Texas at Austin

Austral-Pacific Regional Statement on Invasive Alien Species

October 2002, Honolulu, Hawai'i

Our Objective

"To reduce the chance of invasion of ***invasive alien species*** to islands across the region and to control or, when feasible, rid our islands of existing invasions."

The delegates[1] of the Austral-Pacific Regional Workshop on Invasive Alien Species, hosted by the Bishop Museum and coordinated by the Global Invasive Species Programme (GISP), agreed to issue the following statement:

Recognizing that:

The Pacific is home to the world's island wonders with great biological as well as cultural diversity. Many Pacific islanders live subsistence or semi-subsistent lifestyles and therefore depend heavily on the natural resources surrounding them;

The Pacific is the largest ocean on the planet, with less than 2% land. It harbours 7500 islands of which around 500 are inhabited. All are fragile and many are still pristine;

Twelve percent of the Pacific's species are endemic, many are found only on a few small islands and are thus very vulnerable to the impacts of catastrophic events. The introduction of new species can have an extraordinary effect on islands and may lead to extinction(s);

Invasive alien species (IAS)[2] are the leading cause of extinctions in the Pacific and affect the entire Pacific region. Marine IAS are probably as great a problem as terrestrial IAS;

The need for action is urgent, as we are losing the war against extinction, but islands offer unique opportunities for success in eradication and control of IAS;

Appropriate responses to IAS include prevention, early detection, rapid response, eradication, control and restoration. Prevention is the top priority as it is more cost effective than eradication or control;

There is a major need for regional cooperation and integration of efforts because of:

⇒ the scale of the problem;
⇒ the large number of island countries and territories;
⇒ the rapidly changing natural barriers;
⇒ increasing globalization;
⇒ obligations under global agreements;
⇒ the great number of organizations involved;
⇒ the fact that species may become invasive for the first time after significant time lags;
⇒ the fact that islands are more affected by IAS than their size and population would predict;

[1] Representing the environment and agriculture/quarantine sectors of Australia, American Samoa, Cook Islands, Federated States of Micronesia, Guam, Hawaii, New Zealand, Niue, Palau, Marshall Islands, Samoa, Solomon Islands, Tokelau, Tonga, United States of America, Vanuatu, together with representatives of the SPC, SPREP, GISP, IUCN, CABI, CI, TNC, and the Gordon and Betty Moore Foundation.
[2] This term includes terrestrial, freshwater, and marine species.

⇒ the impact of IAS on the livelihoods (culture, economy and health) of people of the region; and because:

- human and natural pathways now cover the region, which makes it essential that all countries and territories implement prevention and control for the mutual benefit of all;
- IAS are a crosscutting issue at international, national, regional and inter-regional levels;

Have agreed that the following actions are needed:

National

⇒ Cooperation and effective collaboration of key government organizations and other stakeholders is important to address IAS issues effectively. IAS issues should be mainstreamed at all levels from government to communities and across all sectors.

⇒ Key sectors include environment, agriculture (animal, plant protection and quarantine), customs and immigration, fisheries, forestry, transportation, tourism, water, public health etc, as well as civil society. National organizations from all these sectors should improve their working relationships to achieve border control objectives with regard to IAS issues.

⇒ As a key priority, countries should implement prioritized national IAS strategies/action plans or other plans that relate to IAS (such as National Biodiversity Strategies and Action Plans). If these are not yet in place, Pacific island countries and territories (PICTs) should as a priority develop appropriate national frameworks to strategically address IAS issues. Once developed, their implementation should be a key priority.

⇒ A further priority action is to establish national IAS Committees (i.e., with full sectoral representation) and national IAS focal points in countries that do not already have them. The Committee should supervise the implementation of the Strategies/Plans and set IAS priorities and responsibilities, such as identifying key organizations to lead on specific IAS issues in each country.

⇒ Preventing the establishment of new IAS is the most cost-effective approach long-term and should be addressed at both the international and within country (especially between island) levels. Public awareness is the best mechanism for intercepting IAS.

⇒ Civil society should always be engaged, informed and involved in all development of responses to IAS issues. Progress is a direct function of information exchange rate – the rate increases when the whole community understands. Measures are needed to educate and raise awareness at all levels from the school sector (including hands-on projects) to policy makers and the political level and should have community level involvement. Where appropriate, traditional leaders should be involved in decision-making processes to support IAS projects.

⇒ To achieve mainstreaming, the importance of the issue must be made relevant to government and the greater public by, for example, conducting IAS public awareness and education campaigns focusing on key IAS impacts or a flagship species to be protected and by sharing information about economic costs and about a crisis elsewhere in the Pacific to raise awareness of prevention.

⇒ National capacity building of professionals along IAS pathways is urgent. National technical workshops are needed as well as demonstration sites and practical training on specific prioritized IAS issues identified by individual PICTs. Individual development opportunities (e.g. participation in on- or off-shore technical courses, or in real island IAS eradication projects in other countries; work attachments) and skill sharing between countries are also greatly needed.

⇒ Existing resources such as the GISP Toolkit[3] should be used. Innovative control techniques should be sought for and used, incorporating existing traditional knowledge and practices wherever possible.

⇒ Each PICT should develop the skills needed in-country to conduct surveys and establish a long-term monitoring program on IAS.

Regional

⇒ A key priority should be to build links with counterparts across the range of sectoral agencies and across regional borders. Working arrangements and communication channels on IAS should be formalised and well-coordinated among institutions with IAS roles working in the Pacific Region, particularly the Council of Regional Organizations in the Pacific (CROP) agencies such as the South Pacific Regional Environment Programme (SPREP), South Pacific Community (SPC), and South Pacific Applied Geoscience Commission (SOPAC), as well as international organizations such as The Nature Conservancy (TNC), World Wildlife Fund (WWF), the IUCN-Invasive Species Specialist Group (ISSG), the Global Invasive Species Programme (GISP), etc.

⇒ A Regional IAS Working Group should be established for the Pacific made up of all institutions with IAS roles in the Region. SPREP should coordinate the establishment of the group and provide the Secretariat for the group, at least until the Group has its first meeting. All member institutions should nominate IAS focal points to sit on the Working Group. One of the key priorities of the Council should be to discuss and coordinate mandates and work programs on IAS in the Pacific Region.

⇒ A more comprehensive regional IAS strategy and prioritized action plan should be developed with widest possible ownership from Pacific sector organizations, countries and other stakeholders and be prioritized on regional and local levels. Approval for the strategy and action plan should be sought from the highest possible level, the Pacific Islands Forum.

⇒ Assistance should be made available to support PICTs in the development and implementation of national strategies.

⇒ Mechanisms should be developed to address funding shortfalls and mechanisms based on the polluter pays principle (e.g. levies on shipping and air transport) should be considered.

⇒ A key priority for regional and sub-regional organizations should be to collect, share and manage information with PICT members. Development of regional centres of excellence as sources of information should be considered.

[3] Wittenberg, R. & M.J.W. Cock. 2001. Invasive Alien Species: a Toolkit of Best Prevention and Management Practices. CAB International, Wallingford, Oxon, UK.

⇒ As a priority, capacity development projects should be organized regionally to address the limited expertise and capacity of many PICTs. Many of the issues are cross-sectoral and transboundary and are most cost-effectively addressed at the regional level. There is a need for capacity development to be organized and developed regionally but delivered at national level. It should include training, individual development, skills sharing, field days demonstration sites, etc.

⇒ Technical support activities and assistance appropriate for the region, such as regional risk analysis of pathways based on systematic analysis and research, should be undertaken and IAS invasion prediction models developed. A gap analysis should be undertaken of needs in the region to assist in setting priorities. A regional black/dirty list or list of most unwanted species should be developed and existing generic risk assessment methods assessed for potential to be built on to reflect other sectoral concerns. Relevant and specific Pacific control methods and tools for eradication, prevention, and control should be developed.

⇒ Activities undertaken should always be accountable, transparent and subject to peer review.

⇒ Community and communications infrastructure should be improved to enable better communication within and across the region as well as access to information sources outside the region. Databases and information sources on IAS should be coordinated. A resource guide should be available on these services, including those not accessible via Internet.

⇒ Rapid dissemination of information is crucial. As certain parts of the Pacific have limited access to the web, an investigation is needed into the best information exchange practices to use where web-based dissemination of information is restricted. Use of existing systems should be maximised.

⇒ Showing success and solutions is important and needed. Successful pilot projects and demonstration projects should be highlighted.

⇒ Cost benefit analyses should be developed to justify IAS project funding requests.

Global and inter-regional issues

⇒ Progress is dependent on cooperation at the international level. Prevention or control of IAS invasions is an international problem that needs international solutions and needs a coordinated information exchange network at and between all levels.

⇒ International agreements should be used to the best advantage for the Pacific region. PICTs and regional organizations should advocate development of stronger links between international organizations and agreements relevant to IAS prevention and management, including the Convention on Biological Diversity, Food and Agriculture Organization of the United Nations, International Plant Protection Convention, Office International des Epizooties (World Organization for Animal Health), Convention on International Trade in Endangered Species of Wild Fauna and Flora, Ramsar Convention on Wetlands and the Convention on the Conservation of Migratory Species of Wild Animals. Forum leaders and members of other relevant frameworks (e.g. Asia-Pacific Economic Cooperation, World Trade Organization) should be requested to take on IAS issues and to examine all regional trade agreements for their implications for IAS.

Contents

1. Background

1.1 Rationale for strengthening Austral-Pacific cooperation

Invasive alien species (IAS) are non-native organisms that cause, or have the potential to cause, harm to the environment, economies, or human health. They are one of the most significant drivers of environmental change worldwide, consequently placing constraints on environmental conservation, economic growth, and sustainable development. The globalization of trade, travel, and transport is greatly increasing the rate at which IAS are moving around the world, as well as the diversity and number of species being moved. At the same time, changes in land use and climate are rendering some habitats more susceptible to biological invasions.

Article 8(h) of the Convention on Biological Diversity (CBD) calls on member governments to "as far as possible and as appropriate, prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species." However, national and international responses to the IAS problem have thus far been insufficient to counter their increasing toll on natural resources and society. One of the most significant barriers to policy development and implementation has been a lack of awareness of the causes and consequences of biological invasion.

Islands are geographically and evolutionary isolated units. Due to their high degree of species endemism and restricted ranges, islands are particularly vulnerable to IAS. Many Pacific islands are already suffering the consequences of biological invasion. Although the Pacific is one of the world's biodiversity hotspots, more than 70% natural vegetation is now disturbed and a high proportion of the region's total biodiversity is threatened with extinction, including 14% of Pacific bird species. IAS are now considered to be the primary cause for extinctions of native terrestrial biodiversity in the region, followed by habitat loss. Marine and freshwater systems are also impacted by IAS, although less is known about the severity of the consequences.

Many native organisms, including endemic and threatened species, are natural resources or of spiritual significance to people in the Austral-Pacific region. IAS also impact agriculture and other revenue-generating activities such as commercial fisheries and tourism. IAS can thus have severe impacts on livelihoods and economies within the region, especially in the Pacific atoll systems. In some cases, IAS can even alter the socio-economic status of Pacific Island countries and territories (PICTS).

Luckily, the isolated nature of islands can also provide advantages in efforts to minimize the spread and impact of IAS. Because of the physical isolation of islands, it is difficult for terrestrial and freshwater IAS to colonize them on their own accord. Furthermore, the contained nature and relatively small size of islands enables resource managers to implement eradication and control programs that would not be feasible in large, interconnected continental systems. In the Pacific, some islands are still pristine, allowing for the establishment of prevention, early detection, and rapid response programs before problems arise.

The Austral-Pacific region has several characteristics that make regional coordination on IAS issues particularly important. For example, many of the islands share similar ecosystem types, trading partnerships, and strong socio-cultural links. While these commonalities increase opportunities for the introduction and establishment of IAS, they can also facilitate effective cooperation on IAS prevention and management.

Recognizing the existing impacts of IAS and potential for additional invasions, the governments of the Austral-Pacific region have already established several mechanisms and strategies addressing IAS issues (details included in these proceedings). However, major gaps, weaknesses, and policy deficits exist. There are numerous opportunities to improve the efficiency and effectiveness of the legal and institutional frameworks through coordinated actions to raise awareness of the issue, share relevant information, increase consistency in policies and practices, and harmonize quarantine systems and standards, as well as cooperate in the development and implementation of pathway management, risk analyses, surveillance, eradication, control, and other relevant programs.

1.2 Workshop design

Objectives

This workshop was the sixth in a series of seven regional workshops coordinated by the Global Invasive Species Programme (GISP) and its partners, the World Conservation Union-IUCN and CAB International, in 2001-2002. Previous workshops included: Baltic/ Nordic (May 2001), Meso-America and Caribbean (June 2001), South America (October 2001), Southern Africa (June 2002) and South/Southeast Asia (August 2002).

Each workshop had three primary objectives:

1. to raise awareness of the invasive alien species problem and opportunities to manage it;

2. to strengthen and expand cooperation between sectors (especially agriculture and environment), among governments, and between governmental and non-governmental entities; and

3. to lay the groundwork for the development of a comprehensive regional strategy to address invasive alien species.

In order to meet the objectives, the workshop had three introductory sessions in plenary to review the issue and relevant regional mechanisms, three working group sessions to forge cooperation and outline a regional strategy and a final plenary discussion to develop a regional statement and recommendations and define next steps (see agenda in Appendix 2).

Participants

The Austral-Pacific workshop was attended by 49 participants (Appendix 3), many of whom were high-level policy officials in the environment and agricultural sectors. Seventeen Pacific countries and territories were represented: Australia, American Samoa, Cook Islands, Federated States of Micronesia, Guam, Marshall Islands, Nauru, New Zealand, Niue, Northern Mariana Islands, Palau, Samoa, Solomon Islands, Tokelau, Tonga, United States, and Vanuatu. Contributions were also received from French Polynesia. Organizations represented included the Secretariat of the Pacific Community (SPC), the South Pacific Regional Environment Programme (SPREP), CAB International, the World Conservation Union-IUCN (Invasive Species Specialist Group and Commission on Environmental Law), Global Invasive Species Programme, Pacific Science Association, Conservation International, The Nature Conservancy, and the Gordon & Betty Moore Foundation.

While the governments and organizations of Austral-Pacific region already recognize the need for regional cooperation on IAS issues and have worked together in the past through the Secretariat for the Pacific Community (SPC) and the South Pacific Regional Environment Programme (SPREP), never before had so many different sectors come together to develop a comprehensive approach to IAS prevention and management.

Outcomes

This document is one of two complementary reports arising from the Austral-Pacific regional workshop. The second is a compilation of national reports on IAS submitted by the participating countries and territories. This will serve as a regional resource directory of information on IAS issues, policies, programs and key people within the Austral-Pacific Region.

Two additional products include:

⇒ the Austral-Pacific Regional Statement on Invasive Alien Species (pages 5-8); and
⇒ a letter on red imported fire ants (Appendix 5.6).

2. Presentations and contributions

2.1 Defining the issues at the global and regional scale

Introductory remarks and food for thought

Mr. Michael Buck
Workshop Co-Chair
Administrator, Hawai'i Division of Forestry and Wildlife

Aloha. Welcome to the Austral-Pacific regional workshop on invasive alien species (IAS). On behalf of Governor Benjamin Cayetano, we are glad you have chosen the State of Hawai'i as the place to convene this important meeting. As you will hear later in the program, Hawai'i has some of the nation's most challenging IAS issues.

I am honored to co-chair this important meeting. We are a single island state within a large country. However, because of our geographical isolation, we often have to perceive ourselves as a separate nation. In many ways, we have more in common with our Pacific islands neighbors, than with other U.S. states.

I want to use my brief opening remarks to present some personal observations about the future of IAS issues and what we need to do in the Pacific to address them. I apologize if some of my comments reflect my own biases as a state official working within a federal/state government and do not reflect some of your positions or situations.

I do hope that my observations are useful, as I have had the opportunity to work with IAS from a management perspective (stewardship responsibilities for about 800,000 acres of public trust lands in Hawai'i), as well as on policy issues at both the state and federal government levels. I have served, and continue to serve, on the Invasive Species Advisory Committee to the U.S. National Invasive Species Council.

Observations

Given a growing global economy accompanied by increasing free trade politics and pressures, we are just witnessing the tip of the iceberg in regard to IAS challenges. Many IAS have already reached the Pacific, but go unnoticed because they have not begun to spread.

The economic impacts of IAS will drive the call for IAS programs. Along with water, IAS will be the major environmental issue that affects the public health and economic sectors in this century. The public will demand more government action and intervention. Within the U.S., federal agencies primarily associate IAS with environmental and trade concerns and not by the agricultural and public health sectors, although these are starting to get more involved.

Stronger mandates for IAS prevention and control (regulatory action, pathway management) will undoubtedly conflict with other mandates and missions of your organizations (e.g. agricultural production, business promotion, trade, necessary movements of people and cargo into your countries). You can expect many challenges in working within your organizations and in dealing with external constituencies.

We need to strive to develop IAS programs that support and build capacity at the local level and, where possible:

⇒ are non-regulatory and incentive driven; and
⇒ encourage voluntary cooperation between affected private entities.

I stress "where possible," as increased regulatory structure is inevitable and will not be popular with affected sectors. I predict that many of you will need to pursue and develop additional sources of funding for IAS measures. Because of the competition for limited government revenues, you will be forced to look at fees - as a "price of doing business" - for relevant sectors that contribute to the risk of introducing and/or introduce IAS into your country.

Effective control of IAS will probably be most effective and efficient through a regional approach. Management plans, developed by coordinated efforts of relevant agencies and affected local constituents, provide the essential first step toward building larger-scale regional strategies to combat wide ranging IAS.

Investments to support local and regional partnerships engaging people who are prepared to take action now against known IAS can provide valuable lessons for other regions and promote innovation and efficiency in protection and public outreach strategies. As they progress, these partnerships will help identify the policy and legal obstacles to success.

As Pacific Islanders, we are in a unique position to make the case for connecting public health, our economies, and quality of life with the need for effective IAS prevention and mangement programs. We know our lands, we are dependent on our environment for our health and economy, and we are extremely vulnerable to the impacts of IAS. We will need to work together. I hope my comments have been useful and look forward to joining and learning from you in your deliberations over the next three days. Aloha.

Invasive alien species: definitions, causes, consequences and the way forward

Dr. Jamie K. Reaser
then Executive Director, Global Invasive Species Programme

For the purposes of this workshop, some key terms are defined:

alien species	any species that is not native to a specific ecosystem (also referred to as exotic, non-native, non-indigenous) Note: the term *non-native* will be used throughout this publication as the term "alien" has different meanings in other contexts
invasive alien species	an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health (also referred to as alien invasive species). Factors that can make a 'good' invader include rapid growth rate, great dispersal capabilities, large reproductive output, and broad environmental tolerance
vectors	the means by which an IAS is moved

The *causes* of biological invasion are multiple. No country is self-sustaining. Globalization has created a situation in which even the most prosperous countries in the world are now economically dependent on the goods and services provided by other countries. Increasingly, these global markets are not only driven by needs, but also by desires for "more" and things that are "new," "better," "different," or "exotic". Nearly every imaginable good and service is now traded internationally.

While globalization has brought social and economic benefits to many people, it has also brought new challenges and IAS are among the most significant. At no time in history has the rate of biological invasion, nor diversity and volume of invaders been so high and the consequences so great (McNeely et al. 2001).

Land-use and climate change can also facilitate invasion by making habitats more challenging for native species and more hospitable to IAS (Mooney and Hobbs 2001). Because disturbed habitats often favor rapid colonizers, they are particularly vulnerable to the invasion of non-native species (Bright 1998, Baskin 2002). From the perspective of the IAS, it does not matter whether the environmental changes are natural or human induced.

The *consequences* of IAS may be:

Environmental

IAS are one of the most significant drivers of environmental change globally (Sala et al. 2000, McNeely 2001, McNeely et al. 2001). In the United States, IAS now rank second to habitat conversion as a cause of species endangerment and extinction (Wilcove et al. 1998). Even the most well protected natural areas are not immune to the invasion of non-native species (Simonson et al. 2001). IAS are the primary cause of extinctions in island ecosystems.

Economic

Invasive alien species can take a heavy financial toll on governments, industries, and private citizens. A recent study estimates that invasive alien species cost the U.S. more than $100 billion a year (Pimentel et al. 2000) and at least this much in six other countries combined (Pimentel et al. 2001). There are, however, remarkably few quantitative studies of the socio-economic impacts (Perrings et al. 2000, but see Pimentel 2002 for case studies of costs internationally). Worldwide, the losses to agriculture have been estimated to be between $55 billion and nearly $248 billion annually (Bright 1999).

The impact and management costs of a single species can carry a price tag in the millions. For example, the golden apple snail (*Pomacea canaliculata*), introduced from Latin America as a high protein food source, caused losses to Philippine rice crops during the 1980s of approximately US$1 billion (Naylor 1996). Formosan termite (*Coptotermes formosanus*) introduced from East Asia costs an estimated one billion dollars annually in property damage, repairs and control measures in the southeastern United States (Suszkiw 1998).The European gypsy moth (*Lymantria dispar*) was introduced into North Carolina in 1993 and eradicated four years later at a cost of approximately US$19 million (U.S. Army Corps of Engineers, personal communication). The U.S. Department of State contributes more than US$10 million annually to control the sea lamprey (*Petromyzon marinus*) in the Great Lakes shared by the U.S. and Canada (U.S. Department of State, personal communication).

Human health

Typical consequences of IAS human health include disease epidemics, increased pesticide toxicity, and malnutrition due to food and water shortages. Invasive alien species can impact the health of humans, plants, and animals. Pathogens and parasites may themselves be invasive alien species or may be introduced by invasive vectors (e.g. mosquitoes such as *Aedes aegypti*; Bryan 1996, Bright 1998). Cholera (*Vibrio cholerae*) and some of the microorganisms that can cause harmful algal blooms are relocated and released in the ballast water carried by large ships (Wilson 1995). Other high-profile diseases caused by invasive pathogens include malaria (*Plasmodium* spp., parasites), Dengue fever (*Flavivirus* sp., virus), and the human immunodeficiency viruses that cause Acquired Immune Deficiency Syndrome (AIDS). Less well known diseases can also be problematic. For example, the giant African snail (*Achatina fulica*) is a potential food source and is used as a pet, but also provides an intermediate host for rat lungworm (*Angiostrongylus cantonensis*) which can infect the human brain, causing headache, fever, paralysis, coma and even death.

Political

IAS can raise barriers to sustainable development, through impacts on food and water security, human health, poverty, regional stability and migration. International trade and economic growth can be affected when governments and industries are unable to sell some types of food products or commodities or use certain types of containers.

However, IAS management programs such as South Africa's Working for Water Programme (http://www-dwaf.pwv.gov.za/wfw/) can provide positive opportunities to enhance food and water security, employment, education, and health care.

Increasingly, governments like that of the U.S. have become concerned that terrorists might launch deliberate attacks using IAS in the form of biological agents that could impact on humans, wildlife, or domestic animals, or agriculture (Meyerson and Reaser 2002).

How should this range of problems be addressed?

There are four-interlocking goals for comprehensive IAS programs: prevention, early detection and eradication, control, and restoration.

Tools or processes to achieve these goals include:

⇒ risk assessment and management
⇒ research
⇒ monitoring
⇒ education
⇒ policy and regulation
⇒ information management
⇒ international cooperation and capacity building.

Countries and regions face common challenges to meeting these goals. These are scientific (e.g. complexity, uncertainty, mobility of IAS, time lags before a species becomes invasive); political (e.g. lack of awareness, lack of coordination, conflicting policies, policy gaps, costs); and ethical (animal rights, environmental and health risks of pesticides, and biocontrol).

IAS are a human-driven problem. However, whatever the challenge, people are the only solution: there is a need to educate and to "manage" people's values, beliefs, and behaviors. In the words of the botanist, Philip Stewart, "…*what I choose to do shapes a little bit of the world, and the ripples sent out by the actions of us all change the whole world for better or for worse*."

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Invasive alien species in the marine environment: we're in deep

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This presentation describes Hawai'i's problems with marine biological invasions to draw attention to the scale of the problem of marine bioinvasions in the wider regional context. It provides a synthesis of more detailed information provided in Eldredge L.G. & J.T. Carlton, *Hawaiian Marine Bioinvasions: A preliminary assessment* (paper presented at the Ninth International Coral Reef Symposium, Bali, Indonesia, 27 October 2000).

Through the Hawai'i Biological Survey at the Bishop Museum, a count of the total numbers of species in the Hawaiian Archipelago has been carried out. The latest listing (1999) totals 23,150 of which 5047 are non-native species (Eldredge 2000). For the non-native marine and estuarine species, we have been accumulating information from the literature, museum specimens, and through field collections. This preliminary assessment uses the criteria of Chapman and Carlton (1991) which include sudden appearance in local region, appearance in artificial habitats, widespread occurrence, and association with dispersal mechanisms and other IAS.

Based on this assessment we found that the total number of non-native marine and brackish-water species in the Hawaiian Islands is 343: 287 invertebrates, 24 algae, 20 fish and 12 flowering plants. Of a total of 4099 marine invertebrates species, 71 species are introduced arthropods and 53 species are mollusks (Eldredge and DeFelice 2001).

Where non-native species become invasive, impacts can include:

⇒ colonization of non-vacant areas
⇒ reduction of biodiversity
⇒ public health risks
⇒ economic costs (e.g. through hull-fouling of commercial shipping)
⇒ reduction of aesthetic values

Major transport routes across the Pacific provide important pathways for species introductions. The greatest number of introduced species arrived through hull fouling: other key vectors include solid ballast and ballast water. Table 1 shows the probable pathways used by marine invertebrates to reach the Hawaiian Islands. Of these species, 201 (70%) are considered introduced and 86 (30%) cryptogenic (that is, not demonstratively native or introduced). Our data indicate that 248 species (87%) have become established, 15 (5%) failed, 6 (2%) were intercepted, and 18 (6%) are unknown.

Table 1
Marine invertebrates: Probable mechanisms of transport to the Hawaiian Islands

Mechanism	Species	% established
Hull fouling	212	90
Solid ballast	21	90
Ballast water	18	89
International release: fishery	18	28
Parasites on nonindigenous species	8	88
With commercial oysters : unintentional	7	100
Aquarium release	3	67

Examples of marine IAS include the shore crab (*Carcinus maenas*), zebra mussel (*Dreissena polymorpha*), Northern Pacific sea star (*Asterias amurensis*), European green crab (*Carcinus maenas*) and the American comb jelly (*Mnemiopsis leidyi*): the latter has contributed to the destruction of the fishing industry in the Black and Azov Seas following introduction via ballast water. Species that are thought to have been introduced via hull fouling include algae (*Hypnea musciformis* and *Gracilaria salicornia*) and "brown licorice" (*Kappaphycus alvarezii*, which grows over anything and smothers coral). Species that have been intentionally introduced include top shell (*Trochus niloticus;* primarily moved from Palau, deposited on reefs) and giant clams (*Tridacna* spp.; moved from Palau and northern Australia, grown in hatcheries and planted on reefs) on which parasitic snails have hitchhiked.

The non-native species introduced to the Hawaiian Islands have mainly originated in the Indo-Pacific/Philippines region (see Table 2).

Table 2
Origin of non-native marine invertebrates introduced to Hawaiian Islands

Origin	%
Indo-Pacific, Philippines	21.3
Unknown	19.9
Unknown, world	16.4
Tropical western Atlantic (Caribbean)	10.5
Japan-Asia	7.0
NW Atlantic (Europe and Mediterranean)	6.6
West coast North America	6.3
Southern Hemisphere	2.8
Australia and New Zealand	2.4
Tropical eastern Pacific	2.4
Oceania	2.1
Other	2.3

Historically the data on numbers of species introductions have peaked at several different times – probably both due to an increase in introductions and survey efforts:

⇒ during the 1920s, probably through the efforts of Charles Howard Edmondson, the recently arrived invertebrate zoologist at the University of Hawai'i and Bishop Museum;
⇒ during the 1940s, probably through wartime activities and development;
⇒ during the 1970s, through surveys conducted by the US Navy; and
⇒ during the 1990s and the current series of biological inventories of intensity.

In harbors and embayments in Hawai'i, the percentage of non-native species increases greatly: 23% for Pearl Harbour and 17% for Honolulu Harbor, as compared to 1.5% and 1.00% for Midway Island and Kaho'olawe respectively (Coles and Eldredge 2002). Available information suggest that a gradient in the diversity of introduced species exists from intensive to less intensive regions of both shipping traffic and estuarine modification and urbanization.

Recommendations to this workshop include:

⇒ compilation of intensive biological inventories
⇒ carrying out of acute observations
⇒ development of a corps of taxonomists
⇒ collection of voucher specimens.

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Overview of international instruments relevant to IAS

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This paper provides a brief overview of international instruments relevant to IAS and outlines:

⇒ the rationale for international action on IAS;
⇒ the scope of existing treaties and guidelines that address IAS in the context of biodiversity; aquatic ecosystems; plant, animal and human health; transport; and international trade;
⇒ constraints in existing frameworks and recent policy developments; and
⇒ frameworks for regional and subregional coooperation in the Austral-Pacific region.

Why are IAS an international legal issue?

The causes and impacts of biological invasions are often international by definition. Through trade and transport pathways, countries both send and receive non-native species. Species may also be translocated within countries to areas or islands where they are not currently present and become invasive in this new location. For these reasons, unilateral action by a few States can never be enough to prevent unwanted introductions. Cooperation is essential at all jurisdictional levels.

Policy, legal, and technical tools need to address the range of pathways through which non-native species are moved (see Box).

Examples of pathways for intentional or unintentional introductions of non-native species

- trade and movement of goods (non-native species translocated in containers, planting media, untreated wood packaging, some food products)
- movement of people, including for tourism, through air, road, rail and sea transport
- shipping and boating (ballast water, sediment, hull fouling, anchors)
- aviation (in cargo, and on and in the aircraft itself)
- postal and courier services (including biological material purchased via the internet)
- mariculture and aquaculture (fish, molluscs, and crustaceans introduced for production)
- food fish (release of non-natives)
- agriculture (crops and livestock) (direct introductions)
- hunting and fishing (game species and live fish and bait introduced for sport and restocking, movement of equipment)
- aquaria (deliberate discards, discharge of organisms with waste water)
- release of pets or other domestic animals
- horticulture and gardening (dispersal of material from gardens, ponds etc.)
- habitat restoration and landscaping (use of non-native genotypes of native plants, escapes)
- waste disposal and overflow (discharges of untreated effluent to aquatic systems)
- infrastructure development, interbasin transfers of water (dam removal, canals)
- movements of vehicles/equipment during development, famine relief, and military operations
- *Note: non-native species may be carrying pathogens and parasites.*

How does the international regulatory framework address IAS issues?

Nearly fifty internationally-agreed legal instruments or guidelines deal with some aspect of the introduction, control, and eradication of IAS. These instruments set out the policy or technical norms that should form the baseline for national legal frameworks. They fall into three broad categories*:*

⇒ the longest-established agreements focus on controlling the introduction and spread of pests (some of which are IAS, others are not) and diseases to protect human, animal, and plant health through the establishment of quarantine systems. A series of quarantine agreements now mandate and govern sanitary (human health), zoosanitary (animal health), and phytosanitary (plant health) measures to control introductions for such purposes.

⇒ biodiversity-related treaties are concerned with IAS for their possible impacts on native species and ecosystems. Some focus specifically on marine and/or inland water ecosystems; and

⇒ most recently, technical guidelines and codes of conduct aim to minimize risks associated with a limited number of transport and trade-related pathways.

Existing instruments have been developed by different multilateral bodies at different times with different objectives, for implementation by different national agencies and sectoral stakeholders. This affects how they refer to IAS, down to the terms, definitions, and procedures used. Most national systems reflect these sectoral differences and have overlaps, gaps, and result in little contact between IAS specialists in different departments and agencies.

Conservation and sustainable use of biological diversity

The Convention on Biological Diversity (CBD) is the only global instrument to provide a comprehensive basis for measures to protect all components of biodiversity against those non-native species that are invasive. Article 8(h) requires Parties:

"as far as possible and as appropriate, (to) prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species."

Other CBD provisions that should be taken into account when implementing IAS measures relate to strategic and cross-sectoral planning, regulation, and management of potentially damaging processes and activities, involvement of local populations and the private sector, incentives, environmental impact assessment, transboundary notification, and emergency planning.[4]

CBD institutions have prioritized IAS issues in recent policy-making. In 1998, recognizing the problems IAS pose to indigenous and local communities and their negative effects on local and national economies, the Conference of the Parties (COP) designated non-native species as a cross-cutting issue to be taken into account in each thematic work program and identified geographically and evolutionarily isolated ecosystems, including islands, as needing special attention because of their vulnerability to biological invasion.

In 2002, after extensive preliminary work, the sixth meeting of the COP adopted Decision VI/23 on *Alien species that threaten ecosystems, habitats and species*. This decision:

⇒ reaffirms the importance of national and regional IAS strategies and sets out detailed recommendations for the content of national strategies and action plans;

⇒ urges closer international and regional cooperation and specific measures for capacity building, assessment, information and tools;

⇒ urges Parties, other governments, and relevant organizations to promote and implement the *Guiding Principles for the Prevention, Introduction and Mitigation of Impacts of Alien Species that Threaten Ecosystems, Habitats or Species* annexed to the decision.

Information on other biodiversity instruments (including CMS and CITES) is available in the *Guide to Designing Legal and Institutional Frameworks on Alien Invasive Species* (see Further Reading).

Aquatic and marine ecosystems and resources

The emphasis on prevention is particularly important in aquatic and marine systems because IAS can be particularly hard to detect and can disperse rapidly, making eradication or control extremely difficult. For Pacific islands, which often with very long coastlines, marine IAS issues are of critical importance.

Introductions of non-native species to marine ecosystems are covered in a general way by:

⇒ the United Nations Convention on the Law of the Sea (UNCLOS). Parties should take all measures necessary to "prevent, reduce, or control pollution of the marine environment resulting from the intentional or accidental introduction of non-native or new species to a particular part of the marine environment, which may cause significant and harmful changes thereto" (Article 196);

[4] Respectively Art.6(a) and (b), Art.8(l), Art.10, Art.11 and Art.14 of the CBD.

⇒ instruments developed under the United Nations Environment Programme (UNEP) Regional Seas Programme e.g. the Protocol for the Conservation and Management of Protected Marine and Coastal Areas of the South-East Pacific (Paipa, 1989).

