

Guidelines for Invasive Species Management in the Pacific



*A Pacific strategy for managing pests, weeds
and other invasive species*



SPC
Secretariat
of the Pacific
Community



Secretariat of the
Pacific Regional
Environment
Programme

KEY TERMS, CONCEPTS & ACRONYMS

Most terms, concepts and acronyms used in this document are defined at first mention in the text. The following occur frequently and are defined here for ease of reference. Terminology for invasive species has not been standardised internationally, and some of the terms below are defined in the specific context of the Pacific islands.

biocontrol or biological control: Controlling an invasive species by introducing a natural enemy, such as an insect or fungus, that specifically attacks the target species and does not attack other native or economically important species.

biosecurity: Sometimes used to include all aspects of invasive species management, but in this document used in the more restricted sense of preventing the spread of invasive species across international or internal borders, including between islands.

containment: Keeping an invasive species within a defined area.

control: Reducing the population of an invasive species.

effective management: Achieving operational success (e.g. reducing the pest to defined levels) and desired outcomes (reduced impact and recovery of impacted values) of invasive species management.

introduced species: Plants, animals and other organisms taken beyond their natural range by people, deliberately or unintentionally.

invasive species: *Introduced species* that become destructive to the environment or human interests; can also include some *native species* that proliferate and become destructive following environmental changes caused by human activities.

monitoring: Programmes to detect change, e.g. in the distribution of invasive species, the success of management projects etc.

native species: Plants, animals and other organisms that occur naturally on an island or in a specified area, having either evolved there or arrived there without human intervention.

region: When not otherwise qualified, means the Pacific Ocean, with specific reference to the island states and territories members of SPC and SPREP.

surveillance: In this document, defined as *monitoring* to detect the arrival of new incursions of invasive species.

Acronyms

GISD: Global Invasive Species Database
NBSAP: National Biodiversity Strategy and Action Plan
PIER: Pacific Island Ecosystems at Risk (website)
PII: Pacific Invasives Initiative
PILN: Pacific Invasives Learning Network
SPC: Secretariat of the Pacific Commission
SPREP: Secretariat of the Pacific Regional Environment Programme

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WHAT ARE THESE GUIDELINES AND HOW DO I USE THEM?

This document lists the essential components of a comprehensive and effective invasive species management programme. It has been compiled in consultation with Pacific island countries and territories, to support them in developing their invasive species work, and to guide regional and international agencies in providing assistance to them.

In order to facilitate reference and planning, the objectives are grouped into a logical arrangement of nine main Thematic Areas in three sections. All nine Thematic Areas must be taken into account in order to achieve an effective invasive species programme, whether national or regional.

- These Guidelines are intended to be comprehensive and therefore contain many objectives, but **it is not suggested that any country or agency needs to carry out everything.**
- **Not all of the objectives will be necessary for every agency or programme.** Some are appropriate for implementation at a national or local level, while others require international cooperation or are more suitable for implementation by regional or international agencies. Each agency can select the objectives that are considered important for its own programme.
- **These Guidelines may be used as an aid in planning and designing any invasive species programme,** at a local, national or regional level, to ensure that key aspects relevant to any given situation or programme are not forgotten.
- The objectives have not been prioritised, because priorities and immediate needs will differ in different countries and territories. **The Guidelines are intended to facilitate prioritisation** by each country, territory or agency, rather than to set priorities for them.

IF YOU WORK FOR AN INTERNATIONAL OR REGIONAL AGENCY OR NGO, use these Guidelines to help you to:

- Identify your niche for invasive species work in the Pacific.
- Identify priority needs that require action by your agency.
- Identify other agencies with whom you could or should coordinate your work.

IF YOU WORK FOR A NATIONAL OR LOCAL INSTITUTION, use these Guidelines to help you to:

- Identify and prioritise areas needing action within your jurisdiction.
- Design your invasive species strategy and plan your work programme.
- Determine how to coordinate your work with other countries and regional organizations, and benefit from their experience and assistance.

THE INVASIVE SPECIES PROBLEM

“Invasive species” (often called pests and weeds), are plants, animals and other organisms taken beyond their natural range by people, deliberately or unintentionally, and which become destructive to the environment or human interests. Pacific islands are particularly vulnerable to invasive species, because of their isolation and relatively recent human occupation. Pacific island species have not evolved to cope with the impacts of predators, herbivores, insect pests, highly competitive weeds, and diseases brought in from continental areas. Invasive species are responsible for the extinction of more island native species than any other cause. This is exacerbated by the fact that small island states often have limited human, material and financial resources available to tackle such threats.

The movement of plants, animals and other organisms beyond their natural range is rising sharply, due to increased transport, trade and travel. Many species that are introduced to new places by people do not cause problems in their new locations, and many have considerable benefits for economies, including in agriculture, horticulture and forestry. However, invasive species are those that become established and proliferate in ways that threaten biodiversity, natural resources, food security, economic development, human health, and ecosystem services such as water resources, nutrient cycles, erosion and fire regimes. They include vertebrate animals (e.g. rats, goats, cats, mongooses, mynas, fish etc.), invertebrate pests (e.g. snails, slugs, nematode worms, mosquitos, beetles and other insects etc.), weedy plants (trees, vines, shrubs, grasses, seaweeds etc.), and pathogens (e.g. fungi, bacteria and viruses that cause plant, animal or human diseases). They affect agriculture, aquaculture, fisheries, forestry and tourism, reduce land values, damage buildings, obstruct waterways, disrupt trade and transportation, and cause or transmit diseases of humans, animals and crops.

