Palau National Early Detection and Rapid Response (EDRR) framework

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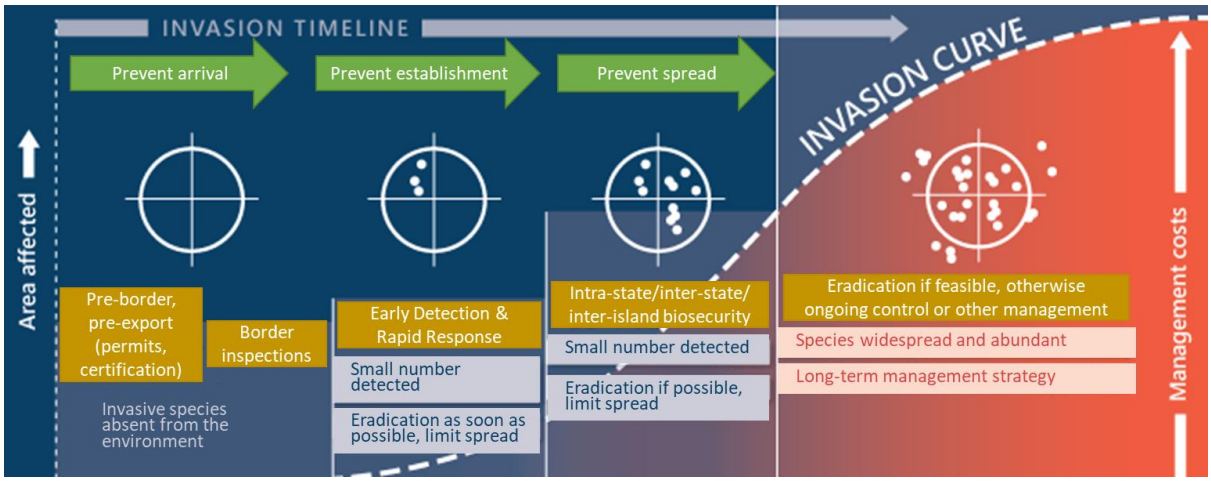
Acronyms and terms

Biosecurity	In the Palau Biosecurity Act, biosecurity is "the control by legal and administrative means of pests and diseases affecting animals, plants and their products, in order to avoid adverse effects from such pests and diseases on the economy and health of the Republic of Palau". This document uses a somewhat broader definition "preventing the arrival, establishment and spread of invasive species"
BOA	Bureau of Agriculture, MAFE
BOE	Bureau of Environment, MAFE
BOF	Bureau of Fisheries, MAFE
CBD	Convention on Biological Diversity
CRB	Coconut rhinoceros beetle (*Oryctes rhinoceros*)
DCLE	Department of Conservation and Law Enforcement, Koror State Government
BD/DOB	Division of Biosecurity, Bureau of Customs and Border Protection, Ministry of Finance
DOF	Division of Forest, Land and Water Management, BOE, MAFE
Emergency Response Plan (ERP) Incursion response Early Detection and Rapid Response (EDRR)	The differences between the terms emergency response, incursion response and EDRR might not be obvious, and they are often used interchangeably: • Emergency response is a general term that describes an event that requires some immediate action to decrease the impact of the event. Ideally, that event has been planned for, but it is not exactly predictable, such as where a cyclone might make landfall, or the detection of a high priority invasive species. • Incursion response is an emergency response where the event is the arrival of a harmful pest or invasive species. • Early detection and rapid response plans also target invasive species or pests. EDRR requires similar actions as for emergency or incursion response, but also includes prioritization beforehand, surveillance (for early detection) and being actively prepared. Active preparedness is crucially important to acknowledge in the Pacific islands because remote locations and lack of locally available treatment products slow the ability to respond rapidly. ERP or EDRR plans can be applied at a national level (only for species not yet in the country) or at a local level (such as a priority species eradicated from a priority site)
EQPB	Environmental Quality Protection Board
FF	Fruit fly (*Bactrocera* species)
GAS	Giant African snail (*Lissachatina/Achatina fulica*)
IIB	Intra-state/inter-island/inter-state biosecurity
ICP	Island Conservation Palau
IS/IAS	Invasive species/Invasive Alien Species. In this framework the term invasive species is used inclusively of all living things (plants, animals, fungi, diseases) that cause potential or realized harm to human interests (agriculture, biodiversity, cultural interests, economy, environment, health)
KCN	Kerradel Conservation Network (Ngaraard)
KSG	Koror State Government
LFA	Little fire ant (*Wasmannia auropunctata*)
MAFE	Ministry of Agriculture, Fisheries and the Environment
MCN	Melekeok Conservation Network
MOF	Ministry of Finance
NBSAP	National Biodiversity Strategic Action Plan/National Biodiversity Strategy and Action Plan
NEMO	National Emergency Management Office
NEPC	National Environmental Protection Council
NISSAP	National Invasive Species Strategy and Action Plan/National Invasive Species Strategic Action Plan
PAN	Protected Areas Network
PCS	Palau Conservation Society
PRISMSS	Pacific Regional Invasive Species Management Support Service: a partnership to support the region, administered out of SPREP.
TNC	The Nature Conservancy
US DOD	United States Department of Defense

Context of biosecurity

Figure 1: The invasion curve[1] helps visualize the context of biosecurity (prevention of arrival, establishment and spread). The green arrows represent the biosecurity priorities at each stage of the life cycle. The yellow boxes indicate the high-level actions required at each stage. Reduction of impact is not traditionally included in the scope of biosecurity, but actions to reduce impact are necessary if the biosecurity actions fail. Island archipelago countries have an advantage regarding the final stage as entire islands can be freed of some invasive species even if the species have been established for a long time (by island-wide eradication).



This context is equally applicable to national and domestic biosecurity. The major differences typically lie in responsibilities, capacity, and the legal frameworks.

What is an Early Detection Rapid Response Framework (EDRR)?

Early Detection and Rapid Response (EDRR) is an approach (or system or framework) that, if followed, will give Palau a better chance of eradicating a newly arriving, potential harmful species before it establishes and spreads. The actions needed can be summarised most simply as "prioritise, prepare, detect, and respond".

The development and implementation of the EDRR framework follows the steps outlined in the EDRR checklist (below). The checklist is based on a review of regional and international EDRR plans and represents a consensus used to develop the PRISMSS Protect our Islands EDRR Toolkit. This framework has been tailored for Palau based on the recent Palau biosecurity systems review and refinement by the main stakeholders.

Early Detection and Rapid Response frameworks are increasingly important as climate change impacts our environment. Invasive species represent a two-edged sword relative to climate change:

- Climate change causes an increase in frequency of extreme weather events. These weather events disrupt natural systems and provides open resource space (disturbed areas). Invasive species are often the first species to colonise these disturbed areas. Natural systems take longer to recover, and invasive species can inhibit or completely prevent their recovery.
- More favourable conditions for invasive species increase the impacts of climate change. The increase in available resources for invasive species increases their impacts. This in turn reduces

[1] Many versions of the invasion curve are found on the web. This curve was adapted from one created by the Australian Invasive Species Council: https://invasives.org.au/blog/setting-the-stage-for-invasive-species-research/. Note that eradication is expensive and unlikely to be feasible for all species and will depend on the tools and practices available and well as risks of reintroduction.

natural resilience to further climate events, impacts food security, provides opportunities for disease.

- Collectively, invasive species and climate change promote a damaging cycle on islands: climate change reduces the ability of island ecosystems to resist biological invasions, making invasions more frequent; invasive species then further disrupt ecosystems reducing their ability to adapt to the effects of climate change.

Ensuring invasive species impacts are minimised and new arrivals are prevented from establishing are therefore key actions to support nature-based, nature-focussed adaptation to the impacts of climate change.

