

DRAFT

**NATIONAL  
INVASIVE ALIEN  
SPECIES  
IMPLEMENTATION  
ACTION PLAN**

July 2004 – June 2007

Addressing  
**“Theme 6 - Biosecurity”**  
of the  
*National Biodiversity Strategy & Action Plan*

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**ACRONYMS**

AGO	Office of the Attorney General
CC	Chamber of Commerce
DEC	Division of Environment and Conservation
EIA	Environmental Impact Assessment
MOH	Ministry of Health
IAS	Invasive alien species
IRATC	Import Risk Assessment Technical Committee
MESC	Ministry of Education, Sports and Culture
MFAT	Ministry of Foreign Affairs and Trade
MNRE	Ministry of Natural Resources and Environment
MOA	Ministry of Agriculture
MWCSD	Ministry of Women, Community and Social Development
MWTI	Ministry of Works, Transport and Infrastructure
NBSAP	National Biodiversity Strategy and Action Plan
NIASIAP	National Invasive Alien Species Implementation Action Plan
NGO	Non Governmental Organisations
PASWG	Public Awareness Specialist Working Group
PWG	Prevention Working Group
SAA	Samoa Airport Authority
SPA	Samoa Port Authority
SPREP	South Pacific Regional Environment Program
SUNGO	Samoa Umbrella for Non Governmental Organisations
TSC	Technical Sub-Committee
UNDP	United Nations Development Programme

## INTRODUCTION

In 2001, the Government of Samoa released the *National Biodiversity Strategy and Action Plan* (NBSAP) for the conservation and sustainable development of the country's biological resources. The NBSAP identifies invasive alien species (IAS) as being one of the greatest threats to Samoa's biodiversity. The National Invasive Alien Species Implementation Action Plan (NIASIAP) addresses this threat, building on the actions identified in 'Theme 6 – Biosecurity' of the NBSAP, as well as elements of Themes 1, 2, 3 and 7, and pursuing the following objective:

*To protect Samoa's native biodiversity from the impacts of invasive alien species, through effective border control and quarantine, and the development and implementation of effective eradication and management programs.*

A few necessary changes have been incorporated since the adoption of the NBSAP, including a change in the definition of invasive alien species and a broadening of the scope of this document by addressing economic and social impacts, along side the environmental impacts.

### **What are invasive alien species?**

*Invasive alien species are species introduced into an area in which they do not occur naturally, usually as a result of human activities, and which threaten environmental or economic resources, or human health, due to the damage they cause, or are likely to cause.*

IAS addressed in this action plan include plants, animals, diseases and parasites within marine (including ballast water and sessile species), freshwater and terrestrial environments.

Genetically Modified Organisms are identified as potential IAS in the NBSAP, however they are not addressed in this action plan. They are addressed separately by a Biosafety Framework Project under the Division of Environment and Conservation (DEC), of the Ministry of Natural Resources and Environment (MNRE).

### **Invasion pathways**

The means by which a new IAS enters Samoa is known as an 'invasion pathway'. Natural pathways include wind and ocean currents, and through the use of morphological (eg. flight) or behavioural (eg. population budding by some ant species) dispersal mechanisms. However, with increasing global trade and travel, humans are now believed to be the key vector for new invasions (GISP 2000). There are two major categories of human-made pathways:

**Intentional introductions** – species introduced deliberately for the purpose of agriculture, fisheries and forestry production, or as garden plants, pets, or biological controls. For example, the common myna bird, *Acridotheres tristis*, was introduced to control ticks on cattle and is now itself an IAS.

**Accidental introductions** – species introduced unintentionally, such as in ships ballast water, on people's clothing and luggage, or as contaminants on equipment and in imports. For example, the giant African snail arrived in Samoa via ship cargo, and has since spread across Upolu. With over 240 trips to Samoa per year by merchant ships (carrying mainly containerised cargo), as well as cruise liners, warships, yachts and fishing vessels, and over 4000 international flights per year between Samoa and other Pacific or Pacific rim countries carrying thousands of people and baggage, there is significant potential for accidental introductions (Green, 2003). The pathways that have the greatest potential for accidental introductions to Samoa are the sea and air links with New Zealand and American Samoa due to the frequency of movement between these countries, and the extensive use of Pago Pago by international fishing fleets and the US Navy (Green, 2003).

## The 'invasives' problem in Samoa

The impacts of IAS are immense, costly and usually irreversible. Impacts can range from adversely affecting the productivity and subsequent economic output of primary industry, such as agriculture, forestry and fisheries, to impeding cultural practices and traditions, and threatening the integrity and biodiversity of natural ecosystems, including vital ecosystem processes.

The devastating impact of IAS on the environment, production systems (crops), and social values of Samoa has been witnessed through invasions of taro leaf blight, the giant African snail (*Achatina fulica*) and merremia vine (*Merremia peltata*).

Taro leaf blight not only devastated Samoa's staple food source, but also decimated farmers' incomes from local and overseas markets. Taro production in Samoa dropped by over 95% (Chan, 1995), and the export value fell from \$US 3.2 million in 1993 to only \$US 53,000 one year later (IPGRI, 2002). The costs were much greater though, with the loss of a major food source for many families, and significant financial outlay to support attempts to address the problem using fungicides and changing cultural practices, which ultimately failed. Significant resources continue to be invested in the research and release of blight-resistant taro varieties to rebuild production capacity in Samoa. However, taro crops now face a new threat, the Taro beetle, which is spreading eastward in the Pacific from Fiji, Papua New Guinea, Solomon Islands and Vanuatu (SPC, 2003).

Merremia vine and mile-a-minute (*Mikania micrantha*), both notoriously aggressive species and among the top 30 invasive plants in the Pacific (SPREP, 2000), are widespread and causing significant damage in Samoa. Although the economic costs have not been quantified, the impacts of these vines via the rapid colonisation of disturbed sites, inhibiting the growth of crops and the regeneration of native vegetation (including secondary growth) following forestry operations and other disturbance events, is clearly visible and of concern to the community and government. Further research is necessary into the true extent of the distribution and impacts of these vines.

The giant African snail has also been a conspicuous invader over the past decade, rapidly spreading across Upolu with adverse impacts on vegetable and root crops, and garden and native plants. Formal research has not been undertaken, however it is likely that the snail has also modified natural habitat and competed with native snails for resources. The snail population appears to have declined since the introduction of a flatworm, *Platydemus manokwari*, however evidence of a direct relationship between the two has not been established, and there is concern that this indiscriminate predator may also become invasive and cause the extinction of many native snails, as has occurred in at least Hawaii (USFWS, 2003) and Guam (Hopper and Smith, 1992).

The above examples illustrate the extensive impacts of just a few of the many species that are known to be invasive in Samoa. One can only imagine the collective impacts of these and other IAS, such as crazy ants (*Anoplolepis gracilipes*), myna birds (*Acridotheres tristis* & *A. fuscus*), the red-vented bulbul (*Pycnonotus cafer*), feral\* pigs (*Sus scrofa*) and cats (*Felis catus*), rats (*Rattus spp.*), and potential IAS such as tilapia (*Oreochromis spp.*), in addition to the many invasive plants of agricultural and environmental concern (Attachment 4), including:

- Merremia (fue lautetele, *Merremia peltata*);
- Mile-a-minute weed (fue saina, *Mikania micrantha*);
- Koster's curse (la'au lau mamoe, *Clidemia hirta*);
- Silktree (tamaligi ena'ena, *Albizia chinensis*);
- Navua sedge weed (tuise tele, tuise fiti; *Kyllinga polyphylla*);
- African rubber tree (pulu vao, *Funtumia elastica*);
- Mint weed (vao mini, *Hyptis pectinata*);
- Leucaena (fua pepe, *Leucaena leucocephala*);
- Torvum weed (lapiti; *Solanum torvum*);
- African tulip tree (fa'apasi, *Spathodea campanulate*).

\* a domesticated or captive animal that has escaped into the wild

Space and Flynn's (2002) study of invasive plant species of environmental concern also identified a further 106 plant species that are common, weedy, or cultivated in Samoa and which may become invasive in the future, based on their behaviour on other Pacific islands.