RATIONALE AND HISTORY OF THESE GUIDELINES

Invasive species are an international problem, so their efficient and effective management in the Pacific requires a comprehensive approach and coordinated action by national and territorial governments, the private sector, local communities and regional agencies. To facilitate this, SPREP was commissioned by its member countries to develop an invasive species strategy for all countries and relevant agencies in the region. A Draft Invasive Species Strategy for the Pacific Islands Region (hereafter the “Draft Strategy”) was published in 2000, following a regional workshop, consultations and technical reviews. It was intended for use only until 2004 and was not intended to be comprehensive, excluding all but nominal mention of some important issues, such as marine invasives and the socio-economic impacts of invasive species.

The *Draft Strategy* recognized the following aspects of the problem and outlined measures to address them:

- Shortage and inaccessibility of information on invasive species and best practice management
- Lack of awareness of the impacts of invasive species
- Insufficient networking, coordination and collaboration
- Inadequate legislation, regulations, cross-sectoral policies, and enforcement
- Shortage of trained personnel and inadequate facilities
- Insufficient funding

The *Draft Strategy* proved useful in guiding regional efforts to tackle invasive species. However, it was recognized that a revision was needed to address its lack of comprehensiveness and lack of a monitorable action plan, to incorporate lessons learnt from recent projects and initiatives, and to address new invasive species threats and emerging issues such as the effects of climate change on invasive species. The process of producing a revision began in 2006, in response to a request from SPREP member countries and territories at their annual meeting. Open discussions were held at Pacific Invasives Learning Network (PILN) meetings in 2006 and 2007, and at the Conference of the Roundtable for Nature Conservation for the Pacific Islands in October 2007, as well as at numerous regional and national meetings. Drafts were

circulated in 2007–8 to an informal advisory group of more than 100 people, including the Roundtable's Invasive Species Working Group and representatives of countries, territories and regional agencies, many of whom contributed comments and suggestions.

This document has been produced at the request of the Pacific countries and territories that are members of the Secretariat of the Pacific Community and the Secretariat of the Pacific Regional Environment Programme. It is intended to help them address the serious problem of invasive species, one of the major threats to livelihoods and biodiversity across the region, to which small island states and territories are especially vulnerable. These Guidelines were endorsed by the 19th meeting of SPREP Council in September 2008 and the meeting of SPC Heads of Agriculture and Forestry, the same month.

FOCUS, PRINCIPLES AND FRAMEWORK

The present document addresses invasive plants, animals, diseases and other organisms, in marine, freshwater and terrestrial environments, and including economic and social impacts. It takes the seven main themes identified in the *Draft Strategy* (Information, Awareness, Infrastructure, Protocols, Legislation, Funding, Linkages), adds others, and organises them all into a logical structure, founded on the following principles:

- Not all introduced species are invasive, and action should be prioritised to deal first with those currently causing, or with potential to cause, the most harm.
- In order to maximise effectiveness and value for money, invasive species risk assessment, prioritisation and management must be based on good science.
- The “precautionary principle” should be applied to the management of introduced species. Where scientific knowledge is insufficient to assess accurately either the risk of a species becoming invasive, or its present or future impact, it should be assumed that impacts will occur and action should be taken to prevent the species spreading or becoming established.
- A hierarchical approach to managing invasives should be adopted, in the following order of priority:
 1. Prevention is more effective and cheaper than management of established invasives, so exclusion of invasives by border control is the first line of defence.
 2. Eradication is more effective and cheaper in the long run than permanent control of a pest population, so eradication should be considered where feasible.
 3. Species that cannot feasibly be eradicated should be considered candidates for biological control.
 4. Species that cannot feasibly be eradicated or controlled biologically, especially species whose value to people prevents the use of biocontrol, should be contained within delimited areas where feasible.
 5. Permanent control of an established pest population by chemical and/or physical methods should normally be considered the last resort approach, where eradication, biological control and containment are all deemed not feasible with current or achievable resources.

The present *Guidelines* aim to provide a comprehensive framework for invasive species management in the Pacific for the foreseeable future. As such, they do not have a defined lifespan, since the nine thematic areas

and their objectives are required permanently for the management of the invasive species threat. However, an Invasive Species Action Plan for the Pacific will also be developed by the Pacific Invasives Partnership (which is the invasive species working group of the Roundtable for Nature Conservation in the Pacific Islands), containing specific activities to be carried out or initiated during its limited lifespan, which will align with the interval between conferences of the Roundtable. The first Action Plan will run to 2012, with the intention that a new Action Plan will be produced on completion of each preceding one. The Action Plan will permit progress on the adoption and implementation of these *Guidelines* to be monitored.

These *Guidelines* are designed to be compatible with relevant international, regional and national conventions and strategies, and to coordinate their application where appropriate. Some of the most important global instruments covering invasive species issues include the Convention on Biological Diversity and its current Island Programme of Work, the Cartagena Protocol on Biosafety, the International Plant Protection Convention, the International Convention for Control and Management of Ships' Ballast Water and Sediments, and the Global Strategy on Invasive Alien Species. Relevant regional strategies include the Pacific Action Strategy for Nature Conservation, the Pacific Plan, the regional strategy on Shipping-Related Introduced Marine Pests in the Pacific islands (SRIMP-PAC) and the SPC Land Resources Division Strategic Plan. Relevant national strategies include National Biodiversity Strategies and Action Plans (NBSAPs), National Invasive Species Strategic Action Plans, National Biosafety Frameworks and National Development Strategies.

Native invaders?