The importance of early detection

The earlier a pest or invasive species is found, the more likely it is to be successfully eradicated (completely removed). The invasion curve below (Figure 1) is a good way to see why this is. The curve shows that as the invasive species spreads over time, covering an increasingly large area, eradication becomes less likely (usually impossible). At the same time control costs (and impacts) increase dramatically.

The importance of rapid response

Surveillance programs promote early detection of invasive species, allowing incursion responses to be rapid. The earlier the species is detected, and a response initiated, the higher the likelihood of eradication. Eradication is always the end goal of EDRR, because it is the most cost-effective option in the long term. If possible, when an invasive species is detected in a new place for the first time, action should be taken as quickly as possible to eradicate it. This requires being prepared.

Objective of the Early Detection and Rapid Response Framework

This framework has been devised to fulfil the requirement for an emergency response plan as specified in the Palau Biosecurity Act 2014, related executive orders and MOUs.

The objective is to provide a workable and agreed framework for early detection of, and rapid response to, the top priority biosecurity threats to Palau. Specifically, the framework aims to respond to any incursion of the following priority species that are not present anywhere in Palau (in order of priority), derived from the draft Palau black list:

1. Brown tree snake.
2. New biotypes of Coconut rhinoceros beetle (CRB).[2]
3. Little fire ant.
4. Coqui tree frog and any other introduced amphibians.
5. Other reptiles, such as red-eared slider turtle and any other snake.
6. Red imported fire ant.
7. Tilapia.
8. Invasive fish and other marine species[3].
9. Mongoose.
10. Wasps.
11. Ivy gourd and all other plants unless *proven* to not be invasive elsewhere.[4]

These species have been prioritized because of their potential impacts to Palau and their high risk of entry. If a species is not specifically permitted on the White List (regulated by MAFE), or accompanied by an import permit and phytosanitary certificate (if required by the Biosecurity Act), it should be treated as a threat.

While it might be tempting to write a framework that covers all possible threats, the number of staff, maintenance of capacity, and funding required would make this unachievable. Once a framework is implemented successfully for key threats, others can be added (for example other priority species from the black list). It is also important to note that best-practice standard operating procedures are not freely available for all species, so eradication cannot be guaranteed for some species. These types of species are the highest priority for prevention.

This framework is to be implemented by the Palau national government, in partnership with the affected state governments, and with the assistance of regional agencies, bilateral partners, and non-governmental agencies.

This framework should be seen as "adaptive" and subject to revision if priority species, pathways, and organizational structures change. Lessons learned from any future incursions should be incorporated into the framework.

[2] Although CRB is already in Palau, a new "biotype" has been found that is not controlled by the virus that controls other biotypes of CRB. This biotype has devastated palms in Guam, the Solomon Islands and Vanuatu. Practices such as night-time unloading of ships that come into Malakal from Guam (or other places that have the new biotype) should be eliminated to reduce this risk.

[3] Priority marine invasive species can be derived from the *Pacific Marine Biosecurity Toolkit*.

[4] A precautionary approach is recommended. The only allowable imports should be from the white list and only in commercial packages from reputable suppliers. Otherwise, as outlined in the Biosecurity Act, phytosanitary certificates and import permits are required and precautionary risk analysis should be undertaken (i.e., only allowed if they are known not to be invasive, rather than not known if they are invasive).

The place of EDRR within biosecurity

Although there are several possible approaches to early detection and rapid response,[5] including doing nothing, this framework is based on the fullest response: eradication is the goal of EDRR.

Early Detection and Rapid Response includes several interconnected biosecurity activities that are used to keep new invasive species from establishing in an area. In some form, actions must be on-going for an EDRR framework to be effective. These actions are:

1. Risk assessment to prioritize target species and pathways.
2. Response preparedness to make sure that staff have the skills and knowledge, and agencies are equipped to conduct surveillance for and undertake response to the target species.
3. Detection – ongoing surveillance for target species (with a major focus on public awareness, and a reporting mechanism).
4. Response, that is rapid and has a high likelihood of resulting in the eradication of the target species (including simulation exercises).

Ideally, the above actions will also be supported by prevention actions (such as border biosecurity checks and controls on imports of high-risk commodities) prior to arrival in the area covered by the EDRR framework.

The EDRR framework checklist

The checklist on the next page provides an overview of the actions required for the EDRR lead agency to implement the framework. The actions are described in more detail in the sections following discussion of the organization structure. Use the checklist as a quick guide.

[5] *Catch it early: invasive species early detection and rapid response* Battler guide page 8.

EDRR FRAMEWORK CHECKLIST			☑
PRIORITISE	Identify risk species and pathways	Prioritize risk species Identify risk pathways for priority species Develop species-specific plans as needed	
PREPARE	Ensure all needs for surveillance and response are in place	Define active surveillance area Decide on treatment products, training, tools Estimate costs Obtain permits Secure safe storage Obtain identification skills Train the team Maintain capacity: run simulations regularly Produce awareness materials	
DETECT	Active surveillance	Surveillance planned Surveys regularly scheduled and done	
	Passive surveillance	Share awareness materials Run regular public awareness campaigns	
RESPOND	Identification and initiation	Confirm identification Declare emergency Assign response leader Get additional resources*	
	Delimiting	Survey extent of incursion Trace back to source if possible Get additional resources	
	Containment	Establish movement controls Establish enforcement regime Maintain stakeholder awareness Get additional resources*	
	Continued surveillance	Continue active surveillance Continue public awareness Get additional resources*	
	Treatment activities (continue until eradication)	Notify public and stakeholders Conduct pre-treatment monitoring Undertake treatment(s) Conduct post-treatment monitoring Get additional resources*	
	Post-response evaluation	Review Refine processes	

* Staff, funds and so on, as needed

Organization

The organizational responsibilities for the EDRR framework can differ depending on the different but complementary needs of detection (surveillance) and response. The roles outlined here may need to be revised depending on the outcome of the agreement between MAFE and MOF regarding responsibilities for detection and response (confirmation of the EDRR lead agency).

Once the EDRR lead agency is confirmed, an incident management system (IMS) could be useful for response, but the workings of such a system are outside the scope of developing this framework. It would be expected that NEMO already have a system that could be used.

Focus on entry points

As the main (official) entry points to Palau that are likely to be first detection points for a new invasive species are in Airai (airport and post office) and Koror (Malakal port), these states have a major role within the EDRR framework.

If future official entry points are designated, those states should also have a major role in the EDRR framework. As it is known Sonsorol and Hatohobei can be entry points (although they do not have legal designation), they should also be included in the framework. And, if reported US DOD activities will result in Peleliu and Angaur being entry points from Guam, they also should be included in the EDRR framework. Surangel dock in Airai is also a potential entry point.

Risk assessment and response preparedness

Risk assessment and response preparedness are the responsibility of the EDRR lead agency and will be included in the final framework once that agency is confirmed.

Roles and responsibilities for Early Detection

Detection involves active and passive surveillance to ensure any new incursions are found early, so they can be rapidly responded to. The option chosen below is dependent on resolution of the issues around biosecurity responsibility.

The provisions in the Biosecurity Act[6] were superseded by the government's organizational restructure of 2021. Executive orders were issued clarifying some of the responsibilities of MAFE and MOF.

Cross-Ministry agreements through a signed MOU between MAFE and MOF are required to formalize the roles of the relevant organizations. Per the MOU, the Division of Biosecurity would undertake surveys (surveillance) as mandated in the Act, and the Bureau of Agriculture (the current NISC Chair) would coordinate information. Both parties consider that the NISC coordinator's role is to facilitate and coordinate surveillance and they will provide personnel. As the coordinator reports to the Director of the Bureau of Environment, the overall responsibility for coordinating response would fall within BOE and MAFE.

An MOU between MOF and MAFE would apportion most of the responsibilities for Parts 1-7 of the Act to MOF and Parts 8-9 to MAFE (and portions of Parts 1-7, relating to import permitting).