As alarming as this is, the reality is that due to limited documentation and research of IAS to date, there is an inadequate knowledge base of the true extent of IAS and their impacts in Samoa. One of the priority actions to be achieved under the NIASIAP is an inventory of IAS, including their past, present and potential future distribution and impacts.

Yet, the problem extends beyond the IAS that have already invaded Samoa, to the many species that may invade in the future, particularly with increasing international trade. Free trade laws may also pose a threat by influencing quarantine policy.

Space and Flynn (2002) identified a further 264 plant species (highest priority species detailed in Attachment 5) which are invasive on other Pacific islands and pose a threat to Samoa. This list includes such species as the purple plague, *Miconia calvescens*, which is purported to be the most destructive invasive plant in the Pacific. It has become a dominant canopy tree over large areas of Tahiti, severely affecting the dynamics of natural ecosystems, threatening the survival of several endemic species, and contributing to landslides (ISSG, 2003).

The aggressive brown tree snake (*Boiga irregularis*) which has been nominated by the Invasive Species Specialist Group as being among the top 100 of the world's worst invasive alien species (ISSG, 2003), is also a significant threat due to its notorious ability to stowaway in cargo. With up to 12,000 snakes/square mile in Guam, the brown tree snake has had devastating environmental and economic impacts (Fritts & Leasman-Tanner, 2001). It has caused the extinction of nearly all native forest birds, and is expected to have a similar impact on native lizards. It also preys on chickens, eggs and pet animals, and causes frequent and costly power outages. The snake is also mildly venomous and known to attack babies and young children (Fritts & Leasman-Tanner, 2001).

The experience of other Pacific islands, particularly Hawai'i, reveals a daunting prospect for Samoa's future if significant preventative steps are not taken against potential IAS. IAS are now Hawaii's key environmental problem, incurring significant costs through direct losses of agricultural and horticultural crops, limited export markets for local produce, and degradation of watersheds. IAS are also the primary threat to native wildlife, with 43% of Hawaii's bird species now endangered (TNCH & NRDC, 1992).

It is widely recognised that once IAS become established they are extremely difficult to eradicate, therefore prevention is the first and best line of defence, and also the most cost-effective (GISP, 2000). Through the efforts of the Ministry of Agriculture (MOA), import risk assessment procedures have been developed to assess the invasive potential of new introductions, and an Emergency Response Plan has been drafted to ensure a rapid response to the detection of new invasions. These are significant steps that are further reinforced by the NIASIAP.

### **Development of the Action Plan**

IAS were identified as a priority management theme in the NBSAP. Consequently, DEC took the lead in developing a national implementation action plan for IAS. Recognising that a response to the serious issue of IAS requires a cooperative approach, the action plan has been developed through a widely consultative process, incorporating the views of stakeholders through the establishment of a National Invasive Alien Species (NIAS) Steering Committee.

The NIAS Steering Committee represented the commitment of over thirty organisations including government agencies, non-government organisations, regional organisations, community groups, and donors representing stakeholders who have a role in preventing or reducing the impacts of IAS.

Meetings of the NIAS Steering Committee over the past two years<sup>1</sup>, and a workshop held in August 2003, culminated in the development of this action plan. Three AusAID-funded volunteers (Australian Youth Ambassadors for Development program) working within DEC assisted throughout the process, and the workshop drew on the IAS experience of a consultant.

### **Guiding Principles**

The Guiding Principles outlined in the NBSAP are complemented by the following principles for the purposes of this action plan:

- **Precautionary Principle**

The precautionary principle advocates a 'prevention rather than cure' approach to decision-making, which involves acting to avoid serious or irreparable potential damage, despite lack of scientific certainty of the likelihood or extent of that damage.

- **Ecosystem Approach**

The integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way, and recognises that humans are an integral component of ecosystems.

- **Beneficiary pays**

The action plan recognises that in principle the beneficiary should pay for services for which the government currently absorbs the cost. For example, the cost of risk assessments of new species proposed for introduction to Samoa is the responsibility of the person proposing the introduction.

### **Structure of the Action Plan**

The NIASIAP is based on four key elements:

- Developing a strategic approach to the management of established IAS;
- Improving the knowledge and understanding of key stakeholders of IAS and their impacts;
- Preventing the introduction and establishment of potential IAS; and
- Fostering regional and international cooperation and collaboration.

As identified in the NBSAP, actions such as these need to be supported by building, at all levels, the capacity of government, the community and other agencies to better prevent and manage the risk of IAS, such as through appropriate training and providing adequate resources. This is an important element highlighted throughout the action plan.

### **Implementation of the Action Plan**

The NIASIAP sets the framework and identifies the key actions that need to be undertaken to effectively assess and manage the threat and impacts of new and existing IAS. The actions have been prioritised, with timeframes and identification of the lead agency/group and relevant partners that will be involved in implementation.

It is intended that the action plan be owned and driven by the Samoan community. This is a living document, to be reviewed annually and revised every three years through a consultative process, and will therefore continue to evolve over time.

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<sup>1</sup> The NIAS Steering Committee has now ceased, with the Technical Sub-Committee now reporting to the National Biodiversity Steering Committee.

## **Roles and Responsibilities**

MNRE is the key government agency responsible for facilitating the implementation and monitoring of the action plan. The Technical Sub-Committee (TSC), chaired by MNRE and involving representatives of key stakeholders, will drive the coordination of the NIASIAP and report to the National Biodiversity Steering Committee.

However, all stakeholders, including regional and local NGOs, Government agencies, private businesses and the general community, play an important role in preventing and managing IAS, and it is intended that they will be actively involved in the implementation of this action plan.

A number of key groups have specific roles and responsibilities in relation to the implementation of the NIASIAP, as outlined below:

### **Technical Sub-Committee –**

- coordinate the implementation of the action plan, including prioritisation and delegation of actions, and dispersal of available resources;
- provide technical advice to the National Biodiversity Steering Committee on issues pertaining to IAS; and
- monitor and review the progress of implementation, and direct future work and outcomes.

### **Government Departments –**

Each relevant Government department is to support and actively participate in the implementation of the NIASIAP, commensurate with their mandate:

- develop the necessary and appropriate legislative framework to provide for the prevention, control and management of IAS;
- develop effective policies and programs;
- provide leadership, coordination and resources for research, assessment, management, education and public awareness relating to IAS;
- promote consultation and a participative approach to the implementation of the NIASIAP.

### **Local NGOs –**

- contribute knowledge and skills to the development and implementation of actions under the NIASIAP;
- represent members' interests;
- provide information to members and the broader community;
- facilitate the participation of communities in relevant actions; and
- support community initiatives through the provision of funding and guidance.