Some "invasive" species may be native to an island, and their invasive behaviour is caused by other disturbances (see definition of invasive species inside front cover). An example is *Merremia peltata* (Chuuk *fidau*; Cooks *kurima*; Fiji *veliyana*, *wa bula*; Guam *lagun*; Kosrae *pala*; Niue *fue kula*; Palau *kebeas*; Pohnpei *ceul*, *iohl*; Samoa *fue lautetele*; Solomons *kwalo ambui*; Tahiti *pohue*; Tonga *fue mea*; Yap *wachathal*), a vine whose original range is not well understood. It may have been carried by early voyagers from SE Asia to Polynesia, but it could be native to at least some Pacific islands. But whether introduced or not, it is a serious invader of natural habitats. It needs full sun for part of its life-cycle, so normally invades only open areas. Its status as an invasive species is therefore partly a result of forest clearance by people. *Merremia* can smother forest edges and invade forest clearings created by logging or by natural events like cyclones. It also invades plantations and is a serious weed of forestry. So, even though it may be native in parts of the Pacific, its invasive behaviour is due at least partly to disturbance of natural habitats by people. It can prevent regeneration of natural forest once it has invaded, so it often requires managing to reduce both ecological and economic impacts.



Right: *Merremia peltata* in American Samoa (photo: Jill Key)

GOAL

To assist Pacific island countries and territories in planning the effective management of invasive species, thereby reducing the negative impacts of invasives on their rich and fragile natural heritage, communities and livelihoods.

These Guidelines aim to:

- Establish a comprehensive framework for all invasive species work in the Pacific
- Address all problem areas and facilitate prioritisation
- Increase action and improve implementation
- Increase efficiency, increase cooperation and reduce duplication
- Guide the work of international and regional agencies, including donors
- Guide the development of country programmes
- Guide strategic and local fundraising

THEMATIC AREAS

A. Foundations

- A1. Generating Support** — Raising awareness of the impacts of invasive species on biodiversity, the economy, human health and socio-cultural values, and generating support for action to manage and reduce them.
- A2. Building Capacity** — Developing the institutions, skills, infrastructure, technical support, information management, linkages, networks and exchanges required to manage invasive species effectively.
- A3. Legislation, Policy and Protocols** — Ensuring that appropriate legislation, protocols, policies and procedures are in place and operating, to underpin the effective management of invasive species.

B. Problem Definition, Prioritization and Decision-making

- B1. Baseline & Monitoring** — Establishing a baseline of information on the status and distribution of invasive species and a programme for detecting change, including range changes and emerging impacts.
- B2. Prioritization** — Establishing effective systems for assessing risk and prioritising invasive species for management.
- B3. Research on priorities** — Understanding priority invasives, including species biology and impacts, and developing effective management techniques.

C. Management Action

- C1. Biosecurity** — Preventing the spread of invasive species across international or internal borders.
- C2. Management of established invasives** — Reducing or eliminating the impacts of established invasive species, by eradication, containment, exclusion, or population reduction by physical, chemical or biological control.
- C3. Restoration** — Restoring native biodiversity or ensuring recovery of other values, after invasive species management.

A. Foundations

A1: GENERATING SUPPORT

Raise awareness of the impacts of invasive species on biodiversity, economies, livelihoods and health, and generate support for action to manage and reduce them.

Justification

Decision makers, the private sector and the general public have limited understanding of the threats posed by invasive species to the environment, economies, human health and cultural values. Invasive species management must compete for funding with many other interests. Lack of awareness, support and funding are key constraints limiting the effectiveness of invasive species management in the Pacific. Active public engagement and adequate financial investment are critical to successful invasive species management. There is a need to increase support for this work, develop shared responsibility, and foster individual efforts and voluntary compliance.

Aim

All strands of society, including funding agencies, decision-makers, economic and other interest groups (agriculture, forestry, horticulture, fisheries, aquaculture, tourism, shipping, public health, military, quarantine) and the general public, are convinced of the importance of invasive species risks and impacts, and of the benefits of invasive species management for biodiversity, the economy and human health, and actively support invasive species management. Sufficient resources are available to enable all national and regional invasive species priorities to be addressed.

Pigs and grasses: highly damaging to island ecosystems but valued by Pacific peoples

Pigs are an example of an introduced species that is extremely damaging to the natural environment and has (for example) contributed to the extinction of some Pacific island birds. However, pigs are also a highly valued source of food. Although such a species may be maintained in captivity for food, or for its cultural or socio-economic value, it should not be allowed to invade natural areas and must be managed or removed from such areas where it has invaded. Owners of pigs should keep them penned, and not allow them into natural or semi-natural areas.

Similarly, many pasture grasses are highly invasive in natural ecosystems, but farmers depend on them as food for their stock animals. However, their spread out of farmed areas should be prevented. Grass seed and plants should never be moved between islands without a full risk assessment being carried out.

Management of species like pigs and grasses is an example of “containment” management (see pages 5 and 19).



Above: Pigs and invasive pasture grasses (photos: Jill Key and Alan Tye).

OBJECTIVE A1.1: Develop awareness raising programmes and materials for key regional, national, sectoral and community target groups, including curriculum development for the formal education sector.

Specific objectives:

- A1.1.a Identify priority audiences for awareness programmes.
- A1.1.b Collate existing surveys of awareness baselines and carry out further surveys where necessary.
- A1.1.c Identify priority messages and understandable, convincing approaches for raising awareness with different target groups.
- A1.1.d Incorporate invasive species issues into existing public awareness programmes where appropriate.
- A1.1.e Incorporate invasive species into primary, secondary, tertiary and adult education.

OBJECTIVE A1.2: Ensure national support by mainstreaming invasive species issues with national and regional decision-makers.

