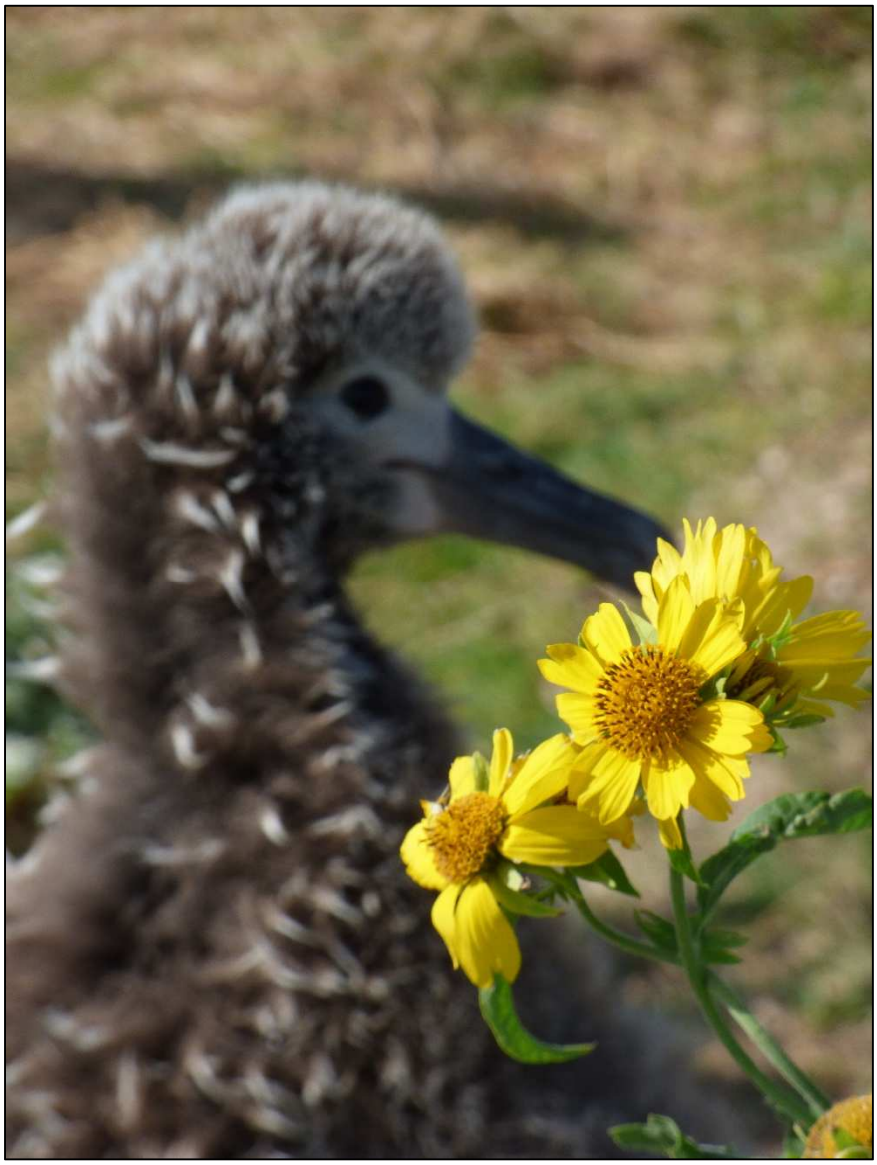
Botanical Survey of Midway Atoll

2015

Prepared for:
United States Fish and Wildlife Service

Prepared by:
Forest Starr and Kim Starr



OBJECTIVE

In order to keep a pulse on the status of plants on Midway, botanical surveys are occasionally conducted. The first known botanical records are from W.A. Bryan in 1902.

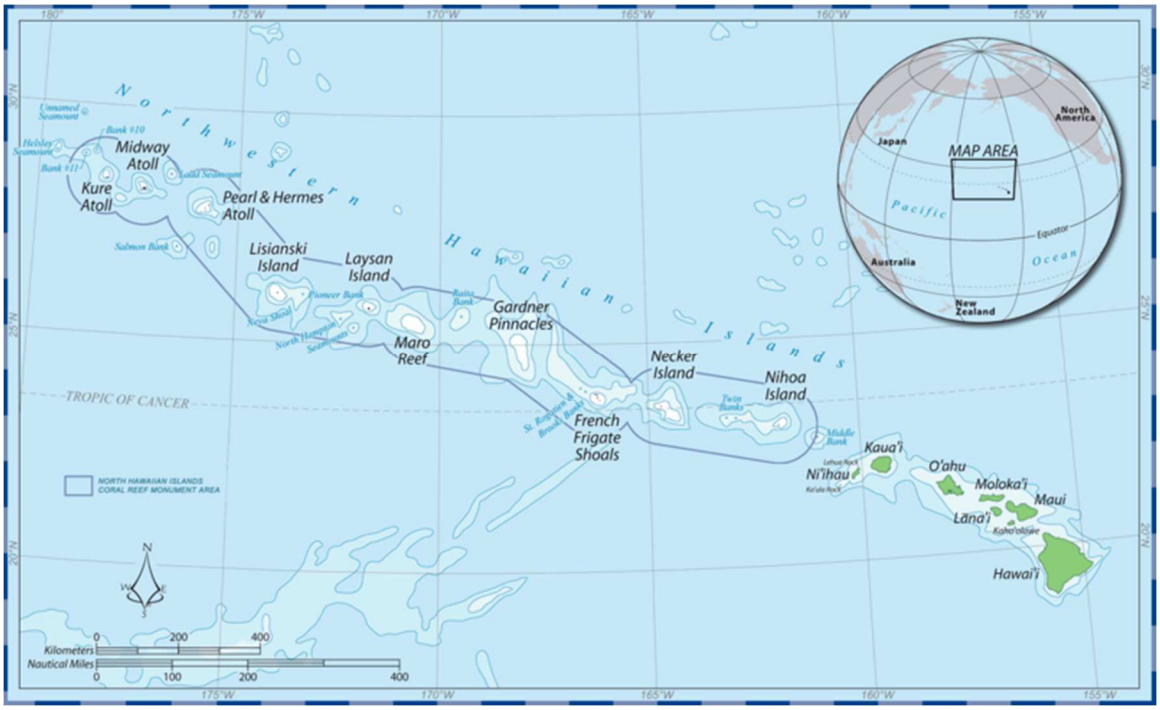
The goal of this 2015 survey was to update the current list of plants known from Midway, with a focus on incipient non-native species.

OVERVIEW

Midway Atoll is located in the North Pacific Ocean, near the northwestern tip of the northwestern Hawaiian Island chain (28N, 177W).

Midway is home to spectacular wildlife, including numerous seabirds, monk seals, turtles, and other marine life; native Hawaiian coastal vegetation; and a rich commercial and military history, including the Pacific Cable Company, Pan American Airways, and the Battle of Midway.

Midway Atoll is now under the jurisdiction of the United States Fish and Wildlife Service under the current title of National Wildlife Refuge, Battle of Midway National Memorial, and Papahanaumokuakea National Marine Monument.



Map of Northwestern Hawaiian Islands.

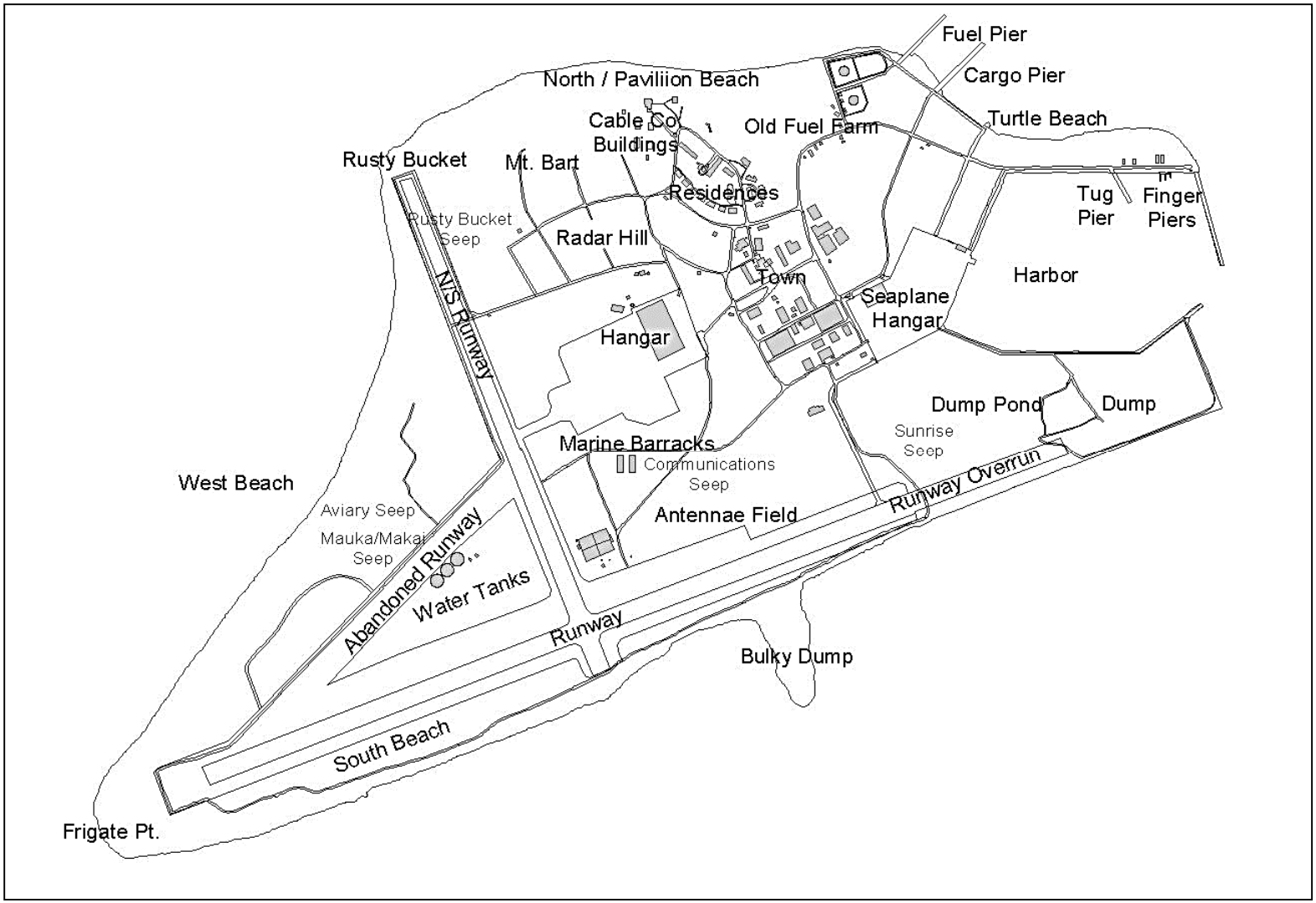
Midway Atoll is made up of three islands, Sand (1117 acres), Eastern (336 acres), and Spit (16 acres), surrounded by a circular reef forming a shallow lagoon around the islands.

The islands consist mostly of sand and coral rubble, much like other northwestern Hawaiian Islands. However, over the years, several tons of soil have been added to make them more amenable to humans.

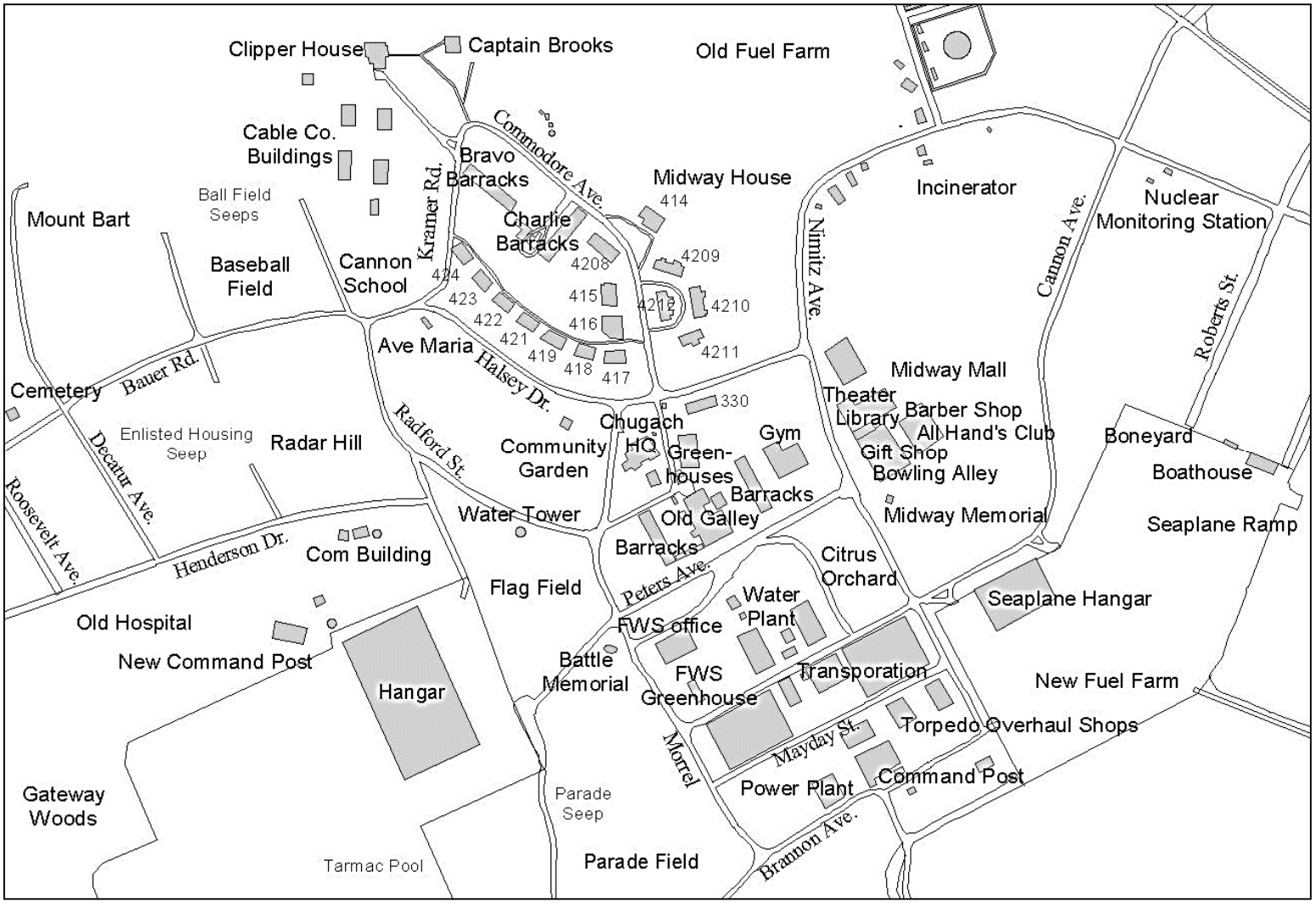
Additionally, unlike most other Northwestern Hawaiian Islands, Midway's vegetation has been greatly increased and diversified. Some plant species have been intentionally introduced, while others arrived as contaminants.

Some species have not caused any management issues. While others, such as golden crown-beard (*Verbesina encelioides*) and ironwood (*Casuarina equisetifolia*), take vast resources to keep in check.

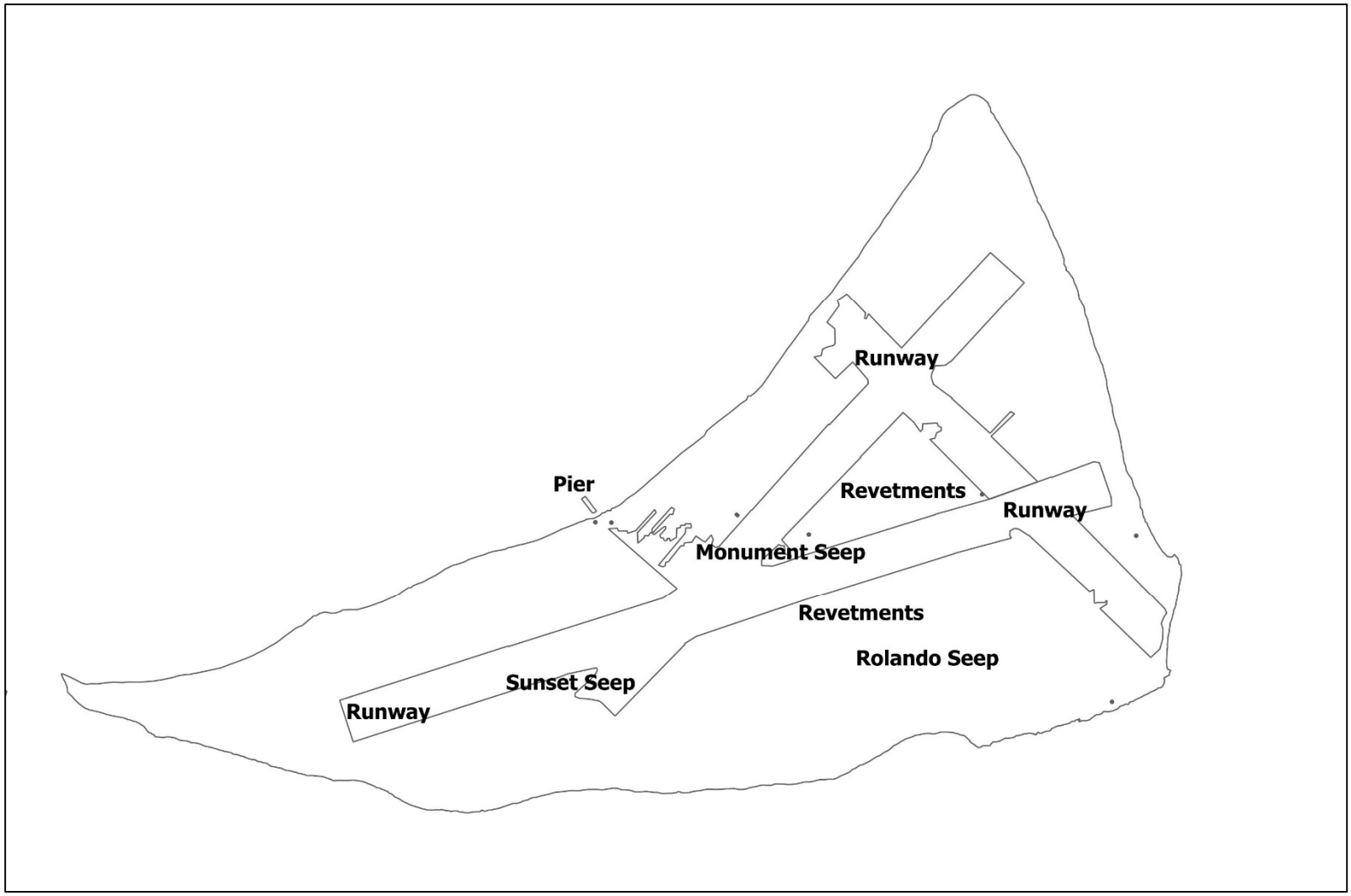
Satellite image of Midway Atoll.



Location names, Sand Island, Midway Atoll.



Location names, Town area, Sand Island, Midway Atoll.



Location names, Eastern Island

METHODOLOGY

Surveying plants in the Town area of Sand Island.

The survey was conducted by Forest Starr and Kim Starr from March 24 through April 7, 2015. Most of the survey time was spent on Sand Island, where the bulk of non-native plant diversity resides. A half day was also spent on Spit Island (April 2), and three half day surveys were done on Eastern Island (March 28, April 2 & 3).

A walk-through method was used, taking paths of least resistance through representative vegetation and visiting sites of potentially high diversity. Plants were noted as they were encountered, along with their relative abundance, and any interesting observations.

Folks on island were interviewed, especially Thai contract workers and FWS staff, to help obtain the history and names of specific plants in gardens and insights about how the vegetation had changed since our last survey in 2008.

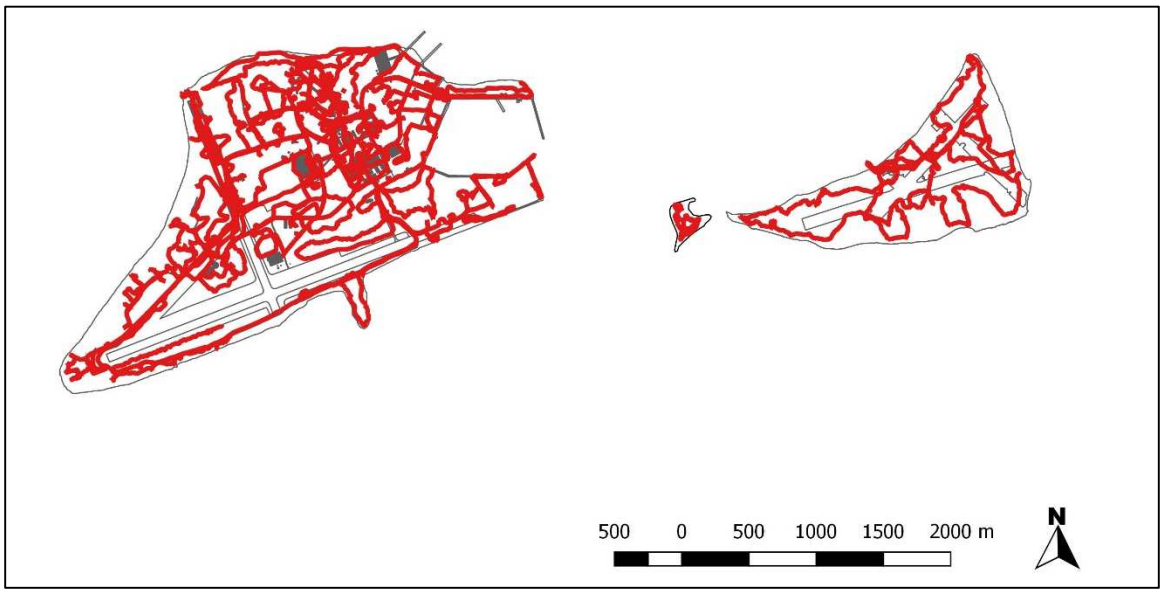
Collections were made of significant new plant records, plants that were not readily identifiable, and plants that were previously known from Midway but had not yet been collected. Collections were submitted to Bishop Museum, Honolulu, Hawaii.

Over 5,000 images were taken of many of the plant species, to provide for identification of individual species and to capture a record of the status of the general vegetation.

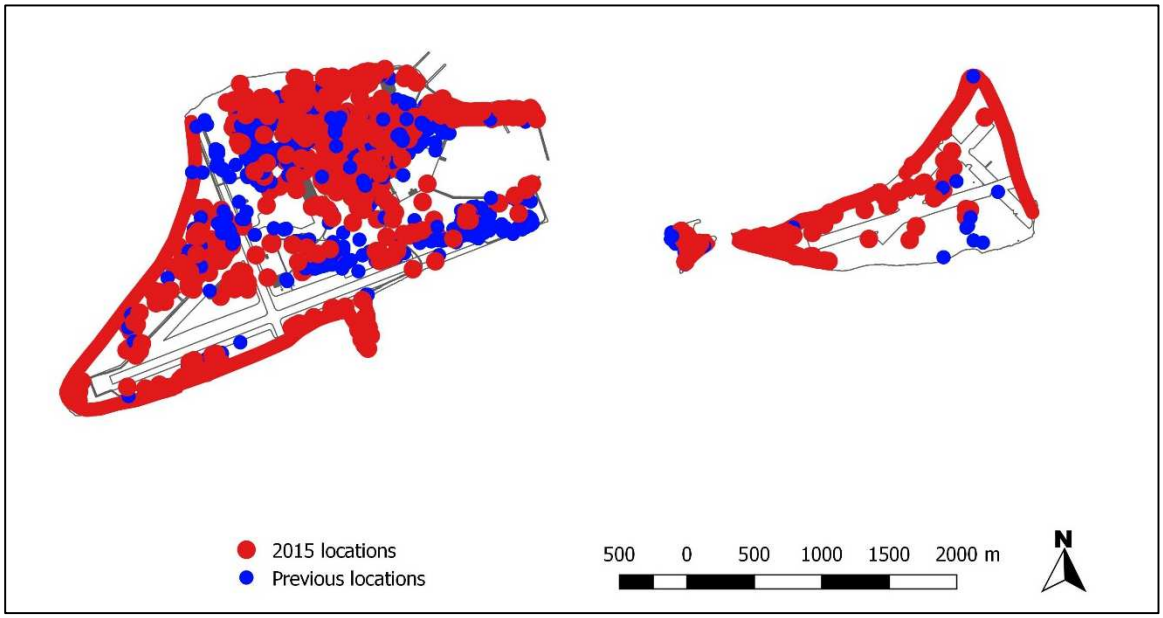
A Garmin global positioning system (GPS) unit was used to record locations when selected species were encountered. A few of the points were also hand drawn from interviews with FWS staff and images taken on Midway.

Additionally, data was merged and incorporated from our 1999 and 2008 surveys, specimen collections, previous GIS work by others, and FWS annual reports.

The focus was on species that had been previously mapped in 1999 and 2008, new or unknown plant species, current priority non-native plants, and less common native plants. A track was also recorded to show areas surveyed in 2015.



Areas surveyed in 2015.



GPS locations collected.

RESULTS AND DISCUSSION

Much of the vegetation on Midway remains as it has for some time. Yet, much has changed since our last survey in 2008.

In general, there are less species overall, both native and non-native. The decrease in non-native species is mostly due to an increase in control efforts and lead abatement activities. The decease in number of native species is mainly because many species that were being planted in 2008 as new introductions did not survive to 2015.

In 2015, there were 190 species observed, 24 (13%) native and 166 (87%) non-native.

Number of Plant Species Observed

Year	Native	Non-Native	Total
2015	24	166	190
2008	28	194	222
1999	12	252	264

Some of the more noticeable differences include a massive reduction of golden crown-beard (*Verbesina encelioides*) over the entire atoll, the result of a significant increase in control efforts, mostly using dedicated herbicide crews. Large swaths of ironwood (*Casuarina equisetifolia*) had also been removed, to allow for more Albatross habitat.

Along with reduction of some of the widespread invasive species, numerous incipient species were greatly reduced in abundance, such as lantana (*Lantana camara*), haole koa (*Leucaena leucocephala*), castor bean (*Ricinus communis*), hoary abutilon (*Abutilon grandifolium*), and sourbush (*Pluchea carolinensis*).

Additionally, some invasive species appeared to have been completely eradicated, such as sand bur (*Cenchrus echinatus*), ivy gourd (*Coccinia grandis*), and Guinea grass (*Megathyrsus maximus*).

Many of the seeps that had been dug for Laysan Ducks between the 1999 and 2008 surveys had since been filled, due to botulism concerns. Associated native plants that had been planted around seeps were also removed, to make searching for dead ducks easier.

There appeared to be more Laysan Albatrosses, and there were definitely more Bonin Petrels, making surveying a lot more challenging, due to the maze of innumerable burrows that now occupy virtually every non-hardened part of the atoll.

South Beach Cart Trail, 1999.

South Beach Cart Trail, 2015.

Many vegetation changes have occurred since our first survey in 1999, as can be seen in these images. This South Beach site first had the Sisal (*Agave sisalana*) removed, then the ironwoods, and finally the understory of *Verbesina*. Grasses and herbs colonized the barren sand, and the native bunch grass, emoloa (*Eragrostis variabilis*), was planted.

Along with the dramatic vegetation changes, of note are an apparent increase in albatrosses, and likely soon, Bonin Petrels. Similar scenarios have played out over much of the atoll. The following text attempts to describe the current status of the vegetation on Midway and some of the changes that have occurred in recent decades.

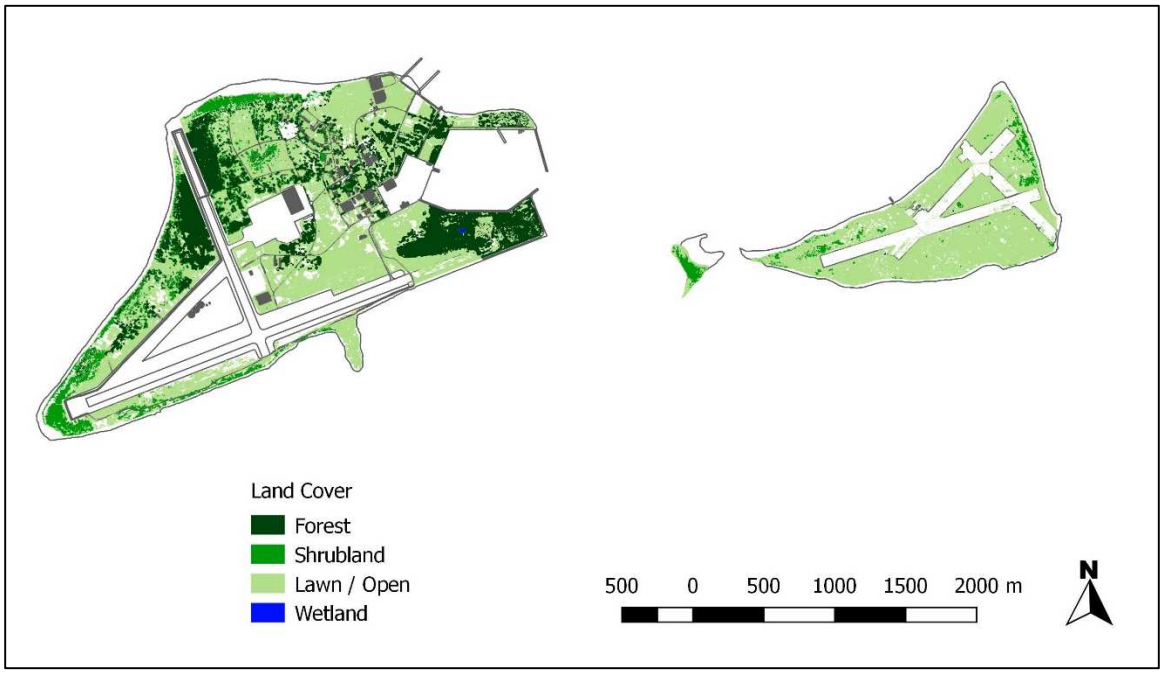
VEGETATION / HABITAT TYPES

The vegetation types at Midway Atoll are mostly determined by proximity to the ocean and current and past land use.

This land cover data is from 2007. It was not ground-truthed and is a bit dated, but it does a good job of showing the major vegetation types at Midway, which are generally about the same in 2015. A more current, detailed, and accurate land cover data set is in the works for Midway, but had not been completed in time for inclusion here.

The following major habitat types are further discussed in the text.

- Forest
- Shrubland
- Lawn / Open
- Wetland
- Developed



General land cover classes at Midway Atoll.

Ironwood forest rises above lawn/open habitat near the Dump, Sand Island.

FOREST

Ironwoods (*Casuarina equisetifolia*) are the tallest trees and most dominant forest trees at Midway Atoll. In areas where ironwood has been planted or established, virtually nothing else grows underneath the tall trees.

Sand Island has many thick ironwood forests, the largest of which are near the southeast and northwest corners of the island, and in Town. All the ironwood trees have been removed from Eastern and Spit Islands, where only scattered seedlings occasionally appear along the coast or in areas where ironwoods used to occur.

Much of the ironwood forests on Sand Island used to have a thick understory of *Verbesina* and wild poinsettia (*Euphorbia cyathophora*), but most of that has been removed in recent years through a dedicated control effort.

Though the ironwoods are generally open enough that walking should be easy, the lack of understory plants to stabilize the sand results in unstable Bonin Petrel burrows that constantly threaten to collapse under foot.

Secondary forest trees, that some would call glorified shrubs compared to ironwoods, include sea grape (*Coccoloba uvifera*), hau (*Hibiscus tiliaceus*), and tropical almond (*Terminalia catappa*). As ironwoods continue to be removed from Midway, these trees will become more important for birds that prefer to nest in trees.

Ironwood Forest, Sand Island.

SHRUBLAND

Naupaka (*Scaevola taccada*) is the dominant shrub at Midway Atoll, where it often forms a band just above the high tide line.

Tree heliotrope (*Tournefortia argentea*) is also a common element of the shrub community, often found just a bit shoreward than naupaka.

The *Scaevola*/*Tournefortia* shrubland band is most evident along much of the south, west, and north coasts of Sand Island, the north and east coast of Eastern Island, and most of Spit Island.

Smaller patches of naupaka and *Tournefortia* can be found inland on Sand and Eastern Island, generally in areas where they have been planted.

Other components of the shrubland include common grasses and herbs found elsewhere on Midway, including *Verbesina*, Spanish needles (*Bidens alba* var. *radiata*), pinewoods fingergrass (*Eustachys petraea*), swinecress (*Coronopus didymus*), and sweet alyssum (*Lobularia maritima*).

Naupaka Shrubland with scattered *Tournefortia,* along the coast near the Old Fuel Farm, Sand Island.

LAWN / OPEN

The bulk of the open areas on Sand and Eastern Islands are covered in a mix of mostly low growing grasses and herbs that look like a lawn or pasture. In 1999, many of these areas were regularly mowed. Mowing has since stopped.

The dominant grass is Bermuda grass (*Cynodon dactylon*), with St. Augustine grass (*Stenotaphrum secundatum*) occupying the shadier sites. The most common native grass is emoloa (*Eragrostis variabilis*), that has been planted and is spreading in many areas.

The most abundant herb is sweet alyssum (*Lobularia maritima*), followed by swinecress (*Coronopus didymus*), and a long list of common weeds present in lawns and open areas in the main Hawaiian Islands. On Eastern Island, many areas also have abundant native nohu (*Tribulus cistoides*) and alena (*Boerhavia repens*).

A subset of this habitat type is the sedgeland, best represented by the Runway Overrun area dominated by pycreus (*Cyperus polystachyos*).

Previously this habitat type also included vast stands of *Verbesina*, which is now restricted to scattered small patches. On Eastern Island, mustard (*Brassica* spp.) used to also be dominant, but is now being reduced in cover through control efforts.

Lawn and open area habitat, Antennae Field, Sand Island.

WETLAND

There is less wetland habitat at Midway then there was in 2008. A number of the seeps and ponds that were created for the Laysan Ducks had recently been filled in, to minimize the effects of botulism on the ducks and to allow for easier searches for dead ducks.

Additionally, much of the lush growth of makaloa (*Cyperus laevigatus*) and other wetland plants had been pulled out, again to make it easier to search for dead ducks. On Eastern Island, no vegetation is allowed near the water line of the seeps.

On Sand Island, Pycreus (*Cyperus polystachyos*) can be found at the margins of some of the wetlands, though clumps that had been pulled out were also observed.

The native succulent akulikuli (*Sesuvium portulacastrum*) was once abundant at Brackish Pond, but apparently was pushed aside by turkey tangle frogfruit (*Phyla nodiflora*).

The wetland on Spit Island was filled in by the 2011 Japan tsunami. A new low spot was created on the eastern side of Spit but did not contain standing water.

In 2008, water morning glory (*Ipomoea aquatica*), a tasty noxious weed, was growing in one of the seeps, likely placed there by a Thai worker. This was removed. The vines are now growing in flooded buckets and the Hydroponics Greenhouse.

One of the Ballfield Seeps, Sand Island.

DEVELOPED - RUNWAY

Active runways are mostly barren, except for the occasional plant trying to germinate and grow in the cracks. Regular control work by airport personnel keeps the runways mostly clear of vegetation.

Margins of active runways contain more cracks, and therefore more vegetation. The margins of runways on Sand Island contain many of the species found in lawn/open habitat, but contain more species adapted to hard-packed sites, such as pearlworts (*Sagina* spp.), spurges (*Euphorbia* spp.), primrose (*Oenothera stricta* var. *stricta*), and the native ena ena (*Pseudognaphalium sandwicensium* subsp. *sandwicensium*).

Abandoned runways on Sand and Eastern Island continue to revegetate. On Sand Island, button sedge (*Fimbristylis cymosa*) was one of the first to colonize the runways, but is now declining in abundance as other species germinate in the *Fimbristylis* clumps and then outcompete them, especially pinewoods fingergrass (*Eustachys petraea*).

On Eastern Island, the main species colonizing runways are the same ones in nearby lawn/open areas, most notably *Verbesina*, swinecress, sweet alyssum, and the native vines nohu (*Tribulus cistoides*) and alena (*Boerhavia repens*).

Active runway and apron, Sand Island.

Abandoned runway, Eastern Island.

DEVELOPED - TOWN

The Town area of Sand Island contains numerous buildings, roads that are heavily travelled, lawns of mostly Bermuda grass and sweet alyssum, and a host of cultivated shrubs and trees, including plumeria (*Plumeria* spp.), hibiscus (*Hibiscus rosa-sinensis*), coconut (*Cocos nucifera*), and Cook Pines (*Araucaria columnaris*).

Town also contains numerous edible plants cultivated at the Residences, the Community Garden, and the Hydroponics Greenhouse. Most of these are benign, such as green onion (*Allium fistulosum*). Others, like bitter melon (*Momordica charantia*), have the potential to spread beyond cultivation.

Native plants are also cultivated in Town. Emoloa is the most common, but small plantings and pots of some of the least common native plants are scattered about. In some cases, such as dwarf eragrostis (*Eragrostis paupera*), the only known locations of the species on Midway are in the FWS Greenhouse.

Some areas of Town, like the Boneyard and all the roads, have large concrete and paved areas with no plants.

Town area, Sand Island.

LOCATIONS

SAND ISLAND

Satellite image of Sand Island

When people first arrived at Midway Atoll, Sand Island was described as "a blinding heap of sand", with scant vegetation. Over the years the island was transformed to become more habitable, and today Sand Island is a little mini-city, with a runway, town, harbor, and all the other necessities to sustain a permanent presence.

The runway on Midway is the last functioning runway left in the Northwestern Hawaiian Islands, is maintained to provide an emergency landing strip for planes travelling across the Pacific, and makes logistics on Midway much easier than other islands in the NWHI. The runway is mostly barren, except for the margins. Large unneeded segments of the runway have been abandoned, and continue to vegetate.

The dark green patches are ironwood (*Casuarina equisetifolia*) forest. There was less ironwood present this survey than our previous survey in 2008, FWS has done significant work to remove ironwoods, and it appears that trend will continue.

Lighter green areas covering much of the island used to be blanketed in a sea of golden crownbeard (*Verbesina encelioides*), but now are mostly sweet alyssum (*Lobularia maritima*) and Bermuda grass (*Cynodon dactylon*). Again, this is due to a significant control program, and is one of the biggest changes since our last survey.

Town and nearby areas are much the same, aging military buildings landscaped long ago with common subtropical ornamentals. There are in increasing number of native plants being used in landscaping, and though the Thai gardens are still present, they are smaller and less diverse. The Hydroponics Greenhouse was fully operational.

Along with stepped up weed control, the biggest change to the vegetation around areas with buildings has been the lead abatement work, that requires removal of virtually all vegetation around most of the structures on the island, to clean up the contaminated soil. This leaves many areas temporarily devoid of all vegetation.

Many of the seeps that were created between the 1999 and 2008 surveys had since been filled in. The seeps that did remain had most of the vegetation in and near them removed, to make it easier to search for dead and dying ducks.

Though some feel the landscape at Sand Island is now less civilized, with shaggy lawns, a decrease in ornamental plants, and less trees, there does seem to be more birds because of the actions.

Previously folks told us they wanted to make Midway look more like Laysan, and that appears to be occurring, with the island vegetation trending towards a smaller and more native palate of plant species.

Though the view of the Parade Field is changing over time, it is still much the same.

When the Clipper House was first built, it was surrounded by bare sand. All the naupaka between the building and the beach has filled in since then. The coconut tree is about the same age as the building, almost 20 yrs. old.

Bare sand and emoloa (*Eragrostis variabilis*) clumps are reminiscent of Laysan, and an increasingly common site on Midway. The ironwood trees in this image are slated to be removed, due to FAA height restrictions for airplane glide paths.

EASTERN ISLAND

Satellite image of Eastern Island.

Eastern Island is the second largest island within Midway Atoll. During the first botanical visits, Eastern was sometimes called "Green" island and was where most of the native plants were located. During WWII, most of the island was paved over and thousands of enlisted men lived there with a functioning runway.

During the 1999 survey, most of Eastern Island had been abandoned, though the runway was still being maintained as an emergency runway and was occasionally scraped. There were also large ironwood trees that had been girdled and killed, but left standing. In 2008, there was still no one living there, the ironwoods had been cut down, and none of the runways were being used as an emergency runway.

Since our last visit in 2008, much of the island was overrun by the 2011 Japan tsunami, and a dedicated control effort against *Verbesina*, *Brassica*, and other widespread weeds was started, with spray crews on the island almost every day.

Though much of the evidence of the tsunami had vanished by the time we surveyed the island, there were still debris piles of plastic, wood, and whatever else the ocean was able to pick up and drop near the center of the island.

Perhaps the greatest change was the dramatic decline in *Verbesina*. Whereas much of Eastern Island used to be covered with a sea of *Verbesina*, in 2015 only spotty patches and small plants were observed.

Eastern Island is still ringed with naupaka and Tournefortia along the north and east coasts, with some of the naupaka also found further inland. Just starting to green up for the season were clumps of *Lepturus* along the coast, often the closest plant to the sea. On the northwest tip was a 20m x 20m stand of akulikuli (*Sesuvium*).

The runways continue to revegetate. Some of the more abundant species are sweet alyssum (*Lobularia*), swinecress (*Coronopus*), mustard (*Brassica*), *Verbesina*, nohu (*Tribulus*), and alena (*Boerhavia*).

Sea grape (*Coccoloba*) is now the tallest vegetation, with scattered clumps, especially near the revetments. All that remains of the ironwood (*Casuarina*) that once dominated much of the island are some decaying stumps.

Many of the native plantings were destroyed in the tsunami, but scattered clumps of emoloa (*Eragrostis variabilis*) still dot the landscape, as do popolo (*Solanum nelsonii*), aweoweo (*Chenopodium oahuense*), and loulu (*Pritchardia remota*).

The lone hedge of spider lily (*Crinum asiaticum*) was still present next to the concrete slabs near the Pier, one of the last reminders of a time when the island was populated.

The three man made seeps are still present, though they were affected by the tsunami, and most of the vegetation has been removed from in and near them to make it easier to look for dead and dying ducks.

Eastern Island is currently covered with mostly very low growing vegetation. Scattered patches of *Eragrostis* and naupaka are visible. Conspicuously absent is the sea of *Verbesina* that used to cover much of Eastern Island.

Undated FWS photo, near Pier on Eastern Island. Of note, clumps of *Verbesina* at base of gun, numerous ironwood groves, and the pillbox still standing on land.

2015. Note lack of *Verbesina* and ironwood. The pillbox has been undermined and is almost in the ocean, next to the exposed shoreline armoring. *Tournefortia* has begun to colonize the coast. Wonder if any of the Gooney birds are the same?

SPIT ISLAND

Satellite image of Spit Island.

Spit Island is a small piece of coral rubble between Sand and Eastern Islands. In recent times Spit Island had been composed of multiple islands, and seems to be inching closer to Eastern Island every year.

Before the BRAC much of the island was covered in ironwoods. These ironwoods were chopped down and removed leaving mostly barren coral rubble and ironwood stumps in 1994. Though the stumps were still present in 1999, the island was quickly revegetating. By 2008, the island was heavily vegetated to the point of becoming almost impenetrable.

In 2015, Spit had changed shape since our last visit, having been run over by the 2011 tsunami and a number of storms. Additionally, the small saline lake on the southwest tip had been filled in with coral rubble by storms. The akulikuli once surrounding that pond was no longer there, but was now present on the eastern side.

Also growing in this low spot on the east side was *Fimbristylis cymosa* and some *Lepturus repens*, both looking a bit brown, and a small planting of akiaki (*Sporobolus virginicus*) that had been planted and washed over, but was coming back.

Along the coast of Spit is a ring of *Tournefortia*, though recent wash overs from the ocean were apparent, especially along the southern and western shores, as there were lots of brown and dying trees still standing, and others torn out of the ground.

Naupaka forms a thicket just inland of the *Tournefortia* and continues to dominate much of the interior of the island. Trails and openings have been cut through the naupaka in a couple spots to allow better access for people and birds, and to provide some relief for the other native plants trying to grow in the area.

Eragrostis variabilis was planted about the small island, and is more numerous than before. On the south side, it had been washed over by the ocean, and while the adult plants were brown and dying, there were seedlings coming up below.

There were a couple dozen popolo (*Solanum nelsonii*) shrubs, looking lanky, at the edges and under the naupaka thicket, along trails, and in openings, sort of vining their way through the naupaka branches. Also interspersed in the naupaka was *Eustachys petraea*, which was being controlled, but still persisting

Understory plants such as alena (*Boerhavia repens*) and nohu (*Tribulus cistoides*) were occasional in some of the more open areas. Red-footed Boobies were nesting in the *Tournefortia* and branches of nohu and popolo were seen in their nest.

Golden crown-beard was found scattered, but only small plants, which were being controlled. One small sweet alyssum (*Lobularia maritima*) seedling and a small patch of *Spergularia marina* were pulled on the northeast side. A small swine cress (*Coronopus didymus*) was found and controlled on the southeast side.

Naupaka, *Tournefortia*, and clumps of *Eragrostis* transition to akulikuli (*Sesuvium*) and other low growing vegetation on the east side of Spit Island.

1999. Saline lake on spit Island, before high surf filled it in.

2015. Area where saline lake used to be on Spit Island. Note newly deposited coral rubble, lack of ground cover, and damaged *Tournefortia* trees. Akulikuli is still present in the area, but is now more abundant on the east side of Spit Island.

SEEPS

Between our 1999 and 2008 surveys a number of seeps were created on Sand and Eastern Islands for the recently translocated Laysan Duck. Many plants were also put in these seeps, such as makaloa (*Cyperus laevigatus*), a common sedge in duck habitat on Laysan.

However, between the 2008 and 2015 surveys, many of the seeps had been filled in, due to botulism concerns. Additionally, by 2015 most of the native plants had been removed from within and near the ponds, to make searching for ducks easier, and in the case of makaloa, because it was taking over much of the pond.

When a dead or dying duck is found, folks must check every seep for more dead or dying ducks for the next two weeks, in order to prevent the botulism from killing more ducks. These "seep checks" take a lot of labor, which is always in short supply in any refuge. By filling in the most botulism prone seeps and removing the vegetation to make seep checks easier, folks were able to reduce the effort necessary to manage the ducks.

Communications Seep on Sand Island was filled in due to botulism concerns. In 2015, the area was once again being utilized by albatross rather than ducks.

Rolando Seep in 2008 (left) and 2015 (right), Eastern Island. All of the remaining seeps have had most or all the vegetation removed to help with seep checks.

TSUNAMI

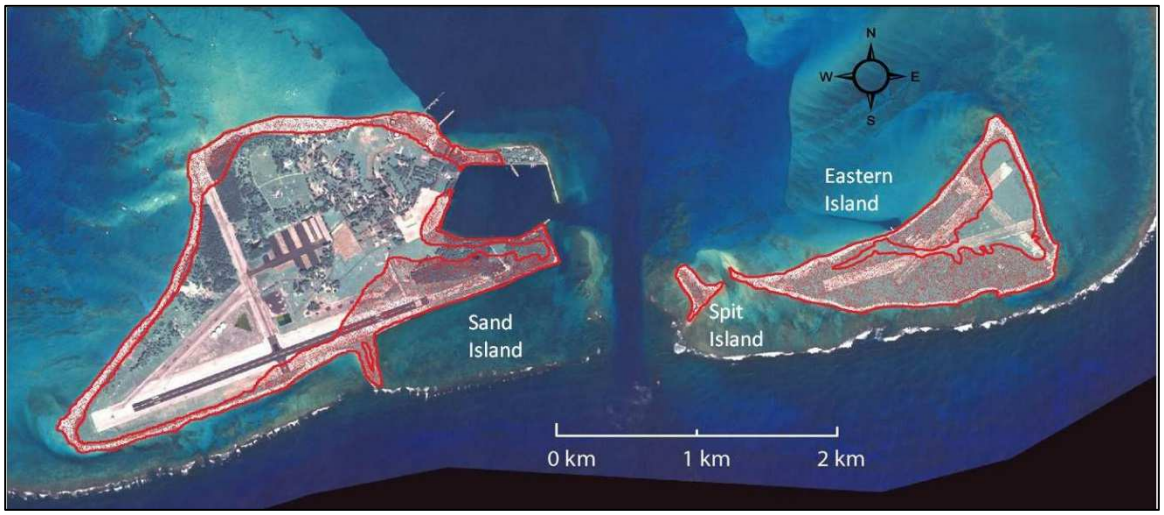
In 2011, a tsunami that was generated in Japan over washed much of Sand Island, most of Eastern Island, and all of Spit Island, resulting in the death of many birds and plants. By 2015, though there remained evidence of the tsunami, life had mostly returned to normal.

After the tsunami, many of the native plantings on Eastern Island died, either by being ripped away by the ocean and debris, or being flooded for an extended period. There was also significant native plant damage on Sand Island.

Non-native plants were similarly affected, with large areas of ironwood near the Dump on Sand Island dying because they had been sitting in sea water that had pooled beneath them for an extended period of time.

Interestingly, though many plants died because of the tsunami, it apparently stimulated a resurgence of the native popolo (*Solanum nelsonii*) on Spit Island, with hundreds reportedly germinating after the tsunami. Popolo was also found in new locations on Sand and Eastern Islands, with folks suggesting the tsunami deposited the seeds there.

Rusty Bucket on Sand Island was overwashed by the Tsunami.



Red areas mark how far inland the 2011 tsunami reached.

GARDENS

For as long as people have been living on Midway there have been gardens. The locations of gardens, types of plant species, and care given to the gardens fluctuates over time.

In 2015, there continued to be less gardens, a trend also apparent between our 1999 and 2008 surveys. The bulk of the decline appears attributable to less people on-island, occasional efforts by FWS to remove the most invasive species or unused plants, and large scale removal of most plants around buildings during the lead abatement project.

There are three main types of gardens on Midway, Personal Gardens around a house or work area, the Community Garden, and the Hydroponics Garden.

Though much less common than they used to be, Personal Gardens continue to persist, mainly around houses. The plants are a mix of mostly edible, but some ornamental. In general the plants are very poorly taken care of, appear seldom harvested or maintained, and a few gardens look completely abandoned. In addition, a few potentially invasive species were being grown, including bitter melon (*Momordica charantia*).

The Community Garden used to overflow with produce, but is now completely abandoned and beginning to be taken over by Bonin Petrels. Nearby banana patches appeared untended and in such poor health they were unable to produce edible fruit.

The Hydroponics Greenhouse stands in stark contrast to the sad state of affairs in gardens elsewhere on Midway. This greenhouse was not functioning during our last survey in 2008, but in 2015 it was producing an amazing array of beautiful produce.

Given the current situation on Midway, we recommend that all edible food production be moved to the Hydroponics Greenhouse. Along with being safer from a lead and other contaminant stand point, it would also produce a lot more food of higher quality, take up less wildlife habitat, and help prevent spread of potentially invasive plant species.

The Hydroponics Greenhouse is currently very productive. Being grown are staples such as lettuce, and Asian favorites like green onion, peppers, and cilantro.

WHAT WOULD YOU DO IF IT WAS NATIVE?

Often we're asked what management actions to take for a particular non-native plant species, especially in regards to whether to control it or not. In these situations, we find it helpful to ask "What would you do if it was native?".

If the plant isn't causing harm, the fact that it is non-native shouldn't immediately result in control efforts. This is especially true in many Wildlife Refuges, where the vegetation is often predominantly non-native, and in many cases is being readily utilized by wildlife.

Tree heliotrope (*Tournefortia*) is a species that can be controversial, because it is non-native, yet it also provides good bird habitat. We used to think it should be removed, because it is non-native, and can display invasive tendencies near the coast. However, we now feel it has a place at Midway and other islands, because it provides large shrub / tree structure that is preferred by many bird species. Control efforts against *Tournefortia* would take considerable resources and likely be deleterious to numerous bird species.

Another example are the many small herbaceous plants and grasses found in lawn / open areas. Virtually all of them are non-native, yet few are of concern for wildlife. Again, a lot of resources could be spent to attempt to control them, with no guarantee of success. Or, they could be tolerated.

In these situations, it is helpful to ask, "What would we do if it was native?". In many cases, the answer will be "Enjoy it".

Tree heliotrope (*Tournefortia*) is classified as non-native on Midway, yet provides good habitat for numerous bird species.

WHAT BIRDS DO YOU WANT WHERE?

We're also often asked what management recommendations we have for areas. In wildlife dense sites like Midway, we find it useful to ask "What birds do you want where?". Another way to look at it is "Build it and they will come".

The raucous cacophony of innumerable birds can seem random and chaotic, but there is a method to the madness, and all the bird species on Midway have habitat preferences, often directly associated with vegetation.

By understanding the habitat preferences of the different bird species on Midway, and having a vision for how many of each bird species folks would like to have around, and where those birds would prefer to be located, a vision for which plant species would be best where comes to light.

For example, if one wants to have White Terns in an area, ironwoods suffice. If however, they would prefer more Gray-backed Terns in an area, then taking the site down to gravel and small plants would be better. For no birds, a paved surface seems to work.

It isn't of course as simple as painting by numbers, many plant species have habitat preferences of their own, such as naupaka and *Tournefortia* generally doing best along the coast. Additionally, bird species have cues beyond vegetation, such as Black-footed Albatrosses that usually nest close to the shore and have strong site fidelity.

All that said, the next time a question arises as to what to do with the vegetation in an area, it is useful to ask "What birds do we want where?".

Laysan Albatrosses prefer soft sand to the hard runway. The military realized this and paved large areas to keep sites free of nesting albatrosses.

VERBESINA

The increased management of golden crown-beard (*Verbesina encelioides*) at Midway has resulted in one of the greatest reductions in a non-native plant species we have ever witnessed. *Verbesina* went from a habitat type in 2008, to scattered hot spots in 2015. *Verbesina* is still present in many places, and will require continued vigilance to manage, but it is amazing what was accomplished, and the wildlife seem to be benefitting.

2008. Sea of *Verbesina* in field south of Seaplane Hangar, Sand Island.

2015. Same area after control efforts, with virtually no *Verbesina*.

COLLECTIONS

List of plants collected during the 2015 plant survey. In addition to our own collections, we also reviewed, retrieved, and are processing collections made by Nik Aspey in 2012.

For each species, a voucher number, scientific name, and significance are given. Vouchers will be deposited at Bishop Museum and any relevant new records will be published in Bishop Museum's Occasional Papers.

More information on each species is available in the Annotated Checklist (Appendix B).

NIR = New Island Record; Add = Additional Material; ID = Identification Needed.

Voucher #	Species	Significance
150404-05	*Atriplex suberecta* (Saltbush)	NIR
150328-01	*Brassica juncea* (Mustard)	ID
150330-02	*Cerastium glomeratum* (Sticky chickweed)	NIR
150404-02	*Cerastium glomeratum* (Sticky chickweed)	NIR
150329-01	*Euphorbia serpens* (Spurge)	NIR
150404-07	*Macroptilium lathyroides* (Cow pea)	NIR
150330-03	*Sagina japonica* (Japanese pearlwort)	Add/ID
150404-03	*Sagina japonica* (Japanese pearlwort)	Add/ID
150330-04	*Sagina procumbens* (Birdeye pearlwort)	NIR?/ID
150404-04	*Sagina procumbens* (Birdeye pearlwort)	NIR?/ID
080601-12	*Solanum torvum* (Turkey berry)	NIR
150330-01	*Stachys arvensis* (Staggerweed)	NIR
150404-01	*Stachys arvensis* (Staggerweed)	NIR
150404-06	*Unknown* Poaceae (*Urochloa*?)	ID

Pressing plant collections, FWS Office, Sand Island.

ERADICATIONS

Midway Atoll is predominantly covered with non-native plants. Many are benign and wildlife are able to successfully utilize them. A subset however, have shown invasive tendencies on Midway and present challenges for native plants or wildlife.

Some of these invasive plant species are widespread and well established, such as golden crown-beard (*Verbesina encelioides*) and ironwood (*Casuarina equisetifolia*) and take major effort and time to address.

However, there are also a number of potentially invasive plant species that are less abundant, and for which refuge-wide management will require less resources. And there are even some invasive species for which eradication is feasible.

The following lists are a summary of selected non-native plant species occurring at Midway Atoll in varying levels of establishment and distribution. They are categorized by distribution and estimated effort to control the populations.

There is additional information about each of these species in the Plant Checklist (Appendix A), Annotated Plant Checklist (Appendix B), and Maps (Appendix C).

Controlling the only known plant of Turkeyberry (*Solanum torvum*) on Midway.

ERADICATED

After years of control efforts, many potentially invasive plant species are no longer known from Midway. Many of these are serious invaders elsewhere. We can't think of another island where as many eradications of invasive species has occurred.

Some of these species have previously been declared eradicated on Midway, and were reintroduced, such as ivy gourd (*Coccinia grandis*) and guava (*Psidium guajava*).

Others have reappeared or were overlooked, and now have been re-eradicated, like Chistmasberry (*Schinus terebinthifolius*).

Any of these could have been overlooked, may persist as seeds in soil, and have the potential to be reintroduced, sandbur (*Cenchrus echinatus*) has been declared eradicated on Laysan Island numerous times.

There are many other species no longer found on Midway that were not included here, because they aren't considered invasive, such as rice (*Oryza* sp.). See the Plant Checklist (Appendix A) for the full list of all species ever known from Midway.

Also of note, is that one of the intentional eradications was a native plant, gray nickers (*Caesalpinia bonduc*). It was also a serial-eradication, arriving multiple times by sea and by bird. This species was removed because of the thorn-laden, vine-like stems that folks worried would cause harm to the abundant wildlife.

This list includes invasive plant species previously observed on Midway since 1999 that were not observed in 2015.

- *Acacia farnesiana* (Klu)
- *Agave sisalana* (Agave)
- *Antigonon leptopus* (Mexican creeper)
- *Atriplex suberecta* (Australian salt bush)
- *Caesalpinia bonduc* (Gray nickers)
- *Cenchrus echinatus* (Sandbur)
- *Cestrum nocturnum* (Night blooming jasmine)
- *Chloris barbata* (Swollen finger grass)
- *Coccinia grandis* (Ivy gourd)
- *Crotalaria incana* (Fuzzy rattle pod)
- *Desmanthus pernambucanus* (Slender mimosa)
- *Digitaria insularis* (Sourgrass)
- *Eriochloa procera* (Cup grass)
- *Eugenia uniflora* (Surinam cherry)
- *Indigofera hendecaphylla* (Creeping indigo)
- *Leptochloa uninervia* (Sprangletop)
- *Megathyrsus maximus* (Guinea Grass)

- *Melinis repens* (Natal red top)
- *Opuntia cochenillifera* (Cochineal cactus)
- *Passiflora edulis* (Passion Vine)
- *Pithecellobium dulce* (Manila tamarind)
- *Psidium guajava* (Guava)
- *Schinus terebinthifolius* (Christmas berry)
- *Spathodea campanulata* (African tulip)
- *Tetragonia tetragonioides* (New Zealand spinach)
- *Thevetia peruviana* (Be still tree)
- *Tridax procumbens* (Coat buttons)
- *Urochloa mutica* (California grass)
- *Vitex trifolia* (Tree vitex)
- *Ziziphus* sp. (Jujube)

Ivy gourd (*Coccinia grandis*), an invasive vine used in Asian cuisine, was eradicated in 1999, was reintroduced as seed from Thailand, and then was re-eradicated. This picture is from 2008, when ivy gourd was found to be well established in multiple locations on Sand Island. Ivy gourd was not observed in 2015.

CLOSE TO ERADICATED

A number of species have had a significant reduction in abundance, again due to persistent control efforts. For these species, only a few individuals remain, and could be relatively easily addressed in a manner of minutes, such as air plant (*Kalanchoe pinnata*) and bitter melon (*Momordica charantia*).

Others have a persistent seed bank and will likely require follow up for some time. Hoary abutilon (*Abutilon grandifolium*), haole koa (*Leucaena leucocephala*), and buffel grass (*Cenchrus ciliaris*) all appear to still have a persistent seed bank.

Turkeyberry (*Solanum torvum*), Castor bean (*Ricinus communis*), Lantana (*Lantana camara*), and Moreton Bay fig (*Ficus macrophylla*) are included in this list, even though all the remaining known individuals were controlled during our 2015 survey, because it is not known if follow up control work will be necessary or not.

This list includes invasive plant species on Midway with very low numbers.

- *Abutilon grandifolium* (Hoary abutilon)
- *Amaranthus spinosus* (Spiny amaranth)
- *Asparagus densiflorus* (Asparagus fern)
- *Cenchrus ciliaris* (Buffel grass)
- *Cyperus involucratus* (Umbrella sedge)
- *Epipremnum pinnatum* (Golden pothos)
- *Ficus macrophylla* (Moreton Bay fig)
- *Gynura bicolor* (Asian spinach)
- *Kalanchoe pinnata* (Air plant)
- *Kalanchoe tubiflora* (Chandelier Plant)
- *Lantana camara* (Lantana)
- *Leucaena leucocephala* (Haole koa)
- *Malva parviflora* (Cheese weed)
- *Mirabilis jalapa* (Four-o'clock)
- *Momordica charantia* (Bitter melon)
- *Ricinus communis* (Castor bean)
- *Solanum torvum* (Turkeyberry)
- *Syngonium podophyllum* (Arrowhead)
- *Xanthosoma robustum* (Ape)

In 2008, when this image was taken, Hoary abutilon (*Abutilon grandifolium*) used to form dense thickets near Radar Hill. In 2015, only one plant was observed.

REDUCED, ERADICABLE

This short list contains species which have had significant work done to control them, and are still relatively widespread or locally abundant, but could possibly be eradicated.

A lot more species could have been added to this list, but these seemed the most potentially habitat altering, yet possibly still eradicable with significant effort.

- *Ficus microcarpa* (Chinese banyan)
- *Pluchea carolinensis* (Sourbush)
- *Phyla nodiflora* (Turkey tangle frogfruit)
- *Setaria verticillata* (Bristly foxtail)

Chinese banyan (*Ficus microcarpa*) is a strangler fig capable of germinating on and damaging structures and other plants like ironwood. All the large fruiting trees have been removed from Midway, and many of the smaller plants controlled, but follow up is necessary to address regrowth and new plants from the seed bank. Persistent diligence could result in eradication of this invasive species from Midway.

WATCH

The following species are invasive elsewhere, but are currently not invasive, or otherwise tolerated on Midway, generally because they are edible, aesthetic, provide bird habitat, or haven't show signs of spread.

Many of these species will likely never spread far, like the lone tree of African Olive (*Olea europaea* subsp. *cuspidata*). Others seemingly have the potential to spread beyond where they are currently growing, such as sea grape (*Coccoloba uvifera*), octopus tree (*Schefflera actinophylla*), and swamp cabbage (*Ipomoea aquatica*).

Keeping an occasional eye on the following species will allow for the greatest number of potential control options should control be deemed necessary.

- *Albizia lebbeck* (Siris Tree)
- *Calophyllum inophyllum* (Kamani)
- *Coccoloba uvifera* (Sea grape)
- *Cocos nucifera* (Coconut)
- *Erythrina variegata* (Indian coral tree)
- *Hibiscus tiliaceus* (Hau)
- *Ipomoea aquatica* (Swamp cabbage)
- *Noronhia emarginata* (Madagascar olive)
- O*lea europaea* subsp. *cuspidata* (African olive)
- *Schefflera actinophylla* (Octopus tree)
- *Tamarindus indica* (Tamarind)
- *Terminalia cattappa* (Tropical almond)

Beautiful and edible, swamp cabbage (*Ipomoea aquatica*), is a Federal Noxious Weed that has previously been released into and then removed from seeps on Sand Island. If folks are reluctant to eradicate this species from Midway, since it makes a tasty stir fry, then keep it contained in the Hydroponics Greenhouse and watch for it in wetlands. Images from coastal wetland on Maui and Clipper House on Midway.

MORE DETAIL

The appendices in this report include the following elements to help provide further information about the status of plants on Midway:

- **Appendix A: Plant Checklist**
  A spreadsheet listing plants found on Midway, current relative abundance on each island within the atoll, historical observations, collection data , and nativity status.

- **Appendix B: Annotated Plant Checklist**
  A more detailed write up for each plant, with the plant's name, a picture if available, and historical and current information.

- **Appendix C: Maps**
  Distribution maps are provided for selected species, showing current distribution and, when available, all previously known locations. Emphasis is on incipient invasive non-native species and rare native plants.

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APPENDIX A: PLANT CHECKLIST

What follows is a checklist of all plants ever reported from Midway Atoll. It is in two sections, one with details for the 2015 survey and another that includes all previously known surveys.

The checklist lists plants found on Midway, relative abundance for each island, collection data, historical observations, nativity status in Hawaii, and current status on Midway.

Additional information is available for all these species in the Annotated Plant Checklist (Appendix B), and a subset of them have Maps (Appendix C).

ISLAND DISTRIBUTION / ABUNDANCE
Distribution during 2015 survey.
R = Rare
O = Occasional
C = Common
D = Dominant

COLLECTIONS
Collections made on Midway at some point in time.
X = Collection exists

STATUS
Nativity in Hawaii.
Native = Naturally occurring in Hawaii
Non-Native = Introduced by humans to Hawaii

HISTORICAL OBSERVATIONS / COLLECTIONS
Reports of observations or collections of plant on Midway.
X = Observed
X = Collected
Y = Reported, does not indicate presence or absence

Surveying plants near the Community Garden on Sand Island.

CHECKLIST SOURCES

List of botanical surveys, collections, and publications used to create the Plant Checklist. Full bibliographic references at the end of the Annotated Checklist (Appendix B).

2015 = F. Starr and K. Starr
2012 = N. Aspey
2008 = F. Starr and K. Starr
2006 = J. Klavitter
2001 = F. Starr and K. Martz
1999 = F. Starr and K. Martz
1998 = J.T. Duncan
1998b = T. Flynn
1995 = M.M. Bruegmann
1993 = K. McDermid
1992 = D. Herbst and W. Wagner
1991 = E. Flint
1988 = D.R. Herbst
1983 = S. Conant
1983b = W. Gagne
1980 = D.R. Herbst
1979 = S.I. Apfelbaum et al.
1979b = C. Corn
1970 = R.M. Beaucamp
1966 = S. Carlquist
1964 = C.H. Lamoureux
1964b = C.R. Long
1962 = C.H. Lamoureux
1962b = H.W. Frings
1960 = S. Carlquist
1959 = Cornelison
1955 = H.F. Clay
1954 = J.A. Neff and P.A. DuMont
1954b = F.R. Fosberg
1945 = G.C. Munro
1944 = E.L. Caum
1941 = F.C. Hadden
1940 = F.A. Bianchi
1936 = G.B. Perry
1935 = J.G. Johnson
1933 = V.J. Meagher
1931 = D.R. Chisholm
1923 = E. Christophersen and E.L. Caum
1912 = J.F.G. Stokes
1911 = W. Captain
1907 = P. Bartsch
1902 = W.A. Bryan

Pohinahina (*Vitex rotundifolia*) voucher collection from 2008.