IAS in coastal and inland wetlands were addressed by the Conference of the Parties to the Ramsar Convention on Wetlands in November 2002 (see Box).

Resolution VIII/18 (Invasive Species and Wetlands) urges Ramsar Parties to:

- address the problems posed by IAS in wetland ecosystems in a decisive and holistic manner, making use as appropriate of the tools and guidance developed by various institutions and processes, including relevant guidelines or guiding principles adopted under other conventions;
- undertake risk assessments of alien species which may pose a threat to the ecological character of wetlands, taking into account the potential changes to ecosystems from the effects of global climate change, and applying the guidance available in Ramsar's *Risk Assessment Framework*;
- identify the presence of IAS in Ramsar sites and other wetlands; the threats they pose to these sites' ecological character, including the risk of invasions by such species not yet present within each site; and the actions underway or planned for their prevention, eradication or control;
- when developing and implementing national IAS strategies and responses, recognize that terrestrial IAS can threaten and affect ecological character of wetlands (e.g. lowering of water tables, alteration of water flow patterns) and ensure that appropriate measures to prevent or control such invasions are in place;
- prior to moving water between river basins, examine carefully the potential environmental impacts due to invasive species;
- work closely with their counterpart national focal points for CBD, U.N. Convention to Combat Desertification, UNESCO Man and the Biosphere Program, International Maritime Organization and others in developing and implementing national IAS policies, strategies and management responses
- ensure that IAS prevention, eradication and control are fully incorporated in national legislation and national wetland and biodiversity policies, strategies and action plans, applying the Ramsar *Guidelines for reviewing laws and institutions to promote the conservation and wise use of wetlands* (Ramsar Handbook 3) and *Guidelines for developing and implementing National Wetland Policies* (Ramsar Handbook 2).

Introductions of IAS into inland water systems have very little coverage under binding instruments, except for the 1997 Convention on the Law of Non-navigational Uses of International Watercourses (not in force). Most existing bi- and multilateral watercourse treaties do not reference this risk.

Instruments for the protection of plant, animal and human health

International instruments and institutions for the protection of plant, animal, and human health are an important part of the international regulatory framework, because the interests they protect may be adversely affected by non-native animals, plants, and micro-organisms (e.g. viruses, bacteria, and fungi) that become invasive.

Plant health

The International Plant Protection Convention[5] (IPPC) provides a framework for international cooperation to prevent the introduction of pests of plants and plant products and to promote appropriate measures for their control. It deals with the spread of pests between countries and phytosanitary measures within a country (see the International Phytosanitary Portal (IPP) at http://www.ippc.int for further information). It is not explicitly a trade or environmental treaty but is directly relevant to IAS issues that fall within its scope.

The IPPC defines "pest" as *"any species, strain or biotype, animal life or any pathogenic agent injurious or potentially injurious to plants or plant products"* e.g. fungi, bacteria, phytoplasmas, viruses and invasive plants. It covers both direct and indirect damage by pests to plants, defined broadly to include natural flora as well as cultivated plants. Non-native organisms that meet the definition of "pest" are covered, as are biological control agents used to control pests in this broad context. Official IPPC definitions can be found in the International Standard for Phytosanitary Terms (ISPM) # 5 "Glossary of Phytosanitary Terms", which is revised annually.

Until the 1990s, the IPPC mainly focused on phytosanitary certification with an almost exclusively agricultural focus. In 1997, it was revised to provide for the development of international phytosanitary standards (ISPMs) recognized within the multilateral trading system. ISPMs are not binding *per se* on World Trade Organization (WTO) Members, but Members that do not comply with available standards must base national measures on risk assessment. Existing ISPMs cover matters such as pest risk analysis, import and release of exotic biological control agents, guidelines for the establishment of pest free areas and guidelines for pest eradication programs. The most recent standards[6] are beginning to take greater account of environmental implications, which could provide an important bridge with the work carried out under the CBD.

The IPPC provides for national mechanisms that are well-suited to prevention, early detection, and control of IAS. Each IPPC party is required to:

⇒ establish a National Plant Protection Organization (NPPO);

⇒ adopt legislative, technical and administrative measures to prevent introduction/spread of pests;

⇒ establish a single official contact point to facilitate the exchange of official information;

⇒ undertake pest risk analysis, in the absence of an ISPM, to provide technical justification for a national phytosanitary measure;

⇒ carry out surveillance of growing plants, including both areas under cultivation (e.g. fields, plantations, nurseries, gardens, greenhouses and laboratories) and wild flora, and of plants and plant products in storage or in transportation, particularly with the object of reporting the occurrence, outbreak and spread of pests, and of controlling those pests;

[5] 1951, revised in 1979 and 1997 (latest revision not yet in force, but countries have agreed to starting implementation due to its imminent acceptance).

[6] In 2003, the IPPC's Interim Commission on Phytosanitary Measures (ICPM) approved standards on the analysis of environmental risks and the coverage of taxa that impact unmanaged as well as agricultural systems: see Supplement on *Analysis of environmental risks* to ISPM No.11 (*Pest risk analysis for quarantine pests,* 2001) and IPPC Supplement No. 2 on *Guidelines on the understanding of 'Potential Economic Importance' and related terms including reference to environmental considerations* to ISPM No.5 (*Glossary of Phytosanitary Terms*). ISPM 3 (Code of Conduct for the Import and Release of Exotic Biological Control Measures, 1996) is currently being revised. Proposals for consideration include its expansion to better address intentional introductions of biopesticides, soil enhancers, pollinators and sterile insects for purposes of pest control and the enhancement of its RA component.

⇒ provide for the protection of endangered areas and the designation, maintenance and surveillance of pest free areas and areas of low pest prevalence;

⇒ establish export certification systems to ensure that exported products comply with the import requirements of trading partners;

⇒ establish inspection procedures and treatments (when appropriate), and

⇒ establish an official process for the implementation of the ISPMs.

Implementation is facilitated by nine regional plant protection organizations (RPPOs). The Pacific is covered by the Asia Pacific Plant Protection Commission (APPPC) and, most relevant to this region, the Pacific Plant Protection Organization. RPPOs are beginning to develop regional phytosanitary standards to facilitate regional harmonization of trade-related measures consistent with the WTO-SPS Agreement (see below).

Animal health

Animal health issues are addressed by the Office International des Epizooties (OIE), which develops standards and guidance on pests and diseases of animals (but not on animals themselves as pests). The International Animal Health Code for Mammals, Birds, and Bees and the International Aquatic Animal Health Code set out standards on import risk analysis and risk management measures for specific diseases and are updated annually. The OIE has an Ad Hoc working group on risk analysis for aquatic animal diseases and a long-established Working Group on Wildlife: this addresses wildlife management and reintroduction issues that have an animal disease dimension, but has not covered related habitat and ecosystem issues.

Human health

Human health can be affected by non-native species providing hosts for diseases. One example is the West Nile virus apparently introduced to New York (U.S.) via an imported non-native bird and then transmitted to local mosquitoes. Because the virus can decimate bird populations and affect other wildlife and humans, it is a serious concern for many Pacific islands represented at this Workshop.

The World Health Organization (WHO) has developed International Health Regulations[7] to prevent the international spread of infectious diseases to humans, which are currently being updated due to changes in disease epidemiology and the increase in international traffic.

Codex Alimentarius (a joint FAO/WHO initiative) deals with food safety and is responsible for international standard setting in this regard.

Technical guidance for certain transport sectors

There is a growing emphasis on the need for technical guidelines or codes of conduct to address specific pathways in a more detailed and practical way than treaty negotiation permits.

[7] Geneva, 1969; amended in 1982.

The International Maritime Organization (IMO), through its Maritime Environmental Protection Committee (MEPC), has focused on prevention efforts to minimise IAS introductions via ships' ballast water. It supports the development of a mandatory legal regime to avoid unilateral responses by individual states in such an international industry, but began by adopting voluntary *Guidelines for the control and management of ships' ballast water to minimize the transfer of harmful aquatic organisms and pathogens*[8] to assist governments, ships' masters, operators and owners, and port authorities to establish common procedures to minimize the risk of introducing harmful aquatic organisms and pathogens from ship's ballast water and associated sediments.[9] The MEPC has also approved a technical circular on design measures for ballast water and sediment options in new ships (MEPC 47th session, London 4-8 March 2002). The IMO Council[10] has now convened a Diplomatic Conference for early 2004 to finalise the the draft IMO *International Convention for the Control and Management of Ships' Ballast Water and Sediments*.

The IMO, Global Environmental Facility (GEF), and U. N. Development Program (UNDP) have jointly developed the GloBallast Programme[11], a global technical cooperation program to assist developing countries to tackle the transfer of harmful aquatic organisms in ships' ballast water and to prepare for the implementation of the future convention. The Programme ran from 2000-3 and was extended until 2004. A favourable mid-term evaluation[12] found that stakeholder participation and support has been impressive and that the project has created a solid foundation of support for the future IMO Convention.

There are no internationally-agreed prevention measures for hull-fouling as an IAS vector, although CBD Decision VI/23 §7 called on the IMO to develop mechanisms to minimise this as a matter of urgency.[13] The IMO International Convention on the Control of Harmful Anti-Fouling Systems on Ships (2001) provides for the global phase-out of tri-butyl-tin (TBT) in paints, but this ban is designed to reduce chemical pollution of the marine environment and could even lead to a significant increase in the number of introductions of invasive fouling species such as ascidians.[14]

[8] Annex to Resolution A.868 (20), 2Oth IMO Assembly, 1997.
[9] At least seven countries and three ports have now enacted legislation requiring ships calling at their ports to comply with the Guidelines e.g. Australia, Canada, Chile, Israel, New Zealand, Portugal, the USA, some States within the USA and some ports around the world, such as Buenos Aires (Argentina), Scapa Flow (Scotland) and Vancouver (Canada).
[10] 89th session, 25-29 November 2002.
[11]The GEF/UNDP/IMO *Global Ballast Water Management Programme for the Removal of Barriers to the Effective Implementation of Ballast WaterControl and Management Measures in Developing Countries.*
[12] Vousden, D. & Okamura, B. 2003. *GloBallast Project Independent Mid Term Evaluation: Final Report* (31 March 2003).
[13] Note that IMO, the International Council for the Exploration of the Sea (ICES) and the International Oceans Commission have recently established a Study Group on Ballast and other Ship Vectors (first meeting held in Vancouver, 24-25 March 2003).
[14] These are also found in submerged man-made structures in ports, harbours and marinas with appropriate salinity and can tolerate high levels of pollution and considerable variations in temperature (*Ballast Water News* Issue 12 Jan-March 2003).

The International Civil Aviation Organization (ICAO) recognizes that civil air transportation represents a potential pathway for IAS introduction (e.g. the brown tree snake, *Boiga irregularis*, to Guam). Contracting States have been urged to take mutually supportive efforts to reduce the risk of introducing potential IAS via this pathway to areas outside their natural range.[15] In 2002, the ICAO surveyed 188 States to gather data for an assessment of whether civil aviation is a 'significant'/'high-risk' pathway for unintentional introductions. The questionnaire covered possible vectors (aircraft structure, cargo, passengers, baggage, packaging, mail) and control measures based on education (brochures, airport notices, quarantine declaration on arrival cards), physical intervention (detector dogs, disinfection of aircraft, searches of passengers, baggage and/or cargo), enforcement and surveillance. The Secretariat's preliminary analysis of the 47 responses shows that about half of the States aware of IAS problems in their respective countries consider that air transport is a contributing factor (the other half lacked the data to respond). The detailed analysis will also cover species-specific information provided by States. The ICAO Council will then determine whether an ICAO prevention strategy is necessary: the matter will be considered by the ICAO Assembly in 2004.

Technical guidance for fisheries and aquaculture

Aquaculture and mariculture operations present a known risk of unwanted introductions (escapes, parasites, and disease). Some technical guidance has been adopted to establish principles and standards and provide best practice guidance for this rapidly growing industry.

Through the Food and Agriculture Organization (FAO), the Code of Conduct for Responsible Fisheries was adopted in 1995.[16] The Code provides guidelines for the responsible introduction, production and management of fish species under managed conditions. It urges States to adopt measures to prevent or minimize harmful effects of introducing non-native species or genetically altered stocks used for aquaculture into waters.

The 1994 Code of Practice on the Introductions and Transfers of Marine Organisms was issued by the International Council for the Exploration of the Sea and the FAO's European Inland Fisheries Advisory Commission. It establishes procedures and practices to diminish the risk from intentional and unintentional introductions of marine alien species into marine and freshwater ecosystems.

Relationship of existing instruments with the multilateral trading system

Non-native species are introduced through trade intentionally (imported products) or unintentionally (e.g. as by-products, parasites and pathogens of traded products, hitchhikers and stowaways in vessels, vehicles, or containers that deliver products or services). National measures to minimize unwanted introductions - quarantine and border controls on live species, commodities, packaging and other vectors - therefore have a direct interface with the multilateral trading system and need to be consistent with applicable rules and disciplines adopted within the WTO framework.

Multilateral environmental agreements do not directly address international trade aspects of non-native species control, except CITES - to a limited extent. The non-binding FAO Code of Conduct for Responsible Fisheries recommends that States develop international agreements for trade in live specimens where there is a risk of environmental damage *inter alia* in importing States.[17]

In contrast, the IPPC, OIE, and Codex Alimentarius have a formal relationship with the multilateral trading system, following the conclusion in 1995 of the WTO Agreement on the Application of Sanitary and Phytosanitary Measures (WTO-SPS Agreement). The SPS Agreement provides:

[15] ICAO General Assembly Resolution A33-18, adopted at the 33rd Session, Montreal 2001.
[16] Guidance developed under this Code includes *Precautionary approach to capture fisheries and species introductions* and *Aquaculture Development* (FAO Technical Guidelines for Responsible Fisheries 2/1996 and 5/1997).
[17] Section 11.2.10.

⇒ that a WTO Member may adopt national measures to protect human, animal, or plant health/life from risks arising from the entry, establishment or spread of pests, diseases, or disease-causing organisms and to "prevent or limit other damage" within its territory from these causes.[18]

⇒ for the use of international standards as a basis for national protection measures that affect trade. The aim is ensure that national measures have a scientific basis and are not used as unjustified barriers to international trade. The Agreement recognizes standards set by three organizations: IPPC (pests of plants and plant health); OIE (pests and diseases of animals and zoonoses); and Codex Alimentarius Commission (food safety and human health).

⇒ for key principles (reflected in the revised 1997 IPPC Agreement) that include consistency in the application of appropriate levels of protection, least trade restrictive alternatives, acceptance of equivalent but different SPS measures and transparency through advance notification of measures.

Consistent with these principles:

⇒ countries may take action when necessary to protect plant/animal health by preventing introduction or carrying out eradication/containment;

⇒ such action should be based on the appropriate level of protection for that country;

⇒ pest risk analysis is to be used in the development of measures;

⇒ countries should base national measures on international standards where available. Where no international standard exists or a higher protection level is sought, the State concerned must justify a national measure through scientifically-based risk assessment; and

⇒ emergency (or provisional) measures are permissible without such analysis, when situations require urgent action or there is insufficient information on which to base action. However, such measures must be reviewed for their scientific justification and modified as appropriate.

Progress and remaining constraints

Terminology

Many different terms are used for non-native species generally (non-indigenous, alien, exotic, foreign, new), the subset that cause damage (pest, weed, harmful, injurious, invasive, environmentally dangerous) and the concept of "introduction." The need to clarify concepts and terms is widely acknowledged, internationally and nationally.

Biodiversity-related instruments (prior to the CBD Guiding Principles) contain few definitions of key terms and concepts. In contrast, the FAO/IPPC Glossary of Phytosanitary Terms provides for standardized use of terms at international, regional and national level and is updated annually. Some key IPPC terms (e.g. "quarantine pest") are roughly comparable but not identical to IAS in the CBD sense. In 2003, the ICPM adopted guidance[19] on the interpretation of the term "economic importance" in the IPPC and ISPMs. This notes that the IPPC has historically maintained that the adverse consequences of plant pests, including those concerning uncultivated/unmanaged plants and wild flora, are measured in economic terms, but recognises that the term "economic" has resulted in some misunderstanding of IPPC's focus. The new Guidelines clarify that:

[18] Abridged from Annex A, Definitions.
[19] Supplement No. 2 on *Guidelines on the understanding of 'Potential Economic Importance' and related terms including reference to environmental considerations* to ISPM 5 (*Glossary of Phytosanitary Terms*).

⇒ pest risk analysis can account for environmental concerns in economic terms using monetary or non-monetary values;

⇒ market impacts are not the sole indicator of pest consequences; and

⇒ members have the right to adopt phytosanitary measures with respect to pests for which the economic damage caused to plants, plant products or ecosystems within an area cannot be easily quantified.

⇒ for a plant pest to have 'potential economic importance', it must have a potential for introduction in the area subject to pest risk analysis, the potential to spread after establishment, and a potential harmful impact on plants (e.g. loss of crop yield or quality; damage to ecosystems, habitats or species; or some other specified value such as recreation, tourism or aesthetics).

At the operational level, it is very important for quarantine and environmental personnel to develop a common approach to terms used in these sectors.

Taxonomic coverage

Biological invasions may be generated by all taxonomic groups at all taxonomic levels. Internationally, only the CBD covers IAS in relation to all levels of the biodiversity hierarchy. Nationally, biodiversity laws that regulate introductions tend to be limited to higher taxa of non-native animals and plants and rarely go below the species level.

Sanitary and phytosanitary instruments potentially cover all taxonomic groups and lower taxonomic categories, but only to the extent that these are injurious to plant or animal health as defined by the IPPC or OIE. The IPPC's trigger for pest classification is "injurious to plants or plant products". This covers alien organisms that could damage wild plants, but not explicitly those that may harm ecosystem function or plant genetic diversity.

Ecosystem/biome coverage

Invasion processes affect all ecosystems, but the impact of particularly aggressive species is especially severe on the structure and function of vulnerable and isolated ecosystems, including small islands, certain lakes, and mountain areas.

Guidance is needed to assist countries and regions to develop appropriate frameworks for vulnerable ecosystems. For the Austral-Pacific region, with 7500 large and small islands, the new Cooperative Initiative on Invasive Alien Species on Islands is particularly relevant (see Saunders, below).

Coverage of pathways and vectors

Many pathways and vectors are still not covered by international rules or guidance.

For transport, only one shipping-related vector (ballast water) has been addressed: equivalent measures to minimize hull fouling are urgently needed. Aviation-related guidance is voluntary and is limited to civil aviation. Land transport is not formally regulated to minimize transfer risks. For inland waterways, there seems to be no guidance on water-borne transport or risks associated with dam removal or canal linkages connecting drainage basins or coasts.

Material moving outside conventional trade pathways (e.g. in development assistance, humanitarian programmes, military operations) falls outside the regulatory framework. A preliminary report on *International Assistance Programmes as pathways for the introduction of invasive alien species*[20] found that serious and under-documented IAS problems still result from such programmes. More concerted work is needed in international funding and technical agencies to assess the nature and severity of associated IAS risks and to support development of better prevention methods and stronger national and international quarantine systems.[21]

Quarantine systems are theoretically broad enough to cover all introductions that can involve the transfer of pests (e.g. passengers, mail, Internet transactions, means of transport). However, national systems vary widely in capacity and resources (inspection facilities, taxonomic capacity, access to information). Many smaller Pacific islands lack the resources to operate comprehensive quarantine and risk assessment systems. Moreover, national systems mainly focus on international boundaries and rarely cover movements between islands within the same country except for high-risk agricultural and forestry pests. This is a very serious deficit.

Prevention, eradication and control

All existing instruments mandate prevention, recognizing the technical difficulties and costs of detecting, eradicating, or containing introduced species after they have become invasive. However, frameworks tend to be weaker on monitoring, eradication, and control for IAS that impact biodiversity, when compared with those that affect agriculture and forestry.

Internationally and nationally, the use of import and export controls to prevent introduction of pests is long established. National plant and animal health services and Customs play a key role in establishing and implementing border controls, import restrictions, and other quarantine measures.

However, some Small Island Developing States lack the technical capacity or resources for adequate quarantine systems and may not be able to meet the standards and requirements of agreements within the multilateral trading system. There are wide variations in the national capacity levels and assessment and control procedures of different trading partners within the Pacific region. This can place islands at risk from other countries in the same region that do not apply such stringent measures. This is another reason why regional technical support, particularly from the Secretariat of the Pacific Community, is particularly important for the Pacific region.

Effective prevention also requires the restriction of further imports and internal movements of IAS. This is important to cut off supply, support containment strategies, and prevent spread to other areas. Measures of this kind are often restricted to agricultural and forestry pests.

[20] Source: unpublished report by CABI Bioscience compiled on behalf of GISP.

[21] Decision V/25 (Biological diversity and tourism) includes as some of the potential impacts of nature-based tourism the increased risk of introduction of alien species by tourists and tourist transportation and the spread of pathogens from humans or companion animals to wild species.

Institutional coordination and synergy

Cooperation between key organizations has expanded significantly over the last five years. The CBD has endorsed closer cooperation with the FAO, WHO, IMO, OIE, Codex Alimentarius, UNESCO and relevant treaty secretariats. The 3rd Joint CBD-Ramsar Work Plan (2002-2006) provides for collaborative actions with GISP, IUCN, and the World Conservation Monitoring Centre (WCMC) to increase the availability of information and guidance on aquatic IAS. In February 2003, the CBD and IPPC Secretariats agreed a Memorandum of Understanding that recognises their overlapping objectives, calls for strengthened cooperation between secretariats and identifies areas for collaboration. There is no equivalent mechanism between the CBD and the OIE, but the OIE has expressed support for the development of closer cooperation (pers.comm., B. Vallat).

Increased engagement of non-State actors

There is growing acceptance of the need to engage trade, transport, and other stakeholders in IAS prevention and management, and to harness their ingenuity in finding solutions and alternatives. The development of codes of conduct and of best practice should be promoted, although voluntary measures of this kind will not necessarily be enough to tackle difficult IAS issues.

In the marine sector, the shipping industry contributes through the International Chamber of Shipping and the International Association of Independent Tanker Owners to the *GloBallast* Global Ballast Water Management Programme which gives practical guidance for the implementation of the IMO voluntary guidelines on board ships.

In the pet and ornamental fish sector, some trade associations participate actively in CBD and CITES discussions relevant to IAS. A small number of trade organizations have developed voluntary codes of conduct for national application, usually directed at the point of retail (e.g. pet shops, garden centers).

Frameworks for regional and subregional cooperation in the Austral-Pacific region

Two Pacific-specific treaties provide for IAS prevention and management:

⇒ the Convention on the Conservation of Nature in the South Pacific (Apia, 1976) requires each Contracting Party to "*carefully consider the consequences of the deliberate introduction into ecosystems of species which have not previously occurred therein*" (Art.V.4).

⇒ the Protocol for the Conservation and Management of Protected Marine and Coastal Areas of the South-East Pacific (Paipa, 1989) requires Parties to take measures to prevent, reduce, and control environmental deterioration in marine protected areas, including, as far as possible, "*the introduction of exotic species of flora and fauna, including transplants*" (Art.VII.2.c). This Protocol is open for accession by any State bordering the South East Pacific (applicable by extension to the coastal Latin American States of the East Pacific).

Pacific institutions and programs already addressing aspects of IAS include:

⇒ the South Pacific Regional Environment Programme (SPREP), the first body in the world to develop a regional IAS strategy, endorsed by the 26 members in 2000 (see Dovey, below). Revisions to the Strategy are currently under consideration, as the existing Strategy is quite general and does not deal with marine or agricultural IAS issues. Opportunities exist to set clearer priorities, to distinguish better between regional and national responsibilities, and to give greater coverage to stakeholder engagement (other sectors and organizations).

⇒ the Pacific Ocean Pollution Prevention Program (PACPOL), approved by SPREP members in 1998, includes invasive marine species as one of its four activity areas and addresses shipping-related vectors, in particular ballast water and hull fouling (see Nawandra, below).

⇒ the Pacific Invasive Species Project, launched by SPREP in August 2002, provides a framework for developing regionally-harmonized measures and regional training and capacity-building.

⇒ the Secretariat of the Pacific Community, a regional technical development agency that works with its 22 member PICTs, donors, and other organizations and countries. The SPC Agriculture Program's Plant Protection Service addresses regional plant pest problems (see Orapa, below).

⇒ the Pacific Basin Information Node (PBIN), a component of the U.S. National Biological Information Infrastructure dedicated to biodiversity issues in the Pacific (see Fornwall, below).

⇒ the Cooperative Initiative on Invasive Alien Species on Islands (see Saunders, below).

⇒ the Pacific Plant Protection Organization (PPPO), the regional plant protection organization within the IPPC framework that provides a coordinating body for the South Pacific (see Orapa, below).

Regional trade-related frameworks need to give greater attention to IAS issues as the expansion of trade agreements and partnerships can have major implications for IAS pathways.

Asia-Pacific Economic Cooperation (APEC), established in 1989, is the main regional vehicle promoting open trade and economic cooperation within the region. It has 21 Member Economies drawn from both sides of the Pacific Basin, including Japan, Australia, New Zealand, the U.S., Mexico, Peru, and Chile. APEC supports research and information tools that could be directly relevant to regional capacity-building and IAS information exchange (e.g. the APEC Virtual Center for Environmental Technology Exchange, http://www.apec-vc.or.jp). There are APEC Study Centers in 19 member economies (100 universities and research centers across the region). APEC has not focused on IAS issues generally, but its Marine Resources Conservation Working Group is currently developing a regional management framework for the control and prevention of introduced marine pests (see Greeves, below).

Conclusion: key steps for regional and national cooperation

The instruments described above give rise to significant national obligations and commitments. There is an urgent need for effective and practical IAS institutional and legal frameworks and much stronger political commitment for regional coordination and cooperation on IAS.

⇒ *develop a holistic focus on pathways as well as intentional introductions*

Pathways and pathway actors need to be identified as part of integrated pathway management, supported by GISP. The expertise of relevant trade and industry sectors should be harnessed through stronger contacts with vector-responsible groups, such as timber and plant traders, aquarium and sport fish traders, transporters, and so on. The region (or sub-region) is a good level to develop contacts with target groups.

⇒ *promote stakeholder and community participation*

Stakeholders involved in or affected by non-native species-related activities need to be engaged and, where appropriate, made accountable. Appropriate education and communication strategies need to be developed, tailored to different target audiences and groups, including enforcement personnel. In the socio-cultural context of the Pacific Islands, it is particularly important to strengthen the role of local authorities, local communities and indigenous peoples in IAS detection and management.

⇒ *collect, share and manage information to support early warning and rapid response*

⇒ develop regional dialogue and strengthen institutions

Broad-based coordination means building links with counterparts across borders, throughout the region, and with trading partners. The need for a sound ecological approach to IAS that includes agriculture justifies increased cooperation between regulatory agencies and key sectors on the development of new instruments and quarantine/import health standards, preferably at the regional level. Regionally-agreed measures and actions may carry greater weight in global fora than unilateral measures.

At the national level:

- decisions should be taken at the right level by the right body, taking into account the affected communities of interest;
- there should be clear lines of authority and appropriate associated accountabilities;
- there should be appropriate public input into decisions but this should be designed to ensure it does not impose unreasonable costs or prevent effective action;
- there needs to be the ability to take rapid decisions in emergencies;
- the responsible institution should have adequate stability of function and resources to enable long-term programs to be run.

⇒ *review and develop strategy and tools*

The review of existing policy, legal, and institutional arrangements serves to identify gaps, inconsistencies, and needed improvements. Where islands in the same sub-region have commonalities in their legal/administrative systems, they may be able to collaborate on parts of a review. The review process may be an integral part of developing a national IAS strategy or action plan.

Sectoral agencies whose programs and projects have implications for IAS need the awareness, tools, and resources to assess these implications in consultation with affected stakeholders. Strategic environmental assessment of policies, programs, and projects that may provide new pathways – for example, transport infrastructure, inter-basin hydrological links and new trade agreements and practices - is central to prevention.[22] These approaches can make it easier to identify some types of risk and make appropriate modifications early on, before potentially irreversible problems develop.

⇒ *make better use of existing measures and expertise*

Generic environmental rules rarely reference IAS risks or cover a broad enough range of activities. Environmental impact assessment (EIA) regulations and criteria need to be expanded to cover activities and processes involving IAS and operating license requirements should apply to premises where non-native species are held in containment or captivity.

[22] The CBD COP has called for use of impact assessment and strategic environmental assessment in the alien species context (Decisions V/18 and VI/23).

There may be scope to streamline regulatory procedures; for example, to minimize applicants for import or movement permits having to make several different applications to different regulatory authorities. Complex systems tend to be less transparent and can deter compliance.

Existing tools may be under-used. For example, competent authorities often have powers under quarantine/agricultural legislation to require land owners and occupiers to control noxious weeds/ "nuisance" species. In practice, implementing regulations are not always issued promptly or publicized and enforced.

⇒ *develop incentives and funding tools*

GISP research found that there are few deterrents to the export, import, or use of IAS. Those who take the risks are seldom those affected by the consequences of a harmful introduction. There are few incentives for importers, users, and other stakeholders to develop alternative practices based on locally-available native species or to manage land to promote ecosystem resilience.

Few countries have mechanisms to generate sustainable funding for public investment in IAS prevention and control programs. This is a serious deficit, particularly for developing countries, and calls for priority research into innovative new approaches.

We need to consider precedents from other areas of environmental management and the agricultural and forestry sectors. Options include the wider application of introducer/user fees, the use of environmental insurance or performance bonds for activities known to present a risk, or levies attached to the product, transporter, or transoceanic passenger.[23]

Further references

Comprehensive review of activities for the prevention, early detection, eradication and control of invasive alien species (UNEP/CBD/SBSTTA/06/INF3, available on http://www.biodiv.org/doc/meetings/sbstta/sbstta-06/information/sbstta-06-inf-03-en.pdf).

IUCN 2000. Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species Approved by the 51st Meeting of the IUCN Council, February 2000 (available on http://www.iucn.org/themes/ssc/pubs/policy/invasivesEng.htm).

Review of the efficiency and efficacy of existing legal instruments applicable to invasive alien species (UNEP/CBD/SBSTTA/06/INF5, available on http://www.biodiv.org/doc/meetings/sbstta/sbstta-06/information/sbstta-06-inf-05-en.pdf).

Report on existing international procedures, criteria and capacity for assessing risk from invasive alien species (UNEP/CBD/SBSTTA/06/INF6, available on http://www.biodiv.org/doc/meetings/sbstta/sbstta-06/information/sbstta-06-inf-06-en.pdf).

Shine, C., N. Williams and L. Gundling (2000). A Guide to Designing Legal and Institutional Frameworks on Alien Invasive Species (IUCN Environmental Policy and Law Paper No. 40).

Detailed technical and advisory material is available from international organizations, governments, and specialist bodies working on IAS issues, including IUCN, GISP and the FAO, which has legal and technical expertise with regard to IAS in agriculture, forestry and fisheries. A list of key websites is given in Appendix 5.1.

[23] *e.g.* Some IMO Members levy port dues to fund national control and monitoring. See further Jenkins, P. *Who should pay? Economic dimensions of preventing harmful invasions through international trade and travel* (paper presented to the GISP Human Dimensions Workshop, Cape Town, September 2000, available from pjenkins@cspinet.org).

The Global Invasive Species Programme's Partnership Network and opportunities for scientific collaboration internationally

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This paper describes the global context for action on IAS issues and opportunities for scientific collaboration internationally through the Global Invasive Species Programme (GISP).

International exchanges of IAS can create global-scale problems that require multi-national solutions. The good news is that we can address these problems, at least in part, through the exchange of information around the world. Modern techniques for rapid information dissemination provide one of the key tools to combat IAS, particularly at the international level.

We need to think globally and act locally in ways suited to local, national, and regional units. Countries do not need to, and cannot effectively, deal with IAS issues in isolation. They can adapt or adopt technical, legal, and policy measures developed in other countries. For example, the U.S. could modify prevention policies used in New Zealand and Australia, countries which have been seriously affected by biological invasions and have led the way in developing strong frameworks.

GISP's aim is to inform policy on IAS and to support the translation of policy into practice. It is an international network of experts from various disciplines: scientists, economists, lawyers, policy makers, resource mangers, and others from all sectors and constituencies affected by IAS. This broad composition is critical to managing IAS because of the broad spectrum of problems that IAS pose. The network requires input, assistance, and information from around the world. Governments, non-governmental organizations (NGOs), intergovernmental organizations (IGOs), industry, academicians, and individuals are all welcome.

GISP Phase I (1997-2000) had three primary partners: IUCN-The World Conservation Union, CAB International, and the Scientific Committee on Problems of the Environment (SCOPE). It gave rise to the following major products:

GISP Phase I products

Biological and socioeconomic syntheses	*Policy and management synthesis*	*Other products*
Invasive Species in a Changing World. 2000. H.A. Mooney, R. J. Hobbs (eds.) Island Press, Washington, D.C.	***A Guide to Designing Legal and Institutional Frameworks on Alien Invasive Species***. Shine, C., N. Williams, L. Gundling. 2000. IUCN Environmental Law Centre.	***Global Invasive Species Database*** http://issg.appfa.auckland.ac.nz/database (Coordinated by IUCN/ISSG)
The Great Reshuffling: Human Dimensions of Invasive Alien Species. McNeely, J.A. (ed.). 2001. IUCN, Gland, Switzerland and Cambridge, UK.	***A Global Strategy on Invasive Alien Species.*** McNeely, J.A., H.A. Mooney, L.E. Neville, P. Schei, J.K. Waage (eds.). 2001. IUCN, Gland, Switzerland and Cambridge, UK. www.gisp.org	***100 of the World's Worst Invasive Alien Species - a selection from the Global Invasive Species Database***. Lowe, S., M. Browne, S. Boudjelas, M. De Poorter, IUCN-ISSG. http://issg.appfa.auckland.ac.nz/database/species/search.asp?st=100ss&fr=1&sts
The Economics of Biological Invasions. 2000. C. Perrings, M. Williamson, S. Dalmazonne (eds). Edward Elgar Publishers.	***Invasive Alien Species: A Toolkit of Best Prevention and Management Practices***. Wittenberg, R., M.J.W. Cock. 2001. CAB International, Wallingford, Oxon, UK. www.gisp.org	
A Plague of Rats and Rubbervines: The Growing Threat of Species Invasions. 2002. Baskin, Y. Island Press, Washington, D.C.	***Invasive Species: Vectors and Management Strategies.*** 2003. Ruiz, G.M. and J. T. Carlton, (eds). Island Press, Washington, D.C.	
Invasive Alien Species: a New Synthesis. Mooney, H.A., J. McNeely, L. E. Neville, P.J. Schei, J.K. Waage (eds). Island Press, Washington, D.C. (in press)		

GISP Phase II involves the establishment of an Executive Board, Advisory Panel, and a Secretariat, which will be based in Cape Town, South Africa. The *GISP Phase II Implementation Plan* defines six major themes that deal with many key IAS issues and provides for the creation of a working group for each theme. These groups, at varying stages of development, have outlined the following actions:

⇒ the *Working Group on National and Regional Capacity Building* has developed a multi-country program to address the invasion of weeds in Africa, as well as initiated the Cooperative Initiative on Invasive Alien Species on Islands through the IUCN Invasive Species Specialist Group.