### **Regional and international NGOs and intergovernmental organisations –**

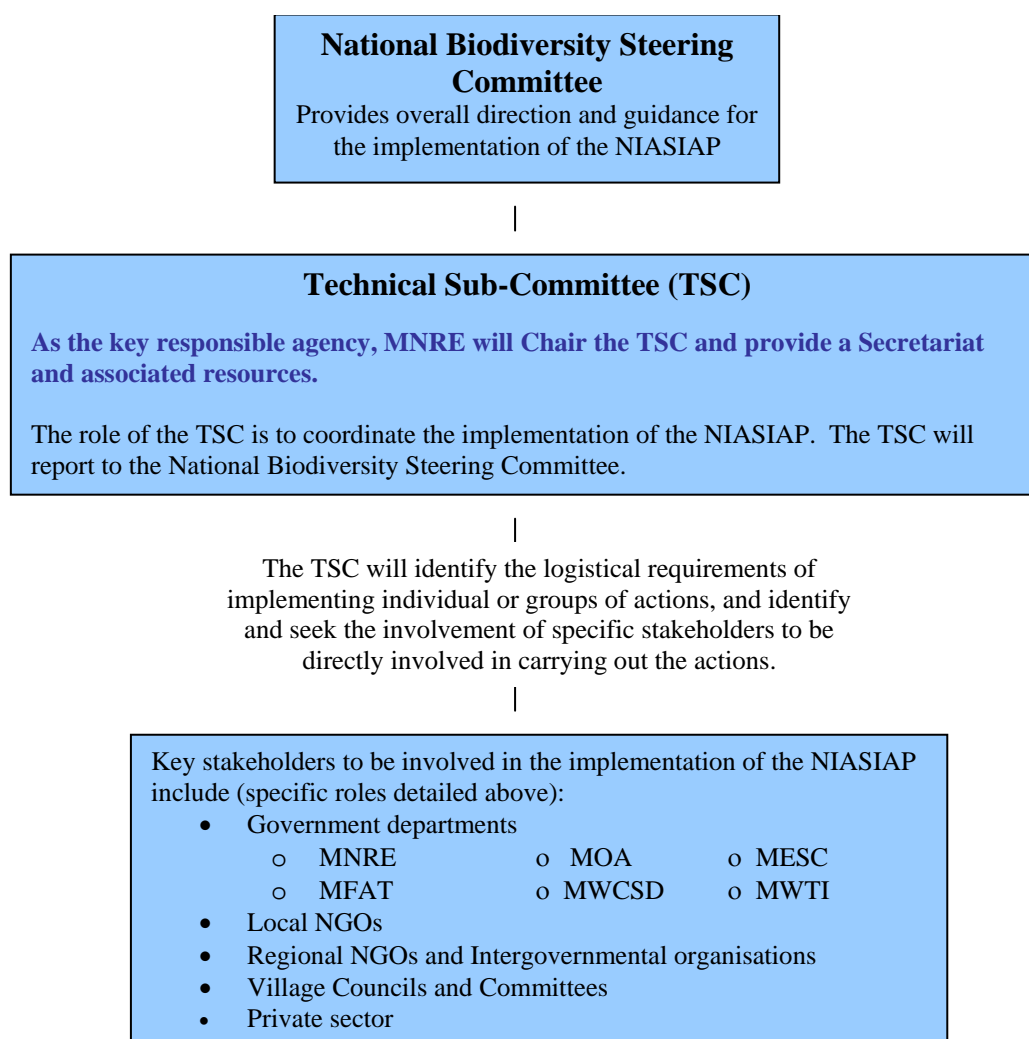
- contribute knowledge and skills to the development and implementation of actions under the NIASIAP;
- share relevant information, research, technical capacity and other resources that will assist Samoa in addressing the issue of invasive alien species; and
- support local initiatives through the provision of funding and guidance.

### **Village Councils and Committees –**

- detect and report new invasions;
- contribute their knowledge and skills to the development and implementation of eradication or management programs;
- initiate and facilitate the participation of villages in local management initiatives; and
- raise awareness and education in relation to IAS.

### **Private Sector**

- revise relevant processes and procedures to minimise the risk of introducing or further spreading AIS; and
- work with Government agencies and other relevant stakeholders to address the IAS problem.

**Figure 1. Linkage between key committees and stakeholders**

## **Securing Resources**

Adequate resources, in the form of funding, personnel and infrastructure, is one of the most crucial elements to the success of this action plan. Among the activities already funded by local budgets are quarantine services under the MOA, and MNRE has provided for the development of a Biodiversity database and field research of management techniques for *Merremia*, and will also provide for administration of the forthcoming Environmental Impact Assessment requirements under the *Planning and Urban Management Act 2004*. Further funding from external sources has been secured for the freshwater and marine (Apia Harbour) surveys under the NBSAP Add-on Project, the myna bird management trials, and the upgrading of quarantine services under the Samoa Quarantine Improvement Project.

There may be some capacity for further funding under local budgets, however Samoa cannot realistically fund the entire action plan. External support will need to be sought in the form of grants, technical assistance and equipment, such as through international and regional programmes (UNDP, Global Invasive Species Programme, ISSG Cooperative Islands Initiative), non-government organisations, and other donor agencies. Specific needs will be further clarified and proposals developed as the implementation of the action plan proceeds and we gain further knowledge of the IAS problem facing Samoa.



## STRATEGIES AND ACTIONS

### Strategy 1 – Manage established invasive alien species

*Objective: To develop appropriate programs and procedures to eradicate IAS where practicable, and to minimise the impacts of established IAS.*

ACTIONS	LEAD AGENCY/ GROUP	PARTNERS	PRIORITY	TIMEFRAME	OUTPUTS
<ul style="list-style-type: none"> <li>• <b>Develop a comprehensive knowledge base of established IAS:</b> <ul style="list-style-type: none"> <li>○ Identify the existing IAS in Samoa, drawing from the Space and Flynn (2002) and other studies, as well as further surveys, including: <ul style="list-style-type: none"> <li>- freshwater survey</li> <li>- marine survey</li> <li>- terrestrial invertebrate survey</li> </ul> </li> <li>○ Undertake a preliminary assessment of the potential environmental, economic and social impacts and values of each of these IAS, and prioritise the species accordingly, identifying the top 50;</li> <li>○ Determine and map the current distribution, past spread, and potential future dispersal of the top 10 species;</li> <li>○ Undertake a formal impact assessment of each of the top 10 priority species.</li> <li>○ Record and maintain information relating to all IAS on a digital database.</li> </ul> </li> </ul>	MNRE MOA	SUNGO, Communities	High	June 2005	Comprehensive list of IAS produced.
	MNRE MOA	SUNGO, Communities	High	June 2005	Impacts assessed and species prioritised
	MNRE MOA	Communities MWCS D	High	Dec 2005	Past, present and potential future distribution determined.
	MNRE MOA	SUNGO	High	As required	10 assessments completed
	MNRE	MOA	Medium	Ongoing	Database updated at least annually.
<ul style="list-style-type: none"> <li>• <b>Identify and prioritise specific species or key sites for eradication efforts:</b> <ul style="list-style-type: none"> <li>○ Assess the feasibility of eradication of the above species (utilise the guidelines outlined in Attachments 1 and 2), whether at a local or national level, and prioritise and initiate eradication programs <ul style="list-style-type: none"> <li>- Where necessary, conduct feasibility or pilot studies to determine the problems and constraints (financial, technical, public awareness and support, or legislative) associated with implementing eradication programs, and the capacity to overcome such constraints.</li> </ul> </li> <li>○ Identify small infestations that have the potential to become invasive, eg. satellite populations of the giant African snail on Savaii, and develop and initiate eradication programs, where feasible.</li> <li>○ Undertake regular monitoring of the sites to ensure the success of eradication efforts.</li> <li>○ Where necessary, develop and implement effective restoration methods for affected areas.</li> </ul> </li> </ul>	MNRE MOA	MWCS D, SPREP, SUNGO, Communities	High	June 2006	Species and sites identified and eradication efforts initiated.
	MNRE MOA	SUNGO, Communities	Medium	June 2006 and ongoing	Eradication programs commenced.
	MNRE MOA	SUNGO, Communities	Medium	As required.	Re-invasions prevented
	MNRE MOA	SUNGO, Communities	Medium	As required.	Restoration successfully undertaken.