Species	Sand	Eastern	Spit	Common name	Family	Status	Coll.
Abelmoschus esculentus				Okra	Malvaceae	Non-Native	X
Abutilon grandifolium	R			Hairy abutilon	Malvaceae	Non-Native	X
Acacia farnesiana				Klu	Fabaceae	Non-Native	X
Acalypha wilkesiana	R			Beefsteak plant	Euphorbiaceae	Non-Native	X
Achyranthes atollensis				Achyranthes	Amaranthaceae	Native	X
Adansonia digitata				Baobab tree	Bombaceae	Non-Native	
Agave attenuata				Agave	Agavaceae	Non-Native	
Agave sisalana				Sisal	Agavaceae	Non-Native	
Aira caryophyllea				Silver hairgrass	Poaceae	Non-Native	X
Albizia lebbeck	R			Siris tree	Fabaceae	Non-Native	X
Aleurites moluccana				Kukui nut tree	Euphorbiaceae	Non-Native	X
Allamanda cathartica				Allamanda	Apocynaceae	Non-Native	
Allium cepa				Onion	Liliaceae	Non-Native	
Allium fistulosum	R			Green onion	Liliaceae	Non-Native	
Allium porrum				Leek	Liliaceae	Non-Native	
Allium sativum				Garlic	Liliaceae	Non-Native	
Allium schoenoprasum				Chive	Liliaceae	Non-Native	
Allium tuberosum	R			Garlic chive	Liliaceae	Non-Native	X
Alocasia cucullata				Chinese taro	Araceae	Non-Native	
Alocasia macrorrhiza				Ape	Araceae	Non-Native	
Aloe vera	R			Aloe	Xanthorrhoeaceae	Non-Native	
Alpinia galanga				Galangal	Zingiberaceae	Non-Native	
Alpinia zerumbet				Shell ginger	Zingiberaceae	Non-Native	
Alternanthera tenella				Joyweed	Amaranthaceae	Non-Native	
Amaranthus dubius				Pakai	Amaranthaceae	Non-Native	
Amaranthus hybridus				Green amaranth	Amaranthaceae	Non-Native	
Amaranthus lividus subsp. polygonoides				Slender amaranth	Amaranthaceae	Non-Native	X
Amaranthus spinosus	R			Spiny pigweed	Amaranthaceae	Non-Native	X
Amaranthus viridis	O			Slender amaranth	Amaranthaceae	Non-Native	X
Ammophila arenaria				European beachgrass	Poaceae	Non-Native	X
Anagalis arvensis	O/C	R		Scarlet pimpernel	Primulaceae	Non-Native	X
Ananas comosus				Pineapple	Bromeliaceae	Non-Native	
Andropogon glomeratus var. pumilus	C			Broomsedge	Poaceae	Non-Native	X

Species	Sand	Eastern	Spit	Common name	Family	Status	Coll.
Anethum graveolens				Dill	Apiaceae	Non-Native	X
Annona muricata	R			Soursop	Annonaceae	Non-Native	X
Anthurium andraeanum				Anthurium	Araceae	Non-Native	
Antigonon leptopus				Mexican creeper	Polygonaceae	Non-Native	X
Apium graveolens	R			Chinese celery, Khuen chai	Apiaceae	Non-Native	X
Apium graveolens var. dulce	R			Celery	Apiaceae	Non-Native	
Araucaria columnaris	O			Cook pine	Araucariaceae	Non-Native	X
Araucaria heterophylla				Norfolk island pine	Araucariaceae	Non-Native	
Arctium lappa				Gobo, burdock	Asteraceae	Non-Native	
Asparagus densiflorus	R			Asparagus fern	Liliaceae	Non-Native	X
Asparagus plumosus				Asparagus fern	Liliaceae	Non-Native	X
Asystasia gangetica				Chinese violet	Acanthaceae	Non-Native	
Atriplex suberecta				Saltbush	Amaranthaceae	Non-Native	X
Averrhoa carambola				Star fruit	Oxalidaceae	Non-Native	
Bacopa monnieri				Aeae	Schrophulariaceae	Native	X
Basella alba				Ceylon spinach	Basellaceae	Non-Native	X
Bidens alba / pilosa				not sure which one	Asteraceae	Non-Native	X
Bidens alba var. radiata	C/D	O/C		Beggartick	Asteraceae	Non-Native	X
Bidens pilosa				Spanish needle	Asteraceae	Non-Native	X
Boerhavia repens	O/C	C	O	Alena	Nyctaginaceae	Native	X
Bothriochloa pertusa	R			Pitted beard grass	Poaceae	Non-Native	X
Bougainvillea spectabilis	R			Bougainvillea	Nyctaginaceae	Non-Native	X
Brassica campestris var. chinensis	R			Pak-choi	Brassicaceae	Non-Native	X
Brassica campestris var. napobrassica				Rutabaga	Brassicaceae	Non-Native	
Brassica campestris var. rapa				Turnip	Brassicaceae	Non-Native	
Brassica juncea		D		Mustard	Brassicaceae	Non-Native	X
Brassica nigra				Black mustard	Brassicaceae	Non-Native	X
Brassica oleracea var. acephala				Kale	Brassicaceae	Non-Native	
Brassica oleracea var. botrytis				Broccoli, Cauliflower	Brassicaceae	Non-Native	
Brassica oleracea var. capitata	R			Cabbage	Brassicaceae	Non-Native	
Brassica oleracea var. gongylodes				Kohlrabi	Brassicaceae	Non-Native	

Species	Sand	Eastern	Spit	Common name	Family	Status	Coll.
Brassica sp.	R			Mustard	Brassicaceae	Non-Native	X
Breynia disticha var. rosi-picta				Snow bush	Euphorbiaceae	Non-Native	
Bromus catharticus	O			Prairie grass	Poaceae	Non-Native	X
Caesalpinia bonduc				Yellow knickers	Fabaceae	Native	X
Cajanus cajan				Pigeon pea	Fabaceae	Non-Native	X
Caladium bicolor				Caladium	Araceae	Non-Native	
Calendula officinalis				English marigold	Asteraceae	Non-Native	X
Calophyllum inophyllum	R			Kamani	Clusiaceae	Non-Native	X
Calyptocarpus vialis	R			Calyptocarpus	Asteraceae	Non-Native	X
Canna indica				Canna	Cannaceae	Non-Native	
Canna x generalis	R/O			Canna	Cannaceae	Non-Native	X
Capparis sandwichiana				Maia pilo, pua pilo	Capparaceae	Native	X
Capsella bursa- pastoris	O	R		Shepard's purse	Brassicaceae	Non-Native	X
Capsicum annuum	O			Red pepper	Solanaceae	Non-Native	
Capsicum annuum var. grossum	R			Bell pepper	Solanaceae	Non-Native	X
Carica papaya	O			Papaya	Caricaceae	Non-Native	X
Carissa macrocarpa				Natal plum	Apocynaceae	Non-Native	X
Casuarina equisetifolia	D	R	R	Ironwood	Casuarinaceae	Non-Native	X
Casuarina glauca	O/C			Longleaf ironwood	Casuarinaceae	Non-Native	X
Catharanthus roseus				Rosy periwinkle	Apocynaceae	Non-Native	X
Cenchrus agrimonioides var. laysanensis				Native bur grass	Poaceae	Native	X
Cenchrus ciliaris	R			Buffel grass	Poaceae	Non-Native	X
Cenchrus echinatus				Sand bur	Poaceae	Non-Native	X
Centaurium erythraea subsp. erythraea	R/O			Bitter herb	Gentianaceae	Non-Native	X
Cerastium fontanum var. triviale				Common mouse ear chickweed	Caryophyllaceae	Non-Native	
Cerastium glomeratum	R			Sticky mouse ear chickweed	Caryophyllaceae	Non-Native	X
Cestrum nocturnum				Night cestrum	Solanaceae	Non-Native	X
Chenopodium murale	O			Goosefoot	Chenopodiaceae	Non-Native	X
Chenopodium oahuense	R	R		Aweoweo	Chenopodiaceae	Native	X
Chloris barbata				Swollen finger grass	Poaceae	Non-Native	X
Chloris divaricata var. divaricata				Star grass	Poaceae	Non-Native	X

Species	Sand	Eastern	Spit	Common name	Family	Status	Coll.
Chloris virgata				Feather finger grass	Poaceae	Non-Native	X
Chlorophytum comosum				Spider plant	Liliaceae	Non-Native	
Chrysanthemum sp.				Chrysanthemum	Asteraceae	Non-Native	
Cibotium sp.				Tree fern	Dicksoniaceae	Non-Native	
Ciclospermum leptophyllum	O			Fir-leaved celery	Apiaceae	Non-Native	X
Citrullus lanatus				Watermelon	Cucurbitaceae	Non-Native	
Citrus aurantifolia	R			Lime	Rutaceae	Non-Native	
Citrus hystrix	O			Kaffir lime	Rutaceae	Non-Native	X
Citrus jambhiri	R			Rough or bumpy lemon	Rutaceae	Non-Native	
Citrus meyeri	R			Meyer lemon	Rutaceae	Non-Native	
Citrus sinensis	R			Orange, valencia, navel, blood	Rutaceae	Non-Native	
Citrus sp.	R			Unknown citrus	Rutaceae	Non-Native	
Citrus x paradisi	R			Grapefruit, star-ruby, white	Rutaceae	Non-Native	
Cleome gynandra				Wild spider flower	Brassicaceae	Non-Native	X
Clusea rosea				Autograph tree	Clusiaceae	Non-Native	
Coccinia grandis				Ivy gourd	Cucurbitaceae	Non-Native	X
Coccoloba uvifera	C	O		Sea grape	Polygonaceae	Non-Native	X
Cocos nucifera	O/C			Coconut	Arecaceae	Non-Native	
Codiaeum variegatum	R			Croton	Euphorbiaceae	Non-Native	X
Colocasia esculenta				Taro	Araceae	Non-Native	
Commelina diffusa				Honohono	Commelinaceae	Non-Native	X
Conocarpus erectus				Buttonwood	Combretaceae	Non-Native	
Conyza bonariensis	O			Hairy horseweed	Asteraceae	Non-Native	X
Conyza canadensis var. pusila	O/C	O/C		Horseweed	Asteraceae	Non-Native	X
Cordia sebestena	R			Kou haole	Boraginaceae	Non-Native	X
Cordyline fruticosa	R			Ti leaf	Agavaceae	Non-Native	X
Cordyline sp.				Cordyline	Agavaceae	Non-Native	
Coreopsis grandiflora				Coreopsis	Asteraceae	Non-Native	X
Coreopsis tinctoria				Golden tickseed	Asteraceae	Non-Native	X
Coriandrum sativum	R			Cilantro	Apiaceae	Non-Native	
Coronopus didymus	C	C/D	R	Swine cress	Brassicaceae	Non-Native	X
Cosmos bipinnatus				Cosmos	Asteraceae	Non-Native	X
Crassula sp.				Stonecrop	Crassulaceae	Non-Native	
Crinum asiaticum	O/C	R		Crinum lily	Liliaceae	Non-Native	X
Crotolaria incana				Fuzzy rattle pod	Fabaceae	Non-Native	X

Species	Sand	Eastern	Spit	Common name	Family	Status	Coll.
Crotolaria pallida				Rattle pod	Fabaceae	Non-Native	X
Cucumis melo				Cantaloupe, Canary melon	Cucurbitaceae	Non-Native	X
Cucumis sativus	R			Cucumber	Cucurbitaceae	Non-Native	
Cucurbita pepo				Squash, zucchini	Cucurbitaceae	Non-Native	X
Cycas circinalis	O			Sago palm	Cycadaceae	Non-Native	X
Cycas revoluta				Sago palm	Cycadaceae	Non-Native	
Cymbopogon citratus	O			Lemon grass	Poaceae	Non-Native	X
Cynara scolymus				Artichoke	Asteraceae	Non-Native	
Cynodon dactylon	D	O		Bermuda grass	Poaceae	Non-Native	X
Cyperus involucratus	R			Umbrella plant	Cyperaceae	Non-Native	X
Cyperus javanicus				Ahu'awa	Cyperaceae	Native	X
Cyperus laevigatus	R			Makaloa	Cyperaceae	Native	X
Cyperus papyrus				Papyrus	Cyperaceae	Non-Native	
Cyperus pennatiformis var. bryanii				Cyperus	Cyperaceae	Native	
Cyperus polystachyos	C	R		Pycreus	Cyperaceae	Native	X
Cyperus rotundus	O/C			Purple nut sedge	Cyperaceae	Non-Native	X
Dactyloctenium aegyptium	O	O		Beach wire grass	Poaceae	Non-Native	X
Daucus carota				Carrot	Apiaceae	Non-Native	
Delonix regia	R			Royal poinciana	Fabaceae	Non-Native	X
Desmanthus pernambucanus				Slender mimosa	Fabaceae	Non-Native	X
Desmodium sandwicense				Spanish clover	Fabaceae	Non-Native	X
Dianthus caryophyllus				Carnation	Caryophyllaceae	Non-Native	X
Dianthus chinensis				Carnation	Caryophyllaceae	Non-Native	X
Dichorisandra thyiflora				Blue ginger	Commelinaceae	Non-Native	
Dieffenbachia sp.				Dumb cane	Araceae	Non-Native	
Digitaria ciliaris	R/O	R/O		Henry's crab grass	Poaceae	Non-Native	X
Digitaria insularis	R			Sour grass	Poaceae	Non-Native	X
Dracaena fragrans	O			Dracaena	Agavaceae	Non-Native	X
Dracaena marginata	O			Money tree	Agavaceae	Non-Native	X
Dracaena reflexa				Pineapple dracaena	Agavaceae	Non-Native	
Dracaena sp.				Unknown dracaena	Agavaceae	Non-Native	
Duranta erecta				Golden dewdrop	Verbenaceae	Non-Native	X
Echinochloa crus-galli				Barnyard grass	Poaceae	Non-Native	X
Eleusine indica	C/D	O		Goose grass	Poaceae	Non-Native	X

Species	Sand	Eastern	Spit	Common name	Family	Status	Coll.
Epiphyllum oxypetalum				Gooseneck cactus	Cactaceae	Non-Native	X
Epipremnum pinnatum	O			Golden pothos	Araceae	Non-Native	X
Eragrostis amabilis	O			Love grass	Poaceae	Non-Native	X
Eragrostis paupera	Y			Native bunch grass	Poaceae	Native	X
Eragrostis variabilis	C	O/C	O/C	Emaloa, Kawelu	Poaceae	Native	X
Eriochloa procera				Cupgrass	Poaceae	Non-Native	X
Ervatamia sp.				Crape jasmine	Apocynaceae	Non-Native	
Eryngium foetidum	R			Long coriander	Apiaceae	Non-Native	X
Erythrina variegata	R			Tiger's claw	Fabaceae	Non-Native	X
Eugenia uniflora				Suriname cherry	Myrtaceae	Non-Native	X
Euphorbia cyathopora	C			Wild poinsettia	Euphorbiaceae	Non-Native	X
Euphorbia heterophylla				Fire plant	Euphorbiaceae	Non-Native	X
Euphorbia hirta	O/C			Hairy spurge	Euphorbiaceae	Non-Native	X
Euphorbia hypericifolia	O			Graceful spurge	Euphorbiaceae	Non-Native	X
Euphorbia hyssopifolia				Spurge	Euphorbiaceae	Non-Native	X
Euphorbia maculata	O/C			Spurge	Euphorbiaceae	Non-Native	X
Euphorbia milii	O			Crown of thorns	Euphorbiaceae	Non-Native	
Euphorbia peplus	C			Petty spurge	Euphorbiaceae	Non-Native	X
Euphorbia prostata	O	O		Small ground fig	Euphorbiaceae	Non-Native	X
Euphorbia pulcherrima				Poinsettia	Euphorbiaceae	Non-Native	X
Euphorbia serpens	O			Matted sandmat	Euphorbiaceae	Non-Native	X
Eustachys petraea	C/D	C	D	Eustachys	Poaceae	Non-Native	X
Ficus benghalensis	R			Indian banyan	Moraceae	Non-Native	X
Ficus benjamina	R			Benjamin tree	Moraceae	Non-Native	X
Ficus elastica				Indian Rubber Tree	Moraceae	Non-Native	
Ficus macrophylla	R			Moreton Bay Fig	Moraceae	Non-Native	X
Ficus microcarpa	O/C			Chinese banyan	Moraceae	Non-Native	X
Ficus sp.				Unknown ficus	Moraceae	Non-Native	
Fimbristylis cymosa	O/C	O	O	Button sedge	Cyperaceae	Native	X
Fimbristylis cymosa spp. umbellato-capitata				Button sedge	Cyperaceae	Native	X
Fimbristylis cymosa subsp. spathacea				Button sedge	Cyperaceae	Native	X
Fragaria x ananassa				Strawberry	Rosaceae	Non-Native	X
Fragaria x ananassa 'Quinault'				Strawberry	Rosaceae	Non-Native	X

Species	Sand	Eastern	Spit	Common name	Family	Status	Coll.
Gamochaeta purpurea				Purple cudweed	Asteraceae	Non-Native	
Gardenia sp.				Gardenia	Rubiaceae	Non-Native	
Glycine max				Soy bean	Fabaceae	Non-Native	
Gomphrena globosa				Globe amaranth	Amaranthaceae	Non-Native	X
Gynura bicolor	R			Asian spinach	Asteraceae	Non-Native	X
Hedychium gardnerianum				Kahili ginger	Zingiberaceae	Non-Native	
Helianthus anuus				Sunflower	Asteraceae	Non-Native	
Heliconia psittacorum				Heliconia	Musaceae	Non-Native	
Heliotropium currasavicum				Nena	Boraginaceae	Native	
Heliotropium procumbens var. depressum	O			Heliotropium	Boraginaceae	Non-Native	X
Hemerocallis sp.				Day lily	Liliaceae	Non-Native	
Hibiscus rosa-sinensis	O			Red hibiscus	Malvaceae	Non-Native	X
Hibiscus sp.				Unknown hibiscus	Malvaceae	Non-Native	
Hibiscus tiliaceus	O/C			Hau	Malvaceae	Native	X
Hibiscus waimeae	R			Kokio kea	Malvaceae	Native	X
Hippeastrum sp.				Amaryllis	Liliaceae	Non-Native	
Hordeum murinum subsp. leporinum				Barley	Poaceae	Non-Native	X
Hylocereus undatus				Night blooming cereus	Cactaceae	Non-Native	
Impatiens balsamina				Balsam, candlestick plant	Balsaminaceae	Non-Native	X
Indigofera hendecaphylla				Creeping indigo	Fabaceae	Non-Native	X
Ipomoea aquatica	R			Swamp cabbage	Convolvulaceae	Non-Native	X
Ipomoea batatas				Sweet potato	Convolvulaceae	Non-Native	X
Ipomoea indica	O			Koali awa	Convolvulaceae	Native	X
Ipomoea pes-caprae subsp. brasiliensis	O/C	R/O		Beach morning glory	Convolvulaceae	Native	X
Ipomoea triloba				Little bell	Convolvulaceae	Non-Native	X
Jasminum sambac				Pikake	Oleaceae	Non-Native	
Juniperus bermudiana	R			Bermuda cedar	Cupressaceae	Non-Native	X
Kalanchoe daigremontiana x tubiflora				Kalanchoe	Crassulaceae	Non-Native	
Kalanchoe fedtschenkoi				Kalanchoe	Crassulaceae	Non-Native	X
Kalanchoe pinnata	R			Air plant	Crassulaceae	Non-Native	X
Kalanchoe tubiflora	R			Chandelier plant	Crassulaceae	Non-Native	X

Species	Sand	Eastern	Spit	Common name	Family	Status	Coll.
Lactuca sativa	R			Lettuce	Asteraceae	Non-Native	X
Lantana camara	R			Lantana	Verbenaceae	Non-Native	X
Lathyrus odoratus				Sweet pea	Fabaceae	Non-Native	X
Lepidium bidentatum var. o wahiense	Y			Anaunau	Brassicaceae	Native	X
Lepidium virginicum	C/D			Pepper grass	Brassicaceae	Non-Native	X
Leptochloa uninervia				Sprangletop	Poaceae	Non-Native	X
Lepturus repens		O	R	Lepturus	Poaceae	Native	X
Leucaena leucocephala	R			Koa haole	Fabaceae	Non-Native	X
Lobularia maritima	D	D	C/D	Sweet alyssum	Brassicaceae	Non-Native	X
Macroptilium lathyroides				Cow pea	Fabaceae	Non-Native	X
Majorana hortensis				Sweet marjoram	Lamiaceae	Non-Native	
Malva parviflora	R			Cheese weed	Malvaceae	Non-Native	X
Malvastrum coromandelianum spp. coromandelianum	R			False mallow	Malvaceae	Non-Native	X
Malvaviscus arboreus				Erect Turk's cap	Malvaceae	Non-Native	
Malvaviscus penduliflorus	R			Turks cap hibiscus	Malvaceae	Non-Native	X
Mangifera indica				Mango	Anacardiaceae	Non-Native	
Medicago lupulina	C			Black medic	Fabaceae	Non-Native	X
Medicago obicularis				Blackdisk medic	Fabaceae	Non-Native	X
Medicago polymorpha	O			Bur clover	Fabaceae	Non-Native	X
Medicago sativa				Alfalfa	Fabaceae	Non-Native	
Megathyrsus maximus				Guinea grass	Poaceae	Non-Native	X
Melilotus alba				White sweet clover	Fabaceae	Non-Native	X
Melilotus indica	C			Yellow sweet clover	Fabaceae	Non-Native	X
Melinis repens				Natal red top	Poaceae	Non-Native	X
Mentha x spicata	O			Mint	Lamiaceae	Non-Native	X
Merremia tuberosa				Wood rose	Convolvulaceae	Non-Native	
Mirabilis jalapa	O			Four o'clock	Nyctaginaceae	Non-Native	X
Momordica charantia	R			Bitter melon, Balsam pear	Cucurbitaceae	Non-Native	X
Monstera deliciosa				Monstera	Araceae	Non-Native	
Moringa oleifera	R			Drumstick tree	Moringanaceae	Non-Native	X
Morus alba	R			White mulberry	Moraceae	Non-Native	X
Murraya paniculata				Mock orange	Rutaceae	Non-Native	X
Musa x paradisiaca	O			Banana	Musaceae	Non-Native	

Species	Sand	Eastern	Spit	Common name	Family	Status	Coll.
Nama sandwicensis				Nama	Boraginaceae	Native	
Nephrolepis hirsutula				Sword fern	Nephrolepiadaceae	Non-Native	
Nephrolepis multiflora				Sword fern	Nephrolepiadaceae	Non-Native	X
Nerium oleander	O/C			Oleander	Apocynaceae	Non-Native	X
Noronhia emarginata	R			Madagascar olive	Oleaceae	Non-Native	X
Ocimum americanum				Limehairy, hoary basil	Lamiaceae	Non-Native	
Ocimum basilicum				Basil	Lamiaceae	Non-Native	X
Ociumum tenuiflorum	R			Thai holy basil	Lamiaceae	Non-Native	
Odontonema strictum				Odontonema	Acanthaceae	Non-Native	
Oenothera laciniata	C			Evening primrose	Onagraceae	Non-Native	X
Olea europaea subsp. cuspidata	R			African olive	Oleaceae	Non-Native	X
Opuntia cochenillifera				Cochineal cactus	Cactaceae	Non-Native	X
Oryza sp.				Rice	Poaceae	Non-Native	
Oxalis corniculata	O			Yellow wood sorrel	Oxalidaceae	Non-Native	X
Oxalis debilis var. corymbosa	O			Shamrock	Oxalidaceae	Non-Native	X
Pancratium littorale				Spider lily	Liliaceae	Non-Native	
Pandanus amaryllifolius	R			Tea Pandanus	Pandanaceae	Non-Native	X
Pandanus tectorius	R			Hala, screwpine	Pandanaceae	Non-Native	X
Paspalum setaceum	C			Paspalum	Poaceae	Non-Native	X
Paspalum urvillei	O/C			Vasey grass	Poaceae	Non-Native	X
Passiflora edulis				Lilikoi, passion vine	Passifloraceae	Non-Native	X
Pedilanthus tithymaloides	R			Slipper flower	Euphorbiaceae	Non-Native	X
Pelargonium x hortorum	R			Fish geranium	Geraniaceae	Non-Native	X
Peperomia obtusifolia				Alien peperomia	Piperaceae	Non-Native	X
Persea americana				Avocado	Lauraceae	Non-Native	
Petroselinum crispum				Parsley	Apiaceae	Non-Native	X
Phaseolus vulgaris				Common bush bean	Fabaceae	Non-Native	
Philodendron sp.				Philodendron	Araceae	Non-Native	
Phoenix sp.				Date palm	Arecaceae	Non-Native	
Phyla nodiflora	C			Phyla	Verbenaceae	Non-Native	X
Phyllostegia variabilis				Native mint	Lamiaceae	Native	
Phymatosorus grossus				Lauae	Polypodiaceae	Non-Native	
Pilea microphylla	O/C			Artillery plant	Urticaceae	Non-Native	X
Pilea serpyllacea				Large artillery plant	Urticaceae	Non-Native	X

Species	Sand	Eastern	Spit	Common name	Family	Status	Coll.
Piper sarmentosum	R			Thai Piper	Piperaceae	Non-Native	X
Pithecellobium dulce				Opiuma, Manila tamarind	Fabaceae	Non-Native	X
Plantago lanceolata	O/C			Narrow leaved plantian	Plantaginaceae	Non-Native	X
Plantago major				Common plantain	Plantaginaceae	Non-Native	X
Plectranthus amboinicus				Mexican oregano	Lamiaceae	Non-Native	
Plectranthus scutellarioides				Coleus	Lamiaceae	Non-Native	
Pluchea carolinensis	O			Sour bush	Asteraceae	Non-Native	X
Pluchea indica				Indian pluchea	Asteraceae	Non-Native	X
Pluchea x fosbergii				Hybrid pluchea	Asteraceae	Non-Native	X
Plumbago auriculata				Plumbago	Plumbaginaceae	Non-Native	
Plumeria obtusa	R			Singapore plumeria	Apocynaceae	Non-Native	X
Plumeria rubra	O			Red plumeria, frangipani	Apocynaceae	Non-Native	X
Poa annua	O	O		Blue grass	Poaceae	Non-Native	X
Polypogon interruptus				Perrenial ditch beard grass	Poaceae	Non-Native	X
Polypogon monspeliensis	O/C			Annual ditch beard grass	Poaceae	Non-Native	X
Polyscias guilfoylei	R			Panax	Araliaceae	Non-Native	X
Portulaca lutea				Ihi	Portulacaceae	Native	X
Portulaca oleracea	O	O		Common purslane	Portulacaceae	Non-Native	X
Portulacaria afra				Jade tree	Portulacaceae	Non-Native	X
Pritchardia hillebrandii	R			Loulu lelo	Arecaceae	Native	
Pritchardia pacifica	R			Fiji fan palm	Arecaceae	Non-Native	
Pritchardia remota	R	R		Nihoa loulu palm	Arecaceae	Native	
Pritchardia spp.				Loulu palm	Arecaceae	?	
Prosopis pallida				Kiawe	Fabaceae	Non-Native	
Pseudognaphalium sandwicensium var. sandwicensium	C			Enaena	Asteraceae	Native	X
Psidium guajava				Guava	Myrtaceae	Non-Native	
Psilotum nudum				Moa	Psilotaceae	Native	X
Psophocarpus tetragonolobus	R			Wing bean	Fabaceae	Non-Native	X
Punica granatum				Pomegranite	Myrtaceae	Non-Native	
Raphanus sativus				Radish	Brassicaceae	Non-Native	X
Ricinus communis	R			Castor bean	Euphorbiaceae	Non-Native	
Rosa sp.	R			Rose	Rosaceae	Non-Native	X
Rosmarinus officinalis	R			Rosemary	Lamiaceae	Non-Native	

Species	Sand	Eastern	Spit	Common name	Family	Status	Coll.
Roystonea sp.				Royal palm	Arecaceae	Non-Native	
Ruellia brittoniana	R/O			Ruellia	Acanthaceae	Non-Native	X
Russelia equisetiformis				Coral / firecracker plant	Schrophulariaceae	Non-Native	X
Saccharum sp.	R			Sugar cane	Poaceae	Non-Native	
Sagina japonica	O/C			Japanese pearlwort	Caryophyllaceae	Non-Native	X
Sagina procumbens	O			Birdseye pearlwort	Caryophyllaceae	Non-Native	X
Salvia officinalis	R			Sage	Lamiaceae	Non-Native	
Samanea saman				Monkey pod	Fabaceae	Non-Native	X
Sanseviera trifasciata	R/O			Mother in law tongue	Agavaceae	Non-Native	X
Santalum ellipticum				Iliahi aloe, coast sandalwood	Santalaceae	Native	
Scaevola taccada	C/D	C/D	D	Naupaka kahakai	Goodeniaceae	Native	X
Schefflera actinophylla	R			Octopus tree	Araliaceae	Non-Native	X
Schinus terebinthifolius				Christmas berry	Anacardiaceae	Non-Native	X
Senna siamea				Pheasant wood	Fabaceae	Non-Native	X
Senna surattensis				Kolomona	Fabaceae	Non-Native	
Sesbania grandiflora	R			Sesban	Fabaceae	Non-Native	X
Sesuvium portulacastrum	R/O	R/O	C	Akulikuli	Aizoaceae	Native	X
Setaria verticillata	O	R/O		Bristly foxtail	Poaceae	Non-Native	X
Sicyos pachycarpus				Anunu	Cucurbitaceae	Native	
Sida fallax	R/O			Ilima	Malvaceae	Native	X
Sida rhombifolia				Cuba jewt	Malvaceae	Non-Native	X
Solanum americanum	O	R		Popolo	Solanaceae	Native	X
Solanum lycopersicum	R/O			Tomato	Solanaceae	Non-Native	X
Solanum melongena	O			Eggplant	Solanaceae	Non-Native	X
Solanum nelsonii	R	R	O/C	Popolo	Solanaceae	Native	X
Solanum torvum	R			Turkey berry	Solanaceae	Non-Native	X
Sonchus oleraceus	O/C	O/C		Sow thistle	Asteraceae	Non-Native	X
Spathodea campanulata				African tulip tree	Bignonaceae	Non-Native	X
Spergularia marina	C	O	R	Saltmarsh sand spurry	Caryophyllaceae	Non-Native	X
Sphagneticola trilobata				Wedelia	Asteraceae	Non-Native	X
Spinacia oleracea				Spinach	Chenopodiaceae	Non-Native	
Spondias sp.				Makok	Anacardiaceae	Non-Native	
Sporobolus africanus				African dropseed	Poaceae	Non-Native	X
Sporobolus indicus	C			Indian dropseed	Poaceae	Non-Native	X
Sporobolus pyramidatus	O/C	C		Sporobolus	Poaceae	Non-Native	X

Species	Sand	Eastern	Spit	Common name	Family	Status	Coll.
Sporobolus virginicus	R	R	R	Akiaki, Beach dropseed	Poaceae	Native	X
Stachys arvensis	R/O			Staggerweed	Lamiaceae	Non-Native	X
Stachytarpheta cayennensis				Oi	Verbenaceae	Non-Native	
Stachytarpheta jamaicensis				Owi	Verbenaceae	Non-Native	X
Stellaria media				Chickweed	Caryophyllaceae	Non-Native	X
Stenotaphrum secundatum	C			St. Augustine grass	Poaceae	Non-Native	X
Strelitzia reginae				Bird of paradise	Musaceae	Non-Native	
Syngonium podophyllum	R			Syngonium	Araceae	Non-Native	X
Tabebuia heterophylla	R			Tabebuia	Bignonaceae	Non-Native	X
Tagetes erecta				Marigold	Asteraceae	Non-Native	X
Tamarindus indica	R			Tamarind	Fabaceae	Non-Native	X
Tamarix sp.				Tamarix	Tamaricaceae	Non-Native	
Terminalia catappa	O/C			False kamani	Combretaceae	Non-Native	X
Tetragonia tetragonioides				New Zealand spinach	Aizoaceae	Non-Native	X
Thespesia populnea	R			Milo	Malvaceae	Native	X
Thevetia peruviana				Be still tree	Apocynaceae	Non-Native	X
Tournefortia argentea	C	C	C/D	Tree heliotrope	Boraginaceae	Non-Native	X
Tradescantia pallida				Purple heart, Day flower	Commelinaceae	Non-Native	X
Tradescantia spathacea	O			Oyster plant	Commelinaceae	Non-Native	X
Tradescantia zebrina				Wandering jew	Commelinaceae	Non-Native	
Tribulus cistoides	O	D	O/C	Nohu	Zygophyllaceae	Native	X
Trichosanthes cucumerina var. anguina				Gourd	Cucurbitaceae	Non-Native	X
Tridax procumbens				Coat buttons	Asteraceae	Non-Native	X
Tropaeolum majus				Nasturtium	Tropaeolaceae	Non-Native	
Unknown Apiaceae				Apiaceae	Apiaceae	Non-Native	X
Unknown Cupressaceae				Cypress tree	Cupressaceae	Non-Native	X
Unknown Liliaceae				Unknown liliaceae	Liliaceae	Non-Native	
Unknown Orchidaceae				Unknown orchids	Orchidaceae	Non-Native	
Unknown Poaceae				Unknown grass	Poaceae	Non-Native	X
Unknown sp.				Unknown	Aloeaceae	Non-Native	
Unknown sp.				Vigna or Canavalia ?	Fabaceae	?	
Unknown sp.				Pencil like cactus	Cactaceae	Non-Native	
Unknown sp.				Unknown pea ?	Fabaceae	Non-Native	
Urochloa mutica				California grass	Poaceae	Non-Native	X

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Veitchia merilii	R			Manilla palm	Arecaceae	Non-Native	X
Verbena litoralis	O			Vervain	Verbenaceae	Non-Native	X
Verbesina encelioides	C	C	O	Golden crown-beard	Asteraceae	Non-Native	X
Vigna unguiculata subsp. sesquipedalis				Long bean	Fabaceae	Non-Native	X
Viola odorata				Sweet violet	Violaceae	Non-Native	
Viola x wittrockiana				Violet, pansy	Violaceae	Non-Native	X
Vitex rotundifolia	R			Pohinahina	Verbenaceae	Native	X
Vitex trifolia				Pohinahina	Verbenaceae	Non-Native	X
Vitis vinifera				Grape	Vitaceae	Non-Native	X
Vulpia myuros				Fox/rat tail fescue	Poaceae	Non-Native	X
Waltheria indica				Uhaloa	Sterculiaceae	Native	X
Wikstroemia uva-ursi				Akia	Thymelaeaceae	Native	X
Xanthium stumarium var. candense				Cocklebur	Asteraceae	Non-Native	X
Xanthosoma robustum	R			Ape	Araceae	Non-Native	X
Xanthosoma sp.				Ape	Araceae	Non-Native	
Zea mays				Corn	Poaceae	Non-Native	
Zinnia violacea				Zinnia	Asteraceae	Non-Native	X
Ziziphus sp.				Jujube	Rhamnaceae	Non-Native	X

Species	2015	2012	2008	2006	2001	1999	1998	1998b	1995	1993	1992	1991	1988	1983	1983b	1980	1979	1979b	1970	1966	1964	1964b	1962	1962b	1960	1959	1955	1954	1954b	1945	1944	1941	1940	1936	1935	1933	1931	1923	1912	1911	1907	1902
Abelmoschus esculentus			X								Y					X																										
Abutilon grandifolium	X	X	X			X			X		Y					X	X																									
Acacia farnesiana		X	X						X		Y																X									X					
Acalypha wilkesiana	X	X	X			X			X		Y																				X				X						
Achyranthes atollensis											Y																													X	X
Adansonia digitata																															X										
Agave attenuata			X			X																																			
Agave sisalana			X			X			X		Y			X			X										X														
Aira caryophyllea																							X																		
Albizia lebbeck	X	X	X			X					Y			X			X										X														
Aleurites moluccana																																		X								
Allamanda cathartica											Y																															
Allium cepa											Y																															
Allium fistulosum	X		X			X																																			
Allium porrum						X																																			
Allium sativum						X																																			
Allium schoenoprasum						X																																			
Allium tuberosum	X		X																																						
Alocasia cucullata											Y						X																									
Alocasia macrorrhiza						X																																			
Aloe vera	X	X	X			X			X		Y						X																									
Alpinia galanga						X																																			
Alpinia zerumbet																	X																									
Alternanthera tenella									X		Y																															
Amaranthus dubius									X		Y																															
Amaranthus hybridus											Y																															
Amaranthus lividus subsp. polygonoides									X																																	
Amaranthus spinosus	X	X	X			X					Y																															
Amaranthus viridis	X	X	X			X			X		Y		X																													
Ammophila arenaria											Y												X																X			
Anagalis arvensis	X	X	X			X			X		Y					X	X						X	X																		
Ananas comosus						X																																				
Andropogon glomeratus var. pumilus	X	X	X			X	X			X								X																									

Species	2015	2012	2008	2006	2001	1999	1998	1998b	1995	1993	1992	1991	1988	1983	1983b	1980	1979	1979b	1970	1966	1964	1964b	1962	1962b	1960	1959	1955	1954	1954b	1945	1944	1941	1940	1936	1935	1933	1931	1923	1912	1911	1907	1902
Anethum graveolens			X			X																																				
Annona muricata	X	X	X																																							
Anthurium andraeanum											Y						X																									
Antigonon leptopus						X			X																																	
Apium graveolens	X		X																																							
Apium graveolens var. dulce	X																																									
Araucaria columnaris	X		X			X																																				
Araucaria heterophylla		X							X		Y						X											X									?					
Arctium lappa											Y																															
Asparagus densiflorus	X	X	X																																							
Asparagus plumosus						X			X		Y						X																									
Asystasia gangetica											Y																															
Atriplex suberecta		X																																								
Averrhoa carambola			X																																							
Bacopa monnieri											Y																											X					
Basella alba						X			X																																		
Bidens alba / pilosa						X			X		Y					X	X						X	X				X	X													
Bidens alba var. radiata	X	X	X													X																											
Bidens pilosa																X							X	X					X													
Boerhavia repens	X	X	X			X			X		Y					X	X		X			X	X	X			X	X			X					X	X	X			X	X
Bothriochloa pertusa	X	X	X			X																																				
Bougainvillea spectabilis	X	X	X			X			X		Y						X											X				X										
Brassica campestris var. chinensis	X		X			X																										X										
Brassica campestris var. napobrassica																																X										
Brassica campestris var. rapa																																X										
Brassica juncea	X	X																																								
Brassica nigra			X		X	X			X		Y						X																									
Brassica oleracea var. acephala																																X										
Brassica oleracea var. botrytis						X																										X										
Brassica oleracea var. capitata	X					X			X																							X										
Brassica oleracea var. gongylodes						X																										X										

Species	2015	2012	2008	2006	2001	1999	1998	1998b	1995	1993	1992	1991	1988	1983	1983b	1980	1979	1979b	1970	1966	1964	1964b	1962	1962b	1960	1959	1955	1954	1954b	1945	1944	1941	1940	1936	1935	1933	1931	1923	1912	1911	1907	1902
Brassica sp.	X	X	X																																							
Breynia disticha var. rosi-picta									X		Y																															
Bromus catharticus	X	X	X			X			X		Y					X	X																								
Caesalpinia bonduc		X	X																																					
Cajanus cajan			X																																					
Caladium bicolor		X	X						X		Y						X																								
Calendula officinalis						X																									X									
Calophyllum inophyllum	X	X	X			X			X		Y																				X									
Calyptocarpus vialis	X	X	X			X			X																															
Canna indica						X			X		Y						X																								
Canna x generalis	X	X	X																																						
Capparis sandwichiana				Y							Y																												X			X
Capsella bursa- pastoris	X	X				X			X		Y		X				X																								
Capsicum annuum	X	X	X			X			X		Y						X																								
Capsicum annuum var. grossum	X					X																																		
Carica papaya	X	X	X			X			X		Y						X															X									
Carissa macrocarpa											Y						X											X													
Casuarina equisetifolia	X	X	X			X			X		Y					X	X						X	X				X				X									
Casuarina glauca	X	X	X			X			X																																
Catharanthus roseus											Y						X											X				X					X				
Cenchrus agrimonioides var. laysanensis											Y																														X
Cenchrus ciliaris	X	X	X			X																																		
Cenchrus echinatus		X	X			X			X		Y					X	X					X	X				X										X			
Centaurium erythraea subsp. erythraea	X	X	X			X			X		Y					X																									
Cerastium fontanum var. triviale						X			X		Y						X																								
Cerastium glomeratum	X	X																																						
Cestrum nocturnum		X	X			X																																		
Chenopodium murale	X	X	X			X			X		Y					X	X						X														X			
Chenopodium oahuense	X	X	X	Y																																				
Chloris barbata		X	X			X					Y					X	X						X				X													
Chloris divaricata var. divaricata						X																																		

Species	2015	2012	2008	2006	2001	1999	1998	1998b	1995	1993	1992	1991	1988	1983	1983b	1980	1979	1979b	1970	1966	1964	1964b	1962	1962b	1960	1959	1955	1954	1954b	1945	1944	1941	1940	1936	1935	1933	1931	1923	1912	1911	1907	1902
Chloris virgata		X				X																																				
Chlorophytum comosum			X			X																																				
Chrysanthemum sp.						X																										X										
Cibotium sp.											Y																															
Ciclospermum leptophyllum	X	X	X			X			X		Y					X	X																									
Citrullus lanatus		X	X			X																																				
Citrus aurantifolia	X	X	X																																							
Citrus hystrix	X	X	X																																							
Citrus jambhiri	X																																									
Citrus meyeri	X	X				X																																				
Citrus sinensis	X	X				X																																				
Citrus sp.	X	X	X			X			X		Y						X																									
Citrus x paradisi	X	X				X																																				
Cleome gynandra						X																																				
Clusea rosea											Y																															
Coccinia grandis		X	X			X																																				
Coccoloba uvifera	X	X	X			X			X		Y					X	X						X				X				X										
Cocos nucifera	X	X	X			X			X		Y						X										X				X										
Codiaeum variegatum	X	X	X			X			X		Y																				X										
Colocasia esculenta									X		Y						X																									
Commelina diffusa											Y																X										X					
Conocarpus erectus						X					Y																				X										
Conyza bonariensis	X	X	X			X			X		Y					X	X				X	X	X	X			X	X			X					X	X				
Conyza canadensis var. pusila	X	X	X			X							X																												
Cordia sebestena	X	X	X			X			X		Y					X															X										
Cordyline fruticosa	X	X	X			X					Y						X														X										
Cordyline sp.		X									Y																															
Coreopsis grandiflora						X																																				
Coreopsis tinctoria																																				X						
Coriandrum sativum	X		X			X																																				
Coronopus didymus	X	X	X			X			X		Y						X						X	X																	
Cosmos bipinnatus						X																																				
Crassula sp.						X			X		Y																															
Crinum asiaticum	X	X	X			X			X		Y						X						X				X														
Crotolaria incana			X			X			X		Y					X	X										X									X	X				

Species	2015	2012	2008	2006	2001	1999	1998	1998b	1995	1993	1992	1991	1988	1983	1983b	1980	1979	1979b	1970	1966	1964	1964b	1962	1962b	1960	1959	1955	1954	1954b	1945	1944	1941	1940	1936	1935	1933	1931	1923	1912	1911	1907	1902
Crotolaria pallida						X					Y						X											X									X					
Cucumis melo						X																										X										
Cucumis sativus	X					X																																				
Cucurbita pepo		X	X			X			X		Y																															
Cycas circinalis	X	X	X			X			X		Y						X																									
Cycas revoluta											Y																															
Cymbopogon citratus	X	X	X			X																																				
Cynara scolymus						X																																				
Cynodon dactylon	X	X	X			X			X		Y					X	X						X	X				X		X											
Cyperus involucratus	X	X	X			X			X		Y					X	X						X					X									X				
Cyperus javanicus									X		Y					X												X									X				
Cyperus laevigatus	X	X	X																																							
Cyperus papyrus											Y						X																									
Cyperus pennatiformis var. bryanii			Y																																							
Cyperus polystachyos	X	X	X			X			X		Y					X																										
Cyperus rotundus	X	X	X			X					Y		X			X	X											X														
Dactyloctenium aegyptium	X	X	X			X			X			X	X																													
Daucus carota						X																										X										
Delonix regia	X	X	X			X					Y			X			X															X										
Desmanthus pernambucanus		X	X			X					Y			X		X	X						X																		
Desmodium sandwicense											Y																	X									X		X			
Dianthus caryophyllus						X																																				
Dianthus chinensis						X																																				
Dichorisandra thyiflora											Y			X																												
Dieffenbachia sp.						X					Y						X															X										
Digitaria ciliaris	X	X	X			X			X		Y					X	X				X		X			X		X	X													
Digitaria insularis	X	X	X			X			X		Y					X																										
Dracaena fragrans	X		X			X											X															X										
Dracaena marginata	X	X	X			X																																				
Dracaena reflexa						X																																				
Dracaena sp.											Y						X															X										
Duranta erecta																																				X						
Echinochloa crus-galli						X																																				
Eleusine indica	X	X	X			X			X		Y		X			X	X					X	X	X				X									X		X			

Species	2015	2012	2008	2006	2001	1999	1998	1998b	1995	1993	1992	1991	1988	1983	1983b	1980	1979	1979b	1970	1966	1964	1964b	1962	1962b	1960	1959	1955	1954	1954b	1945	1944	1941	1940	1936	1935	1933	1931	1923	1912	1911	1907	1902
Epiphyllum oxypetalum						X					Y			X																												
Epipremnum pinnatum	X	X	X			X											X																									
Eragrostis amabilis	X	X	X			X			X		Y					X	X						X	X				X													
Eragrostis paupera	X	X	X			X			X		Y					X						X					X	X													X
Eragrostis variabilis	X	X	X			X			X		Y			X			X						X	X				X					X			X	X	X			X
Eriochloa procera		X	X																																					
Ervatamia sp.											Y																														
Eryngium foetidum	X		X																																					
Erythrina variegata	X	X	X			X			X		Y						X																								
Eugenia uniflora			X			X			X		Y			X																											
Euphorbia cyathopora	X	X	X			X			X		Y					X	X						X	X				X													
Euphorbia heterophylla											Y																	X			X						X				
Euphorbia hirta	X	X	X			X					Y					X						X		X				X									X				
Euphorbia hypericifolia	X	X	X			X					Y					X					X	X	X																		
Euphorbia hyssopifolia		X							X		Y																														
Euphorbia maculata	X	X	X			X					Y		X			X	X																								
Euphorbia milii	X	X	X																																						
Euphorbia peplus	X	X	X			X			X		Y												X	X																	
Euphorbia prostata	X	X	X			X			X		Y					X												X													
Euphorbia pulcherrima		X	X			X			X		Y																	X				X									
Euphorbia serpens	X		X																																						
Eustachys petraea	X	X	X			X			X		Y																														
Ficus benghalensis	X	X	X			X			X		Y						X						X									X									
Ficus benjamina	X	X	X			X																																			
Ficus elastica											Y						X																									
Ficus macrophylla	X		X			X										X																									
Ficus microcarpa	X	X	X			X			X		Y						X											X													
Ficus sp.											Y																														
Fimbristylis cymosa	X	X	X			X			X		Y						X																								
Fimbristylis cymosa spp. umbellato-capitata																X																									
Fimbristylis cymosa subsp. spathacea														X		X								X				X													
Fragaria x ananassa		X				X																																		
Fragaria x ananassa 'Quinault'						X																																		

Species	2015	2012	2008	2006	2001	1999	1998	1998b	1995	1993	1992	1991	1988	1983	1983b	1980	1979	1979b	1970	1966	1964	1964b	1962	1962b	1960	1959	1955	1954	1954b	1945	1944	1941	1940	1936	1935	1933	1931	1923	1912	1911	1907	1902
Gamochaeta purpurea											Y																	X														
Gardenia sp.											Y						X																									
Glycine max											Y																															
Gomphrena globosa						X																																			
Gynura bicolor	X	X	X																																							
Hedychium gardnerianum											Y						X																									
Helianthus anuus			X								Y																					X										
Heliconia psittacorum									X		Y																															
Heliotropium currasavicum																																										
Heliotropium procumbens var. depressum	X	X	X			X			X		Y					X																											
Hemerocallis sp.											Y																															
Hibiscus rosa-sinensis	X	X	X			X			X		Y																					X										
Hibiscus sp.											Y						X											X				X										
Hibiscus tiliaceus	X	X	X			X			X		Y					X							X					X														
Hibiscus waimeae	X	X	X																																							
Hippeastrum sp.											Y																															
Hordeum murinum subsp. leporinum											Y																													X			
Hylocereus undatus											Y																															
Impatiens balsamina						X																																				
Indigofera hendecaphylla		X	X																																							
Ipomoea aquatica	X	X	X			X			X																																	
Ipomoea batatas		X	X			X			X		Y						X															X										
Ipomoea indica	X	X	X			X			X		Y			X		X	X						X					X									X		X			X
Ipomoea pes-caprae subsp. brasiliensis	X	X	X			X			X		Y			X		X	X				X			X				X									X		X			
Ipomoea triloba											Y					X																										
Jasminum sambac														X																												
Juniperus bermudiana	X	X	X																				X																			
Kalanchoe daigremontiana x tubiflora											Y																															
Kalanchoe fedtschenkoi		X	X			X																																			
Kalanchoe pinnata	X	X	X			X			X		Y						X						X																			
Kalanchoe tubiflora	X	X	X			X					Y																															

Species	2015	2012	2008	2006	2001	1999	1998	1998b	1995	1993	1992	1991	1988	1983	1983b	1980	1979	1979b	1970	1966	1964	1964b	1962	1962b	1960	1959	1955	1954	1954b	1945	1944	1941	1940	1936	1935	1933	1931	1923	1912	1911	1907	1902
Lactuca sativa	X	X				X																																				
Lantana camara	X	X	X			X			X		Y					X	X											X								X						
Lathyrus odoratus						X																																				
Lepidium bidentatum var. o wahiense			Y	Y							Y					X						X														X	X				X
Lepidium virginicum	X	X	X			X			X		Y					X	X				X		X	X				X					X			X					
Leptochloa uninervia						X																																				
Lepturus repens	X	X	X			X			X		Y					X	X					X	X																			X
Leucaena leucocephala	X	X	X			X			X		Y					X	X											X								X						
Lobularia maritima	X	X	X			X			X		Y			X		X	X					X	X	X				X	X			X										
Macroptilium lathyroides		X																																								
Majorana hortensis						X																																				
Malva parviflora	X	X	X		X	X			X		Y		X				X																									
Malvastrum coromandelianum spp. coromandelianum	X	X	X			X			X		Y			X		X	X						X					X	X							X	X				
Malvaviscus arboreus									X		Y						X																									
Malvaviscus penduliflorus	X	X	X			X																																				
Mangifera indica			X								Y						X																									
Medicago lupulina	X	X	X			X			X		Y						X											X														
Medicago obicularis																																								X		
Medicago polymorpha	X	X				X			X																																	
Medicago sativa											Y																					X				X						
Megathyrsus maximus		X	X			X			X																											X						
Melilotus alba						X					Y					X																										
Melilotus indica	X	X	X			X			X		Y																										X					
Melinis repens						X					Y					X	X						X				X															
Mentha x spicata	X	X	X			X																																				
Merremia tuberosa											Y																															
Mirabilis jalapa	X	X	X			X			X		Y					X																										
Momordica charantia	X	X	X			X																																				
Monstera deliciosa						X			X		Y																															
Moringa oleifera	X	X	X			X																																				
Morus alba	X	X	X			X			X		Y																	X	X			X									
Murraya paniculata											Y						X											X				X									
Musa x paradisiaca	X	X	X			X			X		Y																	X				X									

Species	2015	2012	2008	2006	2001	1999	1998	1998b	1995	1993	1992	1991	1988	1983	1983b	1980	1979	1979b	1970	1966	1964	1964b	1962	1962b	1960	1959	1955	1954	1954b	1945	1944	1941	1940	1936	1935	1933	1931	1923	1912	1911	1907	1902
Nama sandwicensis			X	Y																																						
Nephrolepis hirsutula																	X																										
Nephrolepis multiflora			X			X			X		Y			X																													
Nerium oleander	X	X	X			X			X		Y						X										X				X					X						
Noronhia emarginata	X	X	X			X			X		Y																																
Ocimum americanum			X																																							
Ocimum basilicum		X				X																																				
Ociumum tenuiflorum	X																																									
Odontonema strictum											Y																																
Oenothera laciniata	X	X	X			X			X		Y			X	X	X																											
Olea europaea subsp. cuspidata	X	X	X			X																																					
Opuntia cochenillifera			X			X			X																																	
Oryza sp.			X																																							
Oxalis corniculata	X	X	X			X			X		Y					X	X										X									X						
Oxalis debilis var. corymbosa	X	X	X			X			X		Y						X																										
Pancratium littorale											Y																																
Pandanus amaryllifolius	X		X																																							
Pandanus tectorius	X	X	X			X			X		Y						X										X				X											
Paspalum setaceum	X	X	X			X																																				
Paspalum urvillei	X	X	X			X			X		Y					X																											
Passiflora edulis			X								Y			X																													
Pedilanthus tithymaloides	X	X	X			X			X		Y																																
Pelargonium x hortorum	X		X			X			X		Y						X															X										
Peperomia obtusifolia						X																																				
Persea americana						X																																				
Petroselinum crispum						X																																				
Phaseolus vulgaris						X			X		Y																																
Philodendron sp.									X		Y																																
Phoenix sp.									X		Y						X										X				X											
Phyla nodiflora	X	X	X			X					Y					X																											
Phyllostegia variabilis											Y																													X			
Phymatosorus grossus											Y																																
Pilea microphylla	X	X	X			X			X		Y		X				X				X	X																					
Pilea serpyllacea						X																																				

Species	2015	2012	2008	2006	2001	1999	1998	1998b	1995	1993	1992	1991	1988	1983	1983b	1980	1979	1979b	1970	1966	1964	1964b	1962	1962b	1960	1959	1955	1954	1954b	1945	1944	1941	1940	1936	1935	1933	1931	1923	1912	1911	1907	1902
Piper sarmentosum	X		X																																							
Pithecellobium dulce			X			X																																				
Plantago lanceolata	X	X	X			X			X		Y					X	X					X	X							X	?				X	X					
Plantago major		X				X			X		Y					X	X					X	X								?				X						
Plectranthus amboinicus		X	X																																						
Plectranthus scutellarioides											Y						X																									
Pluchea carolinensis	X	X	X			X			X		Y					X	X					X	X	X				X														
Pluchea indica											Y					X																										
Pluchea x fosbergii											Y					X							X																			
Plumbago auriculata											Y																															
Plumeria obtusa	X	X	X			X					Y																															
Plumeria rubra	X	X	X			X			X		Y						X														X										
Poa annua	X	X	X			X			X		Y					X	X						X																		
Polypogon interruptus			X			X					Y					X																										
Polypogon monspeliensis	X	X	X			X					Y					X						X		X						X												
Polyscias guilfoylei	X	X	X			X			X		Y																					X										
Portulaca lutea				Y					X		Y										X		X																X			X
Portulaca oleracea	X	X	X						X		Y			X		X	X			X				X				X														
Portulacaria afra		X	X			X					Y																														
Pritchardia hillebrandii	X		X			X																																			
Pritchardia pacifica	X		X			X																																			
Pritchardia remota	X																																								
Pritchardia spp.		X							X		Y						X																								
Prosopis pallida											Y																															
Pseudognaphalium sandwicensium var. sandwicensium	X	X	X			X			X		Y			X		X	X					X	X	X				X	X													
Psidium guajava		X	X			X			X		Y																															
Psilotum nudum											?																												X			
Psophocarpus tetragonolobus	X	X	X																																							
Punica granatum									X																																	
Raphanus sativus						X			X		Y																					X										
Ricinus communis	X	X	X			X			X		Y																	X														
Rosa sp.	X	X	X			X					Y						X														X										
Rosmarinus officinalis	X																																								

Species	2015	2012	2008	2006	2001	1999	1998	1998b	1995	1993	1992	1991	1988	1983	1983b	1980	1979	1979b	1970	1966	1964	1964b	1962	1962b	1960	1959	1955	1954	1954b	1945	1944	1941	1940	1936	1935	1933	1931	1923	1912	1911	1907	1902
Roystonea sp.											Y						X																									
Ruellia brittoniana	X	X	X			X			X		Y			X																												
Russelia equisetiformis		X	X			X																																			
Saccharum sp.	X	X																																								
Sagina japonica	X	?				X																																			
Sagina procumbens	X	?																																								
Salvia officinalis	X																																								
Samanea saman		X	X								Y						X																									
Sanseviera trifasciata	X	X	X			X			X		Y						X															X										
Santalum ellipticum		Y																																								
Scaevola taccada	X	X	X			X			X		Y			X		X	X		X			X		X				X									X				X
Schefflera actinophylla	X	X	X			X			X		Y						X																									
Schinus terebinthifolius						X			X		Y												X					X	X													
Senna siamea			X																																							
Senna surattensis											Y																															
Sesbania grandiflora	X	X	X			X			X																																	
Sesuvium portulacastrum	X	X	X			X			X																																	
Setaria verticillata	X	X	X			X			X		Y					X	X						X	X				X													
Sicyos pachycarpus			Y																																							
Sida fallax	X	X	X	Y							Y			X														X														
Sida rhombifolia						X																																				
Solanum americanum	X	X	X			X			X		Y			X		X	X				X	X	X				X	X								X	X			X	
Solanum lycopersicum	X	X	X			X																									X										
Solanum melongena	X	X	X			X																									X										
Solanum nelsonii	X	X	X			X			X		Y					X					X									X						X		X			X
Solanum torvum	X	X	X																																							
Sonchus oleraceus	X	X	X			X			X		Y					X	X					X	X	X				X	X							X						
Spathodea campanulata			X			X			X		Y																															
Spergularia marina	X	X	X			X			X		Y					X	X																									
Sphagneticola trilobata											Y			X																												
Spinacia oleracea						X																																				
Spondias sp.		X	X																																							
Sporobolus africanus																X	X						X																			
Sporobolus indicus	X	X	X			X			X		Y			X		X																										
Sporobolus pyramidatus	X	X	X								Y																															

Species	2015	2012	2008	2006	2001	1999	1998	1998b	1995	1993	1992	1991	1988	1983	1983b	1980	1979	1979b	1970	1966	1964	1964b	1962	1962b	1960	1959	1955	1954	1954b	1945	1944	1941	1940	1936	1935	1933	1931	1923	1912	1911	1907	1902
Sporobolus virginicus	X	X									Y																	X									X					
Stachys arvensis	X	X							X		Y																															
Stachytarpheta cayennensis											Y																															
Stachytarpheta jamaicensis		X	X			X					Y					X												X								X	X				
Stellaria media		X			X	X			X		Y						X																								
Stenotaphrum secundatum	X	X	X			X			X		Y					X	X						X	X				X													
Strelitzia reginae						X					Y			X																											
Syngonium podophyllum	X	X	X			X			X		Y						X																								
Tabebuia heterophylla	X	X	X			X					Y																														
Tagetes erecta						X																																			
Tamarindus indica	X	X	X			X																																			
Tamarix sp.																																X									
Terminalia catappa	X	X	X			X			X		Y						X		X				X					X													
Tetragonia tetragonioides						X																																			
Thespesia populnea	X	X	X			X			X		Y																	X													
Thevetia peruviana			X			X			X		Y						X						X					X													
Tournefortia argentea	X	X	X			X			X		Y					X	X		X				X	X				X				X									
Tradescantia pallida	X	X	X			X			X								X																								
Tradescantia spathacea	X	X	X			X			X		Y						X																								
Tradescantia zebrina						X			X		Y						X																								
Tribulus cistoides	X	X	X			X			X		Y					X	X			X		X		X				X							X			X			X	X
Trichosanthes cucumerina var. anguina						X																																			
Tridax procumbens		X	X			X					Y					X																									
Tropaeolum majus						X			X		Y			X																		X									
Unknown Apiaceae			X																																						
Unknown Cupressaceae						X			X		Y						X																								
Unknown Liliaceae						X																																			
Unknown Orchidaceae			X								Y						X																								
Unknown Poaceae		X																																							
Unknown sp.						X																																			
Unknown sp.						X																																			
Unknown sp.						X																																			
Unknown sp.						X																																			
Urochloa mutica						X					Y												X					X													

Species	2015	2012	2008	2006	2001	1999	1998	1998b	1995	1993	1992	1991	1988	1983	1983b	1980	1979	1979b	1970	1966	1964	1964b	1962	1962b	1960	1959	1955	1954	1954b	1945	1944	1941	1940	1936	1935	1933	1931	1923	1912	1911	1907	1902
Veitchia merilii	X	X	X			X																																				
Verbena litoralis	X	X	X			X					Y					X																				X						
Verbesina encelioides	X	X	X			X			X		Y					X	X		X			X		X				X	X												
Vigna unguiculata subsp. sesquipedalis			X																																						
Viola odorata											Y																															
Viola x wittrockiana						X																																			
Vitex rotundifolia	X		X																																						
Vitex trifolia		X	X			X			X		Y					X	X						X					X				X									
Vitis vinifera		X	X			X					Y			X																											
Vulpia myuros											Y																										X					
Waltheria indica						X			X		Y			X		X												X														
Wikstroemia uva-ursi			X																																		X					
Xanthium stumarium var. candense											Y																											X					
Xanthosoma robustum	X	X	X																																							
Xanthosoma sp.											Y						X																									
Zea mays						X																																				
Zinnia violacea						X																																				
Ziziphus sp.			X																																							

APPENDIX B: ANNOTATED PLANT CHECKLIST

The following annotated checklist includes information on all terrestrial vascular plant species ever reported from Midway Atoll, a product of an extensive literature search and three botanical surveys done on Midway Atoll by Forest & Kim Starr.

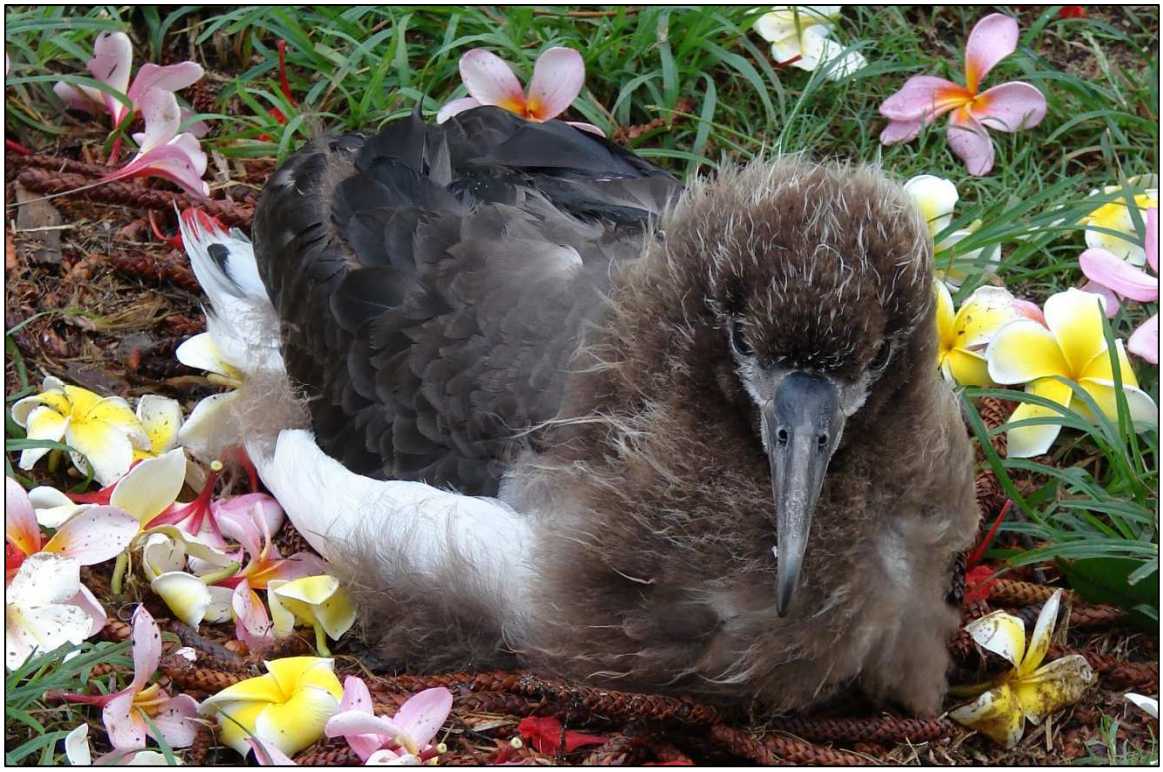
Starr surveys were done:

- 1999 (March 29 - June 30)
- 2008 (May 31 - June 14)
- 2015 (March 24 - April 7)

Species are listed alphabetically by scientific name. A thumbnail image is given for each species. The scientific name is followed by a common and/or Hawaiian name and family.

For each species, synonyms used in previous surveys of Midway Atoll are listed, then place of origin, world distribution, and distribution in Hawaii. A history for each species on Midway is presented, starting with the earliest accounts and ending with the most recent survey. Insights and potential management recommendations are included for many species.

More information about each species can be found in the Plant Checklist (Appendix A). Detailed location information is available for a subset of priority native and non-native species in the Maps section (Appendix C).



Abelmoschus esculentus (Okra) Malvaceae

Also known as *Hibiscus esculentus*. Native to tropical Africa, cultivated in Hawaii and elsewhere as an edible vegetable (Neal 1965). On Midway, okra was known to be cultivated on Sand Island (Herbst and Wagner 1992). It was not observed in 1995 (Bruegmann 1998) or 1999 (Starr and Martz 1999). In 2008, a couple small plants of what was presumed to be okra were observed in the Greenhouse (Starr and Starr 2008). Not observed in 2015.

Abutilon grandifolium (Hairy abutilon) Malvaceae

A widespread tropical weed of New World origin, cultivated for ornament and readily escaping. In Hawaii, naturalized on Midway Atoll and all of the main islands (Wagner et al. 1999). On Midway, first collected by Herbst in 1980 (*Herbst 6438* BISH) on Sand Island. Also recorded by Apfelbaum et al. (1983). In 1995, listed as occasional on Sand Island (Bruegmann 1998). In 1999, (Starr and Martz 1999) it was naturalized in weedy areas near the Doctor Cemetery on the north part of Sand Island. In 2008, this same area by the Cemetery was now choked with this large lanky plant, along with *Lantana* and *Leucaena* (*Leucaena*). On the other side of Henderson Ave. there was a stand of this plant like we had never seen before, practically impenetrable, standing taller than us, raining seeds and plant particles on us as we attempted to get through the tangle while avoiding the innumerable burrows under foot. In 2008, there were also a couple much smaller populations that could perhaps be addressed before they reach the scale of the patches near the Cemetery. These small patches were one plant in the Community Garden, and one plant on the margin of the ironwood forest along the Runway Overrun. There are also a couple patches of a half dozen plants or so on and near Radar Hill that appear to have been controlled but will require follow up (Starr and Starr 2008). In 2015 only one plant was found, adjacent to the Community Garden. The large reduction in distribution was due to control efforts since 2008.