⇒ the *Working Group on Communication, Education and Outreach* has organized a series of regional workshops to identify regional needs and cooperation opportunities and to support the development of regional strategies. Six workshops were held: Nordic/Baltic (May 2001); Mesoamerican/Caribbean (June 2001); South America (October 2001); Southern Africa (June 2002); South/Southeast Asia (August 2002); and Austral-Pacific (October 2002). A seventh, for West Africa, will be held in March 2004.

⇒ the *Working Group on Global Information Management* works on the development of the Global Invasive Species Information Network, which builds and links databases to extract information on which alien species may become invasive. Planned actions include a distributed network of databases, an informatics consortium, regional information hubs and strengthening of early warning capacities.

⇒ the *Working Group on Pathway Management* has initially focused on humanitarian and military operations as a possible pathway for unintentional introductions. One example of an introduction through the 'aid trade' concerns the Western Corn Rootworm, *Diabrotica virgifera virgifera*, which was unintentionally introduced into Europe in the late 1990s by military flights during the Balkan conflict from the U.S. to Bosnia: as a result, one of the worst U.S. crop pests has established and is spreading throughout Eastern Europe where corn is a staple cereal crop (J.Waage, personal communication). On behalf of the U.S. Agency for International Development, GISP is currently investigating the role of international assistance as a pathway for the invasion of non-native systems into the aquatic ecosystems of Southeast Asia.

⇒ the *Working Group on Assessment and Evaluation* works on techniques for predicting potential invasiveness of species that have no history of introduction but are likely to be introduced as a result of globalization. It sponsors workshops to foster collaboration between researchers in the environmental, agricultural and other sectors impacted by IAS. Two ecosystem-scale assessments, inland waters and islands, are currently being untaken by GISP on behalf of the CBD.

⇒ the *Working Group on Law and Policy* will contribute to the review of relevant legal and policy instruments at national, regional and global levels; identify gaps in coverage of taxonomic groups, pathways and vectors and ecosystems; and assist relevant bodies to strengthen existing instruments and develop new tools where necessary.

In conclusion, IAS need to be seen as every nation's economic, environmental, and/or public health problem. They raise intrinsically international problems, and require solutions at all levels. International networks such as GISP can offer technical advice and support to all nations and regions.

Best practices for preventing and managing invasive alien species

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This paper summarizes the issues involved in managing IAS threats to a country, and considers the particular needs of Small Island Developing States (SIDS) in the Austral-Pacific region. More comprehensive practical information is set out in the GISP Toolkit (Wittenburg and Cock 2001). The strategic thinking required is described in the Global Strategy on Invasive Alien Species (McNeely *et al.* 2001).

IAS are species which have colonized a habitat (or more usually a country or island) and thereby compromised the native biota, economy, and/or human communities. IAS have typically aggressive ecological characteristics, including high reproductive capability and tolerance of a wide range of environmental conditions. They are quick to fill vacant niches (especially in modified habitats), often displace native species, and are often resistant to control methods.

There are three conceptual approaches for determining how to deal with IAS threats. These are best thought of as 'defense strategies,' a military analogy which is relevant when addressing biological invasions. These defense strategies are: prevention, early detection and eradication, and control.

Pathways

Before any of these actions occur, an understanding of the pathway(s) by which IAS enter a country is essential. There are two types of human-mediated introductions: intentional and unintentional. Once introduced into a new region, IAS can also self-introduce into other areas via natural dispersal mechanisms (e.g. rafting, airborne propagules). Understanding pathway mechanisms is necessary to stop or minimize the arrival of IAS. Both prevention and early detection strategies require high quality information on the pathways used by IAS.

Some of the pathways which allow IAS into Pacific islands include:

Intentional introductions

⇒ plants introduced for agriculture (including soil improvement) and forestry;
⇒ ornamental plants;
⇒ germplasm importation;
⇒ animals released for hunting or fishing;
⇒ mammals released on islands as a castaway food source;
⇒ biological control;
⇒ escape of species imported for captive care (e.g. farmed animals), which is almost inevitable;
⇒ release into the wild of captive animals, including aquarium animals;
⇒ reintroductions of species assumed to be the same or similar to a native species which has declined (but which may be genetically different);
⇒ release of species to "enrich" the local fauna.

Unintentional introductions

⇒ contaminants (seeds and animals) of agricultural produce, soil and timber products, including nursery plants and cut flowers;
⇒ machinery or equipment used in routine operations (e.g. agricultural, transport, military);
⇒ packaging material, including postal packaging and cargo;
⇒ tourist luggage and equipment;
⇒ diseases and parasites in or on intentionally introduced animals.

Once IAS have been introduced, invasions can be accelerated by other vectors and processes. Examples include the propagation and supply of diseased aquaculture animals and the modification or disruption of natural habitat, e.g. through logging. The latter provides pathways for IAS such as weeds to gain access to new areas, where they may outcompete natives in the revegetation process.

Prevention

Prevention is the most important action for stopping IAS depredations. Preventive measures will almost always be cheaper and more effective than actions taken once the IAS has started a founder population in a new location, and certainly after it becomes established.

Both intentional and unintentional introductions may be prevented or minimized by enforcing international regulations designed to stop IAS reaching the border and by developing appropriate national measures. The design of effective and comprehensive measures demands good knowledge of pathways for entry. Once good regulations and laws are in place, law enforcement agencies need the technical capability and physical resources (e.g. species identification experts, quarantine rooms) to implement these rules. Appropriate training models have been developed for the Pacific region by:

⇒ the Secretariat for the Pacific Community (e.g. risk assessments for invasive species potentially threatening agricultural interests); and

⇒ the South Pacific Regional Environment Programme (e.g. early detection, contingency planning, control and eradication methods).

Import risk analysis methods have been designed for most developed countries and are used in workshops and training for most Pacific Island Countries and Territories (PICTs). Comprehensive models now exist, such as the Australian Quarantine and Inspection Service's (AQIS) template. Risk analysis may be used to generate a 'white list' of species which are environmentally safe to introduce into the country for specific purposes, such as biological control. In contrast, 'black lists' include non-native species known to be potentially invasive and against which safeguards must be adopted, possibly through specific surveillance programs.

For regions with common pathways and/or other commonalities, such as those shared by Pacific SIDS, black lists may be of special value, provided that there is collective agreement between these countries and territories that black listed species will not be allowed to enter the region.

Invasive marine species pose a special and immediate threat, because of Pacific islanders' direct dependence on the inshore marine community for food. Pathways such as ballast water exchange and hull fouling need to be addressed in different ways to those for terrestrial IAS. Keeping marine IAS out of an area will depend on compliance with international regulations and best practice guidelines, such as exchanging ballast water well out to sea. In such cases, the 'boundary' to be protected against IAS needs to be far out to sea. This is essential, because controlling or eradicating invasive marine species in coastal or inshore areas is almost always technically impossible.

Surveillance and early detection

In some respects, early detection is the most significant consideration in an IAS strategy. Even in wealthy countries with relatively advanced border control and quarantine systems, introductions will occur because a species simply "slipped through" or was smuggled. It is almost inevitable that non-native species will gain access to new locations, although the percentage that become established is likely to be small.

Efficient early detection relies on an effective surveillance system with pre-agreed protocols and processes (contingency plans) and the necessary trained personnel in place. These personnel need the necessary taxonomic skills, survey methods, and equipment. Their surveillance efforts should be:

⇒ targeted at ports of entry;

⇒ targeted specifically at high-risk species, as appropriate (this requires a technical assessment to identify those most likely to gain access); and

⇒ done on a well-designed, predetermined, and regular basis.

In order to identify new and potentially invasive organisms, it is necessary to know which species are already present and which are native. Although an obvious need, this requirement may be quite difficult to meet, particularly for invertebrates which are poorly described in many countries.

Once the surveillance system is in place, contingency plans and resources for their implementation need to be developed and trained personnel made aware of procedures. Although the need for this is obvious, government or similar surveillance systems will rarely be sufficient to provide protection through a comprehensive surveillance system, due to the sheer size of the task. It is therefore imperative to use the general public to watch, wherever and however possible. This calls for a well orchestrated public awareness and education campaign.

Detecting species at low densities, as is the case shortly after introduction, often requires research and development of situation-specific methods. Methods for some invertebrate species, such as ants (which present the greatest risk to terrestrial native habitats and species), only work when these species occur at high densities, and may be inadequate for targeting single species. However, some invertebrates, especially those that threaten agricultural systems, can be targeted with specific survey methods, such as those using pheromones.

Once an organism has established itself (hopefully as a tiny founder population with restricted distribution), then a process must be quickly implemented to identify the best course of action. The contingency plan should have been designed in advance with some or all of the following elements in place: containment procedures, public awareness campaign (partly directed at finding out where more populations may occur), expert consultation process, monitoring methodology, legal implications (regulations and procedures which must be followed), and an eradication plan. All of these will need appropriate financial and personnel resources.

Eradication, control, and containment

An assessment of the status of the IAS is a key component of the decision-making process for an established IAS population. Specific considerations include determining whether eradication is possible (this is usually technically difficult) or, if not, whether control is necessary and feasible and if so, which methods should be used. Failing any of these, mitigation may be the only option left – that is, accepting that the IAS is there to stay and focusing management on actions to minimize its impacts on biodiversity or other values.

Once the initial assessment has been made, important components in an IAS program include:

⇒ creating a process for setting management priorities (there will usually be more than one IAS needing management and/or there will be a range of options for the same species);

⇒ best practices for eradication or control (and clearly recognizing the differences between them);

⇒ setting priorities (these may include political and public support, not just ecosystem and species values); and

⇒ efficient monitoring.

Processes for making decisions on priority work are described in detail in Wittenberg and Cock (2001). Management actions which can be pursued on the basis of a written plan will probably include eradication, control, or mitigation. If eradication is contemplated, speed is critical because the cost and difficulty of eradicating IAS populations gets exponentially larger with increasing population size.

It is extremely important to realise that there are some critical differences between eradication and control programs: the corresponding different objectives must be laid out at the start of the project and adhered to without deviation. For example, eradication projects must:

⇒ put all members of the target species population at risk (not the case with control);
⇒ block the pathway(s) responsible for allowing the invasion in the first place;
⇒ guarantee funding, political and administrative support for the entire project;
⇒ never carry out the development of eradication methods on the target population;
⇒ ensure that monitoring of the target species at extremely low densities is technically possible.

For a comprehensive description of the necessary components of an eradication program, see Wittenburg and Cock (2001), and Bomford and O'Brien (1995). The best eradication and control programs require a disciplined, scientific approach using a team of experts.

If biological control is to be used on an IAS which threatens native species, special consideration of risks to non-target native species is required. Quality technical information on their behavior in native ecosystems is even scarcer than for biocontrol species in agriculture-dominated habitats, especially for oceanic islands. Integrated pest management (IPM) techniques should always be investigated and the established protocols for their use followed closely.

'Containment' means confining the IAS to a prescribed range with clear boundaries which can be sustained indefinitely. For this, various eradication and control methods are used in conjunction with natural barriers. The concept can be used in reverse to keep IAS out of a defined area, thereby creating a "safe haven" for native species (referred to as "mainland islands" in New Zealand). Such areas provide exceptional opportunities which offshore islands do not, e.g. relatively large areas suitable for species which require large home ranges, protection of rare species already *in situ*, and practical opportunities for community involvement.

'Control' means reducing and maintaining numbers of IAS to prescribed levels which allow conservation or other values to be maintained at specified levels and/or at a specified quality. Requirements include the ability to:

⇒ monitor target and beneficiary species (including at low densities) sufficiently to allow the benefits of the control actions to be accurately quantified;

⇒ maintain the effectiveness of the control method(s) (e.g. toxin resistance does not evolve);

⇒ develop and carry out methods in a scientific manner consistent with standard operating procedures.

'Mitigation' means accepting that the IAS must be lived with, but a program exists to minimize their impacts. This can be achieved by protecting the most affected native species – perhaps transferring them to an IAS-free environment, using standard translocation protocols. More subtle methods might involve changing the behaviour of the native species, to protect it from the impacts of the IAS. However, mitigation is often expensive and technically difficult, and may only be appropriate as an interim measure before control or eradication options can be pursued.

Methods which can be used for eradication, control and eradication are discussed in detail elsewhere (for an excellent recent compendium, see Veitch and Clout 2002). The most important thing to remember about methods is that they change all the time as technology develops (e.g. new materials, baits). Methods may be most effective when used in combination with each other and with habitat management (integrated approaches). Lateral thinking has also resulted in new ways of using 'old' methods e.g. hunting dogs trained to target IAS as 'prey.'

Strategy

IAS strategies should be considered at an early stage of IAS planning. Strategies provide a conceptual framework for action plans, and require the implementing agency to agree on its overall objectives. However, strategies are only valuable if competent agencies actually follow them. The risks of departing from a strategy's course of action can be minimized if a proper process of development has been formulated and agreed on by stakeholders, following consultation with appropriate groups, whose 'buy-in' is then secured.

The *Global Strategy on Invasive Alien Species* (McNeely *et al.* 2001) has ten elements:

⇒ build management capacity;
⇒ build research capacity;
⇒ promote sharing of information;
⇒ develop economic policies and tools;
⇒ strengthen national, regional and international legal and institutional frameworks;
⇒ institute systems of environmental risk analysis;
⇒ build public awareness and engagement;
⇒ prepare national strategies and plans; and
⇒ build IAS issues into global change initiatives, promote international cooperation to deal with the problems of IAS.

These components could be a useful starting point for any agency when considering how to design their own strategy.

Pacific region

For the Pacific, four specific considerations could serve to focus future IAS work:

⇒ consider a regionally agreed black list of alien species on which countries would cooperate in order to keep them out of the region;

⇒ create centres of excellence for various facets of IAS technical and policy issues. These could be strategically located to provide the greatest benefit to neighbours with the greatest need for services. This would also effectively distribute the costs of fighting IAS among the whole region;

⇒ study relevant international conventions and agreements and develop regional strategies and policy positions to be taken in international fora, in agreement with all countries in the region, to maximise the benefits and minimize the adverse effects of these international instruments; and

⇒ research the new knowledge required to customise existing skills and technology for tackling IAS to fit the Pacific's unique circumstances.

Finally, the problems presented by IAS, while immense, are not insurmountable. Our capability to mitigate their effects is growing exponentially, and will hopefully soon match their rate of increase. Prevention will be the key to winning the war on IAS – and IAS are essentially a security issue. Preventive measures coupled with improving methods to combat existing and growing awareness of the threat of IAS can win the battle against IAS.

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Acknowledgement

Thanks to Alan Saunders (Invasive Species Specialist Group, Species Survival Commission, IUCN, Auckland, New Zealand) for reviewing the text.

Conclusions and recommendations from the invasive alien species session at the 2002 Pacific Region Global Biodiversity Forum

Dr. Maj de Poorter
IUCN - Invasive Species Specialist Group

Introduction

The Global Biodiversity Forum (GBF) was founded in 1993 by IUCN, the World Resources Institute, UNEP, and the African Centre for Technology Studies. Its convenors include a number of other institutions. GBF is an open and independent mechanism that aims to encourage analysis, dialogue and partnership on key ecological, economic, social and institutional issues related to biodiversity and to contribute to the further development and implementation of biodiversity-related conventions at the local, national, regional and international levels.

The GBF, as a multi-stakeholder forum, aims to expand the biodiversity constituency to foster broader involvement and commitment of independent, public and business sector partners to achieving the objectives of the CBD and other biodiversity-related agreements. To date, 25 sessions of the GBF have been held (16 global, 6 regional, 3 national).

The 1st Regional Session of GBF for the Pacific was held in conjunction with the 7th Pacific Islands Conference on Nature Conservation and Protected Areas (Rarotonga, Cook Islands, 4-5 July 2002). The theme was *Global Forces and Their Impacts on the Pacific's Biodiversity: Towards Local and Regional Response Strategies*. Three concurrent workshops addressed traditional knowledge, traditional resources management and biodiversity; climate change, biodiversity and livelihoods on small islands; and IAS in the Pacific.

The focal point for the IAS workshop was Maj De Poorter (ISSG). The coordinators were Greg Sherley (GISP), Lu Eldredge (Bishop Museum, Hawai'i), Liz Dovey (SPREP) and Wren Green (IUCN Oceania). The workshop aimed to provide:

⇒ a technical and situational update on IAS in the Pacific;

⇒ a forum to catalyze and contribute to implementation of the SPREP Regional Invasive Species Strategy (see Dovey and Randall, below);

⇒ an opportunity to link regional, national and local priorities and concerns with global IAS initiatives e.g. the newly-launched Cooperative Initiative on Invasive Alien Species on Islands (see Saunders, below);

⇒ a venue for specialist technical and policy discussions on IAS to better inform the 7th Pacific Islands Conference on Nature Conservation and Protected Areas (which had the theme "Mainstreaming Nature Conservation"); and

⇒ input to this GISP Austral-Pacific Workshop.

Presentations covered IAS threats, current programs in the Pacific, relevant organizations, problems and regional needs. The workshop re-emphasized the urgency of dealing with IAS issues, as many further species extinctions will occur in the Pacific if the threats posed by IAS are not addressed. In spite of the seriousness of the problem, there are good reasons for optimism, however. Methodologies for addressing and knowledge of IAS are improving rapidly. However, lack of awareness of the issues and/or possible solutions may still perpetuate IAS problems. The conservation issues surrounding IAS need to be mainstreamed, as support from both governments and local communities is crucial for successful prevention, eradication, and control of IAS.

The workshop participants adopted conclusions and recommendations addressed to governments and intergovernmental organizations. These are summarized below. For the full text and background documents, see:
http://www.gbf.ch/desc_workshop_old.asp?no=26&app=&lg=EN&now=3.

Summary of the conclusions agreed by GBF workshop participants

1. Dealing with IAS issues requires a collective vision, decided by the core Pacific stakeholders. This vision must underlie long-term strategies undertaken at regional, national and local levels.

2. There is a need for a joint work plan between inter-government organizations and NGOs, integrating programs like the SPREP IAS Strategy and the Cooperative Islands Initiative. This should capitalize on the favorable climate for funding created by recent discussions and decisions under the CBD.

3. It is critical for governments and local communities to support IAS management and prevention efforts. This will require communication on the importance of IAS issues and their relevance to stakeholders. For example:

    - biodiversity impacts can often be demonstrated with a flagship species of importance to the country or community (e.g. project to save the kakerori from extinction in the Cook Islands);

    - biodiversity impacts from key IAS (e.g. Miconia, Brown Tree Snake) can highlight the threats;

    - when discussing IAS issues, include economic as well as biodiversity costs (e.g. foot and mouth disease, crop damage) to show the links between environmental and agricultural impacts and that common interests are at stake;

    - make communication relevant and appropriate to the particular stakeholder or audience: government officials need different types of information to local communities. A 'marketing strategy' should be developed for effective awareness-raising;

    - a crisis (e.g. Cook Islands coconut invader) can create the opportunity to create a wider, long term strategy and system to cope with IAS.

4. It is crucial to highlight solutions and success stories. Methods for prevention, early detection, eradication and control are improving continuously, but many are not aware of this progress. Successful pilot projects and demonstration projects are key advocacy tools for creating awareness, support and buy-in for further (or increased) management actions. Demonstration projects used in awareness-raising and advocacy should ideally cover all aspects of IAS management, including: prevention (e.g. successful prevention of Brown Tree Snake arriving in Hawai'i);. early detection and action; eradication and ecosystem restoration; and control and longer-term management.

5. Prevention of movement of IAS is often focused on national borders. However, prevention of movement of IAS is also urgently needed at an island-to-island level within individual countries.

6. Networks for sharing information and expertise and training and cooperation should be developed and include different types of people and skills. Capacity building is required at national and local community level and practitioners need to be able to make use of skills gained. There is a need to:

- involve agricultural agencies and stakeholders as well as environmental or community stakeholders. IAS awareness-raising may be able to piggyback on agricultural or health training programs;

- listen to local communities (villagers, farmers): they have valuable contributions to make and their concerns need to be addressed;

- consider exchange schemes for practitioners or officials: they often offer valuable opportunities for one-to-one contact and for learning by doing;

- incorporate experience gained from other areas or countries into existing projects;

- widely disseminate information (not limited to databases) on IAS ecology, likely pathways, management options, etc;

- ensure that tools and methods to disseminate IAS management and prevention methods to local users and stakeholders are user-friendly.

7. Marine IAS are an important issue for the Pacific. Available information (e.g. for Hawai'i) shows that these are a severe threat to biodiversity: it is therefore of concern that for most of the Pacific Region there is a gap in information on marine IAS.

   - regulations for risk analysis on marine alien species are not as well developed or as well implemented as those for terrestrial species;

   - methods to prevent marine invasions urgently need further development and research, including at an engineering level (e.g. ship design);

   - ecosystem studies (available niches) will contribute to prevention efforts.

8. Climate change is highly relevant to IAS issues as it can enable marine and terrestrial alien species to switch from being harmless to becoming invasive. During El Niño events, for example, organisms can disperse more than in normal times. Increased storms and resulting damage to ships also increase the risk of release of marine IAS.

Summary of the recommendations made to governments and intergovernmental organizations:

Participants urge SPREP Parties to:

⇒ recommend to the CBD the development of a joint work plan on IAS for the Pacific, based on an integration of the SPREP Regional Strategy and the Cooperative Islands Initiative;

⇒ develop, within SPREP and in cooperation with other relevant international entities, a Regional Risk analysis for marine IAS, including intentional as well as unintentional introductions (pathways and activities).

Participants urge SPREP and the ISSG/IUCN:

⇒ in collaboration with other relevant stakeholders, to conduct an analysis of threatened land habitat and species combined with information on IAS and develop action based on this in cooperation with local and national communities and stakeholders.

Participants urge governments to:

⇒ make greatest possible use of existing mechanisms (including risk assessment) under sanitary and phytosanitary frameworks to increase capabilities for prevention and also investigate a regional approach to such assessments;

⇒ support and endorse funding applications to the Global Environment Facility that address IAS issues;

⇒ support bilateral aid projects that could address IAS and that CBD Art.8(h) objectives;

⇒ focus on the opportunities provided by the results of the IAS discussions at CBD COP6.

Participants urge relevant international conventions, programs, non-governmental organizations and others to take the following actions:

⇒ SPREP and Secretariat for the Pacific Community should further their existing cooperation on IAS projects;

⇒ the CBD, IPPC and other relevant international entities should work together with SPREP to investigate how the different systems can work together, with resulting benefits for the Pacific region in respect to IAS prevention and management. This may include a review on whether the full complexity of IAS issues can be satisfactorily dealt with under existing sanitary and phytosanitary frameworks;

⇒ marine IAS programs in the Pacific should collaborate and coordinate with existing related programs including the Pacific Pollution Prevention Program, the IMO GloBallast programme, the Pacific Island Climate Change Program, the International Coral Reef Action Network, the SPREP Coastal Management Program, and relevant U.S. Fish and Wildlife Service programs;

⇒ IMO should include measures against hull-fouling in its IAS prevention program[24];

⇒ international conventions and programs should develop appropriate fora to ensure village-level participation and ownership in IAS project planning and implementation. Local and national governments should also be included in the above processes;

⇒ international NGOs should coordinate their planning in the same sub-region;

⇒ those involved in information-sharing systems in the region should include existing systems such as the CBD Clearing House Mechanism, IPPC, CAB International, GISP, IUCN, and regionally-produced databases and develop user-friendly tools to disseminate IAS management and prevention methods which target local users and stakeholders.

[24] The IMO focus on IAS is restricted to development of a Ballast Water Convention, and does not extend to hull fouling and other pathways of marine invasion (GISP, L. Jackson, pers. comm.).

2.2 Towards an Austral-Pacific regional perspective

The first three presentations (Tonga, Tokelau, New Zealand) provide an overview of IAS issues and policy frameworks in their respective countries. The final two present case studies on specific areas (American Samoa) and species (Guam).

Invasive alien species in Tonga

Mr. Sione Foliaki
MAF Quarantine and Quality Management Division

Background

The Kingdom of Tonga is situated just west of the International Dateline, east of Fiji, north of New Zealand, and southwest of Hawai'i. It is the only Polynesian country never to have been colonized and the only monarchy in the Pacific, with rich cultural history and traditions. Tonga has many sought-after attributes including a pristine natural environment, warm tropical climate, and beautiful reefs and beaches.

Tonga's economy is based on agriculture (70%), fisheries, remittances from people living overseas, and tourism. Examples include:

⇒ the export of squash-pumpkin to Japan ($15 m/yr)
⇒ vanilla export to U.S., European Union, Japan, New Zealand, Australia ($5 m/yr)
⇒ root crops export (taro, yam, cassava) (>$5 m/yr)
⇒ fresh fish exports (tuna, snapper, etc.) to Japan, U.S., New Zealand (>$10 m/yr)
⇒ tourism and ecotourism, such as whale watching (now a major activity with an estimated value >$10 m/yr)

Tonga is highly vulnerable to new IAS, and has considerable trouble managing existing IAS. Pathways and vectors for introduction of non-native species to Tonga include:

⇒ direct flights to Hawai'i, Fiji, New Zealand, and Australia (e.g. tourists bringing in non-native plant specimens). Tonga has no X-ray machines or dogs, so it would be necessary to do a full search to detect material. The aircraft themselves also provide vectors for introductions;

⇒ ships and yachts (a major vector, also used for drug smuggling);

⇒ the import of personal effects, mainly from Australia and Hawai'i. Even if inspections are carried out, it is impossible to ensure that these effects are free of IAS;

⇒ risk goods (e.g. used machinery, used cars from Japan, construction materials);

⇒ natural disaster relief and assistance (including bulldozers, chainsaws, foods and seeds); and

⇒ forestry.

The marine environment and its habitats are particularly vulnerable off the main island of Tonga, which has implications for fish exports and traditional fishing practices (e.g. foraging for shellfish). Ballast water is a significant pathway for IAS, but marine surveys are needed to identify what is already here and what is invading.

Traditional food crops need to be maintained in Tonga because the residents cannot afford to import food crops. Tonga does grow food crops for consumption and export, and has fresh fruit and vegetable markets open to the general public.

Policy and institutional frameworks

Stakeholders currently involved with the management of IAS include:

⇒ *Ministry of Agriculture and Forestry (MAF).* Its Quarantine and Quality Management Division oversees: compliance with WTO-SPS standards set by IPPC, OIE, or Codex Alimentarius; import risk analysis; import standards; import and export inspection certification; surveillance; and emergency response plans. These powers are exercised in consultation with the Secretariat of the Pacific Community (SPC), especially the SPC Plant Protection Service and the Pacific Plant Protection Organization;

⇒ the *Department of Environment* works in consultation with SPREP on conservation and research;

⇒ the *Ministry of Fisheries* deals with marine import and export requirements and marine conservation and research; and

⇒ the *Ministry of Health* deals with IAS of public health concern, based on standards set by Codex Alimentarius. It works in close consultation with the Ministry of Agriculture and Forestry.

Constraints on IAS prevention and management

Tonga faces the following difficulties in dealing with IAS issues:

⇒ technical deficiencies in national and regional quarantine services (lack of capacity to meet the requirements of WTO-SPS Agreement), border protection and trade facilitation functions;

⇒ lack of trained staff and necessary capacity;

⇒ poor facilities and infrastructure;

⇒ diminishing access to methyl bromide for use as a pesticide as a result of its impacts on the environment (this puts a constraint on international and regional trade);

⇒ shortage and/or inaccessibility of scientific and technical information and expertise required for pest risk analysis and import risk analysis and for the management of IAS and living modified organisms (LMOs)/genetically modified organisms (GMOs);

⇒ cost of accessing and updating technical information (e.g. web, electronic information sources).

⇒ no or minimal surveys to update the pest list, including IAS (Baseline surveys for animals and plants are needed);

⇒ outdated and/or inconsistent legislation to address agricultural-environment-marine-public health concerns;

⇒ poor coordination and collaboration of work programs between government agencies concerned with IAS (e.g. agriculture, fisheries, environment, public health) and with other stakeholders (e.g. shipping and airline agents, NGOs);

⇒ duplication of international/regional work programs, leading to a waste of resources and efforts (e.g. IPPC versus CBD, SPC versus SPREP);

⇒ lack of funding or budget allocations for IAS work from the government, regional or international organizations (SPC, SPREP, IPPC and OIE, CBD, WTO-SPS etc.); and

⇒ lack of awareness among the general public, politicians, decision-makers, and the business sectors.

Invasive alien species in Tokelau

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Tokelau is situated between latitudes 8° and 10° South and longitudes 171° and 173° West. It is a non- self-governing territory under New Zealand's administration and is the smallest administrative unit in the South Pacific region.

Tokelau comprises three atolls (Fakaofo, Nukunonu, and Atafu) and has a total land area of 12.25 km^2. Each atoll consists of a number of reef bound islets encircling lagoons. The islets vary in length from 90 km to 6 km and in width from a few metres to 200m. The maximum height above sea level anywhere is 5 m. The population is about 1800. Tokelau's forest soils are poor (low nutrient and high alkaline), and support only a few food crops which are confined to domestic needs.

Tokelau has no air linkages. However, the inter-island ship service provides a serious threat of introduction of IAS. As Tokelau's only outside connection is to Samoa, all insect pests present in Tokelau are presumed to have come from Samoa. It is foreseeable that all IAS already present in Samoa could arrive in Tokelau due to the social links between the two countries.

Key IAS in Tokelau include:

⇒ Polynesian rat (*Rattus exulans*). This has caused the estimated destruction of 40% of total coconut production in Tokelau. For the last two or three decades, bromodialone wax rat bait with warfarin (active ingredient) has been used as the main control method. However, due to constant and inappropriate use of this single method the rat is developing immunity. The pesticide is now considered ineffective, costly, and environmentally unfriendly as it is not target-specific and tends to destroy other animals such as land and coconut crabs. There is a need to research alternative control methods and to draw on experience from other countries.

⇒ Yellow crazy ant (*Anoplolepsis gracilipes*) is a relatively new arrival. It was probably introduced in 1999, but only emerged in significant numbers in 2001. Although the species is concentrated only on one atoll, its population is now rapidly increasing and there is a high risk of it spreading to the other two atolls. An entomologist from Victoria University (Australia) initiated a study in November 2002.

⇒ Brown house ant (*Pheidole megacephala*) is found only on Nukunonu but is spreading to the outer islets. It has been found foraging on a new scale insect (species unknown) in large numbers, thus helping to spread the scale to new locations.

⇒ Coconut rhinoceros beetle (*Oryctes rhinoceros*) is the most serious coconut pest and has a record of significant damage. In 1997, SPC launched a biological control program with assistance from Samoa, using biological control agents such as the green muscardine fungus

(*Metarrhizium anisopliaei*) and the *Baculovirus* that have been used elsewhere in Pacific. Eighty-five pheromone traps were placed by SPC in June 2002. All the adult beetles caught in the traps were innoculated with virus and then released in the field.

⇒ Spiralling whitefly (*Aleurodicus disperses*) was detected in the late 1980s on Fakaofo and Nukunonu. The major host plants that it infests include banana, pawpaw, and ornamentals. An SPC biocontrol technician released the parasite *Encarsia haitiensis* for in Tokelau in 1991.

⇒ A new scale insect has been found (species unknown; samples have been sent by SPC to the British Museum for identification). It is currently found only in Nukunonu, within the vicinity of a village. Infested plants include bananas, paw paw, lily plants, gardenia plants, and other ornamentals, which have been severely attacked with secondary infections of a sooty mould.

Due to Tokelau's isolation, limited financial resources, and lack of technical knowledge and expertise, it is difficult to identify and utilize a variety of cost-effective measures to control or eradicate IAS. Tokelau, as an isolated and poorly-resourced atoll, is very dependent on assistance and cooperation from other countries in the region, especially Samoa and other atoll countries, to help minimize the risks of introduction of new IAS.

Apart from the few serious insects pests mentioned above, Tokelau is free from many IAS at present. However, this situation will change unless appropriate measures are taken, notably to strengthen quarantine systems in the country.

Invasive alien species issues in Hawai'i

Dr. Lloyd Loope
U.S. Geological Survey

Status of the IAS problem in Hawai'i

Hawai'i is biologically very special, and is highly vulnerable to invasions. It is currently being overwhelmed by IAS; 47 of the world's worst IAS are already in Hawai'i.[25]

Hawai'i has the highest levels of biological endemism of any location of comparable size in the world (>90% for all major groups). Ninety percent of its flowering plants are endemic (i.e. found only in Hawai'i). In comparison, the American state of Indiana (6 times the size of Hawai'i) has no endemic flowering plants. Ninety nine percent of Hawai'i's insects are endemic.

[25] *100 of the World's Worst Invasive Alien Species A selection from the Global Invasive Species Database*, Lowe S.M., M. Browne, S. Boudjelas and M. De Poorter. IUCN-ISSG.

The Hawaiian archipelago offers numerous examples of the evolutionary phenomenon known as adaptive radiation. The high levels endemism and radiation resulted from the extreme isolation of the Hawaiian island chain during its more than 70 million years of evolution and from the highly diverse environments within the archipelago (current elevations go from sea level to 4000 m and annual rainfall varies from less than 200 mm to more than 10,000 mm). Famous examples of adaptive radiation include:

⇒ the Haleakala silversword (*Argyroxiphium sandwicense* spp. *macrocephalum*) in the Asteraceae, which evolved from a common ancestor of a California tarweed (*Hemizona* sp.);

⇒ the Hawaiian honeycreepers (*Vestiaria* spp.). When humans arrived in about the 4th century A.D., these birds comprised a group of 57 very diverse species which had evolved over millions of years of isolation from a common finch-like ancestor. Only 20 species of the original 57 still survive. They provide the world's most impressive example of adaptive radiation among birds; and

⇒ the geometrid moth caterpillar (*Eupithecia* sp.) which has evolved in Hawai'i from herbivorous ancestors to become an ambush predator.