[6] In the Biosecurity Act, the Biosecurity Division was under MAFE's Bureau of Agriculture and thus subjected to the same mandates and laws as MAFE. Now, the Biosecurity Division is under the Ministry of Finance.

The MOU between MAFE and MOF must clearly state which agencies are legally mandated with coordinating information (MAFE), funding and implementing border surveillance (MOF), issuing citations for non-compliance (MOF), initiating a response sequence (MOF), and coordinating cross-sector response, including contacting NEMO and declaring an emergency (MAFE).

Role	Responsibility
Director BOE	Delegates NISC coordinator to coordinate surveillance.
National Invasive Species Committee • NISC Chair (BOA) • NISC coordinator (BOE)	• Facilitates and supports Prioritization and Preparation Steps, including facilitating and coordinating training for cross-ministry stakeholders. • Coordinates or supports active surveillance and reporting by BD, requesting the assistance of stakeholders as needed. May be undertaken as part of a project with funding support. • Requests support (personnel and expertise) from other Bureaus and stakeholders. • Members of the NISC may be asked to lead specific actions, such as active surveillance or awareness raising. • Publicizes their role with all stakeholders ("if you see an unusual plant and animal report to the NISC coordinator on this phone number/email address"). • Building capacity and shares detection report template with all national and state government and NGO stakeholder who might detect an invasive species or be advised by a member of the public of a detection. • Records and tracks all detections. • Shares records of import permits and quarantine within MAFE
Biosecurity response team Could BOE staff, BOA staff, PAN and Koror state rangers, other Koror state Conservation and other staff, staff from other states, NGO staff	Undertakes active surveillance under the guidance of the NISC coordinator.
Local NGOs, regional agencies (SPREP/SPC)	Provide access to experts. If appropriate, provide technical advice or contact technical experts regarding technical advice.
Technical experts	Provide technical advice on surveillance. Provide training if necessary and if funding allows.
All national and state government ministries (including those mentioned above) All NGOs Palau Council of Chiefs and other traditional leaders and organizations Residents and businesses (particularly tour operators and those that work in the environment) Waste facility operators Farmers, fishers and growers associations Port operators Medical professionals Animal Health professionals EQPB	• Target groups for awareness-raising – what they should look out for. • Record details and report any detection to the NISC coordinator. • If advised by other stakeholders (such as members of the public) of a detection, records the details and pass to the NISC coordinator. • If they are not able to do the above, at the very least they will accept responsibility to not "break the chain" of communication and ensure that reports are forwarded to someone who can act (preferably the NISC coordinator).

Roles and responsibilities for Rapid Response

Cells shaded blue indicate potential approvers of the EDRR framework, as they have mandated responsibilities for response under the Act. Cells shaded green indicate key parties involved in surveillance and response as part of their role (whether mandated in the Act or not). Orange indicates parties with a vested interest in the outcomes, or playing more minor roles, for additional circulation and feedback on the draft EDRR framework. This includes NGOs and other organizations that voluntarily take active part in the implementation of the EDRR framework, including surveillance, preparedness, and rapid response, but they have no legal mandate under the Act. ***Note that to be effective, it must be possible for a biosecurity emergency to be declared by the President. This would require the President to consider an incursion a significant threat to Palau.***

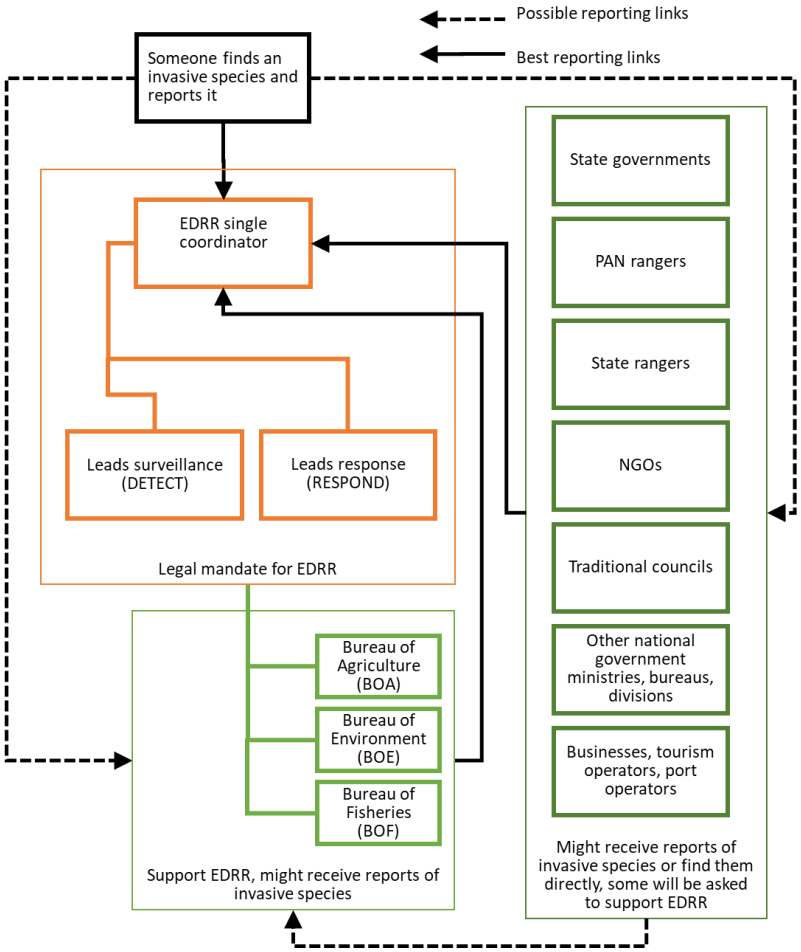
Role	Responsibility
President	Declares a biosecurity emergency response Approval of any decision not to eradicate, or to suspend emergency response.
Minister (MAFE)	Advises the President that a biosecurity emergency response is required. Approves emergency response actions and funding at the request of the Chief of Biosecurity. Approval of any decision not to eradicate, or to suspend emergency response.
Chief of Biosecurity or designate (the Response Leader)	The biosecurity officer with overall responsibility for day-to-day biosecurity. Leads the implementation of emergency response (including movement controls and surveillance). Facilitates approvals for additional staff and funding requests as required. Delegates biosecurity officer responsibilities as needed. Responsible for managing citations and enforcement. Liaises with other government departments. Maintain tools/equipment needed for response at accessible locations at the ports.
National Emergency Management Office	Enable access to emergency funds upon request from the President (mandated by the Act). Assists with coordinating the response.
Biosecurity officers (biosecurity response team)	Undertake response actions with the guidance of the Response Leader. Officers may be delegated to lead specific actions, such as surveillance or movement controls, or distributing awareness materials. May issue citations for breach of directions under the Act.
National Invasive Species Committee • NISC Chair (BOA) • NISC coordinator (BOE)	• Per MOU, the NISC is expected to create response plans and facilitate cross-sector response. • Prepare awareness materials for response.
Biosecurity response team delegates. NISC members Could BOE staff, BOA staff, PAN and Koror state rangers, other Koror state Conservation and other staff, staff from other states, NGO staff.	At the direction of the Chief (under powers of the Act to delegate biosecurity officers), and with appropriate training, will assist with emergency response processes (surveillance/movement controls/treatment) under the guidance of the Response Leader.
Chief of Police	Directs staff to support movement controls at the request of Minister.
Police officers	Support movement controls (assuming with the approval of Chief of Police, although this is not explicit in the Act), or in situations where members of the public are not compliant with Biosecurity mandates.
Ministry of Health	To be advised if the invasive species poses any health risks (such as Red imported fire ant toxins that can cause severe allergic reactions, anaphylaxis and/or infected stings).
EQPB	If required, may need to assist with EIA and to rapidly approve new pesticides/herbicides.