Acacia farnesiana (Klu) Fabaceae

Native to the Neotropics. In Hawaii, formerly cultivated during an attempt to create a perfume industry. The attempt failed but klu was successful in naturalizing on all of the main islands except Niihau and Lanai (Wagner et al. 1999). On Midway, first collected by Chisholm in 1931. Neff and DuMont (1955) also collected this plant in 1954 and found it "as a planted ornamental in some places on Sand Island. One small wild spot has grown up near the enlisted men's residential area." It was observed again in 1995 by Bruegmann (1998). It was not observed in 1999 (Starr and Martz 1999). In 2008, a few dozen of these small spiny trees with fragrant yellow flowers were observed growing on a sand mound between the Cemetery and Henderson Dr. The plants were in a thicket of *Leucaena* (*Leucaena*) and covered an area of about 10m x 10m (Starr and Starr 2008). In 2015, the site was mostly barren, and this plant was not observed, due to control efforts.

Acalypha wilkesiana (Beefsteak plant, Copper leaf) Euphorbiaceae

Native to Fiji. First collected by Meagher in 1933. Hadden (1941) lists an *Acalypha*, though it is uncertain which species he was referring to. Bruegmann (1998) also observed beefsteak plants being cultivated. In 1999, scattered plants were observed in the town area of Sand Island (Starr and Martz 1999). In 2008, a few fine specimens were found scattered about the residential area and near the Midway House (Starr and Starr 2008). In 2015, two locations remained, one in Town at the Old Internet Cafe and another at the Residences at 4208 Commodore Ave.

Achyranthes atollensis (Achyranthes) Amaranthaceae

Also known as *Achyranthes splendens* var. *reflexa*. Endemic to Kure, Midway, and Pearl and Hermes atolls and Laysan (Wagner et al. 1999). Probably extinct or existing as seeds in the soil as no plants were located during a survey by D. Herbst in 1988 (Wagner et al. 1999). *A. atollensis* was last collected by Lamoureux (2794 BISH) in 1964 on Kure Atoll. This collection by Lamoureux, which we observed at Bishop Museum, had leaves as hairy as a cat's ear, and had seeds that could potentially provide an opportunity to bring this species back from extinction. On Midway in 1902, noted by W.A. Bryan as fairly common on Eastern Island, growing up to 4 feet high and growing on the sand mounds of Sand Island. Collected on both Eastern (*Bryan 22448* BISH) and Sand (*Bryan 22449* BISH) Islands. Not observed on Midway since 1902, when it was first collected. Presumed extinct on Midway and throughout the entire range of the species. The related species *A. splendens* still persists in the main Hawaiian Islands.

Adansonia digitata (Baobab tree) Bombacaceae

Native to the grassy plains of tropical Africa, this is one of the largest and longest-lived trees in the world (Neal 1965). Cultivated in Hawaii as a specimen tree. On Midway, this species was planted during Pan-American years (around 1936) and was listed by Hadden (1941) as a species that needed soil and fresh water to live, two things in short supply on Midway. The Baobab tree was not observed by Neff and DuMont in 1954 and has not been seen since.

Agave attenuata (Agave) Asparagaceae

Native to Central Mexico (Brickell and Zuk 1997), and cultivated in Hawaii, this soft, succulent, cactus-like plant was first found on Midway in 1999 where it was cultivated in the residential area of Sand Island (Starr and Martz 1999). The plants were still on Midway in 2008 in the planters at the Midway House. Not observed in 2015.

Agave sisalana (Sisal, sisal hemp) Asparagaceae

Native to Yucatan, Mexico, and widely cultivated in tropical areas, in Hawaii, this large succulent with spiny leaf tips was originally introduced as a commercial fiber crop, and is now locally naturalized in dry sites on all of the main islands except Niihau (Wagner *et al*. 1999). On Midway, Neff and DuMont (1955) report "Occasional plants...occur on Sand Island in the residential and administrative area." Also noted by Apfelbaum et al. (1983) and Bruegmann (1998). In 1999 there were two main patches of sisal on Sand Island, one in the southwest corner and the other on the dunes behind Pavilion beach. About a dozen plants were found in each spot, all of which were removed during that time (Starr and Martz 1999). In 2008, the plants on the southwest corner of the island had not returned. However, two very small plants and one plant about a meter tall persisted on the dunes behind Pavilion / North Beach. The two small plants were hand pulled. The larger plant is marked for removal (Starr and Starr 2008). Not observed in 2015, despite searches of previously known locations.

Aira caryophyllea (Silver hairgrass) Poaceae

First and only time reported from Midway in 1962 by Lamoureux (coll. #2281 NMNH) from Sand Island, on dunes between officer's beach and fuel farm.

Albizia lebbeck (Siris tree) Fabaceae

Native to the Paleotropics; in Hawaii naturalized on Midway Atoll, Niihau, Kauai, Maui, Oahu, and Hawaii (Oppenheimer and Bartlett 2002; Wagner et al. 1999). On Midway, Neff and DuMont (1955) found this tree "as an ornamental and in a few scattered small wild patches about the older part of Sand Islands." Collected by S. Conant in 1983 (*Conant 126* BISH) who adds "this tall, attractive shade tree is growing in front of the bowling alley on Midway." Recorded in 1979 (Apfelbaum et al. 1983). In 1999, (Starr and Martz 1999) the same tree was observed near the Bowling Alley at the Midway Mall on Sand Island. Not observed on Eastern or Spit Islands. In 2008, the lone Albizia was still doing well, in full flower and fruit. Unlike Neff and DuMont, we found no wild patches on Sand Island. However, it may make sense to keep an eye open for any naturalized plants in the future (Starr and Martz 1999). In 2015, a second small tree was present next to the Midway Mall sign and had been protected with plastic mesh.

Aleurites moluccana (Kukui) Euphorbiaceae

A Polynesian introduced tree to Hawaii and cultivated for a variety of uses. The official state tree of Hawaii, though native to Malesia and widespread in many tropical areas including all the main islands of Hawaii (Wagner et al. 1999). On Midway, first collected by G.B. Perry in 1936 (*Perry s.n.* BISH). Not observed since.

Allamanda cathartica (Allamanda) Apocynaceae

Native to Brazil (Neal 1965). Cultivated in Hawaii. Previously known from Midway from literature (Herbst and Wagner 1992). Not observed since.

Allium cepa (Onion) Liliaceae

Onion may have originated in western Asia (Neal 1965). A food crop in many parts of the world and grown in Hawaii for its large edible bulbs (Neal 1965). On Midway, historically known to be cultivated (Herbst and Wagner 1992). Not observed in 1999, 2008, or 2015 (Starr and Martz 1999, Starr and Starr 2008).

Allium fistulosum (Green onion) Liliaceae

Cultivated in Hawaii for food (Neal 1965). First observed on Midway in 1999 (Starr and Martz 1999), where it was cultivated in the residential area of Sand Island. In 2008, a few plants were observed in a pot in a residence along Commodore Ave. (Starr and Starr 2008). In 2015, this savory herb was thriving in the Hydroponics Greenhouse.

Allium porrum (Leek) Liliaceae

Cultivated in Hawaii for food. First observed on Midway in 1999 (Starr and Martz 1999), where it was cultivated in the residential area of Sand Island. Not observed in 2008 (Starr and Starr 2008) or 2015.

Allium sativum (Garlic) Liliaceae

Cultivated in Hawaii. Observed to be cultivated in the residential area of Sand Island, Midway, in 1999 (Starr and Martz 1999). Not observed since.

Allium schoenoprasum (Chive) Liliaceae

Native to Europe, Asia, North America (Brickell and Zuk 1997). Cultivated in Hawaii. Cultivated in the residential area of Sand Island, Midway, in 1999. Collected in 1999 (*Starr and Martz 990429-1* BISH) to document the presence on Midway. Not observed in 2008 (Starr and Starr 2008) or 2015.

Allium tuberosum (Garlic Chive) Liliaceae

A fast growing herb that spreads by rhizomes and self seeding, grown for its edible leaf used in salads, stir fries, and soups (Floridata 2008). Originally from SE Asia and now a weed in parts of Europe and North America (Floridata 2008). First reported from Midway in

2008. Persistent and spreading in gardens. Folks have attempted to cut back the plants in yards, such as 4208, where they were all chopped to the ground, to no avail. This is because the underground bulblets make it impossible to get rid of without digging out all the roots, or using herbicide. Collected from the Water Plant garden (*Starr and Starr 080608-07* BISH) to document the presence on Midway. This plant is quite tasty, but should probably only be grown in containers on Midway, if at all, to minimize the likelihood of it spreading beyond the garden (Starr and Starr 2008). In 2015 spreading chive was found persisting around house 4208.

Alocasia cucullata (Chinese taro) Araceae

From India (Neal 1965), this plant was recorded from Midway by Apfelbaum et al. (1983), but has not been seen before or since. Photo by NTBG 2015.

Aloe vera (Aloe) Xanthorrhoeaceae

Also known as *Aloe barbadensis*. Widespread in tropical and subtropical regions (Brickell and Zuk 1997), this spiny succulent is widely cultivated in Hawaii as a medicinal plant and is naturalized on at least the islands of Kauai, Oahu, and Maui (Lorence et al. 1995; Herbarium Pacificum Staff 1999; Oppenheimer 2003). On Midway, aloe was previously reported by Apfelbaum et al. (1983) and Bruegmann (1998). Starr and Martz (1999) report this succulent plant was commonly cultivated in the residential and harbor areas of Sand Island. In 2008, aloe was still commonly cultivated, especially in the town area (Starr and Starr 2008). In 2015, a few plants were observed in pots near residences and a small remnant patch was observed behind an abandoned building across from the Old Fuel Farm.

Alpinia galanga (Galangal) Zingiberaceae

First reported from Midway in 1999 (Starr and Martz 1999), from the planter boxes at the Water Plant near the heavy equipment repair shop on Sand Island. The name galang came from the worker at the water plant. Galangal is a favored Asian spice, like a mild ginger. Not observed growing before or since.

Alpinia zerumbet (Shell ginger) Zingiberaceae

Widely cultivated in the tropics and a popular ornamental plant in Hawaii (Wagner et al. 1999). On Midway only recorded once, in 1979 (Apfelbaum et al. 1983).

Alternanthera tenella (Joyweed) Amaranthaceae

Widespread in tropical regions of the Western Hemisphere; in Hawaii, cultivated and persisting on Oahu (Wagner et al. 1999). On Midway, previously known from literature (Herbst and Wagner 1992). Noted as occasional on Sand Island in 1995 (Bruegmann 1995). It has not been observed since.

Amaranthus dubius (Pakai, Spleen amaranth) Amaranthaceae

Native to the Paleotropics; in Hawaii naturalized on Kauai, Oahu, Lanai, and Hawaii (Wagner et al. 1999). On Midway, previously known from literature (Herbst and Wagner 1992) and first collected in 1995 (*Bruegmann 2018* BISH) and noted as rare on Sand Island by abandoned housing and along harbor (Bruegmann 1999). It has not been observed since.

Amaranthus hybridus (Green amaranth) Amaranthaceae

Cosmopolitan in warmer regions; in Hawaii sparingly naturalized on Kauai, Oahu and Hawaii (Wagner et al. 1999). On Midway, listed as naturalized by Herbst and Wagner (1992). Not observed since.

Amaranthus lividus ssp. *polygonoides* (Slender amaranth) Amaranthaceae

Cosmopolitan in warmer areas; in Hawaii documented from Midway, Kauai, Oahu and Hawaii (Wagner et al. 1999, Bruegmann 1999). First collected in 1995 by Bruegmann representing a new island record for Midway Atoll. Noted as rare on Sand Island (Bruegmann 1999). It has not been observed since.

Amaranthus spinosus (Spiny amaranth) Amaranthaceae

Widespread in warmer regions; in Hawaii, documented from Kure and all of the main islands except Niihau and Lanai (Wagner et al. 1999) and now known from Midway (Starr et al. 2002). On Midway, previously only known from literature (Herbst and Wagner 1992). Not observed in 1995 (Bruegmann 1998), though urban areas were not surveyed extensively. In 1999, it was restricted to a few small patches in lawn on the North part of Sand Island. This collection (*Starr and Martz 990507-2* BISH) represented a new island record for Midway Atoll (Starr and Martz 1999). In 2008, this spiny shrub was observed around the residential housing, especially near 416 Commodore Ave. and around the Medical Clinic (Starr and Starr 2008). Midway Biotech maps from 2012 and 2013 show this species to be found in low numbers in most sectors of Town (Schubert 2012, Schubert 2013). In 2015, reduced to just a few scattered plants observed in Town.

Amaranthus viridis (Slender amaranth) Amaranthaceae

Native to tropical and subtropical regions of the world; in Hawaii known from Kure, Midway, Laysan, Kaula, Kauai, Oahu, Lanai, Molokai, Maui, Kahoolawe, and Hawaii (Wagner et al. 1999; Shannon and Wagner 1996; Hughes 1995; Wagner and Herbst 1995). On Midway, collected in 1988, (*Herbst and Takeuchi 9074, 9080* BISH) representing a new naturalized record for Midway Atoll at that time (Wagner and Herbst 1995). In 1995, observed as occasional on Sand Island by Bruegmann. In 1999, observed as common on Sand Island. This and other *Amaranth* species were actively sought out and consumed by Midway residents, mostly foreign nationals from Sri Lanka and the Philippines, who use it in the same way spinach would be used (Starr and Martz 1999). In 2008, this species was still common in the lawns of Sand Island. The Thai workers, the only foreign nationals remaining, did not seem to have as much of an affinity for this species (Starr and Starr 2008). In 2015, still a common element of the lawn areas of Sand Island, mostly around Residences and Town.

Ammophila arenaria (San Francisco grass) Poaceae

Native to coastal Europe. Introduced to Midway from the sand dunes of San Francisco Bay as a sand binder. In 1923, the Tanager Expedition collected (*Caum 37* BISH) this plant growing all along the dunes of Sand Island and in places inland, forming a conspicuous element in the vegetation of the island (Christophersen and Caum 1931). In 1954, despite searches, this grass was not found (Neff and Dumont 1955). In 1962, C. H. Lamoureux collected (*Lamoureux 2281* BISH) a few clumps growing among *Scaevola* plants on sand dunes between Pavilion Beach and the fuel farm (Bruegmann 1998). It has not been observed since 1962. Photo by Ellywa (Wikipedia 2008).

Anagallis arvensis (Scarlet pimpernel) Primulaceae

Native to Europe, widely naturalized; in Hawaii, naturalized on Midway Atoll, and all of the main islands except Niihau (Wagner et al. 1999). First collected in 1962 by Frings (*Frings 19, 47* BISH) from both Sand and Eastern Islands. Observed in 1979 (Apfelbaum et al. 1983), collected by Herbst in 1980 on Sand and Eastern Islands (*Herbst 6458, 6428* BISH), and in 1995, it was reported as occasional on Sand Island (Bruegmann 1998). In 1999, (Starr and Martz 1999) common on Sand Island and occasional on Eastern Island. In 2008, observed to be common on Sand Island and rare on Eastern Island. Found in open lawn and compacted areas (Starr and Starr 2008). In 2015, still a locally common element of open, short stature, lawn like areas of Midway on both Sand and Eastern Island. Not observed on Spit.

Ananas comosus (Pineapple) Bromeliaceae

Native to tropical America and cultivated in Hawaii for its fruits (Neal 1965). In 1999, (Starr and Martz 1999) we observed this edible plant being cultivated on Sand Island. This observation represented a new cultivated record for Midway Atoll. In 2008, we did not observe pineapple on Midway (Starr and Starr 2008). In 2015, pineapple was served and folks on island were talking about planting the tops, but no cultivated plants were observed.

Andropogon glomeratus var. *pumilus* (Broomsedge, yellow bluestem) Poaceae

Native to from southern United States through Central America and northern South America. In Hawaii, known from moist areas on Midway Atoll, Oahu, and Hawaii (Snow and Lau 2010). On Midway, first collected in 1979 as *A. virginicus* by C. Corn (*Corn sn.* BISH) where a small population recently established, about 20 x 15 feet in size, was found at the edge of the runway. It was also previously collected in 1993 by K. McDermid (*McDermid sn.* BISH) and in 1998 by J.T. Duncan (*Duncan sn.* BISH) inland from West Beach. Also collected in 1999 (*Starr and Martz 990407-1* BISH) near West Beach cart trail on Sand Island and published as a new island record for Midway Atoll (Starr *et al*. 2002). In 2008, this grass appeared much more abundant /conspicuous, presumably from a decrease in mowing. This grass was most abundant around the runway, especially along the landward edge of the runway overrun, west beach near the runway, and around the water catchment pond (Starr and Starr 2008). In 2015, there was less of this grass, due to control efforts, though it was still prevalent around the Runway, especially by the Catchment.

Anethum graveolens (Dill) Apiaceae

Native to Eurasia; in Hawaii, occasionally escaping from gardens on Oahu and Maui (Wagner et al. 1999) and now also known from Midway Atoll (Starr et al. 2002). Previously not known from Midway, it was first collected (*Starr and Martz 990505-1* BISH) in 1999 (Starr and Martz 1999) from plants that self-seeded themselves and would re-appear in the garden after disturbance, in the residential area of Sand Island. In 2008, dill was found in a planter box by the Water Plant. It was collected (*Starr and Starr 080608-06* BISH) to further document the presence of dill on Midway (Starr and Starr 2008). In 2015, it was no longer present at the Water Plant and was not found anywhere else.

Anthurium andraeanum (Anthurium) - Araceae

Native to Columbia (Dehgan 1998) and cultivated in Hawaii, this plant was recorded from Midway Atoll by Apfelbaum et al. (1983), but has not been recorded in any other survey.

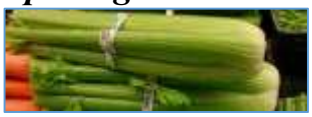
Antigonon leptopus (Hearts on a chain, Mexican creeper) Polygonaceae

Native to Mexico; in Hawaii, naturalized on Kauai, Oahu, Lanai, Maui, and Hawaii (Wagner et al. 1999). On Midway, cultivated and rare on Sand Island in 1995 (Bruegmann 1998). In 1999, (Starr and Martz 1999) found to be sparingly naturalized on Sand Island, where a small area near the harbor was being over-run by this sprawling vine with pink flowers. Collected in 1999, (*Starr and Martz 990505-10* BISH) representing a new island record for Midway Atoll (Starr *et al*. 2002). In 1999, the FWS removed the vine. Not observed in 2008, despite multiple searches in the previously known location (Starr and Starr 2008). Not observed in 2015.

Apium graveolens (Chinese celery) Apiaceae

Probably native to the Mediterranean region (Staples et al. 2005). First recorded on Midway in 2008, at the Greenhouse behind the Galley and in the Residences (Starr and Starr 2008). In 2015, what appeared to be this, a more diminutive form of celery, was observed growing in the Hydroponics Greenhouse.

Apium graveolens var. dulce (Celery) Apiaceae



Probably native to the Mediterranean region (Staples et al. 2005). First recorded on Midway in 2015, where it was growing in the Hydroponics Greenhouse.

Araucaria columnaris (Cook pine) Araucariaceae

Previously recorded from Midway as *A. heterophylla*. More recently determined to likely be *A. columnaris*. The two species are similar in appearance and their identities are regularly confused. *A. columnaris* is native to New Caledonia, the Loyalty Islands, and the Isle of Pines. In Hawaii, it is the more commonly planted of the two *Araucaria* species mentioned here (Staples et al. 2005). Neff and Dumont (1955) were the first to mention *Araucaria* on Midway, as *A. heterophylla*, and note "A few fine specimens [of this pine-like tree] are growing in the old Cable Company compound area and on the lawns of a few officers' quarters, Sand Island." Observed in 1979 (Apfelbaum et al. 1983) and 1995 (Bruegmann 1998). In 1999, the trees were quite large, occurring in the same localities described by Neff and DuMont (1955)(Starr and Martz 1999). In 2008, the trees were still persisting on the lawns around the residences. Collected (*Starr and Starr 080601-16* BISH) to document the presence on Midway, and to help with identification (Starr and Starr 2008). In 2015, several trees were still found in Town and around

Residences. A few trees appeared slightly unhealthy and experiencing some dieback. An occasional seedling was observed below trees or in pots.

Araucaria heterophylla (Norfolk Island pine) Araucariaceae

Also known as *Araucaria excelsa*. Native to Norfolk Island , and cultivated in Hawaii (Neal 1965). Araucaria were first reported from Midway as *A. heterophylla*. However, as noted in *A. columnaris*, there is chronic taxonomic confusion between these two species, and the current best guess for the identity of the Araucaria on Midway is that they are all *A. columnaris*.

Arctium lappa (Gobo, burdock) Asteraceae

Native to Eurasia, a weed in many places, including Hawaii, cultivated by the Japanese as a vegetable (Neal 1965). Previously known from literature (Herbst and Wagner 1992). Not observed before or since. Photo by Christian Fischer (Wikipedia 2015).

*Annona muricata (*Soursop) Annonaceae

Native to Tropical America, exact origin unknown, and cultivated widely throughout the world for its edible fruit, popular in Hawaii, the Philippines, and Southeast Asia (Staples 2005). First observed on Midway in 2008, though, at the time, no flowers or fruit were present, and it was misidentified as *Artobotrys hexapetalus* (climbing ylang ylang). It was located in the yard of 4208 Commodore Ave. where a large plant appeared as if it had been severely cut back and was vigorously rebounding. Collected to document the presence on Midway (*Starr and Starr 080607-12* BISH), however there was not fertile material. In 2015, fruit was present and we were able to identify it as *Annona muricata* (soursop). It was located in the same spot as before, though this time appearing extremely unhealthy with dieback and fruit covered in scales and ants.

Asparagus densiflorus (Asparagus fern) Asparagaceae

Also known as *Asparagus myriocladus*. Sprawling to pendant shrub native to the southeastern Cape region of South Africa (Staples et al. 2005). Commonly cultivated in Hawaii, and a potential weed due to bird dispersed seeds that readily sprout (Staples et al. 2005). Naturalized on the islands of Kauai, Oahu, Maui, and Hawaii (Lorence and Flynn 1999; Oppenheimer and Bartlett 2000; Kraus 2003; Oppenheimer 2003. It is believed that this species was previously reported under the misapplied name, *A. plumosus* in 1999 (Starr and Martz 1999), where this species was cultivated in residential areas. In 2008, the situation was the same, with plants cultivated in the residential area, such as the flowering and fruiting plants in the front planters of the Midway House. Collected from the Midway House planters (*Starr and Starr 080607-02* BISH) to document the presence on Midway. This species has been known to escape

from cultivation, and would probably be good to start to remove from Midway (Starr and Starr 2008). One plant was observed in 2015 at 424 Halsey Dr.

Asparagus plumosus (Asparagus fern) Asparagaceae

Also known as *Asparagus setaceus* (Kunth) Jessop. There has been some confusion over the name, the currently accepted name being *A. plumosus* (Imada et al. 2000). Native to southern Africa and commonly cultivated in Hawaii, now naturalized on Kauai, Oahu, Molokai, Maui, and Hawaii (Starr *et al*. 2002; Oppenheimer and Bartlett 2002; Oppenheimer and Bartlett 2000; Imada et al. 2000; Wagner et al. 1999; Lorence et al. 1995; Oppenheimer 2003). First recorded in 1979 (Apfelbaum et al. 1983). Also observed in 1995 (Bruegmann 1998). Not observed since.

Asystasia gangetica (Chinese violet) Acanthaceae

Native to India, Malay Peninsula, and Africa; in Hawaii, commonly cultivated and documented from Midway and probably from all the main islands (Oppenheimer and Bartlett 2000; Wagner et al. 1999). On Midway, previously known only from literature (Herbst and Wagner 1992). Not observed before or since.

Atriplex suberecta (Saltbush) Amaranthaceae

First recorded in 2012 on Sand Island from Bulky Dump to the east along the cart path. A collection was made (*Aspey s.n. Starr 150404-05* BISH) to document its presence (Aspey 2012). Not observed in 2015, despite multiple searches of the area.

Averrhoa carambola (Star fruit) Oxalidaceae

Tree native to Indonesia, India and Sri Lanka and is popular throughout Southeast Asia, Trinidad, Malaysia and parts of East Asia, and grown throughout the tropics, including Hawaii, for its edible star shaped fruit (Wikipedia 2008). First observed on Midway in 2008, where one young plant was observed in a planter at Sak's garden at the Water Plant on Sand Island, having been brought in from the main islands of Hawaii. It was not looking very healthy, it looked like it had died back and only had a few sets of leaves. In 2015, the gardens around the water plant were mostly abandoned except for a few persisting plants. The star fruit tree was not found here nor elsewhere on Sand Island.

Bacopa monnieri (Aeae) Plantaginaceae

Widespread in tropical and subtropical regions; in Hawaii, known from Midway Atoll and all of the main islands except Kahoolawe (Wagner et al. 1999). On Midway, collected in 1933, (*Meagher 69564* BISH) the only time it was observed. This wetland plant forms prostrate mats near and in fresh water and would do well at Laysan Duck seeps, though this indigenous species can be aggressive and form large mats.

Basella alba (Ceylon spinach, Malabar spinach) Basellaceae

Native to either Africa or tropical Asia, a succulent vine cultivated in Hawaii for its edible greens that are rich in vitamin A and C (Neal 1965). In Hawaii, recently documented as naturalized on the island of Oahu (Wagner et al. 1999; Nagata 1995). Nagata notes that previously collected specimens on Oahu were considered to be escaped, but what appeared to be a truly naturalized population was found in 1988. He notes, "Malabar spinach is slowly becoming naturalized at least on Oahu." On Midway, *B. alba* was first collected by Bruegmann (Bruegmann 1998) during her survey in 1995. It was going to be published as a new island record for Midway (Wagner et al. 1999) but did not appear in Bruegmann's article that year, probably due to its cultivated status. In 1999, it was collected (*Starr and Martz 990421-12* BISH) as cultivated at 330 Halsey Dr. in the residential area of Sand Island, persisting longer than other cultivated species. In 2008, this and all other cultivated plants in the back of 330 Halsey Dr. had been removed. Apparently, FWS Refuge Manager Tim Bodeen cleared out a bunch of these abandoned gardens during the period when Midway went down to a very limited staff (Greg Schubert pers. comm.). Not observed in 2015.

Bidens alba var. *radiata* (Spanish needles) Asteraceae

Native from Florida to South America and the West Indies. In Hawaii, found on Kure Atoll, Midway Atoll, Kauai, Oahu, Maui, Molokai, Kahoolawe, and Hawaii (Wagner et al. 1999; Hughes 1995). On Midway, there appears to be some taxonomic confusion between this species and *B. pilosa*. Collections of both *B. alba* and *B. pilosa* have been made. *B. alba* was collected in 1980 (*Herbst and Takeuchi 6440* BISH) and *B. pilosa* was collected multiple times (*Frings 24* BISH, *Herbst and Takeuchi 6372* BISH, and *Lamoureux 2164* BISH). We are leaning towards *B. alba* var. *radiata* based on the length of the petals. In 1999, (Starr and Martz 1999) this plant was widespread on Sand Island, especially in lawns, but potentially occurring anywhere. This species was also present on Eastern and Spit Islands. In 2008, the situation was basically the same, with Bidens quite widespread and locally dominant on Sand Island, from the middle of town to the vegetation line. One area at the eastern base of Mt. Bart had *Bidens* stems so thick and burly they fell over on each other and created a mat that covered the earth a few inches thick. On Eastern Island, there was just a little bit of Bidens on the western most tip of the island. On Spit Island, there was one small seeding plant on the southern tip of

the island, it was pulled and bagged (Starr and Starr 2008). In 2015, found to be locally common on Sand Island, including the Catchment area, along the coast at North Beach mixed in with naupaka, at the Fuel Farm, Antennae Field, and Cannon School. On Eastern Island, it was occasional on the western side of the island.

Bidens pilosa L. (Spanish needles) Asteraceae

Native to tropical America but now a pantropical weed; in Hawaii on Midway Atoll and all of the main islands (Wagner et al. 1999). Neff and DuMont note "Dr. Fosberg found it common in weedy ground on Sand Island." Not observed since, though this group of *Bidens* is taxonomically challenging. See *B. alba* var. *radiata* for more.

Boerhavia repens (Alena) Nyctaginaceae

Also known as *B. diffusa*; *B. diffusa* var. *tetrandra*; and *B. tetrandra*. Native from Africa eastward to eastern Polynesia and Hawaii. Occurring on Kure, Midway, and Pearl and Hermes atolls, Lisianski, Laysan, French Frigate Shoals, and all of the main islands (Wagner et al. 1999). On Midway, previously collected on both Sand and Eastern Islands in 1902 by W. A. Bryan. Recorded by the Tanager Expedition from both Sand and Eastern Islands where in 1923 it was growing abundantly in the central plain of Eastern Island. Collected by Neff and DuMont in 1954 who note that it was also observed by Fosberg that same year, and was a "common trailing vine found in much of the open or very slightly shaded sandy area of both Sand and Eastern Islands." Numerous collections at Bishop Museum including (*Chisholm, Meagher, Lamoureux 2118, Frings 20, Long 1746, 1750, 2263, Beauchamp 1271,* and *Herbst 6415*). Observed in 1979 (Apfelbaum et al 1983). Also observed as common to occasional on Eastern, Sand, and Spit Islands in 1995 (Bruegmann 1998). In 1999, it was common on Sand and Eastern, in the same type of habitat described by Neff and DuMont, and also observed on Spit Island (Starr and Martz 1999). In 2008, alena was occasional to common on Sand and Eastern Islands, and common to dominant on Spit Island. On Sand Island, it was abundant near the Clipper House and was found about the island in relatively open fields, coastal areas, or in the shade under the ironwoods along the coast where it can formed fairly dense cover. It was doing especially well beneath the ironwoods near the Aviary Seep on West Beach where it appears the ocean may have recently overtopped the dunes, giving alena an advantage over the *Verbesina*. On Eastern Island, alena was found almost anywhere on the island, especially on the abandoned runway, near the Laysan Duck seeps, and along the coast, especially the south coast. Some extra large tuberous roots were observed on the abandoned runway and noddies and sooties terns were nesting in and nearby patches. There did seem to be less alena along the northwest part of the island, where large mats were abundant under the dead ironwoods in 1999. On Spit, it was found over most of the island (Starr and Starr 2008). In 2015, alena was found on all three islands, but there again appeared to be a lot less, presumably a combination of less ironwood and non-target effects of regular herbicide control work occurring to rid the atoll of *Verbesina*. The most alena was found on the runway on the eastern side of Eastern Island,

where large roots with short branches and recently emerging leaves were observed. This species will likely become more abundant again as control work tapers off. Also of note was distorted growth on the alena that emitted a white dust into the air when disturbed. Closer inspection revealed what is likely a rust, perhaps a White Rust (Albuginaceae). Our images from previous trips show this same growth, suggesting the rust has been at Midway for a while. Boerhavia seems to be able to reproduce fine despite the rust.

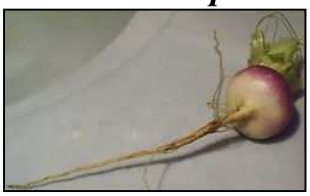
Bothriochloa pertusa (Pitted beard grass) Poaceae

Native to the Paleotropics; in Hawaii, *B. pertusa* is naturalized in open, disturbed sites such as pastures, savannas, and along roadsides on all of the main islands (Wagner et al. 1999). Previously not recorded on Midway. In 1999, we found it localized only on Sand Island in the mowed lawns on either side of the runway near the water catchment pond. Collected in 1999 (*Starr and Martz 990507-4* BISH). This collection represented a new island record for Midway Atoll (Starr and Martz 2000). In 2008, the situation was pretty much the same, with odd clumps of this grass forming in the cracks of the semi-abandoned areas of the runways (Starr and Starr 2008). In 2015, the status remained the same.

Bougainvillea spectabilis (Bougainvillea) Nyctaginaceae

Native to Brazil, the most common bougainvillea cultivated in Hawaii (Neal 1965). On Midway, in 1954, Neff and Dumont (1955) note "A few very nice vines noted growing on residential porches of Sand Island." Noted in almost every botanical survey on Midway, this colorful, spiny, vine-like shrub was still being cultivated in the town area of Sand Island in 1999 (Starr and Martz 1999). In 2008, bougainvillea was still a conspicuous element in the housing area of Sand Island. There were pink, red, orange, purple, and white varieties. There were even a couple brambles near Ave Maria and the Cable Company Buildings that were rose double-flowered forms. A trellis at the Midway House had bougainvillea arched over it. Collected from left over yard clippings at the Midway House (*Starr and Starr 080607-07* BISH) to document the presence on Midway. This spiny yet colorful vine continues to be a conspicuous element of the island flora. Though it requires constant maintenance to keep in check, there has been no sign of long-distance spread by this species (Starr and Starr 2008). In 2015, this sprawling spiny vine was still present in the residential area of Town.

Brassica campestris var. *rapa* (Turnip) Brassicaceae



Turnips are vegetables that have a rosette of green leaves attached to a tuber. On Midway, turnips were reported by Hadden (1941) as being cultivated in the vegetable garden on Sand Island. It has not been reported since. Photo by Paul Fenwick (Wikipedia 2008). In 2015, not observed.

Brassica campestris var. *chinensis* (Pak-choi) Brassicaceae

Previously called *Brassica napus* var. *chinensis*. Pak-choi are greens that are similar to leaf mustard and have smooth leaves that are long, wide, and with white petioles. Pak-choi is reported by Hadden (1941) as being grown in the vegetable garden on Sand Island during the Pan-American Airways era. It was also growing in vegetable gardens on Sand Island in 1999 (Starr and Martz 1999) and 2008. Collected in 2008 from Community Greenhouse (*Starr and Starr 080610-10* BISH) to document the presence of pak-choi on Midway. Photo by Benjwong (Wikipedia 2008). In 2015, not observed.

Brassica juncea (Mustard) Brassicaceae

The identity of the mustard plants on Eastern Island is currently not fully certain. In 2015, most of the *Brassica* plants examined keyed closest to *B. juncea*, but many of the plants also appeared to have intermediate characters. There are a lot of mustard plants on Eastern, and there could possibly be more than one species. If so, there is likely a hybrid swarm. A specimen was collected (*Starr 150328-01* BISH) and submitted to Bishop Museum for archival and further investigation of the identity of the mustard plants at Midway. See *Brassica nigra* for more.

Brassica napus var. *napobrassica* (Rutabaga) Brassicaceae

Rutabaga is a tuberous vegetable similar to turnips but with leaves born on a neck above the tuber. Rutabaga was listed in Hadden (1941) but has not been reported since. Photo by Centers for Disease Control and Prevention (Wikipedia 2008). In 2015, not observed.

Brassica nigra (Black mustard) Brassicaceae

Native to Eurasia; in Hawaii, naturalized on Oahu, Maui, and Hawaii (Wagner et al. 1999). On Midway, first observed by Apfelbaum et al. during their survey in 1979. Bruegmann (Bruegmann 1998) observed this species as common on both Sand and Eastern Islands during her survey in 1995. In 1999 (Starr and Martz 1999), observed as rare on Sand Island and as occasional to common in parts of Eastern Island, especially the southeast corner, where it formed monotypic stands. Collected on Eastern Island in 2001, representing a new island record for Midway (*Starr and Martz 010526-1* BISH). In 2008, observed as common to co-dominant with *Verbesina* over much of the eastern part of Eastern Island, especially near the runways. Not observed on Spit (Starr and Starr 2008). In 2015, there was much less *Brassica* on Eastern Island due to a control effort against it. Along with being sprayed, the *Brassica* plants were heavily attacked by insects, including the Diamond Back Moth (*Plutella xylostella*) and a leafminer. Though less abundant, locally large stands of *Brassica* were still present on the east and south portions of Eastern Island. The identity of the mustard plants on Eastern Island is currently not fully

certain. Aspey (2012) noted the plants on Eastern at that time appeared to key to *B. juncea*. In 2015, most of *Brassica* plants examined indeed keyed closest to *B. juncea*. The specimen from 2001 did get confirmed as *B. nigra*, and pictures from our earlier surveys seem to have plants that key close to *B. nigra*. However, many of our older pictures also have plants that key closer to *B. juncea*. And many have intermediate characters. These two species are closely related and are known to hybridize. Additionally, *B. rapa*, another *Brassica* known to interbreed with these two species, has previously been collected from Pearl and Hermes Atoll (*Conant 107* BISH). There are a lot of mustard plants on Eastern, and there could possibly be more than one species. If so, there is the possibility of a hybrid swarm. Another specimen, this one close to *B. juncea*, was collected (*Starr 150328-01* BISH) and submitted to Bishop Museum for confirmation and archival. However, there is still much more work that could be done to tease out the identity or identities of the *Brassica* plants at Midway.

Brassica oleracea var. *acephala* (Kale) Brassicaceae

Kale is an edible vegetable that is grown for greens to feed to humans, stock, and poultry (Neal 1965). Kale was reported by Hadden (1941) as being cultivated in the vegetable garden on Sand Island. It has not been reported since. Photo by Rasbak (Wikipedia 2008). In 2015, not observed.

Brassica oleracea var. *botrytis* (Broccoli, Cauliflower) Brassicaceae

Broccoli and cauliflower are vegetables with many branched edible inflorescences. Broccoli is green and longer branching while cauliflower is white and more compact (Neal 1965). On Midway, broccoli was previously recorded by Hadden (1941) as being grown in the vegetable on Sand Island. In 1999 (Starr and Martz 1999), both broccoli and cauliflower were being cultivated on Sand Island. Neither were observed in 2008, except in the curry at the Clipper House, and that was presumably brought in by boat or plane. In 2015, not observed.

Brassica oleracea var. *capitata* (Cabbage) Brassicaceae

Head cabbage has numerous round overlapping edible leaves in a round overlapping head (Neal 1965). On Midway Atoll, cabbage was first reported by Hadden (1941) as growing in the vegetable garden at Midway. In 1995 (Bruegmann 1998), purple leaved cabbage was cultivated on Sand Island. In 1999 (Starr and Martz 1999), green, but no purple, cabbage was being cultivated. In 2008, cabbage was not observed (Starr and Starr 2008). In 2015, cabbage was being successfully grown in the Hydroponics Greenhouse.

Brassica oleracea var. *gongylodes* (Kohlrabi) Brassicaceae (Brassicaceae

Kohlrabi is a vegetable that looks like a turnip but the swollen edible stem grows above ground (Neal 1965). On Midway, kohlrabi was previously noted by Hadden (1941) from the vegetable garden on Sand Island. In 1999, it was being cultivated in residential gardens on Sand Island (Starr and Martz 1999). Not observed since. Photo by C. Ford (Wikipedia 2008). In 2015, not observed.

Brassica spp. (Mustards) Brassicaceae

A genus made up of about 40 species, native mainly to the Mediterranean region, and grown as food in Hawaii and elsewhere (Neal 1965). In 2008, in addition to the *Brassica* species mentioned, there were some unidentified *Brassica* observed on Sand Island. Plants were found in vegetable gardens that looked very similar to the Brassica on Eastern Island, but apparently did not come from there, rather they had been brought in from Thailand as seed. Sak, a Thai worker who has been on Midway since 1982, had a can of mustard seeds he had brought from Thailand that he would sprinkle in his planters at the Water Plant when he needed more. The exact identification of the mustard was not determined and though a specimen was collected (*Starr and Starr 080608-02* BISH). It was scrappy and was not identified past the genus level. Similar plantings were found in the Community Greenhouse and the Barber Shop. (Starr and Starr 2008). In 2015, there were some mustard greens in the Hydroponics Greenhouse that we weren't certain the exact identity of.

Breynia disticha var. *rosi-picta* (Snow bush) Euphorbiaceae

Also placed in Phyllanthaceae. Native to Melanesia and widely cultivated for its variegated pinkish, white, and green foliage (Whistler 2000). In Hawaii, cultivated and now naturalized on Maui (Wagner et al. 1999; Lorence et al. 1995). On Midway, previously known from literature (Herbst and Wagner 1992). Also recorded by Bruegmann (1998) as rare on Sand Island. It has not been observed since.

Bromus catharticus (Prairie grass) Poaceae

Also known as *B. willdenowii* and *B. unioloides*. Had a taxonomic change in 1997 (Herbst and Clayton 1998). Native to South America; in Hawaii, naturalized on Midway, Kauai, Oahu, Molokai, Maui, and Hawaii (Wagner et al. 1999; Lorence and Flynn 1997). On Midway, previously collected in 1979 (Apfelbaum et al. 1983) and in 1980 (*Herbst and Takeuchi 6437* BISH). Observed by Bruegmann in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), found near Pavilion beach, Sand Island. In 2008, this grass was much more conspicuous, perhaps due to the no-mow approach being taken. Found in many lawns around town, especially around the Midway House (Starr and Starr 2008). In 2015, the status was mostly the same, this robust grass was found mostly around the residences and in the field across from Charlie Barracks.

*Caesalpinia bonduc (*Yellow nickers) Fabaceae

Climbing shrub with recurved prickles and seeds which float long distances; pantropical in distribution. In Hawaii, indigenous or an early introduction, occurring in dry, disturbed areas on Laysan, Niihau, Kauai, Oahu, Molokai, Maui, and Hawaii (Wagner et al. 1999). In 2008, a lone plant with a few spiny, vine-like stems about five meters long was found south of the Cemetery on Sand Island, close to the intersection of Roosevelt Ave. and Henderson Dr. It is unknown exactly how the plant got in that location, but it seems likely that given the ability of the seeds to float in the ocean, a seed was eaten by a seabird at sea, and then brought to Midway, where the bird either died or puked up the seed. The seed then grew into the burgeoning plant. The plant is native to Hawaii, yet has horrific spines, and can create impenetrable thickets. After much discussion the FWS decided to remove the plant, in the interest of the birds. Collected (*Starr and Starr 080610-13* BISH) to document the presence on Midway. By 2012, 4 locations were noted, a seedling by the cargo pier which was pulled at the time, a seedling near Captain Brooks which was also pulled, a sapling near the Marine Barracks and another small patch along the south cart trail near Bulky Dump(Aspey 2012). Not observed in 2015.

Cajanus cajan (Pigeon pea) Fabaceae

Shrub to 6 ft. in height cultivated in Hawaii and other tropical areas for its edible seeds, as a vegetable, and for forage (Wagner et al. 1999). In Hawaii, known from probably all the main islands, but documented only from Kauai, Oahu, Maui, and Hawaii (Wagner et al. 1999). First recorded from Midway in 2008, where there was a 6 ft. tall specimen of pigeon pea in the Community Garden. The plant was in full seed, with seeds freely falling off the plant onto the ground. This species has spread from gardens in the main Hawaiian Islands. It may make sense to either grow this species indoors, or not plant it at all on Midway. Collected from the Community Garden (*Starr and Starr 080610-04* BISH) to document the presence on Midway (Starr and Starr 2008). Not observed in 2015.

Caladium bicolor (Caladium) Araceae

Native to tropical America (Neal 1965). In Hawaii, this plant is cultivated for its variegated heart shaped leaves (Neal 1965). On Midway, noted as rare in 1995 (Bruegmann 1998), the only time it has been recorded from Midway. Not seen in 1999 (Starr and Martz 1999). In 2008, one small plant in a hanging pot was observed at 4208 Commodore Ave. Not observed in 2015.

Calendula officinalis (English marigold) Asteraceae

Native to southern Europe and cultivated for their showy flowers (Neal 1965). On Midway, recorded by Hadden (1941) as one of the flowers grown during the Pan American Airways era. Not recorded in other surveys. In 1999 (Starr and Martz 1999), collected (*Starr and Martz 990421-2* BISH) as cultivated on Sand Island, where it was rare in distribution. Not observed since.

Calophyllum inophyllum (Kamani) Clusiaceae

Native from eastern Africa, India, Taiwan, and Malesia to Australia and the Tuamotus; in Hawaii this Polynesian introduced tree is often used in landscaping and naturalized in low elevation sites at least on Kauai, Oahu, Molokai, Maui, and Hawaii (Wagner et al. 1999). On Midway, first reported by Hadden (1941). Reported as rare on Sand Island by Bruegmann (1998). In 1999 (Starr and Martz 1999), one tree was observed near the Hangar. In 2008, three mature trees were found just east of the abandoned Marine Barracks. There were lots of seedling about a foot tall underneath the trees. Collected east of the Marine Barracks (*Starr and Starr 080604-04* BISH) to document the presence of kamani seedlings on Midway (Starr and Starr 2008). In 2015, the tree by the Hangar could not be located, the trees and seedlings by the Marine Barracks had been removed when the Marine Barracks were dismantled, and a previously unnoticed tree was found in the plantings along West Beach.

Calyptocarpus vialis (Calyptocarpus) Asteraceae

Native from Texas, south Guatemala, Costa Rica, and Cuba; in Hawaii, naturalized on Midway Atoll and probably all of the main islands (Wagner et al. 1999; Bruegmann 1999). On Midway, first collected (*Bruegmann 2019* BISH) by Bruegmann in 1995 (Bruegmann 1999). In 1999 (Starr and Martz 1999), it was occasional in lawn areas of Sand Island, and was collected again (*Starr and Martz 990429-3* BISH). In 2008, this yellow flowered creeper could still be seen occasionally in the lawn areas of Sand Island, especially in town (Starr and Starr 2008). The same was true in 2015, though perhaps less than before.

Canna indica (Canna) Cannaceae

Native of central tropical South America, probably and early introduction to Hawaii, where it is cultivated as an ornamental (Neal 1965). On Midway, recorded as early as 1979 (Apfelbaum et al. 1983). Also observed in 1995 (Bruegmann 1998). Reported in 1999 (Starr and Martz 1999), as cultivated in the residences where it persists. However, after looking at images from that survey, it now seems that *C. x generalis* is the canna currently on Midway.

Canna x generalis (Garden canna) Cannaceae

Canna indica was hybridized and backcrossed with other Canna species, including *Canna flaccida*, a North American native, leading to hybrids and numerous cultivars that are now generally known as *Canna* x *generalis* (Floridata 2008). Based on review of images from 1999, it appears *C.* x *generalis* may have mistaken for *C. indica* (Starr and Martz 1999). In 2008, garden canna was occasionally observed around residences and other buildings in town on Sand Island. It was collected from the Midway House (*Starr and Starr 080607-09* BISH) to document the presence of garden canna on Midway (Starr and Starr 2008). In 2015, it was still present by the Water Plant and a few Residences, including the Midway House.

Capparis sandwichiana (Maia pilo, pua pilo) Capparadaceae

Endemic to the Hawaiian Islands. Occurring on Midway Atoll, Pearl and Hermes Atoll, Laysan, and all of the main islands. Probably extinct now from Midway, Pearl and Hermes, and Laysan. On Midway, previously collected and recorded for Eastern Island only, where it was fairly common in 1902 (*Bryan 12190* BISH), but uncommon in 1923 (*Caum 23* BISH) in the central plain (Bruegmann 1998). Not observed since 1923. This gangly shrub with fragrant flowers is presumed gone front the NWHI, but is still locally abundant in some parts of the main Hawaiian Islands. In 2005, *Capparis* was reintroduced to Midway Atoll from Laysan (Klavitter 2006), and then planted on Spit Island (John Klavitter pers. comm.). *Capparis* was not observed on Spit Island in 2008, and multiple visits by Klavitter to the planting site on Spit Island also failed to turn up a plant, suggesting Capparis was once again absent on Midway (Starr and Starr 2008). Not observed in 2015, though FWS was considering reintroducing it again.

Capsella bursa-pastoris (Shepard's purse) Brassicaceae

Also known as *Capsella rubella*. Taxonomic change from *C. rubella* to *C. bursa-pastoris* (Wagner and Herbst 1995). Native to Eurasia; in Hawaii, documented from Midway Atoll, Oahu, Lanai, Maui, and Hawaii (Wagner et al. 1999; Herbst and Wagner 1996). On Midway, represented by the collection (*Herbst and Takeuchi 9087* BISH) which was the first record of this species for the Northwestern Hawaiian Islands (Herbst and Wagner 1996). In 1999 (Starr and Martz 1999), this species was rare on Sand Island. Not observed in 2008 (Starr and Starr 2008). In 2015, occasionally found in open areas. On Eastern, found near the Pier.

Capsicum annuum (Red pepper, chili pepper) Solanaceae

Native to tropical America and cultivated and naturalized probably on all of the main Hawaiian Islands (Neal 1965, Wagner et al. 1999).On Midway, previously recorded in 1979 (Apfelbaum et al. 1983) and also in 1995 (Bruegmann 1998). In 1999, hot peppers were cultivated on Sand Island, and were one of the most favored plants. No personal garden on Midway was caught without a good pepper tree. Some of the Sri Lankan foreign nationals would hide whole home-grown peppers in the dry flower vases on the large tables in the Galley, adding extra heat to the already ridiculously hot Midway curry. In 2008, hot peppers were again omnipresent in the gardens of the Thai foreign nationals and in the Community Garden on Sand Island. Hot peppers were one of the more actively utilized plants on Midway. Sak, the Water Plant attendant, had a giant stash of dried peppers at the Water Plant. Hot peppers were again at every meal, this time they were in plain view for all, sliced thin and placed in a bowl with a serving spoon at the end of the buffet line, the peppers presumably grown on-island. Though this plant has a history of spread elsewhere, and is certainly getting moved around Midway by adoring humans, there was no obvious signs of spread beyond gardens (Starr and Starr 2008). In 2015, hot peppers were being grown around the Residences, mostly in buckets, and in the Hydroponics Greenhouse, where the plants looked much healthier.

Capsicum annuum var. *grossum* (Bell pepper) Solanaceae

Native to tropical America and cultivated in Hawaii (Neal 1965). In 1999, bell peppers were cultivated on Sand Island. Collected in 1999 (*Starr and Martz 990510-4* BISH) to document the presence on Midway (Starr and Martz 1999). Not observed in 2008 (Starr and Starr 2008). In 2015, multiple varieties of different colored bell peppers were being grown in the Hydroponics Greenhouse.

Carica papaya (Papaya) Caricaceae

Native to the Neotropics. In Hawaii, widely cultivated for its edible fruit and naturalized on Kauai, Molokai, Maui, and Hawaii and probably also on some of the other main islands (Oppenheimer and Bartlett 2000; Wagner et al. 1999). First observed on Midway in 1999 (Starr and Martz 1999), where this cosmopolitan tree was cultivated in Residences and the Community Garden. A low growing variety of papaya with large fruits seemed a common cultivar on Sand Island. In 2008, papayas were still cultivated in the Residences, the Community Garden, and by the Water Plant. The trees were an odd variety that produced very large fruit. However, the ripe papayas did not seem to be eaten, and some folks on island say the fruits are better green. The emerald beetles appear to like papaya, we watched a group of 100 or so emerald beetles devour a large papaya in less than 24 hours. Collected (*Starr and Starr 080601-03* BISH) to document the presence of papaya on Midway (Starr and Starr 2008). In 2015, papayas were present, but

all the trees were looking really bad, with most trees appearing old and unkempt. The few edible fruit were going unharvested.

Carissa macrocarpa (Natal plum) Apocynaceae

Native to South Africa (Whistler 2000). In Hawaii, often cultivated as a hedge for its attractive foliage, white flowers, and red fruits. On Midway, observed and collected in 1954 growing as a hedge plant in the residential area of Sand Island (Neff and DuMont 1955). It was also observed in 1979 by Apfelbaum et al. (1983). This species has not been observed since.

Casuarina equisetifolia (Ironwood) Casuarinaceae

Native to Australia, widely cultivated in the tropics and subtropics and also widely naturalized; in Hawaii documented from Kure, Midway, and Pearl and Hermes atolls, Lisianski, Laysan, French Frigate Shoals, and all of the main islands (Wagner et al. 1999). On Midway, some of the first ironwood plantings were begun in 1936 by Mr. Steadman, the gardener for the Pan-American Airlines (Hadden 1941). By 1954, Neff and DuMont note, "Abundant on both Sand and Eastern Islands. The original plantings appear to have reached maturity and some are dying. Spreading by natural means the ironwoods have scattered all over Sand Island and trees dully 30 feet high were seen on beach-line dunes on the opposite end of the island from the original plantings. A few trees of similar height were found on Eastern Island and small seedlings occur almost all over this island. Within a few years it, too, will very likely be ironwood-covered." Observed in 1979 (Apfelbaum et al. 1983). Bruegmann (1998) listed ironwood as common to dominant on Sand and Eastern Islands and as rare on Spit Island. In 1999 (Starr and Martz 1999), ironwood dominated most of Sand Island that was not lawn or runway, forming monotypic forests with only an occasional light gap. On Eastern Island, almost all the trees had been treated with herbicide and would soon be felled and burned. During the Base Realignment and Conversion (BRAC) all adult trees have were removed from Spit Island, but seedlings were still constantly popping up. In 2008, ironwood still covered vast areas of Sand Island, often creating forests so dense that no plants grew underneath it. There had however been a lot of ironwoods recently removed by the FWS. Most notable were a line of trees between the Antennae Field and the Runway, and a couples swaths of ironwood trees on West Beach, including one that ran from the Abandoned Runway to the coast. The trees were apparently pushed over using an excavator, put in a pile, and burned (John Klavitter pers. comm.). The burned stumps and remnant jumbles of wood are still visible, utilized as nesting sites by white terns and brown noddies. On Eastern Island, there are no more ironwoods, except a few saplings on the NE tip of the island. Apparently the dead ironwoods on Eastern Island were all felled and either burned or left on the ground. The red-tailed tropicbirds that liked to nest at the base of ironwood trees were finding refuge next to the large logs. On Spit Island, a small ironwood seedling was observed and pulled (Starr and Starr 2008). In 2015, ironwood was still a dominant part of the flora at Midway. Though all the large ironwood trees had

been removed from Eastern Island, there were still seedlings showing up along the coast there, and at Spit. On Sand Island, many stands of ironwood had been removed, but large forests still prevailed over much of the island. It is anticipated the distribution of ironwood will continue to decline at Midway, due to flight clearance mandates from FAA and habitat work by FWS. The next blocks of ironwood slated for removal include the Runway Overrun and the west part of West Beach.

Casuarina glauca (Longleaf ironwood) Casuarinaceae - Naturalized

Native to eastern and southern Australia. In Hawaii, this species persists by root suckers and is documented from Kauai, Molokai, Lanai, Maui, Kahoolawe, and Hawaii (Wagner et al. 1999). Bruegmann (1998) was the first to record this species as a new island record to Midway. During 1999 (Starr and Martz 1999), one patch was found south of the Hangar in the Antennae Field where it was collected (*Starr and Martz 990511-1* BISH) representing a new naturalized record for Midway Atoll (Starr *et al*. 2002). In 2008, a few patches of longleaf ironwood were observed, between the Hangar and Antennae Field, by the Finger Piers, behind the Midway Mall, just West of the Clipper House, and around the Baseball Field. The patches seem to have been in place for some time, and were likely just overlooked in previous surveys. That said, only the Finger Pier *Casuarina* was checked under magnification, so the other patches could have been misidentified. This species can be distinguished from the regular ironwood (*C. equisetifolia*) by its longer leaves with more than ten teeth at segment joints, suckering habit, and on some days the sound of the wind blowing through the canopy (Starr and Starr 2008). In 2015, this longer-leaved ironwood was still found in the same locations, showing more of a propensity to slowly spread by suckering rather than rapidly spreading by seed. In addition to locations mentioned above, it was also found near Bart Hill and the far end of West Beach near the old Cart Trail. We verified the identification of most populations mapped by counting the number of teeth at segment joints: *C. glauca* with 10 or greater, *C. equisetifolia* with 9 or less.

Catharanthus roseus (Rosy or Madagascar periwinkle) Apocynaceae

Native to Madagascar (Whistler 2000). In Hawaii, cultivated in gardens for their attractive flowers (Neal 1965) and now naturalized on probably all of the main islands and Midway Atoll (Wagner et al. 1999). On Midway, D. R. Chrisholm noted this species to be cultivated in 1931 (Bryan 1956). Hadden (1941) also lists "periwinkles" as being cultivated. Collected in 1954 (*Neff and DuMont 36* BISH) who described it "as a flowering ornamental seen near the old Pan-American Gooneyville Lodge on Sand Island." This species was also observed by Apfelbaum et al. (1983) in 1979. It has not been observed since.

Cenchrus agrimonioides var. *laysanensis* (Kamanomano) Poaceae

Also known as *C. calyculatus* var. *uniflorus*. This variety, known from Kure, Midway, and Laysan is now probably extinct (Wagner et al. 1999). This variety was last seen alive on Kure in 1961 by C. H. Lamoureux who observed half a dozen clumps in one small area of the central plain (Lamoureux 1961, Wagner et al. 1990). On Midway, previously collected by W. A. Bryan in 1902, who states that he saw only two or three bunches inland on Eastern Island (Christophersen and Caum 1931). Not collected or observed since, it is probably extinct on Midway and throughout its entire range. However, there is another variety, *C. a. agrimonioides* (species in image) that though endangered, is easily propagated and has become a hardy restoration species on the island of Kahoolawe. This grass could be brought in from elsewhere, as has been done with other natives lately. However, it is a different variety, and some may have reservations because this grass is so aggressive and the fruit can stick to clothes and prick fingers. Another item to think about if contemplating introducing this grass is there are at least two different populations of this variety in the main Hawaiian Islands. The Maui population does not produce fertile material, so the grass can only spread vegetatively. The Oahu population produces seed.

Cenchrus ciliaris (Buffel grass) Poaceae

Native to Africa and tropical Asia; in Hawaii, naturalized and common on all of the main islands except Niihau (Wagner et al. 1999). Buffel grass is known to be invasive on the main Hawaiian Islands and is the dominant grass in the dry lowland areas (Whistler 1995). Previously not recorded from Midway, the collection of this species in 1999 (*Starr and Martz 990427-1* BISH) represented a new island record for Midway Atoll (Starr and Martz 2000). It was probably not intentionally introduced and seeds may have arrived in soil or attached to something. In 1999, it was restricted to a few dozen patches on a grassy lawn near the cargo pier and sea plane ramp by Turtle Beach on Sand Island. Plants were controlled with a foliar spray of roundup. The plants were seeding at the time and we noted the area will need to be monitored in the future. In 2008, buffel grass was still present on Midway in the same spot identified in 1999. However, the patch had been forgotten about was now much larger. It was also much more conspicuous given the no-mow approach to lawns. Interestingly, despite almost a decade of opportunity to spread, no other locations of this grass were found on Midway. Also of note is that red tailed tropicbirds were able to burrow out an existence at the base of plants found in lone clumps, as were Laysan Albatross chicks. Solid patches of this grass seemed to exclude seabirds. Shortly after the survey, control of buffel grass began again (Greg Schubert pers. comm., Starr and Starr 2008). In 2015, only a few small clumps remained, in the same area, between the Cargo Pier and Turtle Beach, the result of a dedicated control effort. Of note, there were no Red-tailed Tropicbirds in the area anymore, likely a result of loss of structure.

Cenchrus echinatus (Sand bur ((naturalized)

Also known as *C. hillebrandianus* Hitchc. Native to the Neotropics and now widely naturalized; in Hawaii, naturalized in dry disturbed habitats on Kure, Midway, Lisianski, Laysan, French Frigate Shoals, Nihoa and all of the main islands (Wagner et al. 1999). Over a million dollars was spent on Laysan to get rid of this grass. This grass is widespread on Kure Atoll, apparently spread during the rat eradication (Dave Smith pers. comm.). On Midway, previously collected from the interior of Eastern Island by E. L. Caum in 1923 (Christophersen and Caum 1931). In 1954, Neff and DuMont (1955) reported finding it mostly along the edges of runways, roads and about larger buildings on Sand and Eastern Islands. It was also observed by Fosberg in 1954 (Neff and DuMont 1955). In 1964, collected by Long from the west end of east-west runway on Eastern Island (Bruegmann 1998). In 1979, collected on Sand Island and observed on Eastern Island (Apfelbaum et al. 1983). In 1980, collected by Herbst and Takeuchi (*Herbst 6378* BISH) from Sand Island and described as common (Bruegmann 1998). In 1995, observed on Sand Island only (Bruegmann 1998). In 1999 (Starr and Martz 1999) observed on Sand Island only, mainly in the town area and along the south side of the east-west runway. There were about a dozen distinct localities, none very large in size. In 2008, many of the town plants had disappeared, perhaps as a result of increased herbicide management of the lawns. The only plant found in town was at residence 4209, right where the boots were taken off. That plant was controlled. The only other place on Midway where sandbur was observed was in the lawns between the runway and the South Beach Trail. Here, there is a series of patches that appear to have gotten larger in the past decade. The FWS was planning to get rid of these plants (Starr and Starr 2008). Not observed in 2015, despite multiple searches of previously known locations. That said, on Laysan this species has returned to the island multiple times after being declared eradicated, perhaps brought in by seabirds, given the locations far from human activity where they seem to first show up in.

Centaurium erythraea subsp. *erythraea* (Bitter herb) Gentianaceae

Native to Eurasia, widely naturalized; in Hawaii, on Midway Atoll and all of the main islands except Niihau (Wagner et al. 1999). On Midway, first collected by Herbst in 1980 (*Herbst 6374* BISH) from Sand Island where it was uncommon. Reported in literature by Herbst and Wagner (1992). Also recorded as occasional on Sand Island in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999) occurring in moist areas, especially near the harbor on the east end of Sand Island. In 2008 just a few plants observed, again in the field north of the Boathouse and on the Runway Overrun Field (Starr and Starr 2008). In 2015, occasional in moist areas and open fields near the North/South Runway and Water Catchment areas.

Cerastium fontanum subsp. *triviale* (Common mouse-ear chickweed) Caryophyllaceae

Native to Eurasia and widely naturalized. In Hawaii, naturalized in somewhat wet sites on all of the main islands except Niihau and Kahoolawe (Wagner et al. 1999). On Midway, first recorded by Apfelbaum et al. (1983). Also observed by Bruegmann (1998). It was rare on Sand Island in 1999 (Starr and Martz 1999), when plants were observed in town and the north part of the Harbor. Not observed since. Photo by Bobbi Hattaway www.discoverlife.org (2011).

*Cerastium glomeratum (*Sticky mouse-ear chickweed) Caryophyllaceae

First reported in 2012 in a few locations on Sand Island: near the Seaplane Hangar, Catchment basins, South Beach Cart Path, and Cargo Pier (*Aspey s.n., Starr 150404-02* BISH) (Aspey 2012). In 2015, it was observed only in a moist low spot near the Fire Station. However, given the previously known distribution, this ephemeral herb could likely come and go in any moist area on Midway. A collection was made (*Starr 150330-02* BISH) to document the continued presence of this species on Midway.

Cestrum nocturnum (Night blooming jasmine) Solanaceae

Native to the Antilles and Central America, widely cultivated and naturalized. In Hawaii, cultivated for its fragrant flowers that bloom at night, now naturalized on Kauai, Oahu, and Maui (Oppenheimer and Bartlett 2000; Wagner et al. 1999). Observed for the first time on Midway in 1999 (Starr and Martz 1999), where a single individual was in the yard of 4212 Commodore Ave. in the residential area of Sand Island. Collected (*Starr and Martz 990409-1* BISH) to document the presence on Midway. In 2008, this lone tree, now standing about three meters tall and wide, was still persisting at 4212 Commodore Ave. on Sand Island. Flowers were present and fragrant at night (John Klavitter pers. comm.). Though this species readily spreads from where it is planted in the main Hawaiian Islands, there was no sign of spread on Midway yet. That said, it would not be too hard to remove the lone tree, heading off any potential problems in the future (Starr and Starr 2008). In 2012, still present in the same location (Aspey 2012). Not observed in 2015.

Chenopodium murale (Goosefoot) Amaranthaceae

Probably native from the Mediterranean area to southwestern Asia; now a cosmopolitan weed; in Hawaii, documented from Kure and Midway atolls, French Frigate Shoals, and all of the main islands (Wagner et al. 1999). On Midway, first collected by Meagher in 1933. Collected again in 1980 by Herbst (*Herbst 6360* BISH). Observed by Apfelbaum et al. (1983). Bruegmann (1998) notes this species as occasional on Sand Island. In 1999 (Starr and Martz 1999), it was also noted as occasional on Sand Island, especially near the fuel farm. In 2008, a few plants were observed on Sand Island by the Torpedo Overhaul Shop and by the 400 housing on Halsey Dr. (Starr and Starr 2008). In 2015, there were still a few plants around the housing and lawn areas in the Residences.

Chenopodium oahuense (aweoweo) Amaranthaceae

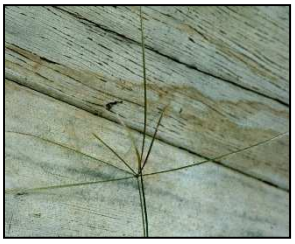
Endemic to Hawaii and known from Lisianski, Laysan, French Frigate Shoals, Necker, Nihoa, and all the main islands (Wagner et al. 1999, Starr et al. 2006). In 2005, brought to Midway from Laysan (Klavitter 2006). In 2008, observed in two planted locations and the FWS Greenhouse on Sand Island. One fruiting plant about a meter and a half tall was observed south of Captain Brooks Tavern in an open sand area next to the trail. It was seemingly planted there. A similar sized plant was also observed east of the Aviary Seep, planted as part of the restoration of the area. There was a small plant in an orange fence at the base of the Midway House sign. A few dozen pots of aweoweo seedlings were observed in the FWS greenhouse. Collected at Captain Brooks (*Starr and Starr 080601-20* BISH) to document the presence of aweoweo on Midway (Starr and Starr 2008). In 2015, occasionally cultivated in pots and in yards around the Residences and at the FWS Office planting in Town. One plant outplanted and doing well near Turtle Beach. On Eastern Island, rare, with a few healthy looking plants outplanted in an area not far from the landing. This species has done well in other restoration projects, such as Laysan and Kahoolawe, and when planted in great enough numbers, begins to spread on its own.

Chloris barbata (Swollen finger grass) Poaceae

Also known as *C. inflata*. Native to Central America, the West Indies, and South America, now widely naturalized; in Hawaii, naturalized in dry, disturbed areas on Kure, Midway, and all of the main islands (Wagner et al. 1999; Herbst and Clayton 1998). On Midway, previously observed by Dr. Fosberg in 1954 and collected by Neff and DuMont in the same year who describe it as locally common in open spaces on Sand and Eastern Islands (Neff and DuMont 1955). Collected by Lamoureux in 1962 on Sand Island (*Lamoureux 2241* BISH) as a weed in Cable Company compound. Collected from Sand Island in 1979 (Apfelbaum 1983). Collected by Herbst in 1980 (*Herbst 6446* BISH) as common in dry highly disturbed areas. Not seen in 1995 (Bruegmann 1998). Restricted to a few small scattered patches on Sand Island in 1999

(Starr and Martz 1999). In 2008, occasionally found in lawns and the edge of roads. In 2012, reported as only present as one patch of tussocks along the north edge of the lawn between the Cargo Pier and Turtle beach (Aspey 2012). Not observed in 2015.

Chloris divaricata (Star grass) Poaceae



Native to New Caledonia and Australia; in Hawaii, naturalized and common in lawns and dry disturbed areas on all of the main islands except Molokai and Hawaii (Wagner et al. 1999). Previously not recorded from Midway. In 1999, we found this species restricted to a few dozen plants on Sand Island in a clearing in the forest near the Rusty Bucket area. The collection on Sand Island in 1999 (*Starr and Martz 990508-1* BISH) represented a new island record for Midway Atoll (Starr and Martz 2000). Not observed in 2008 or 2015. Photo by J. DeFrank CTAHR 2015.