ACTIONS	LEAD AGENCY/ GROUP	PARTNERS	PRIORITY	TIMEFRAME	OUTPUTS
<ul style="list-style-type: none"> <li>• <b>Where eradication is not possible:</b> <ul style="list-style-type: none"> <li>○ Identify key areas, species, communities, crops and other resources which must be protected from the spread of IAS, for example, preventing the further spread of the giant African snail to Savai'i island;</li> <li>○ Establish a priority list of species and areas for management action (such as National Parks and high value crops)</li> <li>○ Conduct feasibility or pilot studies to determine and test the effectiveness and maintenance of barriers and other preventative measures to stop the spread of priority IAS into non-infected areas;</li> <li>○ Develop and implement effective management programs to monitor and inhibit the spread of priority IAS, and to minimise their impact, taking into account community attitudes, resource requirements, and potential risks and constraints. <ul style="list-style-type: none"> <li>– Where practicable, use the adaptive approach to management (Attachment 3)</li> </ul> </li> <li>○ Develop and implement monitoring programs of established infestations of other IAS not of immediate concern.</li> </ul> </li> </ul>	<p>MNRE MOA</p> <p>MNRE MOA</p> <p>MNRE MOA</p> <p>MNRE MOA</p> <p>MNRE MOA</p>	<p>MWCSD, SPREP, SUNGO, Communities</p> <p>MWCSD, SPREP, SUNGO, Communities</p> <p>SPREP, SUNGO Communities</p> <p>MWCSD, SPREP, SUNGO, Communities</p> <p>MWCSD, SPREP, SUNGO Communities</p>	<p>High</p> <p>High</p> <p>High</p> <p>High</p> <p>High</p>	<p>June 2006</p> <p>June 2006</p> <p>As required.</p> <p>June 2007</p> <p>June 2007</p>	<p>Key areas identified for protection</p> <p>Priority list of species and areas for management action prepared.</p> <p>Barriers and other preventative measures developed and tested</p> <p>Management programs developed and implemented for at least the top 5 priority species / areas.</p> <p>Monitoring programs developed and implemented for at least 5 priority species or areas.</p>
<ul style="list-style-type: none"> <li>• <b>Other actions to minimise the spread of established IAS:</b> <ul style="list-style-type: none"> <li>○ Review legislation and recommend appropriate amendments to ensure adequate support for eradication and management actions</li> <li>○ Identify training needs, and develop and implement necessary training and capacity building programs to strengthen Samoa's capacity to research IAS impacts and management techniques.</li> <li>○ Review existing protocols to reduce the risk of native species and IAS escaping from Samoa and invading other nations.</li> <li>○ Review the Botanic Garden living collection and dispose of any species that have the potential to escape and become invasive.</li> <li>○ Incorporate into EIAs an assessment of the invasive threat posed by proposed developments, and introduce mandatory operating procedures as a condition of approval to mitigate the spread of IAS, eg. procedures for the translocation of machinery and equipment.</li> <li>○ Review plant species used for revegetation of roadsides and development projects, and restoration efforts in watershed and forestry areas, and develop a list of approved species.</li> <li>○ Establish a Code of Practice for the plant nursery industry to prevent the sale or distribution of IAS.</li> </ul> </li> </ul>	<p>MNRE MOA</p> <p>MNRE</p> <p>MNRE MOA</p> <p>MNRE</p> <p>MNRE</p> <p>MNRE MOA</p> <p>MNRE</p>	<p>AG</p> <p>MOA</p> <p>MFAT, SPREP</p> <p></p> <p>MWTI, MOA, SUNGO</p> <p>MWTI</p> <p>SUNGO, Nursery industry, MOA</p>	<p>High</p> <p>Medium</p> <p>High</p> <p>Medium</p> <p>High</p> <p>Medium</p> <p>Low</p>	<p>June 2005</p> <p>June 2005 &amp; ongoing</p> <p>June 2005</p> <p>June 2005</p> <p>June 2005</p> <p>June 2006</p> <p>June 2007</p>	<p>Legislation reviewed and amendments proposed.</p> <p>Training needs identified and schedule proposed.</p> <p>Protocols developed and implemented.</p> <p>Living collection reviewed and necessary actions taken.</p> <p>EIA introduced and procedures developed.</p> <p>Plant species reviewed and list of approved species developed.</p> <p>Code of Practice developed and adopted.</p>

**[BOX 1] Case study – Eradication of rats and crazy ants from high priority conservation islands in the Aleipata Marine Protected Area**

Eradication of established IAS is not possible in many situations. However, small offshore islands offer a unique opportunity to achieve such an objective. An eradication project is planned for 2005, to remove rats and crazy ants from the Aleipata islands of Nu'utele and Nu'ulua. The islands are identified as a significant and high priority component of the Aleipata Marine Protected Area, as they represent some of the last remaining habitat for many of Samoa's endangered native wildlife, including threatened bird species. These islands contain a unique range of biodiversity, including the most significant remaining turtle and seabird nesting sites, and are a refuge for the rare ground dove, other land birds and also bats. A goal outlined in the Aleipata Marine Protected Area Management Plan states that: *By the end of 2006, the offshore islands (Nu'utele, Nu'ulua, Fanaatapu and Namua) will have had a restoration program designed and begun implementation focusing on rat eradication, endangered birdlife (land and sea bird) and other native wildlife conservation.*

**[BOX 2] Case study: Assessment of management techniques and the biological characteristics of the widespread *Merremia* vine at O le Pupu Pu'e National Park**

O le Pupu Pu'e National Park has been identified in the NBSAP as one of the high priority management sites affected by *Merremia* vine. A manual control plot is being developed as part of the National Parks and Reserves Work Plan 2003-2004. This on-ground action will assess the effectiveness of various management techniques in the control of *Merremia*.

**[BOX 3] Case study: Control of myna birds**

The continuing population expansion of the common myna (*Maina fanua*; *Acridotheres tristis*) and the jungle myna (*Maina vao*; *A. fuscus*) is of significant concern. They are particularly aggressive and territorial birds which actively compete native species for food and nesting sites. They are also negatively impacting crops by feeding on bananas and papaya.

A trial project has been proposed under the joint DEC/SPREP *Samoa Bird Conservation Project*, which will test the feasibility of a selective and humane multi-catch trap that was designed and tested in Australia. It is anticipated that the trial will be undertaken in Apia, and depending on the success of the trial there is the potential for expansion of the project through partnerships with villages.

**Strategy 2 – Promote public awareness and education**

*Objective: To enhance the knowledge and understanding of the Samoan community and other groups and individuals that may bring IAS to Samoa, about the importance of preventing the introduction of IAS that have not yet reached Samoa, and managing those already here.*

ACTIONS	LEAD AGENCY/ GROUP	PARTNERS	PRIORITY	TIMEFRAME	OUTPUTS
<ul style="list-style-type: none"> <li>• Establish a Public Awareness Specialist Working Group (PASWG) that is responsible for developing a comprehensive awareness and understanding (refer to Box 4 below) program that targets key stakeholders and other groups. The sub-committee should undertake the following:               <ul style="list-style-type: none"> <li>○ Undertake preliminary public awareness activities, utilising television, radio, newspapers, and also posters and fact sheets.</li> <li>○ Conduct workshops of key stakeholders to determine the extent of their knowledge of IAS and their impacts, their needs and concerns, and the existing and potential role of each group in protecting Samoa and its resources from IAS.</li> <li>○ Identify target groups and tailor information to meet their needs and concerns                   <ul style="list-style-type: none"> <li>- Identify appropriate incentives for community ownership of the issue.</li> </ul> </li> <li>○ Based on the needs assessment, produce, package and disseminate information on IAS and their impacts, preventing new species from entering Samoa, and the management of existing invasions:                   <ul style="list-style-type: none"> <li>- Review secondary school and university curricula;</li> <li>- Review existing government programs to identify opportunities to incorporate information on IAS, for example, extension programs for farmers and communities to introduce best practice techniques in the management and/or eradication of IAS;</li> <li>- Enhance awareness of relevant legislation and enforcement</li> </ul> </li> </ul> </li> </ul>	MNRE	MESC, HEALTH, CC, MOA, MWCSD, SPREP, SUNGO.	High	July 2004	PASWG established and active
	PASWG		High	June 2005	Awareness activities undertaken
	PASWG		High	June 2005	Workshops undertaken
	PASWG		High	June 2005	Workshop results analysed and presented to TSC
	PASWG		High	Dec 2005 & ongoing	Program commenced

**[BOX 4] Levels of awareness and understanding**

There are several levels of awareness and understanding. Different groups require different levels. Awareness and education programs should determine the issues of each group and the form and level of information that they require. The levels are:

**Awareness**

This is the stage where an individual is aware of IAS, but does not have extensive knowledge of the issue or the actions that can be taken in regard to prevention and management. Such information can be disseminated through newspapers, television and posters.

**Understanding**

This requires that individuals also understand the issue, and the actions that need to be undertaken in regard to prevention and management. This information needs to be in more detail and requires more one-to-one contact. Need to know their current level of understanding of the issue and what else they should know.