Role	Responsibility
Ministry of Finance (Bureau of Customs and Border Protection) staff and other members of border control	Provide support to Biosecurity team for passive surveillance (port/airport), as delegated by MOF Minister under the advice of Chief of Biosecurity or NISC Chair/BOE Director.
NGOs, regional agencies (SPREP/SPC)	Provide access to experts. If appropriate, provide technical advice or contact technical experts regarding technical advice.
Technical experts	Provide technical advice on treatment products and approach to management. Provide training if necessary and if funding allows. Participate in active response if allowed by NISC Chair and Chief of Biosecurity.
Other national and state government ministries	Assist with compliance with movement controls, inform and engage their staff as directed by the Response Leader (mandated under the Act).
General public	Comply with movement controls (mandated under the Act).
Traditional leaders	Comply with directions of Response Leader regarding movement controls and treatment. Direct villagers to comply with these directions (mandated under the Act).
Local residents in the response area	Comply with directions of Response Leader (mandated under the Act).

Organizational chart

The organization is dependent on the roles and responsibilities outlined above, which is not simply expressed in a chart without the explanation of the roles.

Given the limited resources available to Palau, a distributed approach (with specific roles for specific stakeholders reporting to different agencies and each having their own plan) is not only unnecessary but will likely hinder any framework implementation and not be manageable in the long term.



Communications framework for detection and response

The approach to fulfil the remaining requirements (methods, resources needed, communication channels are discussed below). Again, these do not need to be specific for stakeholders as everything just needs to go back to the EDRR lead agency. The more specific roles are related the EDRR actions and are outlined later in the framework.

Communication methods and channels

Regardless of the organizational responsibilities finally decided, the approach taken in this draft framework is that there is a single point of responsibility for leading the surveillance and response actions required for EDRR (EDRR lead agency). That single point differs depending on the three organization options above. However, stakeholders will follow the same process regardless of where the leadership lies.

Reporting detections

One central contact point is required for EDRR. They manage surveillance activities (for early detection) including public awareness (passive surveillance) and organising surveys (active surveillance). They receive reports that include the information outlined in the template below.

The intent is to make it as easy as possible for stakeholders to report detections, and for the EDRR lead agency coordinator to effectively manage those reports (and any response under this plan).

Note that non-priority species will also be reported, and need to be recorded, but will not by default trigger a rapid response. These need to be prioritised for action on a case-by-case basis.

The EDRR lead agency coordinator role should not be limited to a particular person, so that if the staffing changes, there is still only one contact point. To facilitate this, a single mobile phone (belonging to the role) and email address, such as palauinvasives@gmail.com (which currently exists) should be provided to all stakeholders to contact. For social media (if needed), a single username should be created.

Initial messages to stakeholders for framework rollout

Although initially, as this is a new system, people (stakeholders) will potentially contact a range of organisations that they think are responsible. Therefore, all those organisations should know to forward queries to the EDRR lead agency coordinator.

From the designated email address, all government and NGO stakeholders should be emailed with a message introducing the EDRR framework, the EDRR lead agency, the expectations of the stakeholder and the outline of the detection reporting requirements.

Invited using the designated email address, all government and NGO stakeholders should be invited to meetings introducing the EDRR framework, the EDRR lead agency, the expectations of the stakeholder and the outline of the detection reporting requirements.

Signs should be put up in prominent areas to advertise the contact details and reporting requirements for EDRR. Areas should include all waste management facilities, points of entry, NGO offices, tour operator offices, national and state government offices. These signs could have images of the priority species.

A Facebook post of the above is also needed, which can be repeated at intervals (decreasing over time as needed).

If fire ants arrive, the first signs might be people experiencing excessive stings (both little fre ant and red imported fire ant), or animals or people suffering from clouded corneas (little fire ant). Medical

professionals and animal health professionals (including staff of Ministry of Health (public health)) should be made aware of these special cases, so they know to report unusual "rashes" or blindness that are not caused by disease or have an unknown cause.

Palau is at risk from many venomous snakes, and a key message is that unknown snakes should not be approached but should be reported.

Detection reports

The information required (ideally) for a detection report are as follows (these can be made into a pretty document if needed to be shared with stakeholders, but the key is not the format, but the information included). The template should be in Palauan and English.

Report of an unusual plant, animal or other species that could be new to Palau[7]

"If in doubt, report it".

Email palauinvasives@gmail.com or post to MAFE facebook page https://www.facebook.com/mafepalau or phone Bureau of Agriculture on 6225804 to report a sighting and include all the following information if possible. If any information is not known, that's OK – the main thing to know is "*If in doubt, report it"*.

1. What was found. Was it a plant or animal, or a sign of a plant or animal disease, or just something unusual in the natural environment, or damage that might have been caused by a plant, animal, or disease:
2. Please attach/send photos if possible. Take at least a few photos, from different angles. Try to make them as clear as you can.
3. Date of report:
4. Name of the reporter (your name):
5. Your contact phone/email:
6. Date found:
7. Who was it found by (if not you):
8. Contact phone/email of who found it (if not you):
9. Where was it found (be as specific as possible):
10. Would you like to tell us anything else:

Report # (office use only):

It can be tempting to request a lot of information in a detection report, but this can put people off using it – better to keep it simple and then hopefully they will report it anyway.

Detection recording

All reports should be logged into a spreadsheet (see the EDRR toolkit for an example that can be used).

Following up on a detection

After recording, follow the guidelines outlined in the RESPOND Decision pathway below.

[7] This is the equivalent of a BOA intake form.

Non-attendance at phone and email address

If not attended or busy on another call, the mobile phone message should request that the person calling leave their name and contact.

"This mobile is currently not being attended. If you are reporting an unusual plant or animal or possible invasive species, please leave you contact phone number, and we will get back to you as soon as possible. It is our target to get back to you within 24 hours".

Similarly, the email should also include these details.

It will take time before the single point of contact is embedded in people's minds.

Resources needed

The following are the immediate resources needed to begin implementing the framework. Additional resources will be needed for rapid response and are described in more detail in the RESPOND section.

- Mobile phone belonging to the EDRR lead agency (for reporting detections and managing responses).
- Specific email address, such as palauinvasives@gmail.com (for reporting detections and managing responses).
- Dedicated phone number for reporting.
- Staff and funding to:
  - develop an ongoing awareness program (using face to face meetings and Facebook), produce and regularly share awareness materials to support passive surveillance.
  - Organise and run occasional active surveillance for the target species.
  - Organise training for key stakeholders (biosecurity response team as outlined in the Roles and responsibilities) for managing responses to invasive species (see EDRR framework of actions below).
  - Make and keep up connections with partners inside and outside Palau for support for EDRR (including awareness materials, advice on protocols for active surveillance, commitments to assist with rapid response).

The EDRR framework of actions

This section provides more detail on the actions noted in the checklist (to be managed by the EDRR lead agency).

PRIORITISE: Risk assessment

Risk assessment is an on-going component of international and domestic biosecurity work.

The first step in an EDRR framework is to identify which species should be the target of a response preparedness strategy. The number of species targeted will be limited by funding, training capacity, availability of tools and so on. Having everything prepared for the arrival of a new invasive species can be costly, so while it might be tempting to try to target all potential arrivals, it makes more sense to prioritize those that are most likely to arrive and have the biggest impact, that is, high-risk species.