Chloris virgata Sw. (Feather finger grass) Poaceae

Native to the Neotropics, now widely naturalized; in Hawaii, known from Kure and all of the main island except Niihau (Wagner et al. 1999; Herbst and Clayton 1998). Previously not recorded from Midway. In 1999, we found this species restricted to a few plants in a lawn near the north-west corner of the inner harbor. The collection on Sand Island in 1999 (*Starr and Martz 990507-5* BISH) represented a new island record for Midway Atoll (Starr and Martz 2000). Not observed in 2008 (Starr and Starr 2008). In 2012, only a few plants found around the concrete slabs south of the SK1 building (Aspey 2012). Neither the grass nor the SK1 building was observed in 2015, the building having recently been torn down, leaving the area as mostly bare sand that was being planted out with natives.

Chlorophytum comosum (Spider or bracket plant) Liliaceae

Native to the Cape of Good Hope and cultivated for foliage and whitish flowers (Neal 1965). First recorded on Midway in 1999 (Starr and Martz 1999) as rare to occasional on Sand Island. In 2008, there were at least two plants on island, one in the yard of one of the two story houses and another in a hanging basket in one of the single-story houses along at 4208 Commodore. Still needs to be collected (Starr and Starr 2008). Not observed in 2015.

Chrysanthemum sp. (Chrysanthemum) Asteraceae

Annual and perennial herbs, most of which are from the Eastern Hemisphere, many are cultivated for ornament (Neal 1965). On Midway, previously recorded by Hadden (1941). In 1999 (Starr and Martz 1999), found to be cultivated on Sand Island and rare in distribution. Not observed since.

Cibotium sp. (Hawaiian tree fern, hapuu) Dicksoniaceae

Endemic to the main Hawaiian Islands, but not native to Midway, this large fern was previously reported from Midway (Herbst and Wagner 1992), but not observed before or since. Midway is probably too dry for hapuu to do well.

Ciclospermum leptophyllum (Fir-leaved celery) Apiaceae

Also known as *Apium tenuifolium*. Probably native to Brazil; in Hawaii, naturalized on Midway Atoll and all of the main islands except Niihau and Kahoolawe (Wagner et al. 1999). Collected by Apfelbaum et al. in 1979. Also collected in 1980 (*Herbst and Takeuchi 6373* BISH). In 1995 (Bruegmann 1998), listed as common and naturalized on Sand Island. In 1999 (Starr and Martz 1999), found to be common in lawns of Sand Island. In 2008, this wispy herb was still present in the lawn areas of Sand Island (Starr and Starr 2008). In 2015, *Ciclospermum* continues to be a conspicuous element of lawns and other open low stature vegetated areas, such as the tarmac and abandoned runways on Sand Island.

Citrullus vulgaris (Watermelon) Cucurbitaceae

Native to tropical Africa, widely cultivated for its edible fruit (Neal 1965). In Hawaii, watermelons have long been cultivated since the arrival of Captain Cook (Neal 1965). In 1999 (Starr and Martz 1999), watermelon was recorded as cultivated for the first time on Sand Island. Unlike the main Hawaiian Islands, the fruit flies that sting melons are not yet present on Midway, allowing melons to be easily grown and harvested for consumption. About 2,000 lbs. of melons of various kinds were harvested during their peak in the summer. The melons were grown in the Community Garden by Midway Phoenix employees for use in the Galley. In 2008, the gardens were maintained on a volunteer basis and the melon patch was no longer around. A few seedlings and small plants of presumably watermelon were observed in the Community Greenhouse (Starr and Starr 2008). Not observed in 2015.

Citrus spp. (Citrus) Rutaceae

Native to southeastern Asia, cultivated in Hawaii and elsewhere (Neal 1965). On Midway, there have been observations of citrus trees with no specific reference to species (Apfelbaum et al. 1983; Bruegmann 1998). In 1999 (Starr and Martz 1999), a brand new Citrus Orchard was planted by Clyde, the Midway Phoenix galley manager, to help provide fresh fruit to the burgeoning tourism influx. The orchard was originally planted by the Boneyard off Cannon Ave., but was moved because of poor performance, to the current location near the Midway Mall off Nimitz Ave. Additionally, there were a few citrus trees cultivated in the residential area which had no fruits, and could not be

identified. In 2008, citrus trees were still found in the Citrus Orchard and residential areas of Sand Island. Most of the citrus trees were sterile and did not look overly productive or utilized, but FWS personnel mentioned the trees do bear fruit and the fruit had been sparingly used in the past to make juice (Leona Laniawe pers. comm.). In 2008, the only citrus trees identifiable were a lime (*C. aurantiifolia*) in the Community Garden and kaffir lime (*C. hystrix*) that had recently been planted in multiple spots. In 2015, a few trees in the Citrus Orchard were fruiting and were identifiable. Many trees were in need of some pruning and there were a lot of Bonin Petrel burrows to navigate around. With a little attention and harvesting, the trees could be quite useful. See individual write ups.

Citrus aurantifolia (Key or Mexican lime) Rutaceae

Key or Mexican limes are small and seedy with a high acid content, trees are usually thorny and shrubby with aromatic leaves when crushed (UC Riverside 2015). As mentioned above, in 2008, Mexican lime was found in the Community Garden. In 2015, it was still there, along with Kaffir lime.

Citrus hystrix (Kaffir lime) Rutaceae

Bumpy, green, maturing to yellow skinned citrus fruit with a highly acidic flavor. The leaves are an important flavoring in Thai and other southeast Asian dishes. Native to Indonesia (Trade Winds Fruit 2008). In 2008, a few plants were being cultivated in town on Sand Island. Small trees were observed in the Community Garden, by the Water Plant, and at the Barber Shop. Collected (*Starr and Starr 080610-05* BISH) to document the presence on Midway. Another species that previously was not reported from Midway that is now being cultivated by Thai contract workers to use in cooking (Starr and Starr 2008). In 2015, kaffir lime was found at the Residences, the Community Garden, and a few other places around Town. It is probably the most common citrus on Midway at this time.

Citrus jambhiri (Rough Lemon) Rutaceae

Thought to be native to northeastern India (UC Riverside 2015). It is a hybrid of citron and mandarin (Love et al. 2013). In Hawaii, originally brought as rootstock. When the grafts died off, this rootstock, which grew well and gave decent tasting lemons, became a popular backyard tree (Love et al. 2013). In 2015, this lemon was found in the Citrus Orchard. Perhaps, similar to the elsewhere in Hawaii, the original graft died and now this tree remains in its place. This lemon is a bit tarter than the Meyer lemon, but can be used in a similar fashion for cooking.

Citrus meyeri (Meyer Lemon) Rutaceae

Native to southeastern Asia, cultivated in Hawaii and elsewhere (Neal 1965). Meyer lemon was planted in the new Citrus Orchard on Sand Island in 1999 (Starr and Martz 1999). In 2008, lemons were regularly flown in from Hawaii and were served cut up at the end of the buffet line at the Clipper House. In 2015, the Meyer lemons that were planted in 1999 were found growing and fruiting in the Citrus Orchard. There were at least 3 trees that had abundant fruit and it did not appear they were being harvested, despite their good taste and appearance. The overripe fruit was almost orange in color.

Citrus paradisi (Grapefruit) Rutaceae

Native to southeastern Asia, cultivated in Hawaii and elsewhere (Neal 1965). Star-ruby and white grapefruits were planted in the new Citrus Orchard on Sand Island in 1999 (Starr and Martz 1999). In 2015, the trees in the Citrus Orchard were bearing immature fruit and were not tasted, though a few folks said they had tasted them before and they were good.

Citrus sinensis (Orange) Rutaceae

Native to southeastern Asia, cultivated in Hawaii and elsewhere (Neal 1965). Valencia, Navel, and Blood oranges were planted in the new Citrus Orchard on Sand Island in 1999 (Starr and Martz 1999). In 2015, a few different types of oranges were found fruiting, a type of navel that was immature, and another that did not appear to be a navel, perhaps a Valencia, that was ripe and tasted good. No signs of harvesting were observed even though the fruit were quite tasty.

*Cleome gynandra (*Wild spider flower) Cleomeaceae

Native to Africa and naturalized in many tropical and subtropical regions of the world (Wikipedia 2015). In Hawaii, known from all the main islands except Kahoolawe (Wagner et al. 1999). First reported and collected (*Starr and Starr 990624-01* BISH) from Midway in 1999 from a residence on Sand Island where it was being grown for ornament at 4208 Commodore Ave. Not observed since.

Clusia rosea (Autograph tree) Clusiaceae

Native to the West Indies and Florida. In Hawaii, this tree is often used in landscaping and has naturalized in low elevation areas of Kauai, Oahu, Maui, and Hawaii (Oppenheimer and Bartlett 2000; Wagner et al. 1999). On Midway, known from literature (Herbst and Wagner 1992). Not known from Midway before or since.

Coccinia grandis (Ivy gourd, tam leung) Cucurbitaceae

Native to Africa, Asia, and Australia. In Hawaii, naturalized on Oahu, Maui, and Hawaii (Oppenheimer and Bartlett 2000; Wagner et al. 1999; Starr and Martz 1999). A Hawaii State Noxious Weed that has been a target for chemical and mechanical control by many of the island Invasive Species Committees in Hawaii. Ivy gourd has also been a target for biological control, with a moth and beetle introduced to Hawaii specifically to reduce this species. Ivy gourd was first known on Midway in 1999 when a single sprawling plant was collected (*Starr and Martz 990429-18* BISH) in the vegetable garden in the backyard of 4208 Commodore Ave. (Starr and Martz 1999). According to the resident, Tanya, she brought the plant to Midway by way of seeds obtained in Thailand, for use as a vegetable. The plant had only one flower and no fruit was seen, probably due to the constant pruning / harvesting it received, but the person who was cultivating it said the fruit were red. The plant was sparingly naturalized, about a few sq. meters in size and was growing on a wood pile / fence surrounding the garden. The plant was controlled mechanically a few times and came back. It was then chemically controlled with Garlon and had apparently not grown back (Nancy Hoffman pers. comm.). A quick check of the site in 2001 revealed the ivy gourd had not grown back. It was hoped that the revised plant importation rules, which now prohibited ivy gourd, should help prevent future introductions of plants that could spread beyond the garden. It was also thought that through early detection, swift control, and diligent follow up and monitoring, this potentially harmful species had been nipped in the bud. In 2008, however, ivy gourd was back, and with a vengeance. There were now four discrete locations of ivy gourd. It formed basically a continuous blanket behind 4208 and 415 Commodore Ave. There was also a lone plant crawling on the trellis at 416 Commodore Ave., and a pretty large plant covering the Greenhouse by Chugach Headquarters. A collection (*Starr and Starr 080601-01* BISH) was made to document the presence of ivy gourd on Midway again. Whereas in 1999 only flowers were observed, in 2008, many fruits and seedlings were observed. Apparently between 2001 and 2008, ivy gourd had been re-introduced to Midway from both Thailand and Hawaii, again as seed, for use in soups and as a vegetable (Tawan pers. comm.). The Thai foreign nationals were very forthcoming with information, even if they were to blame for the re-introduction and spread of this notorious vine. The Thai name for ivy gourd is tam leung. It was relayed to the Thai workers that ivy gourd / tam leung was not appropriate for the atoll because it would spread beyond where it was planted. The Thai workers suggested getting rid of the mynah birds, who would likely be able to spread the seeds, rather than get rid of the vine, which had already begun spreading vegetatively into the nearby lawn. The FWS began removal of ivy gourd, again, promptly after the survey. The fruits and all known vines were cut back and treated with Garlon4, the plant parts were all bagged and burned in the Dump, and the sites will be monitored (Greg Schubert pers. comm.). Given the tenacity of this species, both from root stock and now a seed bank, it will likely require years of diligent follow up to assure this vine is completely removed from the Atoll. Additionally, it will be critical that re-introductions are not allowed. This species highlights the fact that the planting policy on Midway was way too loose again, and that a general assessment of what cultivated plants are truly critical to Atoll operations, with an

emphasis on species with the potential to become invasive, should be done. The screening of all plants before importation to Midway, creation of a prohibited and approved list, along with regular surveys of gardens by refuge staff and occasional surveys by plant professionals should help reduce situations like this, or at least help identify these situations as early as possible, while the greatest number of control options exists. Since the survey, many of these items have been addressed, including a newly created "approved" plant list and a call for no new gardens without consultation with the FWS (John Klavitter pers. comm., Starr and Starr 2008). In 2012, the following was reported "still present at one location (SW corner of fence 4208) where 1 small and heavily sprayed stem was still attempting to grow" (Aspey 2012). Not observed in 2015, despite searches of all previously known locations.

Coccoloba uvifera (Sea grape) Polygonaceae

Native to warm parts of America where it can be found in thickets along sandy shores (Neal 1965). In Hawaii, it was previously thought (Wagner 1999) that sea grape produced fruit but did not reproduce. Later, Herbst (1998) recorded it as naturalized on Oahu. It has also been documented as naturalized on Maui (Oppenheimer and Bartlett 2002). On Midway, first observed by Fosberg in February of 1954 and collected later that year by Neff and DuMont who noted "Not uncommon, single trees growing widely scattered over both Sand and Eastern Islands." It has been recorded by almost every botanist visiting Midway since then. In 1999 (Starr and Martz 1999), we observed old cultivated plants persisting and spreading on both Sand and Eastern Islands, especially near old gun emplacements and other sand hills, in some areas carpets of seedlings could be found beneath parent trees. We collected it as naturalized on Spit Island (*Starr and Martz 990401-1* BISH) which represented a new naturalized record for Midway Atoll (Starr *et al*. 2002). In 2008, sea grape was still present on Sand, Eastern, and Spit Islands. On Sand Island, sea grapes were locally common, especially at West Beach. It appears sea grape and other trees were planted decades ago around the large gun emplacements on Sand Island. Sea grape was also observed west of the Dump Pond, east of Captain Brooks, along South Beach, Turtle Beach, the Finger Piers, and at the Catchment Pond where a couple small bushes made nice blinds, allowing one to sneak up on the wading birds without disturbing them. There was also a sea grape seedling growing out of the side of one of the Finger Piers, probably tossed up there as a seed during a high surf event. On Sand Island it didn't appear many birds were utilizing the space occupied by sea grape. It may make sense to cut back some of the patches, to allow the area to be used by albatross and other birds. On Eastern Island, there were thee patches of sea grape, again planted decades ago around revetments. This is one of three non-native tree species remaining on Eastern, the others being ironwood (*Casuarina*) and tree heliotrope (*Tournefortia*). On Eastern Island, the inland trees seem to be providing habitat for quite a number of red-footed boobies, who prefer to nest off the ground. The seagrape seems less affected by the caustic poop of the seabirds, especially the frigate, which appears to have destroyed most of the inland *Tournefortia* on Eastern Island. There doesn't seem to be an immediate need to remove these sea grape trees from Eastern Island. On Spit Island one small single stem tree about two meters tall was found on near the south shore of the island. It looked

like it had washed ashore, grown for a while, and then been controlled, likely by the FWS. Sea grape is known to spread via the ocean to new localities. On Spit Island, it probably wouldn't be too hard to continue removing sea grape when it arrives (Starr and Starr 2008). In 2015, sea grape was GPS'd to get a better handle on the distribution. On Eastern, sea grape was one of the only tree like plants in the center of Eastern Island, with Red-footed Boobies nesting in the canopy of the thickets, and White Terns. On Sand Island, the same general thickets of sea grape existed. However, there were also lots of young sea grape saplings noted. It is not certain whether the sea grape saplings were overlooked in previous surveys, perhaps due to a sea of Verbesina previously occurring in those same areas, or whether the young plants are new. The GPS data from this survey should help answer that going forward. It could be possible that mynah birds are spreading fruit around as some of the saplings appeared a fair distance from parent trees.

Cocos nucifera (Coconut) Aracaceae

Native origin is unknown, but probably somewhere on the shores of the Indian Ocean (Neal 1965). One of the most well known palms in the world, brought to Hawaii by the Polynesians, and currently used mostly for ornament (Neal 1965). On Midway, first reported by Hadden (1941) and again by Neff and DuMont (1955) from Sand Island where this pantropical palm was planted by the Cable Company and the Pan-American Company. Recorded in 1979 (Apfelbaum et al. 1983), and in 1995 (Bruegmann 1998). The 1999 survey (Starr and Martz 1999) observed many mature trees, mainly around residential Sand Island. Coconut fruits occasionally hit albatrosses (young and adults) and injure or kill them. Because of this, coconut fruits were being harvested before they fell off naturally back in 1999. In 2008, mature coconut trees were still present, however the fruits were not being harvested any more. Apparently, the Sri Lankans used to eat the fruits, but they are no longer on island, and the Thai's don't eat the fruit. Additionally the Fish and Wildlife Service (FWS) is no longer targeting coconut fruit for removal. As a result coconut has begun to reproduce on Midway. There was a cohort of coconut seedlings about 1 meter tall under virtually every coconut tree. Also of note for Midway is that coconut plants and plant parts are not allowed into the state of Hawaii without special permits and quarantine measures. We noticed coconut leaf lei being given to departing folks. These were confiscated by United States Department of Agriculture (USDA) agricultural inspectors when the plane arrived in Hawaii and had to go through customs. A collection has yet to be made of coconut from Midway, also due to the import restrictions (Starr and Starr 2008). In 2015, coconuts continued to persist on Sand Island, mostly around Town, with a cohort of young plants under virtually every coconut tree. Apparently the coconut trees are trimmed in September using lift buckets that must be driven through burrowed areas, to prevent branches and fruit from falling on albatrosses that congregate under them. The young fruit that germinate below the coconut trees are occasionally controlled using herbicide. Coconut trees were GPS'd for the first time this survey.

Codiaeum variegatum (Croton) Euphorbiaceae

Native from Fiji westward to Australia, a common ornamental in Hawaii (Neal 1965). On Midway, first reported as cultivated on Sand Island by Hadden (1941). Crotons were also observed being cultivated by Bruegmann (1998), and in 1999 (Starr and Martz 1999) where they were cultivated in the residential and town areas of Sand Island. In 2008, crotons were still conspicuous around the town and residential areas of Sand Island, with many different varieties present. Collected from the planter at the Midway House *(Starr and Starr 080607-10* BISH) to document the presence of croton on Midway (Starr and Starr 2008). In 2015, this ubiquitous ornamental was still present in Town at the old Galley, old Internet Cafe, Midway Mall, and in the Residences.

Colocasia esculenta (Taro) Araceae

Cultivated since ancient times in the tropics and subtropics of the Old World, and later in the warmer regions of the New World and islands in the Pacific. In Hawaii, brought by the Polynesians and used as one of the principal foods (Neal 1965). On Midway, recorded in 1979 by Apfelbaum et al. (1983) and again in 1995 by Bruegmann (1998). Not observed since.

Commelina diffusa (Honohono) Commelinaceae

Native to the Old World tropics, first collected in Hawaii in 1837, now often forming a conspicuous part of ground cover in disturbed wet areas, known from Midway Atoll and all the main islands except Niihau and Kahoolawe (Wagner et al. 1999). Collected in 1931 (*Chisholm s.n.* BISH). St. John apparently observed this species in 1935 (Neff and DuMont 1955). It has not been observed since.

Conocarpus erectus (Button mangrove) Combretaceae

Native to coastal areas of the Neotropics from Florida and Mexico to Ecuador and Brazil, also in tropical western Africa; in Hawaii, this tree is cultivated for landscaping and is naturalized on Kauai, Oahu, Lanai, and Maui (Wagner et al. 1999; Lorence and Flynn 1997). Button mangrove is a known invader of wetlands, such as Kealia Pond National Wildlife Refuge on Maui. On Midway, first noted by Hadden (1941) who listed "button bush" as being successfully grown on Sand Island. Known from literature (Herbst and Wagner 1992). In 1999 (Starr and Martz 1999), three trees were observed near the Midway Mall on the side of the Midway Bowl. They were being formally sheared. No regeneration was noted. In 2008, no *Conocarpus* was observed on Midway, despite visiting the areas where the trees once stood. Apparently FWS Refuge Manager Tim Bodeen had them removed (Greg Schubert pers. comm.). Not observed in 2015.

Conyza bonariensis (Hairy horseweed) Asteraceae

Possibly native to South America now cosmopolitan in distribution; in Hawaii, known from Kure and Midway Atolls, Laysan, French Frigate Shoals, and all of the main islands (Wagner et al. 1999). This species has been collected many times on Midway, the first in 1931. The following specimens are archived at Bishop Museum (*Chisholm sn., Herbst and Takeushi 6373*, *6395*; *Neff and Dumont 5*; *Meagher s.n.*; *Frings 13*, *Lamoureux 2767*). Neff and DuMont (1955) note it being "Locally abundant, mostly along margins of runways and unpaved roadways; also noted in utility areas where the sand has been disturbed, in vacant lots, and in waste land; on both Sand and Eastern Islands." In 1999 (Starr et al.1999), it was observed as common on Sand Island. In 2008, it was still common over most of the island, especially on the sides of the runways around South Beach, Bulky Dump, and the Abandoned Runway Overrun (Starr and Starr 2008). In 2015, a few plants were observed in lawn and open sandy open areas near the Citrus Orchard and other buildings in Town on Sand Island, but there appeared to be a lot less of this species, perhaps as a result of the intensive control program that has been implemented.

Conyza canadensis var. *pusilla* (Horseweed) Asteraceae

Native from southern Canada and the United States south to tropical America; in Hawaii naturalized on Midway Atoll and all of the main islands except Kahoolawe (Wagner et al. 1999; Wagner and Herbst 1995). First collected in 1988 by Herbst (*Herbst 9072* BISH). In 1999 (Starr and Martz 1999), widespread on the runways of Eastern Island, and common on Sand Island, especially on the beaches. It was also observed on Spit Island. Collected on Sand Island (*Starr and Martz 990620-2* BISH) and Spit Island (*Starr and Martz 990623-3* BISH), documenting a new island record for Midway Atoll. In 2008, this species was common on Sand Island, especially near the coast. North Beach had quite a bit of this plant. On Eastern Island, it was present near the newly created Sunset Seep. It was also observed on Spit Island, where it was common in open coral rubble near the south part of the island (Starr and Starr 2008). In 2015, observed in areas near the runway and in sandy open areas in Town on Sand Island and on the western side of Eastern Island. This species currently seemed to be the more common of the two *Conyza* species on Midway.

Cordia sebestena (Kou haole) Boraginaceae

Native to tropical America (Neal 1965). Commonly cultivated in Hawaii. On Midway, first recorded by Hadden (1941). Collected in 1980 by Herbst (*Herbst 6332* BISH). Also recorded by Bruegmann (1998). In 1999 (Starr and Martz 1999) two trees were observed near the Midway Mall on Sand Island. In 2008, those same two trees were about 5 meters tall, in full flower, and doing quite well in the same spot, just off Nimitz Ave. on the Midway Mall side of the sidewalk by the Midway Memorial (Starr and Starr 2008). In 2015, the trees were still there, but looked barely alive. It was unclear whether the trees were just coming out of potential dormancy, the 2015 survey was done earlier than previous surveys, or if the trees were feeling non-target effects from herbicide usage and lead abatement activities. We did come across old photos of the same trees that looked similarly dead but then later flushed out with foliage and flowers.

Cordyline fruticosa (Ti) Agavaceae

Native range unknown, but possibly indigenous to the Himalayas, southeastern Asia, Malaysia, and northern Australia. In Hawaii, this widely used plant is considered a Polynesian introduction, is extensively cultivated, and occurs widely on all of the main islands except Kahoolawe (Wagner *et al*. 1999). On Midway, ti was first noted by Hadden (1941) then again by Apfelbaum *et al*. (1983). In 1999 (Starr and Martz 1999), observed as sparingly cultivated around some of the residences. In 2008, both the red and green forms of ti were present around the residences. Collections were made (*Starr and Starr 080607-13, 080607-20* BISH) to document the presence on Midway. In 2015, both the red and green forms were still present around the Residences, most notable were a few clumps in the yard around house 4208. There were also some near the 400 block of houses, and at the Midway House. The green form looked chlorotic in many locations, though they were growing well at the Midway House.

Cordyline sp. (Cordyline) Agavaceae

Reported from Midway by Herbst and Wagner (1992). It is not sure what species this refers to. The only *Cordyline* species recorded from Midway has been *C. fruticosa*.

Coreopsis grandiflora (Coreopsis) Asteraceae

Native to the southern United States and cultivated in Hawaii (Neal 1965). Observed and collected (*Starr and Martz 990505-5* BISH) for the first and only time in 1999 (Starr and Martz 1999), when this yellow flower was cultivated on Sand Island and considered rare in distribution. Not observed since. Photo by Jose Luis Galvez (Wikipedia 2008).

Coreopsis tinctoria Nutt. (Golden tickseed ((cultivated)

An annual wildflower native to the plains region of North America and occasionally grown in Hawaii as an ornamental bedding plant (Floridata 2008). On Midway, first collected in 1933 by Meagher. Not observed since. Photo by Cory Maylett (Wikipedia 2008).

Coriandrum sativum (Cilantro, Chinese parsley (cultivated) (Apiaceae

Native to the Mediterranean region; in Hawaii, cultivated and naturalized on Oahu (Wagner et al. 1999). Previously not recorded from Midway. In 1999, it was observed in cultivation on Sand Island. This observation represents a new cultivated record for Midway Atoll. Not observed in 2008 (Starr and Starr 2008). In 2015, lush clumps of cilantro were being grown in the Hydroponics Greenhouse.

Coronopus didymus (Swine cress) Brassicaceae

Native to Eurasia. In Hawaii, known from Midway Atoll, Pearl and Hermes Atoll, and all of the main islands. On Midway, first collected in 1962 from Sand Island, in the naupaka near Frigate Point (*Lamoureux 2197* BISH) and on Eastern Island *(Frings46, 50* BISH). It was then recorded in 1979 by Apfelbaum et al. and in 1995 (Bruegmann 1998) as common on Sand and Eastern Islands. In 1999 (Starr and Martz 1999), it was common in open, hard packed areas on Sand and Eastern Islands, and rare to occasional on Spit Island. In 2008, this odiferous herb was occasional to common on Sand Island where it was found in lawns and hard packed areas. On Eastern Island, it was occasionally observed, and on Spit Island, there was very little (Starr and Starr 2008). In 2015, swinecress seemed be much more abundant on Sand and Eastern Islands, where it was one of the most prevalent plant species. The perceived increase in distribution is seemingly due to the control efforts against *Verbesina* and other plants.

Cosmos bipinnatus (Cosmos) Asteraceae

Native to Mexico and cultivated in Hawaii (Neal 1965). Observed for the first and only time in 1999 (Starr and Martz 1999), where it was cultivated in the Boathouse planter with a mix of other random ornamentals. Collected (*Starr and Martz 990421-6* BISH) to help with identification and document the presence of cosmos on Midway. In 2008, this species was not observed on Midway, the planter in front of the boathouse now is draped with native beach morning glory (*Ipomoea pes-caprae* subsp. *brasiliensis*) (Starr and Starr 2008). Not observed in 2015.

Crassula sp. (Stonecrop) Crassulaceae

Several species from South Africa are grown in cultivation in Hawaii (Neal 19654). On Midway, known from literature (Herbst and Wagner 1992). Observed by Bruegmann during her survey in 1995. In 1999 (Starr and Martz 1999), observed as rare on Sand Island where it was being cultivated in the housing area, generally in pots. Not observed since.

Crinum asiaticum (Crinum lily, spider lily) Liliaceae

Native to tropical Asia and cultivated in Hawaii (Neal 1965). In 1954, observed on Midway by Fosberg and Neff and DuMont (1955), who noted, "Occasional fine specimens of "spider lilies" may be seen on Sand Island on the lawns of residences and about administrative buildings." Collected by Lamoureux in 1962 (*Lamoureux 2223* BISH) from near the Cable Company buildings. Also observed in 1979 (Apfelbaum et al. 1983) and in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), persisting in many areas on Sand and Eastern Island. In 2008, spider lily was the only remaining garden type plant on Eastern Island, where a long row of plants persisted on the margin of the concrete pad where the buildings near the pier used to stand. On Sand Island, spider lily was persistent and spreading in the town and residential areas. Some of the larger patches can be found by the Midway House and the Abandoned Galley. Flowers, fruit and seedlings observed (Starr and Starr 2008). In 2015, this persistent lily was found in the same general places as 2008. Most notable are the long row of lilies near the Pier on Eastern, which Red-Tailed Tropicbirds were nesting under, and the plantings in the Town area of Sand Island. The clumps were GPS'd to better document the distribution.

Crotalaria incana (Fuzzy rattle pod) Fabaceae

Widespread in the tropics and subtropics; in Hawaii, naturalized on Midway Atoll and all of the main islands (Wagner et al. 1999; Hughes 1995). On Midway, first collected in 1931 by Meagher. Neff and DuMont (1955) report that in 1954, "Only two or three plants were seen growing on each of the islands." Also observed in 1979 (Apfelbaum et al. 1983) and again in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), observed with *C. pallida* in the disturbed, semi-maintained lawn in the Bart Hill area in the north part of Sand Island. It was not common on Sand Island or observed on Eastern or Spit Islands. In 2008, observed near Charlie Barracks, around the 400 housing on Halsey Dr., and by the Cable Company Buildings on Sand Island (Starr and Starr 2008). Not observed in 2015.

Crotalaria pallida (Smooth rattle pod) Fabaceae

Also known as *Crotalaria mucronata*. Native to Africa; in Hawaii, naturalized on Midway Atoll and all of the main islands except Niihau and Kahoolawe (Wagner et al. 1999). On Midway, previously noted by Neff and Dumont (1955) as *C. mucronata* from St. John's 1935 list. In 1999 (Starr and Martz 1999), observed in the disturbed, semi-maintained lawn in the Bart Hill area in the north part of Sand Island, near *C. incana*. Not observed since.

Cucumis melo (Cantaloupe, canary melon) Cucurbitaceae

Native to tropical Asia or Africa and widely cultivated (Neal 1965). On Midway, previously recorded by Hadden (1941) when cantaloupe was being grown in the vegetable garden on Sand Island. In 1999 (Starr and Martz 1999), cantaloupe and canary melons were cultivated in the Community Garden on Sand Island. Neither were observed as cultivated in 2008, though cantaloupe was available for a bit as cut fruit at the Clipper House, presumably flown in whole from Hawaii (Starr and Starr 2008). Not observed being cultivated in 2015, but still being served at the Clipper House.

Cucumis sativus (Cucumber) Cucurbitaceae

Native to tropical Asia and widely cultivated (Neal 1965). First recorded on Midway in 1999 (Starr and Martz 1999), where it was being cultivated on Sand Island. In 2008, not observed growing on Midway Atoll. It was however at every lunch and dinner at the Clipper House in the salad bar (Starr and Starr 2008). In 2015, this species was being successfully grown in the Hydroponics Greenhouse and served at the Clipper House.

Cucurbita pepo (Squash) Cucurbitaceae

Possibly native to America and cultivated in Hawaii (Neal 1965). On Midway, previously noted by Herbst and Wagner (1992) and by Bruegmann (1998). In 1999 it was cultivated in the town area of Sand Island (Starr and Martz 1999). In 2008, one vine was found on the barrier fence of the Community Garden. Collected (*Starr and Starr 080610-09* BISH) to document the presence of squash on Midway (Starr and Starr 2008). Not observed in 2015.

Cycas circinalis (Sago palm, cycad) Cycadaceae

Native to tropical Asia and some islands in the Pacific (Neal 1965), this palm like tree is cultivated in Hawaii and was first noted on Midway by Apfelbaum et al. (1983) and later by Bruegmann (1998). In 1999 (Starr and Martz 1999), this large, branching cycad was found to be cultivated in the residential and town areas of Sand Island. In 2008, there were still a couple dozen trees remaining, especially near the residences, and the old abandoned galley. There was a lone giant between the Ave Maria field and Radar Hill. Collected from the yard of 415 Commodore Ave. (*Starr and Starr 080607-18* BISH) to document the presence of this species on Midway (Starr and Starr 2008). In 2015, the same clumps persisted in the Town area of Sand Island. However, most appeared to be in a state of decline. It is not certain whether this was from abnormally dry weather, the time of year the survey was done, non-target effects from herbicide usage at their base, or a combination of multiple factors. The locations of this conspicuous plant were GPS'd to better document the distribution of this species.

Cycas revoluta (Sago palm) Cycadaceae

Native to China and Japan (Neal 1965), this smaller usually non-branching version of *C. circinalis* is also cultivated in the Hawaiian Islands and was previously reported from Midway (Herbst and Wagner 1992), but has not been observed since. It is not known if the plant was a misidentified *C. circinalis* or was briefly present.

Cymbopogon citratus (Lemon grass) Poaceae

Commonly cultivated throughout the tropics and Hawaii (Wagner et al. 1999). Previously not known from Midway until collected in 1999 (*Starr and Martz 990429-15* BISH). In 1999, this fragrant grass was cultivated in personal gardens on Sand Island. In 2008, this grass continued to be cultivated in residence gardens and in the community garden (Starr and Starr 2008). In 2015, there were three clumps growing at Residences, including one of which was in soil that was likely lead contaminated. The Community Garden had been mostly abandoned and no lemon grass was seen. It may be best to grow this non-invasive grass that is prevalent in Asian cuisine in the Hydroponics Garden, where it can be safely and effectively grown.

Cynara scolymus (Artichoke) Asteraceae

Native to the Mediterranean region and the Canary Islands, cultivated in Hawaii for food (Neal 1965). Observed as cultivated on Sand Island for the first and only time in 1999 (Starr and Martz 1999).

Cynodon dactylon (Bermuda grass) Poaceae

Possibly native to tropical Africa, widely cultivated and naturalized; in Hawaii, documented on Kure, Midway, and Pearl and Hermes atolls, Laysan, French Frigate Shoals, and all of the main islands except Niihau (Wagner et al. 1999; Herbst and Clayton 1998). First collected on Midway by G.C. Munro in 1945 (*Munro sn.* BISH) where he described it as planted for lawns in pure coral sand. Previously observed by Dr. Fosberg and collected in 1954 by Neff and Dumont (*46* BISH) who described it as an abundant, common lawn grass which had spread over much of Sand Island and was locally common on Eastern Island. They considered it the best sand-binder growing on the islands (Neff and DuMont 1955). Collected in 1962 (*Lamoureux 2265* BISH) from a picnic area in the central part of Eastern Island and from frigate point on Sand Island (*Lamoureux 2090* NMNH). Other collections were made from Sand Island in 1962 (*Frings 2, 31, 26, 32* BISH). Collected again in 1979 (Apfelbaum 1983). In 1980, collected by Herbst on Eastern Island where it was common and on Sand Island (*Herbst and Takeuchi 3461, 6419* BISH) where it was abundant on the golf course and in lawns. In 1995, noted as common on Sand Island and occasional on Eastern Island in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), Bermuda grass was one of the most common grasses on both Sand and Eastern Islands. Apparently Bulky Dump was seeded with Bermuda grass shortly after it was created (Rob Shallenberger pers. comm.). In 2008, Bermuda grass was still found in most lawns on Sand Island. It was also persisting on Eastern Island. Though the FWS was not currently spreading Bermuda grass, it was avoiding it when controlling other species in an area. Bermuda grass makes a great ground cover, at the exclusion of most other plants. It helps bird burrows from crushing as easily. Most enticingly, large amounts of seed can be purchased. However, Bermuda grass can be quite aggressive in areas where it is not wanted (Starr and Starr 2008). In 2015, Bermuda grass was still common on Sand and Eastern islands, and was being avoided when areas were sprayed for other invasive species. There appeared to be two forms of Bermuda grass, a more diminutive one with smaller leaves that is the more common form, and a more robust form that is occasionally mixed in with the smaller form. Since our 2008 visit, the number of Bonin Petrel burrows has increased dramatically. As a result, it is increasingly difficult to walk anywhere off of hardened surfaces without falling in a burrow. Bermuda grass makes a huge difference, allowing for much easier access of areas without disturbing burrows. Bermuda grass clumps have apparently been transplanted on Midway in recent years, and as has been done on Midway in the past, certified weed-free seed could be purchased and spread in areas where there is a lack of desirable vegetation that will colonize the area within the near future.

Cyperus involucratus (Umbrella sedge) Cyperaceae

Also known as *C. alternifolius* ssp. *flabelliformis*. A recent taxonomic change (Herbst and Wagner 1999, Strong and Wagner 1997). Native to tropical Africa, Madagascar, Mauritius, and the Mascarene Islands, often cultivated as an ornamental in greenhouses, in Hawaii, cultivated and naturalized in marshy areas and along streams on Midway Atoll, Kauai, Oahu, Maui, and Hawaii (Wagner et al. 1999; Strong and Wagner 1997; Imada et al. 2000). On Midway, first collected in 1933 by V.J. Meagher (*Meagher s.n.* BISH). Observed again in 1954 (*Neff and DuMont 34* BISH) who noted "two or three densely grown clumps were seen under old ironwoods near the Cable Company compound, a few small plantings about residences, on Sand Island only." Collected again in 1962 by Lamoureux who made collections from Sand Island (*Lamoureux 2300* BISH) "near boy scout cabin", (*Lamoureux* 2282 NMNH) "in planter at BOQ"; and from Eastern Island (*Lamoureux 2276* BISH) "ca. 100 m inland of boat dock, in disturbed area near remains of building, one clump noted from island". Collected in 1979 by Apfelbaum (1983), and Herbst (*Herbst and Takeuchi 6387* BISH) who noted it growing in a rubbish pile on the west end of inner harbor. Noted to be rare in 1995 by Bruegmann (1998). In 1999, observed in moist areas, often under ironwood, including the site described by Neff and DuMont (1955), on Sand Island, occasionally forming monotypic stands that ground nesting birds are unable to penetrate. In 1999, the patches were being removed using herbicide. In 2008, there were even more patches around the island, due mostly to the drop in FWS resources and the creation of Laysan Duck seeps / ponds. The sedges either were moved into the ponds as contaminants or somehow got there on their own and then took advantage of the moisture. This vigorous sedge gets over two meters tall and chokes the land and small ponds, excluding virtually all birds on Midway. It is being removed from pond margins by hand and in other areas with herbicide (Starr and Starr 2008). In 2015, this persistent sedge was all but gone from Midway, the result of weed control efforts and filling of many of the wetlands that it preferred as habitat. The only place we found this sedge was within a jumble of ironwood logs near the Runway Overrun where Sunrise Seep used to be. Continued vigilance will likely result in eradication of this species on Midway.

Cyperus javanicus (Ahu awa) Cyperaceae

Also known as *Mariscus javanicus*. Recent taxonomic name change. *Mariscus* not recognized (Wagner et al. 1999; Strong and Wagner 1997; Tucker 1994). Native to tropical Africa and Asia. In Hawaii, common in moist sites on Midway and all of the main islands except Kahoolawe (Wagner et al. 1999). For Midway, first collected by Chisholm in 1931 (*Chisholm* s.n. BISH). Listed by St. John in 1935 (Neff and DuMont 1955). Collected again in 1980 by Herbst (*Herbst 6430* BISH) from Sand Island where it was growing in a shallow ditch near the runway, southwestern part of the island. Observed again in 1995 (Bruegmann 1998). It has not been observed since.

Cyperus laevigatus (Makaloa) Cyperaceae

Rhizomatous perennial sedge. Widespread in warm temperate and subtropical regions. Indigenous in Hawaii, occurring in mud flats, sandy coastal sites, and on the edge of and in fresh, brackish, and salt water ponds, known from the islands of Laysan, Niihau, Oahu, Molokai, Maui, and Hawaii (Wagner et al. 1999). Introduced to Midway from Laysan in 2004 (Klavitter 2006). In 2008, makaloa was common in the newly created duck seeps on Sand and Eastern Islands, where this wetland sedge was generally the furthest species out in the water. Collected from a duck seep on Eastern Island (*Starr and Starr 080605-03* BISH) to document the presence on Midway (Starr and Starr 2008). In 2015, this species was only observed near Dump (Brackish) Pond on Sand Island, where it had been recently planted, and did not appear to be present on Eastern Island. With Laysan Ducks dying of botulism, it became important to be able to scan the ponds for dead ducks, which was difficult to do with makaloa growing along the pond margins and into the pond. Additionally, in some of the smaller ponds, most of the water surface was displaced by makaloa. As a result, the makaloa and all other vegetation was removed from within and around all the wetlands.

Cyperus papyrus (Papyrus) Cyperaceae

Native to eastern tropical Africa and Madagascar (Wagner et al. 1999). In Hawaii, cultivated in water gardens and sparingly naturalized on at least Kauai and Hawaii (Wagner et al. 1999; Staples et al. 2003). Only observed once in 1979 (Apfelbaum et al. 1983). No collections have ever been made. Perhaps this species had a brief stay on Midway, or maybe Apfelbaum called the large sedge on Midway this species rather than *C. involucratus*.

Cyperus pennatiformis var. *bryanii* (Cyperus --- (endemic) (Cyperaceae

Also known as *Mariscus pennatiformis* subsp. *bryanii*. Rhizomatous perennial sedge. Endemic to the Hawaiian Islands, with var. *bryanii* known only from a small population on Laysan (Wagner et al. 1999). Introduced to Midway from Laysan in April 2008, and growing in FWS greenhouse (John Klavitter pers. comm.). In 2008, this species was not observed in the greenhouse, but could have been overlooked as there were other sedges present, and this species likely would have still been quite young (Starr and Starr 2008). In 2009, still growing well in the greenhouse. Outplanted later that year at Radar Hill and Sunset Seeps, however all of the plants died shortly thereafter, even the ones in the greenhouse (John Klavitter, Greg Schubert, and Penny Knuckles pers. comm.). Not observed in 2015.

Cyperus polystachyos (Sedge) Cyperaceae

Also known as *Pycreus polystachyos* ssp. *polystachyos*. Recent taxonomic name change. *Pycreus* and subspecies not recognized (Wagner et al. 1999; Herbst and Wagner 1999; Tucker 1994). Native to tropical and subtropical regions worldwide. In Hawaii, known from Midway and all the main islands except Kahoolawe (Wagner et al. 1999). First collected on Sand Island by Herbst in 1980 (*Herbst 6340* BISH) where it was uncommon and growing in the safety zone, east end of runway #6-24. Observed in 1995 by Bruegmann (1998). In 1999 (Starr and Martz 1999), we observed this weedy sedge in moist areas on Sand Island, especially near the Dump Pond, but also on the margins of runways. In 2008, this sedge was abundant in moist areas, and was even more widespread and conspicuous than in 1999, due to the stopping of lawn mowing operations and the creation of Laysan Duck seeps around the island. Additionally, this prolific sedge was now on Eastern Island, in the newly created Laysan Duck seeps (Starr and Starr 2008). In 2015, this sedge was common in moist areas, and appeared to be one of the only species tolerated in moist settings, such as near seeps and along the Runway Overrun, where it formed large stands. It comes up regularly as a weed in pots in the FWS Greenhouse (John Klavitter, Greg Schubert, and Penny Knuckles pers. comm.).

Cyperus rotundus (Nutgrass, purple nut sedge) Cyperaceae

A cosmopolitan weed, naturalized in Hawaii on Kure, Midway, French Frigate Shoals, Niihau, Kauai, Oahu, Lanai, Molokai, Maui, and Hawaii (Wagner et al. 1999; Strong and Wagner 1997; Hughes 1995). On Midway, Neff and Dumont (1955) collected this sedge in 1954 (*Neff and Dumont 44* BISH) and noted it to be "Locally abundant on both Sand and Eastern Islands, mostly along the margins of runways, along edges of paved roads, and near foundations of larger buildings where run-off of rainfall apparently controls its distribution". Recorded in 1979 (Apfelbaum et al. 1983). Collected in 1980 by Herbst and Takeuchi (*6336, 6411, 9076* BISH) and noted to be a common weed on Sand Island and growing around abandoned buildings on Eastern Island. The 1999 survey did not observe this sedge on Eastern Island, and there are no buildings remaining. The survey did observe it on Sand Island next to buildings and in gardens (Starr and Martz 1999). In 2008, this hardy sedge was found in areas that received moderate levels of disturbance, especially in lawns in the town area (Starr and Starr 2008). In 2015, this persistent sedge was occasionally observed on Sand Island, mostly in Town in compacted and disturbed sites. Usually it was less than a few centimeters tall.

Dactyloctenium aegyptium (Beach wiregrass) Poaceae

Native to the Paleotropics, now a pantropical weed; in Hawaii, documented on Midway, Kauai, Oahu, Molokai, Maui, Kahoolawe, and Hawaii (Wagner et al. 1999; Wagner et al. 1997; Lorence and Flynn 1997). First collected on Midway in 1988 by Herbst (*Herbst 9075* BISH) from Sand Island. It was collected again in 1991 from near Frigate Point, Sand Island (*E. Flint s.n.* BISH) (Wagner et al. 1997). Noted in 1995, on all three islands of the Atoll (Bruegmann 1998). In 1999 (Starr and Martz 1999), observed this grass on all three islands, especially near the coast, and noted the grass appeared to be an annual on Midway, forming large mats and then dying back. Collected on Spit Island (*Starr and Martz 990623-6* BISH). In 2008, this grass was found on all three islands of Midway, preferring to be near the coast (Starr and Starr 2008). In 2015, this grass was observed on Sand and Eastern Islands, mostly near the coast. On Sand it was prevalent near the Cargo Pier, and in an open area near the FWS Greenhouse where the SK1 Building was removed and beach sand hauled in. On Eastern it was observed near the coast on the south western side of the island and also in cracks of the abandoned runway on the northeast side.

Daucus carota (Carrot) Apiaceae

Native to Eurasia and Africa and cultivated for over 2,000 years (Neal 1965). On Midway, previously recorded by Hadden (1941) in the Pan American Airways vegetable garden. Recorded in 1999 (Starr and Martz 1999), as cultivated in the residential area of Sand Island. Not observed cultivated since, though there are regularly carrots in a bin in the salad bar at the Clipper House, having been brought in from Hawaii.

Delonix regia (Royal poinciana, flame tree) Fabaceae

Endemic and rare in Madagascar, widely cultivated. In Hawaii, also widely cultivated and sparingly naturalized in low elevations of Molokai (Wagner et al. 1999). On Midway, previously recorded by Hadden (1941) and by Apfelbaum et al. (1983) as being cultivated for ornament. In 1999 (Starr and Martz 1999), a few trees were cultivated in the town area of Sand Island. In 2008, there were still a few cultivated trees on Sand Island. There was a fine specimen in full bloom at the Midway House. There was also another tree of similar size across Commodore Ave. that was not in flower. Additionally, there was a lone specimen in front of one of the Cable Company Buildings, and another nice looking tree on the corner of Halsey Dr. and Commodore Ave. Collected from the lawn of the Midway House (*Starr and Starr 080607-01* BISH) to document the presence on Midway (Starr and Starr 2008). In 2015, many of the trees were still present in the same locations, except for the one by the Cable Co. Building, which was removed after most of the buildings were torn down due to dilapidation. However, they had either not yet come out of dormancy, were affected by the abnormally dry weather, or were feeling effects of herbicide at their base, as they were mostly leafless.

Desmanthus pernambucanus (Slender mimosa) Fabaceae

Also known as *D. virgatus* (Wagner et al. 1999; Wagner and Herbst 1995). Native to the Neotropics. In Hawaii, naturalized on Midway Atoll and probably all of the main islands except Niihau and Lanai (Wagner et al. 1999). On Midway, previously recorded by Herbst and Wagner (1992) and by Apfelbaum et al. (1983). Not observed in 1995 (Bruegmann 1998). In 1999, observed as occasional in weedy areas on Sand Island, especially the northern part of the island (Starr and Martz 1999). In 2008, occasionally observed on Sand Island, especially near residences and Cargo Pier (Starr and Starr 2008). Not observed in 2015.

Desmodium sandwicense (Spanish or chili clover) Fabaceae

Native to South America; in Hawaii, widely naturalized and known from Midway Atoll and all of the main islands (Wagner et al. 1999). On Midway, first collected by Stokes in 1912. Bryan (1956) notes that it was reported by Chisholm and St. John in 1931 (as *D. uncinatum*). It was also reported by Neff and DuMont (1955) that St. John listed *D. uncinatum* for Midway in 1935. This species has not been observed since. Photo by Keoki Stender (MarinelifePhotography.com), who was also on Midway when we were living there in 1999.

Dianthus caryophyllus (Pink carnation) Caryophyllaceae

Native to the Mediterranean region and a favorite of the Hawaiians for ornament and lei making (Neal 1965). First and only observation from Midway in 1999 (*Starr and Martz 990421-4* BISH), where it was being cultivated on Sand Island (Starr and Martz 1999). Not observed since.

Dianthus chinensis (Carnation) Caryophyllaceae

Native to eastern Asia and cultivated in Hawaii (Neal 1965). Previously not recorded from Midway. First and only observation from Midway in 1999 (*Starr and Martz 990421-3* BISH), where it was being cultivated on Sand Island (Starr and Martz 1999). Not observed since.

Dichorisandra thyrsiflora (Blue ginger) Commeliniaceae

This ornamental was observed once on Midway, growing in the abandoned greenhouse at the old Pan Am Hotel (Conant 1983). It has not been observed since.

Dieffenbachia sp. (Dumb cane) Araceae

Plants from the warm parts of America (Neal 1965). In Hawaii, cultivated both indoors and outside (Neal 1965). On Midway, first recorded by Hadden (1941) then again by Apfelbaum et al. (1983). In 1999, it was cultivated in pots in the housing area and the hanger. Not observed in since.

Digitaria ciliaris (Henry's crab grass) Poaceae

Also known as *D. sanguinalis*. Native to China, Indo-China, Samoa, and the Philippines; in Hawaii, naturalized and abundant in lawns and pastures, forming thick mats, on Kure and Midway atolls, French Frigate Shoals, and all of the main islands (Wagner et al. 1999). In 1954, Dr. Fosberg described this grass as rare in open sandy areas on Sand Island (Neff and DuMont 1955). Other collections at Bishop Museum are also known from Sand and Eastern Island (*Herbst and Takeuchi 6346, 6421, 6400, 6335*; *Mr. Cornelison s.n.*; *Lamoureux 2761*). Observed on Sand Island in 1979 (Apfelbaum 1983). Considered rare on Sand Island in 1995 (Bruegmann 1998). Found to be occasional on both Sand and Eastern Islands in 1999 (Starr and Martz 1999). In 2008, found to be occasionally present, but no where dominant on Sand and Eastern Islands (Starr and Starr 2008). In 2015, the status was the same, present but not dominant on Sand and Eastern.

Digitaria insularis (Sour grass) Poaceae

Native to the Neotropics; in Hawaii, documented from Midway and all of the main islands except Niihau (Wagner et al. 1999). This grass is readily distinguished from most others on Midway, being much taller. On Midway, previously collected in 1980 (*Herbst and Takeuchi 6354* BISH), and known of at least from 1990 (Wagner et al. 1990). Considered rare on Sand Island in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), found to be rare on Sand Island, limited to a couple small patches, especially in the northwest corner of the island on the margins of ironwood near Rusty Bucket. In 2008, this grass was found in the same general spots, the N/S runway, the corner of Roosevelt and Henderson, and between Cannon Ave. and Roberts Rd. However, it had spread a bit (Starr and Starr 2008). In 2015, live specimens of this grass were not observed. However, what appeared to be recently killed clumps of this species were observed in the ironwoods by the sewage treatment facility by the N/S Runway.

Dracaena fragrans (Fragrant dracaena) Agavaceae

Native to Tropical Africa (Dehgan 1998), and cultivated in Hawaii. In 1999 (Starr and Martz 1999), *D. fragrans* was cultivated on Sand Island in pots or tubs in the housing area and the hangar on Sand Island. A collection was made (*Starr and Martz 990518-2, 990518-3* BISH). In 2008, *D. fragrans* was still being used as a potted plant in town residences, the hotel (Bravo and Charlie barracks), and at the hangar (Starr and Starr 2008). In 2015, there were a couple specimens, most were in the ground near the Residences, and one was barely alive in a five gallon bucket by the Charlie Barracks.

Dracaena marginata (Money tree) Agavaceae

Native to Madagascar (Dehgan 1998), and cultivated in Hawaii. On Midway, this small tree is cultivated in pots and tubs in the housing area and the hangar on Sand Island. Collected in 1999 (*Starr and Martz 990518-1* BISH), representing a new cultivated record to Midway Atoll. In 2008, *D. marginata* was still being used as a potted plant in town residences, the hotel, and at the hangar. It was also in the planters in front of the Midway House (Starr and Starr 2008). In 2015, a large specimen of this *Dracaena* was observed behind house 4208, and a couple smaller plants were growing in the planters in front of the Midway House.

Dracaena sp. (Dracaena) Agavaceae

There are previous references to a *Dracaena* sp. at Midway (Hadden 1941; Apfelbaum et al. 1983; Herbst and Wagner 1992), but no indication as to which species it may have been.

Dracaena reflexa (Pineapple dracaena) Agavaceae

In 1999 (Starr and Martz 1999), a variety of *Dracaena* which has smaller leaves packed closely together, dubbed 'pineapple' dracaena, was observed in the hangar entrance on Sand Island. It was not observed in 2008 or 2015.

Duranta erecta (Golden dewdrop) Verbenaceae

Sprawling vine like shrub with drooping branches, clusters of purple flowers and yellow to orange berries (Floridata 2008). Native to scrub and open woodlands in the West Indies and Central and South America and commonly cultivated in warm areas, including Hawaii, as a hedge or specimen plant (Floridata 2008, Staples et al. 2005). In Hawaii, naturalized on Kauai and Oahu (Lorence et al. 1995; Herbarium Pacificum Staff 1998). On Midway, collected in 1933 by Meagher. Not observed since.

Echinochloa crus-galli (Barnyard grass) Poaceae

Common in warm temperate to tropical regions worldwide; in Hawaii, documented from all the main islands (Wagner et al. 1999). No previous records for Midway Atoll. In 1999, this species was collected near the sea-plane ramp on the north side of Sand Island (*Starr and Martz 990620-1* BISH). This collection represented a new island record for Midway Atoll (Starr *et al*. 2002). Not observed since.

Eleusine indica (Goose grass, wire grass) Poaceae

Native to the Old World but long-naturalized in warm regions of the New World; in Hawaii documented from Kure and Midway atolls, French Frigate Shoals and all of the main islands except Niihau and Kahoolawe (Wagner et al. 1999). First collected in 1923. Other previous collections from Midway at Bishop Museum include (*H.W. Frings 10, 18, 22*; *Caum 32*; *Neff and DuMont 6, 13*; *Herbst and Takeuchi 6357, 6416*; *C.R. Long 1729*). Observed by Dr. Fosberg and collected by Neff and DuMont in 1954 who describe it as locally common, scattered about in open spaces on both Sand and Eastern Islands (Neff and DuMont 1955). Collected on Sand Island in 1979 (Apfelbaum 1983). Occurring occasionally on Sand and Eastern Islands in 1995 (Bruegmann 1998). In 1999 (Starr et al. 199), one of the most common grasses in lawns and waste areas on both Sand and Eastern Islands. The situation was the same in 2008, *Eleusine* can be found in most any lawn on Midway Atoll, on both Sand and Eastern islands (Starr and Starr 2008). In 2015, Eleusine was again common on Sand and Eastern islands, however it had recently been targeted for control.

Epiphyllum oxypetalum (Gooseneck cactus) Cactaceae

Native to Mexico; a cactus grown for ornament in Hawaii (Neal 1965). On Midway, first collected (*Conant 370* BISH) in 1983 "growing on the defunct water tank in the abandoned green house of the old Pan Am Hotel." In 1999 (Starr and Martz 1999) a clump of plants was observed growing on the roof and wall of the abandoned greenhouse south of the old Cable Company buildings on Sand Island. Not observed since. In 2015 the greenhouse was gone, having been removed during lead abatement work. Photo by Samuel Wong (Wikipedia 2008).

Epipremnum pinnatum (Golden pothos, taro vine) Araceae

Also known as *Raphidophora aurea* (Linden and Andre) Bunt. Native to Malaysia (Neal 1965). In Hawaii, cultivated as a vine, sometimes climbing on trees (Neal 1965). On Midway, previously recorded by Apfelbaum et al. (1983). In 1999 (Starr and Martz 1999) this species was observed in the housing area, the hanger, and the Cable Company buildings. The abandoned greenhouse at the cable buildings were covered with this vine. In 2008, golden pothos was still commonly cultivated in the town area where it could be seen planted in a myriad of settings, often crawling up buildings. There was a small plant in a vase with water in the lobby bathroom of Charlie Barracks, the current hotel. There was also a small plant that had either fallen off a railing or had been tossed out of the back of the Captain Brooks bar and was beginning to grow on the naupaka. There were numerous plants of this climbing up the Cable Company buildings and nearby foliage. Collected by the 400 housing on Halsey Dr. (*Starr and Starr 080601-09* BISH) and by the Cable Company buildings (*Starr and Starr 080610-01* BISH) to document the presence of golden pothos on Midway. It probably wouldn't hurt to get rid of this species from Midway, given it's propensity to climb on and destroy buildings (Starr and Starr 2008). In 2015, there was a lot less of this species, but a few plants were still found around Town. Evidence of previous damage to structures was visible and most of the vines looked untended. It would be good to continue removing the rest of the plants, to prevent future damage to the buildings and infrastructure on Midway.

Eragrostis amabilis (Love grass) Poaceae

Also known as *Eragrostis tenella*. Native to the Paleotropics, and now widely naturalized in the tropics; in Hawaii, documented from Midway, Niihau, Oahu, Maui, Kahoolawe, and Hawaii (Wagner et al. 1999). Collections from Midway at Bishop Museum include (*Neff and DuMont 15*, *H.W. Frings 1*, *Herbst and Takeuchi 6444*). In 1954, locally common in open spaces on Sand Island and noted from Eastern Island (Neff and DuMont 1955). Collected on Sand Island in 1979 (Apfelbaum 1983). Occasional on Sand Island in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), observed commonly occurring in lawns on Sand Island, but not on Eastern or Spit Island. In 2008, this grass was the first species observed when getting off the plane, as it grows in the cracks on the runway. It was also common in lawns. Collected from a lawn on Halsey Dr. (*Starr and Starr 080601-18* BISH) to further document the presence on Midway (Starr and Starr 2008). In 2015 this diminutive grass was again observed growing out of the cracks of concrete and other hard packed areas, most notably around the Residences, and just outside of Town, in the gravelly road near the old Sunrise Seep.

Eragrostis paupera (Eragrostis) Poaceae

Also known as *E. falcata*, *E. whitneyi*, *E. w.* var. *caumii*. Native to the Pacific equatorial region; in Hawaii, occurring in coastal sites on Kure, Midway, and Pearl and Hermes atolls, French Frigate Shoals, and formerly known from Barber's Point, Oahu (Wagner et al. 1999). For Midway, there are many collections of this grass at Bishop Museum including (*Neff and DuMont 14*; *Herbst and Takeuchi 3644, 6399*; *W.A. Bryan s.n.*; *C.R. Long 2253*; *H.F. Clay s.n.*). In 1902, noted as not abundant on Eastern Island, but common on the lowland at the west end of Sand Island. Not observed by the Tanager Expedition in 1923 (Christophersen and Caum 1931). Neff and DuMont (1955) reported this species as fairly abundant on parts of Sand Island and locally common on Eastern Island. They observed the species growing along edges and in cracks of runways and plane parking stands. In 1995, observed on Eastern Island in open sand just below the perennial vegetation line as a pioneer species and on Spit Island. In 1997, observed by N. Seto on Sand Island (Bruegmann 1998). In 1999 (Starr and Martz 1999), observed diminutive grass at the runway overrun on the east end of Sand Island where it was rare, and on the south part of Spit Island where it was uncommon. Not found on Eastern Island in 1999. Observed on Spit Island in 2005 by a seal crew, then again in 2007. Seeds from Kure were brought to Midway in 2007 and 2008 (John Klavitter, Greg Schubert, and Penny Knuckles pers. comm.). In 2008, this species was not found at all, despite repeated searches in historically known locations. The only location of this species observed on Midway in 2008 was in the FWS Greenhouse on Sand Island, and that was material that had been brought in from the runway on Kure Atoll (Starr and Starr 2008). This material was later destroyed when *E. paupera* was once again found on Spit Island in 2009 (Penny Knuckles pers. comm.). In 2015, the only location this diminutive grass was observed was again the FWS Greenhouse. The material this time was apparently Midway stock from Spit Island, where *E. paupera* comes and goes on the most exposed cobble areas, with a high count of 40+ plants observed in November, 2013 (Greg Schubert pers. comm.).

Eragrostis variabilis (Emoloa, Kawelu) Poaceae

Also known as *E. cynosuroides*. Endemic to the Hawaiian Islands, occurring on Kure, Midway, and Pearl and Hermes atolls, Lisianski, Laysan, Nihoa and all of the main islands (Wagner et al. 1999). This large clumping grass forms a dominant part of the vegetation on Laysan and Lisianski (Starr and Martz 1999b). On Midway, collected (*W.A. Bryan s.n.* BISH) from Sand Island in 1902 as *E. cynosuroides*. In 1923, recorded (*Caum 36* BISH) by Tanager Expedition from Sand Island only, where it was fairly common, particularly in the central part of the island. Neff and DuMont (1955) note this grass as rare on Sand Island and found in only two locations, one being near the terminal (*Neff and DuMont s.n.,37a* BISH). Conant (1983) notes "This indigenous grass was exceedingly rare on Sand Island, and I would not have collected it had someone not brought me an inflorescence for identification (*Conant 129* BISH). I found two colonies, less than 100 m apart on the beach in area 7. There were fewer than 15 plants total in the two colonies." During the 1995 survey, Bruegmann (1998) also reports this species as

being rare, restricted to a single location at Frigate Point on Sand Island. Other collections at Bishop Museum include (*F.A. Bianchi s.n.*, *V.J. Meagher s.n.*, *D.R. Chrisholm s.n.*, *H.W. Frings 10*, *Lamoureux 2125*). In 1999, the plants Bruegmann and perhaps Conant refer to were observed. In addition, many additional plants had been out-planted from seed brought in from Laysan and propagated on Midway, and it was beginning to spread on its own. On Eastern Island, there was a large patch near the cross runway and was planted in many other places. It was not observed on Spit Island. By 2008, *Eragrostis* had been outplanted en masse in many areas across Sand and Eastern Island, occasionally becoming dominant. Some of the more robust patches on Sand Island were on either side of the boardwalk going to the Clipper House and Captain Brooks, around the new duck pond near the coast on West Beach, and on scattered piles of sand around town. On Eastern, the old plantings now formed solid thickets and newer plantings were doing well around the new duck seeps. There were also out-plantings on Spit Island, mostly on the northwestern and southern sections where it was occasional to common (Starr and Starr 2008). In 2015, this grass was becoming increasingly common on Sand Island, however many of the plantings on Eastern Island were gone. There was a fair amount outplanted on Spit Island as well, though some were being outcompeted by naupaka or washed over by the ocean. Seedlings were observed in various sites on Sand Island and in an area on Spit and it seems like this grass has established fairly well. It is currently being planted along roadsides, dunes, and revetments to help stabilize the sand and provide a cover to prevent weeds from establishing (John Klavitter, Greg Schubert, and Penny Knuckles pers. comm.).

Eriochloa procera (Cupgrass) Poaceae

An unknown grass was found by the Cargo Pier and collected (*Starr and Starr 080611-01* BISH) to help determine identity and to document presence on Midway. It has tentatively been identified as *Eriochloa punctata*. This was the first time it was observed and is the only known location on the atoll. Several dozen scattered clumps occur throughout the field. Shortly after the survey, control of this grass was begun (Greg Schubert pers. comm., Starr and Starr 2008). Not observed in 2015.

Ervatamia sp. (Crape jasmine) Apocynaceae

Also known as *Tabernaemontana*. Possibly a native of northern India (Neal 1965). In Hawaii, a few species are grown in cultivation. On Midway, previously known from literature (Herbst and Wagner 1992). Not observed before or since.

Eryngium foetidum (Long coriander, Pak chi farang) Apiaceae

A tropical perennial herb native to Mexico and South America and widely cultivated throughout the world for use as an edible herb (Wikipedia 2008). In Hawaii, grown by Southeast Asian residents who use the leaves as they do coriander (Staples et al. 2005). In 2008, a small plant of what has been tentatively identified as this species was found on Sand Island, 3501 Cannon Ave., at Sak's garden at the Water Plant, in a planter

box along with other vegetables. The plant smelled like cilantro and Sak reported that the plant was from Thailand and that he eats the leaves which are good for the stomach. A collection was made (*Starr and Starr 080608-01*) to help confirm the identification and to document the presence of this species on Midway Atoll (Starr and Starr 2008). In 2015, this culinary herb was growing in the Hydroponics Greenhouse.

Erythrina variegata (Indian coral tree) Fabaceae

Native from India to southern Polynesia; in Hawaii cultivated for its showy scarlet flowers that bloom in January and February (Neal 1965). On Midway, previously recorded in 1979 (Apfelbaum et al. 1983) and again in 1995 (Bruegmann 1998). In 1999 a couple cultivated trees observed near the Midway Mall and the abandoned marine barracks on Sand Island. In 2008 a lone tree was observed in the Midway Mall, just behind the Library. Two more trees were observed by the Marine Barracks. The trees had ample fruit, but no flowers at the time of the survey. There were no signs of the Erythrina Gall Wasp or the seed boring Bruchid beetle. Collected from trees west of Marine Barracks (*Starr 080604-03* BISH) to document the presence on Midway (Starr and Starr 2008). In 2015, the large tree by the mall had been removed during lead abatement work, but a sapling from presumably that same tree was found growing out of a crack nearby. The two trees west of the now removed Marine Barracks were still there. White Terns were roosting in the trees and Common Canaries were chewing on the freshly unfurling flowers. Ample seed was observed under the trees, but no seedlings were found nearby. One seedling of presumably this species was observed in a pot at the 4208 house.

Eugenia uniflora (Surinam cherry) Myrtaceae

Native to Brazil, now widely cultivated; in Hawaii, cultivated on Midway Atoll and all of the main islands, now sparingly naturalized on Kauai, Molokai, and Maui (Wagner et al. 1999, Oppenheimer 2003). On Midway, previously collected (*Conant 120* BISH) in 1983 by S. Conant who notes "This plant, which may grow to be a small tree bears small, red, edible fruits. It was growing adjacent to the old greenhouse at the abandoned Pan Am Hotel." It was also observed in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), a few plants were observed persisting in the same spot described by Conant, near the greenhouse at the Cable Company buildings. In 2008, one plant was found in that same spot, just south of the Cable Company Buildings, next to a dilapidated old structure. The plant was about three meters tall and wide. It was in flower and had some ripe fruit that tasted both tangy and aromatic. This species is known to spread beyond where it is planted in Hawaii via fruit eating birds, such as mynahs, but has yet to do so on Midway. It may be prudent to remove now before it has a chance to spread (Starr and Starr 2008). By 2015, the structure and all vegetation around it, including the Surinam cherry has been removed. No signs of seedlings or regrowth was noted.