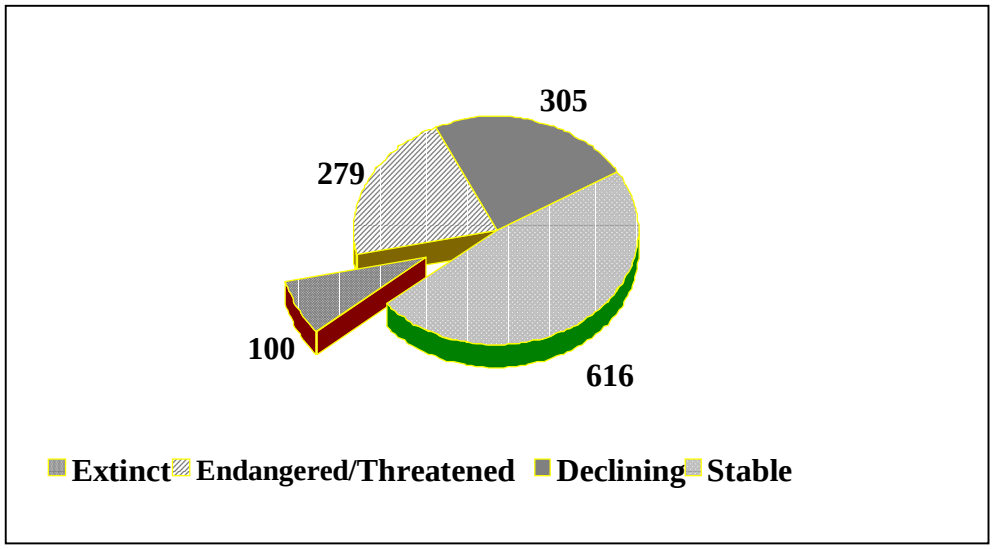
Unfortunately, Hawai'i is in the midst of an IAS crisis affecting not only the archipelago's highly endemic biota, but also its environmental and human health and the viability of its tourism- and agriculture-based economy.

Why is Hawai'i so vulnerable to invasions? One reason is the reduced competitiveness of its highly endemic plants and animals due to their evolution in isolation. Another reason is the great topographic and climatic diversity found within a small area. This provides a wide range of habitats that are easily accessible to pests coming in through Hawai'i's ports-of-entry. Hawai'i's status as a U.S. state, with full exposure to globalization, has not helped.

Hawai'i's biodiversity and agriculture have suffered heavily from IAS introductions. Hawai'i has about the same number of introduced arthropods as the continental U.S. One entomologist (MacGregor 1973) calculated that, per unit area, Hawai'i has a rate of introduction and establishment 500 times that of the continental U.S. (for insects and mites). Although damage by IAS is similar to that in mainland U.S., endemic island populations in Hawai'i are small and highly vulnerable to IAS impacts (Simberloff 1995).

Hawai'i, with 0.2% of the U.S. land area, hosts one-third of the endangered species in the U.S. More native species have been eliminated in Hawai'i than anywhere else in the U.S., or indeed in most other parts of the world. Hawai'i has lost 10% of its native plant species, with many others threatened or declining, and about two-thirds of its original bird species. Although habitat destruction has been an important cause of these extinctions and endangerment, the introduction of IAS has contributed significantly in the past and is now the predominant cause of biodiversity loss in Hawai'i.

Status of Hawaiian plants (Source: United States Geological Survey)



The following are examples of recent invaders to Hawai'i, as well as IAS that have not yet arrived in Hawai'i but are cause for particular concern (red imported fire ant, West Nile virus, wood-boring beetles, brown tree snake).

⇒ *Miconia calvescens*

This tree from the Andes has become the scourge of French Polynesia, following its introduction by a well-meaning American professor in 1937. Each mature tree of this species produces millions of seeds per year, which are spread by birds. By the 1980s, it dominated 70% of the forest on Tahiti. It shades out all native plants and its shallow roots promote erosion and landslides.

The species was found in Hawaiian watersheds in the 1960s. However, control measures were not taken until the 1990s. For the last decade, Hawai'i has tried to control this invasive tree, but the outcome does not look good. Miconia's tiny seeds can easily get into other islands on construction equipment or on someone's hiking boots.

⇒ Coqui (*Eleutherodactylus coqui*)

This Puerto Rican tree frog arrived in Hawai'i in the mid-1990s on nursery material from the Caribbean. It has spread widely, especially on the main Hawai'i Island. Thankfully, there is still some hope of eradicating it on some of the other islands. In native forests, the frog can devour huge numbers of endemic insects. However, many Hawai'i citizens and tourists are much more upset about the very loud calls that it makes at night.

⇒ Red imported fire ant (*Solenopsis invicta*) (RIFA)

The potential threats posed by the RIFA are a major motivator for the improvement of Hawai'i's prevention programs. The species is a threat not just to biodiversity, but to human health, electrical equipment, agriculture, and particularly to human quality of life in island environments. The RIFA has proved to be a large problem over more than sixty years in the south-eastern U.S., where it largely displaces the native ants. It has recently established in California and Australia and has spread, virtually unopposed, from Florida across the Bahamas and Puerto Rico to Trinidad.

The state of California is currently trying to contain the RIFA. However, it is poised to invade not only Hawai'i but other Pacific islands as well. The species is likely to prove especially damaging in archipelagoes where the native biota does not include ants.

⇒ West Nile virus

This virus is another major concern in Hawai'i. It reached New York City in 1999, vectored by mosquitoes and birds. Many North American birds are highly susceptible, as are some domestic animals (e.g. horses) and humans. The virus could be carried to Hawai'i by birds or mosquitoes. Hawai'i already has two major mosquito vectors and its native birds have been seriously reduced through exposure to avian malaria and avian pox. It is likely that West Nile virus could even further reduce Hawai'i's already decimated native bird species by infecting bird populations that have been slowly evolving resistance to the other two diseases over the last 100 years. The Hawai'i Department of Agriculture is taking steps to try to prevent the disease from reaching the state by controlling the flow of birds from the U.S. mainland to Hawai'i.

Other potential invaders of significant concern to Hawaiians include a variety of beetles (in solid wood packing) which could severely damage forests and urban trees, and the Brown Tree Snake (*Boiga irregularis*) which has had significant impacts on human health, electrical installations, tourism, and the general quality of life in Guam.

Most significant challenges to addressing IAS problems

The border protection and quarantine systems in Hawai'i - and worldwide – have a largely agricultural focus. They were built by and for agricultural interests; biodiversity and even human health concerns are afterthoughts. While it is clear that biodiversity and agricultural stakeholders need to work together, the communication is often difficult and cooperation is often less than perfect. Whereas New Zealand has the political will, public support, and apparently the ability to cooperate across sectors to achieve excellent quarantine protection, this is not yet the case in Hawai'i.

Preventing the invasion of non-native organisms into Hawai'i is also complicated because it is a state of the U.S. The U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) has a mandate to protect mainstream American agriculture from incoming foreign pests and to protect the U.S. mainland from pests from Hawai'i. Hawai'i's Department of Agriculture Plant Quarantine Division has a mandate to protect Hawai'i from everything else, but its operations are plagued by inadequate resources and public support. We are trying to address this. More dialogue with the USDA is necessary to better protect Hawai'i's native species against IAS, but the department has limited resources and few inspectors and cannot keep up with the volume of cargo arriving in Hawai'i.

Needs and opportunities to build collaboration throughout the Austral-Pacific region

Hawai'i and other Pacific islands need to collaborate to protect themselves and each other from high-risk IAS pathways. The Pacific Islanders also need to collaborate with major Pacific Rim countries, including the U.S., Australia, New Zealand, Japan, and China, to help prevent the export of pests to vulnerable islands.

We need to explore practical mechanisms for a Pacific-wide RIFA prevention plan, such as the development of a generic RIFA risk assessment which could be adopted for use by different islands. This would enable island nations to regulate high-risk pathways for RIFA, such as nursery stock and construction equipment, requiring them to be pre-certified as free of RIFA by the Department of Agriculture of the source country. A regional RIFA prevention plan could be built on existing models, such as Hawai'i's RIFA Prevention & Rapid Response Plan (2001) and the SPREP draft IAS Strategy, (2000) and benefit from GISP guidance.

Another opportunity for collaboration is a Pacific network of Island Invasive Species Committees. Hawai'i's most effective pressure for improving efforts against invasions arises from alliances of the individuals from federal, state, and private entities who are determined to stop invasions. The primary objective of these groups is to rapidly respond to incipient invasions (a role not otherwise being filled by any agency), and they are also a potentially powerful lobby for improving prevention programs. The first IAS committee was developed on Maui Island in response to *Miconia calvescens,* and there are now similar groups on the Big Island, Oahu, Molokai and Kauai. Other committees been created in American Samoa (ASSIST) and Palau. We need to support the best efforts of these groups.

Invasive alien species in New Zealand: legislative requirements

Dr. Abdul Moeed
Environmental Risk Management Authority

Overview of existing framework

New Zealand has unique and ancient biota, arising from 60 million years of isolation. Most plants and animals are native; there are 2,200 native plants, but no native land mammals. The first humans arrived 1000 years ago. After the first Europeans arrived 200 years ago, land clearing began and non-native animals and plants were introduced. There are now estimated to be 28,000 introduced plants in New Zealand of which 2,200 have naturalized in the wild. Resulting costs, including border surveillance and weed control, are high as tens of millions of dollars are lost in agriculture, forestry, and horticulture operations. The cost of environmental damage in New Zealand has not been quantified.

Prior to 1988, New Zealand's legislation only addressed known pests. The Plants Act 1970 and the Animals Act 1967 were mainly focused on diseases and made no provision for the environmental effects of IAS. The environmental impacts on non-native animals have only considered since 1990.

Major changes were made to New Zealand's legal framework during the 1990s. The key instruments currently relevant to IAS are:

⇒ *Biosecurity Act 1993*

The purpose of this act is to exclude though border control the "unwanted organisms" that are not already established in New Zealand and to eradicate or effectively manage IAS and other unwanted organisms that are already in the country. The Act provides for the appointment of chief technical officers in relevant departments and the development of pest management strategies on a regional or national basis.

⇒ *Hazardous Substance and New Organisms Act 1996*

The Hazardous Substance and New Organisms Act 1996 (HSNO) is concerned with intentional introductions and releases. Its purpose is to protect the environment and the health and safety of people by preventing or managing the adverse effects of hazardous substances and new organisms. The Act defines "new organism" to include species not present in New Zealand before a specified date, species that have been determined to be of particular risk (e.g. if problematic in another country) and are not present in New Zealand, and species that have been eradicated from New Zealand. The definition explicitly covers genetically modified organisms (GMOs).

The HSNO is implemented by the Environmental Risk Management Authority (ERMA), a quasi-judicial body specially created for this purpose. Every application to introduce or manufacture hazardous substances, or to import, develop, release, or field test new organisms must be considered by ERMA and the Act lays down rules concerning public notification of these applications. Penalties for unlawful import or release are a maximum of three months in prison and/or a NZ$500,000 fine.

The application procedure for new organisms is based on a two-tiered approach: a rapid assessment process for new organisms that are obviously of low risk and a full assessment process for those that do not qualify for low risk consideration. The ERMA develops and applies decision-making criteria based on assessment of risks and of monetary and non-monetary costs and benefits. For plants, the weed risk assessment model developed by the Landcare Research Institute is used informally in conjunction with the HSNO's risk assessment requirements.

Any organism approved for import has to meet a set of criteria set down as minimum standards under the HSNO (a kind of environmental bottom line). The ERMA must decline an application to import a new organism if it is assessed as likely to cause significant:

⇒ displacement of any native species within its native habitat;
⇒ deterioration of natural habitats;
⇒ adverse effects on human health and safety;
⇒ adverse effect on New Zealand's inherent genetic diversity; or
⇒ disease, or be parasitic or become a vector for human, animal, or plant disease (unless the purpose is to import or release an organism to cause disease, be a parasite or vector for disease).

All persons who exercise powers under the HNSO must base their decisions on scientific evidence and take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi).

Other laws with relevant provisions include the Conservation Act 1987, Medicines Act 1981, and Fisheries Act 1983.

Future developments

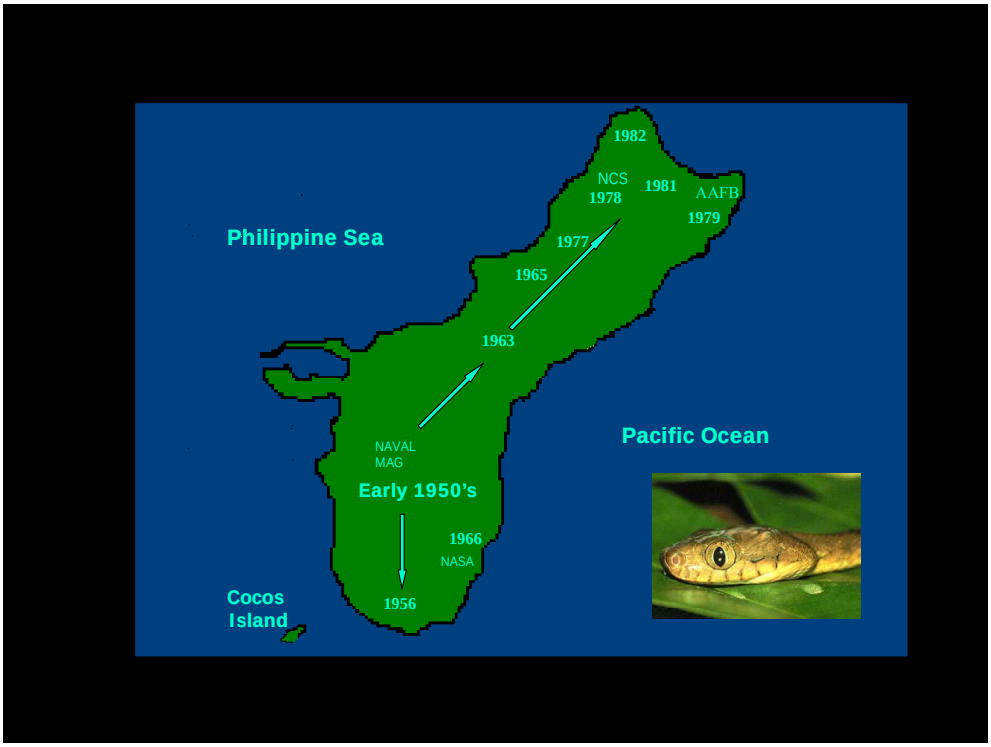
New Zealand recognizes the need to improve compliance with legal requirements. The ERMA's risk assessment procedures are currently under review and it intends to make the process of risk assessment at the border more accessible.

Under the Biosecurity and Conservation Acts, the aim is to detect potential pests early in order to take prompt management action. This will require improvements to current information tools.

Brown Tree Snake control and interdiction in Guam

Mr. Mark Pitzler
U.S. Department of Agriculture, Wildlife Services

The Wildlife Services agency of the U.S. Department of Agriculture has established an operational program to prevent the spread of the Brown Tree Snake (BTS) from Guam to other Pacific islands and the continental U.S. Guam is a U.S. territory located near the Northern Mariana Islands, about 3,800 miles west of Hawai'i. It is a major transportation hub to Micronesia for both defense and civilian aircraft and surface vessels. The BTS was accidentally brought to Guam after World War II and spread throughout Guam's 212 square land miles within 30 years (see map adapted from a United States Geological Survey graphic).



BTS provides an extreme example of the impacts that an introduced predator can impose upon an unprotected ecosystem. The impacts on Guam include:

⇒ native forest birds (only 3 of the 12 native species now survive in the wild and one is on the verge of extinction);

⇒ Recruitment of young in Guam's population of the Mariana fruit bats, already threatened by over-hunting, has been suppressed by snake predation;

⇒ pets and poultry (BTS are semi-constrictors and often attack and kill prey much larger than they can consume);

⇒ human health and safety, from infants and small children to an occasional adult; and

⇒ Guam's electrical infrastructure (14 of Guam's power substations are currently protected in an effort to reduce the number of power cuts and damage to costly equipment).

The Wildlife Services program was started in 1994 with a primary focus on interdiction and has now been expanded to include local resource and wildlife protection.

The first step was to understand Guam's rather complex transportation network. It was soon realized that the local Customs officials only concentrated on imported items and did not physically inspect exports. As the program did not have a regulatory basis, local cooperation had to be progressively developed in order to effectively carry out snake inspections: at times this involved delays in shipments from Guam. BTS control areas have now been established at Won Pat International Airport, Harmon Industrial Centre (14 individual cargo packing warehouses), Andersen Air Force Base, and Apra Harbour (both the commercial port and COMNAVMAR).

Staff determined the highest risk cargo (break-bulk/frozen foods and textiles), transport vectors (commercial aircraft and Department of Defence cargo aircraft) and destination ports for the BTS. These include Hawai'i, Northern Mariana Islands, Okinawa, Diego Garcia, and other Pacific Basin islands.

The operational control program has expanded significantly since 1994, when there were eight staff (one district supervisor, two canine teams, and five wildlife specialists) and just two dogs. The 2002 program had 13 snake detector dogs and 41 staff (one assistant state director, two supervisory wildlife biologists, one canine program manager, 2 clerical assistants, one canine trainer and thirteen canine teams, three field supervisors, eighteen wildlife specialists, and four shop technicians).

A range of BTS control techniques have been developed.

⇒ *Trapping*

Approximately 2500 BTS traps are in operation at any one time. These are manufactured off-island and shipped in. They are designed to be easily serviceable and can be hung anywhere from forest to manmade structures (e.g. fences). They are usually hung at 20 metre intervals surrounding ports of exit. The traps, costing US$15.00 in total, are baited with mice that are fed parafanized feed blocks and a large potato (water source).

⇒ *Fence line searches*

Perimeters of BTS control areas are surrounded by chain link fencing. After nightfall, the BTS become active and, instead of going through the fence, they tend to climb the perimeter fence lines. Fence lines are patrolled by two canine team night shifts whose duties include spot lighting these areas and removing snakes.

⇒ *Public relations*

Public outreach efforts include a display of BTS control measures, distribution of fact sheets, and educating people that snakes are easy to subdue. The aim is to show cargo handlers and other people that they can catch snakes that would otherwise get away. Wildlife Services receives regular requests for education programs (sometimes twice a day) from the general public, state and federal officials, Department of Defence officials, as well as local and national media. Education staff provide instructional sessions on the use of the snake trap, demonstrate the use of the snake detector dogs, and distribute two instructional snake videos and a BTS fact sheet, a colour brochure, and snake poster.

⇒ *Snake detector dogs*

Approximately 13 Jack Russell terriers are currently being used in the program. The breed was selected because of its aggressive nature and because they are agile and light. The dogs are the last line of defence on the island and inspect both air and surface cargo that is about to leave Guam.

⇒ *Temporary snake barriers*

The program is currently deploying several different styles of temporary snake barriers and plans are now being finalized to construct permanent concrete barriers in at least two Guam locations.

The National Wildlife Research Center supports research into BTS control techniques, including snake repellents, snake irritants, inanimate snake attractants, toxicant development and delivery, and strategies for canine efficacy and trapping. Future improvements in control techniques are likely to focus on inanimate lure (replacement of the live mouse), oral toxicants (acetaminophen), immunocontraception and biocontrol (parasites and viruses).

Conclusions from the program to date

⇒ BTS control on Guam is expensive, labour-intensive, and of limited scope;

⇒ native wildlife recovery efforts are dependent upon intensive and, for the near future, continuous control efforts;

⇒ prevention efforts appear to be slowing the arrival of snakes in other locations (discontinuation of control efforts may allow snake reinvasion and benefits of control will quickly disappear);

⇒ continued control efforts, especially in the face of funding shortages, are dependent upon the evolution of available control methods and the development of new control methods;

⇒ eradication on Guam is currently not possible; and

⇒ while snake control on Guam is expensive, the benefits of dispersal prevention greatly outweigh the potential costs associated with the attempted eradication of incipient populations.

IAS awareness program in the National Park of American Samoa

Mr. Tavita Togia
Biological Science Technican, National Park Service

American Samoa is the only U.S. territory south of the equator. Its geographic isolation has resulted in very high biodiversity: it has twice as many coral reef species as those found in Hawai'i and about 1% of all endemic plants. Approximately 30% of the Samoan Archipelago's flora is endemic. American Samoa has rich cultural traditions and practices, including traditional woodworking and natural resources, particularly coconut, fish, and medicinal plants.

The National Park of American Samoa, the U.S.'s 50th national park, was officially established in 1993 with a 50 year lease. Its mission is *inter alia* to preserve Samoan culture, to save and protect the old growth forest and to protect the coral reefs and other marine components within the Park.

The goals of the IAS program in American Samoa include:

⇒ involving students of all ages and the community in solving invasive plant problems, including through school field trips;

⇒ reviving traditional cultural practices and language as they relative to native heritage plants and their uses (e.g. carving canoes);

⇒ preserving and protecting rare and endangered species (e.g. collecting seeds of rare plants); and

⇒ providing food and natural habitats for native wildlife.

The Program for Invasive Species Control and Reforestation of Fagasa began with a weed survey, followed by consultation with the chiefs to discuss negative impacts on the land and a prayer service. As part of the program, the seedlings of native trees with traditional uses were distributed to local people for planting and traditional leaders were encouraged to lead the effort. The program has involved interagency collaboration between USDA and ASSIST (American Samoan Specialist Invasive Species Task Force).

Program staff working in Vatia Village have sought to combat the popularity of IAS plants (some of which are poisonous) by working with people who have planted IAS, explaining why these are a problem, assisting with removal, and suggesting native species to replace them. Under the program, suitable native trees are selected for construction of traditional canoes by a master carver.

Community-based actions in Le'atele have included the building of a greenhouse, where students will learn to propagate native plants for restoration and reforestation. Le'atlele Botanical Garden has been established as the first native botanical garden in American Samoa. It contains traditional, medicinal, rare, or endangered plants. The program staff seeks to develop community ownership of the garden, to give students hands-on experience, and to give opportunities for life-long learning. It has received considerable media coverage.

Future program goals include:

⇒ developing a children's guide to the National Park and its native flora;
⇒ developing a unit plan to be used throughout the school system;
⇒ involving high school students in volunteer service to the park;
⇒ develop a 'plant giveaway' program to raise awareness and incentives to protect culturally significant plants; and
⇒ to utilise all media resources for educational purposes.

Status of the problem throughout the Austral-Pacific Region: informal contributions

Participants were asked to discuss three questions in the context of their respective countries and territories:

⇒ how bad are IAS in your country or territory?
⇒ what has been done?
⇒ what are the prospects for the future?

Palau

Ms. Tarita Holm
National Biodiversity Coordinator

The Republic of Palau is an archipelago in the western Pacific Ocean between 7 degrees North latitude and 134 degrees East longitude. It is located approximately 800 km east of the Philippines and 800 km north of Papua New Guinea. Palau is best known for its marine diversity, though it also hosts a wide variety of terrestrial flora and fauna, including many endemics.

The Bureau of Agriculture is the government agency most involved in IAS management efforts since 1999. They have recently hired an Invasive Species Officer who will be working full time on mapping and monitoring of priority plant species as well as eradication and control efforts using both manual community-based and chemical control methods. Education and awareness is a key objective.

Two main groups have been created at the national level to focus on IAS management and awareness:

⇒ *the Palau Natural Resources Council (PNRC)*

The Council was established in 2000 to provide for proper coordination and cooperation among all agencies, individuals, and organizations involved in managing land-based natural resources. IAS issues are a key focus of the Council's efforts. The Council created the Invasive Weed Committee ("Weedbusters") which conducts an annual Invasive Weed Clean Up to increase public awareness of invasive plants and their impacts. The 2002 campaign focuses on mile-a-minute weed (*Mikania micrantha*) which is now found in about 20 sites on the capital island of Koror and one site on the island of Babeldaob. The goal of the clean up efforts was to reduce the weed's potential to spread by destroying as much of it as possible before the flowering season begins late October.

The Weedbusters have also produced an invasive plant booklet that focuses on eleven species targeted for management in Palau. The SPC has kindly provided funds to print this publication for wide distribution throughout Palau.

With the assistance of U.S. Department of Agriculture (Forest Service), a survey of invasive plant species of environmental concern was carried out from December 2002 – January 2003.

⇒ *the National Task Force on Invasive Animal Species (NTFIAS)*

The Task Force was created in April 2002 and is still coming into operation. It has begun to list all invasive animals (including insects) present in Palau and to identify their range, what level of threat each of them pose, and what actions should be taken to manage them. Problem animal species include rats, pigs, fruit flies, mosquitoes, macaque monkey, and shrews. NTFIAS broadly defines invasive animals as "non-native animals, including insects, which have been introduced to Palau, tend to increase in population, spread and have a negative impact on health, biodiversity, farming, tourism, the environment or the economy." NTFIAS has also prepared a survey to be conducted in all 16 states to identify which invasive animals to prioritize for initial efforts.

Very little is known or being done to address marine IAS. Funding and technical assistance is needed to begin a monitoring protocol for the nation's marine invasives. The best known marine IAS is a hydroid (*Eudendrium carneum*) which was introduced in July 1997 when a floating bridge was brought over from Guangzhou City in Southern China to be used to temporarily connect Koror and Babeldaob after the KB Bridge collapsed in September 1996. Since its introduction, the hydroid has spread rapidly, approximately 3-4 kilometers in each direction in the channel.

The Office of the Palau Automated Land and Resource Information System, PALARIS, is leading a survey and mapping of the following IAS:

⇒ the grass *Imperata cylindrica* in Airai State (the team plans to continue to monitor and treat this grass with herbicides regularly over the next 3 to 5 years until it is completely eradicated);

⇒ 18 sites of bittervine (*Mikania micrantha*) in Koror State for ongoing monitoring; and

⇒ the African Tulip tree (*Spathodea campanulata*) which is now found in five states.

Future work will include surveying and mapping more species and new infestation sites for onging monitoring. Survey work on animal IAS started in 2003 and will address the marine hydroid.

Generally, lack of technical resources and funding are the biggest constraint on IAS efforts in Palau.

Australia

Mr. Warren Geeves
Assistant Director, Marine and International Section, Environment Australia

Australia has 25 invasive alien birds and 20 invasive alien mammals, including the Norway rat (*Rattus norvegicus*), pigs, cats, horses, and deer. The approach to control is *ad hoc*, with approximately Aus$123 million being spent over the last five years. The actual costs are estimated at approximately Aus$3 billion/year.

There are approximately 1050 environmental weeds in Australia. Border control is extremely strict, and is based on quarantine and assessment processes that include weed risk assessment.

The Environment Protection and Biodiversity Conservation Act 1999 imposes special rules on processes determined to be "threatening" to the survival, abundance, or evolutionary development of a native species or ecological community. Invasions by non-native species may be considered a threatening process.

Australia has a relatively strong focus on invasive marine species, although a more comprehensive approach is needed because of the high risk of domestic as well as international translocation. In a survey of 70 ports, half the ports were found to contain 400 marine pests (e.g. the Northern Pacific sea star, *Asterias amurensis*). Australia was the first country in the world to enact legislation to enforce the ballast water guidelines developed by the IMO, and supports current international efforts to develop measures on hull fouling.

In 1996, the Centre for Research on Introduced Marine Pests was established as part of the Commonwealth Scientific and Industrial Research Organization (CSIRO). Through CSIRO, Australia is working on the development of a regional risk management framework for APEC economies for use in the control and prevention of introduced marine pests (see Nawandra, below).

Federated States of Micronesia

Mr. Jackson Phillip
Extension Water Quality Coordinator, College of Micronesia

FSM agencies have collaborated to form an IAS task force to tackle problematic invasions. Examples of IAS efforts include:

⇒ clearing of false kava (*Piper auritum*). This weed was detected in July 2000 and is thought to have come from Hawai'i. As it was spreading rapidly, the governor organized a task force which removed 40,000 plants from 61 locations. Only 44% of this eradication has been successful;

⇒ eradication of the giant African snail (*Achatina fulica*); and

⇒ biocontrol of the rosy wolf snail **(***Euglandina rosea*).

Lack of adequate information is a major constraint, although the U.S. Forest Service has identified several other species for attention.

Commonwealth of the Northern Mariana Islands (CNMI)

Mr. Manny Pangelinan
Project Manager and Invasive Species Ranger
Department of Land and Natural Resources

The CNMI are located in close proximity to several Asian countries and just five minutes from Guam, enabling numerous air and sea travel links that increase the likelihood of introduction of potentially IAS.

The Department of Lands and Natural Resources (DLNR) is the government agency responsible for providing protection, conservation, preservation, and enhancement of CNMI land and marine resources. It recognizes the scale and importance of IAS problems. For Guam, these include:

⇒ Ivy or scarlet gourds (*Coccinia grandis*)

This species was introduced about 11 years ago and is now estimated to cover 35% of the island of Saipan's vegetation. DLNR has used chemical and mechanical control for this species. However, these efforts have not proven cost effective. DLNR is now working with the University of Guam on biocontrol. Specificity testing has been completed and an environmental impact statement is being prepared.

⇒ Brown tree snake, BTS *(Boiga irregularis)*

The CNMI near to Guam have a vital interest in the interdiction and control of the spread of BTS. They have developed a multi-faceted BTS program, in close contact with the Guam program (see Pitzler, above) which targets quarantine, trapping, night searches, and education. The program uses detector dogs and barriers. So far there have been 54 sightings and 15 captures of BTS in the CNMI.

IAS problems of this kind have prompted DLNR to improve its programs with an emphasis on thorough assessments, control and prevention measures, management, additional awareness campaigns, and use of legislation to control infestations on affected islands and to prevent spread to non-affected islands. There is a need to strengthen statutes, regulations, and plant quarantine systems, to increase training, and to extend international stakeholder relationships to increase funding. Information on non-native species is available from a U.S. conducted survey, but needs to be updated. Posters and pamphlets have been developed for school children. The CNMI welcome ideas from regional partners on how to tackle IAS threat more effectively.

Guam

Dr. Russell Campbell
Entomologist, Guam Department of Agriculture

The aquatic wildlife resources division is the largest division in Guam's Department of Agriculture. The island's economy is based on tourism, and there were 1.4 million visitors to Guam in 2000. However, the number of tourists has since decline as a result of economic losses and fears of terrorism. Revenue from tourists has thus declined, resulting in a 30% staff reduction in the aquatic resources division over the last three years.

There are currently 150-200 IAS on Guam. However, due to the publicity campaigns for the Brown Tree Snake and other serious IAS, the public is well aware and supportive of IAS prevention and control efforts.

Some examples of recent measures against IAS include:

⇒ the papaya mealy bug (*Paracoccus marginatus*), a serious pest whose toxic saliva kills Guam's papaya trees. It originates from Ecuador and Mexico, and is thought to have hitchhiked from Ecuador to California, and then been shipped to Guam. The bug has also invaded the Caribbean. Guam has responded by introducing hymenopterous wasps for biocontrol. This wasp is very host specific and it is hoped that in six months, Guam will see a 95% reduction in mealy bugs;

⇒ live poultry from the U.S. has been embargoed to prevent further spread of two diseases: West Nile Virus and Newcastle's disease. There is evidence that more than 40 species of mosquitoes can carry West Nile Virus. Some of these species are already present in the nearby Northern Mariana Islands. West Nile Virus has killed numerous bird species and more than 120 people in the U.S.;

⇒ efforts to restore some of Guam's endangered native species may also be affected by IAS. For example, a Mariana crow (*Corvus tropicus*) died from West Nile Virus in a Texas zoo and the Micronesian Kingfisher (*Haleyon cinnamomina*) is also at risk from this virus. Guam is trying repatriate these species from U.S. zoos and reestablish them on the islands.

Cook Islands

Mr. Poona Samuel
Chief Quarantine Officer, Ministry of Agriculture
Samoa

In November, 2001 the first incursion of Queensland fruit fly (*Bactrocera tryoni*) into the Cook Islands from Hawai'i occurred. The Cook Islands took emergency action to address this incursion by saturating the area of introduction with traps and by removing and destroying fruits. As a result of the rapid response, the fruit fly was eradicated by February 2002, at a cost of a few thousand dollars.

For the Cook Islands, the greatest challenges to address IAS is the lack of awareness amongst decision-makers and administrators who do not understand border control and quarantine or see such prevention systems as an insurance policy. IAS are only taken seriously when they impact on economic interests: for example, tourism is a significant source of income in Guam and, as a result, the aesthetic impacts of IAS on tourist interests draw attention.

Samoa

Mr. Tofa Siitia
Principal Quarantine Officer, Ministry of Agriculture, Forests, Fisheries & Meteorology

Samoa has a population of approximately 170,000. The Ministry of Agriculture, Forests, Fisheries & Meterology has a strong mandate to protect the island against diseases and IAS. Quarantine systems span pre-border to post-quarantine efforts.

Environmental measures are supported by the agricultural quarantine system. However, Samoa welcomes recommendations from environmental specialists on how best to incorporate environmental criteria into import risk analysis procedures.

Samoa has set up a National Invasive Species Committee and, with support from Australia, carried out capacity building and public awareness activities (the "Protect our Natural Heritage" program). The environment department is doing a good job of working with stakeholders, including witch doctors who may have traditional uses for IAS. The government of Samoa recognizes the need to consider the values and beliefs of local people when approaching chiefs and working with communities.

American Samoa

Mr. Manu Tuinoula
Horticulturist, Department of Agriculture

In American Samoa, IAS have been formerly classified as 'noxious weeds.' American Samoa is currently inventorying IAS. However, scientists and policy makers are encountering resistance to classifying plants as invasive where they have a traditional or medicinal use. This conflict of interests could hamper future eradication and control efforts. For example:

⇒ introduced bananas (*Musa* sp.) are invasive but are preferred by islanders because native bananas have an inferior taste. Work is under way to breed disease-resistant native bananas that also taste good;

⇒ the taro plant (*Colocasia esculenta*), presumed to have been introduced from Hawai'i for agricultural use, is affected by taro leaf blight (*Phytophthora colocaisae*);

⇒ invasive animals include the cotton aphid (*Aphis gossypii*), the giant African snail (*Achantina fulica*) and two species of myna birds (*Acridotheros* spp.) and a red-vented bulbul bird (*Pycnotus cafer*). These birds are believed to reduce the populations of some local bird species, damage some fruit trees and vegetables, and are also known to steal food from houses.

An acacia (*Albidia* sp.) eradication program is currently under way. American Samoa rejected a proposal to introduce Bermuda grass (*Sorghum halepense*) under an Australian international assistance program as this grass is highly invasive.