Palau has prioritized the following species that are not present anywhere in the country (in order of priority), derived from the draft Palau black list:

1. Brown tree snake (*Boiga irregularis*).
2. New biotypes of Coconut rhinoceros beetle (*Oryctes rhinoceros*; CRB).[8]
3. Little fire ant (*Wasmannia auropunctata*).
4. Coqui tree frog (*Eleutherodactylus coqui*)and any other introduced amphibians.
5. Other reptiles, such as red-eared slider turtle (*Trachemys scripta elegans*) and any snake.
6. Red imported fire ant (*Solenopsis invicta*).
7. Tilapia (*Oreochromis mossambicus*).
8. Other invasive fish and other marine species. [9]
9. Mongoose (*Herpestes auropunctatus, H. fuscus*).
10. Wasps (various species that are not already present).
11. Ivy gourd (*Coccinia grandis*) and all other invasive plants (including seeds). [10]

The second part of risk assessment is identifying the pathways that risk species are arriving from, which helps determine the surveillance needed to result in early detection. High-risk species are those that are already present in trading partners and pose a serious risk elsewhere. The harm these species could cause if they become established is an important consideration when prioritizing targets for response preparedness. Knowing where the species might come from helps identify the location for potential EDRR (that is, areas for targeted surveillance).

Distributions of priority species

Knowing the current reported distribution of priority species helps assess and manage risk. These are known for many key invasive species and published in lists like CABI, GRIIS.

Once priorities have been set, EDRR plans, and standard operating procedures can be sourced for each species and pathways.

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[8] Although CRB is already in Palau, a different "biotype" has been found that in other places is not controlled by the virus that controls other biotypes of CRB. This biotype has devasted palms in Guam, the Solomon Islands and Vanuatu. The biotype, known as "CRB-G" has been detected in Palau, but it is not known if it is controlled by the virus that controls other biotypes.

[9] The Pacific Marine Biosecurity Toolkit has a list of species that are a high priority for prevention in the Pacific islands region.

[10] Consider whether it might be best to take a more precautionary approach and blanket ban the importation of all plants, and allow the importation only of seeds from approved manufacturers (which have been treated to prevent disease transmission), and only seeds of plants that have been demonstrated to have a low risk of invasiveness elsewhere (such as those that do not appear on the PIER and Plant Pono lists)

So far, key international pathways identified include:

By air

Palau International Airport in Airai state (Babeldaob) has international flights to and from various counties including **Guam (USA), Yap (FSM), Manila (Philippines), Seoul (South Korea), Taipei, and Narita (Japan).** The United States Department of Defense also uses this airport. The Palau airport provides 7 weekly turn-around services between **Guam and Palau, with stops on Yap and Saipan**.

Small planes also travel between **Palau and Guam and Yap.**

Postal deliveries are sent from the Airport to Post Office. For instance, seeds are brought in via packages at the post office.

Military and other special activities

The US DOD is further developing the airstrips at Angaur and Peleliu, with flights from **Guam**. In the past, aircraft were checked for snakes prior to departure from Guam. When it was not possible it conduct pre-departure checks, including checks by detector dogs, Biosecurity staff in Palau were advised so they could be on the lookout. It is uncertain if these processes are still current. It is desirable to ensure they are in place for flights from **Guam to anywhere in Palau**, particularly since **Angaur** and **Peleliu** are not designated entry points and do not have state biosecurity officers either.

Annual Christmas Drops deliver goods from the air to the sea and includes air forces from many countries and source airports, such as (in 2022) PACAF's 374th Airlift Wing from **Yokota Air Base in Japan**, the 36th Wing from Andersen AFB in **Guam**, the 15th Wing from Joint Base **Pearl Harbor, Hawai'i**.

The RBP notes that "Military officials do not inform Palau quarantine officials when aircraft arrive, leave trash for government officials to destroy, and drop cargo and supplies for Palau construction projects. Equipment is washed on the tarmac without proper drainage facilities."

In partnership with Palau, the US DOD is scheduled to build another radar tower in Hatohobei State (possibly Helen Reef although yet to be determined). There is planned military transport ex **Guam to Peleliu and Angaur**.

By sea

Palau is well connected to Asia and the mainland United States, as well as to other islands in the region with two ships per month currently. Shipping lines service Malakal Commercial Dock, bringing cargo from the **US west coast, Japan, Australia, Taiwan, Hong Kong, the Philippines, Guam, and elsewhere.** Another shipping line operates mostly in Asia and brings cargo **from Korea, Japan, the Philippines, Hong Kong, Taiwan, Saipan, Guam, and Yap**. Transshipments between **Guam and Palau** are routine.

Ships unload at Malakal port at night. This is a risk for many species, including insects and birds attracted to light. Of most concern are ships that arrive from Guam, which could be carrying CRB.

Military transport

Guided missile frigates to Palau also visit **Australia, Japan, Philippines, Hawai'i, Singapore**.

Intra-region commercial cargo vessels

Although the intra-regional commercial vessel traffic is light, it is highly regular. Commercial intra-regional shipping follows various routes, including **Guam, Saipan (CNMI), Yap (FSM), and Koror.**

Commercial traffic to most regions of Micronesia is relatively strongly linked to **Guam** (80% of the commercial ships). Palau also receives ships coming directly from **Australia** and **various Asian ports**, including oil tankers arriving once a month from **Indonesia and the Philippines**. A barge travels

regularly between Palau and Yap. Mariana Express Lines from Guam and Kyowa Steamship Lines from Japan travel to Palau (2009-2010).

Fishing vessels

In Palau, many vessels in the "local" fleet return home to Taiwan or the Philippines for New Year celebrations, staying away for a month or longer. These vessels are likely to be colonized by fouling organisms while abroad, and then potentially transport species to Palau upon return.

Fishing vessels based in foreign ports including Taiwan, China, Japan, Korea, and Papua New Guinea also arrive to all Micronesian ports, including large "mother ships," which take off-loaded catch from the locally based fleet.

Cruise ships

Palau receives about five to 10 cruise ships a year (prior to the pandemic), which typically stay three to four days, and arrive from Japan, the Philippines, and Australia.

Yachts and liveaboards

Palau receives about two yachts a month, and many of these travel to Guam and have stopped previously in the Philippines. Yachts are supposed to check in with Sam's yacht club in Koror, but this needs to be enforced. Aimeliik may advocate for creation of a yacht port, in which case they would need to be included in EDRR.

Miscellaneous small vessels

In the past Palau has been visited by a heavily fouled missionary boat from Korea.

There are also various passenger/cargo vessels that run between islands within the Micronesia region. These would include vessels which travel from the main islands such as Majuro, Chuuk, Pohnpei, Yap, and Palau to smaller islands within their boundaries, but some vessels also cross between jurisdictions.

Laid up vessels

In 2009 plans were being discussed in Palau to allow laid-up vessels. Palau was approached by a group that wished to move 30 vessels laid up in Davao, Philippines to the Palau harbor, where mooring spaces are less costly.

Fish Attracting Devices

While FADs appear to be extremely low risk for non-native species introductions and spread, abandoned boats and other floating objects are sometimes deployed as FADs and are not well-monitored (as reported from Palau in 2009 in the RBP). One of the Palauan FADs, an abandoned vessel, ran aground and had to be broken up and sunk. In such cases, the source(s) and relocation of floating objects risks the potential introduction of marine species; it is often not clear what policies or practices for use of vessels or other floating materials throughout the region.

Oil-drilling platforms

Platforms can remain in a location for long periods and develop extensive biofouling communities. These can be transferred (at slow speed) to other locations, posing a high risk of species introductions. There are currently no regulations in Palau for biofouling on drilling rigs and platforms.