Specific objectives:

- A1.2.a Demonstrate the potential economic costs of specific potentially invasive species in the region and the necessity of adequately financing effective biosecurity and rapid-response plans.
- A1.2.b Demonstrate the economic costs of existing invasive species problems in the region and the economic benefits of financing action to manage them.
- A1.2.c Publicise successes in invasive species prevention and management, including cost/benefit analyses.
- A1.2.d Ensure the inclusion of invasive species issues in high-level regional and national meetings.
- A1.2.e Develop mechanisms to factor invasive species management into national and regional decision-making processes on trade and transport, economic development and land use planning.
- A1.2.f Develop mechanisms to include the emergency management of new incursions of invasive species into national and regional disaster management planning and funding.

OBJECTIVE A1.3: Identify and develop long-term external funding mechanisms for the support of invasive species management in Pacific island countries and territories.

Specific objectives:

- A1.3.a Use these Guidelines and accompanying Action Plans to identify priority actions and seek strategic funding from external donors.

OBJECTIVE A1.4: Secure support for invasive species issues among local communities.

Specific objectives:

- A1.4.a Ensure long-term local commitment and sustainability by promoting full participation of local communities and councils in all aspects of invasive species management, including collection of information, awareness raising, identifying priorities, preventing the introduction and spread of invasive species, and project development, management, implementation and evaluation.
- A1.4.b Encourage priority projects identified by processes involving full community participation.

A2: BUILDING CAPACITY

Develop the institutions, skills, infrastructure, technical support, information management, networks and exchanges required to manage invasive species effectively.

Justification

The ability to manage invasive species in the Pacific depends on competent national and regional institutional structures and ready access to adequate infrastructure, equipment, skills, and accurate up-to-date information. Compared to the scale of the problem, there is a lack of trained personnel, strategic planning, infrastructure and equipment, and technical, taxonomic and information backup, for managing invasive species in the Pacific. Invasive species workers are often isolated from colleagues in other agencies and countries, and from the information and skills necessary to plan and achieve their management objectives. Much information on the biology, impacts and control of invasives is in unpublished local reports or even unwritten. Training, information services, networking and skill sharing are thus of paramount importance for the effective management of invasive species in the region.

Aim

Key agencies collaborate and have sufficient, adequately trained staff. Communities have the capacity to participate fully in invasive species management. Sufficient infrastructure and equipment for quarantine and management are available. Sufficient identification services exist, linked effectively to those who require their services. Information on invasive species biology, impacts and management is readily available throughout the Pacific. These developments render the management of invasive species in the Pacific efficient and effective, with a strong scientific basis for decision-making, resource allocation, prediction of the impacts of invasive species introductions, and management.

OBJECTIVE A2.1: Establish and maintain competent regional support and coordination for invasive species management in Pacific island countries and territories.

Specific objectives:

- A2.1.a Maintain the Pacific Invasives Partnership under the auspices of the Roundtable for Nature Conservation in the Pacific Islands as a permanent regional invasive species coordinating and monitoring body, to monitor and evaluate the implementation of these Guidelines and accompanying Action Plans.
- A2.1.b Establish and maintain a system of technical advice and support based on a regional register of invasive species experts and their expertise.
- A2.1.c Establish and maintain an adequate coordination and collaboration mechanism between key regional agencies, including SPREP, SPC, PII and PILN.
- A2.1.d Review and strengthen staffing capacity in key regional agencies.
- A2.1.e Establish and promote regional and sub-regional cooperative initiatives for invasive species management (such as PII, Micronesia Challenge, Micronesia Regional Invasive Species Council).
- A2.1.f Establish and maintain regional resource centres for specific invasive species services (e.g. bio-control, risk analysis, information management).

OBJECTIVE A2.2: Strengthen and maintain competent national and territorial institutions and staffing, to coordinate and manage invasive species programmes and promote full participation, including by local communities, in invasive species management.

Specific objectives:

- A2.2.a Establish and maintain national and territorial invasive species committees, with multi-agency representation and focal points, and with mechanisms to link the committees with senior decision-makers and with community representatives.
- A2.2.b Develop guidelines regarding key skill areas, responsibilities and resources that should be represented in or available to the main invasive species management agencies in countries and territories.
- A2.2.c Review and strengthen national staffing capacity at all levels.

OBJECTIVE A2.3: Develop national invasive species strategies and action plans.

Specific objectives:

- A2.3.a Develop national invasive species strategies that supplement NBSAPs, using sound planning methods and these Guidelines, in a fully consultative process including all levels from national government to local communities.
- A2.3.b Incorporate economic principles into national invasive species strategies, including public investment when invasive species management yields public benefits, and the user-pays principle where benefits are more specific to certain sectors.
- A2.3.c Develop national invasive species action plans to address specific problems identified in national strategies e.g. for priority species, pathways and vectors, vulnerable sites, ecosystems, etc.

OBJECTIVE A2.4: Promote existing training programmes and develop new ones to cover all aspects of the invasive species management process, from planning and fundraising to dissemination of lessons learnt.

Specific objectives:

- A2.4.a Review training that has been delivered in recent years and identify important gaps and target groups.
- A2.4.b Produce guidelines for a range of training methods and content for different target groups, including formal courses, participation in demonstration projects, etc.
- A2.4.c Design and implement a regional invasive species training plan, incorporating repeat training at intervals reflecting staff turnover rates in countries and agencies and post-training capacity development mechanisms.

OBJECTIVE A2.5: Develop and upgrade regional and national facilities for invasive species management.