American Samoa is in the process of setting up a National Task Force for Invasive Alien Species. This will be a joint initiative of the directors of the Department of Agriculture and the Department of Marine and Wildlife Resources.

Because there are strong cultural and family links and networks with and between other countries in the region, for example between Samoa and Tokelau, regional cooperation on IAS is imperative and possible.

Vanuatu

Ms. Phyllis Ganielo
Environment Officer

Measures are in place to support IAS identification, quarantine, and control. The National Biodiversity Strategy and Action Plan (NBSAP) supports a project to coordinate and collate the data already collected. The weeds and pests identified thus far are mainly those with economic impacts: little research has yet been done on those with ecological impacts.

Funding is Vanuatu's greatest barrier to strengthening IAS prevention and management programs. Even when funding is available, there is very little applicable for IAS activities due the conditions attached for the usage of funds.

Most ongoing work on public awareness and quarantine is targeted at fruit flies (*Bactrocera trilineola, B. minuta, B. umbrosa, B. paraxanthodes*). A new source of concern is the Little Fire Ant *Wasmannia auropunctata,* which is highly aggressive and is impacting local customs and practices. Programs are being initiated to eradicate or control this species.

2.3 Perspectives of regional organizations and other stakeholders

The SPREP Regional Invasive Species Strategy - overview and potential next steps

Ms. Liz Dovey and Ms. Suzy Randall
Program Officer and Technical Officer
SPREP Avifauna Conservation and Invasive Species Program

Introduction

Pacific Island countries and territories occupy more than 38 million square kilometers of the Pacific Ocean in their national waters and Exclusive Economic Zones, an area more than three times as large as the U.S. or China. Less than 2% of the Pacific region is land.

The islands support large tracts of intact rainforests that contain unique communities of plants and animals, many with species found nowhere else in the world – for some islands, 80% or more species are endemic. More than 1500 endemic plant species exist in the Pacific and more than 70% of the natural vegetation is undisturbed. For reasons such as these, the Pacific has been named one of the world's global biodiversity hotspots.

The Pacific's biodiversity is both unique and vulnerable. A high proportion of the region's total biodiversity is threatened with extinction, including 14% of Pacific bird species. Many of these endemic and threatened species are resources or of spiritual significance to Pacific people.

The establishment of IAS in natural ecosystems constitutes one of the leading threats worldwide to the loss of biodiversity. The impacts of IAS are numerous and can be irreversible. Pacific Island countries are particularly vulnerable to the effects of IAS due to the high proportion of endemism and the restricted range of some species. IAS are now the principal cause for the extinctions of native biodiversity on land and pose the greatest threat to remaining terrestrial biodiversity in the Pacific. Habitat modification or loss and over-harvesting (including illegal trade) constitute the other two main causes for species extinctions in the Pacific.

With regard to IAS, Islands (as geographically and evolutionary isolated places) differ from continents in a number of ways. Whilst they are significantly more vulnerable to IAS and more likely to suffer catastrophic loss of biodiversity from the impacts of invasion, islands can also provide better opportunities for successful intervention than mainland situations.

Through their National Biodiversity Strategy and Action Plans (NBSAPs), many countries in the Pacific have identified the threat of IAS to their ecosystems, habitats, and endemic species as a major concern. Nearly all NBSAPs recognize the conservation of natural resources as critical for sustainable development. In order to assist these countries, the South Pacific Regional Environment Programme (SPREP) has worked with its member countries to draft an Invasive Species Strategy for the Pacific Island Region.

SPREP is a regional inter-governmental agency responsible for the Pacific environment with the mandate to "promote cooperation in the South Pacific region and to provide assistance in order to protect and improve its environment and to ensue sustainable development for present and future generations." SPREP members include fourteen Pacific countries, eight Pacific territories, and four metropolitan countries including Australia, France, New Zealand, and United States.

SPREP was established in 1982 as a program within what is now known as the Secretariat of the Pacific Community (SPC). It hosts the Secretariats for the Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (SPREP Convention) and the Convention of the Conservation of Nature in the South Pacific (Apia Convention). The Apia Convention addresses the creation of protected areas to safeguard representative samples of natural ecosystems, geological formations, regions, as well as objects of aesthetic interest or historic cultural or scientific value. SPREP is also a member of CROP (Council of Regional Organizations in the Pacific).[26]

Background to the SPREP Invasive Species Strategy for the Pacific Island Region

The New Zealand government provides half the funding for a Program Officer for the Invasive Species Program to be managed by SPREP. The objective of the Program is "to coordinate implementation of SPREP Action Plan output: to prevent, eradicate or control non-indigenous species which threaten ecosystems, habitat and species." One of the Program's establishment aims is for SPREP to assist its member countries to develop an invasive species strategy to guide the efforts of the countries and relevant agencies in the region.

A Bird Conservation Strategy for the Pacific Islands Region is closely linked to the Invasive Species Strategy. The objective of the bird program is to "to recover threatened bird species and to conserve all other indigenous bird species and their habitats." Birdlife International (2002) reports that since the 1800s, birds - especially on small islands - have suffered the most from extinctions, largely due to the introduction of IAS. Key IAS threats include rats, feral cats, ants, pigs, dogs, snakes, and mongooses, all of which prey nestlings and eggs, and sometimes adult birds. Weedy plant species can also replace and smother critical bird habitats.

Prior to drafting the Invasive Species Strategy, a series of reviews were produced. These include a non-technical summary of non-marine pest species, as well as technical reviews of terrestrial and freshwater IAS. These reviews summarized the current knowledge on terrestrial and aquatic IAS on Pacific islands: the threat they pose, their status, how they reached the islands, as well as and the level of protection afforded by statutes and current management. They were circulated to member countries before strategy drafting began.

For practical reasons, the reviews were limited to terrestrial and freshwater IAS and the threat they pose to biodiversity. The project team concluded that the threats that IAS pose to agriculture, health, and other sectors were already being addressed by other agencies and therefore should not be included in the original strategy process. Consideration was not given to marine IAS at the time of these reviews for two main reasons:

⇒ those involved in the Strategy's development did not feel sufficiently informed of marine IAS issues;
⇒ these marine issues were believed to be sufficiently different to terrestrial IAS issues to warrant being addressed separately.

Marine IAS issues have, however, been covered to a certain extent by the SPREP Pacific Ocean Pollution Prevention Program (see Nawandra, below).

[26]CROP is an an ad-hoc committee, permanently chaired by the Forum Secretariat, which brings together the heads of key Pacific Island intergovernmental organizations to discuss and coordinate the work programs and policies of the different regional agencies to avoid either duplication or gaps in the provision of services to member countries. Member organizations include SPC, SPREP, the Forum Secretariat, the Forum Fisheries Agency, SOPAC, Tourism Council of the South Pacific, University of the South Pacific and the Pacific Islands Development Program.

The key findings of the technical reviews were that:

⇒ there is a wide variety of feral animals and weeds in the Pacific and information on their distribution and status is variable;
⇒ key IAS in region are identifiable;
⇒ inhabited islands have many IAS;
⇒ some islands are still pristine and provide harbour for endangered species at risk;
⇒ rats are a key threat to many bird species;
⇒ different islands have different invasive alien fauna;
⇒ there is low capacity within the countries to prevent new arrivals.

In September 1999, the Regional Invasive Species Workshop was held in Nadi, Fiji to draft the Invasive Species Strategy. Participants represented sixteen member countries and SPREP acted as process facilitator. A two page strategy document, which identified seven strategic areas and a list of key IAS issues, was produced.[27]

All twenty-six SPREP member countries endorsed the Strategy at the SPREP Annual Meeting of the Parties in 2000. They confirmed the importance of the Strategy as a platform for obtaining funds for in-country projects and approved its use as a vehicle to: (1) seek funds from international agencies and donor countries; (2) reinforce and guide national biodiversity management plans (such as NBSAPs); (3) complement other regional IAS programs; and (4) guide the development of the annual work plan under SPREP's Regional Invasive Species Program.

Aims and focal areas of the Regional Strategy

The aim of the Strategy is to promote the efforts of Pacific Island countries and territories (PICTs) in protecting and maintaining the rich and fragile natural heritage of the Pacific Islands from the impacts of IAS through cooperative efforts to:

⇒ develop and maintain an effective, coordinated network of information and technical expertise;
⇒ prevent the introduction of new IAS;
⇒ reduce the impact of existing IAS;
⇒ raise awareness;
⇒ build capacity required to manage the threats posed by IAS.

The Strategy is divided into seven focal areas (outcomes):

1. The need for extra **information,** as the nature of the Pacific Islands region is diverse and there have been problems with gathering information and with communication.

2. An **awareness** raising campaign as part of the regional initiative to educate the public about the problems caused by IAS, and to inform PICTs of the management options available for solving or preventing the problems.

3. The need for **infrastructure** throughout the PICTs to manage IAS.

4. The need for **protocols** to be developed, explained, and distributed for use during activities that may accelerate the spread of IAS.

[27]The Strategy can be downloaded, with Technical Reviews, from http://www.sidsnet.org/pacific/sprep/onlinepub_.htm..

5. On a national level, the identification of existing relevant **legislation, policy and institutions** and any gaps, weaknesses and inconsistencies and the need for future policy and legislation to provide for protection of conservation values from IAS.

6. The need for long-term external **funding** mechanisms to ensure PICTs are able to undertake work for the management of IAS threats.

7. The need for networks and **linkages** to establish a flow of information between the PICTs, SPREP and other inter-governmental or non-governmental organizations.

How are we doing? A review of current progress in implementing the strategy

Important progress has been made in implementation of the Strategy, despite the relatively modest funding available to date. A progress reporting and monitoring system is planned (see outline below under Component 7 of the Strategy).

The following boxes summarize the issues raised under each focal area of the Strategy. Each box is followed by a list that provides examples of key regional projects being managed by SPREP.

Component 1: Information

- Strengthen both basic and applied research on IAS by identifying high priority problems.
- Establish biological surveys for all member countries and territories.
- Emphasise prevention, early detection, and evaluation of exotic species that are present or are potential problems.
- Establish long-term monitoring of high-risk native areas for incursions of recognized IAS.
- Strengthen linkages between Pacific Island countries and scientific institutions, sources of technical and research assistance and other bodies of information.
- Share information regionally through the establishment of mutually accessible databases and websites.
- Develop a regional clearinghouse for information on IAS that is easily accessible, perhaps through a web-based information system.

Recent activities

⇒ Collaborating with IUCN-ISSG, New Zealand Department of Conservation, CSIRO, ACIAR, SPC and FAO, among others, to foster the development of Pacific-specific techniques and approaches to IAS prevention, eradication and control.
⇒ Facilitating PIER weeds surveys of PICTs.
⇒ Looking at possible ways to biologically control weeds (NZAID funding approved October 2002).
⇒ Investigating tropical rat baiting protocol (New Zealand Department of Conservation, ISSG).
⇒ Research into rat control alternatives (CSIRO).
⇒ Pilot rat eradication project for Samoa (range of partners).
⇒ *Myna* trap development (Australian National University).

⇒ Contributing to the country literature searches on IAS.
⇒ Assisting countries establish National Invasive Species Committees and national strategies to address the issues.
⇒ Participating in the development of PaciNet[28] and the use of supports like PestNet.
⇒ Building reference materials and accessing key information sources for countries.
⇒ Sharing information in technical workshops and seminars.

Component 2: Awareness

- Raise public awareness of IAS threats to conservation.
- Work with economic interests to raise their awareness of risks to biodiversity from IAS.
- Represent IAS issues at regional and national meetings and with funding organizations in order to increase awareness.
- Develop awareness of the accidental movement of IAS into new relatively pest-free areas, especially their inter-island transfer within one country.
- Promote awareness of the inter-island transfer problem by education programs on identification, establishment of networks (national and regional) and early warning databases.
- Develop awareness of the dangers to biodiversity of accidental introductions of IAS.
- Establish an effective communication network and a manual of existing and potential IAS to assist with identification, behaviour, where to look for these IAS and how to exclude, eradicate or control them.
- Strengthen communication by networking, international linkages, national working groups, regional expert groups and an early-warning database.

Recent activities

⇒ Supporting the functioning of National Invasive Species Committees.
⇒ Arranging for the assistance of Australian Youth Ambassador Suzy Randall, who has a major role in country support and networking.
⇒ Developing new regional networks after asking countries what they want.
⇒ Encouraging the establishment of in-country IAS species committees
⇒ Supporting countries in international negotiations e.g. during CBD COP discussions on Guiding Principles for IAS at COP5 and COP6.
⇒ Injecting a Pacific perspective into global programs e.g. GISP, IUCN ISSG, major NGOs.
⇒ Distribution of *Guide to the Birds of Fiji and Western Polynesia* free of charge to schools in the eight countries covered by the book, as part of the agreement with the author, Dr. Watling, for funding the production of the book.
⇒ Public addresses, media interviews and written articles, magazine and journal articles, school and organization talks, open day displays and activities.
⇒ Arranging and participating in major IAS meetings and workshops.

[28] Editors' note: PACINET is the Pacific loop of BioNET-INTERNATIONAL, The Global Network for Taxonomy. It is managed by SPREP with support from Secretariat of the Pacific Community's Plant Protection Service in the area of agricultural plant protection.

Component 3: Infrastructure

- At the national and regional level, develop ongoing training programs in the areas of species identification, field detection, quarantine inspections, monitoring and a network of resources that allow for the transfer of information to appropriate field workers.
- Develop and upgrade regional and national facilities such as reference collections and specialized facilities for border control.
- Promote and strengthen initiatives that facilitate the use and sharing of existing regional facilities by government agencies in-country and between countries.

Component 4: Protocols

- Promote the use of existing protocols for pest risk assessment, modified to accommodate Pacific Island Countries and Territories, before pests are introduced into a country.
- Develop early-warning and response systems for IAS.
- Develop guidelines for pest management that consider the full biological and conservation consequences of control or eradication operations, including restoration.
- Collaborate with other organizations to develop appropriate policies to address the potential conservation/environmental risks of genetically modified organisms.

Component 5: Legislation

- Survey existing environmental and other relevant legislation in each Pacific Island country or territory to determine its adequacy for protecting biodiversity from IAS threats.
- Develop model legislation which includes provisions for mitigating IAS threats and which makes use of principles developed for IAS by other organizations and countries.
- Produce country specific recommendations for modifying or developing new legislation which adequately regulates the following:
  - importation of all living organisms;
  - surveillance for new incursions;
  - risk analysis of import applications;
  - assessment of environmental risks prior to introduction of GMOs;
  - quarantine procedures;
  - export of pests;
  - movement of species between islands;
  - control or eradication of IAS;

These three components are closely related.

Recent activities

⇒ Twelve PICTs have ratified the CBD. Many have already completed or are well advanced in the development of their NBSAPs.
⇒ Samoa is currently writing its Invasive Species Strategy.
⇒ A major training program is under development now. It will be tested in three PICTs (one in each of Micronesia, Melanesia, Polynesia) in 2003 and then rolled out to the remaining PICTs as finance allows.
⇒ SPREP is working closely with the UNEP-GEF Biosafety Project to ensure that protocols between the two areas are consistent/compatible.
⇒ Much of the work required under Components 3-5 to be undertaken under the GEF and partner proposals.

Capacity building is a major focus of the SPREP Program. Currently, we are facilitating:

⇒ Development and delivery of an in-country IAS prevention course (funded by U.S. and New Zealand);
⇒ Review of country capacity needs (funded by U.S. and New Zealand);
⇒ Development of individual technical capacity, through access to New Zealand Department of Conservation courses under the New Zealand-Pacific Initiative on the Environment (NZ-PIE);
⇒ Development of a buddy system through pairing of off-shore technical specialists and country teams (multiple partners, especially New Zealand).

Component 6: Funding

- Develop long-term external funding mechanisms that will enable PICTs to undertake work for the management of IAS threats.
- Make representation to government leaders to improve long-term funding to address the pressing issues of IAS of conservation concern in the region.
- Demonstrate the extent of the IAS problem in the region by reference to economic cost/benefits and the necessity of taking action.
- Secure support for IAS issues among local communities as well as at national, regional and political levels.
- Develop a regional resource of materials, in easy-to-read language, that identifies the magnitude of IAS problems in the area in order to make representations for more funding.
- Maximise funding self-sufficiency by promoting full participation of local communities in project development, management and implementation to ensure long-term local commitment.
- Promote IAS as a criterion in national, regional and international disaster management plans.

Recent activities

⇒ Funding has been recently approved from NZ-PIE for development of biological controls for key Pacific invasive weed species. The first step of the application uses Samoa as a pilot project and involves a literature survey and clarification of the ecological niche of these key weed species, as listed in the Regional Invasives Strategy.

⇒ Funding is being sought for a range of single country projects:

- Takitimu Conservation Area (Cook Islands) comprising predator control and Kakerori management efforts;

- Kiritimati Island Conservation Area, Kiribati which again includes predator control;

- Aleipata Marine Protected Area Project (jointly with IUCN/Samoa government). This project involves eradicating rats from the major Aleipata Islands and raising local community awareness of the threat of rats to bird conservation and the need for ongoing prevention of rat spread.

⇒ The major funding focus at a regional level is the UNDP-GEF Regional Invasive Species Project, which it is hoped will involve many PICTs in collaborative efforts. The two key components of this include:

- funding measures to support regional and national efforts to prevent the introduction and spread of IAS into countries and between islands (e.g. training programs, information sharing, protocol and legislation development, strategically focused regional and national networks).

- implementing measures to ensure that a number of sites in the Pacific of global biodiversity importance will be restored.

Component 7: Linkages

- Establish and maintain a network among PICTs and organizations that improves communication, cooperation and information sharing, and that maximises the effectiveness of IAS work in the Pacific.

- Develop common standards of border control, staff exchange programs, nomination of an IAS position within appropriate organizations and establishment of national working groups and a regional expert group.

- Regional participation is needed in the development of international standards and programs that govern the movement of IAS in trade.

Recent activities

⇒ Building strong partnerships for priority tasks.

⇒ Supporting other regional initiatives (e.g. ISSG, PestNet).

⇒ Networking, coordination and collaboration – considerable efforts are underway to strengthen the links:

- between SPREP and regional organizations;
- across the region. The Invasive Species Working Group, part of the Round Table on Nature Conservation, is currently the main mechanism for monitoring implementation;
- between (and within) countries; and
- between donors and international organizations.

⇒ Developing networks to include all relevant stakeholders and key practical contact points for the Invasive Species Strategy, in order to strengthen the two-way flow of information and support between SPREP and the PICTs. The type of support SPREP is offering PICTs is as follows:

- support for writing funding proposals for education campaigns, research, eradication/control projects and monitoring;

- specific technical and legal advice and access to the most appropriate technical information, skills, resources and assistance to address their issues effectively;

- training assistance for quarantine staff, environment staff, in survey techniques and ongoing monitoring;

- assistance in linking known specialists external to the PICT to individual projects;

- facilitating access by Pacific Islanders to offshore technical training in IAS management;

- facilitating information exchange and provision of technical advice and news between PICTs, NGOS, inter-governmental organizations, local villages and SPREP; and

- assistance in raising general awareness of the conservation issues and priorities of IAS.

Where to from here? Increase awareness and build on the Invasive Species Strategy

The Austral-Pacific Workshop provides great opportunity to increase the exposure of the Strategy to new sectors and organizations. It is also a good opportunity to hear about the progress individual countries are making in implementing the Strategy. We look forward to seeing the individual country reports as a starting point.

One aim of this Workshop is to continue to raise awareness of the Strategy amongst a wider range of government sectors (agriculture and quarantine) and regional and non-government sectors (NGOs and IGOs) than were present at the initial workshops organized by SPREP. This should increase the collaborative opportunities for engagement in the Strategy. Increasing ownership of the Strategy will facilitate its expansion to encompass new ideas and identify any information gaps.

A major gap that was identified by countries when writing the Invasive Species Strategy was the need for a regional strategy on marine IAS. Since then, SPREP has identified other issues that are also not adequately reflected in the existing seven focal areas. It is hoped that this Workshop will put in place a process to review the Strategy Components in order to add more ideas either in the form of additional components or within the existing focal areas. Examples of points to include are:

⇒ application of the precautionary approach to any intentional introduction of species;

⇒ greater stakeholder engagement of other sectors (agriculture, quarantine, health, economic), the private sector at both regional and national levels and NGOs;

⇒ updates to the Strategy to incorporate elements arising from global discussions and agreements since it was created and to give greater guidance as to priorities, responsibilities and targets;

⇒ assistance to countries to identify the tools needed to manage the most destructive IAS and to provide tools for ecological restoration;

⇒ identification of areas where legal protection has been given to safeguard habitats or threatened species and of remaining areas that should be protected i.e., areas that include a range of habitat types, pest-free islands and areas recognized as having high conservation values (the ecosystem approach);

⇒ the three-stage hierarchical approach (prevention, eradication, control);

⇒ review of the adequacy of law enforcement: legal statutes are ineffective if compliance mechanisms do not exist; and

⇒ economic analysis on the impacts of IAS on agriculture and health. This quantification of the effects of IAS would assist in securing additional funding for prevention, control and eradication projects.

Conclusion

Coordinated work is well underway in the Pacific, and the opportunity exists to do more and make it even better. We can build on the SPREP Invasive Species Strategy and include the components of marine IAS, identify key regional priority actions and responsibilities, and engage a range of other sectors and organizations. Furthermore, we can send a united regional message to our partners and funders and work together even more effectively to address this most serious of threats.

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Risk of marine spills in the Pacific Islands region and its evolving response arrangements

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Introduction and background

The term the 'Pacific Islands region' is used to describe that area of the Pacific Ocean encompassing the island countries and territories that make up the sub-regions of Melanesia, Micronesia, and Polynesia (excluding Easter Island), New Zealand, and Hawai'i. These 14 countries and 7 territories are all members of SPREP. Australia, France, New Zealand and the United States of America are also members of SPREP due to their proximity and close links or the presence of their territories within the region. They are known as "Metropolitan Members."

Within this region exists a diversity of physical and biological environments, from large, high, jungle-clad continental islands in the west to rugged volcanic outcrops and isolated, low-lying coral atolls throughout the north and east. The total combined land area of these islands constitutes a mere 550,000 km^2, spread across a huge 30 million km^2 of ocean. Coastal and marine environments are therefore extremely important. The importance of coastal and marine environments to every aspect of the lives of Pacific Islanders cannot be overstated. The impacts of marine pollution, including ship-related pollution, constitute a major concern for Pacific Island peoples.

Table 1. SPREP Countries and Territories*

Country	Land area, km^2	Combined sea area, km^2	% land area/ sea area	Population	Population/ km^2
French Polynesia	3521	4,742,000	0.074%	188814	53.6
Kiribati	811	3,457,000	0.023%	77658	95.8
FS Micronesia	701	3,012,000	0.023%	105506	150.5
Papua New Guinea	462840	2,413,000	19.181%	4705126	10.2
Marshall Islands	181	1,996,000	0.009%	43380	239.7
Cook Islands	237	1,977,000	0.012%	18617	78.6
Solomon Islands	28370	1,612,000	1.760%	285176	10.1
Fiji	18272	1,285,000	1.422%	715375	39.2
New Caledonia	19103	1,082,000	1.766%	196836	10.3
Pitcairn	47	842,000	0.006%	49	1.0
Tuvalu	26	753,000	0.003%	9043	347.8
Northern Marianas	471	746,000	0.063%	58846	124.9
Tonga	747	665,000	0.112%	94649	126.7
Vanuatu	12190	655,000	1.861%	142419	11.7
Palau Islands	488	607,000	0.080%	17270	35.4
American Samoa	200	405,000	0.049%	46773	233.9
Tokelau	10	325,000	0.003%	1507	150.7
Niue	259	320,000	0.081%	2239	8.6
Nauru	21	310,000	0.007%	9919	472.3
Wallis and Futuna	255	259,000	0.098%	13705	53.7
Guam	541	219,000	0.247%	133152	246.1
Samoa	2935	134,000	2.190%	161298	55.0
TOTAL	**552 226**	**27 816 000**	**1.98%**	**7 027 357**	**12.7**

**Combined sea area = territorial sea + EEZ*

Sources: USP GIS Unit, CIA World Factbook, MapInfo integration of SPREP EEZ map.

[29] The author was unable to attend the workshop. Queries and comments may be addressed to sefanaian@sprep.org.ws.

The development of PACPOL

Cooperative multilateral programs to address shipping related marine pollution are well-established in many other regions, including the Baltic Sea, Caribbean Sea, Indian Ocean, the Mediterranean Sea, and the East Asian seas. The need for a similar initiative in the Pacific Islands region had long been recognized by SPREP member countries. This need is reflected in the National Environmental Management Strategies (NEMS) that have been prepared by SPREP for each island member country.

In response to this need, SPREP and the International Maritime Organization (IMO) produced the *SPREP/IMO Strategy and Work Program for the Protection of the Marine Environment in the South Pacific Region*. This was published in 1993. Unfortunately, for various reasons, the SPREP/IMO Strategy was not implemented.

The Pacific Ocean Pollution Prevention Program (PACPOL) was instigated in 1998 to revise and update the SPREP/IMO Strategy. It represents a concerted effort to resurrect the Strategy and proceed with program implementation. The development of PACPOL was undertaken through funding from the Commonwealth Secretariat (COMSEC) and the Canadian International Development Agency (CIDA) under the Canada-South Pacific Ocean Development Program Phase II (C-SPOD). SPREP Members at the 10th SPREP Meeting (September 1998) approved PACPOL's 5-year Strategy and Work Plan. Implementation began in October 1999 as funding from C-SPOD came on line.

The PACPOL Strategy and Work Plan include activities aimed at addressing shipping related marine pollution in four focal areas:

⇒ marine spills
⇒ ships' waste management
⇒ port operations
⇒ invasive marine species

Shipping in the region

The Pacific Islands have an extremely rich maritime heritage. The islands themselves were first populated by some of the greatest mariners in human history who used wooden canoes held together by coconut fibre and used the stars and their intimate knowledge of the sea to navigate thousands of miles of open ocean. There are also the epic voyages of European exploration, with seafarers such as Magellan, Tasman, Cook, and Bligh carving their places into history with their own outstanding feats of navigation. World War II heralded another major chapter in maritime history. Some of the largest naval battles in history were fought in the Pacific Theatre.

In modern times, as island states located within the world's largest ocean, the island members of SPREP are overwhelmingly dependent on shipping for economic survival in the modern age. The initial marine spill risk assessment for the region is currently being completed. Its aim is to characterise quantitatively the shipping routes, pattern and frequency of voyages and types of cargoes as well as to map navigational hazards and assess the level of shipping risk at both the regional and national levels. This data has been mapped on a Geographic Information System (GIS) to determine marine collision and grounding hazard potential, and will be used for shipping management and contingency planning purposes at both levels. Shipping in the region can be grouped into the following broad categories:

⇒ transit shipping: ships which pass through the region without stopping, en route to other destinations;

⇒ international shipping (as distinct from transit shipping): ships calling at the major ports of the region from outside the region, either with incoming cargo or tourists (cruise ships) or to take out exports;

⇒ regional shipping: ships trading (both cargo and passengers) between the countries and territories within the region;

⇒ domestic shipping: ships trading (both cargo and passengers) within each country in the region;

⇒ foreign fishing fleet: fishing vessels from distant fishing nations operating within the region;

⇒ domestic fishing fleet: local fishing vessels from the Pacific Islands; and

⇒ mscellaneous: special purpose vessels such as warships, research vessels, tourist vessels, private yachts, pleasure craft and fishing vessels.

Figure 1. Shipping movements in the Pacific

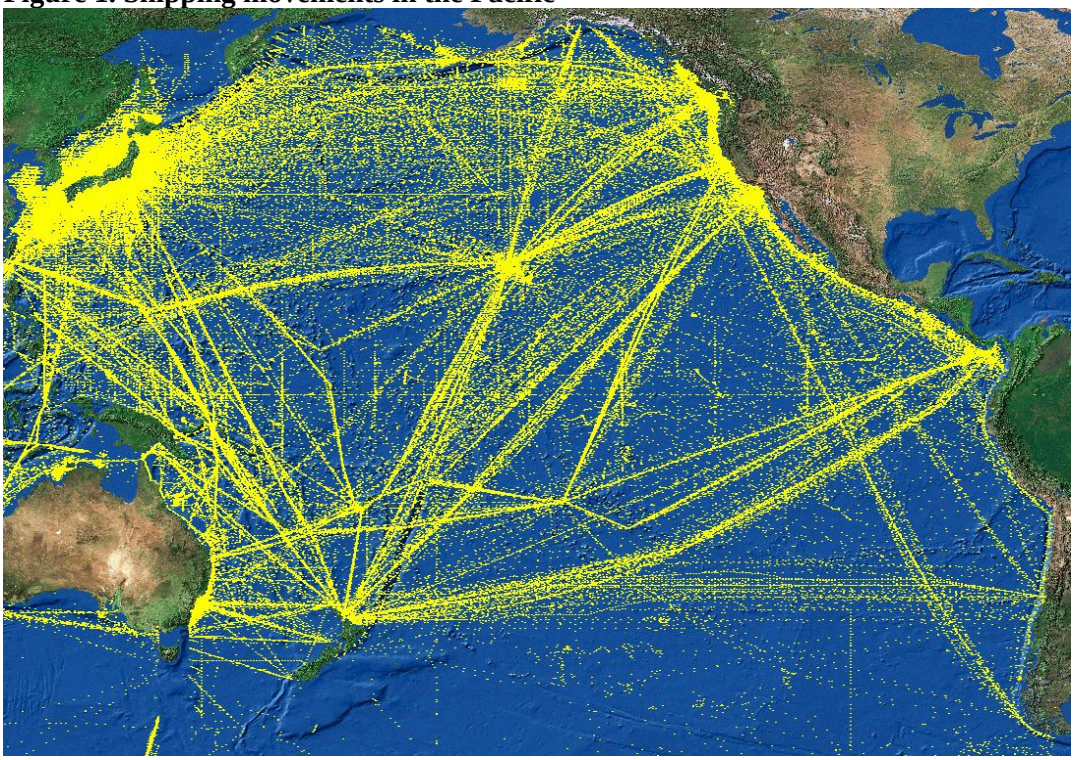


Figure 2: Long-line vessels fishing effort, 1999

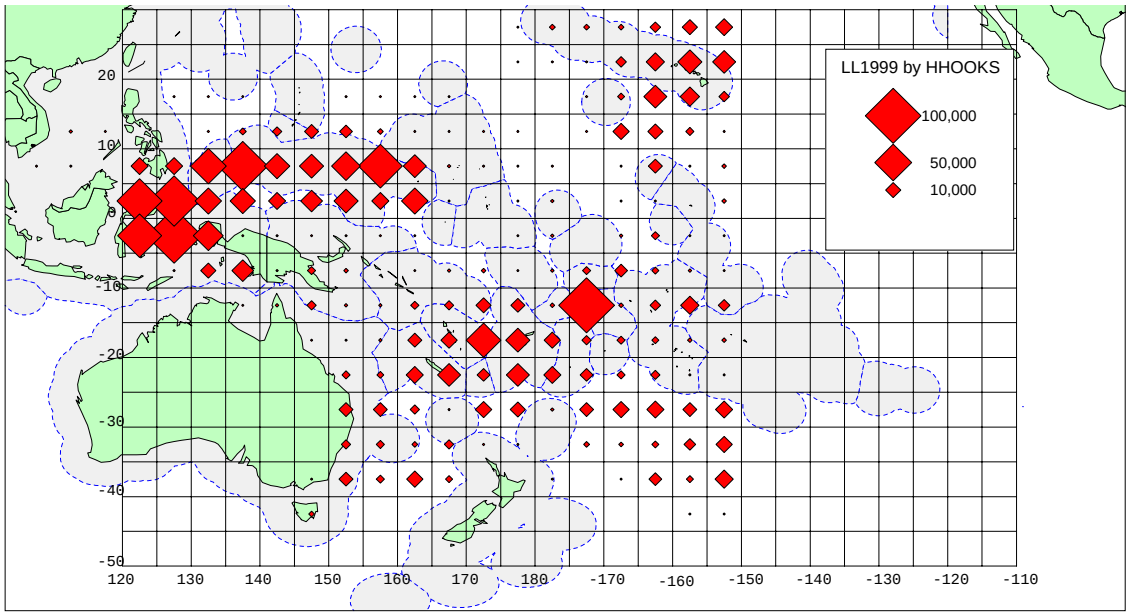
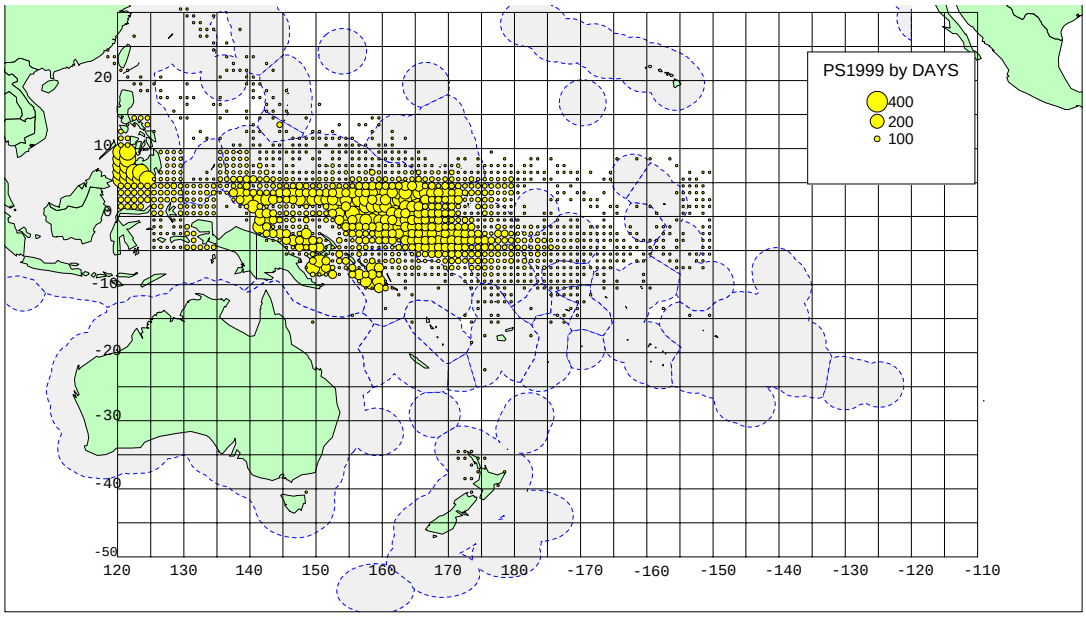


Figure 3: Purse-seine vessels fishing effort, 1999



Marine pollution in the region

Despite the benefits and necessity of shipping, this human use of the ocean can also cause a wide range of environmental impacts. These include:

⇒ shipping accidents resulting in sometimes-catastrophic releases of oil and possibly other contaminants;

⇒ the disposal of ships' wastes, including oil, plastics and other garbage into the sea;

⇒ the dumping of wastes other than ships' wastes at sea (as defined by the London Convention);

⇒ the leaching into the sea of toxic chemicals from anti-fouling paints on ships' hulls;

⇒ coastal and marine environmental impacts from the development and operation of ports that serve the shipping industry; and

⇒ the translocation and introduction of marine species across environmental barriers attached to ships' hulls and within ships' ballast tanks.