Euphorbia cyathophora (Wild poinsettia) Euphorbiaceae

Native from eastern and southern United States to northern South America and the West Indies; in Hawaii, naturalized on Midway Atoll, Kauai, Oahu, Molokai, and Maui (Wagner et al. 1999). Collections at Bishop Museum include (*Neff and DuMont 9*, *Herbst and Takeuchi 6329*, *H.W. Frings 12*). Observed by Apfelbaum et al. (1983) and also by Bruegmann (1998). In 1999 (Starr and Martz 1999), it was found in mostly forested areas on Sand and Eastern Islands. It was surmised this species may decline in abundance as ironwood (*Casuarina*) forests are removed from the islands. In 2008, this colorful plant could be found virtually anywhere on Sand Island, but was most dominant on the margins of and quite a ways under the ironwoods on Sand Island, especially near the N/S Runway, where it created chest-height thickets. On Eastern Island, it occurred where the ironwoods used to be, mostly the northern shore of the western part of the island (Starr and Starr 2008). In 2015, wild poinsettia was much less common, having been the target of control efforts for a number of years. It was still present in similar habitat, mostly associated with ironwoods, but was no where as abundant as in the past.

Euphorbia heterophylla (Kaliko) Euphorbiaceae

Also known as *E. geniculata*. Native from southern United States to Argentina and the West Indies; in Hawaii, naturalized on Midway Atoll and all of the main islands except Molokai (Wagner et al. 1999). On Midway, Neff and DuMont (1955) report St. John listing this as an addition to the flora of Midway in 1931, as *E. geniculata*. They observed this species to be "Abundant on Sand Island, common as an understory among the thinner stands of ironwoods and as dense marginal growth about the edges of this stands. Also present on Eastern Island." It was collected in 1931 by Chisholm and in 1944 by Caum. It has not been observed since. It is not known whether this species died out, since it has not been observed since 1954, or whether the 1931 and 1954 determinations were actually the closely related *E. cyathophora* which now dominates the same habitat described by Neff and DuMont. There are specimens of this species at Bishop Museum which could be checked.

Euphorbia hirta (Hairy spurge) Euphorbiaceae

Also known as *Chamaesyce hirta*. Native from southern United States to Argentina, the West Indies, and the Paleotropics; in Hawaii, naturalized in low elevations on Kure and Midway atolls, French Frigate Shoals, and all of the main islands (Wagner et al. 1999). Reported in Bryan (1956) as observed on Midway by Chisholm in 1931. Neff and DuMont (1955) report this species to be "occasional or locally common. Most frequently seen in open sandy utility areas where the soil has been disturbed during recent years." Collected by Frings in 1962 from Sand Island (*Frings 25* BISH). Collected by Long in 1964 from the East-West runway on Eastern Island (*Long 1724a* NMNH). Collected by Herbst in 1980 from Sand and Eastern Island (*Herbst 6390, 6397* BISH). In

1999 (Starr and Martz 1999), found to be common on Sand Island. In 2008, common on runways and other hard packed areas on Sand Island (Starr and Starr 2008). In 2015, the status was the same, present in hard packed areas.

Euphorbia hypericifolia (Graceful spurge) Euphorbiaceae

Also known as *Chamaesyce hypericifolia.* Native from southern United States to Argentina and the West Indies, widely naturalized; in Hawaii, naturalized on Kure and Midway Atoll, French Frigate Shoals, Kauai, Oahu, Maui, and Hawaii (Wagner et al. 1999). Collected on Eastern Island in 1964 by Long (*Long 1724b* NMNH) from the East-West runway and by Lamoureux (*Lamoureux 2764* NMNH) who noted "beside S edge of runway in SW corner of island". Collected again on Eastern Island in 1980 by Herbst (*Herbst 6427* NMNH), who also collected it on Sand Island (*Herbst 6351* BISH). Noted by Herbst and Wagner (1992) as naturalized on Midway. In 1999, it was recorded as occasional to common on Sand Island and rare on Spit. In 2008, it was most common around the Residences and near Radar Hill on Sand Island (Starr and Starr 2008). In 2015, it was once again present near the Residences on Sand Island.

Euphorbia hyssopifolia (Hyssopleaf sandmat) Euphorbiaceae

Also known as *Chamaesyce hyssopifolia*. Native from southern United States to Argentina and the West Indies, naturalized in the Paleotropics; in Hawaii, known from Midway Atoll, Kauai, Oahu, Lanai, Maui, and Hawaii (Wagner 1999, Bruegmann 1999; Herbarium Pacificum Staff 1999). On Midway, first collected (Bruegmann 2029 BISH) in 1995 where it was noted as uncommon on Sand Island (Bruegmann 1999). In 2012, reported as rare to occasional (Aspey 2012). Not observed in our 1999, 2008, or 2015 surveys but could have been easily overlooked.

Euphorbia maculata (Spotted spurge) Euphorbiaceae

Native throughout eastern United States, naturalized in western United States and Europe; in Hawaii, known only from Kure and Midway atolls (Wagner et al. 1999). On Midway, collected on Sand Island in 1980 (*Herbst and Takeuchi 6392* BISH) and 1988 (*Herbst 9070, 9079*). Also collected in 1999 (*Starr and Martz 990623-10* BISH), on Sand Island, where it was common to occasional (Starr and Martz 1999). In 2008, this little spurge was found in lawns and hard packed areas, especially near South Beach, Frigate Point, and the Fuel Farm. In 2015, still found in the same areas.

Euphorbia peplus (Petty spurge) Euphorbiaceae

Native to temperate Eurasia, now a cosmopolitan weed; in Hawaii, naturalized on Midway Atoll, Kauai, Maui, and Hawaii (Wagner et al. 1999; Lorence et al. 1995). Collected by H. W. Frings (*28* BISH). In 1999 (Starr and Martz 1999), this delicate herb was found to be common on Sand Island, especially in shady areas. In 2008, occasionally observed in shady areas on Sand Island (Starr and Starr 2008). In 2015, this diminutive herb was found over much of Sand Island, usually near ironwoods. In many places it was the only plant in the understory.

Euphorbia milii (Crown of thorns) Euphorbiaceae

Succulent climbing plant to 6 ft. in height with densely spiny stems cultivated throughout the world, including Hawaii, for its showy flowers and drought tolerance. Native to Madagascar (GRIN 2008). On Midway, grown in pots at the Barber Shop behind the Midway Mall and at 4208 Commodore Ave. (Starr and Starr 2008). In 2015, a couple plants observed in pots at different residences along Commodore and Halsey.

Euphorbia pulcherrima (Poinsettia) Euphorbiaceae

Native to tropical America, the symbol of Christmas, cultivated in Hawaii, where it flowers for the season (Neal 1965). On Midway, first recorded by Hadden (1941). Neff and DuMont (1954) found this species "Growing as an ornamental at one residence formerly occupied by Pan-American employees, on Sand Island." Observed by Bruegmann in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), cultivated in the housing area of Sand Island. In 2008, a few plants observed on Sand Island at Charlie Barracks, the housing area, and the Com Buildings (Starr and Starr 2008). Not observed in 2015.

Euphorbia prostrata (Prostrate spurge) Euphorbiaceae

Also known as *Euphorbia prostrata* Aiton. Native from southern United States to South America, the West Indies, and the Paleotropics. In Hawaii, naturalized in low elevations on Midway Atoll and all of the main islands except Niihau (Wagner et al. 1999; Hughes 1995). Neff and DuMont (1954) report seeing this species "only occasionally on Sand Island, growing along the edge of paved runways." It was then collected on Eastern Island in 1980 by Herbst and Takeuchi (*6412* NMNH). In 1999 (Starr and Martz 1999), it was occasional on both Sand and Eastern Islands. In 2008, this prostrate spurge was common on the hard packed areas of Sand and Eastern Island, especially near and on the runways (Starr and Starr 2008). In 2015, the status was the same, present in hard packed areas.

Euphorbia serpens (Prostrate spurge) Euphorbiaceae

Native to South America, but naturalized widely elsewhere (Wikipedia 2015). In Hawaii, known from the islands of Kauai and Maui (Wagner et al. 1997, Oppenheimer 2003). First recorded the NWHI at Sand Island in 2008, where a few small plants were in a picture we took along the coast just east of Bulky Dump. The plant was originally misidentified as *E. maculata*, but later after reviewing photos for an inquiry about a related species from the Kure folks, it was noticed the Midway plants were actually *E. serpens*. It is distinguished from *E. maculata* by the glabrous nature, red on the tiny flowers, and the more heart-shaped leaves. In 2015, this species was still present in the area east of Bulky Dump and was also observed near the Cable Company Building. A collection was made (*Starr 150329-01* BISH) to confirm the identification and document the presence on Midway.

Eustachys petraea (Finger grass) Poaceae

Also known as *Chloris petraea*. There has been a recent taxonomic name change from *Chloris petraea* to *Eustachys petraea* (Wagner et al. 1999; Wagner and Herbst 1995). *E. petraea* was also documented as newly naturalized to the state of Hawaii occurring on Midway and French Frigate Shoals (Wagner et al. 1999; Wagner and Herbst 1995). On Midway, occurring occasionally on Sand Island in 1995 (Bruegmann 1998). This species was probably misidentified as St. Augustine grass (*Stenotaphrum secundatum*) on Spit Island in 1995. The same mistake was made in 1999 (Starr and Martz 1999) before fertile material was eventually found. This grass was one of the most common grass species on Sand Island in 1999. Also collected on Spit Island in 1999 (*Starr and Martz 990623-7* BISH). In 2008, this sprawling grass was found to be common across much of Sand, Eastern, and Spit Islands. On Sand Island, it could be found in a variety of locations, often as the dominant grass. One interesting location was in virtually every *Fimbristylis* clump on the abandoned runway, where this grass is able to germinate. On Eastern Island, this grass was observed for the first time, where it is a dominant over much of the northern shore of the western tip of the island. On Spit Island, this grass is dominant over much of the island, and could potentially displace the healthy *Solanum nelsonii* patches on the northern tip of the island. In 2015, it was still common on all three islands. A common understory plant for naupaka in coastal environs such as Frigate Pt. and North Beach on Sand Island, in the naupaka along the northwestern coast on Eastern, and throughout the extensive naupaka stands on Spit, where it was being controlled.

Ficus benghalensis (Indian banyan) Moraceae

Native to India, this large evergreen tree is cultivated in Hawaii (Neal 1965). The pollinating wasp for this species is not yet known to be present in the state of Hawaii (Nishida 1994), therefore, this species does not develop fertile fruit and is not yet known to spread. On Midway, the Indian banyan is listed among species of trees that were grown successfully in a sand and soil media during the early experimental plantings (Hadden 1941). Collected in 1962 by Lamoureux (*Lamoureux 2220* BISH) from the Cable Company area noting that the trees were "10 m tall some developing multiple trunks with red fruit". It was also observed in 1979 (Apfelbaum et al. 1983) and in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), observed as rare and grown in cultivation. No reproduction was noted. In 2008, a couple dozen large trees had begun growing into each other around the Cable Company Buildings. They had sent down copious aerial roots, many of which had rooted in the ground, forming a labyrinth of vines. These magnificent trees will likely continue to slowly sprawl out, forming a giant interconnected canopy similar to the one created by the giant Banyan on Front Street, Maui. Though the planted trees have been creeping out into new land for some time, there was no sign of the pollinator wasp for this species, and no seedlings were noted. Some of these trees appear to already be touching some of the old Cable Company buildings, and have the power to devour them if left unchecked (Starr and Starr 2008). In 2015, many of the trees were gone, having been removed during lead abatement work. They were stacked in a windrow to the west of the old buildings, and at least one of the trees had rooted and was growing. A few of the trees in the southwest corner of the grove remained and were still imposing features in the landscape, a network of roots and branches towering above the ground. No seedlings or evidence of the pollinator wasp for this species were noted.

Ficus benjamina (Benjamin tree) Moraceae

Native to India, sometimes called the weeping fig because of its long weeping branches, this graceful fig is commonly cultivated in Hawaii (Neal 1965). The pollinating wasp for this species is not yet known to be present in the state of Hawaii (Nishida 1994), therefore, this species does not develop fertile fruit and is not yet known to spread. First recorded on Midway in 1999 (Starr and Martz 1999), where this close relative of *F. microcarpa* was found to be occasionally planted, and also used in pots on Sand Island. No reproduction was noted. In 2008, two trees of this species were noted, a large one with a fine weeping habit just east of the Gym, and a smaller one in front of 4208 Commodore Ave. This species does not spread sexually, so should not be a problem unless it's pollinator wasp shows up, or if it is planted too close to structures, as the roots of this species can be quite destructive. The plant at 4208 Commodore Ave. looks like it will quickly outgrow its location (Starr and Starr 2008). In 2015, the only *F. benjamina* observed was the large tree by the Gym. No signs of reproduction or pollinator wasp presence were noted.

Ficus elastica (Indian rubber tree) Moraceae

Native to India, cultivated in Hawaii (Neal 1965). On Midway observed in 1979 (Apfelbaum et al. 1983). In 1999 (Starr and Martz 1999), what was thought to be this species was collected from West Beach (*Starr and Martz 990512-1* BISH), but was actually determined by Derral Herbst and George Staples of Bishop Museum to be *F. macrophylla*. There could have been rubber trees on Midway at some point and then they disappeared, or previous authors may have made the same mistake we did, and rubber trees never really existed on Midway. Not observed in 2008 or 2015. See *F. macrophylla* for more.

Ficus macrophylla (Moreton Bay fig) Moraceae

Native to Queensland and New South Wales, Australia (Neal 1965). In Hawaii, this large tree is often planted as a street tree and has an extensive surface root system (Neal 1965). This fig was recently published as a newly naturalized record on the island of Maui (Oppenheimer and Bartlett 2000) and as a new island record for the island of Hawaii (Starr *et al*. 2002). The pollinator wasp is present in Hawaii, therefore, reproduction is possible and occurring. First collected by Herbst in 1980 (*Herbst 6331* BISH) from Sand Island. On Midway, *F. macrophylla* was previously not reported, even though it had been collected in 1980, and was probably being misidentified as *F. elastica* or *F.* sp. In 1999 (Starr and Martz 1999), two large trees of what was determined to be this species (*Starr and Martz 990512-1* BISH) were growing on either side of the cart path between West Beach and the runway on Sand Island. No reproduction was noted. However, the pollinator wasp for *F. macrophylla, Pleistodontes froggatti*, had been recorded from Midway Atoll (Nishida 1999). The wasp was collected in 1997 in malaise traps near West Beach and town areas. Exit holes and live wasps were also observed in ripe *F. macrophylla* fruit in 1999 and 2001. *P. froggatti* was published as a new island record for Midway by Beardsley (1999). In 1999, it was noted that with the pollinator present, there was a potential for reproduction, and that control of this species now before it gets out of control and costly to remove would be prudent. In 2008, the two large trees were still there, with exit holes and live wasps still present in ripe fruit. Additionally this species had begun to spread sexually. A few saplings were observed on dead ironwood logs near the large *F. macrophylla* tree near the Cart Path on West Beach, and a three meter tall tree of *F. macrophylla* was observed growing next the water storage tank at the Water Plant in the middle of town. Sak, the Water Plant attendant, said that about nine years ago his nephew Tawan found the seedling of this plant on the large water tanks on the runway, had pulled it off the structure, and gave it to Sak who planted it in town. Collected (*Starr and Starr 080608-09* BISH) to document the spread of *F. macrophylla* on Midway. *Ficus* literature suggests that 100 *Ficus* trees is the minimum capable of sustaining a pollinator wasp population, as the wasp only lives a few weeks. However, with just two trees on Midway the wasp has been able to survive for more than a decade, presumably due to the asynchronous fruiting of *F. macrophylla*, allowing for some ripe fruit to be available at different times of the year. Another reason this *Ficus* is able to

spread on Midway is because of the common mynah, one of the only non-native birds on Midway. It seems likely that if the wasp and mynah persist on Midway, and the half dozen known trees are not removed, this *Ficus* will continue to spread, devouring trees and destroying structures (Starr and Starr 2008). In 2015, all the known trees had been controlled, but two more young trees were found in a thicket near the previously known trees on West Beach. These were treated and will be monitored. No additional signs of spread or evidence of the pollinator wasp were found.

Ficus microcarpa (Chinese banyan) Moraceae

Also known as *Ficus retusa*. Native from Ceylon to India, southern to China, Ryukyu Island, Australia, and New Caledonia. In Hawaii cultivated and now naturalized on Midway Atoll, Kauai, Oahu, Molokai, Maui, and Hawaii, but probably on all of the main islands (Wagner et al. 1999; Hughes 1995; Lorence et al. 1995, Starr et al. 2002). The pollinating wasp, *Parapristina* [*Euprestina*] *verticillata*, was introduced to the Hawaiian Islands around 1938 (Wagner et al. 1999). On Midway, Neff and DuMont (1955) note "A number of banyans of varying size appear to be doing well about the old Cable Company area and about Pan-American's deserted Gooneyville Lodge, on Sand Island." Chinese banyan was also previously observed in 1979 (Apfelbaum et al. 1983). In 1995, it was listed as naturalized and rare on Sand Island (Bruegmann 1998). In 1999, Chinese banyan was found to be cultivated and naturalized on Sand Island. It was surmised seeds were probably being dispersed by introduced mynah (*Acridotheres tristis*) birds. Plants were found to grow in the ground or as epiphytes. Small plants of this species were observed coming up on stumps, buildings, and in the cracks of sidewalks, presenting one of the greatest threats to preservation of historical buildings and structures on Midway. The Cuban Laurel Thrip was present on Midway, creating leaf-folding damage on the leaves of *F. microcarpa*. The pollinator wasp, *Parapristina* [*Euprestina*] *verticillata*, was not recorded by Nishida in 1998, however, it must have been present for this species to be reproducing. Collected in 1999 *(Starr and Martz 990428-3* BISH) to document the new naturalized record for Midway Atoll (Starr *et al*. 2002). In 2008, the large trees of this species remained, a few small seedlings from 1999 had grown up to be large trees, there was a whole class of three meter tall trees scattered about the island, and lots of little seedlings were sprouting on stumps and structures over the entire island. Collected (*Starr and Starr 080601-10, 080601-19* BISH) to further document the spread on Midway. *F. microcarpa* is probably the single greatest plant threat to the historical structures on Midway. It will be tough to control the plants of this species, as they often germinate way up in trees and are somewhat resistant to herbicide. However, the sooner this species is addressed the easier it will be. The list of structures that currently have this species growing on them is long and getting longer, including the Cable Company Buildings, Seaplane Hangar, Old Galley, Midway Mall, Power Plant, Harbor Sea Wall, and Gym (Starr and Starr 2008). In 2015, there were no large trees of this species, all having been removed. The remaining plants, all relatively small, were predominantly near where previous large trees existed, mostly in Town and along West Beach. Some of the small trees found appeared to have been cut and controlled before, but were regrowing. Some were high up in trees, which will require additional equipment to reach. Due to the

difficult to kill nature of the species, along with precarious locations up in trees and on structures, many small plants remain on Sand Island. It is not known how long the seed bank remains viable, but despite the challenges, with no fruiting trees and regular control efforts, eradication seems feasible.

Ficus sp. (Unknown fig) Moraceae

An unknown *Ficus* species is historically known from literature (Herbst and Wagner 1992). It is not known which of the four *Ficus* species known from Midway this would have referred to.

Fimbristylis cymosa (Button sedge, mauu aki aki) Cyperaceae

Also known as *F. c.* ssp. *spathacea*, *F. c.* ssp. *umbellata-capitata*, *F. pycnocephala*. Widely distributed in coastal areas across the Pacific Basin including Australia, western Malesia, Pacific islands, and the Neotropics; in Hawaii occurring on Kure, Midway, Laysan, French Frigate Shoals, and all the main islands except Kahoolawe (Wagner et al. 1999). Two subspecies are sometimes recognized, *F. c*. ssp. *spathacea* and *F. c.* ssp. *umbellato-capitata*. Wagner et al. (1999) report that "At best, these are weak subspecies still in the process of differentiation." On Midway, first collected by Neff and DuMont (1955) who noted this species was locally common on both Sand and Eastern Island where it was observed near road, runway, and building sites. Also recorded in 1979 (Apfelbaum et al. 1983). Conant (1983) collected this species (*Conant 138* BISH), noting "This small sedge was common throughout the island, especially on the runways". In 1995, Bruegmann noted this sedge from all three islands of Midway (Bruegmann 1998). In 1999 (Starr and Martz 1999), this sedge was found to be common on Sand, Eastern, and Spit Islands, especially in open, hard-packed areas and on runways. During this same survey, what appeared to be both subspecies and intermediates between the two were seen on Midway. Plants more closely allied with *F. c. umbellata-capitata* seemed to be the most common form. For the purposes of the 1999 survey, the two were not split. In 2008, this sedge was still present on Sand, Eastern, and Spit Islands. However, the numbers appeared down. On Sand Island the abandoned runways, which supported literally a mile of *Fimbristylis* clumps was being further colonized by grasses and other herbs, such as *Eustachys petraea*, at the expense of *Fimbristylis*. On Eastern Island, *Fimbristylis* was hard to find, with only a few sad looking clumps on western portions of the abandoned runways and along the western coast where a small healthy patch occurred. On Spit, the story was the same, heavy vegetation that had moved in over the past decade was displacing *Fimbristylis*, which was still found around the lake, and on the extreme margins of the coast, where there was little to no vegetation to compete with (Starr and Starr 2008). In 2015, this clumping sedge continued to decline in abundance, mainly due to other vegetation germinating in the sedge clumps and then outcompeting them. This was again most apparent on Sand Island in the triangle area between the Runways by the Catchment Pond and Water Tanks. On Eastern there are still a few clumps found on the abandoned runway on the northeast side, though most specimens appeared browner than green. The lake on Spit Island was no longer present, due to inundation by waves. There were scattered clumps mixed in on the northeastern tip where

a large patch of akulikuli (Sesuvium portulacastrum) occurred. These were also browning.

Fragaria x *ananassa* (Strawberry) Rosaceae

A cultivated variety in Hawaii (Neal 1965). Recorded on Midway for the first time in 1999, when strawberries were being cultivated on Sand Island for the French restaurant, the Clipper House. Garden variety strawberries and the 'Quinalt' cultivar were growing in 50 gallon drums to provide a fresh, yet affordable desert. Collected in 1999 (*Starr and Martz 990421*-9 BISH, *Starr and Martz 990421*-10 BISH), to document the presence of strawberries on Midway. Not observed since, except in the salad bar at the Clipper House, having been flown in from Hawaii.

Gamochaeta purpurea (Purple cudweed) Asteraceae

Also known as *Gnaphalium purpureum*. Taxonomic name change from *Gnaphalium purpureum* to *Gamochaeta purpurea* (Wagner et al. 1997). Neff and DuMont (1955) report that Fosberg observed this species on Sand Island and noted "Very rare, found in the shade of a building at the Air Terminal". Not observed before or since. This species could easily be mistaken for the native enaena (*Psuedognaphalium*).

Gardenia sp. (Gardenia) Rubiaceae

Cultivated in Hawaii (Neal 1965). On Midway, previously observed in 1979 (Apfelbaum 1983). Not observed before or since.

*Glycine max (*Soy bean) Fabaceae

Also known as *G. soya*. Native to southeastern Asia, widely cultivated for food (Neal 1965). On Midway, previously known from literature (Herbst and Wagner 1992). Not observed before or since. Photo by Jurema Oliveira (Wikipedia 2008).

Gomphrena globosa (Globe amaranth) Amaranthaceae

Native to the Neotropics and originally described from India, cultivated and escaped in many parts of the world. In Hawaii, naturalized on at least Kauai and Oahu (Wagner et al. 1999; Lorence et al. 1995). First recorded from Midway in 1999 (Starr and Martz 1999), where it was collected (*Starr and Martz 990429-17* BISH) from cultivated material in the residential area of Sand Island. Not observed since.

Gynura bicolor (Asian spinach) Asteraceae

An Asian genus of several species, some of which have edible leaves eaten like spinach. In Hawaii, one species is grown in hanging baskets as an ornamental, *Gynura* 'Purple Passion' possibly a hybrid between *G. aurantifolia* and *G. procumbens*; and at least one other, *Gynura bicolor*, is grown as a vegetable (Staples et al. 2005). On Midway, in 2008, this vine like plant was found on Sand Island, 3501 Cannon Ave., at Sak's garden at the Water Plant in a planter box. Sak called it "Pat tum pang" or something like that. He reported that it is a Chinese plant that was brought from Thailand 18 years ago. A collection was made (*Starr and Starr 080608-03* BISH) to further identify this species and to document its presence on Midway Atoll (Starr and Starr 2008). In 2015, there were now three locations of this plant, all in Town on Sand Island. It was still at the Water Plant, where it appeared abandoned and was beginning to spread vegetatively, it can both root at nodes and grow from vegetative cuttings. It was also found at the abandoned looking greenhouse by the Hydroponics Greenhouse and by one of the 400 block Residences. Along with potential for vegetative spread, this species also potentially carries Pyrrolizidine alkaloids, which are chronic mammalian liver toxins. We used to grow this species for food, but no longer grow or eat it because of the potential toxins. Due to its ability to grow vegetatively, care should be taken when disposing of this plant or moving it.

Hedychium gardnerianum (Kahili ginger) Zingiberaceae

Native to the Himalayas and adjacent regions and cultivated in the tropics; in Hawaii, naturalized on Kauai, Maui, Lanai, and Hawaii (Wagner et al. 1999). Kahili ginger is known from the literature (Apfelbaum et al. 1983) but no botanical survey has come across it before or since.

Helianthus annuus (Sunflower) Asteraceae

A native of the western United States grown for its ornamental flowers and edible seeds (Neal 1965). In Hawaii, cultivated and now naturalized on the island of Hawaii (Wagner et al. 1999). On Midway, previously recorded by Hadden (1941) and not observed by others until 2008, when a lone plant was found by Refuge Biologist John Klavitter in a pot in the Community Garden. The plant was pulled and a collection made (Greg Schubert pers. comm.). No sunflowers were observed in 2015.

Heliconia psittacorum (Heliconia) Musaceae

Several species of Central and South America are grown in gardens of Hawaii (Neal 1965). On Midway, previously known from literature (Herbst and Wagner 1992). Reported by Bruegmann (1998). Not observed since.

Heliotropium curassavicum (Seaside heliotrope, nenea) Boraginaceae

Indigenous to coastal areas from southern United States to South America and the West Indies, Pacific Islands, and Australia; in Hawaii, occurring on the islands of Laysan, French Frigate Shoals, Nihoa, and all of the main islands (Wagner et al. 1999). Introduced to Midway from Laysan in 2005, but did not establish (Klavitter 2006). Not observed since.

Heliotropium procumbens var. *depressum* (Heliotrope) Boraginaceae

Native from southern United States south to Central and South America and the West Indies; in Hawaii documented from Midway Atoll, French Frigate Shoals, Kauai, Oahu, and Maui (Wagner et al. 1999; Herbst and Wagner 1999). On Midway, previously recorded by Bruegmann (1998) who noted it as occasional on Sand Island. In 1999 (Starr and Martz 1999), observed as occasional on both Sand and Eastern Islands. In 2008, occasional on Sand Island. Observed at Midway Mall, but mostly found near the coast at places like the Old Fuel Farm and Bulky Dump. Not observed on Eastern Island. Rare on Spit Island, where a small plant was found on the southern tip of the island (Starr and Starr 2008). In 2015, this species was still occasionally observed in open areas on Sand Island. It was especially common in areas with hard packed substrate, such as the Runway Overrun, near the Fire Station, and by the Fuel Farm. Not observed on Eastern or Spit.

Hemerocallis sp. (Day lily) Liliaceae

A genus of about 13-15 from China, Korea, and Japan, many cultivars are known (Neal 1965). On Midway, previously known from literature (Herbst and Wagner 1992). Not observed since.

Hibiscus rosa-sinensis (Red Chinese hibiscus) Malvaceae

Native to China, the most common hibiscus used for hedges in Hawaii (Neal 1965). On Midway, previously recorded by Bruegmann (1998). In 1999 (Starr and Martz 1999), observed as cultivated in the town part of Sand Island. In 1999, the emerald beetles were studied, and as volunteers for the FWS part of our duties were to feed captive emerald beetles *Hibiscus* flowers and monitor how they developed. We usually got flowers from the trees just east of the FWS office. In 2008, *Hibiscus* was common in town, as a formally sheared hedge. Most of the flowers on Midway were red, but pink was present as well, including a giant pink-flowered tree *Hibiscus* right behind the Library in the Midway Mall, as well as one yellow flowered plant in the lawn near the gym. Collected at the Midway Mall (*Starr and Starr 080611-04* BISH) to document the presence on Midway (Starr and Starr 2008). By 2015, this ubiquitous ornamental had declined in abundance, mostly due to lead abatement activities around many of the structures in

Town. Additionally, many of the Hibiscus on Midway suffer from nutrient deficiencies given the sandy soil. And what appeared to be non-target effects of herbicide also seemed to be affecting the vigor of some of the plants.

Hibiscus sp. (Hibiscus) Malvaceae

Mentioned in previous surveys (1941, 1954, 1979). It is uncertain which species these are referring to.

Hibiscus tiliaceus (Hau) Malvaceae

Widespread in the tropics and subtropics worldwide. In Hawaii, known from Midway Atoll, French Frigate Shoals, and probably all of the main islands (Wagner et al. 1999). It is uncertain whether hau is indigenous or a Polynesian introduction. On Midway, Neff and DuMont (1955) collected (*26* BISH) this species in 1954 and add "Hau trees are to be found about the residential sector on Sand Island, and one or more near the old control tower on Eastern Island. Occasional specimens occur widely scattered about the Sand Island scrub." In 1999 (Starr and Martz 1999), semi-wild plants were observed spreading vegetatively from initial plantings on gun emplacements in the scrub between North Beach and the runway on Sand Island. In 2008, this sprawling plant was still expanding its range on Sand Island. Virtually every large gun emplacement on Sand Island seems to have had hau planted at the base of it, along with sea grape (*Coccoloba*) and tropical almond (*Terminalia*). From each of these plantings hau has spread and is now creating quite large thickets that are probably the most impenetrable thickets currently found on Midway. Although hau moves relatively slowly on Midway, without intervention and given time, many of the areas along West Beach will likely be completely overrun by this species, as has been done elsewhere in Hawaii. There is also a pretty impressive patch of hau at the northeastern base of Mt. Bart. Not observed on Eastern or Spit Islands (Starr and Starr 2008). In 2015, the hau patches remained in the same locations and continued to slowly creep out. They don't have quite the vigor on Midway as in the main Hawaiian islands, where it can be wetter and warmer. However the species is surviving and slowly spreading. Non-target herbicide effects were noticed on many of the hau patches. Though currently not providing useful habitat for many seabirds, hau could possibly provide structure for some species when the ironwoods along West Beach are removed later in 2015.

Hibiscus waimeae (White Hawaiian hibiscus, kokio keokoe) Malvaceae

Hibiscus with white fragrant flowers endemic to Waimea Canyon and the western and northern valleys of Kauai (Wagner et al. 1999). First observed on Midway in 2008, where a lone individual was cultivated in the lawn of the Midway House. This native hibiscus and some other native plants had recently been planted at the Midway House, brought in from Oahu Home Depot. The tree was a little over two meters tall and was surrounded by a two meter fence. The white flowers were blooming. Collected from the lawn of the Midway House (*Starr and Starr 080607-04* BISH) to document the presence

on Midway (Starr and Starr 2008). In 2015, the plant in the Midway House lawn was still present.

Hippeastrum sp. (Amaryllis ((cultivated)

Native to tropical America. Many forms are grown in gardens of Hawaii (Neal 1965). On Midway, previously known from literature (Herbst and Wagner 1992). Not observed since.

Hordeum murinum subsp. *leporinum* (Barley) Poaceae

Also known as *Hordeum leporinum*. *H. leporinum* now *H. murinum* subsp. *leporinum* (Wagner et al. 1999; Herbst and Clayton 1998). Native to Europe, and naturalized in North America; in Hawaii, naturalized in somewhat moist sites on Midway, Lanai, Maui, and Hawaii (Wagner et al. 1999). Collected by Caum in 1924 (*Caum 37* BISH) on Sand Island. Noted from Midway by Herbst and Wagner (1992). However, not reported or observed since. Photo by Rasbak (Wikipedia 2008).

Hylocereus undatus (Night blooming cereus) Cactaceae

Native to Central America and widely cultivated throughout the tropics; in Hawaii, widely cultivated and often spreading vegetatively on all of the main islands (Wagner et al. 1999). On Midway, previously known from literature (Herbst and Wagner 1992). Not recorded before or since.

Impatiens balsamina (Garden balsam, candlestick plant) Balsaminaceae

Native to southeastern Africa and grown in Hawaii for ornament (Neal 1965). On Midway, known only from 1999 (Starr and Martz 1999), where it was observed being cultivated near housing by barracks on Sand Island. Collected (*Starr and Martz 990421-17* BISH). Not observed before or since. Photo by Kurt Stueber (Wikipedia 2008).

Indigofera hendecaphylla (Creeping indigo) Fabaceae

Prostrate herb that is widespread from tropical Asia to Malesia and Australia; in Hawaii, introduced as a pasture legume, although it is poisonous to cattle, and now naturalized in dry disturbed areas on the islands of Kauai, Oahu, Molokai, Lanai, Maui, and Hawaii (Wagner et al. 1999; Herbst and Wagner 1999; Starr et al. 2002; Oppenheimer 2003; Herbst et al. 2004). In 2008, a small patch about 5 m wide was found in flower and fruit on the side of Hennessey Ave. near the incinerator building and collected (*Starr and Starr 080605-01* BISH) to document the presence on Midway. The patch was shown to FWS staff who planned to remove it shortly thereafter (Starr and Starr 2008). Not observed in 2015.

Ipomoea aquatica (Swamp cabbage, ung choi) Convolvulaceae

Pantropical in distribution and widely used in Asia for food. In Hawaii, cultivated and naturalized in wet areas such as streams or ponds on at least Oahu, Maui, and Hawaii (Imada et al. 2000; Wagner et al. 1999). On Midway, first recorded by Bruegmann (1998) as being cultivated on Sand Island. In 1999 (Starr and Martz 1999), this hollow stemmed vine was being cultivated in personal gardens on Sand Island for the edible leaves. It was generally grown in little water ponds lined with plastic. It was collected (*Starr and Martz 990511-4* BISH). In 2008, this plant was again found in gardens of residences and in the enclosed greenhouse. Though we saw no sign of spread on Midway, this species is a Federal Noxious Weed, and apparently was found in the newly created duck seep by the Baseball Field (Leona Laniawe pers. comm.). Those plants were removed with some difficulty, and though it was not known how it got there, it was surmised the plant was intentionally put in the seep by a Thai foreign national (Starr and Starr 2008). In 2015, there were four locations of this tasty water loving vine found, two in the Residences, one in the Hydroponics Greenhouse, and the other in the abandoned greenhouse by the Hydroponics. They were all being cultivated in pots.

Ipomoea batatas (Sweet potato) Convolvulaceae

Of American origin, pantropical in distribution and widely cultivated; introduced to Hawaii by the Polynesians and naturalized probably on all of the main islands but documented from Kauai, Oahu, and Hawaii (Wagner et al. 1999). On Midway, first recorded by Hadden (1941) as being cultivated in the vegetable garden. Also observed by Apfelbaum et al. (1983). Observed and collected by Bruegmann (1998). In 1999 (Starr and Martz 1999), it was observed as cultivated in personal gardens on Sand Island for the edible tuber, often growing with *I. aquatica*. A collection was made (*Starr and Martz 990510-2* BISH). In 2008, sweet potato was still cultivated on Sand Island, observed in the garden of 4208 Commodore Ave. (Starr and Starr 2008). Not observed in 2015, the garden at 4208 was virtually all gone, mostly due to lead abatement work.

Ipomoea indica (Koali awa, morning glory) Convolvulaceae

Also known as *Ipomoea indica* f. *indica*. Indigenous to the Hawaiian Islands and pantropical in distribution; occurring on Kure and Midway atolls, Lisianski, Laysan, Nihoa, and all of the main islands (Wagner et al. 1999). On Midway, first recorded in 1902 by W. A. Bryan from both Sand and Eastern Islands, where it was plentiful in the center of Eastern Island. In 1923, found by the Tanager Expedition on Sand Island only, where it was on the beach near the landing (Christophersen and Caum 1931). Collected in 1933 by Meagher. Neff and DuMont (1955) report collecting this species "growing profusely near residence on Sand Island." and add finding "Several plants growing near an old building in the revetment area on the south shore of the island." Collected (*Herbst 6433,6405* BISH) by Herbst in 1980 who noted, "Vine with blue flowers turning pink in

the afternoon, collected near pro-shop of the golf course; and vine with blue flowers turning pink in the afternoon, east side of island, growing over *Scaevola* shrubs, not common". Collected (*Conant 128* BISH) in 1983 by S. Conant (1983) who noted this species to be "common in the abandoned housing area on Midway." In 1999 (Starr and Martz 1999), what was determined to be this species was collected (*Starr and Martz 990507-1* BISH) near the old 6000 housing, probably the same area described by Conant, where it was sprawling down a hill into the lawn. It was also observed near the old church site. In 2005, material of this species was brought from Laysan to Midway (Klavitter 2006). In 2008, there appeared to be two distinct forms of *I. indica* on Midway, one that resembled the native form we have seen elsewhere in the NWHI, with lighter colored flowers, and one that more resembled ornamental forms, with dark purple flowers. The native looking form was most common near the Cemetery, at the base of the Midway House sign, and in the planter below the Midway Atoll welcome sign just east of the Hangar. The suspected ornamental form occurred around the Ave Maria and Captain Brooks (Starr and Starr 2008). In 2015, it was determined the bulk of the native looking form, with the lighter colored flowers, was Laysan material that had been propagated and planted in numerous locations. This form was present in many locations around Town, especially the Flag Field, by the Enlisted Housing Ponds, Ballfield Ponds, Midway Mall, and the Residences. Additionally, there was a location of a native looking form on the West Beach side of Frigate Point, that apparently recently appeared and hadn't been planted there (Greg Schubert pers. comm.). The dark purple ornamental forms were still present at Ave Maria, Radar Hill, and Captain Brooks. There was also a small population of the ornamental form on West Beach. It was once common on Eastern Island and may be a good additional ground cover to the nohu there.

Ipomoea pes-caprae ssp. *brasiliensis* (Beach morning glory)
Convolvulaceae

Indigenous to the Hawaiian Islands and pantropical in distribution; in Hawaii, occurring on beaches on Midway Atoll, Lisianski, Laysan, French Frigate Shoals, Nihoa, and all of the main islands (Wagner et al. 1999). On Midway, it was first observed in 1923 by the Tanager Expedition only on Sand Island where a few plants were found growing inland. Neff and DuMont (1955) collected this species, noting "Locally common, this plant is most often found in open sandy areas in the interior of both islands, or along the sandy upper beach-line." Other collections at Bishop Museum include those made in 1962 (*Frings 44*) from Eastern Island; 1964 (*Lamoureux 2812*) also from Eastern Island, southwest of boat dock near beach and in one spot halfway between dock and north point of island; and 1980 (*Herbst 6345*) from the southeast part of Sand Island. Conant (1983) reports "This attractive, indigenous morning-glory was quite rare on Sand Island...only one small colony (2 plants, each less than a meter long) in Area 7 and another, larger (2 sq. m) colony on the east side of the runway." During the 1995 survey, Bruegmann (1998) found this species as occasional on Sand Island and did not observe it on Eastern Island. In 1999 (Starr and Martz 1999), it was observed on both Sand and Eastern Islands. On Sand Island, it was common at Bulky Dump, South Beach, and Rusty Bucket. Scattered plants were also found elsewhere including the Harbor and in out-

planting sites. On Eastern, it was restricted to one site on the northeast tip of the island. It was absent from Spit Island. In 2008, beach morning glory was occasionally observed along the coast, especially along the south shore of Sand Island. It was also found in plantings in town, such as the FWS Office native plant garden. The plantings from 1999 at the Old Fuel Farm had established and that area had lots of this coastal vine, occasionally draping over the rusting rip-rap along the shore. It was also still found on the coast at Rusty Bucket and Bulky Dump. On Eastern Island, beach morning glory had spread over much of the eastern part of the north shore. It was also found in the newly created duck seeps. On Spit Island, there was one small plant near the coast and the south part of the island (Starr and Starr 2008). In 2015, beach morning-glory was once again present on Sand Island, especially near the coast. Patches were observed at Bulky Dump, along South Beach, the filled in seeps on West Beach, Cargo Pier, around the margins of the Harbor, and in scattered restoration plantings. The plants did look a bit ragged this survey, perhaps a combination of winter storm damage and non-target effects of weed control. Similarly, a few ragged plants were found closest to the ocean on the northeast coast on Eastern, much less than previously observed. It was not found on Spit this time.

Ipomoea triloba (Little bell) Convolvulaceae

Native to the West Indies; in Hawaii, known from Midway Atoll, Kauai, Oahu, Maui, and Hawaii (Oppenheimer and Bartlett 2002; Wagner et al. 1999). On Midway, collected by Herbst in 1980 (*Herbst 6443* BISH) and noted by Herbst and Wagner (1992). Not recorded during any other surveys.

Jasminum sambac (Pikake, Arabian jasmine) Oleaceae

Native to India, cultivated in Hawaii for their fragrant flowers (Neal 1965). On Midway, previously collected (*Conant 125* BISH) by Conant (1983) who notes "This fragrant, ornamental shrub was growing in the old greenhouse at the abandoned Pan Am Hotel." This was the only time this species was observed or collected on Midway.

Juniperus bermudiana (Bermuda juniper) Cupressaceae

Endemic to Bermuda (Wikipedia 2008). In Hawaii, naturalized on West Maui from mesic forests and shrublands around 1,000 ft. elevation, possibly spread by fruit eating birds (Oppenheimer 2002b). First collected on Midway in 1962 (*Lamoureux 2221* NMNH). During the 1999 survey (Starr and Martz 1999), two trees were observed, as *Cupressus* sp., on Sand Island, one by the Clipper House restaurant and one by the marine barracks. In 2008, the same two trees were still persisting, however they were now placed in *Juniperus bermudiana*, based on learning of Lamoureux's collection and a pretty good fit with the description of the species. Collections were made from both trees (*Starr and Starr 080604-02, 080610-03* BISH) to further document the presence of this enigmatic conifer on Midway and help pin down the identity (Starr and Starr 2008). In 2015, the two trees remained, one by the Marine Barracks and one between the Clipper House the Ballfield Seep. No signs of spread were observed.

Kalanchoe fedtschenkoi (Air plant) Crassulaceae

Also known as *Bryophyllum fedtschenkoi*. Native to Madagascar. In Hawaii, cultivated in rock gardens (Neal 1965). On Midway, first collected in 1999 (*Starr and Martz 990429-11* BISH) from a cultivated plant on Sand Island. It was rare in distribution (Starr and Martz 1999). In 2008, a lone plant in a pot at the Ave Maria was observed. Not observed in 2015.

Kalanchoe daigremontiana x *tubiflora* (Kalanchoe hybrid) Crassulaceae

Previously recorded as cultivated (Herbst and Wagner 1992). Not observed since.

Kalanchoe pinnata (Air plant) Crassulaceae

Native range unknown but widely established in tropical areas; in Hawaii naturalized on all the main islands except Kahoolawe (Wagner et al. 1999). On Midway, observed previously in 1979 (Apfelbaum et al. 1983) and in 1995 (Bruegmann 1998). In 1999, it was observed at the abandoned Pacific Cable Company buildings. It was also used as a potted plant in the residential areas and at the Hangar. In 2008, it was observed around residences, including the Midway House, where it was persisting and spreading. This species can be quite invasive and should probably be removed from Midway (Starr and Starr 2008). In 2015, just a few unhealthy plants were observed, in pots at a couple of the Residences.

Kalanchoe tubiflora (Chandelier plant) Crassulaceae

Native to Madagascar; in Hawaii, naturalized on Kauai, Oahu, Lanai, Maui, and Hawaii. Perhaps this is the same plant as above (*K. daigremontiana* x *tubiflora*). First observed on Midway in 1999 (Starr and Martz 1999), where it was considered rare in the residential area of Sand Island. In 2008, a lone plant in a pot was observed at 416 Commodore Ave. Collected (*Starr and Starr 080601-07* BISH) to document the presence of *K. tubliflora* on Midway. This is another *Kalanchoe* that is able to establish in the wild. It would be easy enough to dispose of the lone known plant on Midway, before it has the opportunity to spread beyond the garden (Starr and Starr 2008). In 2015, only observed at 4209 Commodore Ave. in a pot.

Lactuca sativa (Lettuce) Asteraceae

Possibly derived from a European weed, grown for its edible leaves (Neal 1965). Recorded for the first time in 1999 (Starr and Martz 1999). It was cultivated in the personal gardens of the residential area and in the hydroponics facility on Sand Island. Collected (*Starr and Martz 990429-16* BISH). Not observed in 2008, except in the Clipper House for lunch and dinner, and that was presumably flown in from Hawaii. Though likely to be cultivated again soon as the Hydroponics Greenhouse was just getting

revamped and planned to cultivate lettuce again (Starr and Starr 2008). In 2015, four varieties of lettuce were vigorously growing in the Hydroponics Greenhouse and were served at every lunch and dinner.

Lantana camara (Lantana) Verbenaceae

Probably native to the West Indies, now widely distributed; in Hawaii, this thorny shrub is also widely naturalized and is now a serious weed, occurring on Midway Atoll and all of the main islands (Wagner et al. 1999). On Midway, first collected in 1933 by Meagher. Recorded by Neff and DuMont (1955) who found this plant "only as a hedge and ornamental plant in the residential and administrative area of Sand Island." Also observed in 1979 (Apfelbaum et al. 1983). Collected again in 1980 by Herbst from Sand Island and noted it as occasional (*Herbst 6385* BISH). In 1995, Bruegmann (1998) listed it as occasional and naturalized on Sand Island. In 1999 (Starr and Martz 1999), *Lantana* was considered occasional on Sand Island. It was not observed on Eastern or Spit Island. It was mentioned this was another species that appeared to have been planted as an ornamental, spread beyond the confines of the garden, and become sparingly naturalized. On Sand Island, this thorny shrub was found scattered in several areas, but was nowhere found in high densities, yet. Not observed on Eastern or Spit Islands. In 2008, *Lantana* had increased in both distribution and density on Sand Island. *Lantana* was again locally common south of the Cemetery and northeast of the Seaplane Hangar, but it was getting harder to navigate through the ever enlarging thorny thickets, which were in heavily burrowed fields. There were also smaller patches behind residences on Commodore Ave., on Radar Hill, west of the Tug Pier, and north of the Dump Pond. *Lantana* is said to be so dense in the Galapagos that the petrels are inhibited from burrowing in infested areas. If left unchecked *Lantana* could spread much further than its current distribution on Midway. Some control measures have been taken to remove *Lantana* from Midway, but much remains. It would make sense to continue focused efforts to remove all the *Lantana* from Midway. Non-native common mynah birds (*Acridotheres tristis*) probably aid in the dispersal of *Lantana* on Midway. Removing the mynah birds would likely decrease the long-distance dispersal of *Lantana* (Starr and Starr 2008). In 2015, there was amazingly only one *Lantana* plant noted, near the Tugboat Pier. The massive reduction in distribution was due to a concerted control effort. It is not known how long the seedbank of *Lantana* remains viable, but this species is very close to becoming eradicated.

Lathyrus odoratus (Sweat pea) Fabaceae

Native to northern temperate regions and also from South America and Africa, widely cultivated in Hawaii and elsewhere for ornament. First observed and collected on Midway in 1999 (Starr and Martz 1999) in the planter box at the Boathouse on Sand Island (*Starr and Martz 990421-5* BISH). This was one of many non-native plants recently brought in to make the atoll more attractive to visitors. Not observed in 2008, the planter box now has native beach morning glory growing out of it (Starr and Starr 2008). Not observed in 2015, the planter box appeared abandoned.

Lepidium bidentatum var. *o-waihiense* (Anaunau) Brassicaceae

Also known as *Lepidium o-waihiense*. Variety endemic to the Hawaiian Islands. Previously known from Kure, Midway, and Pearl and Hermes Atolls, Laysan, Kauai, Oahu, Molokai, Lanai, Maui, and Hawaii (Wagner et al. 1999). Now presumed extinct on Kure, Midway, and Laysan. Also becoming rare on the main islands. On Midway, first collected from Eastern Island by Bryan in 1902. Collected by the Tanager Expedition on Eastern Island in 1923 where it was common in the central plain, but also observed as not uncommon on Sand Island. Collected by Long in 1964 (*Long 2259* NMNH) on Eastern Island on the NW side of the East-West runway. Collected by Herbst in 1980 (*Herbst 6406* BISH) also from Eastern Island, where he found a single large colony on the southeast corner of the island. Not observed since 1980. Not seen in 1999 survey. In June of 1999, seeds were collected from Pearl and Hermes and propagated in the Midway nursery for future out-planting at Midway Atoll. In 2005, reintroduced to Midway from Laysan (Klavitter 2006). In 2008, there were no signs of the native *Lepidium* on Midway or any progeny of the seeds that had been brought from Pearl and Hermes or Laysan. Given the close similarity between the native *L. bidentatum* and the non-native *L. virginicum*, managing any potential re-introductions of *L. bidentatum* will always be challenging. Perhaps an intense search on Eastern Island in the areas where it was last seen could be done (Starr and Starr 2008). In 2010, seeds were introduced from Laysan (John Klavitter, Greg Schubert, and Penny Knuckles pers. comm.). However, they did not do well and were only able to produce a few plants. Some of these were outplanted on Eastern in 2014 and there was a plant in the greenhouse that produced a few more seedlings more recently. In 2015, this species was not observed. There continued to be talk of attempting to reintroduce it yet again to Midway, yet potential efforts are tempered by the abundance and similar appearance and structure of the widespread *L. virginicum*, and the lack of establishment of the species the previous times it was attempted.

Lepidium virginicum (Pepper grass) Brassicaceae

Native to eastern United States; in Hawaii known from Midway Atoll, Kauai, Oahu, Molokai, Maui, and Hawaii (Wagner et al. 1999; Lorence et al. 1995). On Midway, first collected by Meagher in 1933. Also collected in 1940 by Bianchi and in 1954 by Neff and DuMont (1955) who note "Rare, only two or three plants noted on each of the islands." Also collected by Frings in 1962 and Lamoureux in 1964. Also observed by Apfelbaum et al. in 1979. Collected again in 1980 by Herbst. Noted as common on Sand Island by Bruegmann (1998) in 1995. In 1999 (Starr and Martz 1999), found to be widespread on Sand Island, a common weed in lawns and waste places, but not found on Eastern or Spit Islands. In 2008, this cosmopolitan weed was common to dominant in the lawns of Sand Island, especially around town. The canaries, which are much more abundant now that the rats are gone, seem very fond of the seeds of this species (Starr and Starr 2008). In 2015, this species was once again abundant on Sand Island, despite recent efforts to keep it in check. Observed in most lawns and many open areas, large patches of

it were observed around Town, Bart Hill, West Beach, and the Marine Barracks. Not observed on Eastern or Spit.

Leptochloa uninervia (Sprangletop) Poaceae

Native to warmer regions of the Americas (Wagner et al. 1999). Sprangletop is weedy in wetlands and water ditches on the main Hawaiian Islands. Previously not recorded from Midway. In 1999 (Starr and Martz 1999), a single plant was observed and collected (*Starr and Martz 990507-3* BISH) from a moist area on a hill near the NAF Hangar on Sand Island. This collection represented a new island record for Midway Atoll (Starr and Martz 2000). In 2008, this area was searched and no plants were observed (Starr and Starr 2008). Not observed in 2015.

Lepturus repens (Lepturus) Poaceae

Native to the Mascarene Islands, Sri Lanka, Malaysia, northern Australia, and Polynesia; in Hawaii occurring near the high tide line in coastal areas of Kure, Midway, and Pearl and Hermes atolls, Lisianski, Laysan, and French Frigate Shoals (Wagner et al. 1999). In 1902, collected from Midway on both Sand and Eastern Islands (*W.A. Bryan s.n.* BISH), where it was noted as common in bunches on Sand Island. It was not observed by the Tanager Expedition in 1923. Other collections at Bishop Museum include (*C.R. Long 2490, 2491*; *Herbst and Takeuchi 6417*). Observed in 1979 (Apfelbaum et al. 1983). Observed as rare on Sand Island in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), occurring on Sand, Eastern, and Spit Islands where it was found at the extreme coastal edge of the vegetation line. On Sand Island, it was occasional to common on the north and west beaches. On Eastern Island, it was found along the north shore, especially west of the dock. On Spit Island, it was restricted to the north section. In 2008, this grass was present on all three islands, but not in large numbers. Apparently, the plant is an annual and is more abundant in the winter months (Greg Schubert pers. comm.). On Sand Island, there was a single plant in a crack on the finger piers, perhaps a contaminant that hitched over from Eastern Island. No other plants were observed on Sand Island. Though, we did not search the vegetation along the western and southern beaches extensively due to access restrictions and it could have been overlooked in these areas. A planting spot on West Beach by the new duck seeps was visited, but the plants had not persisted. On Eastern Island, this grass was more abundant, and could be found along the most coastal portions of the northern shore, being most abundant at the extreme east and west tips of the north shore. On Spit Island, this curious grass was again most common at the extreme tips of the island, growing closer than any other species to the ocean (Starr and Starr 2008). In 2015, *Lepturus* was only observed in abundance on the northern coast of Eastern Island, where it was usually the closest plants to the ocean. Most of the plants looked dead, but as mentioned by Greg Schubert, and as we witnessed on Laysan in September of 2013, *Lepturus* greens up later in the year. On Spit, there were a few plants observed near the eastern coast that were brown. Not observed in the wild on Sand Island, though only the northern coast was surveyed completely, due to access restrictions along other beaches. There were a dozen or so clumps growing in pots in the FWS

Greenhouse, having been brought over from Eastern Island to outplant elsewhere (Klavitter et al. pers. comm.).

Leucaena leucocephala (Koa haole, haole koa) Fabaceae

Also known as *Leucaena glauca*. Native to the Neotropics, cultivated for various uses including fodder, firewood, and erosion control; in Hawaii, naturalized and very common, sometimes forming the dominant element of the vegetation, on Midway Atoll and all of the main islands (Wagner et al. 1999). On Midway, first collected by Meagher in 1933. Previously recorded by Neff and DuMont (1955) who report that in 1954, "The only plant seen was growing on the lawn of the Administration Building on Sand Island." It was also observed in 1979 (Apfelbaum et al. 1983), collected by Herbst in 1980, and by 1995 was recorded as occasional on Sand Island (Bruegmann 1998). In 1999 (Starr and Martz 1999), occasionally found in waste and urban areas on Sand Island, where it was well established at Midway, but did not appear to have come close to filling its potential range yet. In 2008, *Leucaena* was still widely dispersed across Sand Island, but had established some pretty large patches in areas where it was previously just spotty. One area of note was between the Cemetery and Henderson Rd., an area that looked unlike most any other on Midway, with a just above head height canopy of *Leucaena* forming a dog hair thicket over a pretty large area. Interestingly, *Leucaena* was also intentionally cultivated on Midway. Sak, a Thai worker who has been on the island since 1982, was cultivating *Leucaena* in his garden at the Water Plant. Sak showed us how he would eat the green *Leucaena* seeds and pods, splitting a pod in front of his mouth and having all the seeds fall into his mouth. The green seeds were actually not bad, similar to edamame (soy beans). The green seed pods weren't nearly as good, having that peculiar smell that *Leucaena* foliage makes when it is damaged. The eating of *Leucaena* seeds or other plant parts should likely be done in moderation, or not at all, as apparently horses that eat too much *Leucaena* will start loosing the hair in their manes and tails (Robert Hobdy pers. comm.). Getting rid of *Leucaena* on Midway will take a long term effort, but is seemingly important for the seabirds given the proven ability of *Leucaena* to dominate portions of the island and exclude albatrosses. The FWS currently controls *Leucaena* in areas they are actively managing, but the current staff level does not allow for island wide control. Additionally the long-lived seed bank and intentional cultivation may complicate control efforts. Not yet observed on Eastern or Spit Islands (Starr and Starr 2008). In 2015, the distribution of *Leucaena* on Midway was way down, due to control efforts. We were only able to locate a few small plants, all near previously known patches, including West Beach, Doctors Cemetery, Residences, and under the ironwoods inland of the Cargo Pier. We would have never anticipated the level of control that has been achieved, given how entrenched the species was on Midway. It will be interesting to see how long the seed bank lasts, and if the current level of control can be maintained.

Lobularia maritima (Sweet alyssum) Brassicaceae

Native to Eurasia; in Hawaii, a common ornamental now naturalized on Kure, Midway, Oahu, Molokai, and Maui (Wagner et al. 1999; Wagner and Herbst 1995; Hughes 1995). First noted on Midway by Hadden in 1941. On Midway, Neff and DuMont (1955) found "Sweet alyssum grows in abundance over large portions of both Sand and Eastern Islands." Also observed in 1979 (Apfelbaum et al. 1983). Conant (1983) collected (*Conant 136* BISH) this plant and adds "This common, naturalized ornamental has been on Midway for several decades, and continues to maintain itself". By 1995, Bruegmann (1998) reported sweet alyssum as common to dominant on Sand, Eastern, and Spit Islands. Similarly, in 1999 (Starr and Martz 1999), this fragrant crawler was found to be common to dominant in many areas of Sand, Eastern, and Spit Islands. And, again, in 2008, sweet alyssum was the dominant groundcover in many areas of the atoll, on Sand, Eastern, and Spit Islands (Starr and Starr 2008). In 2015, sweet alyssum was again the dominant cover over much of Sand and Eastern islands. One small seedling was found and pulled on Spit. Sweet alyssum has many positive attributes and is being tolerated in areas where active control work is occurring. However, the species does little to hold the soil and walking through areas on Sand Island dominated by sweet alyssum is treacherous, as there are now so many Bonin Petrel burrows under foot that are much more prone to collapse than in areas dominated by better soil binders like Bermuda grass.

Macroptilium lathyroides (Cow pea) Fabaceae

Native to the Neotropics, in Hawaii, introduced for fodder and now naturalized on all the main islands and Nihoa (Wagner et al 1999). Aspey (2012) is the first to report this species from Midway, noting one patch growing on the south side of the most easterly concrete inspection ramp of the Seaplane Hangar. A collection was made to document the presence on Midway (*Aspey s.n.*, *Starr 150404-07* BISH). In 2015, the location was surveyed. The area, an unloading dock for gravel and other items, had been recently sprayed and there were no living plants in the area. The Aspey collection had fertile material, so a seedbank could potentially persist. Not observed at the collection site or anywhere else in 2015.

Majorana hortensis (Sweet marjoram) Lamiaceae

Cultivated in Hawaii (Neal 1965). First recorded on Midway in 1999 (Starr and Martz 1999) where it was cultivated in a pot on Sand Island. Not observed since. Photo by Raul654 (Wikipedia 2008).

Malva parviflora (Cheese weed) Malvaceae

Native from the Mediterranean region through Asia Minor to India, a weed throughout the world. In Hawaii, naturalized in disturbed areas on French Frigate Shoals and all of the main islands. Reported in Apfelbaum et al. (1983). Collected in 1988 (*Herbst and Takeuchi 9077* BISH). Noted by Bruegmann as rare on Sand Island (Bruegmann 1998). In 1999 (Starr and Martz 1999), found to be occasional in areas near the fuel farm on Sand Island. Collected in 2001 (*Starr and Martz 010520-1* BISH), representing a new naturalized record for Midway Atoll (Starr *et al*. 2004). Apparently in the years just prior to 2008, cheese weed had gotten out of control on Midway, getting up to chest height in areas like the field north of the Midway House (Greg Schubert pers. comm.). The FWS then targeted cheese weed and brought it back under control. In 2008, it was only occasionally found scattered about the lawn areas of Sand Island, including near Charlie barracks, the field across from Charlie barracks adjacent to the Midway House, and the field at the Ave Maria (Starr and Starr 2008). In 2015, only one small patch was observed, near the Underground Hospital between Radar Hill and the Taxiway. This species is close to being eradicated if control continues.

Malvastrum coromandelianum subsp. *coromandelianum* (False mallow) Malvaceae

Also known as *Malvastrum coromandelianum*. Pantropical in distribution; in Hawaii, documented from Midway Atoll and all of the main islands (Wagner et al. 1999). On Midway, first collected by Chisholm in 1931 and by Meagher in 1933. Neff and DuMont (1955) note "Occasional plants may be found about the residential area on Sand Island, and two or three are growing near the old control tower on Eastern." Collected in 1979 (Apfelbaum et al. 1998). Collected by Herbst in 1980 (*Herbst 6353* BISH) from Sand Island near the old hangar. Also collected (Conant 118 BISH) in 1983 by S. Conant who notes "This weedy plant was collected on Roosevelt Avenue past the cemetery...It is not particularly common on the island." Listed as occasional on Sand Island in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), occasionally found it in lawn areas on Sand Island. No *Malvaceae* found on Eastern or Spit Islands, including this species. In 2008, a few plants were found in the abandoned looking planters by one of the 400 houses on Halsey Dr. (Starr and Starr 2008). In 2015, observed by the Harbor and the Residences.

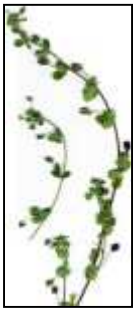
Malvaviscus penduliflorus (Turk's cap) Malvaceae

Plants on Midway had been referred to as *Malvaviscus arboreus*, however the flowers on the Midway plants are pendulous, not erect. It is not known if perhaps true *P. arboreus* existed on Midway, or more likely that this is just an artifact of name changes over time. Native probably to Mexico and now widely cultivated. In Hawaii, cultivated and sparingly naturalized at least on Kauai, Maui, and Hawaii (Wagner et al. 1999). On Midway, previously recorded in 1979 (Apfelbaum et al. 1983). Also recorded by Bruegmann in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), it was cultivated in the residential areas, and sparingly naturalized in and near the courtyard of the abandoned Cable Company buildings. In 2008, this sprawling hibiscus-like plant that never fully unfurls it's hanging red flowers was still common in the town and residential areas of Sand Island, where it was generally sheared to keep it in check. There was still a pretty large patch between some of the Cable Company buildings. Collected at the housing on Halsey Dr. (*Starr and Starr 080601-13* BISH) to document the presence on Midway. This plant does not seem to spread far, but can take over ground, excluding albatross. Additionally, if Midway were to be abandoned, this is likely one of the species that would begin claiming new ground (Starr and Starr 2008). In 2015, this sprawling hibiscus like plant was persisting in the Residences area of Sand Island. This species seems to have less nutrient deficiency issues than most of the true Hibiscus on Midway. However, some of the leaves were showing signs of potential non-target effects of herbicide. The thickets appear to be regularly cut back, keeping them in check for the time being.

Mangifera indica (Mango) Anacardiaceae

Native to Asia; in Hawaii, first introduced from Mexico in the early 1800's and often becoming naturalized in valleys (Wagner et al. 1999). On Midway, recorded by Apfelbaum et al. (1983) during their survey in 1979. Bruegmann did not observe mango in 1995 (Bruegmann 1998), nor was it observed in 1999 (Starr and Martz 1999). In 2008, two mango starts about a foot tall were noted, one in the FWS greenhouse and another in the yard of 4208 Commodore Ave. (Starr and Starr 2008). Not observed in 2015.

Medicago lupulina (Black medick) Fabaceae



Native to Europe and temperate Asia. In Hawaii, documented from Midway Atoll, Kauai, Oahu, Maui, and Hawaii (Wagner et al. 1999; Lorence et al. 1995). On Midway, previously recorded during a survey in 1954 by Neff and DuMont who note that "Fosberg found it growing as an escape from a lawn. We found a few specimens about the residential area, on Sand Island." Noted as common on Sand Island in 1995 (Bruegmann 1998). In 1999, found to be common in grassy areas of Sand Island (Starr and Martz 1999). In 2008, this yellow flowered trifoliate creeper with black fruits was still common on Sand Island, found in the lawns of town and other open areas. Collected by the housing on Halsey Dr. (*Starr and Starr 080601-17* BISH) to document

the presence on Midway (Starr and Starr 2008). In 2015, it was still common in open areas. Observed by the Residences, Bart Hill, and West Beach. Additionally, it was very abundant around some gravel piles on the Abandoned Runway between the Water Tanks and West Beach.

Medicago orbicularis (Blackdisk medick) Fabaceae

Native to Africa, temperate and tropical Asia, and Europe (GRIN 2008). Cultivated for forage and naturalized in southern United States. Collected once in 1911 by C. Wilkes. Not observed since.

Medicago polymorpha (Bur clover) Fabaceae

Native to Europe and temperate Asia to China and Japan, also in northern India, widely cultivated for fodder; in Hawaii, naturalized on Midway Atoll, Kauai, Oahu, Lanai, Maui, and Hawaii (Wagner et al. 1999; Bruegmann 1999). First collected (*Bruegmann 2013* BISH) from Midway in 1995 (Bruegmann 1999). Observed in 1999 (Starr and Martz 1999), as occasional in lawns on Sand Island. Not observed in 2008. In 2015, sparingly observed in lawns near Residences.

Medicago sativa (Alfalfa) Fabaceae

Native to Europe; in Hawaii, cultivated and naturalized on Midway Atoll, Kauai, Oahu, Lanai, Maui, and Hawaii (Wagner et al. 1999; Oppenheimer et al. 1999; Wagner and Herbst 1995; Wagner et al. 1997). On Midway, collected by Meagher in 1933 and recorded by Hadden (1941). It has not been observed since. Photo by Fir0002 (Wikipedia 2008).

Megathyrsus maximus (Guinea grass) Poaceae

Also known as *Panicum maximum* and *Urochloa maxima*. Native to Africa; in Hawaii, common on all of the main islands (Wagner et al. 1999) and now also known from Midway (Starr *et al*. 2002). First observed on Midway in 1995, on Sand Island (Bruegmann 1998). In 1999, one small patch was observed on Sand Island, west of the northwest corner of the harbor. This grass was noted to be currently restricted to one small patch, but had the potential to expand its range. Control efforts were made by FWS. Collected in 1999 (*Starr and Martz 990505-11* BISH), representing a new island record for Midway Atoll. In 2008, this robust grass was found in the same spot by the harbor, but the large patch had become a smaller, more dispersed patch. Another patch about 5m x 5m was found along the N/S runway near Rusty Bucket. The FWS planned to continue controlling this grass (Starr and Starr 2008). In 2015, this grass was not observed, despite searches in the previously known locations. Presumed eradicated or in very low distribution.

Melilotus alba (White sweet clover) Fabaceae

Native to Europe, widely cultivated for fodder; in Hawaii, naturalized on Midway Atoll, Molokai, Maui, and Hawaii (Wagner et al. 1999; Shannon and Wagner 1996; Wagner and Herbst 1995). On Midway, first collected in 1980 (*Herbst and Takeuchi 6368* BISH). In 1999, one small patch was observed in a lawn near the Fuel Farm on Sand Island. Not observed since.

Melilotus indica (Sweet clover) Fabaceae

Native from the Mediterranean region and southwestern Europe to India. In Hawaii, naturalized on Midway Atoll, Kauai, Oahu, Maui, and Hawaii (Wagner et al. 1999). On Midway, previously listed by Herbst and Wagner (1992). Recorded as rare on both Sand and Eastern Island in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), found to be occasional to common in lawn areas on Sand Island, and not observed on Eastern Island. In 2008, observed in the lawns on Sand Island, growing in and amongst *Medicago lupulina* (Starr and Starr 2008). In 2015, once again a component of lawns and open areas, especially around Town, the Residences, and the Cargo Pier.