Disaster relief

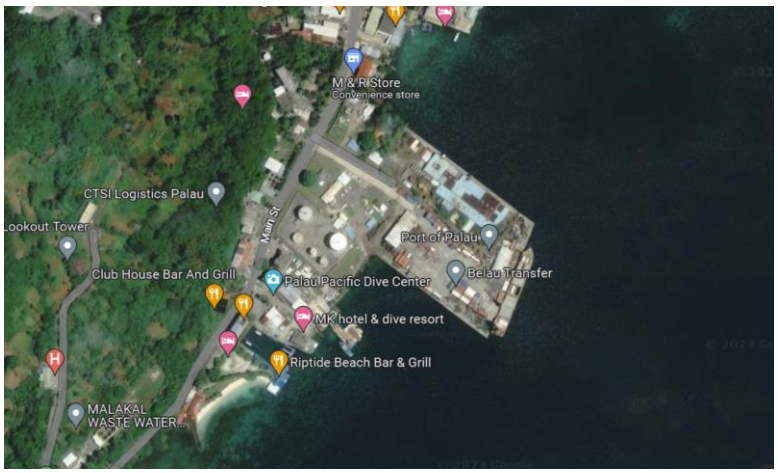
Humanitarian emergencies in general and damage caused by extreme events such as cyclones may directly carry new invasive species, but their major threat is an indirect one through consequent relief operations. Large shipments of supplies and relief materials may enter the country over a short period from a variety of different countries, at a time when border control may be limited or of lower priority. While humanitarian needs are the priority, disaster management planning needs to

incorporate biosecurity to avoid the potential longer-term impacts of new invasive species on the economy and environment.

PREPARE: Response preparedness

Once the potential target species are decided, the key to **rapid** response is having as much as possible ready to go before an incursion happens. Being prepared involves:

1. Identifying responsibilities and roles for leading and supporting EDRR (see organization).
2. Identifying who can assist with technical support and funding for the response.
3. Sourcing appropriate protocols for surveillance and response.
4. Ensuring appropriate permits are in place (environmental license/import permit). An environmental impact assessment (EIA) may be needed from the EQPB for permits; and ensuring safe and secure storage for the treatment products and equipment on arrival (housing of biosecurity treatments).
5. If time and resources allow, estimate the costs of response:
    - contacting suppliers for quotes for, and ordering, the treatment product(s) and application tools.
    - estimating purchase costs for treatment (including equipment and freight).
6. Define the priority areas for focused surveillance (around entry points and common post-entry areas, with emphasis on Malakal port). This is the focus area for targeted surveillance (for many potential species of concern), and the area that would have been used to estimate the resources needed for response preparedness.
7. Training the biosecurity team[11] in how to recognize the priority species; how to do surveillance. If time and resources allow also train the team in treatment protocols including use of treatment products and monitoring. Should staff change roles or move out of the team, training should be kept up to date. This is particularly important for key leader of the emergency response.
8. Starting an on-going awareness program.[12]
9. Ensuring that the above capacity is maintained within the Biosecurity team. Run simulations if possible.



Above: An aerial view of an area targeted for EDRR active surveillance. This is the highest risk entry point. Image sourced from Google Maps (http://maps.google.com).

[11] See roles and responsibilities.
[12] See awareness section for more detail.

DETECT: Surveillance

Surveillance of high-risk sites is the best form of defense against incursions of invasive species. High-risk areas for entry of invasive species include wharves and jetties, seaports, airports, devanning sites, sea container storage sites and transitional facilities. Nearby areas that could provide suitable habitat (nesting sites, shelter) or resources (food) for invasive species, should also be part of the surveillance actions.

Surveillance can require many resources, particularly time. These costs are only a tiny fraction of the economic and social costs of invasive species in the long term.

Active surveillance

Active surveillance involves surveys undertaken by trained biosecurity staff. Surveillance techniques will vary depending on the target. The Annexes describe where to find active surveillance protocols for the target species (where available).

It is critical that staff undertaking surveys are familiar with species that are already present, so that new arrivals can be detected quickly. To assist with familiarity, active surveillance should be undertaken on a regular basis, with the schedule dependent on the frequency of transport to the target area, and the time and resources available.

Incorporate EDRR into active surveillance SOPs at the airport, port, and post office.

Passive surveillance (awareness raising)

Passive surveillance involves building public awareness of emerging biosecurity risks and encouraging notification to biosecurity staff. Such surveillance needs an awareness campaign to inform the public about the threat. If budget and time are an issue, awareness can focus on key interested parties only, such as port and airport workers, importers, people using boats to travel between islands.

Of course, no process is perfect. Sometimes the first detection will not be at the initial point of entry. This is why passive surveillance through public awareness is important, along with an effective reporting system.

Passive surveillance (awareness raising) requires regular positive reinforcement to continue to be effective. The Annexes have information for passive surveillance suggestions for the target species (and can be added to once the target species are confirmed).

An awareness program will be planned by Palau, potentially using Facebook, radio, and face to face work with communities.

Awareness messages that are more general can also be useful ("report any unusual plants and animals to the EDRR lead agency", "be a good neighbor", for example).Citizen science initiatives are useful tools to engage interested parties, and can result in early detection, as well as reinforcing community vigilance in an enjoyable way. One example is the use of iNaturalist, which can be educational as well as giving access to technical experts. Reports on iNaturalist would need to be monitored by the EDRR lead agency.

Sharing resources that compare native versus invasive species[13] would be useful to:

a) Encourage replacement of invasive plants with native plants.

[13] As developed by the late Dr Joel Miles.

b) Create awareness of the differences between invasive plants and animals and similar native species as an early detection tool. For example, the differences between invasive frogs and snakes and native frogs and snakes.

See the Detection reporting and recording processes outlined earlier.

RESPOND: Rapid response

Once an incursion of a target invasive species is detected through surveillance the following general actions are undertaken in as *short a timeframe as possible*. The actions for the specific targets are described in detail in the Annexes.

Response actions once a potential target has been detected are:

1. Confirmed identification of target species.
2. Delimiting of the area (that is, the limits of the incursion, and the area subject to treatments to eradicate the invasive species, and movement control of goods and people outside the area).
3. Continued surveillance to detect any spread (including active surveillance and public awareness).
4. Containment and movement control.
5. Treatment of the biosecurity emergency area using pesticides (or other means depending on the protocols for the target pest/invasive species).
6. Post-response evaluation.

See Organization section for roles and responsibilities for response.

Response in detail

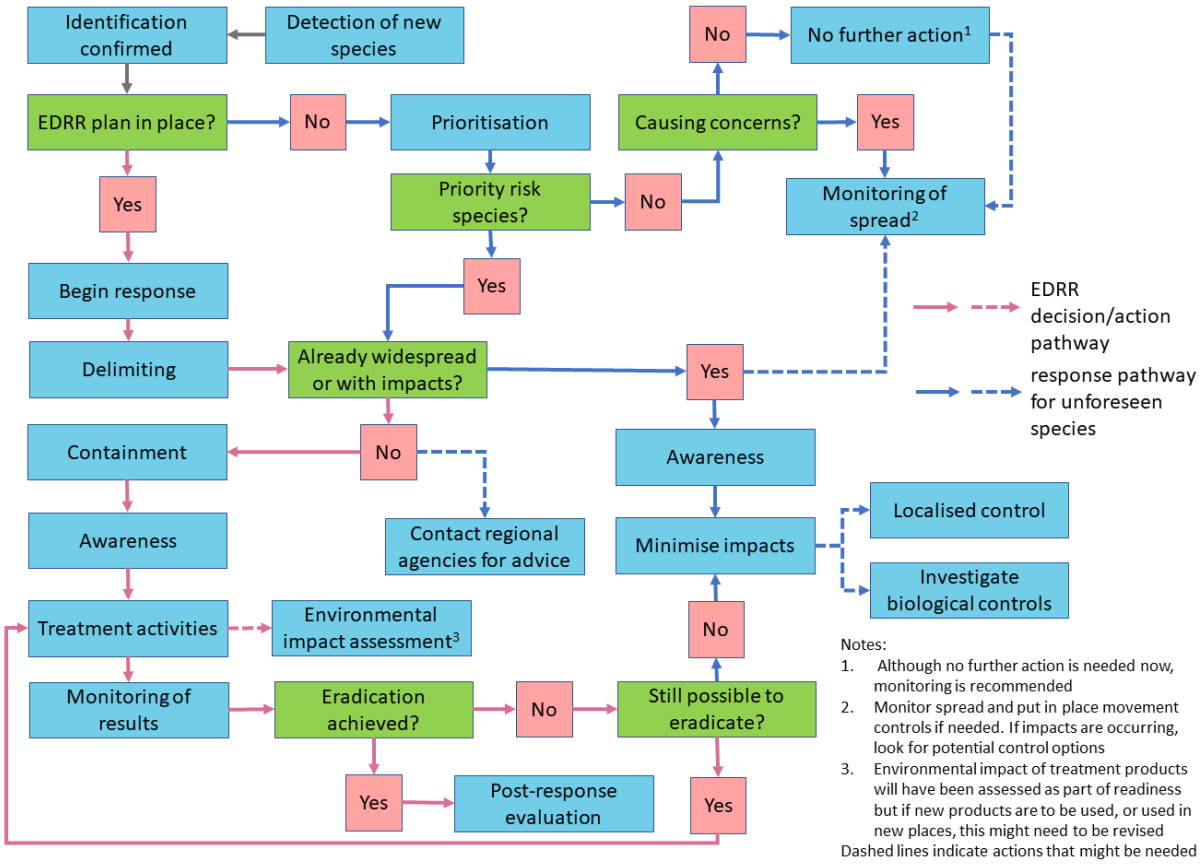
The faster the response is initiated, the greater the likelihood of successful eradication.