Marine spills are perceived as a significant shipping-related pollution hazard for the Pacific Islands. A marine spill risk assessment was carried out as a first attempt at quantifying the issue in our region and to assist our members to address the issue of shipping related marine spills.

PACPOL's activities for addressing shipping-related invasive marine species

The existing situation

Management of invasive marine species (IMS) is non-existent in the region. Level of awareness is very low and there are no legal and institutional structures in place to effectively address the issue. In SPREP's draft Regional Strategy on Invasive Species, drawn up in 1999, it was decided to address IMS separately. This was due to two main reasons: participants were not fully aware of the issues (most coming from the traditional quarantine and terrestrial invasive species backgrounds) and IMS issues were seen as sufficiently different to invasive terrestrial species issues to warrant separate treatment.

Consistent with its mandate, PACPOL only addresses issues relevant to shipping-related IMS and focuses on ballast water and hull fouling vectors for IMS.

PACPOL invasive marine species activities

This is the only focal area of PACPOL where no implementation of program activities is occuring. We have not been able to secure funding primarily because funding sources have not been available until recently. We have submitted proposals to a number of donors and are consulting with the Global Ballast Water Program on the possibility of being included as a region in their second phase. The IMO has indicated the inclusion of IMS as a thematic area in its Technical Cooperation, which means that funding is available in the 2004-2005 funding cycle to carry out program activities.

In the meantime, we have been working to raise awareness with our members on the potential impacts of IMS particularly through ship-related vectors. Presentations have been made to SPREP staff by the Globallast Technical Adviser and this was followed up by a presentation on IMS to the 3rd PACPOL Workshop (Tahiti, October 2002) by the coordinator of the GloBallast pilot project in Dalian, China. PACPOL has made a presentation at the Association of Pacific Ports Meeting and also during missions to member countries. The objective of these presentations is to raise member awareness, secure support for implementation of activities when funding comes on line and to give our members notice so that they can make arrangements to facilitate implementation.

There are two specific activities under the IMS focal area of PACPOL:

⇒ *IMS risk assessment of the Pacific Islands Region*

The aim is to assess the risks in the Pacific Islands Region from shipping: it will include both ballast water and hull fouling vectors. Two regional activities undertaken over the past 18 months should facilitate this assessment because they provide data on shipping routes, volumes, type of cargoes, and the port waste reception facilities. These activities are the Regional Marine Spill Risk Assessment and the Review of Ship's Waste Management in Pacific Island Ports.

⇒ *Surveys for IMS in Pacific Island ports*

These need to be carried out for all ports in the region to determine the presence/absence of IMS, assess the impacts of IMS where present and ultimately recommend management options. We have considered ports within the region and have assessed that the most at risk are the bulk loading ports for sugar/woodchips, ore and phosphate. A proposal has been lodged with AUSAID to fund pilot surveys of bulk loading ports in Fiji and Nauru. The surveys are proposed to be carried out by a team from the Bishop Museum and James Cook University in conjunction with a team from the University of the South Pacific (USP). The USP team will, through this survey, become proficient in the use of CRIMP techniques to become the regional centre for providing this service to the Port Authorities.

It is then intended to hold a regional training workshop on these techniques, primarily involving the University of Papua New Guinea and the University of Guam, so they can set themselves up as sub-regional centres. It was decided to have these teams resident within the Universities because of the small size and limited expertise of regional agencies and their high staff turnover. The aim of these arrangements is to make IMS port surveys more cost-effective for Port Authorities in the region.

The practice of mid-ocean transfer of ballast water has been raised as a concern for the region, but has not been addressed through a specific activity. The Pacific region straddles the main shipping routes between the Americas and Asia and is concerned about the potential impacts by ships in exchanging ballast water in transit. Documented studies by the Cawthron Institute of ships plying the East Asia-New Zealand route have shown freshwater from the Sepik River in Papua New Guinea in their ballast tanks. If fresh water from the Sepik River can be taken in, then there is a real chance that purged ballast water could reach inland waters.

Towards a regional IMS strategy

In the long term, PACPOL IMS initiatives need to be incorporated into an overall Regional Invasive Marine Species Strategy. This Strategy will address all IMS, including those from the non-shipping vectors such as the aquarium industry, mariculture, quarantine, and intentional releases. The SPREP draft Regional Invasive Species Strategy has indicated the need and provides a valuable template for a Strategy to address IMS. Using the draft SPREP Strategy as a template, the main elements of a Regional IMS Strategy could be as follows:

Aims

To assist Pacific Island countries in protecting and maintaining the rich and fragile natural heritage of the Pacific Islands region from IMS impacts through cooperative efforts to:

⇒ raise awareness of IMS and its related issues;
⇒ assess the status and risk of IMS at the national and regional level;
⇒ build the legal, institutional and human capacity required to manage IMS;
⇒ prevent the introduction of new invasive species;

⇒ manage the impact of existing invasive species;
⇒ develop and maintain an effective, coordinated network of information and technical expertise.

Strategy 1: Information

⇒ Carry out an IMS risk assessment at the regional and national levels. Emphasise prevention and early detection, and evaluation of IMS that are present or are potential problems. Establish long-term monitoring of high risk native areas for incursions of recognized invasive species;

⇒ Strengthen both basic and applied research on IMS by identifying high-priority research needs, and encouraging work on high priority problems. Establish regional capacity to carry out IMS surveys;

⇒ Strengthen linkages between Pacific island countries and scientific institutions, sources of technical and research assistance or other bodies of information. Share information regionally through the establishment of mutually accessible databases and web sites;

⇒ Develop a regional clearing-house for information on IMS that is easily accessible, perhaps through a web-based information system; and

⇒ Establish close links with the IMO, UNEP and other international organizations carrying out work related to IMS.

Strategy 2: Awareness

⇒ Raise public awareness of IMS and its potential ecological, economic and health impacts. A specific program needs to be put in place to raise the awareness and gain the support of all community leaders, particularly at the political level; and

⇒ Develop public awareness materials and programs that are targeted at raising awareness at specific community levels: decision-makers, practitioners/professionals/private sector, general public and children.

Strategy 3: Institutional capacity

⇒ Identify the institutional structures and capacity level appropriate to each country to manage IMS;

⇒ Consider regional arrangements where national capacities are inappropriate. Where this is the case, create opportunities for regional agencies to establish and strengthen regional capacity to assist countries to meet IMS management requirements (e.g. the current PACPOL initiative to assist the USP to establish the capacity to do IMS port surveys);

⇒ At the national and regional level, develop ongoing training programs in the areas of survey/assessment, inspection, enforcement, analysis, monitoring etc. and a network of resources that allow for the transfer of information to where it is required;

⇒ Develop and upgrade regional and national facilities such as reference collections and specialised facilities for border control;

⇒ Promote and strengthen initiatives that facilitate the use and sharing of existing regional facilities by government agencies in-country and between countries (e.g. South Pacific Regional Herbarium, Bishop Museum collections, quarantine facilities); and

⇒ Develop and strengthen tools and procedures to:

- promote the use of existing protocols for risk assessment, modified to accommodate Pacific island countries in the management of IMS;

- identify, develop and adapt relevant IMS sampling and survey protocols;

- develop guidelines for management of potential IMS vectors that consider the full ecological, economic and health impacts;

- collaborate with other organizations to develop appropriate policies to address the potential risks of GMOs.

Strategy 4: Policy and legislation

Review existing policy and legal framework in each Pacific island country to determine its adequacy for addressing the threats of IMS. Develop model policies and legislation that includes provision for mitigating these threats, meets obligations under international legal instruments and which makes use of principles for IMS management developed by other organizations (such as IMO, UNEP, IUCN) and countries. Produce country-specific recommendations for modifying or developing new legislation that effectively regulates the following:

⇒ identification of responsible agency;
⇒ provision of powers to administer and regulate;
⇒ risk assessment;
⇒ management of IMS vectors;
⇒ control of importation of all living organisms;
⇒ surveillance for new incursions;
⇒ assessment of environmental risks prior to introduction of genetically modified organisms;
⇒ quarantine and other inspection/control procedures;
⇒ control or eradication of invasive species; and
⇒ monitoring.

Strategy 5: Funding

⇒ Develop long-term funding mechanisms that will ensure Pacific island countries are able to undertake activities to manage IMS. Secure support for the establishment of these mechanisms from decision makers at all levels of the community in particular at the political level;

⇒ Maximise funding self-sufficiency by promoting full participation of local communities and the private sector in strategy/activity development, management and implementation to ensure a long-term local commitment; and

⇒ Promote IMS as a criterion in national, regional, and international disaster management plans.

Strategy 6: Linkages

Establish and maintain a network among Pacific island countries and organizations that improves communication, cooperation and information sharing, and maximises the effectiveness of invasive species work in the Pacific. Specific actions include: development of common standards of border control, staff exchange programs, nomination of an invasive species position within appropriate organizations and establishment of national working groups and a regional expert group; and

Encourage regional participation in the development of international conventions, standards and programs that address IMS (IMO, UNEP etc). Maintain close partnerships with these international agencies and organizations.

Conclusions

The region still needs to convene a forum to bring together the relevant agencies and organizations to initiate the consultation process necessary to address IMS issues. A number of regional programs and organizations, such as SPREP (Invasive Species and PACPOL Programs), the University of the South Pacific (Institutes of Marine Studies and Applied Sciences) and the Marine Aquarium Council, are currently carrying out good work in this area. Australia and New Zealand are amongst the most progressive countries in addressing IMS (and IAS in general) and will have much to offer to the region. The level of awareness of IMS issues in the region is increasing and it is hoped that soon it will reach a level where the need for this forum is realised.

It is important that IMS continues to be considered as a component of the overall Regional Invasive Species Strategy. While a number of IMS management issues will be unique, many of the approaches, institutional structures and legal provisions that need to be put in place will be generic to all invasive species issues. It is hoped that current work on the Regional Invasive Species Strategy (which is wholly terrestrial in focus) will pave the way for a complementing Regional IMS Strategy.

The focus of the draft SPREP Regional Invasive Species Strategy is very conservation and biodiversity (ecological) oriented. I believe that this sectoral approach is too limited for the region and hope that we can eventually have a strategy that also includes economic and health aspects. Developing country governments (any government for that matter) is more likely to bring resources to bear when an issue is shown to have impacts on its economic well being and also the health of its populace rather then just ecological impacts.

For the shipping-related aspects of the IMS Strategy, two factors will need to be considered. The first is that shipping is an international industry that is most effectively regulated through international legal instruments. Close attention will need to be paid to these international legal instruments and close links established with their international secretariats. The second aspect is that it is essential to have private sector involvement and cooperation. The shipping and port industries are key stakeholders whose cooperation is essential to the effectiveness of any strategy in this area.

Acknowledgements

I thank GISP for the invitation to attend and present at this workshop. I believe that the workshop is a timely one and hope that it will facilitate co-operation and implementation of initiatives within the region. It is unfortunate that prior commitments preclude my attendance, but I wish all a successful workshop and look forward to the outcomes.

The role of the Secretariat of the Pacific Community in addressing IAS issues

Mr. Warea Orapa
SPC Plant Protection Service

Introduction

The Secretariat of the Pacific Community (SPC), previously known as the South Pacific Commission, was established in 1947 and is the oldest regional organization in the Pacific. It is a regional technical development agency that works in partnership with its 22 member Pacific Island Countries and Territories (PICTs) [30], donors and other organizations and countries to deliver its objectives. The SPC consists of three sector-based divisions: Land Resources, Marine Resources, and Social Resources.

The Agriculture Program is part of the Land Resources Division and contributes to the economic and social well being of the region's people through sustainable agricultural development. To achieve its goals the Agriculture Program has four major objectives. These are:

1. increasing the efficiency and sustainability of agriculture;
2. improving food security and public health;
3. facilitation of trade in agricultural products; and
4. help decrease impact of natural disasters (SPC, 2001).

The Plant Protection Service (PPS) is part of the SPC Agriculture Program and is mandated to address regional plant pest problems. "Plant pests," as referred to in this paper, include mammals, birds, arthropods, mollusks, weeds, and diseases caused by pathogens, virus, and nematodes.

The SPC views sustainability as an important concept in agriculture. Existing generations of Pacific Islanders have to take care of the environment and resources in a way that does not impoverish future generations. The PPS has developed a collaborative network in the SPC member countries and territories to implement and promote sustainable development by limiting the impacts of plant pests. This is done by preventing new introductions, increasing preparedness of PICTs and collaborating in the management of important pests. Under the fourth objective listed above, impacts of IAS on agriculture, the environment and the livelihoods of people can be addressed. Many IAS are detrimental to agriculture and are equally damaging across other land-use practices such as agroforestry, aquaculture, recreation and biodiversity conservation.

The implications of IAS for biodiversity and the environment gained widespread global recognition after the first environmental summit in Rio de Janeiro a decade ago. However, in the Pacific region, the SPC (through the PPS) has been addressing IAS issues from the perspective of pests since 1950. Traditionally, before the influence of Western ideals and capitalism, Pacific Islanders depended entirely on subsistence agriculture and fisheries, attempting to exist in harmony with their environment. Traditional agriculture, which still exists in most islands, and the environment are a continuum. However, this status quo has been changing since the arrival of European explorers: during the last few decades, increasing international linkages and trade have seen the introduction of numerous pests, many of which have become invasive. With IAS threatening all sectors (social, economic, and environmental), the livelihoods of Pacific Island people are often directly affected. It is in this holistic context that the SPC supports the efforts of its member countries and territories and will continue to promote regional and global efforts to prevent pest incursions while fulfilling its mandate.

[30] SPC Member Countries and Territories: American Samoa, Cook Islands, Guam, Fiji, Federated States of Micronesia, French Polynesia, Kiribati, Marshall Islands, Nauru, New Caledonia, Niue, Commonwealth of the Northern Marianas Islands, Palau, Papua New Guinea, Pitcairn, Samoa, Solomon Islands, Tonga, Tokelau, Tuvalu, Vanuatu, and Wallis and Futuna

The Plant Protection Service's primary focus

Since its inception, the PPS has been involved in preventing the introduction of plant pests and building the capacity of SPC member PICTs to address plant pest problems. It has also funded and undertaken pest management projects using its teams and expertise.

PPS' primary focus is on implementation of national and regional strategies for the sound management of plant pests in agriculture, forestry and the environment. It emphasizes the "3P rule" of Prevention, Preparedness, and Pest Management among the SPC member countries in the regions.

Prevention

The PPS encourages and supports SPC member countries to maintain effective levels of biosecurity (quarantine services) at their borders to prevent the movement of new pests into and out of individual PICTs. It is also involved in facilitating trade and tourism for the sustenance of the small island economies through regular development and training of national quarantine staff in import risk analysis.

Some current eradication work that has been undertaken with SPC support or as collaborative work in the Pacific Islands region include:

⇒ Fruit flies (*Bactrocera* spp) in Tahiti, Nauru, Palau and New Britain (Papua New Guinea);
⇒ Taro beetles (*Papuana* spp.) on Ovalau in the Fiji Islands;
⇒ Singapore daisy; (*Sphagneticola trilobata*) on Niue;
⇒ Giant sensitive plant (*Mimosa diplotricha*) on Niue and Wallis and Futuna;
⇒ Giant African snail (*Achatina fulica*) on Kosrae, Federated States of Micronesia;
⇒ African tulip tree (*Spathodea campanulata*) in Palau and Yap;
⇒ Mile-a-minute weed (*Mikania micrantha*) for Pohnpei, Yap and Palau;
⇒ False kava (*Piper auritum*) in Pohnpei, Federated States of Micronesia (FSM); and
⇒ Cogon grass (*Imperata cylindrica*) in Yap and Palau.

Preparedness

PPS' second key role involves directly assisting member PICTs or increasing their capabilities to detect newly introduced pest species that could adversely affect agriculture and the environment. The PPS collaborates with SPC member countries and territories to build capacity and to develop nationally and regionally coordinated emergency response plans (ERPs) to contain incursions of new pests, many of which are IAS. To date, ERPs for pests have been designed for five PICTs: more are due to be completed in the next few years. For some island countries, ERPs will be designed to contain pests of higher taxa animals (mammals, birds, fish, reptiles, etc.): in others, ERPs have focused only on agricultural pest incursions. Several PICTs have not yet developed ERPs.

The structure and implementation process for ERPs will vary between countries because of differing governmental and/or legislative structures. However, all ERPs should be expected to serve the same purpose of containing new pest incursions, many of which will involve IAS. IAS issues for taxa not traditionally addressed by SPC have, until recently, been seen as a largely environmental matter and are expected to come under SPREP's mandate.

The PPS also provides training and development of manpower capabilities in pest diagnostics, ERP implementation and design and implementation of appropriate eradication or management strategies. This is an ongoing capacity-building activity for PPS because many PICTs are too small to independently sustain biosecurity and pest management strategies.

Pest management

The PPS promotes and supports the development and implementation of sustainable pest management systems based on biological control and traditional practices. It is involved in the assessment of occurrence, distribution and invasiveness of pests through surveys and some collaborative research. An important aspect of providing plant protection services in the PICTs is prioritisation of important pest issues and threats and deciding on suitable management practices. For example, *Chromolaena odorata* is seen as an important pest/IAS threat to many PICTs: biological control has been preferred to other options in Papua New Guinea (mainland and several outer islands), Palau, Guam, and the Federated States of Micronesia.

In addition, PPS provides PICTs with regular technical advice and information and conducts extension and diagnostic services to address individual pest problems. It has a well established information dissemination network through the national quarantine services, using regularly published pest alerts, technical publications on pest management recommendations and the SPC's mass media network.

The PPS develops, maintains and updates the Pacific Pest List Database (PLD) for the region as well as for individual island countries and territories. The PLD records occurrences of plant pests (arthropods, weeds and diseases only), many of which are also IAS. It also contains information on new records of new occurrences and names of species intercepted by quarantine services. The database has been completed for five PICTs: data for others will be completed in the next few years.

Regional and global responsibilities

The PPS works in collaboration with PICTs and their national quarantine or plant protection services which are usually located in national departments of agriculture, forestry and fisheries. In addition:

⇒ PPS acts as the secretariat for the Pacific Plant Protection Organization (PPPO), the coordinating body in the Pacific for the International Plant Protection Convention (IPPC);

⇒ PPS is responsible for participating in various activities to achieve IPPC's objectives and for gathering and disseminating information on IPPC;

⇒ the PPPO, funded by Australia, New Zealand and the United States governments, complements PPS' role by placing global quarantine and plant protection issues in a regional perspective;

⇒ PPPO's Executive Committee has six elected representatives, two from each of Micronesia, Melanesia and Polynesia. It helps Pacific Island countries to comply with global quarantine measures for international trade. Member countries of the PPPO meet every three years; and

⇒ the Regional Technical Meeting on Plant Protection (RTMPP) is a meeting of representatives from national plant protection services of member PICT's, Australia and New Zealand. Countries present papers on their current plant protection situation and recommendations are made for improvements and new services. The RTMPP provides an important consultative mechanism for identifying plant protection issues, many involving IAS, for the SPC Plant Protection Service.

The PPS also implements the CBD's objectives in collaboration with member governments and regional organizations such as SPREP. A large number of IAS which impact on the environment and biodiversity are of concern to SPC as they directly impinge on agricultural productivity and contribute to altering the socio-economic status of many member PICTs. While SPC and SPREP do not duplicate work, as many may believe, their respective activities are supposed to be complementary or collaborative when addressing certain key IAS problems.

Literature cited

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Information and publications can be found at the Plant Protection website: http://www.spc.int\pps.

CAB International: activities to support an IAS strategy in the Pacific

Dr. Soetikno S. Sastroutomo, Senior Project Officer, and Dr. W.H. Loke
CAB International

CAB International is an international, intergovernmental non-profit organization, owned by 41 member countries. CABI has two divisions: Publishing and Bioscience. Its annual budget is $30 million, of which only 3% comes from core funding. The remainder is generated by specific projects, with 60% coming from the publishing division.

CABI's Head Office is in Wallingford, UK. In addition, CABI has:

⇒ three Regional Centres (Africa, Caribbean and Latin America, and South-East Asia);
⇒ three Bioscience Centres (United Kingdom, Switzerland, Pakistan); and
⇒ five country offices (USA, India, China, Thailand, and Costa Rica).

CABI activities relevant to invasive alien species

Relevant CABI activities are mostly related to agriculture. For biocontrol of invasive plants, completed projects include:

⇒ *Salvinia molesta* in Malaysia (Australian Centre for International Agricultural Research (ACIAR));
⇒ *Mikania micrantha* in Malaysia (Malaysian Oil Palm Growers' Council (MOPGC)) and Indonesia;
⇒ *Chromolaena odorata* in Malaysia;
⇒ *Parthenium hysterosporum* in India; and
⇒ *Rottboellia cochincochinensis* in Thailand.

Ongoing activities include:

⇒ *Mimosa pigra* in Malaysia (monitoring of bioagents);
⇒ *Eichhornia crassipes* in Malaysia (monitoring);
⇒ *R. cochincochinensis* in Malaysia;
⇒ *Eichhornia crassipes* in Malawi (UK Department of International Development, World Bank);
⇒ *Mikania micrantha* in India (UK Department of International Development);
⇒ *Lantana camara* in Australia (Queensland Department of Natural Resource Management);
⇒ *Cryptostegia grandiflora* in Australia; and
⇒ Several important weeds of North American origin.

Future programs will include regional projects on management of:

⇒ *Mikania micrantha* in Indonesia, Malaysia, China, India, Philippines and Papua New Guinea;
⇒ *R. cochincochinensis* in Indonesia, Malaysia, Philippines and Thailand; and
⇒ *Chromolaena odorata* and *Austropatorium inulaefoium* in Indonesia and Malaysia.

For biocontrol of invasive insects, mostly using parasitoids, completed projects include:

⇒ leaf miner control (species name) in Indonesia, Malaysia, and Vietnam; and
⇒ diamond back moth (species name) control in the Philippines, Bangladesh, Laos, Indonesia, and Vietnam (Asian Development Bank, UN Food and Agriculture Organization etc.).

Ongoing insect projects include:

⇒ diamond back month control in DPR Korea (SPC) and Vietnam (FAO); and
⇒ *Spodoptera exigua* in Malaysia (Ministry of Science, Technology and Environment).

CBI's future program of work includes a regional project on management of newly-introduced invasive insects (mites, whiteflies, leaf miners) in South-East Asia: this is still at the concept stage.

CABI's broader contribution to management of IAS

CABI's specific development objectives are:

⇒ knowledge management for human development;
⇒ rural livelihoods and food security improved for the resource poor; and
⇒ sustainable development and the environment.

CABI pursues the third objective by supporting national strategies to reverse current trends in the loss of environmental resources and for sustainable use of biodiversity, with particular regard to areas in which CABI has globally-acknowledged scientific skills. Through its understanding and use of microbial biodiversity, CABI seeks to maintain agro-biodiversity in systems under change and threat. Management of IAS is addressed through management of biological threats to the sustainability of natural systems and agriculture.

CABI can contribute to IAS management in the following ways:

Knowledge generation

⇒ survey and document IAS and their potential risks;
⇒ underpin national strategy development through pathway and risk analysis, biocontrol survey and research and development of identification materials and capacity for IAS management.

Knowledge access and availability

⇒ promote the global IAS agenda;
⇒ produce Crop Protection and Invasive Species Compendia;
⇒ support institutional and policy framework development; and
⇒ support national IAS strategies and action plans.

Knowledge use

⇒ biocontrol agent community awareness, introduction and monitoring;
⇒ Regional Weed Programs for major economic weeds;
⇒ community pest detection, monitoring, and decision support systems; and
⇒ environmental and socio-economic impacts of IAS assessed, ameliorated and managed properly.

Cooperative Initiative on Invasive Alien Species on Islands

Alan Saunders
IUCN Invasive Species Specialist Group

Background

The Cooperative Initiative on Invasive Alien Species on Islands (the "Cooperative Islands Initiative") is a joint initiative of IUCN's Invasive Species Specialist Group and the New Zealand Government, under the umbrella of the Global Invasive Species Programme (GISP).

A wide range of species have invaded and colonised new sites. Islands are especially vulnerable to IAS and dramatic ecological impacts have been attributed to IAS on islands. For example:

⇒ declines in palatable trees (e.g. rata) due to browsing by Australian brushtail possums (*Trichosurus vulpecula*) in New Zealand;
⇒ declines in red land crabs (*Gegarodea natalis*) on Christmas Island, following invasion by yellow crazy ants (*Anoploepis gracilipes*);
⇒ extinctions of native birds on Guam as a result of brown tree snake (*Boiga irregularis*) predation;
⇒ changes in forest patterns and processes as a result of the invasive weed *Miconia*.

IAS have had - and continue to have – dramatic impacts on island ecosystems. On islands in north-west Mexico, for example, 21 out of 23 extinctions of native animals have been attributed to the effects of invasive mammals. Feral cats caused most of these extinctions. IAS are now the main cause of extinctions on islands. More than 54% of recent bird extinctions on islands have been attributed solely or largely to IAS. Their effects continue to escalate as more IAS colonise new islands.

While it is easy to feel overwhelmed by the sheer scale of the IAS problem, recent experience suggests that in some cases at least, the problem is manageable. Some points to note:

⇒ preventing further invasions must be a high priority. For example, preventing red imported fire ants (*Solenopsis invicta*) from spreading through the Pacific Islands is potentially achievable and would result in significant benefits for the economies as well as the biodiversity of these islands;

⇒ once populations of IAS have established, consideration may be given to eradicating them (i.e., removing every individual of the pest population); and

⇒ although very fragile and vulnerable, islands also present unique opportunities for management. It may be feasible to eradicate IAS from islands and, because they are generally easier to defend than sites with less obvious boundaries, it may be possible to reduce the chances of further invasions;

Examples of IAS control on islands

Each island is different in terms of its invasibility and the opportunities it presents for eradication and ecosystem restoration. In the last few decades IAS have been successfully managed (through eradication or control) on a range of different types of islands.

Some of the earliest invasive mammal eradications were undertaken in New Zealand. In the 1960s, feral goats (*Capra* sp.) were eradicated over a period of weeks from Macaulay Island (120 hectares) in the Kermadec Group. Habitat for seabirds such as the white-naped petrel (*Pterodroma cervivalis*) has improved dramatically following the removal of the goats.

On Hauturu/Little Barrier Island, feral cats (*Felix domestica*) were eradicated in the 1980s. Forest and seabird populations have recovered to the extent that some forest birds are now being 'cropped' for translocation elsewhere. Interestingly, there was a widely-held and commonly-expressed view at that time that it was not possible to eradicate cats from a 3000 hectare island. A key change that has occurred since eradications have been undertaken is in people's attitudes and a growing recognition that eradication may well be possible.

In the Korapuki Island (18 hectares) in the Mercury Group, rabbits and rats were eradicated in a single operation. Lizard populations have recovered dramatically with one species increasing 40-fold after just six years.

Outcomes such as these clearly indicate not only the impacts that IAS may have, but also the potential of native species to respond to the removal of such threats. Almost invariably where compelling evidence of the impacts of IAS can be demonstrated when responses are measured.

Until the late 1970s, eradicating rodents even from small islands was considered impossible. Following early ground-based operations, where toxic baits were placed by hand in bait stations on grids throughout relatively small islands, techniques have advanced rapidly. Helicopters with under-slung bait buckets, guided by sophisticated satellite navigation systems, now allow for very precise bait distribution over much larger and more rugged islands.

Building on these successes, New Zealand's Department of Conservation has now treated islands up to 11,500 hectares. A strategic approach has been adopted to allow for eradication of different suites of IAS on even larger islands around New Zealand.

Eradications are also being undertaken in other regions:

⇒ in north-west Mexico, the Island Conservation and Ecology Group has undertaken 23 eradications of several types of IAS. The Group is planning further eradications including on much larger islands, such as Guadaloupe and Socorro. Internationally significant conservation outcomes can be expected from such projects;

⇒ following eradication of feral cats from Long Cay, British West Indies, the island is once again a safe refuge for endangered rock iguanas;

⇒ in the Northern Mariana Islands, feral pigs and goats were eradicated from Sarigan Island (500 hectares), allowing native forests to recover;

⇒ weeds are increasingly being targeted for eradication. In the Galapagos Islands, a population of Andean raspberry (*Rubus glaucus*) was eradicated before it became widely distributed; and

⇒ in Mauritius, significantly more butterflies were counted on transects in Conservation Management Areas that had been fenced to exclude invasive browsing mammals and from which selected weeds had been removed, compared to unmanaged sites.

While the Cooperative Islands Initiative focuses on conserving biodiversity, there are often economic, health, and other social benefits from managing IAS. In Nauru, for example, mangos are once again a staple in the local diet following the eradication of fruit flies.

Unfortunately, in some cases, total eradication of an IAS is either not feasible or inappropriate. In the Takitumu Conservation Area in Rarotonga, for example, management is directed at intensive control of rats to reduce predation on an endemic flycatcher known as the Rarotongan flycatcher (*Kakerori*). Through this cooperative project involving local landowners, the Cook Islands Environment Service, the New Zealand Department of Conservation, and SPREP the number of kakerori has risen from 29 individuals in 1989 to more than 250. Funds are now being generated through nature tourism in the project area. The kakerori is now an icon in Rarotonga and the Takitumu project a source of pride for Cook Islanders.

There is a pressing need for more effective use of IAS control programs on islands around the world, as well as significant opportunities to apply this 'Mainland Island'-type approach to control suites of pests.

Role of the Cooperative Islands Initiative

Islands and other isolated and vulnerable ecosystems have repeatedly been identified by the CBD, GISP, and IUCN as needing cooperative approaches to manage IAS. Representatives from small island states and from states with islands have strongly supported the concept of a cooperative IAS program. The Cooperative Islands Initiative was specifically endorsed by the Sixth Meeting of the Conference of the Parties to the CBD (April 2002). The Initiative was proposed by the New Zealand Government and the IUCN-ISSG, under the umbrella of GISP. Seed funding has been provided by the New Zealand Government and the Pacific Development Trust.

The primary goal of the Initiative is to "conserve island biodiversity by building capacity to manage IAS." The scope of IAS management includes:

⇒ preventing new incursions;
⇒ early detection/rapid response;
⇒ eradicating established IAS where feasible; and
⇒ controlling IAS at selected sites.

Under the Initiative, a strategy is being developed which includes the following activities:

⇒ sharing information and expertise;
⇒ promoting cooperation and partnerships;
⇒ seeking funds;
⇒ encouraging directed research;
⇒ advocating active intervention;
⇒ facilitating capacity building;
⇒ providing technical advice and support; and
⇒ facilitating demonstration projects.

Initial objectives are to:

⇒ compile and disseminate information;
⇒ provide technical advice and support;
⇒ facilitate demonstration projects; and
⇒ develop partnerships.

The Initiative has a global scope, but initial activities have focused on the South Pacific in order to refine the strategy and develop capacity within the ISSG and its partners. Efforts are already being made to broaden activities beyond the Pacific.

Important progress has already been made in relation to the initial objectives and further actions are now being defined:

Compile and disseminate information

⇒ manage the Global Invasive Species Database.

This is an independent, readily accessible database, developed in GISP Phase I and now managed by the ISSG in association with the National Biological Information Infrastructure (NBII) and other partners. The Database will form part of the Global Invasive Species Information Network being developed by GISP.

⇒ develop information transfer mechanisms (e.g. *Aliens* newsletter, ISSG list server, technical publications).

⇒ enhance networks (one-to-one contact is best).

Provide technical advice and support

⇒ facilitate and coordinate advice through the ISSG network (over 150 specialists world-wide);
⇒ training, including inputs to established training programs;
⇒ skills sharing, including facilitating staff exchanges, peer review and audit; and
⇒ avoiding predictable mistakes.

Promote demonstration projects

Priority is given to identifying and facilitating projects that can demonstrate the achievability and value of IAS management activities. Such projects will be important in raising awareness and enhancing support for IAS management on islands. Criteria for selecting these projects include:

⇒ important anticipated biodiversity outcomes;
⇒ technically achievable;
⇒ cutting edge techniques and approaches; and
⇒ political and community support.

Develop partnerships with:

⇒ island states and countries with islands;
⇒ other management agencies (govt/NGOs);
⇒ local communities;
⇒ funders;
⇒ research institutions;
⇒ others who can influence outcomes.

Key challenges which the Cooperative Islands Initiative will face:

⇒ evaluating and predicting risks;
⇒ setting priorities;
⇒ engaging people;
⇒ demonstrating success; and
⇒ improving biosecurity.

How can the Cooperative Islands Initiative help you - and how can you help us?

This is a 'bottom-up' project-focused initiative that aims to achieve important conservation outcomes on the ground. Any suggestions of how we might make better progress towards our goal would be welcome.

Abating the threat from IAS: The Nature Conservancy's Invasive Species Initiative

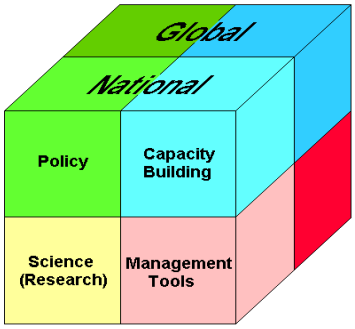
Dr. Ann Bartuska
The Nature Conservancy

The Nature Conservancy (TNC) recognizes that many of its conservation achievements are at risk due to IAS. It has established a major Invasive Species Initiative (ISI) which will cover nearly 30 countries in which TNC is active, engage local communities, and address the need for more taxonomic information.