Melinis repens (Natal red top) Poaceae

Also known as *Rhynchelytrum repens*, *R. roseum*, *Tricholaena rosea*, and *T. repens*. Taxonomic name change to *Melinis repens* (Wagner et al. 1999, Herbst and Clayton 1998). Native to Africa, now widely naturalized throughout the tropics; in Hawaii, on Midway and all of the main islands (Wagner et al. 1999). On Midway, in 1954, considered rare, being found (*Neff and DuMont 17* BISH) in only two or three small areas on the older, undisturbed part of Sand Island (Neff and DuMont 1955). In 1962, collected on Sand Island by C. H. Lamoureux (*2161* BISH) who found it as a weed by the roadside in the northeastern part of wooded polygon east of Administration Building and north of Sea-Air rescue Hangar. Observed in 1979 by Apfelbaum et al. (1983). In 1980, D. Herbst and W. Takeuchi (*6339* BISH) collected it as an uncommon weed on Sand Island (Bruegmann 1998). Not observed 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), two small patches were observed, one west of the northeast corner of the harbor and the other on the east side of the north-south runway north of the cart trail. Not observed in 2008, including the two locations it was previously known from (Starr and Starr 2008). Not observed in 2015. Presumed eradicated or in very low distribution.

Mentha x *spicata* (Mint) Lamiaceae

Native to Eurasia and Australia. In Hawaii, cultivated for food (Wagner et al. 1999). Mints are a taxonomically challenging group with many similar species that hybridize and are virtually indistinguishable without fertile material. Mint was first recorded on Midway in 1999 (Starr and Martz 1999), where it was cultivated on Sand Island. Collected in 1999 (*Starr and Martz 990428-2* BISH) and determined by Bishop Museum to be close to the species *M. aquatica*. In 2008, the mints were still cultivated in gardens, and had begun to spread beyond the garden vegetatively, especially at the Community Garden and the Greenhouse. More work could be done to determine the identities of the different mints on Midway, by collecting fertile material from the myriad of forms found there. Regardless of the exact identity of the mints on Midway, plants that display invasive tendencies, such as spreading beyond where they are planted, should probably be removed from the island (Starr and Starr 2008). In 2015, mint continued to be cultivated and established near the Community Garden on Midway. It was also cultivated in the Residences. It is uncertain how far the species could spread beyond gardens on Midway, given the harsh growing conditions. However, the mint is still surviving in multiple locations.

Merremia tuberosa (Wood rose) Convolvulaceae

Pantropical in distribution; in Hawaii known from all of the main islands (Wagner et al. 1999). On Midway, noted by Herbst and Wagner (1992) but not recorded during any other surveys.

Mirabilis jalapa (Four o'clock) Nyctaginaceae

Native to tropical America, cultivated for medicinal and ornamental purposes, now widely naturalized and pantropical; in Hawaii, naturalized on Midway Atoll, Kauai, Oahu, Lanai, Maui, and Hawaii (Wagner et al. 1999). Collected by Herbst and Takeuchi in 1980 (*Herbst and Takeuchi 6435* NMNH) from the northeast part of Sand Island near the dump. Previously listed by Herbst and Wagner (1992) and observed as rare and naturalized on Sand Island by Bruegmann (1998). In 1999 (Starr and Martz 1999), it was persisting in the lawn areas near the north part of Sand Island. In 2008, *Mirabilis* was found persisting in semi-shaded areas in the residences, despite recent attempts by folks to kill it by cutting it to the ground. Also, found persisting at the Cable Company Buildings, and in a small patch on the east side of the cart path that goes to the Aviary Seep (Starr and Starr 2008). In 2015, the planting at the 4208 house was persisting and continued to regrow, even after repeated control efforts. A young group of seedlings that had recently germinated were observed and pulled under the ironwoods on the road to the now abandoned Aviary Seep.

Momordica charantia (Balsam pear, bitter melon) Cucurbitaceae

Native from tropical Africa to Australia. In Hawaii, widely cultivated and naturalized on all of the main islands (Wagner et al. 1999). Recorded from the first time in 1999 (Starr and Martz 1999), where it was cultivated in the residential area of Sand Island and collected (*Starr and Martz 990421-11* BISH) from escaping plants near there, where plants were starting to germinate in lawns and waste areas, likely with the potential to spread far beyond the current plantings. Published as a new island record for Midway Atoll (Starr and Martz 2000). In 2008, there were only two locations of this vine found on Sand Island, one at 415 Commodore Ave. growing on a chain link fence. The other at the Water Plant, where a single vigorous fruiting specimen was climbing up a nearby papaya tree. This may be a good species to try and get rid of on Midway, and to place on the prohibited plants list for Midway (Starr and Starr 2008). In the June 2012, Google Street View, a sprawling *Momordica* vine was still present at the Water Plant. In 2015, the vine at the Water Plant was gone, and the only *Momordica* observed was a lone plant growing in the Residences at house 418. No seedlings were observed, though we have observed seedlings in the lawn at that same general area back in 1999.

Monstera deliciosa (Monstera) Araceae

Native to tropical America, one of the more common species of *Monstera* cultivated in Hawaii (Neal 1965). On Midway, historically known from literature (Herbst and Wagner 1992) and observed by Bruegmann (1998). In 1999 (Starr and Martz 1999), it was observed as cultivated in the housing area of Sand Island. In 2008, it at first appeared there was a vine of monstera on a tree near the Cable Company buildings on Sand Island. A collection was made (*Starr and Starr 080610-01* BISH), but further investigation of images and specimen resulted in an identification of golden pothos (*Epipremnum pinnatum*), leading to a finding of no monstera observed on Midway in 2008 (Starr and Starr 2008). Not observed in 2015 either. Presumed eradicated from Midway.

Moringa oleifera (Ben tree, drumstick tree) Fabaceae

Native to tropical Africa or India. In Hawaii, grown for ornament, food, and many other uses (Neal 1965). First recorded from Midway in 1999 (Starr and Martz 1999), where it was cultivated in the residential area of Sand Island. Collected (*Starr and Martz 990622-2* BISH) to document presence on Midway. In 2008, this species was still cultivated on Midway, in the town and residences of Sand Island, with some very large trees around the Community Garden (Starr and Starr 2008). In 2015, the trees had not yet leaved out after winter, were suffering from an apparently abnormally dry winter, or possibly had been affected by herbicide applied below them. Whatever the cause, most of the Moringa trees on Midway looked sickly and barely alive. This is a very hardy tree and despite the unkempt appearance, most of the trees known from 2008 were still alive in

2015. As with many plants on Midway, the trees did not appear cared for or regularly harvested from. No signs of spread have ever been noted.

Morus alba (White mulberry) Moraceae

Native to China, widely cultivated. In Hawaii, sparingly naturalized on Kauai, Oahu, Molokai, Maui, and Hawaii (Wagner et al. 1999). On Midway, Neff and DuMont (1955) note, "Reported by Hadden as growing here; we did not find it but Fosberg located an unhealthy-looking specimen growing in an opening in the scrub on Sand Island". Later, it was one of the species planted near gun emplacements. In 1999 (Starr and Martz 1999), it was observed on Sand Island near gun emplacements, and in the town area. In 2008, a few specimens were observed, mostly in town. One plant was just east of the FWS office, it had a few ripe fruit that tasted fine. Another tree with really chlorotic leaves was observed by the Cable Company Buildings, it too had a few ripe fruit. It was also located in the Ave Maria field on the Radford St. side. Occasionally, it was also found on gun emplacements in the area just south of the radar field (Starr and Starr 2008). In 2015, three locations of this species were observed, east of the FWS Office, between the Water Tower and the Community Garden, and by the Gun Emplacement near the Doctor Cemetery. A few fruit were tasted and were juicy albeit tart, since they weren't quite ripe yet and the Mynah Birds and Common Canaries were quick to snatch them up. Laysan Ducks were observed under the trees by the FWS Office / Old Internet Cafe, they appeared to either be eating fruit that had fallen from the tree, or bugs found under the tree.

Murraya paniculata (Mock orange) Rutaceae

Native from India to the Philippines and the East Indies, cultivated in Hawaii (Neal 1965). On Midway, first recorded by Hadden (1941) as being cultivated. Neff and DuMont (1955) collected this plant (*53* BISH), noting "Seen only as a planted hedge in the residential area on Sand Island." It was observed for the last time in 1979 by Apfelbaum et al. (1983). Not observed since.

Musa x *paradisiaca* (Banana) Musaceae

Said to have originated from India (Neal 1965). Many species of *Musa* are cultivated in Hawaii. Mr. Steadman, the gardener for Pan-American Airways in 1936, planted many vegetables, including banana. In 1941, Hadden reported that banana could be grown if protected from the winds. Neff and DuMont (1955) note banana as, "Few plants were found on Sand Island in the older area near the Cable Company and Pan-American buildings, and an occasional one as an ornamental about a residence. They appear to be surviving but not thriving." Also observed in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), observed in cultivation near residences on Sand Island. In 2008, bananas were found in small patches in the town areas. The bananas did not seem

particularly exceptional, mostly an odd blueish tinged fruit variety not seen much in the main Hawaiian Islands. The patches seem to have gotten larger, especially around the community garden, and some looked abandoned. Bananas were regrowing in the "mulch pile" off Roberts St. by the harbor. A collection was made (*Starr and Starr 080601-11*), but was thrown out after noticing the HDOA import regulations declare it is illegal to bring banana plant parts into the state of Hawaii from Midway (Starr and Starr 2008). In 2015, there were less banana patches than in 2008, and most of the plants look unkempt and in ill-health. The largest patches were still by the Community Garden, with a few scattered, much smaller, patches around the Residences. There again appeared to be two varieties of bananas, one with glaucous-blue fruit and closed leaf petiole canals, that is likely 'Ice Cream' or a similar variety in the Bluggoe group. The other, with more familiar looking bananas and a more open leaf petiole canal is likely the 'Hawaiian Apple' variety of the Pome group. None of the banana plants appeared to be thriving. Most looked abandoned and not cared for. There were no bunches worth harvesting growing. Some of the plants were showing some of the most intense nutrient deficiencies we've ever seen in bananas, with ultra-chlorotic leaves suggesting a lack of Magnesium or other essential nutrient. Perhaps it would be best to remove all the languishing patches of bananas from the Residences, as none of them seem capable of producing fruit, and begin taking care of the best looking bananas in the Community Garden. Trimming leaves and removing dead trunks is an obligate first step. Pulling weeds away from the base, fertilizing, and irrigating would go a long way towards being able to harvest some fruit and justify having the banana plants around.

Nama sandwicensis (Nama) Boraginaceae

Also placed in Hydrophyllaceae. Endemic to the Hawaiian Islands and known from Lisianski, Laysan, and all the main islands except Kahoolawe (Wagner et al. 1999). In 2005, introduced from Laysan but did not establish (Klavitter 2006). Introduced again in April of 2008 (John Klavitter pers. comm.). In 2008, a few small plants were observed in front of the Midway House sign. There were also some plants in pots in the FWS greenhouse (Starr and Starr 2008). Not observed in 2015.

Nephrolepis hirsutula 'Superba' (Scaly sword fern) Nephrolepidaceae

Known from Australia, Asia, Fiji, and central Polynesia (Wilson 1996), Apfelbaum et al. (1983) are the only observers to report this fern from Midway Atoll. It has not been seen before or since, and could have either died out or been a misidentification of *N. multiflora*. Photo by Tau'olunga, Wikipedia (2008).

Nephrolepis multiflora (Sword fern) Nephrolepidaceae

Native to India and tropical Asia (Wilson 1996), this hardy fern often escapes from cultivation in the main Hawaiian islands and was first collected on Midway Atoll by S. Conant (*Conant 122* BISH) in 1983 growing on the defunct water tank at the old greenhouse of the abandoned Pan American Hotel on Sand Island. Considered rare in 1995 by Bruegmann (1998). In 1999 (Starr and Martz 1999), this fern was still rare, being sparingly cultivated in residential areas and the commercial sport fishing huts. In 2008, sword ferns were still sparingly cultivated in the residential areas of Sand Island (Starr and Starr 2008). Not observed in 2015.

Nerium oleander (Oleander) Apocynaceae

Native from southern Europe to Persia. In Hawaii, oleander is a common ornamental shrub (Neal 1965). On Midway, collected in 1931 by D.R. Chrisholm (*s.n.* BISH). Neff and DuMont (1955) report St. John including this in a list of new plant additions to Midway Atoll in 1931. They also collected it "As an ornamental and hedge plant in the residential area of Sand Island." Also observed in 1979 by Apfelbaum et al. (1983) and in 1995 by Bruegmann (1998). In 1999 (Starr et al. 1999), both pink and white flowered forms were widely cultivated in the residential and town areas of Sand Island. Collected (*Starr and Martz 990505-8* BISH). In 2008, the oleanders persisted, some are now quite large. There are both white and pink flowers, and a double pink form. Plantings persist by the old Barracks next to the Abandoned Galley, the Midway Mall, and behind Pavilion / North Beach (Starr and Starr 2008). In 2015, about a dozen patches persisted in Town, especially near the Midway Mall and around the Residences. Seed was found on one of the hedges. No seedlings were seen.

Noronhia emarginata (Madagascar olive) Oleaceae

Native to Madagascar, grown rarely in Hawaii, this tree resembles kamani (Neal 1965). On Midway, previously noted by Herbst and Wagner (1992) and recorded by Bruegmann in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), one plant was observed at the abandoned Marine Barracks south of the hangar on Sand Island. In 2008, two mature trees were observed on the side of the road by the Marine Barracks. The trees had green fruit, a lot of nuts both in the tree and on the ground, and a layer of leaf duff on ground. There was no regeneration noted. The popping fruits sounded like automatic gun fire when we drove over them with the golf cart, as the untouched fruit lay in a blanket over the rarely used road. Collected (*Starr and Starr 080604-01* BISH) to document the presence on Midway. Though showing no sign of spread on Midway yet, Madagascar olive has spread on Maui in moist areas, and it would not be too hard to get rid of the two trees if folks were looking for something to do (Starr and Starr 2008). In 2015, the two trees west of the now removed Marine Barracks still persisted.

Ocimum americanum (Limehairy, hoary basil) Lamiaceae

Hoary basil is native to Africa, the Indian Subcontinent, China, and Southeast Asia (Wikipedia 2015). Distinguished by dull, hairy leaves with serrate margins and white flowers. In 2008, the main basil being cultivated in gardens on Sand Island appeared to be *O. americanum*. A seed packet with Thai writing and the name *O. americanum* was found in the Greenhouse, and most plants on the island at that time seemed to fit this species (Starr and Starr 2008). In 2015, this basil was no longer found, or was overlooked. The more common basil being grown was the Thai holy basil.

Ocimum basilicum (Basil) Lamiaceae

Pantropical in distribution; in Hawaii, naturalized on Niihau, Oahu, Molokai, Maui, and Hawaii (Wagner et al. 1999). First recorded and collected from Midway in 1999 (Starr and Martz 1999) where a few forms of basil were being cultivated on Sand Island (*Starr and Martz 990421-14*, *16* BISH). In 2008, basil was still one of the more commonly cultivated plants in gardens on Sand Island. In 2015, no basil of this variety was observed.

Ocimum tenuiflorum (Thai holy basil) Lamiaceae

Native to the Indian Subcontinent (Wikipedia 2015). Distinguished by purple flowers and wavy leaf magins on slightly hairy leaves. In 2015, this variety of basil appeared to be the most common form on Midway, where it was observed growing in pots at Residences.

Odontonema strictum (Odontonema) Acanthaceae

Native to Central America (Neal 1965). Cultivated in Hawaii for its bright flowers (Neal 1965). On Midway, previously known from literature (Herbst and Wagner 1992). Not observed before or since.

Oenothera laciniata (Evening primrose) Onagraceae

Native to eastern North America, now naturalized in many parts of the world. In Hawaii, known from Kure and Midway atolls, Maui, and Hawaii (Wagner et al. 1999; Wagner and Herbst 1995). On Midway, first collected by Herbst in 1980 (*Herbst 6396* BISH) from cracks in the runway on Sand Island. Collected again (*Conant 370* BISH) by S. Conant (1983) and by Wayne Gagne (*Gagne s.n.* BISH) in the same year. In 1995, it was common on Sand and Spit Islands and occasional on Eastern Island (Bruegmann 1998). In 1999 (Starr and Martz 1999), found to be common on Sand Island, where this prostrate herb with cute flowers that open near sunset was observed in lawns and runway margins. Also found to be occasional on Spit Island, and rare on Eastern Island. In 2008, found to be common on Sand Island, especially near the coast. It was most common on the south side of the island by Bulky Dump, but was also found in town near the old Galley and Cannon Memorial, and on the north side of the island by the old Fuel Farm and Fuel Pier. Not observed on Eastern or Spit Islands (Starr and Starr 2008). In 2015, this primrose was once again common on Sand Island, where it was growing in hard packed and open areas. It was especially common from the Cargo Pier to Turtle Beach, in Town, near the NAF Hangar, and on abandoned runways. Not observed on Eastern or Spit Islands.

Olea europaea ssp. *cuspidata* (African olive) Oleaceae

Native to the Mediterranean region; in Hawaii, widely cultivated as a hedge or wind break and now naturalized on Kauai, Maui, and Hawaii where it is becoming a serious pest and is spreading rapidly by game birds (Wagner et al. 1999; Starr and Martz 1999; Lorence et al. 1995). First recorded from Midway in 1999 (Starr and Martz 1999). Collected (*Starr and Martz 990514-1* BISH) from the only known individual on Sand Island. The lone tree was 20 meters north of the old seaplane hangar. In 2008, the tree was still there, in the same spot, just off the road on the corner of Cannon Ave. It looked like it may have gone through a bit of senescence, but was still alive. A young *Ficus microcarpa* tree had germinated on a concrete object next to the olive and may eventually overtop it. It seemingly would not be too hard to get rid of this olive (Starr and Starr 2008). In 2015, the lone olive tree remained in the same spot. It still looked unhealthy but continues to persist. No additional plants were observed.

Opuntia cochenillifera (Cochineal cactus) Cactaceae

Native range unknown, but probably from southern Mexico or northern Central America (Wagner et al. 1999). Cultivated as a host for cochineal insects to make dye; in Hawaii, now spreading from cultivation on Kauai, Oahu, and Maui (Wagner et al. 1999, Oppenheimer 2004). On Midway, cultivated and first recorded by Bruegmann (1998). In 1999 (Starr and Martz 1999), observed and collected (*Starr and Martz 990505-6* BISH) as cultivated in the residential area of Sand Island. A plant at 4209 Commodore

Ave. was removed, to make way for native plants. In 2008, there were still a few of these prickly plants persisting in the residential area of Sand Island, including plants at the Midway House, 4212 Commodore Ave., and the two story 400 houses on Hadley Dr. (Starr and Starr 2008). In 2015, this prickly plant was not observed, and has presumably been eradicated from Midway.

Oryza sp. (Rice) Poaceae

Two species are commonly cultivated, *Oryza sativa* and *Oryza glaberrima*, native to tropical and subtropical southern Asia and southeastern Africa (Wikipedia 2008). Previously not recorded from Midway, in 2008, a bucket of *Oryza* sp. was being grown at one of the residences (416 Commodore Ave.) on Sand Island. The flooded conditions may promote mosquitoes (Starr and Starr 2008). Not observed in 2015.

Oxalis corniculata (Yellow wood sorrel) Oxalidaceae

Native origin unknown, cosmopolitan in distribution; in Hawaii, known from Midway Atoll and all of the main islands (Wagner et al. 1999). First collected on Midway in 1933 by Meagher. On Midway, Neff and DuMont (1955) collected this species and found it to be "occasional, scattered about on both Sand and Eastern Islands." Also collected in 1980 by Herbst from Sand Island (*Herbst 6377* BISH). Observed by most botanists visiting Midway since then. In 1999 (Starr and Martz 1999), this cosmopolitan weed was observed to be occasional to common, especially near urban areas on Sand Island. It was not observed on Eastern Island. In 2008, yellow wood sorrel was occasionally observed in the lawns of Sand Island (Starr and Starr 2008). In 2015, it was not common, observed at one of the Residences near the cultivated plants.

Oxalis debilis var. *corymbosa* (Shamrock) Oxalidaceae

Native to South America; in Hawaii, naturalized on all of the main islands except Niihau and Kahoolawe (Wagner et al. 1999). On Midway, previously observed in 1979 (Apfelbaum et al. 1983) and in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), it was occasional on Sand Island. In 2008, this purple-flowered, bulblet-forming *Oxalis* was occasionally observed in lawns and gardens in the residential area of Sand Island. Collected (*Starr and Starr 080601-04* BISH) to document the presence on Midway (Starr and Starr 2008). In 2015, found in the lawn near cultivated plants at the Residences.

Pancratium littorale (Spider lily) Liliaceae

Native to southern Europe and cultivated in Hawaii (Neal 1965). On Midway, previously known from literature (Herbst and Wagner 1992). Not observed before or since.

Pandanus amaryllifolius (Tea pandanus, pandan, bai toey) Pandanaceae

Mound forming shrubby plant to 5 ft. tall with aerial roots (Staples et al. 2005). Apparently rare in the wild, but widely cultivated in tropical Asia for cooking, with probable origins in the Moluccas (GRIN 2008). In Hawaii, occasionally cultivated mostly by residents of southeast Asian origin who use the scented leaves as flavoring for rice, beverages, and pudding like desserts (Staples et al. 2005). The leaves have a vanilla like flavor. On Midway, in 2008, several plants similar to *Freycinetia* which appear to be this species were found growing in gardens on Sand Island, including the Community Garden, the small greenhouse behind the old galley, and in a pot at the barber shop. The Thai workers called it a pandanus, which it looked like. They apparently used the fragrant leaves for tea. Collected (*Starr and Starr 080608-08* BISH) to help confirm the identity and to document the presence on Midway (Starr and Starr 2008). In 2015, s small cultivated plant was observed at the Residences.

Pandanus tectorius (Hala, screwpine) Pandanaceae

Occurring in Pacific islands of Polynesia, Melanesia, Micronesia, also New Caledonia to northern Australia, New Guinea, west to the Philippines, Moluccas, and Java; in Hawaii, occurring on all of the main islands except Kahoolawe (Wagner et al. 1999). On Midway, one of the trees listed as able to survive in a soil and sand mixture (Hadden 1941). In 1954, occasional specimens were observed occurring in the administrative and residential area. In addition, one individual was observed in the *Scaevola* scrub near the south end of Sand Island (Neff and Dumont 1955). Observed in 1979 (Apfelbaum 1983) and in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), about a half dozen trees were noted. Three trees were observed near the Midway Mall and a few were observed on a sand revetment across the runway from the water storage tanks. In 2008, the same trees persisted on Sand Island. In addition, a thickety looking tree of hala was observed in the courtyard of the Cable Company buildings, and a tree with lots of aerial roots was observed near one of the old large gun emplacements on West Beach west of the Aviary Seep. Collected from plants near Midway Memorial (*Starr and Starr 080611-02* BISH) to document presence on Midway (Starr and Starr 2008). In 2015, there was only one live tree observed, near the Navy Memorial. The trees known from the Cable Company courtyard and near the runway by West Beach were not relocated and are presumed dead. This species appears to be declining on Midway and it wouldn't be surprising if it disappeared completely.

Paspalum setaceum (Paspalum) Poaceae

Native to Mexico and the southeastern United States (Whistler 1995). Previously not known from the Hawaiian Islands, on Midway it was found in 1999 (Starr and Martz 1999), to be one of the most common species on the island, occurring wherever there were lawn areas. The collection on Sand Island in 1999 (*Starr and Martz 990622-1* BISH), represented a new state record for Hawaii (Starr and Martz 2000). In 2008, this species was again one of the most common grasses on the island, found in lawns virtually everywhere from the middle of town to Frigate Point (Starr and Starr 2008). In 2015, this continued to be a common grass over much of Sand Island and was especially abundant in the lawn by the Old Fuel Farm.

Paspalum urvillei (Vasey grass) Poaceae

Native to the New World; in Hawaii, documented from Midway and all of the main islands except Niihau and Kahoolawe (Wagner et al. 1999). On Midway, collected in 1980 by Herbst and Takeuchi (*6371* BISH) and recorded as occasional on Sand Island and rare on Eastern Island in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), it was found to be occasional on Sand Island, scattered about roadsides and ditches, especially moist areas. In 2008, it was basically the same situation, a few clumps were observed across the island, generally in moist locations. This and other tall grasses were much more conspicuous now that mowing had stopped (Starr and Starr 2008). In 2015, this grass continued to be prevalent on Sand Island, especially near moist sites such as the Catchment Pond.

Passiflora edulis (Passion fruit, lilikoi) Passifloraceae

Native to Brazil, widely cultivated for its edible fruits. In Hawaii, cultivated and naturalized on Kauai, Oahu, Lanai, Molokai, Maui, and Hawaii (Wagner et al. 1999; Hughes 1995). On Midway, previously collected (*Conant 124* BISH) by S. Conant (1983) who notes "This vine was growing and fruiting vigorously adjacent to and on the old greenhouse of the abandoned Pan Am Hotel." Not observed in 1999. In 2008, there was one chlorotic looking vine sprawling over the plants in the back of 4208 Commodore Ave. on Sand Island. Even though the vine looks innocuous enough, given the ability of this species to persist on Midway, and the proven history of spread beyond where it is planted in the main Hawaiian Islands, it may make sense to remove this vine and put it on the prohibited plants list for Midway (Starr and Starr 2008). Not observed in 2015, most of the plants in the area it used to grow have been removed during weed control or lead abatement work.

Pedilanthus tithymaloides (Slipper flower) Euphorbiaceae

Native from the West Indies to northern South America, a succulent plant grown as an ornamental in Hawaii and elsewhere (Wagner et al. 1999). First collected on Midway in 1995 by Bruegmann (*Bruegmann 2030* BISH) who noted "Sand Island, rare around J housing, planted and potentially naturalized in mowed grassy areas". Collected again in 1999 (Starr and Martz 1999), where a couple varieties were being cultivated in the housing area of Sand Island (*Starr and Martz 990429-12*, *14* BISH). In 2008, this tall succulent with red "flowers" still persisted on Midway in the residences, including 4208 Commodore Ave. (Starr and Starr 2008). In 2015, a few plants continued to be grown at the Residences.

Pelargonium x *hortorum* (Fish geranium) Geraniaceae

Native to South Africa, cultivated in Hawaii (Neal 1965). On Midway, previously recorded possibly by Hadden (1941) who lists simply "geraniums". Also observed by Apfelbaum et al. (1983) and by Bruegmann (1998). In 1999 (Starr and Martz 1999), this species was cultivated in the residential area and by the hangar on Sand Island. In 2008, pink and red varieties of this colorful plant were cultivated at the Midway house and at residences along Commodore Ave. and Halsey Dr. Collected at the Midway House (*Starr and Starr 080607-08* BISH) to document the presence on Midway. In 2015, one lone pink flowered plant was found in a pot at 4208 Commodore Ave.

Peperomia obtusifolia (Peperomia) Piperaceae

Native to tropical America, grown in Hawaii (Neal 1965). On Midway, previously not recorded before this survey. In 1999 (Starr and Martz 1999), it was observed as cultivated in the residential area of Sand Island. Collected (*Starr and Martz 990429-10* BISH) to document the presence of the species on Midway. Not observed since.

Persea americana (Avocado) Lauraceae

Native to tropical America, widely cultivated and naturalized in the main islands of Hawaii (Neal 1965, Wagner *et al*. 1999). First recorded on Midway in 1999 (Starr and Martz 1999), where it was observed as a cultivated tree in a garden. Not observed since.

Petroselinum crispum (Parsley) Apiaceae

Native to the Mediterranean region (Neal 1965). Cultivated for flavoring food. First recorded from Midway in 1999, when it was collected (*Starr and Martz 990421-15* BISH) from cultivated material in the residential area of Sand Island. Not observed since.

Phaseolus vulgaris (Common bean) Fabaceae

Native to tropical America. Commonly cultivated in Hawaii for its pods that are used for forage and food (Neal 1965). On Midway, previously recorded by Herbst and Wagner (1992) and again by Bruegmann (1998). In 1999 (Starr and Martz 1999), this species was occasionally grown in gardens in the residential area of Sand Island. Not observed since.

Philodendron sp. (Philodendron) Araceae

Native to tropical America, these climbers are cultivated in Hawaii for their foliage (Neal 1965). Historically known from literature (Herbst and Wagner 1992). Observed in 1995 as rare on Sand Island (Bruegmann 1998). It was not observed since.

Phoenix sp. (Date palm) Aracaceae

Native probably to North Africa or India (Neal 1965). Cultivated in Hawaii and used for many purposes. *Phoenix* palms were first recorded by Hadden (1941). A number of *Phoenix* palms of no specific type were also observed by Neff and DuMont (1955) among Cable and Pan-American plantings and lawns of residences. Recorded in 1979 (Apfelbaum et al. 1983) and in 1995 (Bruegmann 1998). However, no *Phoenix* palms have been observed on Midway since.

Phyla nodiflora (Phyla, turkey tangle fogfruit) Verbenaceae

Native to South America, cultivated in Hawaii as a groundcover (Neal 1965). In Hawaii, cultivated and occasionally escaping from gardens, naturalized on Midway Atoll and Maui (Wagner et al. 1999, Starr et al. 2002). On Midway, first collected in 1980 (*Herbst and Takeuchi 6364* BISH). In 1999 (Starr and Martz 1999), found to be naturalized, forming dense mats in moist areas on Sand Island. It was collected (*Starr and Martz 990512-2* BISH) and represented a new naturalized record for the state of Hawaii (Starr *et al*. 2002). In 2008, this prostrate crawler with purple flowers had spread in distribution on Sand Island and was now known from Eastern Island. On Sand Island, it was common to dominant in wet areas, especially near the Dump Pond, where *Phyla* appears to have overtaken the bulk of the akulikuli (*Sesuvium*), and in the newly created duck seeps. Also found in town, by the old Fuel Farm, on the abandoned Runway Overrun, at Bulky Dump, and on West Beach. Found for the first time on Eastern Island, where there was one small patch in the Sunset Seep. We are not sure if *Phyla* is in the recently created duck seeps because it was a contaminant in plantings, or if it was able to get to the area on its own and then take advantage of the moist conditions (Starr and Starr 2008). In 2015, Phyla was once again common, preferring moist and hard packed areas, such as from near the Old Fuel Farm through to Turtle Beach, low spots along West Beach, and areas near the Runway Overrun and now filled in Sunrise Seep. It was now being controlled in wetland areas, such as in and around Brackish Pond and the Runway Overrun.

Phyllostegia variabilis (Native mint) Lamiaceae

Endemic to the Hawaiian Island, formerly occurring on Kure and Midway atolls and Laysan, now presumed extinct (Wagner et al. 1999). On Midway, previously recorded from Eastern Island only, where one moderate sized clump was found in the central plain in 1923 (Christophersen and Caum 1931). In 1923, it had already been eradicated from Laysan Island, and this was the only known occurrence of the species. Not observed since and probably extinct throughout its entire range.

Phymatosorus grossus (Lauae) Polypodiaceae

Also known as *Phymatosorus scolopendria*. Native to the Old World Tropics (Valier 1995), in Hawaii, this fern grows readily on rocks, trees, or the forest floor, especially in disturbed areas of second growth. It thrives from salt-swept boulder beaches to shaded lowland forests (Valier 1995). This fern was previously reported from Midway (Herbst and Wagner 1992), but has not been observed since.

Pilea microphylla (Artillery plant) Urticaceae

Native to southern Florida, the West Indies, and Mexico south to tropical South America. In Hawaii, cultivated and naturalized in low elevation, mesic, disturbed sites at least on Kauai, Oahu, Maui, and Hawaii, but probably on all of the main islands (Wagner et al. 1999). On Midway, previously collected on Eastern Island in 1964 by both Long and Lamoureux (*Long 1748* US, *Lamoureux 2765* US) south of the east-west runway and at edge of runway in southwest corner of island (Shannon and Wagner 1996). In 1988, collected on Sand Island by D. Herbst and W. Takeuchi (*9069* BISH). In 1999 (Starr and Martz 1999) found to be common on the roofs of buildings on Sand Island, but not seen on Eastern Island. One small plant was observed, and removed, from Spit Island. In 2008, this pesky plant was locally abundant on Sand Island, especially in the FWS greenhouse and on rooftops. On Eastern Island, plants were observed in the cracks on the pier and in the newly created duck seeps. It is not known if the plants in the seeps were contaminants in the plants recently put in the seeps, or if the plants were in the area and just taking advantage of the moist conditions. Not observed on Spit Island. This tiny plant does not usually interrupt natural areas but can be a menace in nurseries (Starr and Starr 2008). In 2015, present in hard-packed moist areas, such as Runways and in Town.

Pilea serpyllacea (Large artillery plant) Urticaceae

First and only observation from Midway made in 1999 (Starr and Martz 1999) where this succulent was cultivated in the residential area of Sand Island, generally in pots. Collected (*Starr and Martz 990421-13* BISH) to document the presence on Midway. Not observed since.

Piper sarmentosum (Thai piper, Cha plu) Piperaceae

Herbaceous creeping to erect plant that is cultivated in India and southeast Asia as spice and medicine. In Thailand the young leaves are eaten raw or cooked. Also used raw to wrap ginger, peanuts, roasted coconut meat, dried shrimp, chilli, shallots, lime and, sweet coconut meat sauce to make miang kam bai chaa phluu, a kind of snack. The leaves are also mixed in khaao yam, blanched as a vegetable or put into curries. (Earthcare Enterprises 2007). Native to termperate and tropical Asia (GRIN 2008). The identity of this plant is not 100% certain. First observed and collected in 2008 at Sak's garden at the Water Plant (*Starr and Starr 080608-05* BISH) to help with identification and to document the presence on Midway (Starr and Starr 2008). In 2015, one unhealthy plant was observed in a pot at one of the Residences.

Pithecellobium dulce (Manila tamarind) Fabaceae

Native to the Neotropics from Mexico to Venezuela, now widely cultivated throughout the tropics. In Hawaii, cultivated as a street tree and now naturalized on all of the main islands except Kahoolawe (Oppenheimer and Bartlett 2002; Wagner et al. 1999). Collected on Midway for the first time in 1999 (*Starr and Martz 990510-1* BISH) from the personal garden adjacent to the galley. There was also another tree on the south side of the galley. The fruits were picked and eaten by the Filipino workers. There was even a special stick situated by the tree for picking the fruit. In 2008, the small tree and the personal garden on the north side of the Galley had been dismantled, in fact the entire Galley had been abandoned. However, the small tree on the south side of the Galley was still there, and was now one large tree or multiple trees growing together. The fruits did not appear to be harvested as rabidly as before, or at all. This is a fairly weedy, thorny species that has established and spread on every main Hawaiian Island it has been introduced to. Perhaps the lone remaining tree should be removed before it does the same on Midway (Starr and Starr 2008). In 2015, there was no sign of Manila tamarind in any of the previous locations it was known from. It does have a potentially long-lived seed, but appeared eradicated on Midway.

Plantago lanceolata (Narrow leaved plantain) Plantaginaceae

Native to Europe and north-central Asia, widely naturalized. In Hawaii, naturalized on Midway Atoll, French Frigate Shoals, and all of the main islands except Niihau and Kahoolawe (Wagner et al. 1999). On Midway, Neff and DuMont (1954) note "While this plant was reported 20 years ago [by St. John in 1931], the senior author, thoroughly familiar with it at home, did not find it." This species was observed by almost every other botanist visiting Midway since then. In 1999 (Starr and Martz 1999), it was found to be scattered in grassy areas of Sand Island. In 2008, this cosmopolitan weed was locally abundant on Sand Island, especially on the margins of runways and roads (Starr and Starr

2008). In 2015, again present in hard packed areas, especially abundant between Old Fuel Farm and Cargo Pier.

Plantago major (Common plantain) Plantaginaceae

Native to Europe and northern and central Asia, widely naturalized; in Hawaii, naturalized on Midway Atoll and all of the main islands except Niihau and Kahoolawe (Wagner et al. 1999). On Midway, first collected in 1933 by Meagher. Collected on Eastern Island by Lamoureux in 1962 (*Lamoureux 2813* BISH) from SW of the dock, and on Sand Island in 1964 (*Lamoureux 2813* NMNH) from the roadside, near main ship piers, eastern part of island. Also collected by Herbst in 1980 (*Herbst 6356* BISH) from near the maintenance buildings on Sand Island. Recorded in 1979 (Apfelbaum et al. 1983) and in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), found to be very rare, restricted to one small area just north of the seaplane hangar on Sand Island. Not observed since.

Plectranthus amboinicus (Greek oregano) Lamiaceae

Native to tropical Africa and widely cultivated in Hawaii and elsewhere to flavor food (GRIN 2008, Staples et al. 2005). A mound forming herb with oregano scented hairy leaves (Staples et al. 2005). In 2008, this plant was being grown in a hanging basket at the residence of 4208 Commodore Ave. Widely naturalized in the tropics and listed as invasive on several Pacific Islands, such as Fiji, Tonga and Samoa where it is found as a roadside weed and in rocky or sandy areas in woods and thickets (GRIN 2008, PIER 2008). Not observed in 2015.

Plectranthus scutellarioides (Coleus) Lamiaceae

Also known as *Solenostemon scutellarioides*. Native to eastern Asia and Malesia, now pantropical through cultivation; in Hawaii, various forms are cultivated and now naturalized at least on Kauai, Oahu, Maui, and Hawaii (Wagner et al. 1999). Previously recorded from Midway in 1979 (Apfelbaum et al. 1983). It has not been observed since.

Pluchea x *fosbergii* (Hybrid pluchea) Asteraceae

A spontaneous hybrid between *P. indica* and *P. symphytifolia* (Wagner et al. 1999). In Hawaii, known from Midway Atoll, Kauai, Oahu, Molokai, and Maui (Wagner et al. 1999). Previous collections from Midway at Bishop Museum include (*Lamoureux* 2294, *Herbst and Takeuchi* 6441). Not observed since.

Pluchea indica (L.) Less. (Indian pluchea) Asteraceae

Native to southern Asia; in Hawaii, recorded from Midway Atoll, Laysan, and probably all of the main islands (Wagner et al. 1999). Previously collected from Midway (*Herbst and Takeuchi 6362, 6442* BISH) in 1980 and described as not common. Not observed before or since.

Pluchea carolinensis (Sour bush) Asteraceae

Also known as *P. symphytifolia* and *P. odorata* (Wagner et al. 1999; Wagner and Herbst 1995). Native to Mexico, the West Indies, and northern South America; in Hawaii, naturalized on Kure and Midway atolls, French Frigate Shoals, and all of the main islands (Wagner et al. 1999). Many collections from Midway exist as Bishop Museum for this species, including (*Neff and DuMont 1*; *Herbst and Takeuchi 6424, 6348*; *Lamoureux 2012, 2266, 2180, 2131; C.R. Long; H.W. Frings 7, 36*). Neff and DuMont (1955) report that this species is "More widespread on Eastern Island than on Sand Island, but abundant on both. This weed species has taken over many open areas where the soil was disturbed by construction work, such as along the margins of runways, and now forms an almost impenetrable barrier to heights of four to five feet." Also observed by Apfelbaum et al. (1983) and by Bruegmann (1998). The situation did not seem so bleak in 1999 (Starr and Martz 1999), but scattered individuals and small patches were observed on Sand, Eastern, and Spit Islands. Numerous plants of all life stages were observed near the Dump Pond on Sand Island. On Spit, only one small plant was observed and collected (*Starr and Martz 990623-11* BISH). In 1999, the potential range of this plant seemed much larger than the current range. In 1999, *Pluchea* was being controlled. In 2008, this odiferous plant was not observed on either Eastern or Spit Islands, in stark contrast to the impenetrable thickets that existed 50 years prior. In contrast, the *Pluchea* on Sand Island had begun to explode in distribution, mostly in areas it was previously known from. Most notable is the population south and east of the Dump, which forms a pure stand. Elsewhere Pluchea enjoys the boundary between the ironwoods and grasslands on the Runway Overrun. Pluchea can also be seen where the ironwoods between the Antennae Field and the Runway were removed, and on the edge of the ironwoods where the runway taxiway heads towards the hangar. There are also about a dozen smaller populations scattered across the island (Starr and Starr 2008). In 2015, there were no plants on Spit or Eastern, and very few found on Sand Island. Control efforts had removed all the large individuals, the only plants of this species found this survey were small seedlings, mostly in the low moist areas that run along the northern boundary of the east end of the Runway and Runway Overrun. Similar species show a short lived seedbank and eradication seems attainable for this species.

Plumbago auriculata (Plumbago, cape leadwort) Plumbaginaceae

Native to South Africa, widely planted. In Hawaii, recently published as a newly naturalized record (Herbarium Pacificum Staff 1999) with collected material from Maui. On Midway, previously known from literature (Herbst and Wagner 1992). Not observed since.

Plumeria obtusa (Singapore plumeria) Apocynaceae

Native to America (Neal 1965). Cultivated in Hawaii, its white flowers are often strung into lei (Neal 1965). On Midway, previously known from literature (Herbst and Wagner 1992). In 1999 (Starr and Martz 1999), observed as cultivated on Sand Island. In 2008, two trees were observed in the residential / town area of Sand Island. One tree was next to the two story house on the corner of Commodore Ave. and Halsey Dr., the other was between the Gym and the Midway Mall. Neither of the *P. obtusa* trees looked particularly vigorous, and were not in flower. Collected (*Starr and Starr 080601-15* BISH) to document the presence on Midway (Starr and Starr 2008). In 2015, the tree in the Residences was still there, but had not leafed out for the season yet. The tree by Midway Mall was not relocated, it was probably removed during lead abatement work.

Plumeria rubra (Plumeria, frangipani) Apocynaceae

Native to tropical America; in Hawaii, this plumeria is cultivated and has pink to red, rose colored flowers (Neal 1965). On Midway, *Plumeria* sp. has been recorded previously by Hadden (1941), Apfelbaum et al. (1983), and Bruegmann (1998). In 1999 (Starr and Martz 1999), observed as cultivated on Sand Island and collected (*Starr and Martz 990505-9* BISH). In 2008, a fine array of plumeria cultivars persisted on Midway, mostly in the residential area, and most impressively in front of the Midway House. The plumeria were in full bloom during the early June survey, with white, yellow, and pink based varieties. White terns nested on the branches of the plumeria. One young tern chick fell out of a plumeria tree near Ave Maria one evening, on to the back of one the authors, but the chick held fast to the branches once placed back in the tree (Starr and Starr 2008). In 2015, most of the plumeria trees were still in the same spots. Unlike 2008, the trees were mostly bare and had not flowered or leaved out for the season yet.

Poa annua (Annual blue grass) Poaceae

Native to Europe; in Hawaii, documented from Kure and Midway atolls and all of the main islands except Niihau and Kahoolawe (Wagner et al. 1999). On Midway, Observed in 1979 (Apfelbaum et al. 1983). Collected in 1980 by Herbst and Takeuchi (*6391* BISH). Common on Sand Island in 1995 (Bruegmann 1998) and 1999 (Starr and Martz 1999). Though present on Sand Island in 2008, it didn't seem that abundant. Observed near Charlie Barracks (Starr and Starr 2008). In 2015, this diminutive grass was occasionally observed in open areas on Sand Island, especially in Town. It was also observed in the cracks of the least vegetated runways on Eastern Island.

Polypogon interruptus (Ditch beard grass) Poaceae

Native to South America; in Hawaii, known from Kure and Midway atolls, Kauai, Oahu, Maui, and Hawaii (Wagner et al. 1999; Wagner and Herbst 1995). Perennial. Clumping. Inflorescence interrupted. Glumes not lobed. Glume awns 1.5-4.5 mm. Lemma awn often similar size to glume awns. On Midway, collected in 1980 by D. Herbst and W. Takeuchi (*6383* BISH) on Sand Island growing in saturated soil below a dripping air conditioner. This grass and the related *P. monspeliensis* can be challenging to distinguish. The easiest difference is whether the plant is an annual or perennial, this species being perennial. In situation where this may not be readily discernable, the true defining characters are mostly microscopic, this species having glume that is not lobed and generally shorter awns than *P. monspeliensis*. In 1999 a couple collections of this grass were made near the abandoned marine barracks on Sand Island (*Starr and Martz 990511-2, 990511-3* BISH) (Starr and Martz 1999). In 2008, grasses that most approached this species were evident at the Enlisted Housing Seep, but the identify was not certain. In 2015, all the *Polypogon* plants observed and looked at in detail appeared to be *P. monspeliensis*.

Polypogon monspeliensis (Annual beard grass, Rabbitfoot grass) Poaceae

Native to Europe; in Hawaii, documented from Midway, Kauai, Oahu, Maui, and Hawaii (Wagner et al. 1999). Annual. Inflorescence plume-like, dense. Glumes lobed. Glume awns 2-10 mm. Lemma awn often much smaller than glume awns. First collected from Midway in 1945 by G. C. Munro, where it was growing in coral sand with Bermuda grass. Collected from Eastern Island by H. W. Frings (*48* BISH) in 1962 and by C. R. Long (*1756* BISH) in 1964 who found it common on the middle south side of the east-west runway. In 1980, D. Herbst and W. Takeuchi (*6343* BISH) collected it from Sand Island growing along sides of west, shallow ditch. In 1999, what was likely P. monspeliensis was found to be locally common on Sand Island, growing in moist areas around the fuel farm, dump pond, and runway overrun (Starr and Martz 1999). In 2008 this grass was found in moist areas, such as the old fuel farm containment basins and

around the newly created duck seeps. In 2015, all the *Polypogon* plants observed and looked at in detail appeared to be *P. monspeliensis*. They occurred in the same general areas, open moist sites, especially the Runway Overrun and the Old Fuel Farm.

Polyscias guilfoylei (Panax) Araliaceae

Native to southern Polynesia and one of the commonest hedge plants in Hawaii (Neal 1965). On Midway, previously recorded by Hadden (1941) and by Bruegmann (1998). In 1999 (Starr and Martz 1999), observed near the Midway Mall and other places in town. In 2008, one plant was observed near the Gym along with a small hedge along 4212 Commodore Ave. Collected (*Starr and Starr 080607-14* BISH) to document the presence of panax on Midway (Starr and Starr 2008). In 2015, a few 2m tall plants were growing at Residence 418.

Portulaca lutea (Ihi) Portulacaceae

Widespread in the Pacific from New Caledonia to Pitcairn Island north to Polynesia and Micronesia; in Hawaii, on all of the Northwestern Islands except Kure and Pearl and Hermes atolls, and on Oahu, Molokai, Lanai, Maui, and Hawaii (Wagner et al. 1999). On Midway, in 1923, found by the Tanager Expedition only on Eastern Island, where a few plants grew in the central plain. Collected again on Eastern Island by Lamoureux in 1962 from the central part and in 1964 from near the boat dock (*Lamoureux 2254, 2811* BISH). Bruegmann (1998) notes this species from Eastern Island, where it was rare in distribution. Both *P. lutea* and *P. oleracea* are historically known from Midway Atoll. In addition, the two readily hybridize. In 1999 (Starr and Martz 1999), we were unable to determine the differences between the two species and lumped all sightings into *P.* sp. In 2005, there was a failed reintroduction of this species from Laysan (John Klavitter pers. comm.). In 2008, we were familiar with the differences between the two species and saw no plants that would fit into *P. lutea* (Starr and Starr 2008). In 2015, we again looked closely at many of the Portulaca on Sand and Eastern Island and none appeared to fit into *P. lutea*, especially when looking at flower size and number of stamens.

Portulaca oleracea (Common purslane, pig weed) Portulacaceae

Probably native to the Old World and nearly cosmopolitan in distribution; in Hawaii, on Midway Atoll, Pearl and Hermes Atoll, Laysan, French Frigate Shoals, Nihoa, and all of the main islands except Kahoolawe (Wagner et al. 1999). On Midway, previously collected in 1954 by Neff and DuMont (1955) who note "Locally abundant, widespread in open sandy areas on both Sand and Eastern Islands." Also collected in 1962 on Eastern Island by Frings and in 1966 by Carlquist (*Carlquist 2349d* BISH) who noted, "In vicinity of airport with *Tribulus cistoides* and *Boerhavia diffusa*, on coarse coral rubble sand along shore". Conant (1983) adds "This is a common weed on Midway and

other NWHI. She also notes *P. oleracea* as rare on both Sand and Eastern Islands. It was collected near the abandoned Pan Am Hotel (*Conant 133* BISH)." Bruegmann (1998) notes *P. oleracea* as rare on both Sand and Eastern Islands. Both *P. lutea* and *P. oleracea* are historically known from Midway Atoll. In addition, the two readily hybridize. In 1999 (Starr and Martz 1999), all similar *Portulaca* species were lumped under *P.* sp. In 2008, all the *Portulaca* observed appeared to be *P. oleracea*. This cosmopolitan weed was common in fields and open areas on Sand and Eastern Islands, especially in areas with compacted ground. There was also one small plant on the southwestern tip of Spit Island (Starr and Starr 2008). In 2015, the status remained the same, this succulent plant was occasionally found in open areas of Sand and Eastern islands, and all the plants seemed to be much closer to *P. oleracea* than *P. lutea*.

Portulacaria afra (Jade tree) Portulacaceae

Native to South Africa and cultivated as an ornamental in Hawaii and elsewhere (Neal 1965). On Midway, known from literature (Herbst and Wagner 1992). In 1999 (Starr and Martz 1999), observed as cultivated in the residential area of Sand Island. In 2008, one plant was observed in a pot at 4211 Commodore Ave. Collected (*Starr and Starr 080607-16* BISH) to document presence on Midway. Not observed in 2015.

Pritchardia hillebrandii (Loulu lelo, Molokai fan palm) Arecaceae

Endemic to Hawaii, occurring on cliffs, 30-600m elevation, in mesic to wet areas on the windward coast of Molokai (Wagner et al. 1999). There is a state recognized exceptional population on Huelo Islet, a windward islet of Molokai, and it is the most commonly grown native Hawaiian palm species in Hawaii (Staples et al. 2005). In 2015, it was determined the tall *Pritchardia* by the Navy Memorial was *P. hillebrandii*. Looking at pictures we took, retired Hawaii Forester Bob Hobdy said the tree appeared to be *P. hillebrandii* based on the robust, straight peduncles with the large open clusters of 3/4 in. diameter spherical seeds borne on a yellowish, glabrous rachis that is at an abruptly 90 degree angle to the peduncle (Bob Hobdy pers. comm.). In 2015, the tree was 20 ft. tall, was in fruit, and there were a half dozen or so small seedlings that had germinated at the base of it. The base was surrounded by Bonin Petrel burrows.

Pritchardia pacifica (Fiji fan palm) Arecaceae

The Fiji fan palm is native to Fiji and has been cultivated in Hawaii since 1870 (Staples et al. 2005). In 2015, it was determined the lone 20 ft. tall *Pritchardia* by the Midway House was *P. pacifica*. Looking at pictures we took, retired Hawaii Forester Bob Hobdy said the tree was clearly *P. pacifica* given the smooth trunk, inflorescences shorter than leaf petioles and spherical seeds 1/2 in. diameter in tight clusters. No seedlings were observed under or near the tree. The tree was likely going to have to be removed during upcoming lead abatement work.

Pritchardia remota (Loulu, Nihoa fan palm) Arecaceae

An endemic and endangered Hawaiian palm occurring at cliff bases and terraces, 200-800m elevation, in the East and West Palm valleys of Nihoa (Wagner et al. 1999). In 2009, about 300 seeds of Nihoa fan palm were collected from Nihoa and brought to Midway. These were propagated in the FWS greenhouse, and over the next few years were planted on Sand, Spit, and Eastern Islands (John Klavitter, Greg Schubert, and Penny Knuckles pers. comm.). Most died, but as of 2015, a dozen or so Nihoa fan palms were still alive. On Sand Island, the largest was about five feet tall and was growing next to Carport entrance at the Midway House. This was the healthiest looking *P. remota* at Midway. The palm was scheduled to be relocated as part of the lead abatement project, as was another smaller palm on the west side of the front entrance to the Midway House. A few smaller palms, about two feet tall, persisted elsewhere on the island. There were two by the building across from the Finger Piers, one in the native plant garden in front of the FWS Office, and one near the FWS Greenhouse. In the FWS Greenhouse were another half dozen in pots. On Eastern, there were 2 loulu, one 3 ft. tall, the second about half that size, planted near each other in small depressions on a sand hill near the Pier. None of the palms planted on Spit Island were still alive.

Pritchardia spp. (Loulu) Arecaceae

A genus of 33 or more species with 26 of these native to Hawaii, the remainder from Fiji and the Tuamotus (Neal 1965). On Midway, first recorded in 1979 (Apfelbaum et al. 1983). Also reported by Bruegmann (1998). In 1999 (Starr et al 1999), and 2008, we observed a few mature trees by the Gooney Statue and the Midway House. At the time it was not known which species of *Pritchardia* these palms were. However, the identities of these palms, a couple of which were still present in 2015, have since been determined, see the other *Pritchardia* spp. for more.

Prosopis pallida (Kiawe) Fabaceae

Native to Peru, Colombia, and Ecuador and now naturalized in Puerto Rico, Hawaii, and Australia. A Federal Noxious Weed in the United States. In Hawaii, this thorny tree is naturalized and often the dominant tree of the coastal lowlands on Midway Atoll and all of the main islands (Wagner et al. 1999). Reported from Midway (Herbst and Wagner 1992). Though, it has not been found before or since.

Pseudognaphalium sandwicensium var. *sandwicensium* (Enaena) Asteraceae

Also known as *Gnaphalium sandwicensium*, *G. sandwicensis* f. *canum*. There has been recent taxonomic revision and new varietal combinations for those plants formerly treated as species of *Gnaphalium* (Wagner et al. 1999; Wagner et al. 1997). Endemic to the Hawaiian Islands (Wagner et al. 1999). *P. s*. var. *sandwicensium* is known from Kure and Midway Atolls, Niihau, Kauai, Oahu, Molokai, Maui, and Hawaii (Wagner et al. 1997). On Midway, Neff and DuMont (1955) collected this species (*4* BISH) and reported it to be "Locally common along margins of runways and in old administrative areas on Eastern Island, and thinly but widely scattered in similar locations on Sand Island." Also collected in 1979 by Apfelbaum et al. (1983). Conant (1983) notes "Collected from a drainage ditch on the north side of the buildings at the Midway terminal building (*Conant 131* BISH) and from sandy soils on the northwest side of the housing area (*Conant 130* BISH)." Other collections include (*Herbst and Takeuchi 6361, 6363, 6426*; *Lamoureux 2267*; *C.R. Long 1734*, *H.W. Frings 51*). In 1995, observed as common on Sand Island by Bruegmann (1998). In 1999, this species was observed to be abundant near the fuel farm and occasionally on the pebble covered roofs in town on Sand Island. Collected on Spit Island (*Starr and Martz 990623-9* BISH), where it was rare. Not observed on Eastern Island. In 2008, this species was still common on Sand Island in various place, including: what is now called the Old Fuel Farm; around town including around the FWS office and greenhouse, and around the Old Galley; on the abandoned north/south runway, especially abundant on the newly painted orange X's; by the water tanks in the middle of the runways; and along the coast from Bulky Dump to the runway overrun area. It was rare on Eastern Island, found only at the Sunset Seep where it was likely either out-planted or introduced accidentally along with the out-planted *Solanum nelsonii* that it was next to. No plants were found on Spit Island in 2008 (Starr and Starr 2008). In 2015, the distribution was similar, but it was only found on Sand Island this time. Plants were commonly found in somewhat moist open areas and were locally common still by the Old Fuel Farm, abandoned runways, cracks in the concrete of the Seaplane Hangar, by Cargo Pier Beach, Rusty Bucket, and in Town, especially areas where buildings were removed and sand was replaced (apparently from Cargo Pier Beach). It has not been actively propagated in the FWS Greenhouse, though there is mention of utilizing it more for outplantings in suitable areas, including Eastern and Spit (Klavitter et al. pers. comm.).

Psidium guajava (Guava) Myrtaceae

Native to the Neotropics, now widely cultivated and naturalized in tropical and subtropical regions of the world. In Hawaii, a serious weed and naturalized on all of the main islands (Wagner et al. 1999). On Midway, previously recorded in 1995 by Bruegmann who notes this species being cultivated by the abandoned Cable Company buildings. She notes that this species could become a major threat if allowed to spread (Bruegmann 1998). In 1999 (Starr and Martz 1999), a few plants observed persisting at

the Cable Company buildings and in an opening in the ironwood (*Casuarina*) forest near Rusty Bucket. By 2008, all those previous plants had been removed by the FWS. However, a new small plant was discovered in the personal garden next to the Water Plant. Sak, the Water Plant attendant, said he brought the plant in from seed from Hawaii. The plant was unbranched, sterile, about a meter tall, and protected by orange fencing. Despite the tangy and sweet fruit, in Hawaii, guava is considered one of the worst weeds of the lowlands. It would be fairly easy to remove the one known tree from Midway, again and place it on the prohibited list (Starr and Starr 2008). Not observed in 2015 and presumed eradicated from Midway, again.

Psilotum nudum (Moa) Psilotaceae

Native to the main Hawaiian Islands (Palmer 2003) and apparently native to Midway, this fern ally was first collected in 1923 by Caum (*Caum 35* BISH) as sparingly present in the sandy plain near the lighthouse of Sand Island (Christophersen and Caum 1931). Moa has not been observed on Midway since.

Psophocarpus tetragonolobus (Wing bean) Fabaceae

High climbing twining vine with trifoliate leaves and winged pods, cultivated for its edible beans (Floridata 2008). Probably native to Papua New Guinea and Indonesia and widely cultivated in the tropics, especially in Myanmar, India, Malaysia, Indonesia, Thailand, Bangladesh, West Africa, the West Indies and South Florida (Floridata 2008). In 2008, collected in the Community Garden (*Starr and Starr 080610-06* BISH) to document the presence on Midway. It was also being grown in the small enclosed greenhouse behind the abandoned galley (Starr and Starr 2008). In 2015, one recently dead vine was growing in the Residences.

Punica granatum (Pomegranate) Myrtaceae

Native to Persia, grown ornamentally in Hawaii, and also for its edible fruit (Neal 1965). On Midway, it was first recorded from Midway in 1995 (Bruegmann 1998), reported to be rare and cultivated on Sand Island. It has not been observed since.

Raphanus sativus (Radish) Brassicaceae

Native to Eurasia; commonly grown for its root which is eaten raw (Neal 1965); in Hawaii, documented from all of the main islands except Niihau and Lanai (Wagner et al. 1999). Recorded from Midway for the first time in 1999 (Starr and Martz 19999), when a mature, seeding, semi-cultivated plant was collected on Sand Island (*Starr and Martz 990429-4* BISH). Not observed since.

Ricinus communis (Castor bean, castor-oil bean) Euphorbiaceae

Native to Africa and perhaps India. In Hawaii, naturalized on all the main islands (Wagner et al. 1999). On Midway, observed by Fosberg and Neff and DuMont (1955) who report "An occasional small plant was seen on Eastern Island. On Sand Island, there are several fairly large patches, some of them far distant from the residential area." Also observed in 1979 (Apfelbaum et al. 1983) and in 1995 (Bruegmann 1995). In 1999 (Starr and Martz 1999), castor bean was found to be naturalized on Sand Island, where it was occasional on the north part of the island, including some large patches near the cart path. It was not observed on Eastern or Spit Islands. Control efforts were underway by the FWS. In 2008, castor bean was still present on Sand Island, and though it had spread to new areas, it was gone from some other areas it had been in. A few of the locations that were no longer present include a couple of populations on West Beach that seemed to have disappeared with the ironwoods that were removed from the area, and the site behind Pavilion / North Beach, which apparently does have seedlings germinate from time to time, but they are removed. Some of the areas that currently have patches of castor bean are the Marine Barracks, Dump Pond, Boneyard, West Beach, and most notably the area around Radar Hill and the Cemetery (Starr and Starr 2008). In 2015, only two small seedlings were observed and pulled, at Radar Hill, a known hot-spot for this species, which has a potentially long-lived seed bank.

Rosa sp. (Rose) Rosaceae

Many roses are cultivated in Hawaii (Neal 1965). On Midway, roses have previously been recorded by Hadden (1941) grown for ornament. They were also observed by Apfelbaum et al. (1983). In 1999 (Starr and Martz 1999), roses were cultivated in the residential and town area of Sand Island. In 2008, roses were still found in many of the gardens around the residences of Sand Island. There were also roses in town at the Water Plant and the Barber Shop. The roses on Midway ranged in flower color from pink to rose. Collected from 4208 Commodore Ave. (*Starr and Starr 080607-11* BISH) to document the presence on Midway (Starr and Starr 2008). In 2015, there were still a few rose bushes remaining at a couple Residences.

Rosemarinus officinalis (Rosemary) Lamiaceae

A couple large untidy plants, with patches of dead branches, persisted in the Community Garden. Though looking uncared for, apparently the plants were still occasionally used.

Roystonea sp. (Royal palm) Arecaceae

Native to southern Florida and Cuba (Neal 1965). Cultivated in Hawaii. On Midway, previously recorded in 1979 (Apfelbaum et al. 1983), but not since then.

Ruellia brittoniana (Ruellia) Acanthaceae

Native to Mexico; in Hawaii, on Midway, Kauai, Maui, and Oahu (Oppenheimer and Bartlett 2002; Wagner et al. 1999). On Midway, first collected (*Conant 127* BISH) on Sand Island in 1983 by Sheila Conant who reports "A large colony of these plants was growing around some of the abandoned buildings of the old Pan Am Hotel, and was probably brought in as an ornamental for landscaping purposes." Also observed in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), this species was persisting around old buildings and cultivated in residential areas on Sand Island. In 2008, the situation was the same, plants persisting in the residential area and around the Old Cable Co. buildings (Starr and Starr2008). In 2015, the plants by the Cable Company buildings were gone, the whole area had been dug up during lead abatement work. A few plants persisted by the 4208 house, though lead abatement work was going to occur there later in the year.

Russelia equisetiformis (Coral plant, firecracker plant) Scrophulariaceae

Native to Mexico, cultivated in Hawaii (Neal 1965). Recorded from Midway for the first time in 1999 (Starr and Martz 1999), where it was cultivated in the residential area of Sand Island. Collected in 1999 (*Starr and Martz 990429-7* BISH) to document the presence on Midway. In 2008, this gangly plant with red flowers was still cultivated in the residential area of Sand Island. There was a large plant in flower at 4212 Commodore Ave. (Starr and Starr 2008). Not observed in 2015.

Saccharum sp. (Ko, sugar cane) Poaceae

Reported by Aspey (2012) as being planted in the Community Garden. In 2015 there were a half dozen small clumps of sugar cane persisting in the community garden. They looked disheveled and like they weren't being used much, but didn't seem to be spreading.

Sagina japonica (Japanese pearlwort) Caryophyllaceae

Native to eastern Asia and previously known in Hawaii from a collection at the Honolulu Airport in 1985 where it was considered probably not established (Wagner et al. 1999). In 1999, it was collected from Midway on Sand Island, where it was uncommon on the hard packed coral runway (*Starr and Martz 990510-6* BISH) representing a new island record for Midway Atoll (Starr et al. 2003). Not observed in 2008 (Starr and Starr 2008). In 2012, not observed, though *S. maxima* reported from the same locations (Aspey 2012), who made a collection (*Aspey s.n., Starr 150404-03* BISH). In 2015, once again found to be scattered and locally common along the Runway and other hard packed areas, including the Cargo Pier area and in Town. Often growing intertwined with *S. procumbens*. This species appears to be ephemeral on Midway, which may explain why is wasn't observed in 2008. Taxonomic uncertainty remains regarding the *Sagina* on Midway. Two taxa are reported here, but there very well could be more than two taxa on Midway. Another collection was made (*Starr 150330-03* BISH), to further document this species on Midway and to hopefully get an expert opinion on what names should be places on the Midway *Sagina* spp. This is the more robust and common of the two *Sagina* spp., and is usually 5-merous.

Sagina procumbens (Birdseye pearlwort) Caryophyllaceae

Native to Eurasia and North Africa and naturalized in temperate areas (ISSG 2015). In 2012, *S. apetala* was reported from the same general locations *S. japonica* had been known from (Aspey 2012), who made a collection (*Aspey s.n., Starr 150404-04* BISH). In 2015, this *Sagina* was less common, but was in the same general locations as *S. japonica*, moist hard-packed sites, especially along the Runway near the Fire Station. It was often growing intertwined with *S. japonica*. Taxonomic uncertainty remains regarding the *Sagina* on Midway. Two taxa are reported here, but there very well could be more than two taxa on Midway. A collection of this *Sagina* was made (*Starr 150330-04* BISH), to further document this species on Midway and to hopefully get an expert opinion on what names should be places on the Midway *Sagina* spp. This is the more diminutive and of the two *Sagina* spp., and is usually 4(5)-merous.

Salvia officinalis (Sage) Lamiaceae

Native to northern and central Spain, Southern France, and the western Balkan Peninsula and widely cultivated outside its native range for use as a culinary herb (Staples et al. 2005). In Hawaii, sage is frequently cultivated though tending to turn leggy and woody after a few years and requiring replacement (Staples et al. 2005). In 2015, a couple plants were growing in the Community Garden, in the southeast corner, along with a clump of rosemary bushes. The two appeared to have been there a while and both were beginning to get woody and leggy. This plant is not known to spread and likely does not pose much of a threat.

Samanea saman (Monkeypod) Fabaceae

Native to the Neotropics from Mexico to Peru and Brazil, now widely cultivated. In Hawaii, a popular street tree, now naturalized probably on all of the main islands (Wagner et al. 1999). On Midway, reported by Apfelbaum et al. (1979) and previously known from literature as cultivated (Herbst and Wagner 1992). It was not observed in 1995 (Bruegmann 1998), nor in 1999 (Starr and Martz 1999), yet in 2008 there was a big old monkeypod tree right next to the Bowling Alley at the Midway Mall on Sand Island. The tree measured over twice as tall as the Midway Mall and was in slight flower. There was a lot of fruit on the ground. No seedlings noted. Collected (*Starr and Starr 080611-03* BISH) to document the presence on Midway (Starr and Starr 2008). In 2015, the tree by the Midway Mall was gone, having been removed during lead abatement work. No other mokeypod trees were observed.

Sanseviera trifasciata (Mother in law tongue) Aloeaceae

Native to tropical Africa (Dehgan 1998), *Sanseviera* is cultivated in Hawaii and is naturalized on Kauai, Oahu, and Maui (Imada et al. 2000, Flynn and Lorence 2002, Starr et al. 2003). There are previous references to a *Sanseviera* sp. and *S. trifasciata* at Midway (Hadden 1941, Apfelbaum et al. 1983, Bruegmann 1998). In 1999 (Starr and Martz 1999), this species was cultivated in many areas of Sand Island including cross point, the hangar, and the residences, where it was persisting and spreading vegetatively. In 2008, collected (*Starr and Starr 080607-03* BISH) to document the presence on Midway, where it can be found persisting at old planting sites and in currently maintained gardens. This plant seems to live on and slowly spread after humans have abandoned an area. It may be good to chip away at some of the abandoned patches of this, such as the one on the east side of the old Water Treatment Facility by the Runway (Starr and Starr 2008). In 2015, this ubiquitous plant was still persisting on the east side of the old R2 Water Treatment Facility, at the Water Plants, and by the Midway House.