Specific objectives

- A2.5.a Review regional and national invasive species management facilities and produce long-term development plans.
- A2.5.b Strengthen essential regional and national facilities such as inspection and quarantine stations and rapid response centres.
- A2.5.c Develop and promote links to regional and international institutions providing facilities unavailable within individual countries, such as biocontrol or rapid-response facilities.

OBJECTIVE A2.6: Develop regional and national taxonomic support for invasive species management

Specific objectives:

- A2.6.a Develop and strengthen national and regional species reference collections.
- A2.6.b Develop and strengthen linkages with taxonomic institutions and experts within and outside the region, such as BioNet and Pacinet.

OBJECTIVE A2.7: Develop regional information resources on invasive species, including internet-based information systems, which are easily accessible both within and outside the region.

Specific objectives:

- A2.7.a Establish and maintain a regional database of invasive species projects, including technical information, objectives, results, outcomes and lessons learnt.
- A2.7.b Support the further development and maintenance of global information resources, such as the Global Invasive Species Database (GISD), Global Register of Invasive Species and Global Biodiversity Information Forum as key repositories of global invasive species information useful for the Pacific.
- A2.7.c Develop and maintain regional information resources, such as the Pacific Islands Ecosystems at Risk (PIER) web site, the Pacific Pest List Database and the SPREP Information Resource Centre, as services for information circulation and supply.
- A2.7.d Encourage input of Pacific information to regional and international information resources, such as PIER and GISD.
- A2.7.e Develop a comprehensive database of pesticide information, including legal status per country.

OBJECTIVE A2.8: Strengthen and maintain networks of expertise, resources, linkages meetings, workshops and exchanges between countries, territories, scientific institutions and other sources of technical and research assistance, that facilitate communication, cooperation and information sharing between invasive species workers.

Specific objectives:

- A2.8.a Support and strengthen global, regional and sub-regional invasive species networks, exchanges and skill-sharing mechanisms, such as the Aliens-I listserver, PILN, Pestnet, Pacific Ant Prevention Programme and the Micronesia Regional Invasive Species Council.

A3: LEGISLATION, POLICY AND PROTOCOLS

Ensure that appropriate legislation, policies, protocols and procedures are in place and operating, to underpin the effective management of invasive species.

Justification

Invasive species have economic, environmental, social and cultural impacts, so their management can involve many different agencies working to different pieces of legislation and procedures. Responsibilities and laws may be unclear, inadequate or incompatible. Compliance and enforcement are also often inadequate. Adequate, consistent legislation, agreed protocols, general compliance and effective enforcement are vital for coordinated, effective action. Some laws and protocols exist and only need promoting, implementing or enforcing, while other situations require new or strengthened laws and protocols.

Aim

All countries work within a consistent legislative framework, aligned with regional and international instruments. Protocols are mutually agreed and sufficiently similar throughout the Pacific that all those involved in the management of invasive species achieve efficient and effective cooperation. Legislation and procedures are widely understood, generally complied with, and enforced.

OBJECTIVE A3.1: Develop, promote and adopt an effective policy and legal framework for invasive species management in the Region.

Specific objectives:

- A3.1.a Review environmental, fisheries, agricultural, aquacultural, forestry, horticultural and biosecurity legislation in each Pacific country and territory to determine their adequacy for protecting biodiversity, economies and health against invasive species, identifying gaps, inconsistencies and conflicts.
- A3.1.b Develop, disseminate and adopt practical legislative guidelines covering all activities that affect invasive species management, including export-import, trade, transport, construction, military activities, emergency response, development assistance, research, aquaculture, horticulture, agriculture, tourism, surveillance, risk analysis, biocontrol, eradication, declaration of noxious pests etc., using best principles including these Guidelines and international standards.
- A3.1.c Ensure the full participation by all stakeholders, including local communities, in the development and implementation of legislation.
- A3.1.d Incorporate economic principles into national legislation for addressing invasive species including appropriate taxes, the user-pays principle, and public investment when invasive species management yields public benefits.
- A3.1.e Develop mechanisms to improve compliance with and enforcement of invasive species legislation.

OBJECTIVE A3.2: Develop and promote sound policies and effective, standardised protocols derived from consistent legislation and aligned with applicable international requirements, for invasive species management in the region, based on sound scientific information and management principles.

Specific objectives:

- A3.2.a Periodically review existing national and regional policies and procedures to manage trade, movement, holding, release into the environment, establishment and management of invasive species.
- A3.2.b Develop model technical protocols and procedures for the Pacific, enabling countries to use best practice in developing or modifying their internal procedures.

OBJECTIVE A3.3: Ensure full Pacific participation in the development of international standards, conventions and programmes that govern or affect invasive species issues, including movement in commerce, to ensure that they reflect the Pacific's needs.

Specific objectives:

- A3.3.a Promote membership of and contributions to international conventions, committees and working groups by Pacific countries and agencies.
- A3.3.b Ensure that national and regional contributions to international policy-making are consistent and based on full consultation between all concerned sectors.

Join the regional invasives information network and link to regional invasives services

The Pacific Invasives Learning Network (PILN) was launched in 2006. PILN runs an email information and linkage service for all invasive species workers in the Pacific, which anyone can join by writing to <piln@sprep.org>. In addition to providing a professional network for invasive species workers, PILN carries out a number of activities



Above: PILN meeting, Mo'orea, French Polynesia, 2007

with individual countries and territories in the region. PILN promotes and assists with the formation of national invasive species committees or teams, with each team having a comprehensive membership of all agencies with responsibility for any aspect of invasive species management in their country or territory. PILN also manages an exchanges and training scheme, to assist Pacific invasives workers to gain skills and experience at training workshops or by exchange visits to related projects managed by colleagues in other islands. Finally, PILN acts as a linkage to other regional invasive species services that can be provided by NGOs and similar agencies, including the Pacific Invasives Initiative (PII), which can assist with project design, monitoring and evaluation, as well as providing training, professional expertise, and a range of tools for invasive species management. Further information can be found at <www.sprep.org/piln>.