The generic response is described in the sections below. These generic actions are tailored depending on the selected target. Specific actions for the target species are outlined in the Annexes and can be built upon as resources become available.

The Roles and responsibilities section outlines the roles of people involved in the EDRR response.

Decision pathway

The simplified decision pathway on the next page shows key questions and actions and can be followed for any response (for an already prioritized species or for something unexpected). The Response Leader or delegate should use this together with the EDRR checklist.



Detection and identification

Once a potential detection has been reported to the EDRR lead agency, a designated trained person will lead the response process. This is the Response Leader.

The Response Leader will alert the Minister responsible to the potential incursion and obtain approval to initiate the response.

The Response Leader will confirm identification of the target. If needed the Response Leader may contact SPC (crop pests) or SPREP (invasive species) or other agencies to assist with identification. This would not be necessary unless the emergency involves a species not already prioritized for EDRR (see pathway above). SPREP or SPC will facilitate liaison with appropriate experts to confirm identification as soon as possible.

On confirmation of identification the Response Leader will notify the Minister responsible, who will approve continuation of the response and advise the President and Minister that:

- a biosecurity emergency should be declared, and a response should be initiated as per the Biosecurity Act 2014; and
- depending on the limits of the incursion, additional funding or resources may be required for a successful response.

At this point eradication of the target is the response goal. If eradication is considered not achievable, the strategy must be adapted. Typically, the new strategy will be one of on-going control of the species.

Mobilisation of staff

The responsible Minister will authorize relief staff for biosecurity so that the Response Leader and other Biosecurity team members can focus on the response as their highest priority.

The responsible Minister approves staff attachments to assist staff to undertake delimiting and approves additional funding for delimiting materials (if needed).

The responsible Minister approves additional staff to tailor awareness materials and prepare to assist Biosecurity staff with advising affected interested parties.

The response is the *only priority work* for all staff mobilized at this point.

As per section 66 of the Biosecurity Act a Notification of emergency declaration is required and must be published as per section 82 of the Act and posted on signs in the Response area.

Delimiting

As per section 67 of the Biosecurity Act, and using the powers given in section 54, the response area must be delimited.

The Response Leader will lead the delimiting of the incursion. The Response Leader and staff will train attached staff on surveillance/delimiting methods and on field identification of the target.

From the first detection point standard surveillance methods for the species will be used to find the limits of the incursion. The limits are defined as the area where the target species is detected, PLUS an appropriate buffer zone. These limits define the Response area.

Once the Response area is known it will be apparent that either the area is:

a) within the area targeted for EDRR surveillance (for which EIA has been undertaken and Environment Licenses have been obtained), and of a size that treatment products have been provided for; or
b) outside the EDRR area or larger than the previously estimated size.

If the Response area is within the EDRR area, treatment should be undertaken according to the protocols for the target species.

At this point, depending on the extent of the incursion, and if not done previously, the Response Leader may need to escalate the response as a National Disaster (depending on the species and legislation provision. The Minister, as appropriate, will consult with NEMO (as per section 67 of the Biosecurity Act). NEMO is responsible for working with the appropriate ministry/organization in case of disaster.

Extension of Response area

It should be noted that there may be more than one Response area if the pest/invasive species has been moved around prior to detection.

At this point, depending on the extent of the incursion, and if not done previously, the Response Leader may need to escalate the response as a National Disaster (depending on the species and legislation provision. The Minister, as appropriate, will consult with NEMO (as per section 67 of the Biosecurity Act). NEMO is responsible for working with the appropriate ministry/organization in case of disaster. Should insufficient funding be available to continue with the response, movement controls and surveillance should continue. However, if the target is not eradicated, it is likely to spread throughout the country and preparations should be made to contain the invasive species and reduce potential impact. Because of the consequences of not eradicating the target species, the decision not to proceed from this point must be made at the highest levels.

Although it might take time to mobilize funds/staff/outside assistance, and obtain any necessary additional resources, the rest of the response process (movement controls and surveillance) must continue until the decision has been made to stop eradication efforts.

Continued surveillance

During the Response phase, active and passive surveillance must be promoted and continued.

Surveillance may need to increase in intensity to determine if the target species has spread.

With the approval of the responsible Minister the Response Leader may assign an additional team member to lead the surveillance effort, so the Response Leader can focus on the response.

Containment

Movement controls are used to contain an incursion and prevent the invasive species spreading from an infested area.

There are two parts to the containment of the species.

1. Restriction of natural spread: preventing target invasive species independently (by flight or on foot) spreading to new areas. This is done by removing potential habitat and buffer clearance (depending on the target species).
2. Reducing the risk of jump dispersal: ensuring target invasive species are unable to 'hitchhike' out of the infested area and establish elsewhere. This requires the control of movements of goods and commodities that can act as pathways.

Both parts of containment involve surveillance. High value areas (for biodiversity or agriculture or human well-being [homes, schools and hospitals]) close to the Response area should be identified and secured.

Depending on the target species, specific commodities will be barred from movement out of the actual biosecurity emergency area. Spot checks of vehicles will need to be undertaken to ensure compliance.

With the approval of the responsible Minister, the Response Leader may assign an additional team member to lead the containment and movement control effort, so the Response Leader can focus on the response.

Assistance from law enforcement

Compliance with movement controls may be more effective if assistance from law enforcement personnel is obtained. In this case the responsible Minister would request that the Minister of Justice mandates the assistance of law enforcement personnel.

Any person who does not comply with movement control restrictions is subject to a fine according to the specifications in Part 12 of the Biosecurity Act.

Awareness and engagement

Once the Response area is defined, affected interested parties within the area must be fully informed regarding the reasons for the response, consequences of not treating the area, and potential hazards of treatment. People will naturally be concerned about the use of chemicals/pesticides, especially around homes, schools, hospitals, markets, and food stores.

In some cases, there may be initial (or persistent) resistance to treatment. It will be important to ensure interested parties know the consequences of allowing the target to persist and spread. The concerns of interested parties are important and must be treated with respect and appropriate information.

One difficult situation is when, despite understanding the consequences, owners still refuse treatment to be undertaken on their property. In this case legislation can assist with ensuring compliance (section 68 of the Biosecurity Act) can be invoked by the Minister, on the advice of the Director and with the advice of Cabinet, to provide for treatment of goods and land in the Response area. Refusal may be subject to fines (Part 12 of the Act).

Treatment program for the Response area

The treatment program commences once the Response area has been defined, movement controls have been established, ongoing surveillance has been implemented, and interested parties have been engaged.