Santalum ellipticum (Iliahialoe, coast sandalwood) Santalaceae

Endemic to Hawaii where it is found near the ocean or in dry shrubland and forest up to 1000m elevation on all the main islands, and extinct on Kahoolawe and Laysan (Wagner et al. 1999). In 2012, 9 seeds were brought in from Oahu but did not germinate. On Laysan, this small statured tree is also being reintroduced, though as of 2013, only a few small trees persisted in camp there. It has also been used with some success at other coastal restoration sites on the Main Islands, such as Kanaha Beach and Kahoolawe, though at Kanaha Beach, many plants died once washed over during the last tsunami. Planting away from the ocean overwash zone would likely be more successful in the long run.

Scaevola taccada (Naupaka kahakai) Goodeniaceae

Also known as *S. frutescens*; *S. koenigii*, and *S. sericea*. Occurring throughout tropical and subtropical Pacific and Indian Ocean coast. In Hawaii, common in coastal areas throughout the Hawaiian Archipelago, except not on Gardner Pinnacles, Necker, and Nihoa (Wagner et al. 1999). On Midway, naupaka was noted as early as 1902 (Bryan 1905) from both Sand and Eastern Island, though as more common on Eastern Island and scarce on Sand Island. This native shrub was also present when the Pacific Cable Company began their endeavors (Hadden 1941). At that time, the Cable Company (on Sand Island) began to spread *naupaka*, along with *alena* (*Boerhavia repens*) and European beach grass (*Ammophila arenaria*) to make the island more inhabitable. Naupaka was again recorded by the Tanager Expedition on both Sand and Eastern Islands in 1923 where it completely encircled Eastern island in a broad belt (Christophersen and Caum 1931). Apparently, by this time Sand Island had already seen much change due to human occupation and Eastern Island was relatively the same. It was also noted by Neff and DuMont (1955) as "Abundant. The dominant vegetation of both islands. It is gradually creeping to the tops of the old revetments, recapturing areas lost to military destruction. Where undisturbed, in vacant lot, and in waste land." By 1979, while naupaka remained a prominent native plant, damage from rats was apparent. Apfelbaum et al. (1983) report that, "We found severe damage to *Scaevola* especially inland of the fore-dune where larger Ironwood were present as canopy elements. Rat damage was found only on *Scaevola*. The rodents chewed succulent apical and lateral buds which reduced lateral and vertical growth potentials of *Scaevola*. In some places, particularly along the west beach, damage was so severe that we believe *Scaevola* is certain to be eliminated." In 1995, Bruegmann found similar damage and reported that naupaka was the most commonly observed native species, but "Very few seedlings and saplings were observed, and most of the mature individuals appear extremely old." Since then, rats have been eradicated. In 1999, there were numerous seedlings and saplings observed, and adult plants appeared in fine health. Naupaka was common to dominant on parts of Sand, Eastern, and Spit Islands. In 1999, it was actively propagated and out-planted at various sites on Midway. In 2008, naupaka was doing well on Sand Island, almost too well in some places. Naupaka was no longer actively propagated, and the small plants that were planted had each now become large patches. Though many of these were perhaps providing habitat for red-tailed tropicbirds, it did seem the naupaka made life challenging for the albatross. Many of the buildings now had a ring of naupaka around them, that may have provided some buffer from the animals and softened the profiles of the building, but will also require continual maintenance to keep off the structures. We are guilty of planting a couple naupakas in front of our house when we lived in 4209 Commodore Ave. in 1999. By 2008, those little plants had completely devoured the lawn and were rubbing up against the house. North Beach is another area where naupaka cover has increased dramatically. What used to be barren sand and a few naupaka plants in front of the Clipper House is now a sea of impenetrable naupaka. The same has occurred at the Old Fuel Farm. Frigate Pt. is also much less navigable now, though at least the naupaka is used by boobies and frigates once again. On Eastern Island, the naupaka was common to dominant on the far east side of the island, especially between the two runways, but didn't

form continuous stands as thick as those on Sand Island. It was also found along the southern and northern shores of the western tip of the island, and near newly created duck seeps. The boobies and frigates make their nests in the naupaka, utilizing most of the plants available on Eastern Island. On Spit Island, naupaka now forms an impenetrable thicket in the center of the island. Just 15 years ago the island was basically completely barren. In 2008, it is impossible to traverse the middle of the island without extraordinary effort. The increase in naupaka has seemingly resulted in more red-footed boobies who like being off the ground and less grey-back terns who prefer bare ground. The naupaka has not yet reached the popolo (*Solanum nelsonii*) patch at the north part of the island, but is poised to quickly engulf the plantings of popolo on the southeast part of the island. Naupaka is a native plant that can provide great bird habitat, but is also very aggressive and should be spread sparingly and with the long term in mind (Starr and Starr 2008). In 2015, naupaka was dominant over much of Spit Island, ringed much of the north and east coasts of Eastern Island, and was common over much of Sand Island, especially along the coast. As mentioned previously, it can be useful habitat for some bird species, but will tend to dominate an area at the exclusion of most other plant species. There were several areas where trails were being kept to allow access for humans and seabirds, including North Beach, Frigate Pt., and Spit Island.

Schefflera actinophylla (Octopus tree) Araliaceae

Native to Australia and New Guinea, widely cultivated indoors and outdoors; in Hawaii, naturalized at least on Kauai, Oahu, Maui, and Hawaii, but probably on all of the main islands (Wagner et al. 1999). On Midway, previously recorded by Apfelbaum et al. (1983) and by Bruegmann (1998). During 1999 (Starr and Martz 1999), there were several cultivated trees in the town area of Sand Island and it was beginning to spread beyond initial plantings, germinating in trees and on buildings. No naturalized specimens were collected and it had yet to be published as a new island record for Midway Atoll. In 2008, *Schefflera* was still persisting in the town area and around the residences. However, no seedlings were noted. There was a single large tree by the Midway Mall. There were a pair of trees on either side of residence 4211 Commodore Ave., the one in the front yard being much larger. There was also a single large tree directly next to 4208 Commodore Ave. that had been severely cut back to the main stump, and was beginning to regrow. This pollarded *Schefflera* also had an orchid in coconut husk hanging on it. Collected (*Starr and Starr 080601-14* BISH) to document the presence of *Schefflera* on Midway (Starr and Starr 2008). In 2015, two of the Schefflera trees remained, one by the Residences and one by the Midway Mall, both are quite large now. Again we found no seedlings, which is surprising given the fruit set, available seed dispersers, and ample germination sites. Yet, for some reason this species has yet to spread on Midway.

Schinus terebinthifolius (Christmas berry) Anacardiaceae

Native to Brazil. In Hawaii, documented from Midway Atoll and all of the main islands (Wagner et al. 1999). On Midway, collected by Neff and Dumont (*25* BISH) on Sand Island as an ornamental in 1954, who add "Noted only as a hedge plant on Sand Island". Also listed by Bruegmann (1998) as naturalized and rare on Sand Island. In 1999 (Starr and Martz 1999), four trees were observed on Sand Island, two trees by Pacific Cable Company buildings and two trees at Marine barracks, one of which was female. These appeared cultivated but could have been naturalized. As of July 2000, three had been removed, and only one tree remained, being slated for removal in the near future (Nancy Hoffman pers. comm.). No *Schinus* plants were observed in 2008, despite multiple searches at previously known locations (Starr and Starr 2008). In 2015, there were no *Schinus* observed. However, Refuge Manager Dan Clark relayed that in 2014 he had found a fruiting *Schinus* poking out of an *Oleander* hedge near Captain Brooks, and that it had been controlled. Close inspection of that site revealed a dead tree that was likely the *Schinus*. No seedlings were observed nearby. This species has likely been eradicated from Midway, again.

*Senna siamea (*Pheasant wood, ki lek) Fabaceae

Native to tropical Asia, including Cambodia, Laos, Myanmar, Thailand, Vietnam, and Malaysia; cultivated and naturalized throughout the tropics (GRIN 2008). In 2008, we found a small tree of what appears to be this species growing in the Community Garden. There was no fertile material however, so the identification is tentative. Would be good to confirm the identification once it flowers/fruits. In Thailand, the young leaves and flowers are used in curry dishes. Collected in the Community Garden (*Starr and Starr 080610-08* BISH) to help with determination and to document the presence on Midway (Starr and Starr 2008). Nothing like this was found in 2015.

Senna surattensis (Kolomona) Fabaceae

Probably native to Australia; in Hawaii, cultivated and now naturalized on Kauai, Oahu, and Maui (Wagner et al. 1999). On Midway, previously known from literature (Herbst and Wagner 1992). It has not been observed since.

Sesbania grandiflora (White flowered Sesbania, dok khae) Fabaceae

Commonly cultivated in Hawaii (Wagner et al. 1999). The flowers are eaten as a vegetable in southeast Asia (Wikipedia 2008). First reported from Midway in 1995 (Bruegmann 1998) where this species was cultivated on Sand Island. In 1999, a few plants were cultivated in the residential area of Sand Island, for the edible leaves and flowers. It was collected (*Starr and Martz 990505-4* BISH) to document the presence on Midway. In 2008, this tall, pinnately-compound tree / bush with large, white, pea-like flowers was cultivated at residences along Commodore Ave. and in the Community Garden. The tree in the Community Garden is 10+ meters tall, and has apparently grown to that height in nine years, as images from 1999 show that nothing but tomatoes were growing there (Starr and Starr 2008). In 2015, there were a few of these trees remaining in the same spots, but they were unhealthy looking. It is not certain whether it was that the plants had not leaved out yet after winter, or if they were showing signs of non-target herbicide effects given the weed control efforts below them. No sign of spread has ever been observed and it is generally not considered to be invasive.

Sesuvium portulacastrum (Akulikuli, sea purslane) Aizoaceae

Pantropical in distribution. In Hawaii, occurring in coastal habitats of Midway and Pearl and Hermes atolls, Lisianski, Laysan, Necker, and all of the main islands (Wagner et al. 1999; Bruegmann 1999). First collected from Midway on Spit Island in 1995 by Bruegmann. In 1999 (Starr and Martz 1999), observed on Sand, Eastern, and Spit Islands. On Sand Island, it was found at the dump pond where it formed large mats, and at bulky dump where a few small plants sprung up. On Eastern Island, small patches were found on the south shore, and the west and northeast tips. On Spit Island, it was common, especially around the small pond. During 1999, it was also being propagated and out-planted in various places including the Fuel Farm on Sand Island. In 2008, this mat forming succulent was still found on Sand, Eastern, and Spit Islands. On Sand Island, the large population at the dump pond had been mostly overrun by *Phyla nodiflora*. The bulky dump patches seemed to be doing fairly well where there was occasional salt spray. The fuel farm plantings never made it. On Eastern Island, akulikuli was only seen on the far west tip of the island, as the closest plant to the ocean. On Spit Island, the large akulikuli mat around the lake was still doing well, and actually had grown quite a bit in size. Collected at the dump pond at Sand Island to further document the presence of this species on Midway (*Starr and Starr 080602-03* BISH) (Starr and Starr 2008). In 2015, akulikuli was found in the same general locations as previous surveys, generally in saline conditions and often the closest plant to the ocean. On Eastern it was present on the western tip of the island, from the high tide line to about where most other vegetation starts. A number of birds were utilizing it to sit on, as it is softer than the sand cobble. On Spit Island, the previous lake at Spit Island had been mostly filled in by coral rubble during high surf events and akulikuli was less abundant in that location, though new land had been created on the eastern side of Spit and akulikuli was now most abundant along a moist depression and sandy berm on the eastern end of the island. Akulikuli was being

sparingly utilized by Red-Footed Boobies as nesting material. On Sand Island, akulikuli was thriving at Bulky Dump, apparently maintaining a competitive advantage in the salt spray zone. It was being propagated in the FWS Greenhouse, was in pots at the Residences, and was recently outplanted at Brackish Pond, the east side of Sector 32 facing the Harbor, and Cross Point.

Setaria verticillata (Bristly foxtail, mauu pilipili) Poaceae

Native to Europe; in Hawaii, documented from Kure, Midway, and Pearl and Hermes atolls, French Frigate Shoals, Nihoa, and all of the main islands (Wagner et al. 1999). The bristly seeds stick to passersby and can be transported between islands in the atoll. Locally abundant in open spaces on both Sand and Eastern Islands in 1954 (Neff and DuMont 1955). Noted as occasional from both Sand and Eastern Islands in 1995 (Bruegmann 1998). Collections at Bishop Museum include (*H.W. Frings 9, 30*; *Herbst and Takeuchi 6402, 6330, 6402*; *Lamoureux 2175*; *Neff and DuMont 7*). In 1999 (Starr and Martz 1999), found to be occasional to common on Sand Island in lawns and waste places. On Eastern Island, occurring over most of the island, especially near revetments. Two small patches were found on Spit Island during the 1999 survey and pulled. In 2008, this grass was still present on Sand and Eastern Islands. On Sand Island, it was found in lawns, mostly in town, around the residences, and by the Cable Company buildings. On Eastern Island, it was observed in hard packed open areas. Not observed on Spit Island (Starr and Starr 2008). In 2015, there was less bristly foxtail, likely due to ongoing control, on both Sand and Eastern Island. On Sand Island, a few plants were found around the Residences and in Town. On Eastern, a plant was found just inland and east of the Pier. It was not found on Spit. Continued control should reduce the population even further and perhaps this noxious grass could be eliminated.

Sicyos pachycarpus (Anunu) Cucurbitaceae

Endemic to Hawaii and known from dry herb or shrubland coastal communities of all the main islands, Laysan, and Nihoa. Introduced to Midway from Laysan in April 2008 (John Klavitter pers. comm.). Not observed in 2008, though they may have not yet germinated (Starr and Starr 2008). Not observed in 2015, it appears that on Kure they consider *Sicyos* a weed and knock it back with herbicide. FWS is no longer considering introducing any of the *Sicyos* species known from the NWHI.

Sida fallax (Ilima) Malvaceae

Native from Pacific islands to China; in Hawaii, documented from Midway Atoll, Nihoa, and all of the main islands (Wagner et al. 1999). On Midway, in 1923, the Tanager Expedition observed and collected only one small plant on Eastern Island (*Caum 31* BISH). S. Conant (1983) collected it from Sand Island and adds "This plant was collected (*Conant 316* BISH) on Roosevelt Avenue across from the cemetery. Although I

searched carefully for this species all over the island, the small colony (about 5 plants) from which a specimen was taken were the only plants I found." Not observed by Bruegmann in 1995 (Bruegmann 1998). Not observed on Sand, Eastern, or Spit Islands in 1999. In 2004, rediscovered on Midway by the Doctor's Cemetery, though apparently it was unintentionally destroyed while removing the similar looking *Abutilon grandifolium*. (Klavitter 2006; Klavitter, Schubert and Knuckles pers. comm.). In 2008, another lone plant, about a meter tall, was found growing on the north side of the Midway Mall, and was brought to our attention by FWS employees Greg Schubert and Pete Leary. The plant had orange fencing around it and had been propagated by cuttings in the FWS nursery (Starr and Starr 2008). In 2015, ilima was only observed around the Town area of Sand Island, mostly in pots. Many of the plants looked chlorotic, though a few looked healthy and were flowering.

Sida rhombifolia (Cuba jewt) Malvaceae

A pantropical weed; in Hawaii, on all of the main islands. First recorded from Midway in 1999 (Starr and Martz 1999), where a few plants were found on the margin of an ironwood (*Casuarina*) forest near the abandoned seaplane hangar on Sand Island. Collected (*Starr and Martz 990514-2* BISH) to document the new island record for this species (Starr and Martz 2000). Not observed since.

Solanum americanum (Glossy nightshade, popolo) Solanaceae

Also known as *Solanum nigrum*. Widely distributed in tropical and warm temperate regions. In Hawaii, questionably indigenous and occurring on Kure, Midway, and Pearl and Hermes atolls, Lisianski, Laysan, Nihoa, and all of the main islands (Wagner et al. 1999). On Midway, first collected by Neff and DuMont (1955) who note it to be "Occasional, found mostly in utility areas about buildings." Conant (1983) adds "This indigenous plant was not common on Midway, but that may be due to the fact that there had been a rather severe dry season. The plants from which this collection was made (*Conant 135* BISH) were nearly dead, growing on a fence adjacent to the school building." Bruegmann (1998) notes this species as common on Sand Island. In 1999, we found it to be common on Sand Island, and occasional on Eastern and Spit Islands. This species was observed in almost every habitat type on Midway, and collected on Spit Island (*Starr and Martz 990623-2* BISH). In 2008, popolo was common in the lawns and opens area on Sand Island. It was not observed on Eastern Island. On Spit Island, it was observed in a couple spots near the shore. It is not known whether this species is native or not, complicating management recommendations. At first, we were leaning towards non-native and were controlling it in places like Kanaha Beach on Maui. After discussions with Hawaii bio-geography expert Jonathon Price (pers. comm.) we changed our position and have been treating *S. americanum* as native. Frank Howarth (pers. comm.), entomologist with Bishop Museum, suggests that perhaps there was / is a native form and that perhaps additional non-native forms have also recently arrived. Given the clouded history of this plant and how common it is elsewhere, we would not worry about

controlling plants in areas where they are unwanted, or letting them run wild in areas where they are doing no harm (Starr and Starr 2008). In 2015, this species was occasionally observed on Sand Island, found by the old R2 Waste Water Facility, Frigate Point, and West Beach, sometimes doing fine on hard packed surfaces. On Eastern Island it was only observed near the Pier. Not observed on Spit Island. It was now being controlled islandwide, but still persists in some areas.

*Solanum lycopersicum (*Tomato) Solanaceae

Native to western South America, widely cultivated in Hawaii (Neal 1965). First noted on Midway in 1999 (Starr and Martz 1999), where it was occasionally observed in gardens, and was extensively planted in the Hydroponics Facility and the Community Garden. The tomatoes were grown by employees of Midway Phoenix and were used in the nearby Galley for island meals. In 2008, there were a lot less people on Midway, a lot less tomatoes, and the Galley had been abandoned. Tomatoes were observed in small numbers in the little Greenhouse next to the Hydroponics Facility. There were plans however to ramp up production of tomatoes on Midway, as Chugach had recently hired an employee to start up the Hydroponics Facility again. Collected from the Greenhouse (Starr and Starr 080610-11 BISH) to document presence on Midway. Tomatoes are not allowed on Lehua Island, Laysan, and other places because they could establish and spread. However, given how useful and perhaps economical non-flown-in tomatoes could be on Midway, the motivation there seems to keep tomatoes in check on Midway, especially if grown indoors and done with hybrid tomatoes that do not have viable seeds (Starr and Starr 2008). In 2015, multiple varieties of tomatoes were growing well in the Hydroponics Greenhouse and were being served at the Clipper House. There were also a couple not so happy looking plants growing at the Residences. No wild tomatoes were observed beyond cultivation.

Solanum melongena (Eggplant) Solanaceae

Native to southeastern Asia, cultivated in Hawaii for food (Neal 1965). First observed on Midway in 1999 (Starr and Martz 1999), where it was cultivated in residential areas of Sand Island. There were white and purple flowered forms collected (*Starr and Martz 990429-2*, *990511-5*, *6* BISH). In 2008, eggplant was indeed still a favored plant in the gardens of Sand Island with many varieties, most of which were stout to roundish shaped fruits that were green, yellow, or purple when ready to eat (Starr and Starr 2008). In 2015, a variety of eggplants continued to be grown at the Residences, including purple and yellow.

Solanum nelsonii (Popolo) Solanaceae

Also known as *S. laysanense*; *S. nelsonii* var. *intermedium*. Endemic to the Hawaiian Islands, previously occurring in coastal sites on Kure, Midway, and Pearl and Hermes atolls, Laysan, Nihoa, Niihau, Kauai, Oahu, Molokai, Maui, and Hawaii (Wagner et al. 1999). *Popolo* has declined dramatically in the Northwestern and Main Hawaiian Islands and is now presumed extinct on Kure, Laysan, Kauai, Oahu, Maui, and Hawaii (Wagner et al. 1999). On Midway, *S. laysanense* was recorded from both Sand and Eastern Islands in W. A. Bryan's 1902 collection (*Bryan E, F* BISH). *S. nelsonii* var. *intermedium* was recorded only from Eastern Island, where it was observed by the Tanager Expedition to be abundant in the central plain on Eastern Island (*Caum 29* BISH) in 1923 and then again in 1944 on Sand Island (*Caum 256* BISH). It was also collected by Meagher in 1933 with no notes as to which island. In 1964, Lamoureux made a collection (*Lamoureux 2768* BISH) from Eastern Island. And, in 1980, Herbst and Takeuchi made a collection on Eastern Island. It was not observed on Midway Atoll in 1995 (Bruegmann 1998), however, reports of it were made in 1996 by Nanette Seto. It was then reported as extinct from Midway Atoll (Wagner et al. 1999). However popolo persisted on Midway and was collected from Spit Island in 1999 (*Starr and Martz 990623-1* BISH), where a few plants (all life stages) were found on the northeast shore just inside the vegetation line. Seeds were collected and propagated at the Midway nursery for future out-planting at Midway Atoll. It was not observed on Sand or Eastern Island. In 2008, popolo was observed on Sand, Eastern, and Spit Islands. On Sand Island, there were a couple dozen pots of popolo seedlings in the greenhouse. There was also a small planting of a couple plants on the makai side of the boardwalk headed to the Clipper House. On Eastern Island, popolo was observed planted on the upper margins of the newly created duck seeps. There was also a lone individual observed on the northern shore of the western tip of the island, just inside the naupaka line, apparently not planted by FWS (John Klavitter pers. comm.). On Spit Island, popolo was common on the north tip of the island, where it had spread dramatically since 1999. There were dozens of mature plants along with lots of young plants and seedlings in the open areas. Popolo was also planted on the southeast part of the island. There may even be a few more plants found in the naupaka thicket. Flowers and abundant green and ripe fruit were present. Though doing well on Spit Island, popolo may get crowded out if the naupaka continues to march outward, covering the island. In an even nearer term, it may be interesting to try remove some of the encroaching non-native *Eustachys* grass that is forming large patches on Spit Island, to see if popolo sprouts up in those areas. This species is now teetering on extinction, with the populations on Midway Atoll one of the last refugia for this species. One giant storm could obliterate the entire population of popolo on Spit Island, a tsunami could do the same for all of Midway Atoll, so it is important to continue to collect seed and outplant it in as many appropriate locations as possible. Additionally, the Midway plants appear morphologically distinct from the popolo in the Main Hawaiian Islands. The Midway plants appear much more bush / shrub like, sometimes up to a meter tall with woody bases. Whereas the Maui Nui plants appear much more prostrate, hugging the ground, more like a vine. The foliage on the Midway plants are also more blue green than the Maui Nui plants which have an almost furry brown tomentose to them.

Additional plantings on Sand and Eastern Island, along with selective control of plants encroaching on popolo on Spit Island would help tremendously with the recovery of this species, as would re-introducing it to nearby Kure Atoll (Starr and Starr 2008). In 2015, popolo was observed on Sand, Eastern, and Spit Islands. Spit Island continues to be the stronghold for this species at Midway, despite being inundated by the 2011 Japan tsunami, after which, several hundreds of plants germinated before being overrun by *Eustachys* and naupaka (Klavitter et al. pers. comm.). On Spit Island, dozens of mature plants were growing in open coral cobble and amongst the naupaka thickets. Red-Footed Boobies were utilizing popolo branches in their nests. On Eastern Island, there was one luxuriant plant near the Pier that had shown up in the decaying remains of an ironwood stump. On Sand Island, a few plants of popolo were growing in sector 32 east of the Dump, and hundreds were recently propagated and growing in small pots at multiple spots in Town.

Solanum torvum (Turkeyberry, makhua phuang) Solanaceae

Native to the Antilles, now a pantropical weed; in Hawaii, naturalized on Oahu, Maui, and Hawaii (Wagner et al. 1999, Oppenheimer et al. 1999, Starr et al. 2003). First observed on Midway in 2008, where a few large, spiny, bushes and some nearby seedlings were observed in the Community Garden. There were also a couple small plants, including seedlings, in the garden of 4208 Commodore Ave. Collected from 4208 Commodore Ave. and the Community Garden (*Starr and Starr 080601-02, 080601-12* BISH) to document the presence on Midway. Though the green fruits of this species are tasty in green curry, *S. torvum* is a notorious weed, and is listed as both a Federal Noxious Weed and a Hawaii State Noxious Weed. In order to prevent infestations of this species from establishing any further on Midway, it would make sense to remove all the known plants, put it on the prohibited plant list for Midway, and monitor the known sights for the next few years (Starr and Starr 2008). In 2015, all the plants had been controlled, except for one next to the Community Garden that appeared to have grown back from a very large stump. It was treated while we were there, but it had gone to fruit, so the site should be monitored.

Sonchus oleraceus (Sow thistle) Asteraceae

Native to Europe; in Hawaii, known from Kure, Midway, and Pearl and Hermes atolls, French Frigate Shoals, Nihoa, Kaula, Lehua, and all the main islands (Wagner et al. 1999). First collected on Midway in 1933 by Meagher. Other collections from Midway Atoll at Bishop Museum for this species include (*H.W. Frings 23, 49, 77*; *Lamoureux 2239*; *Herbst and Takeuchi 6445*, *C.R. Long 1707*). Neff and DuMont (1955) note that "An occasional plant was seen growing along utility roads and in service areas on both Sand and Eastern Islands." Also observed in 1979 by Apfelbaum et al. (1983) and in 1995 noted by Bruegmann (1998) on Sand, Eastern, and Spit Islands. In 1999 (Starr and Martz 1999), found to be occasional on Sand, Eastern, and Spit Islands. In 2008, still found to be occasional on Sand, Eastern, and Spit Islands, generally growing in open disturbed areas

(Starr and Starr 2008). In 2015, occasionally found on both Sand and Eastern Islands, often near the coast.

Spathodea campanulata (African tulip tree) Bignoniaceae

Native to tropical Africa, and introduced to the main Hawaiian Islands for ornament, this beautiful tree with bright orange flowers is now widely naturalized, and considered a major pest by many. On Midway, this species is restricted to a clump of a dozen trees persisting by the 6000 housing and was first recorded by Bruegmann during her survey in 1995. The clump remained virtually unchanged between 1999 (Starr and Martz 1999) and 2008. Though seemingly not showing signs of aggressive spread, perhaps due to a somewhat dry environment on Midway, this clump could easily be eradicated. Collected (*Starr and Starr 080610-12* BISH) to document the presence of African tulip on Midway (Starr and Starr 2008). In 2015, the remains of these trees were observed in a pile next to where they used to grow.

Spergularia marina (Saltmarsh sand spurry) Caryophyllaceae

Native to Eurasia and also apparently from North America; in Hawaii, naturalized on Kure and Midway atolls, French Frigate Shoals, Kauai, Oahu, Molokai, and Maui (Wagner et al. 1999). On Midway previously recorded in 1979 (Apfelbaum et al. 1983), in 1980 by Herbst who collected it on the SE end of the inner harbor of Sand Island (*Herbst 6349* BISH) and on the edge of the runway on Eastern Island (*Herbst 6409* BISH), and in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), it was common on Sand, Eastern, and Spit Islands. Found in hard packed and sandy areas. In 2008, this ephemeral herb was once again common on Sand, Eastern, and Spit Islands, preferring hard packed areas. On Sand Island, it was found by the Fuel Farm and Runway Overrun. On Eastern Island, it was present on the runways and was even able to grow out of the cracks on the pier. On Spit Island, it formed carpets in open areas (Starr and Starr 2008). In 2015, this prostrate herb was found in hard packed areas, especially near the coast, on Sand, Eastern, and Spit islands. On Sand Island, it was once again prevalent from the Fuel Farm to Turtle Beach, it also was the closest plant to the rip-rap along the southern part of the Harbor. On Eastern it was common along the coast east of the Pier. Only one small patch was found on the eastern side of Spit Island.

Sphagneticola trilobata (Wedelia) Asteraceae

Also known as *Wedelia trilobata*. Taxonomic name change from *W. trilobata* to *S. trilobata* (Wagner et al. 1999; Wagner et al. 1997). Native to the New World tropics; in Hawaii, cultivated as a ground cover and now naturalized on Midway Atoll and probably all of the main islands (Wagner et al. 1999). On Midway, previously collected in 1983 by S. Conant who noted "This creeping herb with its bright yellow flowers is a common ground cover in the main Hawaiian Islands...It was collected (*Conant 118a*

BISH) from around a flagpole in front of the school building." This was the first and only time this species was observed or collected on Midway.

Spinacia oleracea (Spinach) Chenopodiaceae

Native to southwestern Asia, spinach is a common vegetable used for greens and is cultivated in Hawaii and elsewhere (Neal 1965). First and only record from Midway in 1999 (Starr and Martz 1999), when spinach was observed as rarely cultivated on Sand Island. Not observed since. Photo by Rasbak (Wikipedia 2008).

Spondias sp. (Makok) Anacardiaceae

First reported in 2008 from Sand Island, where one tree was being cultivated at 415 Commodore Ave. (Starr and Starr 2008) Not observed in 2015, most of the plants around the Residences had been removed during lead abatement work.

Sporobolus africanus (African dropseed) Poaceae

Native to Africa; in Hawaii, documented from all of the main islands except Niihau (Wagner et al. 1999; Herbst and Clayton 1998). On Midway, observed in 1979 (Apfelbaum et al. 1983) and documented from literature (Herbst and Wagner 1992). In both the 1999 (Starr and Martz 1999) and 2008 surveys, there was taxonomic confusion between *S. africanus* and *S. indicus*. Based on previous collections, and information in the Manual of Flower Plants (Wagner et al. 1999), we lumped the species observations under *S. indicus*, until the true identities can be better determined.

Sporobolus indicus (Indian dropseed) Poaceae

Native to the Neotropics; in Hawaii, documented from Midway, Kauai, Oahu, Lanai, and Hawaii (Wagner et al. 1999). On Midway, collected (*Conant 132* BISH) "From a roadside near the mess hall" (Conant 1983). Also collected by Herbst and Takeuchi (*6380* BISH). Bruegmann (1998) listed this species as rare on Sand Island. See *S. africanus* for 1999 and 2008 surveys. In recent surveys it was realized there is taxonomic confusion between *S. africanus* and *S. indicus*.. Based on previous collections, and information in the Manual of Flower Plants (Wagner et al. 1999), we lumped the species observations under this species until the true identities can be better determined. In 1999, observed as common on Sand Island (Starr and Martz 1999). In 2008, locally common on Sand Island, especially on the margins of roads (Starr and Starr 2008). In 2015, this clumping grass was occasionally observed in lawn areas and compacted sites throughout Sand Island. Not observed on Eastern or Spit Islands.

Sporobolus pyramidatus (Sporobolus) Poaceae

Native to North and South America; in Hawaii, documented from Kure, Laysan, French Frigate Shoals, and Oahu (Wagner et al. 1999; Wagner and Herbst 1995). Observed as common on Tern Island at French Frigate Shoals, and restricted to the guano hard pans on Laysan Island in 1999 (Starr and Martz 1999). On Midway, known from literature (Herbst and Wagner 1992). Not observed on Midway in 1999 (Starr and Martz 1999). In 2008, found to be present on Sand, Eastern, and Spit. On Sand Island, this clumping grass was found along abandoned portions of the N/S runway, just north of Henderson Dr. On Eastern Island, it was locally abundant on the eastern portions of the abandoned runways and occasional on the western portions. On Spit Island, it was present on the north part of the island. Collected on Sand, Spit, and Eastern Islands (*Starr and Starr 080602-01, 080603-01, 080605-02* BISH) to document the presence on Midway. Two of the vouchers (*080602-01, 080605 02*) were identified by folks at Bishop Museum as the closely related *Sporobolus piliferus*. However, many of the grass identifications from Bishop of *S. piliferus* from this period were later changed back to *S. pyramidatus*, so we will stick with *S. pyramidatus* for all the short clumping Sporobolus grasses on Midway, but there very likely could multiple very similar looking species. Further work could help further elucidate the situation on Midway, but regardless of name, management would be the same. In 2015, these grasses were still occasional to common in hard packed areas, especially abandoned runways, on Sand and Eastern Islands.

Sporobolus virginicus (Akiaki, beach dropseed) Poaceae

Native to coastal sites in tropical and subtropical areas worldwide; in Hawaii known from Midway, Laysan, and all of the main islands (Wagner et al. 1999). Collected by Chisholm in 1931 (*Chisholm sn.* BISH). Also observed by St. John in 1935 (Neff and DuMont 1955). Not observed since then. This hardy dune grass was apparently known once from Midway Atoll, yet does not seem to have persisted. In the main Hawaiian Islands, it is a dominant of coastal sand dunes, and has been successfully used in native plant restoration projects where it holds the sand and make a good barrier against weeds. This may be a good candidate for potential re-introduction to Midway Atoll, allowing for a Bermuda grass like structure using native plants. Re-introduction is a little complicated by the fact that akiaki does not produce seeds, though it is readily propagated from cuttings. In 2015, akiaki had been reintroduced (in 2011) from James Campbell National Wildlife Refuge, Oahu, and was being propagated in the FWS Greenhouse. It had been outplanted at a few sites on all three islands. On Sand Island, small plantings occurred at the FWS Office, Clipper House, Cable Co Building, and Old Marine Barracks. On Eastern, it was found at Sunset Seep near the pond margins, and on Spit, a small patch was observed near the akulikuli patch on the northeastern tip. Apparently it had been washed over by the ocean. As the temperatures warmed up, the grass seemed to green up and become more noticeable. Most of the patches had not spread much and it appeared to be struggling a bit. In Hawaii and elsewhere, there can be different forms of this grass, one robust and one less so. The following is from a USDA pamphlet on native plants in

dune restoration (Williams 2007). "Some authorities (Duncan and Duncan 1987) recognize two forms of this grass, a smaller type with leaves usually less than 2-inches long and a more robust type with leaves up to 6-inches long. The more robust type also has larger rhizomes (underground stems) and seedheads and is more common on beaches and dunes." It may help to bring in starts from a few different areas/different varieties to see which form performs best at Midway. This grass prefers moist dune sites near the ocean, such as where akulikuli is found.

Stachys arvensis (Staggerweed) Lamiaceae

Native to Europe and Asia, widely naturalized; in Hawaii, known from all of the main islands except Niihau and Kahoolawe (Wagner et al. 1999). Previously recorded by Herbst and Wagner (1992) and noted by Bruegmann in 1995 as rare on Sand Island (Bruegmann 1998). It was not observed in 1999 (Starr and Martz 1999) or 2008. However it was noted by Aspey in 2012 (Aspey 2012), who reported that this species reappeared after some trenching along the south side of Peters Ave. north of the Citrus Grove and formed a long stand covering 30-40 ft. length. This was the only location found on Sand Island during that survey. Aspey made a collection which was left in the FWS Office. In 2015, about 1-2 dozen plants were found in the northeast corner of the Community Garden. A few plants were also found in the field just inland of the Cargo Pier. A collection was made at the Community Garden (*Starr 150330-01* BISH). In addition, the Aspey collection was brought back to include with our submission to Bishop Museum (*Aspey s.n., Starr 150404-01* BISH). Though previously recorded, this species was not officially collected and documented as naturalized on Midway. These collections represent a new island record for Midway Atoll.

Stachytarpheta cayennensis (Oi, vervain) Verbenaceae

Also known as *Stachytarpheta dichotoma*. Native from Cuba and Mexico, south to Peru and Argentina, now widely naturalized in the tropics and subtropics; in Hawaii, known from Kauai, Oahu, Lanai, Maui, and Hawaii (Wagner et al. 1999). On Midway, previously recorded by Herbst and Wagner (1992). Not observed since.

Stachytarpheta jamaicensis (Owi, vervain) Verbenaceae

Native to tropical and subtropical areas of the New World, now widely distributed; in Hawaii, known from Midway Atoll, Kauai, Oahu, Lanai, Maui, Kahoolawe, and Hawaii (Wagner et al. 1999). On Midway, first collected by Chisholm in 1931 and by Meagher in 1933. Noted by Neff and DuMont (1955) to have been listed by St. John in the 1931 additions to the flora of Midway. Also collected by Lamoureux in 1962 (*Lamoureux 2311* NMNH) and by Herbst in 1980 (*Herbst 6369* BISH) on Sand Island from an area between the golf course and the ocean. In 1999 (Starr and Martz 1999), restricted to a small area east of the Midway Mall on Sand Island. In 2008, observed only in the Antennae Field on Sand Island (Starr and Starr 2008). Not observed in 2015.

Stellaria media (Chickweed) Caryophyllaceae

Native to Eurasia and widely naturalized; in Hawaii, naturalized on Kure Atoll, Kauai, Oahu, Lanai, Maui, and Hawaii (Wagner et al. 1999). On Midway, first previously recorded in 1979 (Apfelbaum et al. 1983). Also reported in 1995 (Bruegmann 1998). In 1999, it was uncommon in the lawn in the north part of Sand Island. In 2001, it was collected (*Starr and Martz 010520-2* BISH) representing a new island record for Midway Atoll (Starr *et al*. 2003). In 2008, we did not come across this species. Though, in 2012, it was observed again by Aspey who noted the distribution on Sand Island as "occasional to frequent" (Aspey 2012). In 2015, we did not observe this species, though it could have easily been overlooked.

Stenotaphrum secundatum (St. Augustine grass) Poaceae

Native to both shores of the Atlantic Ocean, and widely used in lawns and to bind sand. In Hawaii, documented from Midway, Kauai, Oahu, Molokai, Lanai, Maui, and Hawaii (Oppenheimer and Bartlett 2002; Oppenheimer and Bartlett 2000; Wagner et al. 1999). On Midway, Neff and DuMont (1955) collected this species (*20* BISH) and reported it as, "Occasional, in open spots in the older vegetated section of Sand Island." Also collected by Herbst and Takeuchi (*6394* BISH). Recorded from all three islands of Midway in 1995 (Bruegmann 1998). However, it may be that the Eastern and Spit observations actually represented *Eustachys petraea*. In 1999 (Starr and Martz 1999), this mat forming grass was found to be a common lawn grass on Sand Island, especially in the shade. It was not observed on Eastern or Spit islands in 1999. In 2008, St. Augustine grass was still locally dominant in parts of Sand Island including the residences near the Midway House, the FWS headquarters, the area around the Torpedo Repair Shops, and the north harbor breakwater (Starr and Starr 2008). In 2015, this robust grass was found in the same general locations, as well as in the Antennae and Parade Fields and West Beach. It seems to prefer growing in semi-shade, often found near ironwoods or where ironwoods have been removed.

Strelitzia reginae (Bird of paradise) Musaceae

Native to South Africa and grown as an ornamental in Hawaii (Neal 1965). On Midway, observed by Conant (1983) who notes "Two plants...were growing in the old greenhouse of the abandoned Pan Am Hotel." In 1999 (Starr and Martz 1999), this plant was being cultivated near residences and in town. Not observed since.

Syngonium podophyllum (Syngonium) Araceae

Native to tropical America, these climbers are cultivated in Hawaii for their distinctive palmate foliage (Neal 1965). On Midway, previously recorded in 1979 (Apfelbaum et al. 1983) and in 1995 (Bruegmann 1998). During the 1999 survey (Starr and Martz 1999), it was observed as cultivated in the housing area of Sand Island. In 2008, this vine was still being cultivated on Midway, where it would climb up plants and structures. Collected to document the presence of this vine on Midway (*Starr and Starr 080610-02* BISH). There are two leaf forms of this vine, the simple immature heart-shaped form and a mature compound form. This is another vine that would probably be good to remove from Midway, because of its habit of climbing on structures (Starr and Starr 2008). In 2015, a few vines were found at 4208 Commodore Ave. It wouldn't take much to eradicate this species from Midway. The house was being prepped for lead abatement and it is likely that these plants will be removed anyway.

Tabebuia heterophylla (Pink tecoma) Bignoniaceae

Native to tropical America (Whistler 2000). In Hawaii, grown for its attractive foliage and flowers that occur frequently throughout the year (Neal 1965). Though *Tabebuia* sp. was previously reported in literature (Herbst and Wagner 1992), *T. heterophylla* was recorded from Midway for the first time in 1999 (Starr and Martz 1999), where a few trees were cultivated in the town area of Sand Island. Collected (*Starr and Martz 990505-14* BISH). In 2008, there was a large specimen in full flower and fruit near the Ave Maria, and a small bush / tree of presumably this species that was formally sheared into a ball at the Midway Mall in front of the Gift Shop. According to Whistler (2000), this species is known to spread out of the garden on its own. Though it has apparently not done so on Midway yet (Starr and Starr 2008). In 2015, a tree of presumably this species persisted near the Ave Maria. It had lost all of its leaves and was in a deciduous state.

Tagetes erecta (Marigold) Asteraceae

Native to Mexico, cultivated for their attractive flowers (Neal 1965). First observed on Sand Island in 1999, where it was cultivated in the planter box in front of the Boathouse, with a bunch of other garden variety ornamentals. Collected (*Starr and Martz 990421-7* BISH). Not observed in 2008, despite a visit to the planter box it had been previously been growing in, which was now filled with the native pohuehue (Starr and Starr 2008). Not observed in 2015.

Tamarindus indica (Tamarind) Fabaceae

Probably native to tropical Africa and Asia. In Hawaii, a common tree grown mainly for its edible fruits (Neal 1965). Observed for the first time on Midway in 1999 (Starr and Martz 1999), where there was one large tree was near the Citrus Orchard by the Midway Mall. A collection was made to document the presence on Midway (*Starr and Martz 990428-4* BISH). In 2008, the large, 15+ meters tall tree was still there. It was laden with fruit and had lots of seedlings and saplings beneath it. It also appeared someone tried to graft it at some point. The branches were much lower to the ground than they were in 1999, when they had been trimmed up high. There also appeared to be much more fruit available in 2008, which was quite tasty. An abandoned fruit picking stick or something was found grown over with grass near the tree, signs the tree perhaps is not utilized much these days. Another small tamarind tree was found in a recently created planting made out of buckets in front of the Barber Shop behind the Midway Mall. Presumably the Barber Shop plant came from one of the numerous seedlings beneath the large tamarind tree, someone likely dug one out, potted it up, and took it to the Barber Shop. Tamarind is not the most invasive plant, though it can persist, and has shown an ability to reproduce on Midway. It may make sense to remove the young plants beneath the large tree to help assure tamarind does not start to move by itself, and to decrease the temptation of humans to move the plant to other parts of the island. The most conservative approach would of course be to remove all the known trees and put tamarind on the prohibited plant list for Midway (Starr and Starr 2008). In 2015, the only tamarind observed on the island was the now very large tree near the Citrus Grove. No seedlings were observed underneath it. There was still a semi-abandoned looking picking/beating pole, suggesting folks do occasionally try to harvest some of the lowest hanging fruit. The area is now riddled with Bonin Petrel burrows, making access to the area difficult.

Tamarix sp. (Tamarix) Tamaricaceae

Native from western Europe to the Himalayas, resembling *Casuarina*, cultivated in Hawaii (Neal 1965). On Midway, reported by Hadden (1941) as one of the trees planted during the Pan-American era (1936). It has not been observed since.

Terminalia catappa (False kamani, Tropical almond) Combretaceae

Native to Malesia and widely cultivated for shade and edible seeds. In Hawaii, commonly planted and naturalized in coastal areas in at least Kauai, Oahu, Maui, and Hawaii (Wagner et al. 1999). On Midway, Neff and DuMont (1954) note that "Scattered trees may be found almost all over Sand Island, and a few nice specimens were seen on Eastern Island." Collected in 1962 (*Lamoureux 2184* BISH) and 1970 (*Beauchamp 1275* BISH). Also recorded by Apfelbaum et al. (1983) and by Bruegmann (1998). In 1999 (Starr and Martz 1999), it was found to be widely planted on Sand Island and spreading beyond original plantings. Individuals were also observed germinating on the beach of Sand Island. This tree was not observed on Eastern or Spit Islands. In 2008, large trees

were scattered about much of Sand Island, especially near the residences, in town, around old gunnery emplacements, and around the Cable Company Buildings. There were also a couple lone trees between the Marine Barracks and the Runway. Though prolific seeds were found under most trees, along with small seedlings, this species did not seem to be spreading too far beyond the existing trees. That said, this prolific seeder should be occasionally monitored on Midway and should probably not be further planted (Starr and Starr 2008). In 2015, most of these deciduous trees were leafless and easily recognized by their large stature and numerous nuts on the ground below. Some were just beginning to leaf out towards the end of our survey as the weather warmed. The tree is widely found on Sand Island and is most common in Town and West Beach. Scattered individuals were also found in abandoned housing areas and near old building sites, as well as one majestic looking tree near the Fire Station. An occasional seedling was found near/under parent trees, but no saplings or intermediate trees were observed, only fairly old trees and small seedlings. Some trees had curling leaves, perhaps from herbicide. White Terns were observed in trees, Red Tailed Tropicbirds were observed at the base, and a few folks reported that the Laysan Ducks eat the husk and outer parts of the nut.

Tetragonia tetragonioides (New Zealand spinach) Aizoaceae

Native to New Zealand, Tasmania, Australia, Japan, and South America. In Hawaii, cultivated and established on Midway Atoll, Nihoa, Kauai, Oahu, Maui, and Hawaii (Wagner et al. 1999, Oppenheimer et al. 1999, Starr and Martz 2000). New Zealand spinach is highly invasive in the Farallon Islands off California (Peter Pyle pers. comm. 1999). On Midway in 1999 (Starr and Martz 1999), it was restricted to two small patches on Sand Island. One near the Dump Pond and the other just off the cart path near the western tip of the South Beach trail. Collected by Sri Lankan foreign national Ramashandran Sudarshan (Sean) near the Dump Pond on Sand Island (*Starr and Martz 990510-5* BISH) representing a new island record for Midway Atoll. The FWS targeted this species for eradication. Not observed in 2008, despite searches of previously known locations (Starr and Starr 2008). Also not observed in 2015 and presumed to have been eradicated.

Thespesia populnea (Milo) Malvaceae

Native to the Old World, now pantropical in distribution. In Hawaii, milo is indigenous or possibly Polynesian introduced, used in landscaping, and occurs probably on all of the main islands (Wagner et al. 1999). On Midway, Neff and DuMont (1955) report "One milo tree was noted growing on the lawn of the Administration building on Sand Island." Observed as rare on Sand Island in 1995 (Bruegmann 1998). In 1999 (Starr and Martz 1999), a few were found scattered about the northern coast of Sand Island, most likely, these were left over cultivated specimens. In 2008, there was one tree in the yard of 4210 Commodore Ave., and another larger tree just east of the cart path heading up to the Clipper House. Fruits were present, but there was no sign of spread. Collected at 4210 Commodore Ave. (*Starr and Starr 080607-15* BISH) to document the presence on

Midway (Starr and Starr 2008). In 2015, the same two trees persisted. They appeared chlorotic, but were still growing and fruiting. As the FWS removes ironwood trees, they are looking for alternative species to provide habitat and structure for birds that previously utilized the ironwoods. Milo is being considered as one of those species. From what we have seen on Midway, milo appears to persist and stay put where it is planted. It should however not be planted in wetland areas, as it can create dog-hair thickets of seedlings under and near parent trees.

Thevetia peruviana (Be still tree) Apocynaceae

Also known as *Cascabela thevetia*. Native to tropical America (Neal 1965). In Hawaii, cultivated as a hedge and now naturalized on Kauai, Oahu, Maui, and probably on the other main islands (Wagner et al. 1999). On Midway, collected in 1954 (*Neff and DuMont 27* BISH) from cultivated material in the residential area of Sand Island (Neff and DuMont 1955). Also observed in 1979 by Apfelbaum et al. (1983) and in 1995 by Bruegmann (1998). In 1999 (Starr and Martz 1999), this fragrant, yellow-flowered, sappy shrub was still cultivated in the residential area of Sand Island, and was persisting in areas that had been recently cleared near the cemetery on the north part of the island. Not observed on Eastern or Spit Islands. Collected in 1999 (*Starr and Martz 990505-7* BISH), representing a new naturalized record for Midway Atoll (Starr et al. 2002). In 2008, be-still tree was still persisting and reproducing in the area just south of the Cemetery, between Roosevelt Ave. and Decatur Ave. There did not appear to be any more cultivated plants in town (Starr and Starr 2008). Not observed in 2015 and presumed to have been eradicated.

Tournefortia argentea (Tree heliotrope) Boraginaceae

Currently known as *Heliotropium foertherianum*. It is treated here as *Tournefortia argentea* because most folks are more familiar with this name. Also previously known as *Messerschmidia argentea*. Native to tropical Asia, Madagascar, tropical Australia, and Polynesia; in Hawaii naturalized and common in coastal areas of Kure, Midway, and Pearl and Hermes atolls, Lisianski, Laysan, French Frigate Shoals, and all of the main islands except Kahoolawe (Wagner et al. 1999). Tree heliotrope was reported by Hadden (1941) as one of the trees that were tried and successfully grown during the Pan-American Airways era (about 1936). On Midway, Neff and DuMont (1955) collected this species, noting "Not uncommon, but widely scattered on both Sand and Eastern Islands. Often seen emerging above the *Scaevola* scrub." Also observed in 1979 by Apfelbaum et al. In 1995, Bruegmann reported it as occasional on Sand and Eastern Island and as rare on Spit Island. In 1999, found to be common on Sand, Eastern, and Spit Islands, especially in the area just behind the high-water mark, but also well inland. In 2008, this tree was locally common to dominant on some parts of the coast of Sand, Eastern, and Spit Islands, yet generally rare inland on Sand and Eastern Islands. On Sand Island, *Tournefortia* formed an almost continuous band along the southern coast from Bulky Dump to near Frigate Point. There are also some trees along the coast on West Beach. The rest of the coastline

does not appear to be optimal for *Tournefortia*. Inland on Sand Island, the only *Tournefortia* trees are near the housing and other areas where it had been planted. The inland trees on Sand Island are not being utilized by boobies, frigates, or other species that prefer to nest / roost in trees. On Eastern Island, *Tournefortia* is common along the Eastern coast of the island. Here, frigates and boobies seem to not nest in the *Tournefortia* directly on the coast, preferring the trees just inland. Many of the trees furthest inland appear to have succumbed to too much frigate nesting, as their caustic poop seems to kill the trees. *Tournefortia* is also now common on the southwest part of Eastern Island. On Spit Island, the *Tournefortia* has gone from rare in 1995, to common in 1999, and dominant in 2008. Boobies and white terns were utilizing the trees. At the same time, the gray-back terns that used to nest on the open coral are now excluded from the area. It is not clear how the burgeoning *Tournefortia* forest will fare against the increasing naupaka thicket on Spit, but the entire island of Spit seems suitable for *Tournefortia* (Starr and Starr 2008). In 2015, distribution is fairly similar to before with a ring of Tournefortia around the coast near the high water mark on all three islands, several in Town and the Residences on Sand Island, and sparingly inland on Eastern. Many trees along the coast of all three islands were brown and dying back from recent ocean wash overs. Tournefortia is not native but is being tolerated and outplanted for its structure and usefulness to wildlife. It is controlled in some areas, such as Spit Island, but outplanted in others, such as on Sand Island.

Tradescantia pallida (Day flower, purple heart) Commelinaceae

Trailing perennial producing ascending purple stems, native to Mexico (Brickell and Zuk 1997). Cultivated as a groundcover in Hawaii. On Midway, previously observed in 1979 (Apfelbaum et al. 1983) and in 1995 (Bruegmann 1998). Found to be cultivated in residential area on Sand Island in 1999 (Starr and Martz 1999) and 2008. Collected in 1999 (*Starr and Martz 990429-8* BISH), and 2008 (*Starr and Starr 080601-06* BISH), to document the presence of *T. pallida* on Midway (Starr and Starr 2008). In 2015, a single plant found growing out of a pot at a Residence.

Tradescantia spathacea (Oyster plant, Moses-in-the-cradle) Commelinaceae

Also known as *Rhoeo spathacea*. Clump forming perennial with rosettes of semi-erect, linear leaves, dark green above and deep purple beneath, native to Central America (Brickell and Zuk 1997). Cultivated in Hawaii. On Midway, previously observed in 1979 (Apfelbaum et al. 1983) and in 1995 (Bruegmann 1998). During the 1999 survey (Starr and Martz 1999), cultivated in containers and near buildings in the residential areas, the new sport fishing operations, the abandoned marine barracks, and the hanger. In 2008, this succulent was still common around residences where it persisted and spread from plantings in yards and in pots. The plants at the fishing operation and the marine barracks were no longer there. Collected (*Starr and Starr 080607-17* BISH) to document presence of *T. spathacea* on Midway (Starr and Starr 2008). In 2015, a few of the clumps

and potted plants persisted around Charlie Barracks and the Residences, the most common of the *Tradescantia* spp. left on Midway.

Tradescantia zebrina (Wandering jew) Commelinaceae

Trailing perennial, leaves silver green above and purple beneath, native to S. Mexico (Brickell and Zuk 1997). Cultivated in Hawaii. Newly naturalized to Kauai and Maui (Lorence and Flynn 1997; Oppenheimer and Bartlett 2000; Starr et al. 2004). On Midway, previously observed in 1979 (Apfelbaum et al. 1983) and in 1995 (Bruegmann 1998). Observed to be rare to occasional on Sand Island during the 1999 survey. Not observed since.

Tribulus cistoides (Nohu) Zygophyllaceae

Native to the Old World, now a pantropical weed. In Hawaii, an indigenous plant occurring on all of the Northwestern Hawaiian Islands, except Gardner Pinnacles and Necker, also on all of the main islands (Wagner et al. 1999). On Midway, previously recorded by the Tanager Expedition and W. A. Bryan for Eastern Island only, where, in 1902, it was observed to be fairly common on the sandy shore, and in 1923, was common in the central plain (Christophersen and Caum 1923). Collected by Johnson in 1935 from Eastern Island. Neff and DuMont (1955) described it as a "Locally abundant trailing ground cover on sandy areas on both Sand and Eastern Islands." Collected by Frings in 1962 from Eastern Island. Also collected on Eastern Island by Long in 1964 and by Carlquist in 1966. In 1980, collected by Herbst from Eastern Island where he noted it as common. By 1995, *Tribulus* was all but gone on Midway. Bruegmann (1998) reports that *Tribulus* "Was collected on Sand Island in 1954 and 1966, but no other reports are known and it was not found during this survey." She adds that "Only one adult and two seedlings were observed on Eastern Island during this survey." In 1997, Nanette Seto, with the United States Fish and Wildlife Service, reported observing this species on Sand Island. In 1999 (Starr and Martz 1999), this thorny native with brilliant yellow, fragrant flowers was found to be common on Eastern Island, especially the east part, and was locally abundant on Sand Island, especially near South beach and Frigate Point. It was also present on the north part of Spit Island, where it was collected (*Starr and Martz 990623-5* BISH). In 2008, *Tribulus* was occasionally found on Sand and Spit Islands and was dominant over much of Eastern Island. On Sand Island, *Tribulus* was most common in scattered patches along South Beach, but the plants were quite small. On Eastern Island, *Tribulus* was present over much of the island and vast fields of *Tribulus* covered much of the eastern part of the island, often to the exclusion of *Verbesina*. It was also becoming abundant along the southern coast as well. On Spit Island, there were small patches here and there, most commonly in open areas on the north part of the island. *Tribulus* appears to have had a rapid increase in population between 1995 and 1999, continuing on through 2008. The best correlation with sudden increase in *Tribulus* seems to be with the removal of rats from Midway Atoll around 1997. It is possible the rats were damaging the plant and once the rats were removed, the seeds left in the soil germinated, and this species returned to its pre-rat distribution. Ground nesting birds and many plants, including

naupaka (*Scaevola*) displayed a similar population explosion with the removal of rats in 1997. In the Main Hawaiian Islands, *Tribulus* was a target of a biological control program in the late 1960's, which decimated the patches there within a matter of years after release of stem-boring and seed-predating beetles. The *Tribulus* biocontrol beetles (*Microlarinus* spp.) do not yet appear to be on Midway, making Midway a remote refugia for this spiny yet colorful native plant (Starr and Starr 2008). In 2015, the distribution of nohu was about the same on all three islands, being occasional on Sand and Spit and dominant over much of Eastern Island, especially the northeast side. On Sand, it was nowhere dominant, with only a lone patch here and there in open fields with the most found in the strip between the runway and the South Beach bike/cart trail. On Eastern, some dieback is occurring presumably through spray drift from *Verbesina/Brassica* control, but there are enumerable seeds in the ground and will likely spring right back once control slows down. On Eastern and now Spit, Red Footed Boobies use nohu as nesting material. There is some research going on to determine if the thorns are detrimental to wildlife such as Laysan Ducks or Albatross.

Trichosanthes cucumerina var. *anguina* (Snake gourd) Cucurbitaceae

Native to India. Grown in Hawaii and elsewhere for its ornamental fruits, which are edible when green (Neal 1965). In 1999 (Starr and Martz 1999), it was collected for the first time on Midway (*Starr and Martz 990505-15* BISH) from a single plant cultivated in a personal garden near the Fuel Farm. By 2008, this and many other personal gardens had been abandoned and dismantled. As a result, there were a lot less oddities like this being grown in disparate locations across the island. Not observed since. Photo by Sangfroid (Wikipedia 2008).

Tridax procumbens (Coat buttons) Asteraceae

Native to Mexico, Central America, Venezuela, and Colombia to Peru and Bolivia, now widely naturalized. A Federal Noxious Weed in the United States. In Hawaii, known from Midway Atoll and all of the main islands except Niihau (Wagner et al. 1999). On Midway, previously collected by Herbst (*6338* BISH). In 1999, observed as occasional in lawns and along runways on the south part of Sand Island. In 2008, it was still most abundant along the sides of the runway on Sand Island (Starr and Starr 2008). Not observed in 2015.

Tropaeolum majus (Garden nasturtium) Tropaeolaceae

Native from Mexico to Chile, cultivated in Hawaii (Neal 1965). On Midway, first recorded as cultivated by Hadden (1941). Previously collected (*Conant 119* BISH) by S. Conant in 1983. Observed as cultivated on Sand Island by Bruegmann in 1995. In 1999, a few cultivated plants were observed in planter boxes at the Boathouse and at the sport fishing facilities near the harbor on Sand Island. Not observed in 2008. The planter at the Boathouse now had native beach morning glory in it and the sport fishing facilities had

been abandoned and all the non-native ornamentals removed (Starr and Starr 2008). Not observed in 2015.

Unknown Cupressaceae (Cypress tree) Cupressaceae

On Midway two individuals of an unknown species of Cupressaceae persist on Sand Island. Previously reported by Apfelbaum *et al*. (1983) and Bruegmann (1998). In 1999 (Starr and Martz 1999), two trees were persisting on Sand Island, one by the Clipper House restaurant and one tree by the marine barracks. These trees were tentatively called *Cupressus* sp., following what others had guessed. In 2008, research into additional collections from Midway turned up a record of *Juniperus bermudiana* by C. Lamoureux (*Lamoureux 2221* NMNH). Perhaps this is the identity of the unknown Cupressaceae reported from Midway and is what we are calling the few remaining trees that are still found on Sand Island (see *Juniperus bermudiana* for more detail).

Unknown Fabaceae - Pea-like

In 1999, an unknown pea being cultivated in a vegetable garden on Sand Island was collected (*Starr and Martz 990429-13* BISH) but was unidentifiable.

Unknown Fabaceae - Mucuna-like

In 1999, an unknown *Mucuna*-like plant was found coming up on its own near the coast and West Beach cart trail. The plant was unfertile at the time of collection (*Starr and Martz 990513-1* BISH) and succumbed to the dry summer months and died before ever flowering or fruiting. It remains unidentifiable.

Unknown Orchidaceae (Unknown orchids) Orchidaceae

An unknown orchid reported from Midway in 1979 (as *Vanda* sp.) (Apfelbaum et al. 1983). No orchids observed in 1999 (Starr and Martz 1999). In 2008, an unknown orchid observed growing in a coconut husk on the side of a *Schefflera actinophylla* tree at 4208 Commodore Ave.

Unknown plant (Unknown plant)

A small "pencil like" cactus, cultivated on Sand Island, was collected in 1999 (*Starr and Martz 990429-9* BISH) but was not identifiable because it lacked fertile material. Not observed since.

Unknown Poaceae (Unknown grass) Poaceae

An unknown diminutive grass was collected by Aspey in 2012, who noted "3 decumbent patches within a 5m x 5m area, 15m west of building 5340 under Casuarina cover south of Hangar (41)" (UTM 462892,3120257) and tentatively identified by him as *Brachiaria subquadripara*, which is now known as *Urochloa distachya*. Though not observed in 2015, the collection made by Aspey (*Aspey s.n., Starr 150404-06* BISH) was located in the FWS office and was submitted to Bishop Museum for determination of identity.

Unknown sp. Aloeaceae

In 1999, an unidentified succulent plant with spines similar to *Agave* or *Aloe aristata* was observed in the residential area of Sand Island. Not observed since.

Urochloa mutica (California grass, Para grass) Poaceae

Previously known as *Brachiaria mutica* and *Panicum purpurascens*. The native range is unknown, now pantropical; in Hawaii, known from Midway, Kauai, Oahu, Lanai, Maui, and Hawaii (Wagner et al. 1999). On Midway, collected in 1954 (*Neff and DuMont 37* BISH) and found in only two areas on Sand Island, under the ironwoods near the Cable Company compound (Neff and Dumont 1955). Collected on Sand Island in 1962 by C.H. Lamoureux (*Lamoureux 2299* BISH) in the open field under antennae east of Barrier Hangar (Bruegmann 1998). Known from literature (Herbst and Wagner 1992). Not observed in 1979 or 1995 (Apfelbaum 1983, Bruegmann 1998). In 1999 (Starr et al.), one small patch was observed in the same spot described by Lamoureux. By 2008, the FWS had gotten rid of the lone patch with a combination of mowing and herbicide (Starr and Starr 2008). In 2015, no signs of this grass were found.

Veitchia merrillii (Manila palm) Arecaceae

Native to the Philippines and becoming widely planted for its neat compact habit (Jones 1995), this palm is cultivated in Hawaii (Neal 1965) and was previously not known from Midway. A collection made in 1999 (*Starr and Martz 990510-3* BISH), in the town area of Sand Island, representing a new cultivated record for Midway Atoll. In 2008, two four meter tall trees were still persisting along Peters Ave. in front of the abandoned galley (Starr and Starr 2008). In 2015, one of these ornamental palms persisted in the same location.

Verbena littoralis Kunth (Vervain, owi) Verbenaceae

Native from Mexico through Central America to South America, widely naturalized; in Hawaii, known from Midway Atoll and all of the main islands (Wagner et al. 1999). On Midway, first collected by Meagher in 1933. Also collected in 1980 by Herbst (*Herbst 6367* BISH). Recorded by Herbst and Wagner (1992). In 1999 (Starr and Martz 1999), observed as occasional on Sand Island. In 2008, found scattered about Sand Island. Though nowhere abundant, this non-descript plant with purple flowers was found to be patchy in the field between Turtle Beach and the Cargo Pier (Starr and Starr 2008). In 2015, only a few plants observed in the Parade Field and the field by Charlie Barracks.

Verbesina encelioides (Golden crown beard) Asteraceae

Native to Mexico and the southwestern United States. In Hawaii, known from Kure, Midway, and Pearl and Hermes Atolls and all of the main islands except Niihau (Wagner et al. 1999; Starr et al. 2002). There are many collections from Midway of this species at Bishop Museum, including (*Neff and DuMont 2*; *Herbst and Takeuchi 6423, 6382*; *H.W. Frings 8, 21*; *R.M. Beauchamp 1270*; *C.R. Long 1749*). Initially recorded for Midway by Neff and DuMont (1955) who reported this species to be "Abundant on both islands, though more widespread on Eastern than on Sand. Forms a dense cover on many of the open areas in the interior of the islands, taking over areas that would be better vegetated if in grasses. Offers the only bit of color on the islands with its multitude of golden blossoms." Also observed by Apfelbaum et al. in 1979. Bruegmann (Bruegmann 1998) recorded this species as dominant on both Sand and Eastern Island, but not from Spit, during her survey in 1995. In 1999 (Starr and Martz 1999), found to be one of the most widespread plants on all three of the islands in the atoll. It was collected from Spit Island during this survey (*Starr and Martz 990623-4* BISH) where it was occasional in distribution. In 2008, *Verbesina* was dominant over much of Sand and Eastern Islands, and was present in a few scattered patches on Spit Island. On Sand Island, the stopping of mowing in conjunction with a ramped down crew has allowed some previously lawn like areas to become over run with *Verbesina*. In some places, the *Verbesina* is over 2 meters tall, in monotypic dog-hair thickets. However, due to the determination of the FWS and others, there are large areas of Sand Island where *Verbesina* is barely present. On Eastern Island, Verbesina is dominant over much of the island, except for areas near the newly created duck seeps, where control efforts have been focused, and in areas where there is a lot of Tribulus or other ground covers. On Spit Island, a few scattered patches were observed in the ever thickening naupaka thickets. FWS pulled these. Along with ironwood, this weedy flower has been a high priority for alien plant control for some time, as it dominates vast portions of the landscape, and seems to make it difficult for albatross and other seabirds to nest. Going forward is seems that locally focused efforts, experimenting with new control techniques, and intensive planting of natives after *Verbesina* control will likely yield the best results (Starr and Starr 2008). In 2015, there was much less *Verbesina* on all the islands, the result of an intensive control effort, consisting of a multi person crew along with volunteers on daily basis. While severely knocked down, there seems to be a persisting seed bank, as it was still present on all three islands, mostly as small emerging plants less than 1m tall, and a few areas on Sand and Eastern Island where there were larger flowering plants. Areas of heavier infestations on Sand Island were usually found further from Town, such as the Antennae Field, in naupaka thickets along North Beach and Frigate Pt., in areas with barren sand and lots of Bonin Petrel burrows, such as east of Captain Brooks, and other disturbed areas where there was recent clearing of ironwoods or buildings. On Eastern, larger plants were usually in areas where the crew had yet to retreat. Only small seedlings were seen on Spit and they were being controlled.

Vigna unguiculata subsp. *sesquipedalis* (Long bean, cow pea) Fabaceae

Commonly cultivated in tropical Asia where it is one of the most important legume crops as it is drought and shade tolerant, grown from human consumption and animal fodder (GRIN 2008, Wikipedia 2008). In 2008, collected in the Community Garden (*Starr and Starr 080610-07* BISH) to document the presence on Midway. It was also being cultivated for its edible beans at the enclosed greenhouse behind the abandoned galley and at Sak's garden at the Water Plant (Starr and Starr 2008). Not observed in 2015.

Viola odorata L. (Sweet violet) Violaceae

Native to Europe and Asia, with dark violet or white fragrant flowers, leaves and flowers in a basal rosette, with hairy leaf stalks, and spreads by stolons (Wikipedia 2008). Herbst and Wagner (1992) note *Viola odorata* as cultivated and known from literature. Not recorded since. Photo by Strobilomyces (Wikipedia 2008).