B. Problem Definition, Prioritization and Decision-making

B1: BASELINE AND MONITORING CHANGE

Establish a baseline of information on the status and distribution of invasive species in the Pacific and a programme for detecting change, including range changes and emerging impacts.

Justification

Lack of information on the status and distribution of invasive species and potentially invasive species in the region hampers their management. Information on the status and distribution of invasive species and of native biodiversity is essential for monitoring the movement and impacts of invasives, for prioritisation of species for management, for planning effective management projects and for evaluating their success. Monitoring is also essential for detecting trends and emerging threats such as the effects of climate change on invasive species.

Aim

Knowledge of the status and distribution of invasive species and native biodiversity in the region is adequate and readily available, facilitating prioritisation, planning and effective management. Effective systems are in place for monitoring the movement of invasive species within and between countries and islands, and for monitoring management outcomes.

OBJECTIVE B1.1: Generate, update and make available status and distribution information and checklists of invasive and native species for all member countries and territories.

Specific objectives:

- B1.1.a. Periodically review existing species information and checklists, identify gaps (ecosystems, countries or taxonomic groups) and plan priority surveys.
- B1.1.b. Carry out priority surveys and compile status and distribution information resources, including checklists and geographic information systems, for priority gaps.
- B1.1.c. Publish available information locally and online, including in the resources listed under A2.7 above.

OBJECTIVE B1.2: Monitoring invasive species movement between countries, territories and islands, at ports and other entry points. This is biosecurity surveillance, and is covered under Objective C1.4 below.

OBJECTIVE B1.3: Design and promote a series of standard techniques for monitoring the spread of invasive species within islands.

Specific objectives:

- B1.3.a. Identify priority species for immediate monitoring in each country and territory.
- B1.3.b. Design and promote a series of standard techniques for monitoring the spread of invasive species within islands, in sensitive natural areas and other high-risk sites.
- B1.3.c. Draw up and implement individual monitoring plans.

B2: PRIORITIZATION

Establish and implement effective systems for assessing risk and prioritizing invasive species for management.

Justification

Most countries and territories contain large and increasing numbers of species introduced from other places by people, either deliberately or accidentally. Some of these are known to have serious impacts, while others do not, and many are valuable crops, ornamentals etc. Perhaps the largest group is species that are not yet causing problems in a given country but which may become invasive in the future, including recently introduced species. Risk analysis, including weed and pest risk assessment and pathway analysis, has three main functions: to determine which species may become serious problems, among the total of introduced species already present in a country; to determine whether to permit or refuse the introduction of a new species into a country, territory or island; and to determine the importance of pathways for the introduction of known pests.

Aim

Countries and regional planners are able to determine invasive species risks as objectively as possible, using effective decision tools to prioritise management. Resources are dedicated to the species causing the most damage or posing the greatest risks.

OBJECTIVE B2.1: Design, develop and implement simple and effective invasive species risk assessment and prioritisation systems throughout the Pacific.

Specific objectives:

- B2.1.a Design and promote model risk assessment systems for all invasive taxa, which can be applied to both import control decision-making and to planning the management of established invasive species.
- B2.1.b Develop databases of key invasive species which can be imported into standardised risk assessment systems and adapted for use in different island territories.
- B2.1.c Apply effective species and pathway risk assessment to both import control decision-making and to planning established invasive species management in all countries and territories.

B3: RESEARCH ON PRIORITIES

Understanding priority invasives, including research on species biology and impacts, and development of effective control techniques.

Justification

Prioritisation identifies species for immediate management action, but may also identify species for which further research is needed in order to refine prioritisation, such as research on possible impacts. Effective management requires an understanding of the target species' ecology and population dynamics. Effective techniques for managing a species may not exist and will then need to be developed. Acquiring the necessary knowledge for effective management thus requires species-focused research. Research is also required to improve management practice, based on better evaluation of management outcomes.

Aim

Invasive species managers have access to the information necessary for designing effective management projects for priority species.

OBJECTIVE B3.1: Carry out research on the impacts, ecology, biology and control of high priority invasive species.*Specific objectives:*

- B3.1.a Develop regional and national invasive species research plans based on objective prioritisation.
- B3.1.b Investigate the environmental, economic and other impacts of invasive species whose impacts are unconfirmed but suspected to be serious.
- B3.1.c Investigate the ecology, biology and population dynamics of priority invasive species.
- B3.1.d Review current knowledge of management techniques for high priority invasive species and develop effective techniques where necessary.
- B3.1.e Develop best practice procedures for prevention, eradication, control and restoration projects.

Why use Risk Assessment? — Predict impacts and use money wisely.

Risk Assessment is used to answer several different questions.

Some of these are border control/quarantine questions, such as:

- Someone proposes to introduce a new ornamental plant or crop species. Do you permit it to enter?
- What pathways need managing to prevent known pests in a neighbouring country from entering your island?

While questions about managing established introduced species include:

- You have 500 introduced plant species in your country, and you know the top 10 invaders. But which of the many plants in people's gardens might become the next problem?