**Acceptance**

While some individuals may be aware of and understand the problems of IAS, they may not care or be motivated to do anything about it. For people to accept the information and change the way they act in relation to IAS, it is necessary for information to be presented in a manner that addresses their needs and concerns. This requires a clear understanding of the needs and concerns of the individual/group, and working with them to encourage the adoption and implementation of the necessary actions to better manage IAS.

**Strategy 3 – Prevent the introduction of new invasive alien species**

*Objective 1: To strengthen the existing Import Risk Assessment (IRA) procedure and associated import protocols for proposed new introductions*

ACTIONS	LEAD AGENCY/ GROUP	PARTNERS	PRIORITY	TIMEFRAME	OUTPUTS
<ul style="list-style-type: none"> <li>○ Establish a Prevention Working Group (PWG) to review relevant legislation, and recommend necessary amendments to ensure there is appropriate and effective support for the IRA process.</li> </ul>	MNRE MOA	SAA, SPA, SPREP, SUNGO, UNDP <b>Other partners:</b> AG, MFAT	High	Dec 2004	Legislation reviewed and amendments proposed
<ul style="list-style-type: none"> <li>○ Develop and introduce EIA procedures for proposed imports of new organisms.</li> </ul>	MNRE	MOA	High	June 2005	EIA process in operation for proposed imports of organisms.
<ul style="list-style-type: none"> <li>○ Continue to strengthen the IRA process, incorporating comprehensive assessments of environmental, social and economic costs and benefits.</li> </ul>					
<ul style="list-style-type: none"> <li>• Review the membership of the IRA Technical Committee (IRATC);</li> </ul>	IRATC		High	July 2004	IRATC reviewed and amendments implemented
<ul style="list-style-type: none"> <li>• Review and recommend improvements to the IRA methodology and consultative process;</li> </ul>	IRATC		High	August 2004	IRA standards reviewed and improvements implemented
<ul style="list-style-type: none"> <li>• Undertake a benchmark IRA;</li> </ul>	IRATC		High	Oct 2004	Benchmark IRA estab. & documented
<ul style="list-style-type: none"> <li>○ Establish formal protocols for the screening of proposed introductions of new organisms into Samoa by Government agencies.</li> </ul>	PWG	MFAT	High	August 2004	Formal protocols established
<ul style="list-style-type: none"> <li>○ Consolidate IRA skills, identify further training needs, and develop and implement necessary training and capacity building programs to support the IRA process.</li> </ul>	IRATC		High	Sept 2004 & ongoing	Training needs identified and schedule proposed
<ul style="list-style-type: none"> <li>○ Review and update the Pest List (Quarantine) and Biodiversity (DEC) databases to ensure information remains current and readily accessible.</li> </ul>	MOA MNRE	IRATC	Medium	June 2005 & ongoing	Databases updated and maintained to meet information needs

**Objective 2 - To review and enhance the Emergency Response Plan (ERP) to ensure an immediate and effective response to the detection of any potential invasive alien species**

ACTIONS	LEAD AGENCY/ GROUP	PARTNERS	PRIORITY	TIMEFRAME	OUTPUTS
<ul style="list-style-type: none"> <li>○ Revise the existing ERP and associated protocols to ensure that appropriate actions are initiated immediately following the detection of potential IAS;</li> </ul>	PWG		High	Dec 2004	ERP revised and endorsed by key stakeholders
<ul style="list-style-type: none"> <li>○ Recommend legislative amendments to ensure effective support for the ERP (undertake in conjunction with legislative review under Objective 1)</li> </ul>	PWG		High	Dec 2004	Legislative amendments recommended
<ul style="list-style-type: none"> <li>○ Incorporate the ERP under the National Disaster Management Plan (NDMP), or other appropriate legislation, to ensure adequate resources and support for the ERP.</li> </ul>	PWG		High	Dec 2004	ERP included under the NDMP
<ul style="list-style-type: none"> <li>○ Review IAS present amongst Samoa's trading partners and ensure existing databases include essential information for an effective response, especially potential environmental and economic pests.               <ul style="list-style-type: none"> <li>▪ Assign species to very high, high, medium and low priority categories.</li> </ul> </li> </ul>	PWG		High	June 2005 & ongoing	Species identified & databases updated.
<ul style="list-style-type: none"> <li>○ Develop specific contingency plans for high priority species (as identified under Objective 3);</li> </ul>	PWG		High	June 2005	Contingency plans developed
<ul style="list-style-type: none"> <li>○ Develop and test a simulated IAS disaster.</li> </ul>	MOA & MNRE	Other key stakeholders identified in ERP	Medium	Dec 2005	Simulation undertaken
<ul style="list-style-type: none"> <li>○ Develop a comprehensive illustrated manual that covers the key invasive organisms of most concern to Samoa, based on their potential environmental, social and economic damage. It should include information on their:               <ul style="list-style-type: none"> <li>▪ Biology;</li> <li>▪ Behaviour;</li> <li>▪ Potential environmental, economic and social impacts;</li> <li>▪ Most likely invasion pathways;</li> <li>▪ Handling and disposal techniques; and</li> <li>▪ Eradication techniques and strategies.</li> </ul> </li> </ul>	PWG		Low	June 2007	Manual produced

**Objective 3: Enhance the current inspection and surveillance system and procedures for potential invasive alien species.**

ACTIONS	LEAD AGENCY/ GROUP	PARTNERS	PRIORITY	TIMEFRAME	OUTPUTS
<ul style="list-style-type: none"> <li>○ Identify all likely entry pathways and the relative risk for entry of potential high-priority IAS (as identified under Objective 2)</li> </ul>	PWG	HEALTH, MWTI, CC	High	June 2005	Entry pathways and level of risk for priority species identified
<ul style="list-style-type: none"> <li>○ Assess the adequacy of current surveillance for high-risk IAS:               <ul style="list-style-type: none"> <li>● Assess the effectiveness of existing early-warning traps for the fruit fly, and recommend any appropriate changes;</li> </ul> </li> </ul>	PWG	.	High	Dec 2005	Early-warning system reviewed and changes recommended to MOA and TSC for action.
<ul style="list-style-type: none"> <li>● Identify other high priority species for which early warning systems and other specific preventative measures would be valuable (in conjunction with preparation of contingency plans under Objective 2), and identify appropriate mechanisms;</li> </ul>	PWG		High	June 2006	Further preventative measures identified and proposed to MOA and TSC.
<ul style="list-style-type: none"> <li>● Assess the effectiveness of civilian and cargo inspections &amp; surveillance, and recommend improvements.</li> </ul>	PWG	CC	High	June 2006	Effectiveness assessed and improvements recommended to MOA
<ul style="list-style-type: none"> <li>● Review and identify changes to current reporting and coordination procedures between agencies, including points of contact, and formalise protocols.</li> </ul>	PWG		Medium	June 2007	Review undertaken and protocols formalised
<ul style="list-style-type: none"> <li>○ Conduct an audit of current skills and experience, identify important gaps and recommend appropriate training for border control, quarantine and general surveillance.</li> </ul>	PWG		High	June 2006 & ongoing	Audit conducted and training program scheduled.

**Strategy 4 – Foster regional and international cooperation on invasive alien species**

**Objective 1: To foster regional and international cooperation on IAS, to effectively address the threat of potential new invasions and manage established IAS.**

ACTIONS	LEAD AGENCY/ GROUP	PARTNERS	PRIORITY	TIMEFRAME	OUTPUTS
<ul style="list-style-type: none"> <li>● Assess Samoa's participation in regional and international conventions, treaties, and non-binding resolutions, and recommend further action in relation to binding and non-binding instruments not yet ratified or endorsed;</li> </ul>	MNRE	MOA, SUNGO, MFAT, MWTI, SPREP, UNDP, SPC, USP	Medium	June 2005	Participation in relevant instruments reviewed and further action recommended.
<ul style="list-style-type: none"> <li>● Reinforce Samoa's existing partnerships and establish new links and cooperative arrangements in relation to IAS to maximise the sharing and exchange of information, research, technologies, technical capacity and other resources.</li> </ul>	MNRE	CC, MOA, SUNGO, MFAT, MWTI, SPREP, UNDP, SPC, USP	Medium	Ongoing	Regional collaboration on IAS further reinforced.