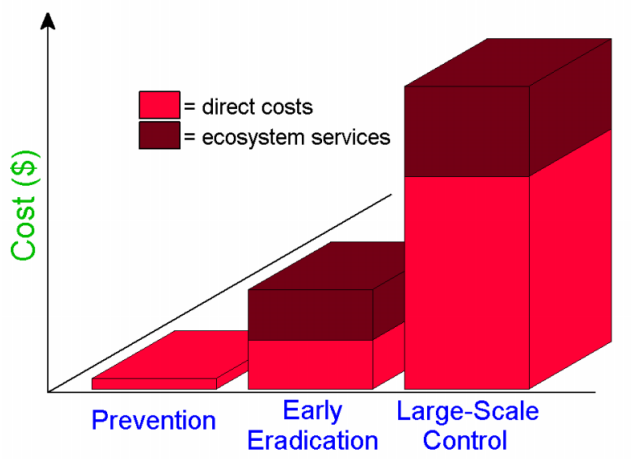
The overarching goal of the Initiative is to reduce and manage the threat to biological diversity, and reduce the concomitant social costs, caused by non-native organisms invading ecosystems. Both the social and biological components are paramount to the Initiative.

The Nature Conservancy
Saving the Last Great Places

The TNC ISI Approach



TNC aims to promote capacity building, policy, science (research), and management tools at global and national levels. Through the ISI, TNC hopes to encourage governments and other bodies to allocate substantial resources to prevention, detection, and rapid response/eradication at multiple scales of organization, from international down to conservation area and local scale.



The Initiative has established seven clear goals, each supported by various activities.

1. **Each country in which TNC is active adopts policies to prevent harmful new IAS and to control existing species**

TNC will develop partnerships to identify needs for new policies, procedures and regulations and establish projects at country and local levels to evaluate key ISI strategies for prevention, early detection, and rapid response.

By way of example, TNC has identified coordinators throughout TNC regions to form a conduit to reach local level partners to address the *Melaleuca* invasion.

2. **Tools, techniques and information are available and deployed to adequately prevent, detect, assess and manage invasions with the result that invasions no longer cause any net loss of biodiversity**

TNC will promote the building of local and wider knowledge, skills and abilities to address all taxa and the maintenance and expansion of learning networks globally. It will collaborate in the development of new tools, decision support systems, a tool-kit for managers and assessments of the effectiveness of different treatments. TNC will ensure that both staff and partners have access to these tools and scientific information.

3. **All ecoregions and sites have an accurate assessment of threats posed by IAS (all taxa) on conservation targets**

TNC will support assessments of threat and abatement strategies and the establishment of partnerships to meet data collection and management needs for effective information systems (e.g. with U.S. Geological Survey and NatureServe). This is the starting point for creating a menu that can be followed and a process for problem-solving in the future. There is a need for more information and closer integration of databases and information systems that can be shared to identify issues, threats and trends.

4. **Harmful new introductions are prevented at continental, operating unit and conservation area scales**

Opportunities for action include the adoption of protocols to prevent accidental introductions and a TNC Invasive Weed Prevention Policy to ensure a consistent approach.

5. **Newly established invaders are quickly detected and rapidly controlled to minimize damage to biodiversity at continental, operating unit and conservation area scales**

Opportunities for action include the development of an early detection cadre of volunteers linked with trained professionals (e.g. fishermen reporting sightings of new fish species) as well as support for a web-based early alert system throughout the region.

6. **All high priority existing invasions are identified and controlled to mitigate and reverse impacts to biodiversity on conservation sites**

7. **The general public recognizes the urgency and seriousness of the issue and routinely carries out actions to prevent and manage IAS**

Public outreach and education about the risks associated with IAS are critical. There is a need to identify best management practices and to communicate successes.

The Pacific Basin Information Node – opportunities for supporting a regional IAS strategy in the Pacific

Dr. Mark Fornwall
United States Geological Survey

An information system is currently being developed in Hawai'i as part of a U.S. national system called the National Biological Information Infrastructure (NBII). NBII is collaborating with many national and international organizations (including the United Nations, CBD, and the Global Biodiversity Information Facility) to build a global information system dedicated to conservation and biodiversity.

This presentation covers the portion of the NBII dedicated to biodiversity issues in the Pacific Region, the Pacific Basin Information Node (PBIN). It provides an overview of PBIN, a report on progress to date and some observations on how PBIN could contribute to the accomplishment of an IAS Strategy for the Pacific.

Overview

PBIN's mission is to provide decision-makers, scientists, and managers with the high quality information they need to make informed decisions about the biota in their country. PBIN considers that if people have access to such information, they will make sound judgments about their biodiversity with significant 'on the ground' benefits for conservation in their country.

PBIN is a group of Federal, State, educational and non-governmental organizations that have come together under this shared vision. It has a budget of $850,000 and is involved in all aspects of conservation from research to making decisions about Pacific island biota and environments. It aims to join others throughout the Pacific region and has begun a dialogue with certain Pacific countries, SPREP and the ISSG on how it can become part of the solution to IAS threats to biodiversity.

When fully developed PBIN will include:

⇒ analysis and synthesis tools to help scientists and decision-makers sort through the data and make reliable predictions on the future of Pacific island biota;

⇒ technology support that helps partners link to PBIN to share and access data;

⇒ data warehousing. PBIN's goal is for data developers to retain their data sets whenever possible. Where partners can no longer maintain their data sets but the data is still useful to others, PBIN may be able to store it for them;

⇒ data mining to help others extract needed data from PBIN, its collaborators or other information sources available through the global information infrastructure;

⇒ collaboration, which is key to attacking many of our biodiversity problems. PBIN will provide venues for collaboration in real time through new portal technologies it is currently testing; and

⇒ education and training opportunities for interested partners to enable them to participate in and use the information system and to help them build capabilities and capacity.

Progress to date

PBIN was established in 2001. Its initial focus has been on Hawai'i, but it would like to change this and reach out to other countries and territories in the Pacific region.

A key component is infrastructure development, namely data collection, organization and management. These are at the heart of any information system: the science or decision-making supported by that system will only be as good as the data and information it provides.

Biodiversity science progresses by first asking two questions:

⇒ what is it?
⇒ where was it found?

With these two pieces of information, we can address the questions of cause and effect, processes and relationships. Answers to these questions can help advance understanding of our biodiversity and environment. As this knowledge grows, we can better inform management and facilitate improved decision-making and implementation of better management practices.

PBIN has begun by addressing these two important questions.

What is it?

The Bishop Museum has agreed to build upon the existing Integrated Taxonomic Information System (ITIS) to develop a taxonomic authority for species found in Hawai'i and the Pacific Islands. ITIS is a taxonomic authority begun in North America and, in partnership with Species 2000, is becoming part of the global catalogue of life. ITIS Pacific will build upon the early work of the Hawai'i Biological Survey, which is part of the Museum, and will gradually be extended to other islands to create a collaborative Pacific Biological Survey.

Before we can understand and evaluate the impact that IAS are having in Hawai'i, we need to fill in missing data gaps. The Bishop Museum is leading work on the development of an efficient system for identifying and sampling biodiversity hotspots in Hawai'i to ensure that we know all species that occur on Hawaiian islands. This system will rely heavily on data already available through PBIN.

With this data, decisions can be made about monitoring programs, early warning systems, risk assessments and possibly other strategies important for addressing IAS problems.

Where is it?

This question is addressed in a similar way. The Hawai'i Natural Heritage Program at the University of Hawai'i is working with organizations throughout the state to make available spatial data for the entire archipelago. This collaboration, with groups such as the Invasive Species Committees and watershed partnerships, involves digitizing data, creating meta data and addressing the difficult questions relating to data collection protocols and database structure to ensure that the data can be integrated across the various sources.

This data should help us in a variety of ways including the discovery of new invasions, monitoring key areas, assessing impacts of invaders and perhaps assessing risks of newly arrived species.

The real advancements will probably come when we can combine the "what" and the "where" information with other biotic and abiotic information to begin forecasting. PBIN is currently working with the Maui High Performance Computing Centre to do this and has begun a project to study the influence of invasive diseases on the island's birds.

Lastly, PBIN continues to develop, identify and link to key information sources over the internet. The Hawaiian Ecosystems at Risk site (HEAR) is expanding and through this, PBIN assists in the development and accessibility of the Pacific Islands Ecosystem at Risk site (PIER). Most recently, PBIN added information from the Global Compendium of Weeds developed by Rod Randall in Western Australia. PBIN hopes to incorporate a new weed risk assessment tool being developed by the U.S. Forest Service and the University of Hawai'i

PBIN's next steps will be to identify new ways to assist resource managers in accomplishing key strategies for combating IAS. It will:

⇒ work with the state quarantine office to develop information systems that could aid them in their prevention activities;

⇒ work with stakeholders on the ground to improve reporting of new species as they appear (early warning system);

⇒ seek additional partnerships throughout the Pacific and other island nations to learn and share key information, expertise and strategies.

What can PBIN offer?

SPREP's draft IAS Strategy is a solid plan that covers much of what needs to be done. From an information perspective, PBIN would like to cooperate with GISP, Pacific Island nations, and others to help fight IAS threats to biodiversity.

PBIN can offer:

⇒ access to information on prevention and management. PBIN hopes to make all its data accessible via the web as it is added;

⇒ data repatriation, where possible. Many museums have collections from islands throughout the Pacific and that data needs to be provided to the islands;

⇒ sharing of ITIS Pacific taxonomic information so that people can easily identify and correctly name the organisms for which they are concerned; and

⇒ experience gained from integrating and collecting data sets and from work done with the state quarantine office in Hawai'i.

I would like to again thank GISP for this opportunity and if anyone would like to visit our PBIN site or contact me personally I would be happy to discuss our efforts further.

Development of a risk management framework for APEC Economies for use in the control and prevention of introduced marine pests

Mr. Warren Geeves
Assistant Director, Marine and International Section, Environment Australia

Background

Within APEC Economies, little is known about marine IAS and there is little practical information on measures to prevent and control introductions of IAS such as seastars which have become seriously invasive. In order to find out what would be most useful to APEC Economies, Australia, and Chile decided to pursue the development of agreed regional measures.

Australia's Centre for Research on Introduced Marine Pests (part of CSIRO, the Commonwealth Scientific and Industrial Research Organization) and the Inter-America Centre for Sustainable Ecosystems Development therefore carried out a consultancy covering:

⇒ *Management capabilities and approaches*

Institutional arrangements are fragmented in most countries, baseline surveys of marine IAS and capacity to detect incursions are limited and vector management is unbalanced. The main focus is on ballast water and aquaculture, whereas there are few or no management measures in place for recreational boating, dredging, fishing boats or hull fouling.

⇒ *Priorities and hazards for APEC economies*

Hazard levels were found to be variable. Ships' ballast water and hull fouling are the most important vectors and international shipping, aquaculture and biodiversity are the most threatened values. Commercial shipping and the number of trading partners are the most important factors affecting pathway strength.

⇒ Considerations for an APEC management framework

There is a need for better risk management, defined as "culture, processes and structures that are directed towards the effective management of potential opportunities and adverse effects." Effective management can be achieved by economies working collectively and maximising opportunities for management at the pre-border, border and post-border levels. The Consultancy also identified the need to build awareness of marine IAS problems in APEC economies, to develop appropriate information systems and tools, and to develop and adapt current institutional structures in individual economies and the region as a whole.

Elements for a draft Introduced Marine Pests Management Framework

These were developed at a workshop in Hobart, Australia (12-15 November 2001) which included representatives from 15 APEC economies, SPREP, IMO, and APEC working groups on fisheries and transportation, as well as stakeholders from the shipping industry, aquaculture, environmental and resource management, and research institutions. These elements include:

- Risk assessment and cost benefit analysis;
- Risk management: development of common requirements, protocols, procedures and management frameworks for specific risks;
- Development of cooperative projects;
- Regional communication; and
- Recognition of IMP as a global issue.

Looking to the future, the Workshop identified four future directions:

- identification of focal point in each economy;
- establishment of legislative/policy basis for management;
- agreement on common requirements and a timeline; and
- proposals for cooperative projects.

The next step is to develop a framework for consideration by APEC leaders. A further workshop will be held for this purpose in Chile in 2003.

3. Summary of plenary discussions

This section outlines the main points raised during discussion of the thematic and country presentations (see 2.1-2.3). Many are developed more fully in the Regional Statement (see pp. 5-8) and/or the Working Group discussions (see Part 4 below).

Context

Pacific islands are particularly vulnerable to IAS impacts for reasons that include (a) the high degree of endemism resulting from evolution in isolation; (b) the proximity of ports of entry to diverse habitats, which are thus easily accessible to introduced pests; and (c) capacity constraints on managing existing IAS, let alone detecting and addressing new arrivals.

The loss of native habitat has led to the loss of native predators and reduction of predator controls on prey populations. In addition to globalization processes, biosecurity is also influenced by external factors such as the risk of bioterrorism, market decline and drops in tourist and trade movements.

Mainstreaming IAS issues

IAS issues will affect all environmental programs in the Pacific region and need to be mainstreamed across government departments and down to the community level.

Existing systems tend to be constructed around protecting agriculture and are often inadequate for addressing IAS problems. Dialogue needs to be improved between agricultural and environmental communities, to better protect native species. Financial planners need to be educated so as to better understand border control and quarantine so that they are willing to invest in results that are not readily measurable.

Economic impacts will probably drive the expansion of IAS programs, for example when IAS get increasing attention as they start to affect water and public health. Tourism is an important industry for the Pacific, and once IAS begin to have aesthetic or health impacts, the industry is likely to start taking the issue seriously. Because the causes and consequences of IAS are multi-sectoral, it is particularly important for agricultural, public health, and environmental programs to join forces.

IAS issues need to be addressed to specific target audiences through situation-specific examples (e.g. by focusing on flagship native species, key IAS such as the Brown Tree Snake (*Boiga irregularis*), economic costs or crises in the particular region).

Policy, legal and institutional frameworks

International instruments provide uneven coverage, with few binding measures for freshwater systems and a stronger focus on intentional introductions than pathway management. Better coordination is needed between the existing complex set of institutions and instruments.

The Pacific region should support stronger links between relevant international bodies and actively promote closer coordination between Pacific intergovernmental organizations. International NGOs should coordinate planning of IAS activities for the region. A Pacific Islands IAS Committee should be established, possibly backed by regional centers of excellence.

The interface between IAS-related instruments and the multilateral trading system is a key issue, as alien species are moved in increasing volumes in the course of trade. Some Pacific Island countries and territories expressed concern that they do not have the technical capacity to meet the international plant and animal health standards recognized under the WTO-SPS Agreement.

Regional trade bodies, such as APEC, should address trade-related aspects of IAS issues and new regional and subregional trade agreements should be assessed for IAS implications. Trading partners within the region should try to follow common approaches, yet national capacity to implement prevention and risk analysis measures varies widely between islands.

Although the region can oversee and facilitate, the main practical actions will be at the national and local level. Effective national legislation and implementation are ultimately dependent on political will. New Zealand has managed to get political and private sector support for its strong regulatory framework, under which applicants conduct and pay for import risk assessments: this does not appear to have led to any loss of business.

Many National Biodiversity Strategy and Action Plans (NBSAPs) identify IAS information and action needs. Although some island IAS committees have been more talk than action to date, committees can provide important opportunities for policy formulation, targeted pressure on decision-makers and involvement of a wide range of stakeholders, including local authorities. One constructive step after the Austral-Pacific Workshop could be to organize national workshops on IAS.

As far as possible, progress should be incentive-driven rather than dependent on regulation. Trade and industry expertise needs to be harnessed to encourage private sector innovation to minimize risks of unwanted introductions. Codes of conduct have real potential, though experience shows that in some areas voluntary measures may not be sufficient. A combination of carrot and stick may be appropriate. Some interesting precedents exist, such as Western Australia's nursery industry awards scheme. New types of funding mechanisms involving trade and industry stakeholders should also be explored.

Pathways and vectors

The vulnerability of PICTs has increased with airline and shipping links to countries outside the Pacific region. The proximity of some islands to the continents (e.g. Micronesia and Asia) and close socio-cultural links between islands (e.g. Samoa and Tokelau) increase the likelihood of species translocation.

Systematic analysis and research into pathways is needed to develop prediction tools and risk classification or profiles. Guam's Brown Tree Snake (*Boiga irregularis*) program provides an interesting case study for defining high risk destinations and high risk cargo and transport pathways and vectors prior to selecting targeted management measures. This kind of approach needs to be applied to other parts of the Pacific. In-country inter-island measures need to be addressed as well.

Each country or territory needs to identify its highest risk pathways. Tonga's presentation, for example, references not only hull fouling and ballast water, but also yachting, risk goods (used machinery and vehicles), equipment, and commodities used in disaster relief and assistance. Other presentations refer to newly-identified vectors such as the mosquitoes that may carry West Nile Virus.

Key emerging pathways include Internet-based and other forms of mail order (i.e., there are now many direct mail companies where people can directly order IAS, particularly seeds). The Pacific needs to determine the scale of these pathways for the region. One approach to managing the problem, partly-funded by the U.S. government, involves the use of "web crawlers" that look for lists of IAS on the Internet and send a message to the vendor to indicate where they are selling prohibited species. Some countries have strengthened their postal controls. For example, in Australia mail systems are now more sensitive and recipients in Australia may be sanctioned for mail order of certain goods. New Zealand inspects 100% of incoming mail.

IAS in the marine environment

Marine IAS are poorly addressed in most national frameworks, although they are now considered as great a problem as terrestrial IAS. Information on marine IAS is needed as scientists are only just beginning to look at the issue in depth.

Participants discussed the need for Pacific Islanders to prevent IAS from moving from the Pacific Islands to other areas through the major shipping routes. Participants cited situations in barnacles were exported on hulls from Hawai'i and – conversely – of a military ship in Pearl Harbor that arrived with 30 non-native species on it, of which two have prospered. Policy mechanisms are needed to address these pathways.

A stronger focus on hull fouling is needed. Australia has experimented with eradication of IAS in harbors using copper sulfate or chlorine (eradication by chlorine was successful). The use of hull antifouling paints was considered. Tributyltin (TBT) is one option, but this has been banned in the U.S. because it threatens marine biodiversity. It has also been banned in Australia on vessels <25 m in length, and the IMO's new International Convention on the Control of Harmful Anti-fouling Systems on Ships will prohibit its use on large commercial ships. This treaty was adopted in October 2001 and will come into force when 25 member states representing 25% of the world's merchant shipping tonnage have ratified the treaty.

The ballast water situation in Pacific Island countries and territories (PICTS) needs further analysis. Most PICTS do not know if they are acting as exporters and/or importers of marine IAS in ballast water. PICTs need to assess the risks they face and the risks they may pose to other countries.

Australia's experience of tackling the incursion and eradication of Black Striped mussel (*Mytilopsis* sp.) in the Northern Territory was discussed. The competent authorities used pre-existing powers to implement mandatory inspection of all yachts arriving in specific ports in the Northern Territory. As the mussel has not reoccurred in Darwin, the inspection regime does demonstrate that it is possible to prevent marine IAS incursions, provided that there is political willingness to bear the cost of the prevention mechanisms. In this case, the prevention was cost-effective: the Northern Territory pearl industry is worth Aus $50 million per year and could have been severely affected by the IAS.

Tools and approaches

IAS issues may be conceptualized with the following approaches: prevention; early detection and eradication; control; and restoration. Prevention needs to be the top priority as it is more cost effective than eradication or control. Island to island (in-country) prevention is extremely important, yet most regulations apply only to inter-country movements and not domestic movements.

Best use should be made of existing expertise and capacity for implementing phytosanitary measures and IPPC requirements. There needs to be continuity of quarantine measures within and between adjacent countries with close social and economic ties. The GISP Toolkit can provide important guidance.

The region will need to consider the development of new tools where necessary, such as an agreed regional "black list" of IAS. Capacity for implementation at local level needs to be increased and tools and methods must be user-friendly.

Risk assessment, including for biocontrol

Some Pacific islands also lack technical capacity to conduct their own risk analyses to the standard required by the WTO-SPS Agreement, which might limit their ability to engage fully in international trade. At present, risk assessments are usually done at the national level. Region-wide risk assessments could, however, make the most efficient use of limited funds, as well as information sources and expertise. There is scope to tailor import risk analysis to the Pacific context and opportunities for the region to develop generic risk assessment methods to assist individual countries. Some regional models exist (e.g. SPC/Pacific Plant Protection Organization developed an import risk analysis module in 1998 that has been adopted as a tool by Pacific islands).

Existing risk analysis mechanisms need to be broadened to take account of possible impacts of IAS on biodiversity. Several islands would welcome guidance on how to incorporate environmental considerations into import risk analysis. New Zealand's presentation described how minimum environmental criteria have been incorporated into its risk assessment framework. Environmental impact assessments of activities involving alien species may require collaboration with tertiary institutions such as universities.

Regional protocols on risk analysis of biocontrol methods would be useful. There is a need for adequate screening to ensure the safe introduction of alien species for biocontrol, as some islands have experience of biocontrol becoming invasive themselves after a number of years. On the other hand, the implications of not undertaking biocontrol can be enormous: the costs and risks of not acting must be weighed against those of using biocontrol agents.

The SPC has certain protocols that could be used for biocontrol risk analysis. New Zealand's system involves tests on biocontrol agents to see if they will affect native species and congeners. A protocol has been developed to ensure that parasitism will not evolve after several generations. However, it can be difficult to fully test species for these risks in a greenhouse: there are limitations and guesswork involved.

Eradication and control

The region needs to research and implement innovative management techniques, where possible incorporating traditional knowledge and practices.

The effectiveness of control methods was discussed with reference to rats. Some islands that have lost forest cover – and habitat for predator species - have major rat problems. In Tokelau, constant and inappropriate use of bromodialone wax rat bait with warfarin has enabled rats to develop immunity to the poisons. Alternative control methods need to be developed with the assistance of other countries. Experience from other parts of the region was shared: Malaysia has successfully used the barn owl (*Tyto alba*) for some rat control. However, introducing barn owls to small islands could lead to a new problems and the owls would likely be ineffective in controlling "house rats."

For Brown Tree Snake (*Boiga irregularis,* BTS) management in Guam and the Northern Mariana Islands, full-scale eradication is not possible because funding is not increasing and current technologies are not economically feasible. The aerial broadcast of acetaminophen could be very effective but is very expensive: scale of delivery is also a stumbling block. Certain technologies address only certain age classes and are only suited to quarantine control only. Toxin, bait, and delivery have to be synchronized in order to be successful. Electric fences for control of BTS have deteriorated in the sun and during typhoons, although concrete fencing is more resistant.

Funding constraints also limit the extension of Guam's program to islands such as Palau, although education materials and training can be offered. Although the program shows how expensive control operations can be, there are many benefits that go beyond the individual species concerned. There are no firm estimates of dollar return on control measures, but it is likely to be small-scale.

Measures are also needed to minimize or monitor use of IAS in private gardens that can impact on rural communities if they escape and spread. There seem to be few examples of such approaches. In the National Park of American Samoa, which has an invasive plants program, about 30% is spent on education and 70% on eradication programs.

Capacity and resource issues

The paucity of personnel resources and funding was repeatedly cited as the biggest obstacle to progress on IAS. This is particularly problematic for the Pacific due to the number of isolated islands and dependence on external assistance for biosecurity measures. Adequate resources need to be mobilised to achieve realistic objectives for IAS prevention and management.

GISP invites participants to submit ideas for follow-up workshops and initiatives at national and multi-national levels. For example, GISP is now raising funds for an African Weed Program involving multiple following a joint approach by the respective national governments.

Education, awareness and respect for traditional practices

Increased public awareness is the best mechanism for intercepting IAS. Mobilizing individuals and involving communities can help to overcome financial limitations. A well-informed media can greatly assist in these efforts.

Particularly where IAS have a traditional or medicinal use, there may be resistance to classifying a plant as invasive. Local customs may also get in the way of practical action to respond to IAS impacts.

Traditional practices can be used to reduce IAS threats. Traditional leaders should be encouraged to lead the way in community IAS projects that promote conservation and restoration of native species. Educational projects should include information on traditional uses of native plants. A native plant "giveaway" program can be developed to raise awareness and promote native plants instead of IAS.

Children can be effective IAS managers and public educators. American Samoa has developed a children's guide to protected natural areas and a unit plan for use throughout the school system. High school students are encouraged to participate in volunteer service in protected areas

Networking and sharing of information

Prevention and management methods are improving, but solutions need to be better communicated and successful pilot and demonstration projects highlighted. Progress is directly linked to the rate of information exchange and to coordinated information-sharing at the international level.

Regional IAS practitioners can learn from each other and learn by doing. There needs to be regional 'buy in' for such networking.

Information constraints are still a problem in the Pacific. In particular, taxonomic information needs to be made more readily available so that the IAS can be identified to species. Information exchange practices need to be adequate to meet the needs of Pacific Islanders (and not exclusively dependent on access to the web).

Throughout the region, baseline information on IAS needs to be updated (e.g. through biological inventories, acute observations and reports, development of a corps of taxonomists and other specialists and collection of voucher specimens).

Specific actions on the red imported fire ant (RIFA)

Several government representatives and observers met separately to discuss options for concerted regional action on RIFA. They agreed on the need for coordinated preventive action to stop its spread beyond the Pacific Rim to the islands of the Pacific. They jointly endorsed a letter to the American and Australian federal departments of agriculture requesting consideration of appropriate preventive measures. A copy of this letter can be found in Appendix 5.6.

4. Summary of working group discussions

In order to identify the elements for a strategic plan of action to address IAS in the Pacific, participants met in two workshop groups for 1.5 days. Each working group (WG) addressed the same list of questions developed by the Workshop Steering Committee, which have been used in used in all of GISP's other regional workshops. As there were many points of overlap between the two groups' discussions, these were synthesised to avoid duplication. There were no significant points of disagreement between the two groups, although there were some different emphases. Where points were raised by only one WG, this is indicated. Appendix III lists the membership of each team.

4.1 What do participants hope to achieve through regional cooperation?

The general objective is to reduce impacts from IAS as well as invasion rates. Participants identified a series of broad goals for regional cooperation.

Strengthening and integration of regional and national approaches

⇒ better integration between existing programs and strategies at the regional and national levels. The SPREP IAS strategy should be revised with greater 'buy in' from all sectors (agriculture, tourism, environment etc.);

⇒ establishment of national strategies on IAS. National Biodiversity Strategies and Action Plans (NBSAPs) may need to be reviewed and updated to ensure they meet IAS needs. NBSAPs could be distilled to generate an agreed regional approach;

⇒ permanent stable network of contacts, and identification of national focal points;

⇒ establishment of common approaches to specific threats and issues e.g. pathway identification and management, quarantine, sharing of information on protocols and best practices, and in-country prevention and management at the level of individual islands and geographically distinct ecosystems;

⇒ shared priorities between governments and non-governmental organizations and across sectors; and

⇒ increased involvement and responsibility of local communities in IAS management (WG1).

More effective inter-regional and intra-regional cooperation

The desired outcomes fall into three categories:

⇒ a much higher profile for regional IAS issues, and a specific Pacific focus where issues at the Asia-Pacific level are different. The region needs to work together to raise regional IAS issues more systematically in international fora (e.g. the Barbados +10 Conference in 2004[31]). PICTs should encourage high political engagement for this purpose (e.g. Foreign Secretary level);

[31] Editor's note: this Conference will examine progress on the Small Island Developing States Plan of Action adopted by Caribbean and Pacific states in Bridgetown, Barbados in 1994

⇒ enhanced intra-regional coordination, particularly between English- and French-speaking Pacific countries and territories (WG1); and

⇒ greater political recognition of IAS issues by all PICT governments, possibly working through the Pacific Islands Forum and APEC, to obtain additional resources and government support. Improved bargaining power is needed to get governments to deal effectively with IAS issues.

Gap analysis at the regional level

This should identify strengths, weaknesses and actions that are best carried out at the regional level:

⇒ identification of regional priorities for prevention, rapid response, and management efforts at the pan-Pacific level. Obvious species that no Pacific island wants include Red Imported Fire Ant (*Solenopsis invicta*), Brown Tree Snake (*Boiga irregularis*) and *Miconia* (as opposed to national management of IAS already present);

⇒ priority hubs (e.g. localities with high volumes of goods transportation) for focused prevention and monitoring measures;

⇒ opportunities for transboundary analysis and assessment of IAS issues (regional and national); and

⇒ possible opportunities to leverage the regional transport system (i.e. for education; WG1).

Regional prioritising should not exclude national priorities. Each country should also prioritise its needs (guidance may be needed for this) and review this list periodically. National priority lists should be made available for others to consult.

Improved regional sharing of information

⇒ consolidate the number of lists of IAS related information (impacts, habitats, U.S.D.A. and other national lists) and create a central database in order to facilitate risk assessment and prevention;

⇒ share information on potential hazards, as early action may be possible elsewhere; and

⇒ transfer information on successful use of biocontrol to other countries in the region.

Expertise and technology to facilitate rapid regional response

⇒ rapid access to new technology for identification of IAS (e.g. scanners, web based identification systems) and increased deposit of voucher specimens;

⇒ access to and rapid deployment of experts through an established regional network: link existing systems (e.g. SPC, SPREP, IUCN); and

⇒ support for sharing and exchange of resources and experience.

4.2 What are the challenges to strengthening and expanding regional cooperation?

The challenges identified by working group participants fall into three categories.

Lack of resources and capacity

⇒ inadequate funding;
⇒ insufficient human resources, with limited technical expertise available in individual Pacific countries and territories;
⇒ varying levels of capacity and capabilities; the regional level lacks the 'critical mass' of expertise;
⇒ technological gaps e.g. lack of necessary infrastructure for efficient information exchange; and
⇒ poor transport and other infrastructure.

Attitudes

⇒ absence of high-level political recognition or clear leadership and followership on IAS issues;

⇒ 'turfmanship,' continued conflicts of interest (e.g. economic/ ecological; community benefit/ personal gain; long-term/ short-term) and possibly corruption. The economic case for action on IAS issues has not yet been made effectively, and existing IAS efforts may not be sustainable;

⇒ lack of accountability amongst industry stakeholders for activities that may lead to biological invasions;

⇒ some cultural and traditional practices of communities and individuals;

⇒ low public understanding or awareness of IAS impacts, lack of sufficient education opportunities and reluctance to ask questions; and

⇒ not enough success stories, creating a perception that IAS problems are overwhelming.

Characteristics of the Pacific region

⇒ geographical dispersion and remoteness;

⇒ small size of many countries;

⇒ the number of different countries and different political, legal and institutional systems;

⇒ problem of the 'weakest link' (capacity gaps in just a few countries can undermine effectiveness of measures in neighbouring states and in the region as a whole); and

⇒ lack of precedents in the region, with few appropriate models to follow.

4.3 What can the region do to overcome these challenges?

Policy, coordination and legislation

⇒ A regional IAS strategy should be agreed and supported at the highest level, with improved links with French-speaking PICTs at the political level. The strategy process should identify the IAS issues that are best dealt with regionally, such as:

- pathway analysis;
- emergency funds for rapid response to problem species that are emerging;
- rapid response procedures built up around key IAS; and
- model early warning and early detection systems.

⇒ The region needs to strengthen existing regional organizations (e.g. SPREP) and the links and coordination between existing IAS Programs to avoid duplication and better inform leaders and policy makers. Key organizations that should be involved include the Pacific Island Forum, SPREP, SPC, South Pacific Applied Geoscience Commission (SOPAC), FAO, and NGOs;

⇒ Effective lobbying to support Pacific issues needs to be done in the right strategic fora;

⇒ Policy tools, such as memoranda of understanding between funders and recipients, need to be formally established to ensure commitments are followed through. IAS 'advocates' could be trained to deal with politicians, funders and local communities;

⇒ National strategy development should involve stakeholders and IAS communities and be backed up by regional expertise;

⇒ New and updated legisation is needed, together with stricter enforcement, higher penalties and application of the polluter pays principle (WG1); and

⇒ The region should support a peer review process for IAS procedures, policies and programs.

Actions and capacity development

⇒ A regional Action Plan should address the needs identified at the regional level. Signature projects should be developed that are successful and have a significant public outreach component e.g. for flagship species, particularly birds;

⇒ An adaptive management approach can needed to improve understanding and reduce uncertainty. Skill sharing programs between sites are recommended (attachment training);

⇒ Communications infrastructure (good internet access, related telecommunications services) is needed to overcome communication and travel challenges. Databases and links should be collated to identify information gaps at the regional level;

⇒ The region could establish strategically located nodes of technical expertise and capacity and provide countries with information on how to access training and capacity-building. Regional action should include a focus on training of local parataxonomists and the development of comprehensive cost-benefit analyses that take market and non-market costs of IAS into account; and

⇒ There should be a regional roster of experts who con provide expert consultation, supported by an additional roster of expertise beyond the region where needed.

Awareness-building and outreach

⇒ Public awareness needs to be developed through regional-level programs and media. Pressure from below can improve Government accountability on IAS issues; and

⇒ Regional and national activities should involve traditional leaders and provide for consultation between affected communities and the agencies that serve them.

Funding

⇒ Regional thematic approaches that could be attractive to funders include:

- atolls;
- flagship species;
- pathways;
- specific IAS; and
- agreed long-term regional strategy (WG1).

⇒ Funding should also be sought to cover regional attendance at all important meetings, which provide important international contact opportunities (WG2);

⇒ Steps should be taken to develop a regional sustainable funding mechanism with stakeholders whose activities lead to introductions of IAS (airlines, shippers, tourism operators) and/or that benefit commercially from such species (WG1).

4.4 How can we promote further collaboration and cooperation within existing frameworks?

Between regional organizations

⇒ Broader regional coordination and engagement could be developed through the Council of Regional Organizations of the Pacific (CROP), which includes the Forum Secretariat;

⇒ SPREP and SPC should hold joint meetings and collaborate regularly. They and other relevant organizations (ISSG, GISP, TNC etc.), should nominate IAS focal points and formalise a working relationship with a) each other and b) others in the region. One option may be to expand the SPREP Roundtable (which includes NGOs and other bodies) to include IAS; and

⇒ Regional organizations should have formal channels of communication for IAS information.

Between regional organizations and Pacific Island countries and territories

⇒ Regional representation for the Pacific as a whole could be extended, as some islands (e.g. Hawai'i) are not currently members of Pacific-based organizations. There is a need to explore ways for all territories and states to be represented in organizations like SPC. Hawai'i as a state in the Pacific should request SPREP for observer status;

⇒ Regional resources (e.g. information on how to eradicate IAS) must be accessible regardless of whether a Pacific island is a country or territory;

⇒ SPC and other relevant organizations could give PICTs clearer information about their respective roles with regard to IAS issues. In turn, PICTs need to inform existing institutions and programs about their respective situations and to ask how such organizations can contribute to meeting their national needs; and

⇒ Communication between regional organizations on IAS issues needs to be delivered to PICTs in a coordinated fashion. Procedures should be established or strengthened for this purpose.