Risk Assessment systems permit you to predict impacts of a species before they take place, so you can decide to refuse permission to bring a species into an island, or you can decide to try to eradicate a species that is already there, which has not yet become a problem but probably will in the future if it is left unmanaged. So Risk Assessment = species prioritization and prediction — it allows you to evaluate invasiveness and impact of a species, or risk of impact, before a problem gets bad, and allows you to act while it is still affordable. So Risk Assessment = rational use of resources.

Beneficial invaders?

Can invasive species be beneficial? Many introduced species are beneficial to people, such as crops, but once they become invasive they are, by definition, causing problems (see definitions inside front cover). Some invasives are still valuable to people (see box on pages 8–9), but do any invaders have environmental benefits?

The general answer is no, except where they compensate in some way for another kind of environmental damage caused by people. Examples of this include biocontrol agents, substitutes for extinct species, or in highly degraded ecosystems.

Biocontrol agents are species introduced deliberately to control other invasive species. They are usually natural enemies of the pest back in its area of origin. Animals introduced for control of pests have often become pests themselves, like myna birds, cane toads, cats, mongooses, and the flatworm that has been taken around the Pacific in misguided attempts to control Giant African Snail. General predators like these should never be used as biocontrol agents. Only very specific agents like fungi or insect parasites, which attack only the target species, should be used, and only after laboratory testing to prove they are specific.

Ecological substitutes are a new concept and have not been widely used yet. One example is the introduction of Giant Tortoise species to islands in the Seychelles and Galapagos, to replace extinct Giant Tortoises that were essential for maintaining native vegetation. In a similar way, the shrub *Leucaena leucocephala* (Cooks *mara'inu*; Fiji *vaivai*; Kiribati *te kaitetua*; Micronesia *tangan-tangan*; Nauru *bin*; Niue and Samoa *fua pepe*; Tonga *siale mohohe*) provides ground cover and can reduce erosion in badly degraded landscapes, but is highly invasive itself and its benefits should be regarded as temporary, until better efforts to restore native forest can be made, such as is happening in projects in Fiji, Guam and elsewhere.

So, invaders do not normally bring environmental benefits, and any benefits they do bring should be regarded as temporary solutions, or last resort substitutes to maintain an ecosystem where a key native species has gone extinct.



Left: *Leucaena leucocephala* on Naviti Island, Fiji (photo: Alan Tye)

C. Management Action

C1: BIOSECURITY

Prevent the spread of invasive species across international or internal borders.

Justification

Preventing the passage of species across borders is the most cost-effective way of managing the threat they pose. Costs per species are lower for prevention than for management of established invasives, and prevention avoids impacts of a species whereas control is usually implemented only after impacts have occurred. Prevention works by identifying pathways and establishing four barriers: 1) Pre-export control aims to prevent the export of known pests from places where they are established, to other islands; 2) Pre-border control regulates importation to an island or country; 3) At-border control aims to prevent the arrival of species on-island; 4) Post-border rapid response (immediate eradication) aims to eliminate newly-arrived pests before they can spread far beyond the point of arrival. An effective biosecurity system must include all four elements. Rapid response is cheaper the sooner an arrival is detected, while numbers are small. Rapid response requires a surveillance programme, tested response plans in place, and resources ready for action.

Aim

Effective systems are in place throughout the Pacific to regulate intentional introductions and to detect and manage unauthorised or accidental introductions across borders.

OBJECTIVE C1.1: Pre-export control. Develop and implement improved inspection, treatment, packing and transportation procedures and methods, for transport leaving countries and islands harbouring priority invasive species.

Specific objectives:

- C1.1.a Promote the development and implementation of stronger international standards governing control of potentially invasive species at export, with particular attention to the main trading partners of Pacific countries.
- C1.1.b Review export inspection procedures directed at specific priority invasive species and identify gaps.
- C1.1.c Develop and implement adequate export controls directed at preventing the export of specific priority invasive species.

OBJECTIVE C1.2: Pre-border control. Implement a rigorous process of risk analysis in relation to the deliberate introduction of species and the movement of potential carrier goods between countries, and between islands within a country.

Specific objectives:

- C1.2.a Establish and implement national and internal (inter-island) risk and impact assessment for proposed deliberate movements of species and for the movement of goods that may accidentally carry invasive species.
- C1.2.b Facilitate a common, regional approach to decision-making on proposed introductions, including on the categorization of species as (1) low-risk, (2) minimally restricted “permitted” species, (3) moderate-risk “restricted” species and (4) high-risk “prohibited” species, and the automatic prohibition of any organism or good not included on the permitted or restricted lists.

OBJECTIVE C1.3: At-border control. Establish and maintain effective quarantine, transport and border control systems at national borders and between islands within countries.

Specific objectives:

- C1.3.a Review existing border controls, transport controls and quarantine systems to identify gaps in country or pathway coverage (movement of ships, planes, people, other organisms, goods etc) and technical or resource constraints.
- C1.3.b Develop and implement adequate border controls and terrestrial and marine quarantine control systems throughout the Pacific.

OBJECTIVE C1.4: Post-border rapid response. Establish and maintain effective systems to detect incursions of invasive species reliably and quickly, and mount rapid responses to them.

Specific objectives:

- C1.4.a Review existing port and border surveillance and rapid response arrangements and identify national, island or taxonomic gaps.
- C1.4.b Develop and implement adequate surveillance systems at island entry points throughout the Pacific, using a series of standard techniques.
- C1.4.c Develop a regional information centre for monitoring the spread of invasive and potentially invasive species and make available status and distribution updates from islands.
- C1.4.d Develop and implement model contingency plans for managing different kinds of newly arrived pest species and carry out field trials.