## GLOSSARY

**Biological Diversity (Biodiversity):** The variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (Convention on Biological Diversity). Components include:

**Genetic Diversity:** The variability in the genetic makeup among individuals within a single species. In more technical terms, it is the genetic differences among populations of a single species and those among individuals within a population.

**Species Diversity:** The variety of species – whether wild or domesticated – within a particular geographical area. A species is a group of organisms which have evolved distinct inheritable features and occupy a unique geographic area. Species are usually unable to interbreed naturally with other species due to such factors as genetic divergence, different behaviour and biological needs, and separate geographic location.

**Ecological (ecosystem) Diversity:** The variety of ecosystem types (for example, forests, deserts, grasslands, streams, lakes, wetlands and oceans) and their biological communities that interact with one another and their non-living environments.

**Biosafety:** The policies and actions taken to manage risks from the intentional introduction of new organisms, including genetically modified organisms, which could adversely affect biodiversity, people or the environment.

**Biosecurity:** The protection of people and natural resources, including biodiversity, from unwanted organisms capable of causing harm.

**Border Control:** The policies and actions taken to prevent the accidental or illegal introduction of unwanted organisms across national borders. Border control includes re-import pest control, certification, inspection and surveillance, and emergency responses.

**Conservation:** The prevention and protection of natural and historic resources for the purpose of maintaining their intrinsic values, providing for their appreciation and recreational enjoyment by the public, and safeguarding the options of future generations.

**Invasive Alien Species:** Invasive alien species are species introduced into an area in which they do not occur naturally, usually as a result of human activities, and which threaten environmental or economic resources, or human health, due to the damage they cause, or are likely to cause

**Native Species:** A plant or animal species that occurs naturally in Samoa. A synonym is “indigenous”.

**Protected Area:** A geographically defined area that is protected primarily for nature conservation purposes or to maintain biodiversity values, using any of a range of legal mechanisms that provide long term security of either tenure or land use purpose. It may be either publicly or privately owned.

**Species:** A group of organisms, sharing common features (similar phenotype) and being isolated from other groups in terms of reproduction.

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## Attachment 1 - Criteria to assess the feasibility of local eradication

(adapted from Braysher & Saunders, 2002)

To help determine whether eradication is likely to be successful, six criteria can be applied: three are essential for the achievement of eradication and three will help managers decide whether eradication is preferable to ongoing control.

### Essential criteria

- *Invasive species can be killed at a faster rate than they can replace themselves*

This seems obvious but it is difficult to achieve in practice. There are two main reasons. Firstly, many populations of invasive species have a high natural rate of increase. Secondly, as the density of an invasive species declines, it takes progressively more time and more expense per individual animal to locate and remove the last few individuals.

- *Immigration can be prevented*

This criterion can be met for small islands but is very difficult to achieve over a wide area. If an invasive species can recolonise an area from nearby populations, or by escape or release from captive populations, elimination of the species will at best be temporary. Immigration to a local area may be prevented where a suitable structure and control creates a perfect barrier.

- *All reproductive individuals are at risk from the available techniques*

It is not necessary to remove all individuals of an invasive species at the first attempt. However, all reproductive or potentially reproductive members of the invasive species pest population must be able to be taken by the techniques available. This is rarely possible in part because there is only a limited armory of techniques, and trap-shyness, bait-avoidance, and resistance to poisons, are common among pest animals.

### Desirable criteria

- *The invasive species can be monitored at very low densities*

If the invasive species cannot be detected at very low densities, then there is no way of knowing whether all individuals have been eliminated. However, most population assessment techniques cannot detect individuals at very low densities.

- *The socio-political environment supports eradication*

Even when all the technical problems can be met, social and political factors may prevent successful eradication. Community attitudes may oppose killing large numbers of animals on moral, emotional or cultural grounds. Also, eradication is expensive. Political factors may withdraw funds from the program before eradication is achieved.

- *The high costs of eradication can be justified.*

It is appealing to think that the value of perpetual freedom from an invasive species is very high, but this may not be so. Future benefits such as those obtained from eradicating an invasive species have a lower economic value than benefits that are available immediately. This is because the value of future benefits is discounted. Calculating discount rates involves the reverse of the equation to calculate interest rates on invested money. The practice of discounting the value of future benefits assumes that land managers act in an economically rational manner. However, invasive species often evoke strong emotional responses to the extent that management aims and expenditure are often far from rational. The resource being protected also has to have a monetary value allocated to it in order to determine whether eradication is economic. Yet the monetary value of conservation and biodiversity is difficult to assess. There are methods to do so, such as contingent valuation, but their usefulness is debatable.

- *Eradication programs should not have detrimental impacts on native flora and fauna*

Eradication programs should not be implemented if there is potential for the direct and/or indirect effects of the program on the environment to be greater than the expected positive outcomes of removing the invasive species.

## Attachment 2 - Reality check

A reality check can help determine whether invasive species control is likely to be desirable and effective. The questions and factors in the following should be considered. The list is not meant to be exhaustive, nor are the factors in any particular order. Consultation with individuals, agencies and local stakeholders with knowledge of the species and the area may identify other issues and help answer the questions.

### **REALITY CHECK: assessing the likelihood that invasive species management in the proposed area will be feasible and desirable \***

#### **Is pest animal management practical?**

It may be technically possible to undertake management action, but it may be impractical to apply it on the scale necessary. For example, the technique might work at a small experimental site, but farm management practices and other difficulties may make it impractical at a large scale.

#### **Is it economically desirable?**

Are sufficient resources available to effectively manage pest animal damage, both in initial costs and ongoing management? For example, the most effective technique to control rabbits in central Australia may be ripping rabbit warrens. However, the cost per square kilometre to rip rabbit warrens, and long-term follow-up is estimated to be three to four times the gross margin per square kilometre from free-range cattle production.

Consider the following:

- the cost of implementing the plan in relation to long-term benefits
- the relationship with other management actions
- resources available for essential follow-up and ongoing maintenance pest management
- technical and financial resources available for an adequate monitoring and evaluation program.

#### **Is it environmentally acceptable?**

Widespread aerial poisoning for example may have unacceptable impacts on non-target wildlife or domestic animals.

#### **Is it politically acceptable?**

Is the proposed action consistent with:

- prevailing government policy?
- local community or catchment group priorities and issues?

The cost and impact of the proposed management may have such negative consequences that action will be blocked at the political level.

Does the action build on past work, and if so how successful has that work been?

Is the action an important initiative that sets the scene for subsequent actions by other key managers such as adjoining landholders?

#### **Is it socially acceptable?**

The techniques proposed and the potential impact on other organisms may be unacceptable to parts of the community on conservation and/or animal welfare grounds.

Is there:

- local enthusiasm and ownership by management for the proposed action on the invasive species?

- commitment to long-term follow-up and maintenance?
- the required neighbour cooperation/support?

Does the work have high demonstration value to encourage similar work in other areas?

Does the work improve the awareness and understanding of the local community about the production and/or conservation values of the area?

Will the work improve our understanding of the effectiveness and efficiency of invasive species management to achieve production and/or conservation outcomes?

***NOTE: If the answer to any of these questions is no, then effective management of invasive species damage is unlikely or will be difficult. Before effective invasive species management can proceed, the 'no' should be changed to a 'yes', for example, by gaining the support of a key blocking group through a targeted communication campaign.***

### Attachment 3 - Adaptive management

Complete knowledge of the damage caused by invasive species and how to best manage them is often not known. To deal with this uncertainty it is best to adopt an *adaptive* approach to management.

For most species, there is no standard method for all situations, and often there are limited resources and time to research the problem. In these cases the best management approach is to use each invasive species management program as an ongoing experiment from which to learn and build on existing knowledge. This is called adaptive management or 'learning by doing'. The key is to be specific about the objective of each program, to monitor progress and to evaluate results. In doing so it is important to realise that knowledge and insights can come from programs that fail to meet the desired result as well as from those that succeed. Adaptive management is particularly important given the wide range of situations that require the management of invasive species and their impacts. Flexibility is also important, that is, recognising the different circumstances and restrictions at each site, and the need to adapt to changing circumstances or conditions.