Emergency responses (WG1)

⇒ Emergency response plans (ERPs) coordinated by SPC, and associated legal measures, need to incorporate IAS considerations;

⇒ SOPAC and other organizations (civil defence, police, coast guard, military) may introduce IAS when they respond to natural disasters and therefore should be actively involved in IAS issues;

⇒ Policy makers and higher authorities should be made aware of IAS issues so that if an invasion occurs as a result of a natural disaster, groups are poised for action. IAS guidebooks or manuals could be distributed to emergency response organizations; and

⇒ A priority list of IAS threats could be established to facilitate recognition of IAS outbreaks as an emergency situation.

Listing (WG1)

⇒ With regional backing, each country in the South Pacific could develop a black list of IAS, Black listing can be a gradual process, with species of concern being added after risk analysis;

⇒ A grey 'watch' list may be developed for other species of possible concern, as a softer approach to promote wide 'buy in' and avoid creating opposition;

⇒ Black and grey lists should also be established for marine IAS;

⇒ Species and major pathway lists can build on existing tools developed by IUCN-ISSG and PIER; and

⇒ All listing should be done with care because of the trade implications and should be based on risk analysis.

Information and communication

⇒ Existing electronic channels for information exchange (e.g. PestNet, ALIENS-L) can be used or extended to cover IAS;

⇒ Existing publications and materials specific to IAS should be more widely publicised and new publications, newsletters and extension materials encouraged;

⇒ A clearing house mechanism is needed for information on past successes and failures of IAS management and the proceedings from the ISSG conference on eradication[32];

⇒ A regional IAS awareness week could be organized using regional media;

⇒ More technical workshops on IAS should be held. Countries and/or organizations should have the opportunity to recommend who should be invited. Invitations to workshops should go through the proper channels and be sent to the highest level possible;

⇒ Existing regional and national IAS committees should actively engage all relevant sectors, including transportation and tourism. Fisheries stakeholders need to be involved through a marine IAS workshop; and

⇒ Existing skill sharing programs should be expanded by making more funds available for travel (e.g. to observe eradication efforts in New Zealand).

4.5 What are the existing resources that can be utilised to further regional cooperation?

Existing institutional resources

Participants supported the development of a comprehensive contact list of IAS resources, people, and organizations. They drew up a non-exhaustive inventory of existing resources, which is presented here in the form of a table.

Organization	General resources	Specific IAS resources/ programs
Intergovernmental organizations		
SPREP	Education and training Bird Conservation Program Pacific Pollution Program (PACPOL) Biosafety Program Coastal and Marine Program International Waters NBSAP (also WWF, UNEP, UNDP) Legal Program	Regional Invasive Species Program Technical report and Regional Strategy SPREP to lead revision of regional IAS strategy in consultation with all relevant bodies. The process needs additional buy in from other Oceania countries and NGOs.
SPC	Agriculture Pest Management (Including IPM) Identification Marine and coastal Expert assistance Extensions Program Plant protection Media centre	IAS risk assessment workshops Freshwater invasives program Plant protection
NGOs		
IUCN		ISSG Cooperative Islands Initiative (with GISP and New Zealand government)
WWF	NBSAPS Biodiversity Traditional Knowledge	

[32] Veitch C.R. & M.N.Clout (eds.). (2002). *Turning the tide: the eradication of invasive species.* IUCN ISSG. IUCN, Gland, Switzerland and Cambridge, UK.

	Wildlife Conservation Society (WCS)	
TNC		Invasives Species Initiative
Conservation International		Working in Melanesia biodiversity hot spots.
Research institutes and information networks		
University of South Pacific (USP)	Marine Program Identification Training (environmental science) PIMRIS (Pacific Island Marine Resource Information Service) Tropical Agriculture	Agriculture
Bishop Museum		General willingness to assist e.g. provide information, conduct surveys
PIER (Pacific Islands Ecosystems at Risk)		
HEAR (Hawaiian Ecosystems At Risk)		
Pacific Government Programs		
Institut de Recherche pour le Développement)		These French government surveys involve biological surveys that can be used for IAS work
Landcare Trust (NZ)		

Funding/donor institutions

⇒ Hold a funders' meeting after the Austral-Pacific Workshop and use workshop recommendations (i.e. Regional Statement) to support funding applications;

⇒ Build awareness among funders to ensure that the projects they fund do not inadvertently promote unwanted introductions (e.g. erosion control using IAS);

⇒ A directory of funding agencies for the Pacific (e.g. EU) should be compiled; and

⇒ The Global Environment Facility has developed an IAS project proposal: development of this funding program should also involve SPC. GEF is already funding a relevant Forest Program in Melanesia.

Several U.S. funding agencies can support IAS efforts in the Pacific. There is a need to contact these agencies, understand strategies and identify areas that they could fund consistent with their mandates. Possible sources of funding include:

⇒ the USDA (APHIS, USDA Forest Service), which should also cover the South Pacific;
⇒ the U.S. Forest Service which has funds to cover U.S. territories;
⇒ the Fish and Wildlife Service which has an IAS strategy that extends beyond U.S. borders; and
⇒ NRCS (National Resources Conservation Service).

Private sector

Industry groups, such as Hawaiian airlines, shipping and tourism, may be funding sources. Mechanisms need to be developed to approach these groups so that they contribute to IAS prevention and management and, in return, receive a positive benefit (e.g. media attention, sponsorship).

University and research institutions are both potential resources. They could also sponsor students to attend meetings, which allows for reporting back and helps to build a regional network for the future.

4.6 What additional resources are needed?

Equipment and manpower

⇒ Basic equipment to do the job (vehicles, petrol, other infrastructure);
⇒ Better use of secretariat resources for relevant conventions;
⇒ Donations of new or used equipment to the Pacific by agencies, corporations and governments; and
⇒ More people working on quarantine, early warning systems and other IAS issues.

Information and outreach

⇒ A regional resource directory (electronic and hardcopy) that is regularly updated. This should reference IAS databases, videos, publications, funding sources, list-serves, technical resources, etc;

⇒ A compendium of basic IAS reference materials (e.g. biology and taxonomy texts, toxins manuals, management information) for distribution to remote areas without internet access; and

⇒ Information on how to source basic commodities for IAS management (e.g. for chemical control).

⇒ A printed and electronic resource kit of the most unwanted IAS for the region.

Funding

⇒ Seed funding to initiate projects;
⇒ Operational funding where necessary for key institutions;
⇒ An emergency contingency fund for rapid response; and
⇒ Funds for communication technology and internet access, possibly from foundations linked to Intel, Dell, etc.

4.7 Who needs to be involved, when and where?

⇒ SPREP and SPC could take the lead to compile and circulate recommendations from this Workshop, through a focal point to be identified;

⇒ Islands in the East Pacific should also be involved (e.g. Easter Islands and the Galapagos);

⇒ Politicians, decision makers and industry stakeholders, including retailers, pet industry, agriculture, aquaculture and fisheries;

⇒ Officers in IAS jobs should evaluate how cooperation can be carried out with their counterparts in other institutions and agencies;

⇒ Education departments should support the inclusion of IAS issues in school programs and curricula;

⇒ Schools and learning centres can set up demonstration projects involving students and village communities. These initiatives can also be taken by theatres, small bag companies, the media, Rotary Clubs and Chambers of Commerce; and

⇒ Existing videos (e.g. New Zealand Department of Conservation) can be circulated throughout the region.

4.8 What are the next steps to establishing a comprehensive program of regional collaboration and promoting action?

WG1 summarized the key next steps that could be taken after this Workshop. They include:

⇒ establishment of a regional IAS steering committee: SPREP and SPC should identify lines of communication on IAS issues at and between the global, regional and national levels;

⇒ participants to report to their respective institutions on the workshop's recommendations and to present the results and recommendations to the national media, with a focus on species important in that country to maximise attention;

⇒ participants to organise an inter-departmental meeting involving plant quarantine, environment, forestry, fisheries and other relevant agencies; and

⇒ establishment of national IAS coordinating committees and nomination of focal points.

Priority actions should include:

⇒ organising technical training on IAS on specific issues: e.g. project-based workshop on rodent eradication, monitoring, marine IAS issues and quarantine systems;

⇒ assessment survey of IAS;

⇒ identify flagship IAS, using IUCN reference tools;

⇒ pest alert for specific IAS;

⇒ develop a database on people who are working on IAS issues in the country (scientists, educators, NGOs, private sector); and

⇒ through the ISSG skills register, identify people who can help with needed technical skills;

⇒ public awareness campaign on IAS with traditional leaders, private sector, theater, schools, media, religious leaders and so on.

5. Appendices

Appendix 5.1
Abbreviations and useful websites

APEC	Asia-Pacific Economic Cooperation
APPPC	Asia-Pacific Plant Protection Commission
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CRIMP	Centre for Research on Introduced Marine Pests
CROP	Council of Regional Organizations in the Pacific
FAO	Food and Agriculture Organization of the United Nations
Forum	Pacific Islands Forum (known until 27 October 2000 as the South Pacific Forum)
GISP	Global Invasive Species Programme
GISP Toolkit	Wittenburg and Cock 2001. Invasive Alien Species: a Toolkit of Best Prevention and Management Practices. CAB International, Wallingford, Oxon, UK (available on http://www.cabi-bioscience.ch/wwwgisp/gt1goto.htm).
Global Strategy	McNeely, J.A., H.A. Mooney, L.E. Neville, P.J. Schei, & J.K. Waage (eds.). 2001. Global Strategy on Invasive Alien Species. IUCN, Cambridge, U.K., in collaboration with GISP
IPPC	International Plant Protection Convention
ISSG	IUCN Invasive Species Specialist Group
IUCN	World Conservation Union
NBSAPs	National Biodiversity Strategies and Action Plans
OIE	Office International des Epizooties (World Organization for Animal Health)
PICTs	Pacific Island Countries and Territories
SOPAC	South Pacific Applied Geoscience Commission
SPC	Secretariat of the Pacific Community
SPREP	South Pacific Regional Environment Program
TNC	The Nature Conservancy
UNEP	United Nations Environment Programme
USDA	U.S. Department of Agriculture
WHO	World Health Organization
WTO-SPS	World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures

Further background information and resources are available through the following web sites:

Convention on Biological Diversity	http://www.biodiv.org/programs/cross-cutting/alien/
Codex Alimentarius	http://www.codexalimentarius.net
Cooperative Islands Iniative	http://www.issg.org/islandIAS.html#IslandIAS
FAO	http://www.fao.org
Global Invasive Species Programme	http://www.gisp.org
GloBallast Program	http://globallast.imo.org
International Civil Aviation Organisation	http://www.icao.int/
International Maritime Organization	http://www.imo.org
IPPC (International Phytosanitary Portal)	http://www.ippc.int/IPP/En/default.htm
IUCN	http://iucn.org
IUCN Invasive Species Specialist Group	http://www.issg.org/
OIE	http://www.oie.int
Ramsar Convention on Wetlands	http://www.ramsar.org
World Health Organization	http://www.who.int
WTO (sanitary/phytosanitary measures)	http://www.wto.org/english/tratop_e/sps_e/sps_e.htm

Appendix 5.2 - Workshop agenda

The Prevention and Management of Invasive Alien Species: Forging Cooperation throughout the Austral-Pacific Region

Venue: Bishop Museum, Honolulu, Hawai'i

Dates: 15-17 October 2002

Day 1: Morning session (15 October)

Plenary – Defining the issue on the global and regional scale, moving from global perspective to regional perspective

Time	***Objective***	**Speaker (s)**
07:30	Bus departs from front of hotel for Bishop Museum	
08:30	Welcome and opening ceremony	*Dr. Allen Allison*, Vice President of Science, Bishop Museum *Mr. Michael Buck*, Administrator, Hawai'i Division of Forestry and Wildlife
09:00	Welcome and overview of the workshop objectives	*Dr. Jamie K. Reaser* Executive Director, Global Invasive Species Programme (GISP), us Office of the Secretariat
09:10	Overview of the invasive alien species issue globally – problem definition, causes, and consequences	*Dr. Jamie K. Reaser*
09:35	Invasive alien species in the marine environment: we're in deep	*Dr. Lucius Eldredge* Invertebrate Zoologist, Bishop Museum
10:00	Overview of international instruments addressing invasive alien species issues	*Ms. Clare Shine,* The World Conservation Union-IUCN Member, GISP Law and Policy Working Group
10:25	Question and Answer	Facilitated
10:35	Break	
10:55	The Global Invasive Species Programme's (GISP) Partnership Network and opportunities for scientific collaboration internationally	*Dr. Richard Mack* Professor, Washington State University Co-Chair, GISP Evaluation and Assessment Working Group
11:20	"Best practices" for preventing and managing invasive alien species	*Dr. Greg Sherley* Department of Conservation, New Zealand Co-Chair, GISP Facilitation and Cooperation Working Group
11:45	Conclusions and recommendations from the Invasive Alien Species Session at the 2002 Pacific Region Global Biodiversity Forum	*Dr. Maj de Poorter* IUCN - Invasive Species Specialist Group
12:05	Question and answer	Facilitated
12:20	Lunch	

Day 1: Afternoon session

Co-chairs: TBA

Plenary –Moving from global perspective to regional perspective

Time	**Objective**	**Speaker(s)**
13:45	Panel presentations – Case studies (20 min each)	*Mr. Mike Pitzler* - Brown Tree Snake *Mr. Tavita Toga* - Community-based approaches *Mr. Sione Foliaki* - Issues in Tonga *Mrs. Luisa Naseri Sale* - Issues in Tokelau *Dr. Lloyd Loope* - Issues in Hawai'i
15:25	Question and answer session	Facilitated
15:45	Break	
16:05	Status of the problem throughout the Austral-Pacific (invited government representatives will be given the opportunity to make brief remarks on the status of their invasive alien species problem and efforts to address it)	Facilitated
17:40	Announcements and adjourn	Co-chair
18:00	Reception and poster session	
20:45	Bus returns to hotel	

Day 2: Morning session (16 October)

Plenary – Opportunities for addressing invasive alien species in the Austral-Pacific through existing regional instruments and programs

Time	**Objective**	**Speaker(s)**
07:30	Bus departs from front of hotel for Bishop Museum	
08:30	The Regional Invasive Species Strategy - South Pacific Regional Environment Program (SPREP) overview and potential next steps	*Ms. Liz Dovey* SPREP
09:00	Secretariat for the Pacific Community (SPC) - activities to support an IAS strategy in the Pacific	*Mr. Warea Orapa,* Secretariat of the Pacific Community
09:20	CAB International (CABI) - activities to support an IAS strategy in the Pacific	*Dr. Soetikno Sastroutomo,* CAB International
09:40	The Cooperative Initiative of IAS on Islands – partnership at work in the South Pacific	*Mr. Alan Saunders,* ISSG
09:50	Question and answer session	
10:00	Break	
10:20	The Nature Conservancy - activities to support an IAS strategy in the Pacific	*Dr. Ann Bartuska* The Nature Conservancy
10:40	The Pacific Basin Information Node – opportunities for supporting a regional IAS strategy in the Pacific	*Dr. Mark Fornwall* U.S. Geological Survey
11:00	Group discussion	Facilitated
11:50	Overview of objectives for Working Groups	Co-Chair
12:00	Lunch (plenary session guests depart)	

Day 2: Afternoon session (16 October)

Working groups – begin exploring regional approach to achieving success throughout the region

Time	**Objective**	**Speaker (s)**
01:30	Working Groups on Regional Cooperation Separate into two working groups to address the following questions: • What do participants hope to achieve through regional cooperation? • What are the challenges to strengthening and expanding regional cooperation? • What can the region do to overcome these challenges?	Each group individually facilitated w/ rapporteur
04:00	Break	
04:20	Plenary – presentation of group summaries	Chair from each working group
04:50	Group discussion	Facilitator
05:25	Announcements and adjourn	
05:30	Bus departs for hotel	

Evening

Working Group coordination teams compile notes from Session 1 and compile list of recommendations arising from the discussions

Day 3: Morning session (17 October)

Time	**Objective**	**Speaker (s)**
07:30	Bus departs from front of hotel for Bishop Museum	
08:30	**Working Groups on Regional Cooperation** Two working groups address the following questions: • How can we promote further collaboration within existing frameworks? • What are the existing resources that can be utilized to further regional cooperation? • What additional resources are needed? • Who needs to be involved, when, and where?	Each group individually facilitated w/ rapporteur
10:45	Break	
11:05	Plenary – presentation of group summaries	Chair from each working group
11:35	Group discussion	Facilitator
12:00	Lunch	

Day 3: Afternoon session (17 October)

Time	**Objective**	**Speaker (s)**
01:30	*Presentation of draft regional recommendations*	Team leader
01:45	*Group discussion*	Facilitator
02:15	***Working Groups on Regional Cooperation*** Two working groups address the following questions: • What are the steps to establishing a comprehensive program of regional collaboration and promoting action? • What are the steps that can be taken immediately and who should take them? • What is at least one action that each participant will pledge to take soon after the Workshop?	Each group individually facilitated with rapporteur
03:30	Break	
03:50	Plenary – presentation of group summaries	Chair from each working group
04:25	Discussion - finalization of regional recommendations	Team leader
05:00	Closing Remarks and adjourn	Co-Chairs
05:30	Bus departs for hotel	

Appendix 5.3 - Participants list

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Appendix 5.4
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	WORKING GROUP 1	**WORKING GROUP 2**
Facilitator	Ted Osius/Soetikno Sastroutomo	Greg Sherley
Rapporteur	Soetikno S. Sastroutomo/Clare Shine	Maj de Poorter/Dick Mack
Notetaker	Laura Meyerson	Alenka Remec
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	Warren Geeves (Australia)	Tania Temata (Cook Islands)
	Poona Samuel (Cook Islands)	Mike Pitzler (Guam)
	Russell Campbell (Guam)	Lyle Wong (Hawai'i)
	Morgan Wairiu (Solomon Islands)	Pene Agadio (Nauru)
	Michael Buck (Hawai'i)	John Bungitak (Marshall Islands)
	Frederick Muller (Marshall Islands)	Abdul Moeed (New Zealand)
	Jackson Philip (Micronesia)	Manny Pangelinan (Northern Mariana Islands)
	Crispina F. Konelio (Niue)	Tarita Holm (Palau)
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	Lloyd Loope (U.S.G.S. Hawai'i)	Lu Eldredge (Bishop Museum)
	Warea Orapa (SPC)	Cynthia Mackie (Gordon & Betty Moore Foundation)
	Alan Saunders (Cooperative Islands Initiative)	Dana Roth (U.S.Department of State)
	Carly Vynne (Conservation International)	
	Liz Dovey (SPREP)	

Appendix 5.5
Poster abstracts

Eradication of Wedelia Species

Plant Protection Service, Department of Agriculture, Tuvalu Group
E-mail: Lelix_George@yahoo.com

Wedelia (*Wedelia trilobata*) is an invasive noxious weed that was introduced into Tuvalu in the early 1990's as an ornamental plant for gardens. It is also considered a serious IAS in Samoa, Fiji Islands, Cook Islands, Niue, and many other Pacific island countries.

Wedelia is a fast growing creeper with attractive, green, glossy leaves, and small yellow flowers. It rarely produces seed, but grows easily from cuttings and each small piece of stem can develop into a plant. It rapidly escapes from gardens to roadsides and plantations, where it can overgrow plants and develop into thick cover. Regular slashing or mowing will not kill the weed, but helps to spread it further. *Wedelia* can be controlled only by removing the whole plant by hand, or repeated spraying with a herbicide.

Wedelia was first found near the air field and outside the prison on Funafuti Island, but has now spread to other islands such as Vaitupu, Nanumea, and Nui. It is likely that people have taken cuttings from these areas to grow in their gardens and along roadsides, which explains the rapid spread of this weed.
If the weed becomes established in plantations, it will compete with our crops for nutrients, light, and water, and reduce crop yield. Also it will be a place for rats to reproduce. If *Wedelia* is not eradicated now, it will become a serious weed pest in Tuvalu, and have a negative impact on our agriculture, livestock, forestry and environment.

The Department of Agriculture, therefore, has to start a campaign to eradicate this weed from our island, and we need your support to successfully eradicate *Wedelia* from Tuvalu.

Keywords: controlled , eradicated, impact

Biological Control Against Coconut Scale

A.J. Dabek, Plant Protection Adviser(CFTC), Department of Agriculture, Tuvalu Group;
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Coconut scale (*Aspidiotus destructor*) is an IAS that was introduced into one of the island in Tuvalu called Nanumaga in 1994. How this pest manage to reach an isolated island in the Central Pacific several hundred kilometres from the nearest known source of the scale is problematic. Almost certainly, however, it was transported to Nanumaga on infested plant material by human means from a foreign country (possibly Fiji or Nauru) in breach of quarantine regulations. None of the other eight Tuvaluan islands/atolls became infested up to this year.

Coconut scale rapidly and severely infested range of plants hosts in 1994 including coconut, breadfruit, pawpaw, banana, pandanus, frangipani, even the principal food security crops, pulaka (*Cytosperma chamissonis*) and taro.

Coconut palms which affected by the pest become extensively yellowed, necrotic and will gradually wither. This is due to the toxic saliva of the scale which is injected into the frond tissues as the numerous individual insects feed on them. It is quite probable that at least some of the most heavily infested palms will die, an outcome often observed with younger palms.

Coconut scale can be controlled by the using of biological control, in particular the introduction of ladybird (coccinellid) beetles predatory on the scale insect.

If the scale spread to any of the other Tuvaluan islands/atolls, it will be a very big problem to the Tuvaluan people, as our crop yield will reduce. If coconut scale is not eradicated now it will become a serious insect pest in Tuvalu and have a negative impact on our agriculture, livestock, forestry and environment.

The Department of Agriculture therefore has to ensure that principles of quarantine and their significance should now be promulgated to the Tuvaluan people to increase awareness and the Quarantine Service given a heightened public profile.

Keywords: infested, controlled, eradicated

Building an Invasive Species Committee: From Grass Roots to Established Foundation

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An Invasive Species Committee (ISC) is a voluntary partnership of government, private and nonprofit organizations, and concerned individuals working to exclude, contain, and control the most IAS in order to conserve native biodiversity and minimize adverse ecological, economical, and social impacts. In Hawai'i, a combined, state-wide effort has been implemented, by county, to address the unique concerns that threaten these oceanic islands.

To develop a ISC, groups need to: 1) identify and prioritize incipient invasive plant and animals and 2) develop and adopt a unified mission statement and the action plan, including specific objectives and methodologies.

Partnerships with government agencies, private and nonprofit organizations, and concerned individuals prove to be the supporting backbone of an ISC. These partnerships, as they develop, bring funded support to help implement common goals.

Success of an ISC depends on realistic goals, efficient reporting, and an annual review of endeavors. Both failures and successes can be shared on a state-wide basis to aid in an effective fight against IAS.

Hawai'i's Emergency Environmental Work Force Program: Implementing Invasive Alien Species Control Projects Statewide

Laura Hillis and Kim Tavares, Big Island Invasive Species Committee, 16 E. Lanikaula St., Hilo, HI 96725, USA; Tel: 808-974-4140; FAX: 808-974-4148; Email: miconia@aloha.net

In October 2001 the Hawai'i State Legislature passed a bill to establish the Emergency Environmental Workforce (EEWF) for individuals who lost their jobs because of Hawai'i's recent economic downturn since the terrorist attacks of September 11. The EEWF was similar to Franklin D. Roosevelt's Civilian Conservation Corps in which unemployed workers during the Great Depression were hired by the federal government to clean land, construct trails and build public facilities. EEWF workers would help eradicate environmentally harmful IAS. Three specific environmental goals were cited by the Legislature: 1) Isolate the spread of Dengue fever by reducing mosquito breeding areas; 2) Eradicate the Miconia (*Miconia calvescens*) plant and other invasive plants that threaten to destroy native forests; and 3) Reduce coqui frog (*Eleutherodactylus coqui*) and little fire ant (*Wasmannia auropunctata*) populations. The Legislature appropriated $1,500,000.00, employing approximately two hundred twenty-five (225) workers between December 2001 and June 30, 2002. The large majority of these funds were used to pay workers' wages, because the EEWF worked within the infrastructures of existing environmental programs, such as the Invasive Species Committees (ISC's). All participating agencies reported excellent results working with EEWF crews, and are very grateful for the support that the State provided.

Keywords: Hawai'i, policy, jobs

Development of an Internet Map Server to Assist Conservation Partners in their Efforts to Fight Invasive Weeds and Pests

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The Hawai'i Natural Heritage Program is developing a web site with Internet map server, allowing users to access current incipient non-native species location information on the web. The site allows the user to display the distribution of the top incipient alien species per Hawaiian island as defined by the Invasive Species Committees (ISCs). HINHP is currently working with each ISC, the Hawai'i Ecosystems at Risk program (HEAR), Bishop Museum, and the United States Geological Survey's Biological Resource Division to define the specific database and information needs of this collective management effort. A prototype web site is currently accessible to conservation partners to assist land managers in their efforts to track and control IAS in Hawai'i. Current capabilities include overlay analysis, buffering tools, and database search tools. HINHP is also developing mapping procedures which will help to ensure data integrity for all alien species mapping efforts in the state.

HINHP is part of the Center for Conservation Research and Training at the University of Hawai'i. This project is made possible through major funding from the Pacific Basin Information Node(PBIN), a regional information node of the United States National Biological Information Infrastructure (NBII).

Keywords: non-native, map, ArcIMS

Quarantine, Interdiction, and Rapid Response: The Blueprint for an Effective Brown Tree Snake Prevention Program

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The Brown Tree Snake (BTS, *Boiga irregularis*) is an IAS on Guam and its outliers that continues to severely threaten Pacific island economies and ecological resources. The BTS is believed to spread from island to island primarily in cargo shipments. Despite extensive BTS quarantine, inspection, and interdiction programs on Guam and complementary interdiction programs in the Commonwealth of the Northern Mariana Islands (CNMI), 56 probable BTS sightings have been reported on Saipan, CNMI since 1982. Of these sightings, 11 BTS's have been captured and fully documented, possibly indicating an incipient population on Saipan. The USGS-based Interagency Rapid Response Team has therefore been developed to respond to BTS sightings. Individually quarantine, interdiction, and rapid response programs are limited by available control techniques and these are constrained by logistic and political limitations. However, collectively these programs represent the most effective approach for preventing BTS introductions. We will suggest short and long-term strategies that would constitute a comprehensive BTS Interdiction Program for biogeographic regions at risk.

Keywords: *Boiga irregularis*, Brown Tree Snake, interdiction programs

History and Status of Miconia (Miconia calvescens) Control and Mapping on Maui

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From first discovery of miconia (*Miconia calvescens*) in a botanical garden in 1988 on the island of Maui, knowledge of *Miconia* distribution and resources devoted to control have steadily increased. Recent partnership developments and increases in support from federal, state, county, and private entities have dramatically increased the level of miconia invasion knowledge and the scope of control work. Maui Invasive Species Committee currently serves as the hub of information on *Miconia* control. Using mapping grade GPS units to collect both spatial and tabular information on *Miconia* control efforts, and combined with existing background data, a *Miconia* GIS (Geographic Information System) has been created. This GIS is used not only to track and report on previous efforts, but has become a decision-making tool guiding strategy development and control work efforts, both on the ground and in the air. In 2002, Haleakala National Park initiated several new measures supporting *Miconia* operations. With an estimated 30,000 acres of potentially infected forest on Maui and the promise of a massive air and ground control effort, GIS will continue to play a crucial role as new technologies will enable crews to edit data real time and managers to schedule control efforts in the most efficient and effective manner possible.

Keywords: *Miconia calvescens,* Hawai'i, GIS

The Role of the Department of Land and Natural Resources – Division of Forestry and Wildlife in Managing Invasive Alien Species

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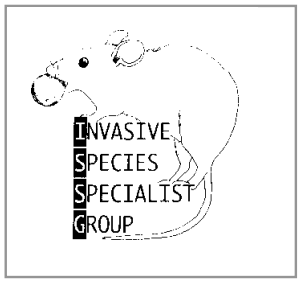
The Hawai'i Department of Land and Natural – Division of Forestry and Wildlife manages 800,000 acres of public land for watershed protection, forestry, conservation, public hunting and recreation. The Division was formed 99 years ago to address the loss of forests to land uses, feral animals and their resultant impact on the state's water supply for agriculture and human consumption. Current efforts to address invasive species include funding Invasive Species Committees and landscape level Watershed Partnerships. The urban forestry program is working with the horticulture industry and the US Forest Service to develop a weed risk assessment to prevent new invasive alien species from being introduced through forestry or the nursery trade. Predator control of rats, cats, and mongoose occurs in natural areas that support rare and endangered native birds and in coastal areas that support seabird colonies. Introduced game mammals and birds are managed through public hunting programs and funding fencing and control projects to exclude animals from conservation areas.

Keywords: Hawai'i, regional government, policy

Appendix 5.6
Red imported fire ant letter



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16th October 2002

The Hon. Warren Truss
Minister for Agriculture, Fisheries and Forestry
Parliament House
Canberra ACT 2600
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Dear Mr Truss

We were recently attendees at an Austral-Pacific regional meeting of the Global Invasive Species Programme at Bishop Museum, Honolulu, Hawai'i, 15-17 October 2002. We had discussions at the meeting of the very ominous threat to our island nations by the Red Imported Fire Ant (*Solenopsis invicta,* RIFA), arguably the world's worst ant pest. This ant is now established in California and Queensland, source areas for a large quantity of the goods (and people with baggage) that come by airplane or ship to our countries. We are certain that without concerted efforts RIFA will in the near future invade many if not most Pacific islands, just as it has invaded Caribbean islands from Florida over the past 20 years.

Many of our islands lack native ants, and our endemic species are already threatened by predation by invasive ants. We suspect that our islands are more vulnerable to damage by RIFA than most other locations in the world. We expect that if RIFA comes it will severely damage our countries' biodiversity, agriculture, tourism, human health, and quality of life. Since our people live so close to and depend on the land for their livelihood, we are especially concerned about the misery that RIFA may bring to them.

We have written to the United States Department of Agriculture asking for substantial help in dealing with this potentially huge problem.

(continued…….)

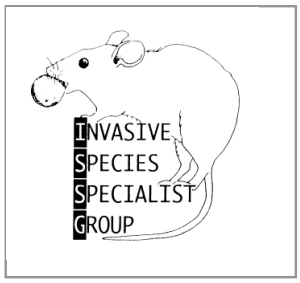
Specifically, we requested enhanced surveillance and pre-clearance certification of all vectors (e.g. nursery stock, agricultural machinery, construction equipment, used cars) of significant RIFA risk departing the continental United States for Pacific islands (including Hawai'i).

We would like to request help from Australia as well. We applaud the vigorous efforts underway in Queensland to contain RIFA and wish Queensland and Australia well in this extremely important endeavour. Nevertheless, we would appreciate any early warning and protection your country could give in the event that containment fails locally. Thank you for any help you can give us.

Sincerely,

Alan Saunders
Coordinator, Islands Initiative, Invasive Species Specialist Group

Participants at the Austral-Pacific Regional Workshop on Invasive Alien Species, Bishop Museum, Honolulu, Hawai'i, 15-17 October, 2002, included representatives from the Secretariat of the Pacific Community, the South Pacific Regional Environment Programme, World Conservation Union (IUCN), IUCN's Invasive Species Specialist Group, CAB International, Conservation International, the Gordon and Betty Moore Foundation, The Nature Conservancy, the Pacific Science Association, and the Global Invasive Species Programme, and national representatives from American Samoa, Cook Islands, Federated States of Micronesia, Fiji, Guam, Hawai'i (USA), Marshall Islands, Nauru, New Zealand, Niue, Northern Mariana Islands, Palau, Samoa, Solomon Islands, Tokelau, Tonga, and Vanuatu.



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16th October 2002

«FirstName» «LastName»
«JobTitle»
«Company»
«Address1»
«Address2»
«City»
«Country»

Dear Mr «LastName»

We were recently attendees at an Austral-Pacific regional meeting of the Global Invasive Species Programme at Bishop Museum, Honolulu, Hawai'i, 15-17 October 2002. We had discussions at the meeting of the very ominous threat to our island nations by the Red Imported Fire Ant (*Solenopsis invicta,* RIFA), arguably the world's worst ant pest. This ant is now established in California, the source area for a large quantity of the goods (and people with baggage) that come by airplane or ship to our countries. We are certain that without concerted efforts RIFA will in the near future invade many if not most Pacific islands, just as it has invaded Caribbean islands from Florida over the past 20 years.

Many of our islands lack native ants, and our endemic species are already threatened by predation by invasive ants. We suspect that our islands are more vulnerable to damage by RIFA than most other locations in the world. We expect that if RIFA comes it will severely damage our countries' biodiversity, agriculture, tourism, human health, and quality of life. Since our people live so close to and depend on the land for their livelihood, we are especially concerned about the misery that RIFA may bring to them.

We would like to make a plea for assistance in avoiding this fate. We appreciate the vigorous efforts underway in California to contain RIFA. Nevertheless, we fear outgoing goods and products from the U.S. infected with RIFA. Can the United States Department of Agriculture provide us with substantial help in dealing with this potential problem?

(continued……)

Ideally, we would most appreciate enhanced surveillance and pre-clearance certification of all vectors (e.g. nursery stock, agricultural machinery, construction equipment, used cars) of significant RIFA risk departing the continental United States for Pacific islands (including Hawai'i). We will be grateful for any help you can give us.

We are sending a similar letter to the Ministry of Agriculture, Forestry and Fisheries in Australia, which has recently been infected with RIFA and now poses a threat to us from the other side of the Pacific.

Sincerely,

Alan Saunders
Coordinator, Cooperative Islands Initiative
Invasive Species Specialist Group

Participants at the Austral-Pacific Regional Workshop on Invasive Alien Species, Bishop Museum, Honolulu, Hawai'i, 15-17 October, 2002, included representatives from the Secretariat of the Pacific Community, the South Pacific Regional Environment Programme, World Conservation Union (IUCN), IUCN's Invasive Species Specialist Group, CAB International, Conservation International, the Gordon and Betty Moore Foundation, The Nature Conservancy, the Pacific Science Association, and the Global Invasive Species Programme, and national representatives from American Samoa, Cook Islands, Federated States of Micronesia, Fiji, Guam, Hawai'i (USA), Marshall Islands, Nauru, New Zealand, Niue, Northern Mariana Islands, Palau, Samoa, Solomon Islands, Tokelau, Tonga, and Vanuatu.