C2: MANAGEMENT OF ESTABLISHED INVASIVES

Reduce or eliminate the impacts of established invasive species, by eradication, biological control, containment or physical-chemical control.

Justification

For management of invasive species that are established in a country or island, a hierarchical approach to choice of management goal is adopted. (1) Eradication (complete removal of the species from an island), if feasible, is the preferred goal, since management cost is minimal after eradication is achieved, although continued surveillance is required to ensure that re-invasion does not occur. (2) If assessment shows that eradication is not feasible with available resources, then biological control should be considered because, if successful, it also requires minimal further investment. (3) Species that cannot feasibly be eradicated or controlled biologically, especially species whose value to people prevents the use of biocontrol, should be contained within delimited areas or excluded from important areas, where feasible. (4) Permanent control of an established pest by chemical or physical methods requires permanent investment, so should be considered the last resort option. In order to ensure value for investment, all management projects should monitor operational effectiveness (success in achieving pest control) and outcomes (success in protecting biodiversity or other values) and disseminate results to allow improved future management practice.

Aim

Impacts of established invasive species are reduced or eliminated by means of effective eradication, bio-control, containment/exclusion, or chemical-physical control.

OBJECTIVE C2.1: Develop and implement decision tools to assist in choice of management goal and technique.

Specific objectives:

- C2.1.a Design and adopt decision tools for management planning throughout the region, to assist in choice of management goal based on determination of the feasibility and costs of different management options, and to ensure the efficient use of limited management resources.

How to choose a management goal?

As a manager, once you have selected your target species, either because its impacts are already obvious or because you have used risk assessment (see page 15) to identify it, then you must decide on your management goal. Is the objective to eradicate the species completely from the island? Is that possible (= how much would it cost)? If not, is the species a potential target for biological control? Do you just want to keep the species out of high-biodiversity areas such as a national park? Or if the species is already widespread and common, do you just want to reduce its population and impacts in certain places such as on farms or in national parks?

To choose between these options, consider the following:

1. Eradication. If the impacts of the species exceed the benefits of having it on your island, determine if it can be eradicated completely from the island. An eradication programme may be expensive, but it is a one-off cost and afterwards the cost of the pest and its management reduce to near-zero. Also, the predictability of eradication success and the calculation of its cost can be done very reliably these days, at least for mammals and plants.

2. Biocontrol. If the species is a plant or insect that is not highly valued locally, consider if biological control is an option. This can be used to control some invasive but useful plants too, as it only reduces their competitiveness and impact—it does not eliminate them. Biocontrol requires using only very specific control agents (like fungi or insect parasites) that attack only the target species. General predators like flatworms, myna birds, cane toads, cats and mongooses should never be used for biocontrol because they can cause extinction of native animals and they usually do not control the pest because they have too much alternative food available. Safe biocontrol agents are known for some pests and weeds and may be relatively cheap to use. But if no known agent exists for the pest species, an expensive research programme will be required to find one.

3. Long-term management. If eradication and biocontrol are not feasible for your target, then define the management goal more precisely. Why do you want to manage it (i.e. what damage is it causing and where)? Do you need to manage only in certain areas? Once these questions have been answered you can make two decisions in order to achieve management goals: (1) choose the best techniques and (2) decide where to use them. Techniques include hunting, trapping, baiting, manual control of invasive trees and bushes, herbicides, pesticides and many others. Using these options implies permanent costs, and the level of control that can be achieved depends on the annual budget available.

Right: Leaf damage to invasive *Miconia calvescens* seedlings caused by a fungal biological control agent in Tahiti. This can kill the seedlings and reduces the competitiveness of adult *Miconia* trees enough to allow native plants to recover. (photo: Alan Tye)



OBJECTIVE C2.2: Design and implement effective management programmes appropriate for each species and situation, and incorporating best-practice standards.

Specific objectives:

- C2.2.a Design all management projects to best-practice standards based on latest information and with full participation of all concerned, and incorporating adequate monitoring of results and evaluation of success.
- C2.2.b Design and implement eradication projects for species in situations where eradication is judged feasible with accessible resources.
- C2.2.c Design and implement effective biological control projects for appropriate species, especially widely-distributed species that are difficult to manage by other means.
- C2.2.d Design and implement containment or exclusion projects for species in appropriate situations, including containment for useful but invasive plants such as crops, and exclusion from sites of exceptional conservation value.
- C2.2.e Design and implement effective physical/chemical control projects for appropriate situations, especially high-value sites invaded by a variety of introduced species.

C3: RESTORATION

Remedial action to restore native biodiversity or ensure recovery of other values, following invasive species management.

Justification

Sometimes, control of an invasive species is followed by rapid and adequate recovery of the native ecosystem or of the economic or cultural value affected by the target species. But in some cases, populations of native species may fail to recuperate or other unforeseen adverse consequences may occur, such as invasion by other introduced species. In such cases additional intervention may be required to assist the recovery of native biodiversity or to ensure recovery of economic or other values. This may include specific restoration projects for individual native species, or management of additional invasive species.

Aim

Native species and ecosystems and other impacted values recover adequately following invasive species management.

OBJECTIVE C3.1: Design and implement restoration projects to ensure that invasive species management projects achieve their ultimate goal, be it recovery of native species and ecosystems, economic value or other value.

Specific objectives:

- C3.1.a Ensure that all invasive species management programmes are accompanied and followed by long-term monitoring and evaluation of outcomes.
- C3.1.b Where further intervention is identified as necessary to achieve full recovery of biodiversity or other values following invasive species management, design and implement restoration projects or follow-up invasive species management projects as required.

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