From this point the Response area is also referred to as the treatment area.

Detailed treatment procedures for each target species are outlined in the Annexes, and the general principles are summarised here. The Response Leader leads all treatment-related activities.

1. Immediate pre-treatment activities (see Annexes for details)

- Ensure treatment products and resources *for the entire eradication*[14] have been obtained, or that they will be available in the appropriate time frame.
- Notify interested parties via community meetings, signs, and information leaflets.
- Restrict access to the treatment area if necessary. This may not be possible if the treatment area is in a residential area or school.
- Complete staff mobilization and training of attached staff in treatment procedures, with an emphasis on safe handling.
- Pre-treatment monitoring to assess environmental status. This is done to ensure there are no non-target effects of treatment (this may be required as part of obtaining environmental permits or licenses).

2. Treatment activities (see Annexes for details)

- Final pre-treatment delimiting.
- Undertake treatment.

3. Immediate post-treatment activities (see Annexes for details)

- Post-treatment monitoring to assess any negative environmental effects.
- Review of treatment activity.
- Immediate post-treatment delimiting.

4. Post-treatment review

After treatment activities and monitoring are undertaken, a review of the status is undertaken, and includes debriefs within the team and discussions with interested parties. Any issues (problems or concerns) must be addressed before proceeding with further treatments, that is, adaptive management.

The above four activities are undertaken multiple times depending on the target species (see Annexes).

Many factors affect successful eradication. At some point it may become apparent that the response will not result in eradication or that the cost of repeated treatments is too high. See Response risks below.

[14] Eradication of some invasive species requires repeated treatment. This is particularly true for insects such as red imported fire ant and little fire ant, plants, and reptiles. Having sufficient resources for the entire eradication is important, as often, once treatment starts it needs to be completed.

Post-response

Once the treatment activities have ceased (that is, the eradication has been achieved or the strategy has changed to management), the Response should be reviewed. Review and refine response processes and this document as required. This should include feedback from all interested parties.

Continue with surveillance to ensure that the target species does not re-infest the area. In some cases (such as ants), the species can be difficult to detect while at low numbers, so eradication may not have been achieved.

Ensure response preparedness actions are sustained.

Response risks

Eradication of invasive species is often not simple. Many factors can negatively affect the outcome of an eradication program. Some key risks, their likelihood, and influences on success are outlined below.

The likelihood of the risk eventuating is influenced by how well risks are controlled. Other aspects, such as the biology of the target species, the situation of the biosecurity emergency area, and the knowledge of eradication tools for the target species will also influence the likelihood of eradication success/risk profile.

Risk	Uncontrolled likelihood	Influences
Spread outside of the containment area.	High	Movement control compliance.
Environmental damage caused by treatment.	Low-High	Appropriate treatment products used. Products used in accordance with manufacturer guidelines.
Injury to team members or the public caused by treatment.	Low-High	Tools and products used according to manufacturer's instructions/MDS. Health and Safety Guidelines consistently followed.
Inability to eradicate using chosen/available resources.	Medium	Environmental conditions make eradication difficult. Correct use of treatment products. Selection of correct treatment products. Selected treatment products are appropriate for the environment. Persistence with treatments. Commitment of funding and support.
Repeat incursion of the target species.	Medium	Surveillance is maintained. Risk mitigation in source countries or islands (import restrictions).

Annexes

Distributions of priority species

This information can potentially be derived from the GISD or GRIIS databases, or from CABI for the priority species.

The 2019 (and hopefully still current) distributions of Little Fire Ants and Red Imported Fire Ants can be found in the distribution database in the Pacific Invasive Ant Toolkit.

Protocols/Standard Operating Procedures for target species

- Protocols for fire ants
- Protocols for rodents

Include other protocols as they are developed. Protocols developed through Protect our Islands will be available here.

Example EDRR plans

A plan for prevention of establishment of new ant species in Hawai'i, with special attention to the red imported fire ant. 2001. Hawai'i Ant Group (an interagency group consisting of representatives from Hawaii Department of Agriculture, Bishop Museum, University of Hawai'i, U.S. Geologic Survey, U.S. Department of Agriculture, and U.S. Fish and Wildlife Service). On request.

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Coordinated Incident Management System (3rd edition). Advice on how to operate an incident response system.

Environmental and Social Impact Assessment (ESIA) for potential incursion of little fire ant and/or red imported fire ant in Tarawa, Kiribati. 2018. Prepared by Meghan Cooling and Monica Gruber, Pacific Biosecurity for New Zealand Ministry of Foreign Affairs and Trade and Government of Kiribati (MELAD). https://piat.org.nz/uploads/PIAT_content/docs/ESIA_Tarawa_Synergy%20Pro.docx

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Pacific Invasives Initiative. 2011. Resource Kit for Rodent and Cat Eradication. http://www.pacificinvasivesinitiative.org/rk/

Pacific Invasives Initiative. 2013. Resource Kit for Invasive Plant Management. http://ipm.pacificinvasivesinitiative.org

Protect our islands with biosecurity. SPREP invasive species battler guide. 2020. SPREP. Apia, Samoa. https://www.sprep.org/sites/default/files/documents/publications/pisb-series-biosecurity_0.pdf

Protect our Islands EDRR Toolkit. If resources required to fulfil the needs of this plan are not available in the EDRR Toolkit, please lodge a request with PRISMSS, so that they can look for ways to develop them, or locate technical advice.

Remove rodents from small tropical islands with success. SPREP invasive species battler guide. 2016. SPREP. Apia, Samoa. https://www.sprep.org/attachments/Publications/BEM/remove-rodents-small-tropical-islands.pdf

The invasion curve: a tool for understanding invasive species management in South Florida. 2018. WEC347, UF/IFAS. Prepared by Rebecca G. Harvey and Frank J. Mazzotti, University of Florida UF/IFAS Extension. https://piat.org.nz/uploads/PIAT_content/pdfs/Harvey%20and%20Mazzotti_2016_Invasion%20curve.pdf. Adapted from Invasive Plants and Animals Policy Framework, State of Victoria, Department of Primary Industries, 2010. http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/protecting-victoria/invasive-plants-and-animals/invasive-plants-and-animals-policy-framework

Links to other biosecurity resources

See the Pacific Biosecurity Protect our Islands webpages for up-to-date resources.

Example biosecurity plans, templates, and other biosecurity resources

- Biosecurity guidelines for the Phoenix Islands Protected Area
- Biosecurity protocols for entering the Phoenix Islands Protected Area
- Biosecurity Plan for Ouvea Atoll, Loyalty Islands, New Caledonia
- New Zealand Department of Conservation inter-island biosecurity guidance for Pacific island countries
- Protect our Islands *clean boats, clean boats* framework for biosecurity in the Pacific islands region

General biosecurity and invasive species management resources

- Global Register of Introduced and Invasive Species (GRIIS)
- Pacific Marine Biosecurity Toolkit
- Invasive Battler Guides (Battler Resource Base)
- iNaturalist (post an image for an expert to identify)
- PestNet Community and Factsheets/Pacific Pests, Pathogens and Weeds
- Invasive Plant Management
- Rodent and Cat Eradication Toolkit
- Protect our Islands EDRR factsheets for priority species
- Standard Operating Procedures for invasive ant EDRR
- Standard Operating Procedures for rodent EDRR
- NENS Pacific weeds factsheets
- Coconut Pests and Diseases Toolkit
- Pacific Invasive Ant Key (PIAKey)
- Pacific Invasive Ant Toolkit (PIAT)
- Pacific Pest List Database (PLD)
- Global Invasive Species Database (GISD)
- Invasive Species Compendium (CABI)
- Pacific Island Ecosystems at Risk (PIER)
- PlantPono
- GBIF/PBIF
- UK Overseas Territory biosecurity toolkit