Where practicable, the adaptive management approach should underpin the development of the overall outcomes and objectives of management plans for managing invasive species.

Adaptive management addresses the need to:

- accept that knowledge of the system being managed is always incomplete – not only is the science imperfect, but the system itself is a moving target, evolving because of the impacts of management and the progressive expansion of the scale of other human activities;
- develop an integrated experimental design that allows clear separation of the effects of as many changes as possible, so that a sensible balance of management tools and policies can be developed; and
- explore imaginative ways to set priorities for investing in research, monitoring and management.

If the adaptive management approach is to be used as the basis of the management plan, advice should be sought from groups or individuals with appropriate knowledge and experience in its use.

## Attachment 4 - Invasive or potentially invasive plant species in Samoa

Source: Space, J. & Flynn, T., 2002

English Common Names	Samoan Common names	Scientific Name	Family	Habit
African tulip tree, fireball, fountain tree	Fa'apasi	<i>Spathodea campanulata</i>	Bignoniaceae	tree
Arrowhead plant, goosefoot plant	-	<i>Syngonium angustatum</i>	Araceae	vine
Asparagus fern (climbing), ornamental asparagus, plumose.	-	†* <i>Asparagus setaceus</i>	Liliaceae	vine
Asparagus fern, sprengeri fern, smilax, regal fern	-	†* <i>Asparagus densiflorus</i>	Liliaceae	herb
Blue fig, blue marble tree, quandong	Sapatua, siapoatua, siapatua	<i>Elaeocarpus angustifolius</i>	Elaeocarpaceae	tree
Blue rat's tail, dark-blue snakeweed, false verbena, nettleleaf velvetberry	Mautofu tai, mautofu vao, mautofu fualanumoana	<i>Stachytarpheta cayennensis</i>	Verbenaceae	herb
Bronze-leaved clerodendrum	Losa, losa Fiti	<i>Clerodendrum quadriloculare</i>	Verbenaceae	shrub
Buffalograss, guinea grass, green panic,	Vao kini	<i>Panicum maximum</i>	Poaceae	grass
Cardinal flower, fire spike	Totoe	<i>Odontonema tubaeforme</i>	Acanthaceae	shrub
Chinese albizia, silk tree.	Tamaligi uliuli, tamaligi ena'ena;	<i>Albizia chinensis</i>	Fabaceae	tree
Cinnamon tree	Tinamoni, tigamoni;	<i>Cinnamomum verum</i>	Lauraceae	tree
Cockroach berry, devil's apple	-	† <i>Solanum capsicoides</i>	Solanaceae	herb
Coral bean tree, red sandalwood tree, red bead tree, bead tree, false wiliwili, peacock flower-fence, Polynesian peanut.	Lopa	<i>Adenanthera pavonina</i>	Fabaceae	tree
Dieffenbachia, dumb cane	-	<i>Dieffenbachia seguine</i>	Araceae	herb
Dissotis, Spanish shawl, pink lady	-	<i>Dissotis rotundifolia</i>	Melastomataceae	herb
Eared pepper, anise piper, Veracruz pepper	'Ava Tonga	†* <i>Piper auritum</i>	Piperaceae	shrub
Giant sensitive plant, nila grass	Vao fefe palagi	<i>Mimosa invisa</i>	Fabaceae	shrub
Glorybush, lasiandra, princess flower	-	† <i>Tibouchina urvilleana</i>	Melastomataceae	herb
Guava	Ku'ava	<i>Psidium guajava</i>	Myrtaceae	tree
Guava (strawberry), cherry guava, cattley guava, Chinese guava	Ku'ava	†* <i>Psidium cattleianum</i>	Myrtaceae	tree
Honolulu rose, stickbush, glory bower	Losa Honolulu, losa Onolulu	<i>Clerodendrum chinense</i>	Verbenaceae	shrub
Ivy gourd, scarlet-fruited gourd.	-	†* <i>Coccinia grandis</i>	Cucurbitaceae	vine
Koster's curse, soap bush.	La'au lau mamoe	<i>Clidemia hirta</i>	Melastomataceae	shrub
Lantana	Latana	<i>Lantana camara</i>	Verbenaceae	shrub
Laurel, Ecuador laurel, salmwood, Spanish elm	Kotia	<i>Cordia alliodora</i>	Boraginaceae	tree
Luck plant, wild hops.	-	† <i>Flemingia strobilifera</i>	Fabaceae	shrub
Metal leaf; red ivy, cemetery plant (Fiji)	Suipi	<i>Hemigraphis alternata</i>	Acanthaceae	herb
Mile-a-minute weed, Chinese creeper, American rope, bittervine;	Fue saina	<i>Mikania micrantha</i>	Asteraceae	vine
Molucca albizia	Tamaligi pae'pae	<i>Falcataria moluccana</i>	Fabaceae	tree
Navua sedge	Tuise tele, tuise fiti	<i>Kyllinga polyphylla</i>	Cyperaceae	sedge
No common names known.	-	† <i>Flemingia macrophylla</i>	Fabaceae	tree
Oyster plant, boat plant, boat lily, moses in a boat.	-	* <i>Tradescantia spathacea</i>	Commelinaceae	herb
Panama hat plant.	-	† <i>Carludovica palmata</i>	Cyclanthaceae	shrub

English Common Names	Samoa Common names	Scientific Name	Family	Habit
Pothos, money plant.	-	† <i>Scindapsus aureus</i>	Araceae	vine
Prickly solanum, devil's fig, turkeyberry	Lapiti	<i>Solanum torvum</i>	Solanaceae	shrub
Privet	-	† * <i>Ligustrum spp.</i>	Oleaceae	shrubs
Rubber tree (African), silk rubber;	Pulu vao	<i>Funtumia elastica</i>	Apocynaceae	tree
Rubber tree (Brazilian), Hevea, Para rubber tree.	-	<i>Hevea brasiliensis</i>	Euphorbiaceae	tree
Rubber tree (Panama), Mexican rubber tree, uletree	Pulu mamoe	<i>Castilla elastica</i>	Moraceae	tree
Sesbania, hummingbird tree, sesban, scarlet wisteria tree, corkwood tree.	Sepania	<i>Sesbania grandiflora</i>	Fabaceae	small tree
Shoebuttan ardisia	Togo vao;	<i>Ardisia elliptica</i>	Myrsinaceae	shrub
Silk oak, silky oak, he oak, silver oak, spider flower.	-	* <i>Grevillea robusta</i>	Proteaceae	tree
Wandering zebra, wandering jew	-	* <i>Tradescantia zebrina</i>	Commelinaceae	herb
Water hyacinth.	-	<i>Eichhornia crassipes</i>	Pontederiaceae	aquatic herb
Wedelia, trailing daisy, Singapore daisy, creeping ox-eye	-	<i>Wedelia trilobata</i>	Asteraceae	herb
White ginger, butterfly lily, ginger lily	Teuila paepae	<i>Hedychium coronarium</i>	Zingiberaceae	herb
White tephrosia, white hoary-pea	-	† <i>Tephrosia candida</i>	Fabaceae	shrub
Wood rose	-	<i>Merremia tuberosa</i>	Convolvulaceae	vine
Yellow ginger, cream ginger	Teuila	<i>Hedychium flavescens</i>	Zingiberaceae	herb

\*Only seen in cultivation

† Currently of limited extent, but pose significant threat to Samoa and should be assessed for eradication or control.

## Attachment 5 - Invasive or potentially invasive animals in Samoa

English Common Names	Samoa Common Names	Scientific Name	Form
Ant - big-headed - yellow crazy	Loi	<i>Pheidole megacephala</i> <i>Anoplolepis gracilipes</i>	invertebrate
Cat (feral)	Pusi	<i>Felis catus</i>	mammal
Diamond back moth	Faatua taimane ai kapisi	<i>Plutella xylostella</i>	invertebrate
Fruit fly	Lago tuia o fuala'au aina	<i>Bactrocera xanthodes</i> , <i>B. kirki</i> , <i>B. distincta</i> , <i>B. obscura</i> , <i>B. near xanthodes</i> , <i>B. samoae</i> , <i>B. aenigmatica</i>	invertebrate
Giant African snail	Sisi Aferika	<i>Achatina fulica</i>	invertebrate
Mealy bug - annona - cryptic - Pacific - Pandanua - Pandanus - Pineapple		<i>Dysmicoccus neobrevipes</i> <i>Pseudococcus cryptus</i> <i>Planococcus sp.</i> <i>Ferrisia virgata</i> <i>Laminicoccus pandani</i> <i>Dysmicoccus brevipes</i>	invertebrate
Myna - common - jungle	Maina fanua Maina vao	<i>Acridotheres tristis</i> <i>Acridotheres fuscus</i>	bird
Pig (feral)	Pua'a aivao	<i>Sus scrofa</i>	mammal
Rat - Norway - Polynesian - ship	Isumu	<i>Rattus norvegicus</i> <i>Rattus exulans</i> <i>Rattus rattus</i>	mammal
Red-vented bulbul	Manu palangi	<i>Pycnonotus cafer</i>	bird
Rhinoceros beetle	Manu'ainiu	<i>Oryctes rhinoceros</i>	invertebrate
Tilapia - Mossambique - Nile	Tilapia	<i>Oreochromis mossambicus</i> <i>Oreochromis niloticus</i>	fish
Topminnow, molly	I'a vai	<i>Poecilia mexicana</i>	fish



## Attachment 6 - Priority invasive plant species for exclusion from Samoa

High priority plant species (from an environmental perspective) for exclusion from Samoa and for rapid eradication if found (Space, J. & Flynn, T., 2002).

A full list of species of environmental concern can be found in the original source.

Common Name	Scientific Name	Invasive in	Comments
All grasses	All Poaceae species not already present in Samoa.	Pan-tropical.	Grasses are easily introduced as contaminants in imported seed, imported sand and gravel or on used machinery, and by their nature tend to be invasive.
All <i>Rubus</i> species (raspberries, blackberries, thimbleberries, brambles)	<i>Rubus spp.</i>	Australia, La Reunion, Mascarine Islands, Fiji, New Caledonia, Solomon Islands, French Polynesia, Hawai'i, Vanuatu, Galapagos Islands	In general, where <i>Rubus</i> species are not present on tropical islands, they should not be introduced. If already introduced, they should be evaluated for eradication. The vines form thorny thickets and the fruits are widely dispersed by birds
Allspice, pimento, sipaisi	<i>Pimenta dioica</i>	Tonga ('Eua), Hawai'i.	An invasive forest tree. The seeds are bird-dispersed.
Blady grass, cogon grass	<i>Imperata cylindrica</i>	Australia, New Zealand, Micronesia, New Caledonia, Papua New Guinea, Philippines, Solomon Islands, Southeast Asia, Vanuatu.	A very invasive grass species elsewhere and a problem for agriculture as well as the environment. Several infestations in Micronesia (Palau and Yap) are presently subject of eradication programs.
Brazilian pepper, Christmas-berry	<i>Schinus terebinthifolius</i>	It is a major problem in Hawai'i as well as Florida (US) and the Indian Ocean islands of La Réunion and Mauritius.	The fruits are very attractive to birds, aiding its spread. It is present, though uncommon, in American Samoa (Tutuila) as well as in French Polynesia (Tahiti) and New Caledonia (Îles Loyauté). It should be excluded or, if found, evaluated for prompt eradication.
Cat's claw climber	<i>Macfadyena unguiscati</i>	Hawai'i, Niue, New Caledonia	An aggressive vine that climbs trees and also forms a dense ground mat. Control is difficult because it has tuberous roots and reproduces from pieces and cuttings. Also found in Australia.
Fountain grass	<i>Pennisetum setaceum</i>	A major problem in Hawai'i. Also present in Australia, Fiji, French Polynesia and New Caledonia.	This grass species is often sold as an ornamental through seed catalogues and so could be imported into Samoa via the mail system.
Hiptage	<i>Hiptage benghalensis</i>	Hawai'i, La Réunion, and Mauritius	The seeds are wind-dispersed and it can also reproduce from cuttings.
Ivy gourd, scarlet-fruited gourd	<i>Coccinia grandis</i>	Hawai'i, Federated States of Micronesia, Fiji, Guam, Tonga,	Very aggressive smothering vine, with extensive tuberous root system. Propagates via pieces of vine or cuttings, bird-dispersed seeds and possibly via feral pigs.
Madras thorn, Manila tamarind	<i>Pithecellobium dulce</i>	Hawai'i, Fiji and French Polynesia.	A thorny tree with seeds that are bird-dispersed
Melaleuca, cajeput, paper bark tree, punk tree	<i>Melaleuca quinquenervia</i>	US (Florida State), Fiji, Tahiti and Hawai'i.	It produces large quantities of wind-dispersed seeds and reproduces profusely after fire or other disturbance. It is a major problem in the State of Florida (US).
Musizi, umbrella tree	<i>Maesopsis eminii</i>	Fiji	A large African tree that has been introduced into other countries as a timber tree. Fruit-eating birds and possibly fruit bats spread the seeds. It has become a problem in a number of countries.

Common Name	Scientific Name	Invasive in	Comments
Other members of the family Melastomataceae that are not native or present in Samoa should also be excluded.	<i>Arthrostemum ciliatum</i> , <i>Heterocentron subtriplinervium</i> , <i>Medinilla magnifica</i> , <i>Medinilla venosa</i> , <i>Melastoma candidum</i> , <i>Melastoma sanguineum</i> , <i>Memecylon floribundum</i> , <i>Ossaeca marginata</i> , <i>Oxyspora paniculate</i> , <i>Tetrazygia bicolor</i> and <i>Tibouchina herbacea</i> .		
Passionfruit	<i>Passiflora tarminiana</i> , <i>Passiflora rubra</i> and other <i>Passiflora</i> species not already present ( <i>Passiflora alata</i> , <i>Passiflora caerulea</i> , <i>Passiflora coccinea</i> , <i>Passiflora edulis</i> , <i>Passiflora pulchella</i> )	Hawai'i, Cook Islands and New Zealand.	Smotherers vegetation.
Purple plague, miconia, velvetleaf, bush currant.	<i>Miconia calvescens</i>	Hawai'i, French Polynesia	Undoubtedly the most destructive invasive plant in the Pacific. It has been a disaster to the forest ecosystem of Tahiti and has subsequently spread to other islands in French Polynesia. This species is an attractive garden plant and might be introduced this way or as tiny seeds on shoes or used equipment.
Rubber vine, India rubber vine, Palay rubber vine	<i>Cryptostegia grandiflora</i>	Australia	A climbing vine that has become a serious problem in NE Queensland, Australia. Also found in New Caledonia and Fiji.
Siam Weed, trifid weed	<i>Chromolaena odorata</i>	Australia, Micronesia, Papua New Guinea, Philippines, Southeast Asia	Highly invasive pan-tropical weed. Likely to show up in Samoa at some point in time and should be promptly eradicated if found. It has tiny, wind-dispersed seeds that can also travel on boots, clothing or used equipment. This species would be a major agricultural problem.
Sour bush	<i>Pluchea carolinensis</i>	Hawai'i, Tonga	An fast-growing shrub that forms thickets. Seeds are wind-dispersed.
Trumpet tree	<i>Cecropia peltata</i>	French Polynesia.	Invasive tree that has become widely established in the forests of Tahiti and Raiatea.
Trumpet tree, guarumo	<i>Cecropia obtusifolia</i>	Hawai'i and the Cook Islands (Rarotonga).	This very rapidly growing tree forms dense stands which seriously impede the growth of other plants, and it can invade gaps in native forest.

Note: the lists included in Attachments 4, 5 and 6 are based on information available at the time of developing the NIASIAP, and will be amended as more information becomes available.