Viola x *wittrockiana* (Violet, pansy) Violaceae

Small mound forming plant that thrives in cooler weather; grown for their showy flowers that look like a face; a result of hybridizing other violet species that are native to Europe and Asia (Floridata 2008). On Midway, first recorded in 1999 (Starr and Martz 1999), where this violet was observed in the planter at the boat house on Sand Island. Collected in 1999 to document the presence on Midway (*Starr and Martz 990421-1* BISH). In 2008, the planter box that was filled with a myriad of non-natives in 1999, now supported a luxuriant planting of native beach morning glory (*Ipomoea pes-caprae* subsp. *brasiliensis*), and viola was nowhere to be seen (Starr and Starr 2008). In 2015, no violets were found, the planter they used to be in looked abandoned. Photo by Hardyplants (Wikipedia 2008).

Vitex rotundifolia (Pohinahina) Verbenaceae

Low growing sprawling plant with furry leaves that smell like *Eucalyptus* when crushed; indigenous to China, Taiwan, and Japan, south to Malesia, India, Sri Lanka, Mauritius, Australia, Pacific Islands, and Hawaii, where it commonly occurs on sand dunes on all the main islands except Kahoolawe (Wagner et al. 1999). Occasionally cultivated as a sand binder and as an ornamental groundcover or bedding plant in Hawaii. Observed on Midway for the first time in 2008, where a small but flourishing planting was observed next to the entrance of the Midway House on Sand Island. Apparently, the plants were recently bought at an Oahu Home Depot and brought to Midway. Collected from the Midway House (*Starr and Starr 080607-05* BISH) to document the presence on Midway. Though native, this sprawling species can be invasive (Starr and Starr 2008). In 2015, the only place this vine occurred was still at the Midway House, where plants had

been dug up in anticipation of lead abatement work. Folks were interested in potentially using it in plantings elsewhere for stabilizing sand. Grown best from cuttings, this woody vine can be utilized to help stabilize areas of drifting sand. It has, however, been considered invasive in parts of the East Coast of North America and should be used sparingly at first to see how it acts beyond gardens on Midway.

Vitex trifolia (Tree vitex) Verbenaceae

Previously recorded from Midway as *Vitex trifolia* var. *subtrisecta* f. *subtrisecta* and *Vitex trifolia* var. *subtrisecta* f. *variegata*. Native to Asia and Australia, planted for hedges in Hawaii (Neal 1965). Recorded in 1941 by Hadden. First collected on Midway in 1955 where it was as an ornamental on Sand Island (Neff and DuMont 1955). Observed in 1982 (Apfelbaum et al. 1983). In 1995, listed as rare on Sand Island (Bruegmann 1998). In 1999, observed as persisting on Sand Island, especially in the area east of the Midway Mall. In 2008, tree vitex was persisting and slowly spreading vegetatively east of the Midway Mall. There was also a thicket east of the main entrance to the Dump. Though multiple varieties of this species have been recorded from Midway, both variegated and normal leaf color were observed on a single plant east of the incinerator. Though not spreading quickly, it may be good to remove the known patches before they expand their thickets much further (Starr and Starr 2008). All the known patches were controlled and this species was not observed in 2015 and is presumably eradicated.

Vitis sp. (Grape) Vitaceae

Primarily of tropical and subtropical areas, a few species are cultivated in Hawaii (Wagner et al. 1999). On Midway, first collected (Conant 123 BISH) by S. Conant in 1983. In 1999 (Starr and Martz 1999), it was observed persisting on the greenhouse south of the Cable Company buildings on Sand Island. It was also grown in cultivation in residential areas of Sand Island. In 2008, the only grape vines observed were a series of plants growing on a trellis on 416 Commodore Ave. The leaves were utilized for food. Ivy gourd (*Coccinia grandis*) was growing in this same trellis. Collected (*Starr and Starr 080601-08* BISH) to document the presence on Midway (Starr and Starr 2008). Not observed in 2015.

Vulpia myuros (Foxtail fescue) Poaceae

Native to Europe. In Hawaii, documented from Midway and all of the main islands except Niihau and Kahoolawe (Wagner et al. 1999). On Midway, previously known from literature (Herbst and Wagner 1992). Not observed since.

Waltheria indica (Uhaloa) Sterculiaceae

Also known as *W. i.* var. *americana*. Pantropical, questionably indigenous to Hawaii, occurring on Midway Atoll and all of the main islands (Wagner et al. 1999). On Midway, Bryan (1956) notes that it was previously recorded in 1931 by Chisholm. Later, Conant (1983) collected this species (*Conant 134* BISH) and notes "This indigenous plant was not common, but the small colony by the cemetery was vigorous." Also observed in 1995, by Bruegmann. In 1999 (Starr and Martz 1999), a few plants were found southeast of the old fuel farm on Sand Island, they had been fenced by FWS. No plants were observed on Eastern or Spit Islands. In 2008, not observed on Midway, despite multiple searches at the previously known location east of the incinerator (Starr and Starr 2008). Also not observed in 2015.

Wikstroemia uva-ursi (Akia) Thymelaceae

Densely branching shrub with orange berries and fragrant flowers; endemic to Hawaii, occurring on dry open coastal and lowland areas on the islands of Kauai, Oahu, Molokai, and Maui; and now commonly cultivated as an ornamental groundcover (Wagner et al. 1999). First recorded from Midway in 2008, when a few plants were found on the southwest corner of the Midway House on Sand Island. Apparently, the plants were recently bought at an Oahu Home Depot and brought to Midway. Collected from the Midway House (*Starr and Starr 080607-06* BISH) to document the presence on Midway (Starr and Starr 2008). Not observed in 2015.

Xanthium strumarium var. *canadense* (Cocklebur) Asteraceae

Probably native to the New World, now a cosmopolitan weed; in Hawaii, known from Midway Atoll and all of the main islands (Wagner et al. 1999). For Midway, Neff and DuMont reported that they "Knew of St. John's report [1931] of cockleburs on Midway, but did not find the plant." It was also collected by Chisholm in 1931 (*D.R. Chrisholm* s.n. BISH). It was reported in Herbst and Wagner (1992) based on the same information, but has not been observed since the 1931 collection.

Xanthosoma robustum (Ape) Araceae

Native to Mexico, Costa Rica, Guatemala, Honduras, Nicaragua (GRIN 2008). In Hawaii, naturalized on moist areas of Kauai, Oahu, Maui, and Hawaii (Staples and Woolliams 1997; Imada et al. 2000; Oppenheimer and Bartlett 2000; Herbst et al. 2004). Ape was first noted from Midway by Apfelbaum et al. (1983). In 1999, it was observed persisting in gardens and near the galley (Starr and Martz 1999). In 2008, this plant was again found persisting in the gardens of the residences and on the west side of the recently abandoned galley. Collected (*Starr and Starr 080607-19* BISH) to document the

presence on Midway (Starr and Starr 2008). In 2015, a lone plant was found at the 4208 Commodore Ave. residence. This is a very persistent plant. Avoid moving soil from areas where this plant is known from to other areas, as root fragments can regrow.

Zea mays (Corn) Poaceae

Probably native to the Mexican Plateau (Neal 1965). Corn has been cultivated in Hawaii for more than a century (Neal 1965). Recorded for the first time from Midway in 1999 (Starr and Martz 1999), where it was being cultivated in the residential area of Sand Island. Not observed in 2008 (Starr and Starr 2008). Present in the June 2013 Google Street View images of the Community Garden. Not observed in 2015.

Zinnia violacea (Zinnia) Asteraceae

Cultivated plants were observed for the first time in 1999 (Starr and Martz 1999), in the residential area of Sand Island. It was collected (*Starr and Martz 990505-2, 990421-8* BISH) as *Z.* sp. Identified by George Staples (BISH). Not observed since. Photo by Howard F. Schwartz, Colorado State University, (Bugwood.org 2008).

Ziziphus sp. (Jujube) Rhamnaceae

Genus of about 40 species of spiny shrubs distributed in warm-temperate and subtropical regions throughout the world (Wikipedia 2008). Some species are used medicinally or eaten (Wikipedia 2008). In 2008, this thorny shrubby plant was being grown at 415 and 416 Commodore Ave. where several mature plants and some seedlings were observed, and at the PWA shop where a few plants were being grown. Collected (*Starr and Starr 080601-05* BISH) to help determine identity and to document the presence on Midway. The Thai's called this plant jujube and reported that they eat the fruit like an apple and that it was sweet and sour. Some *Ziziphus* species are considered invasive (PIER 2008). Given that the plant is spiny and already producing seedlings, it should probably be removed and put on the prohibited list (Starr and Starr 2008). In 2015, none were observed, they had been removed during weed control and lead abatement work.

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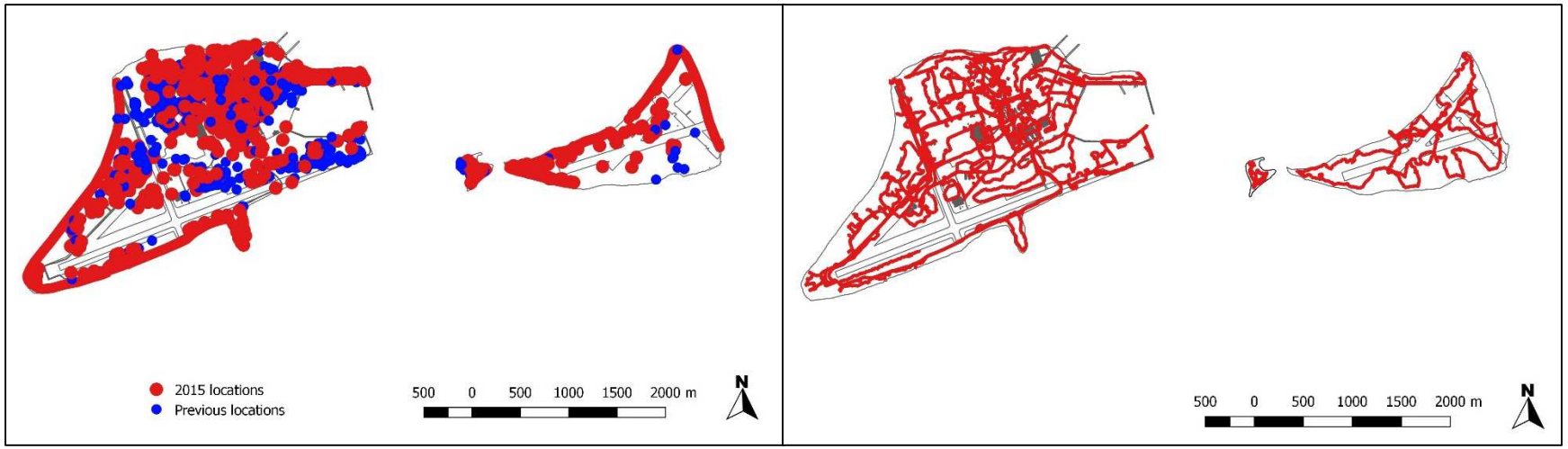
APPENDIX C: MAPS

The following 77 maps for selected plant species at Midway Atoll show their known distribution in 2015, and when available all previously known locations. Over 1,800 locations have been collected, about 1,000 of which were collected in 2015.

Emphasis is on incipient invasive non-native plants and less common native plants. Additionally, some of the conspicuous urban forest trees, species that aren't invasive but would be good to keep an eye on, and other species of interest were mapped.

Most of the points were collected with a GPS during our 1999, 2008, and 2015 surveys. A few of the points were hand drawn using high resolution satellite imagery, from data collected during interviews with FWS staff, images taken on Midway, specimen collections, previous GIS work by others, and FWS annual weed control reports. A track was recorded to show areas surveyed.

More information is available for all these species in the Plant Checklist (Appendix A) and Annotated Plant Checklist (Appendix B).



Points collected to make maps, and areas surveyed in 2015.

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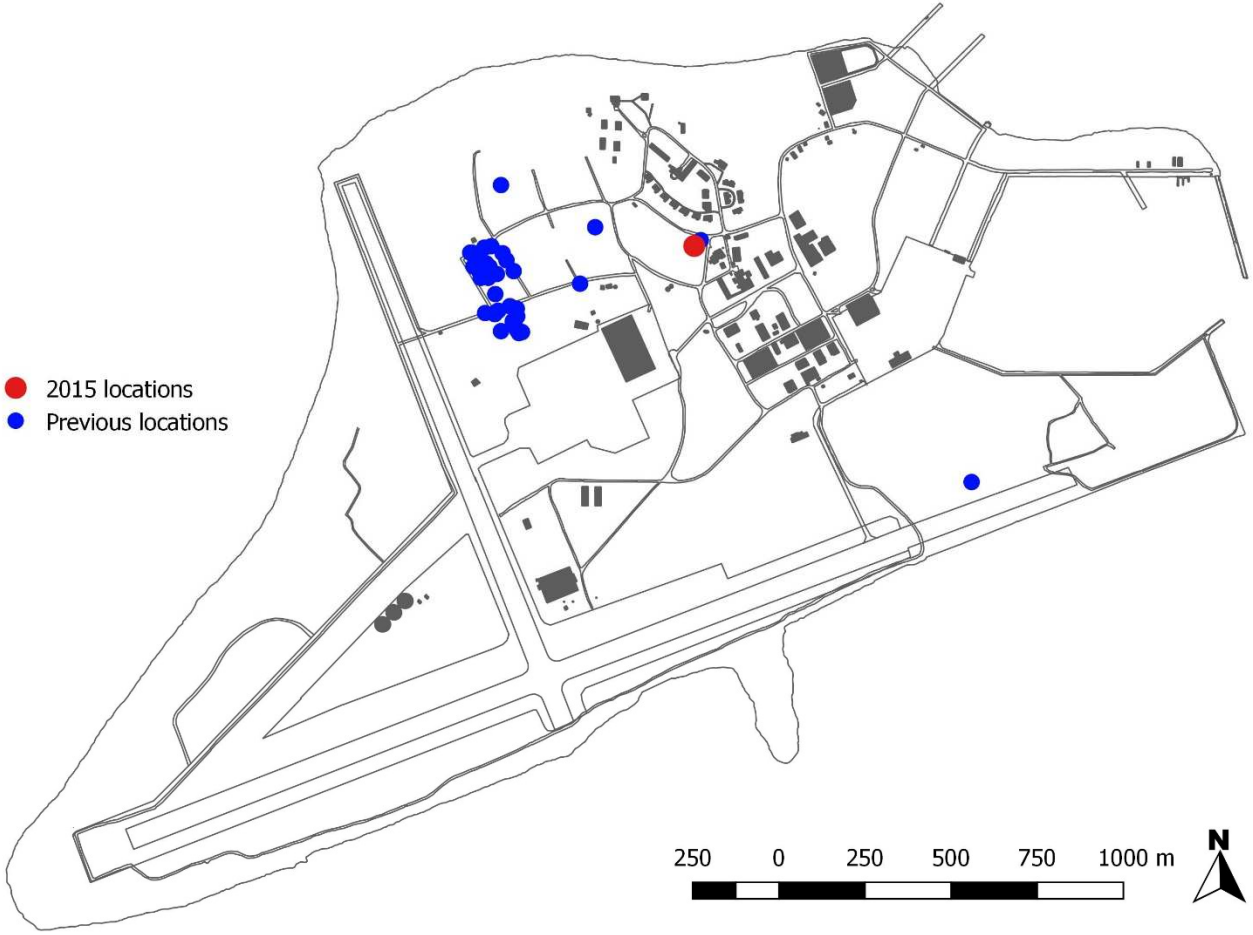

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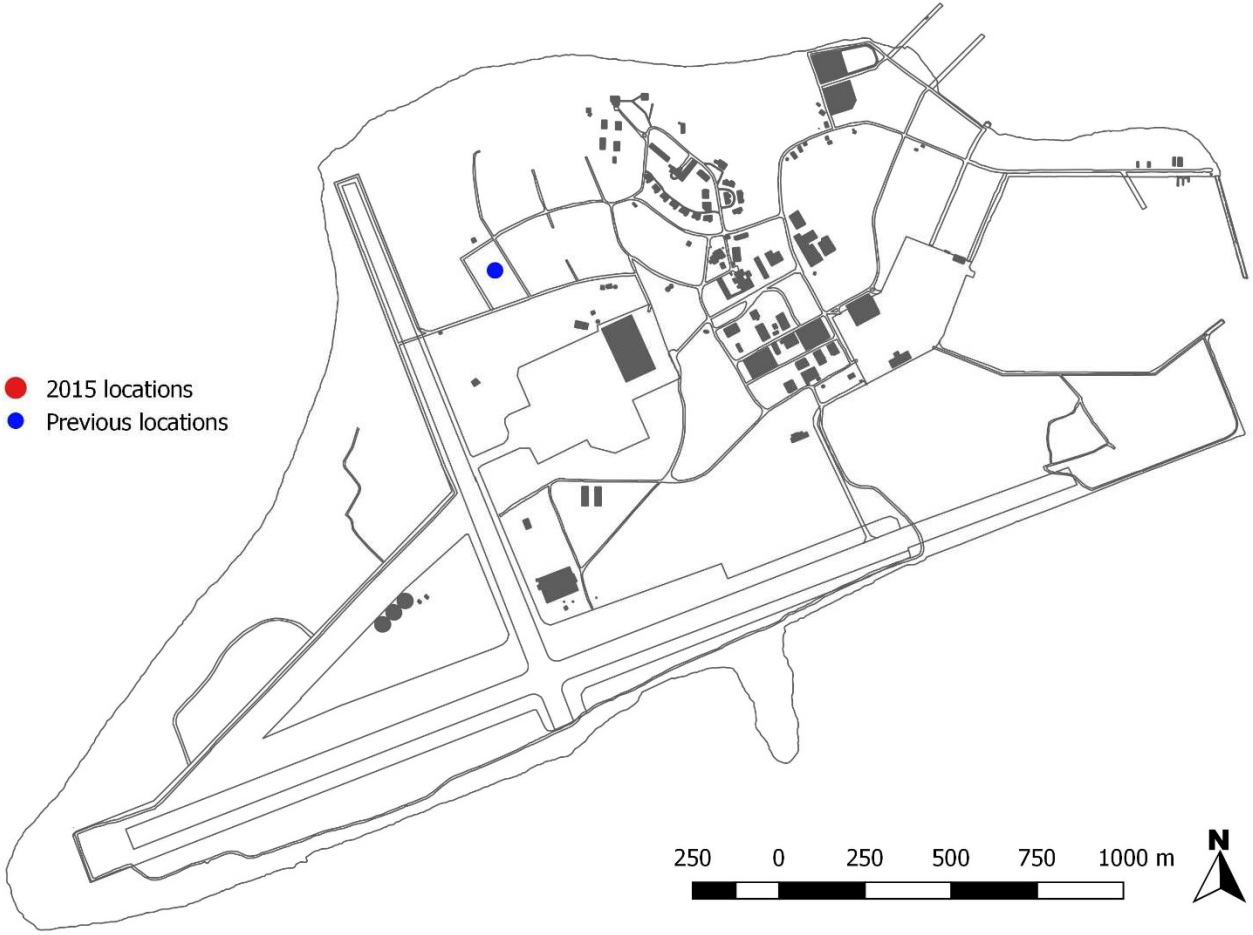
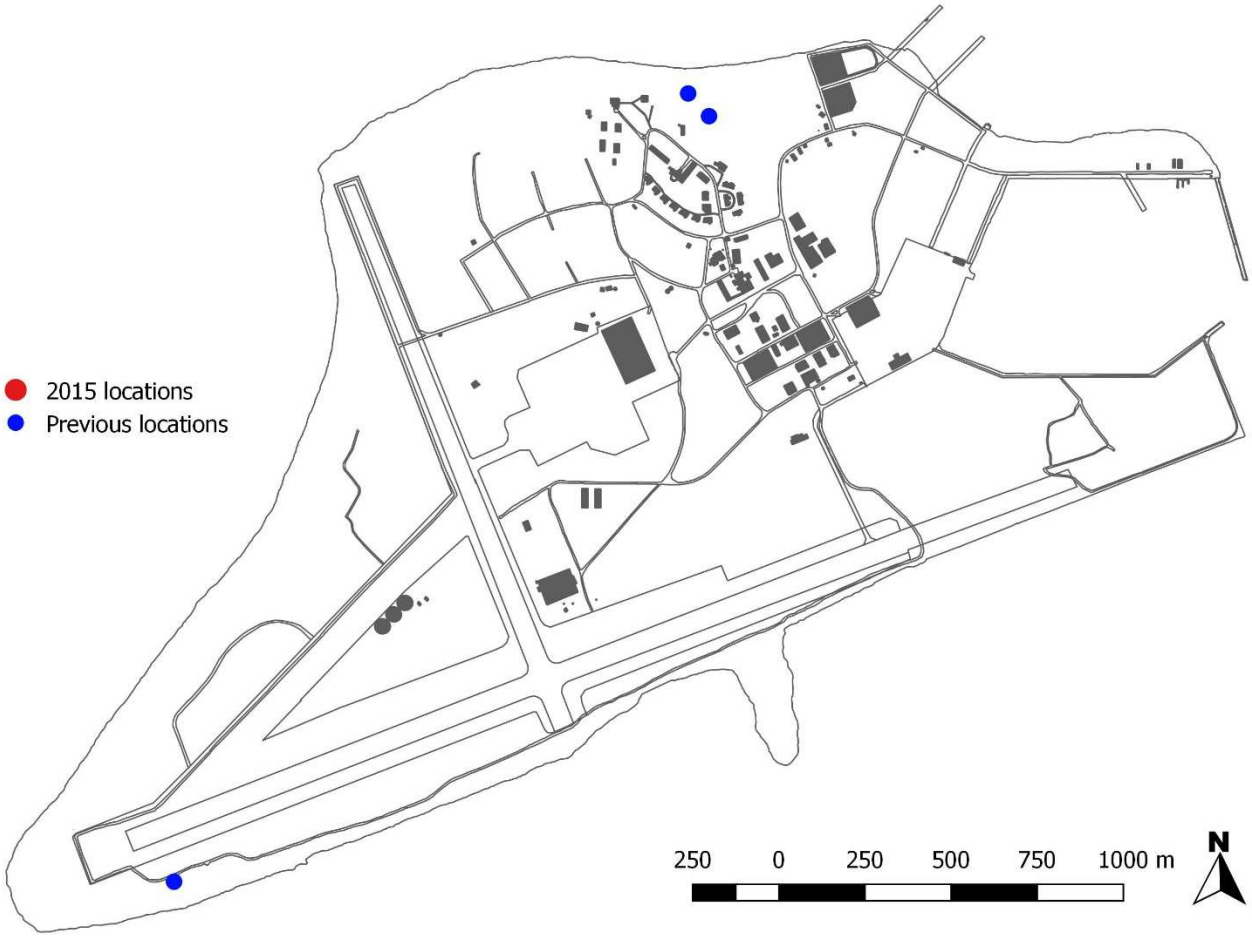
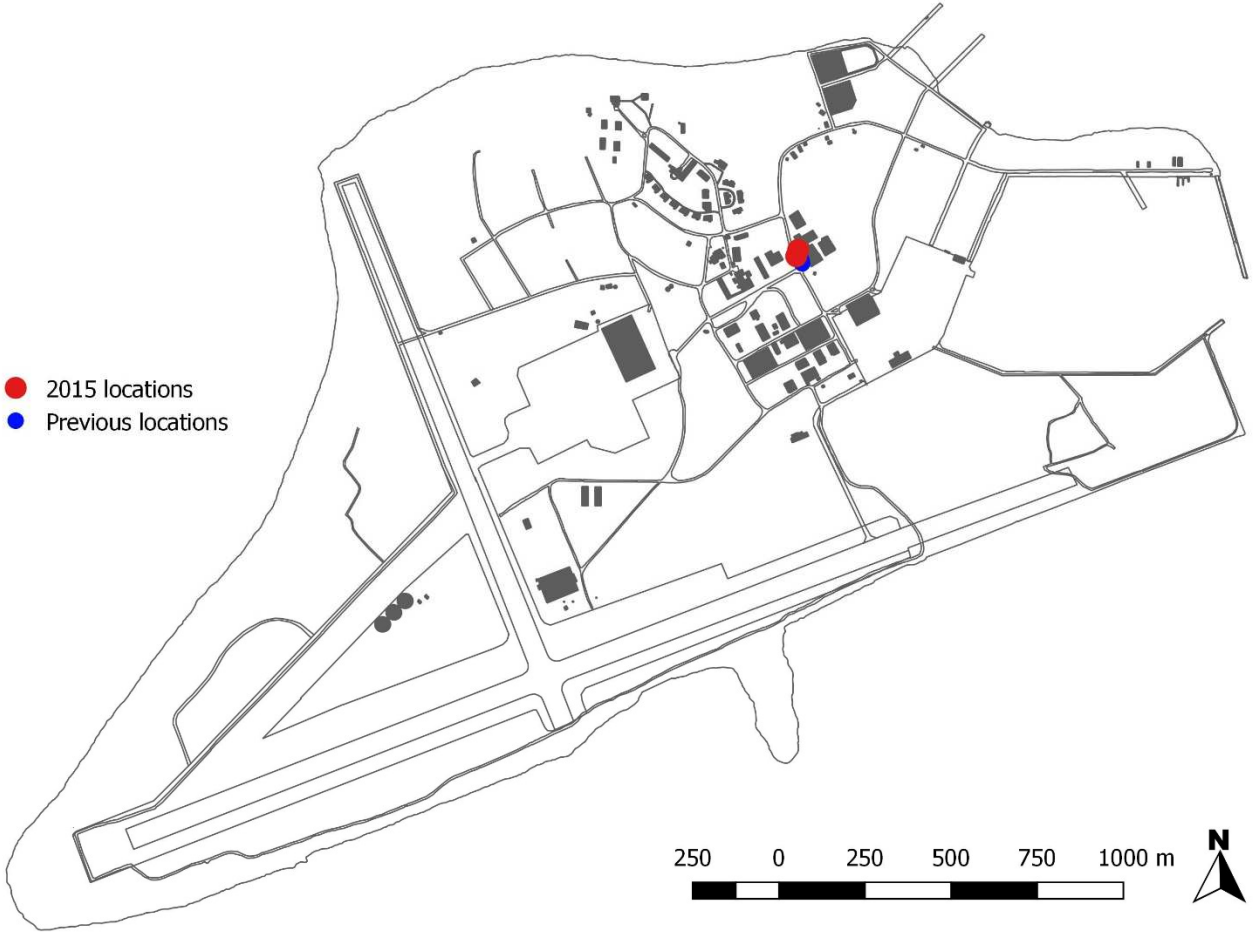


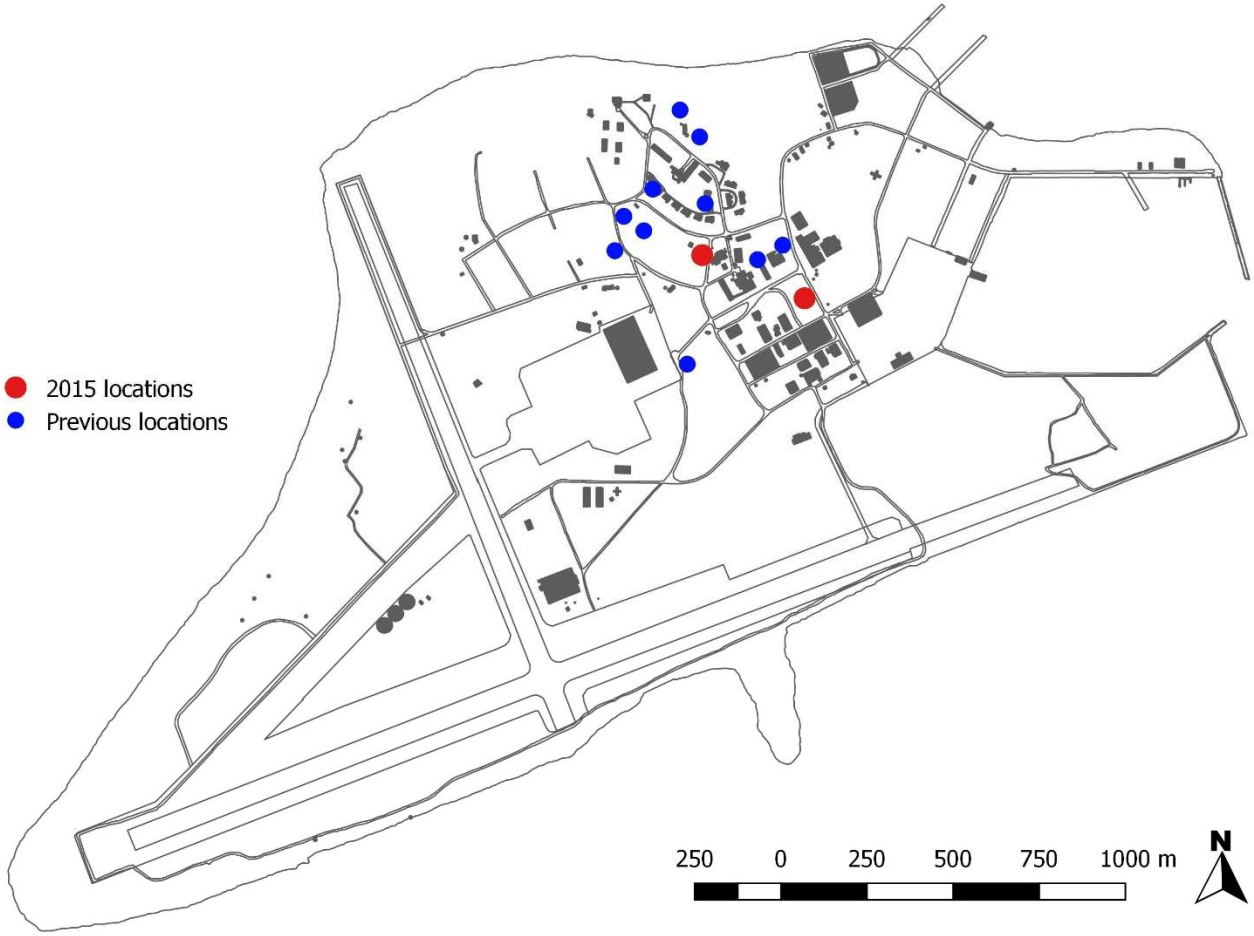
Agave sisalana



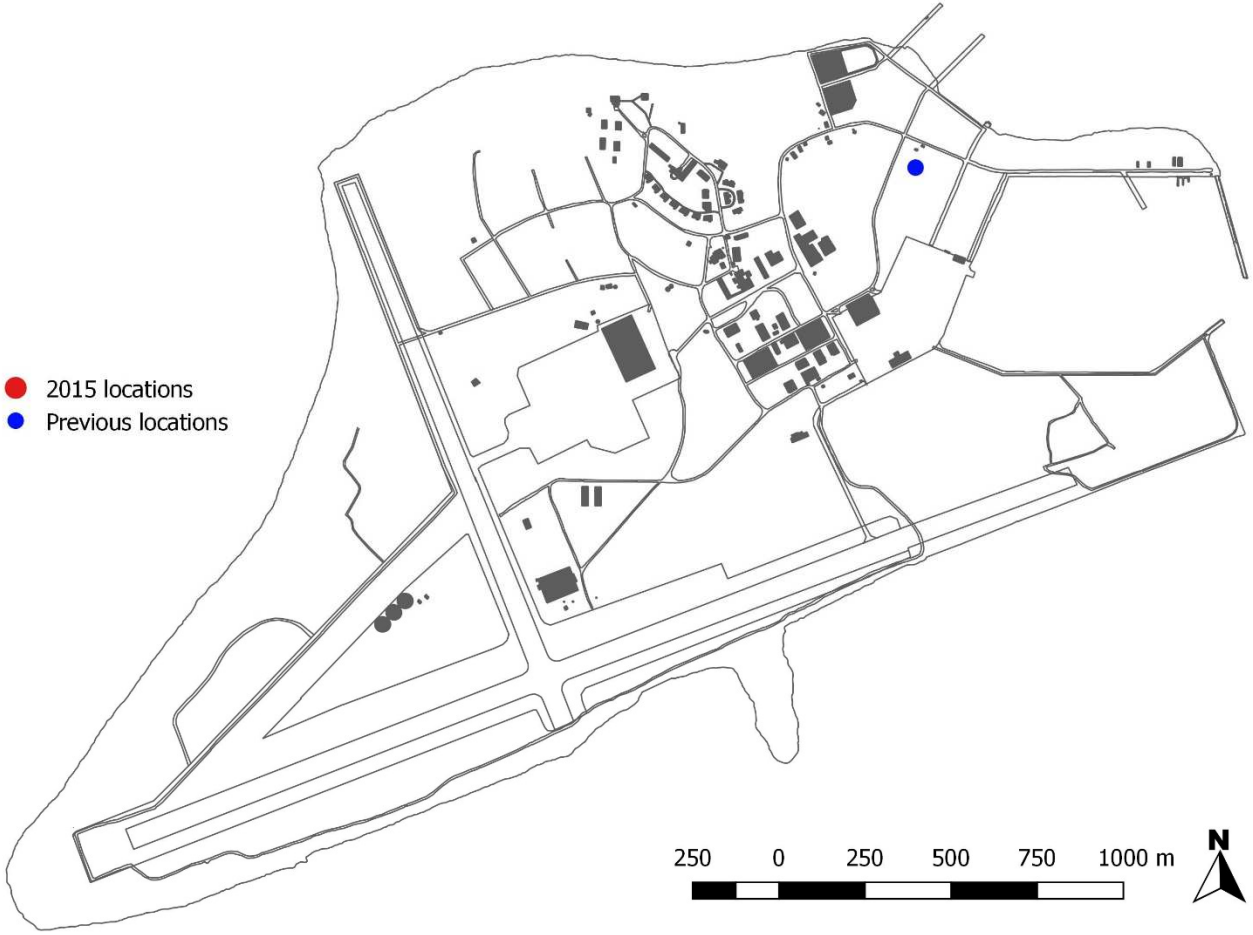
Albizia lebbeck



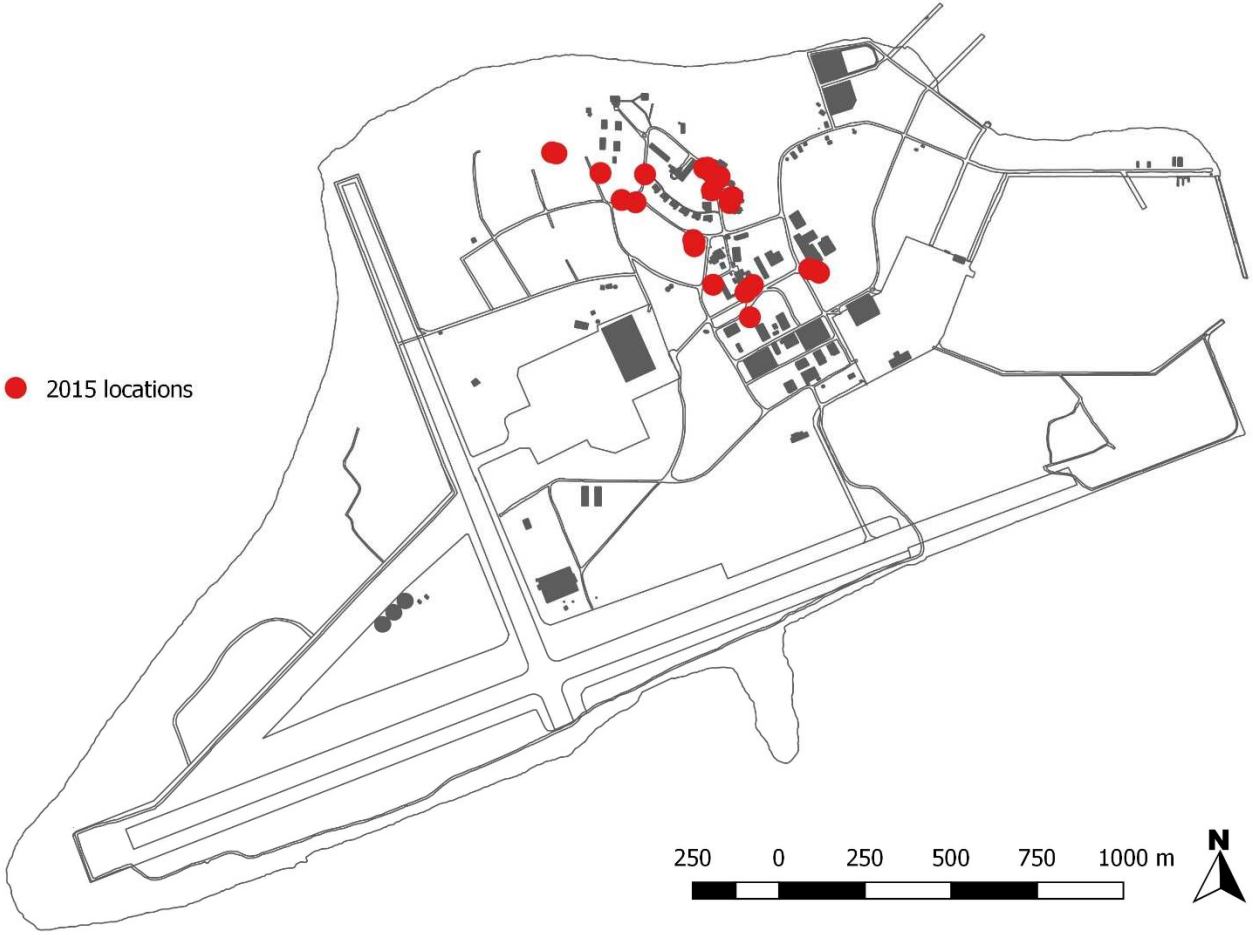
Amaranthus spinosus



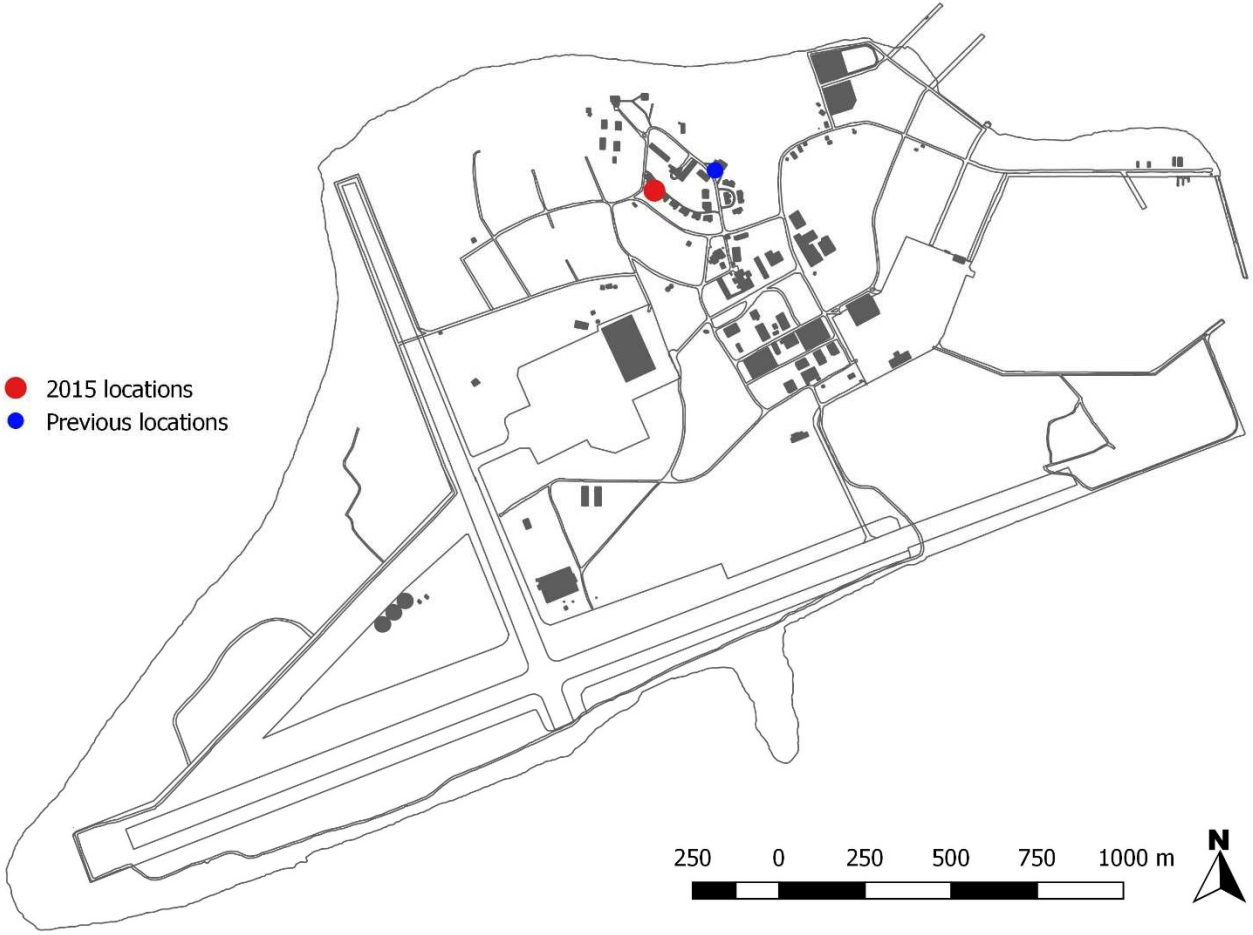
Antigonon leptopus



Araucaria columnaris



Asparagus densiflorus



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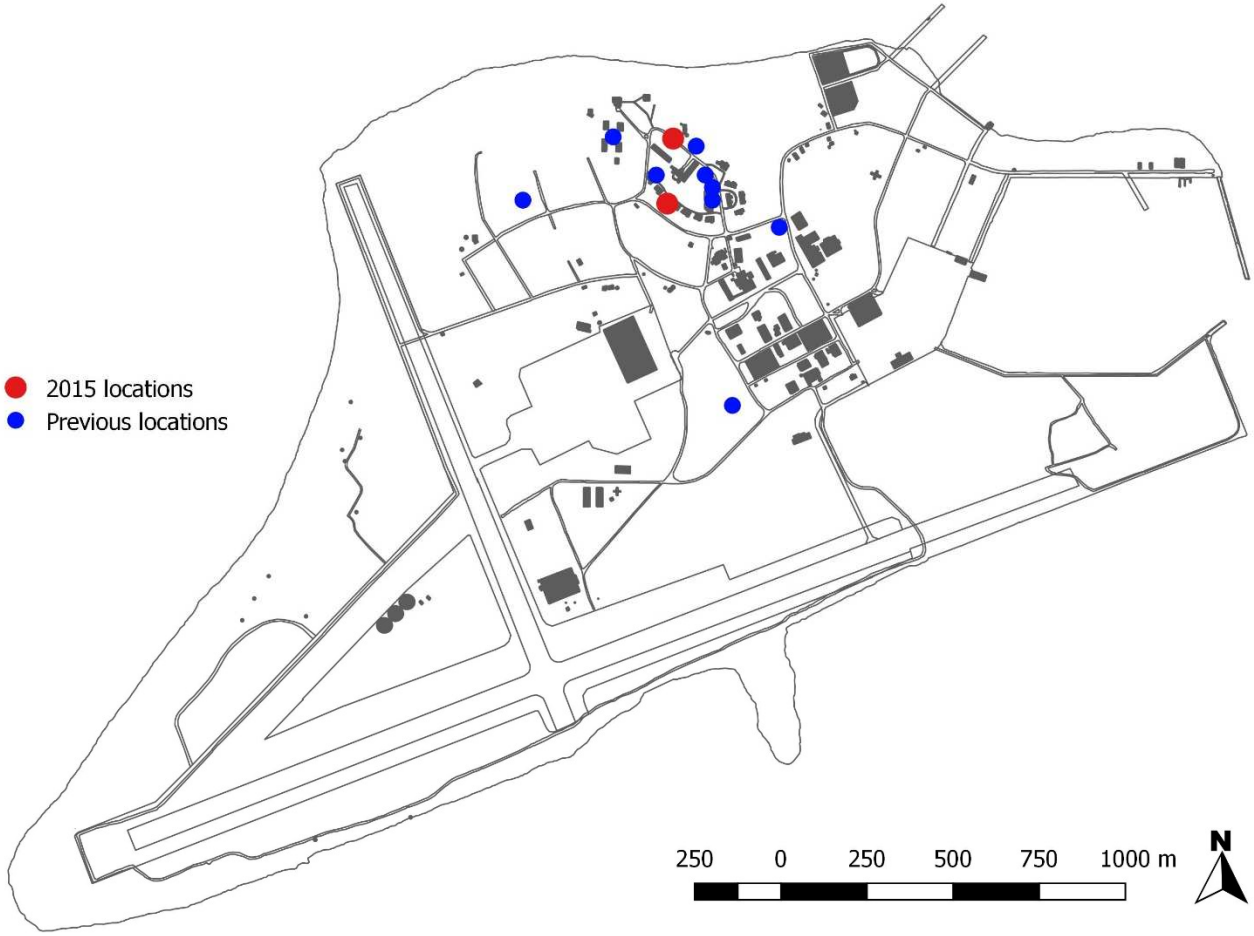

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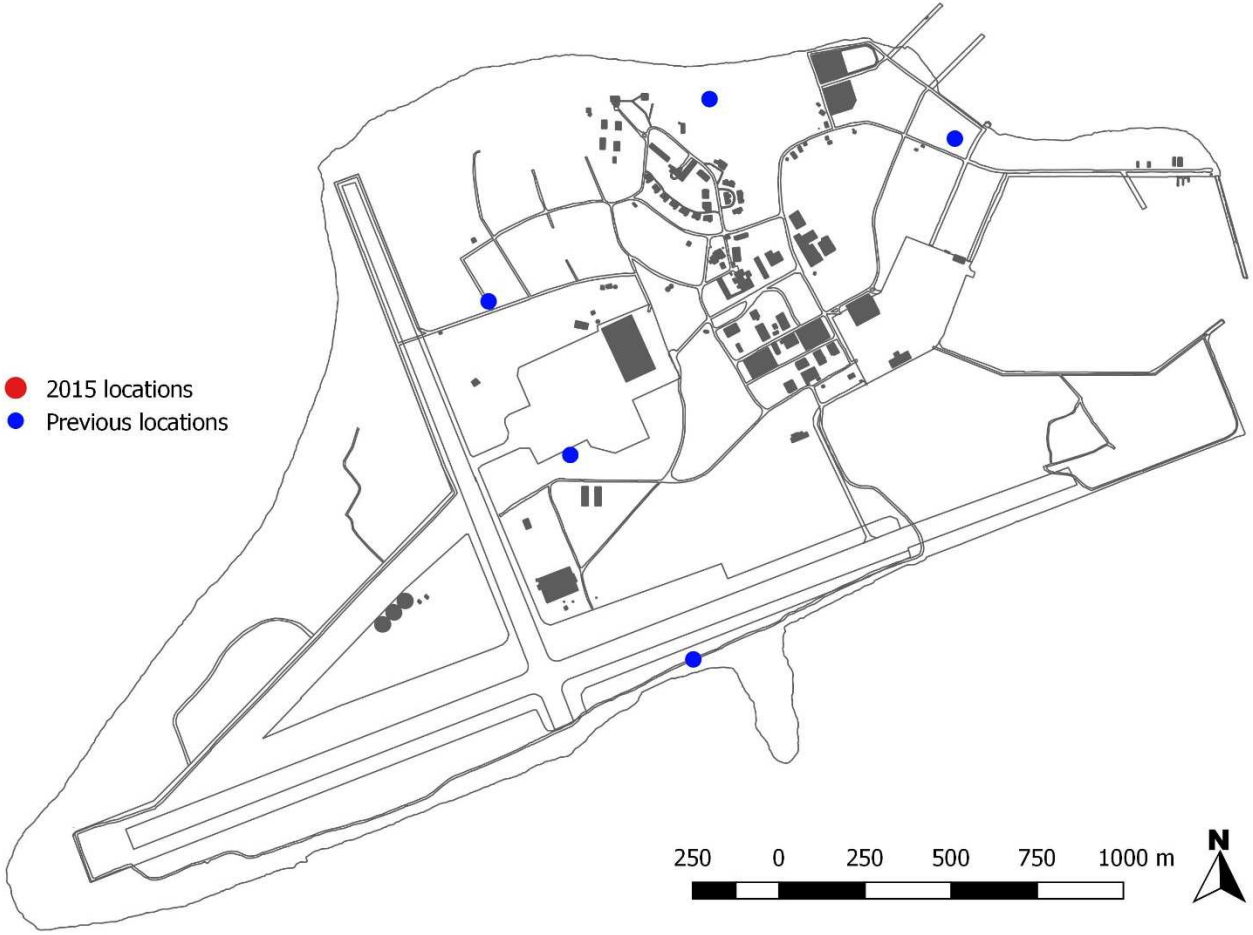

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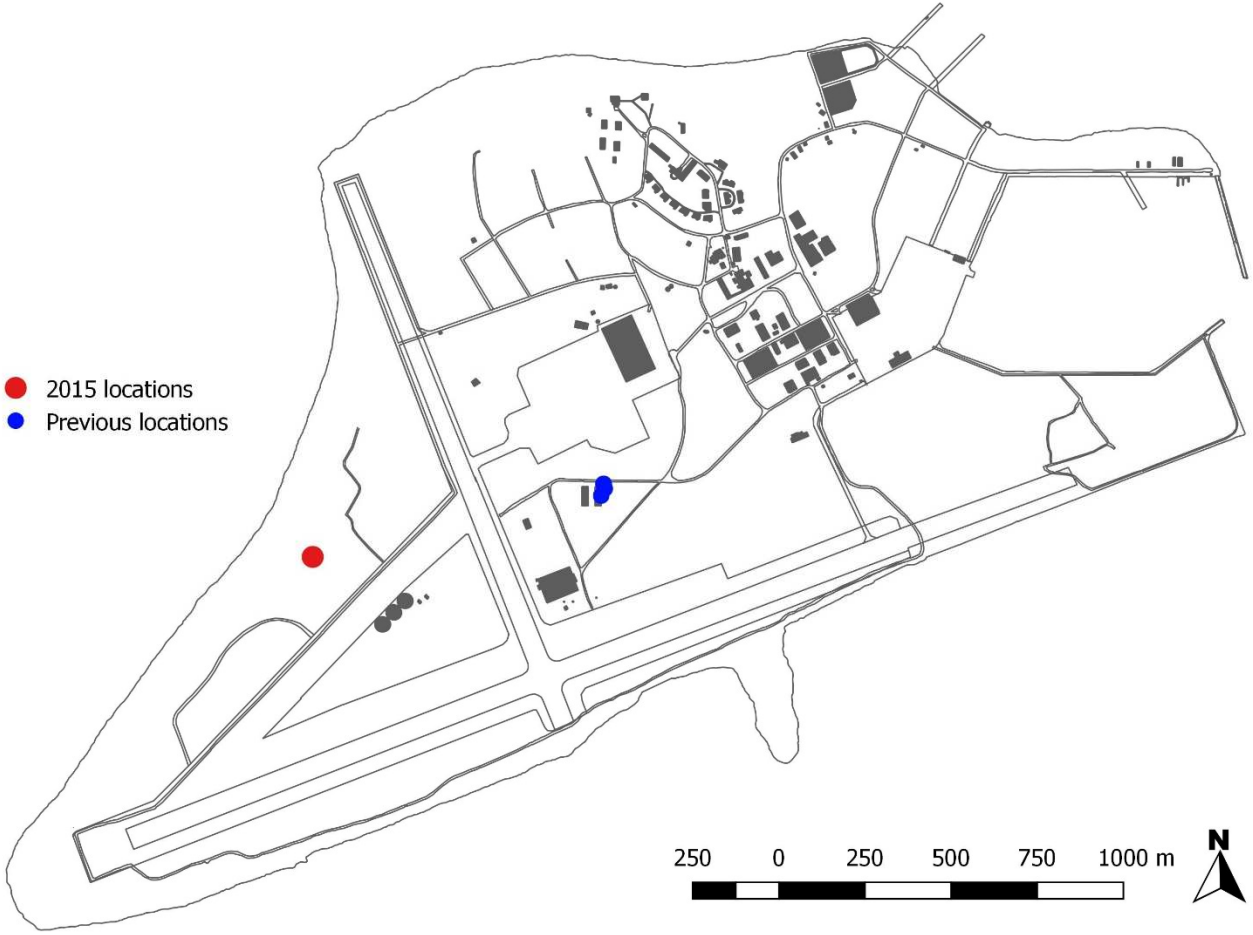
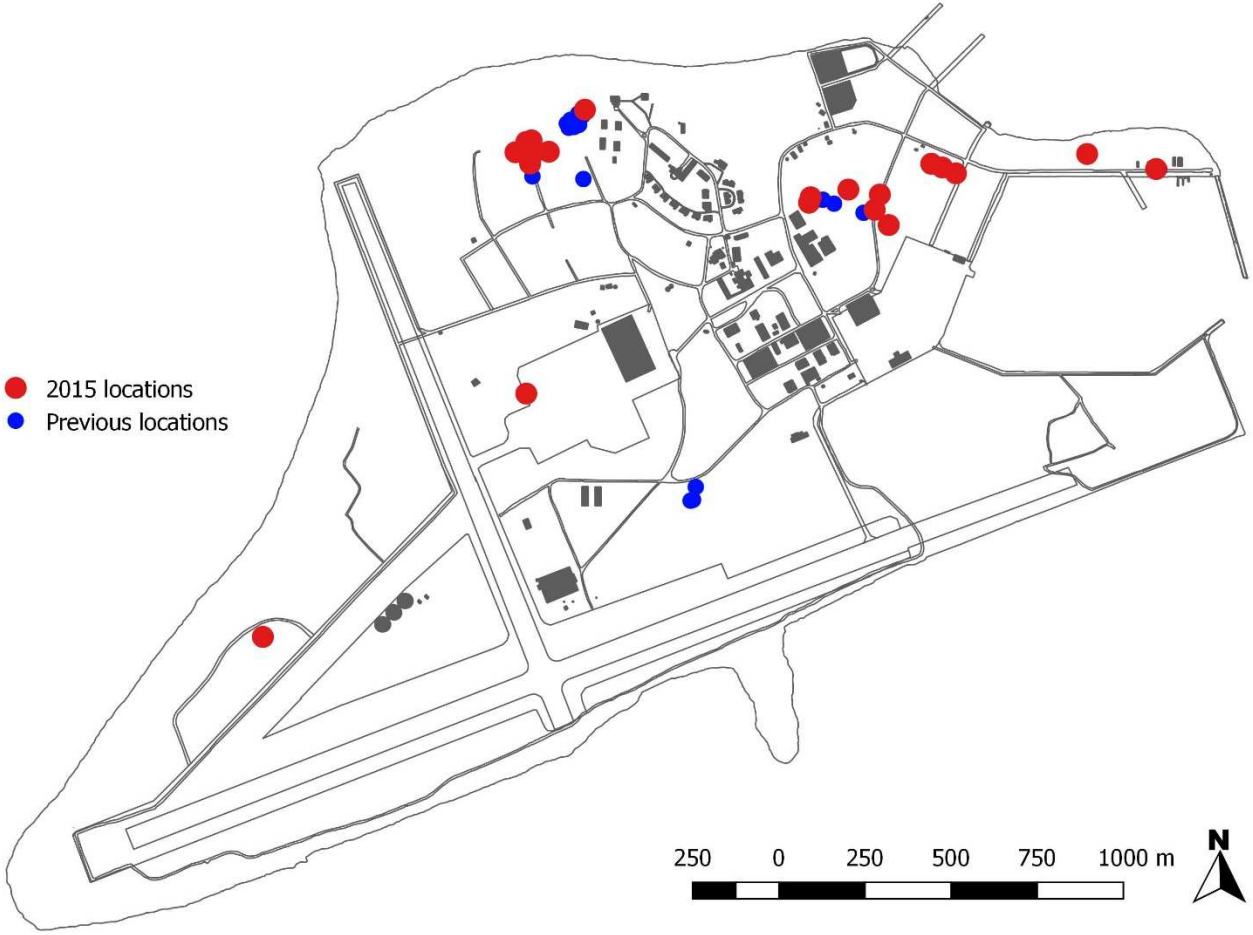


Casuarina glauca



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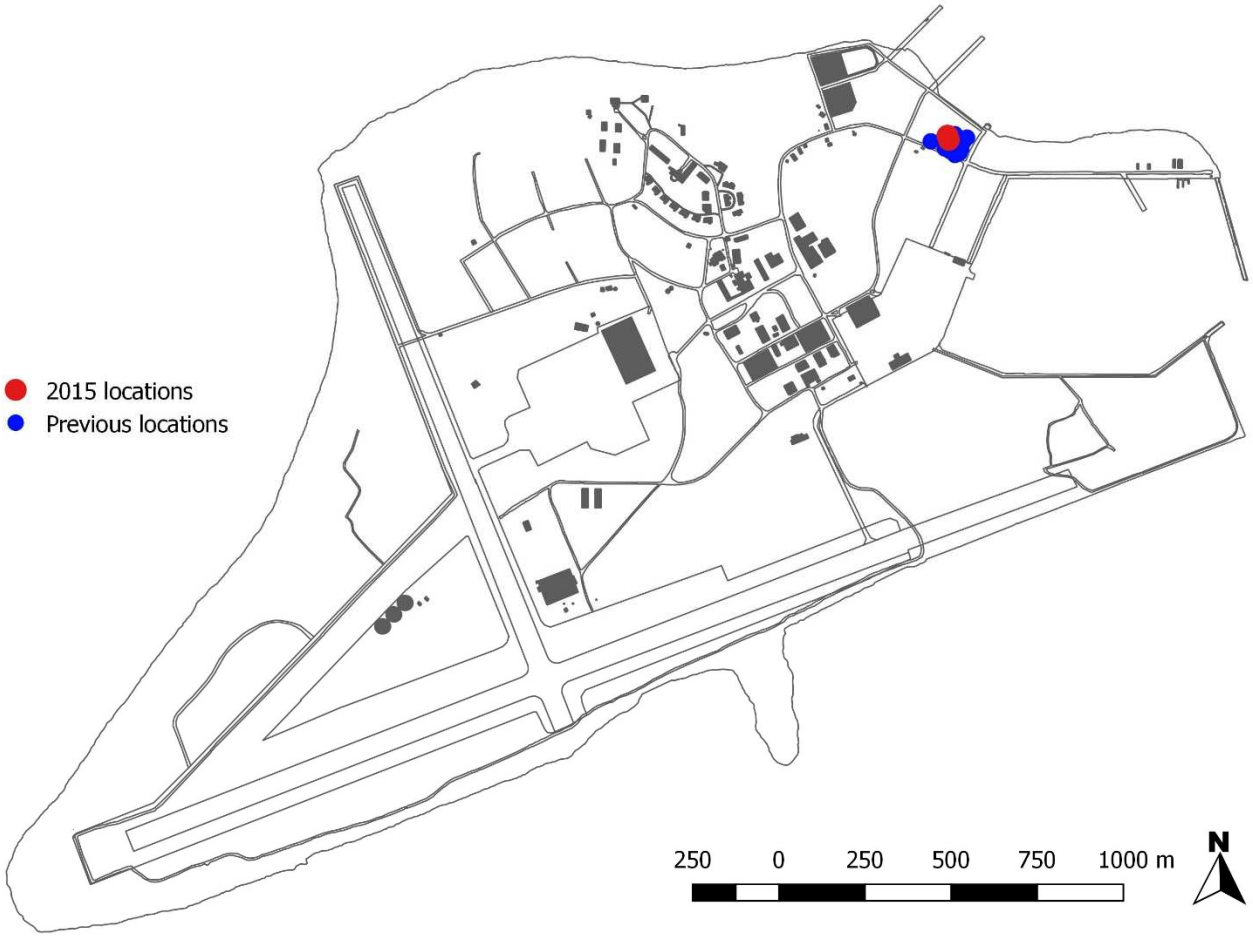
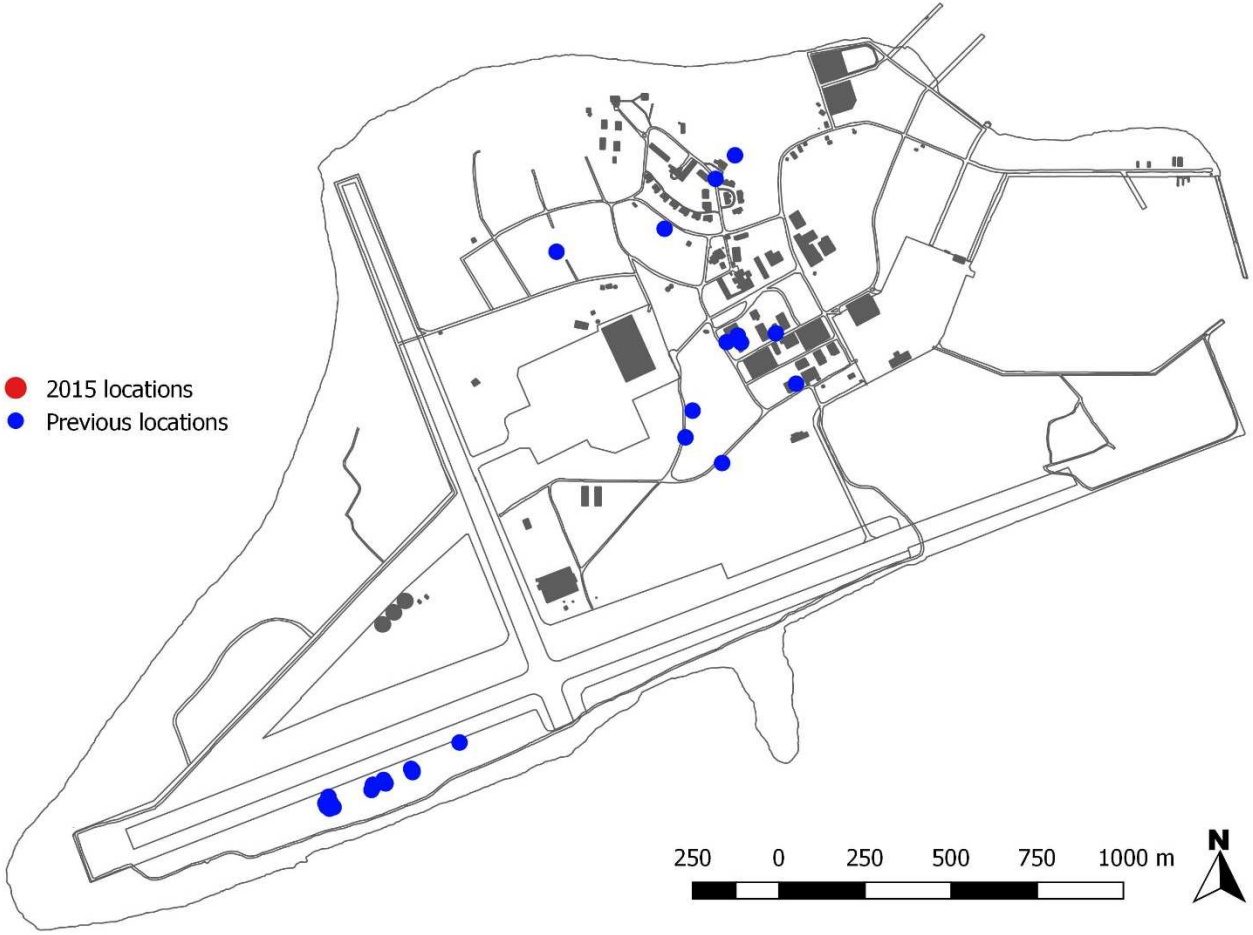


Cenchrus echinatus



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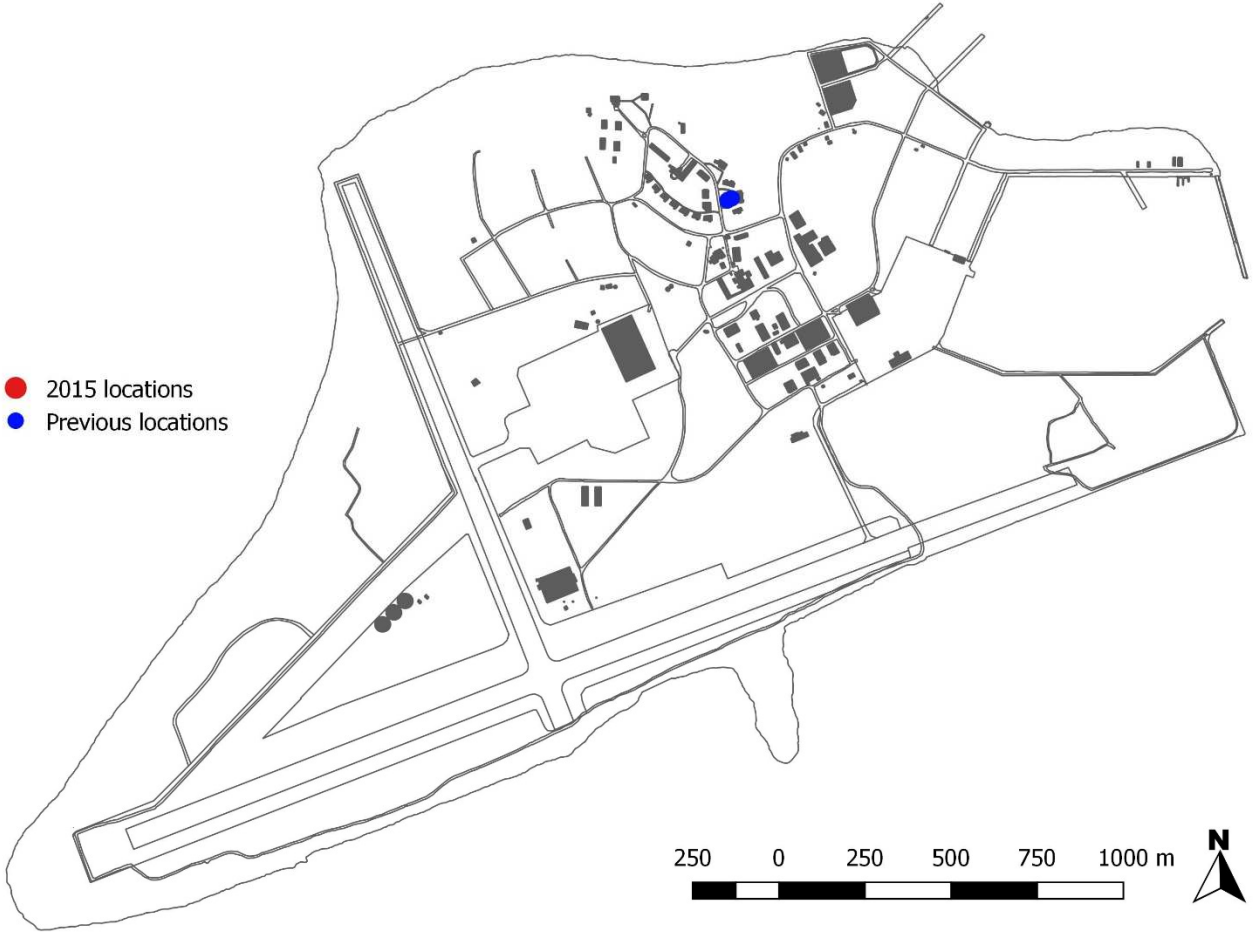
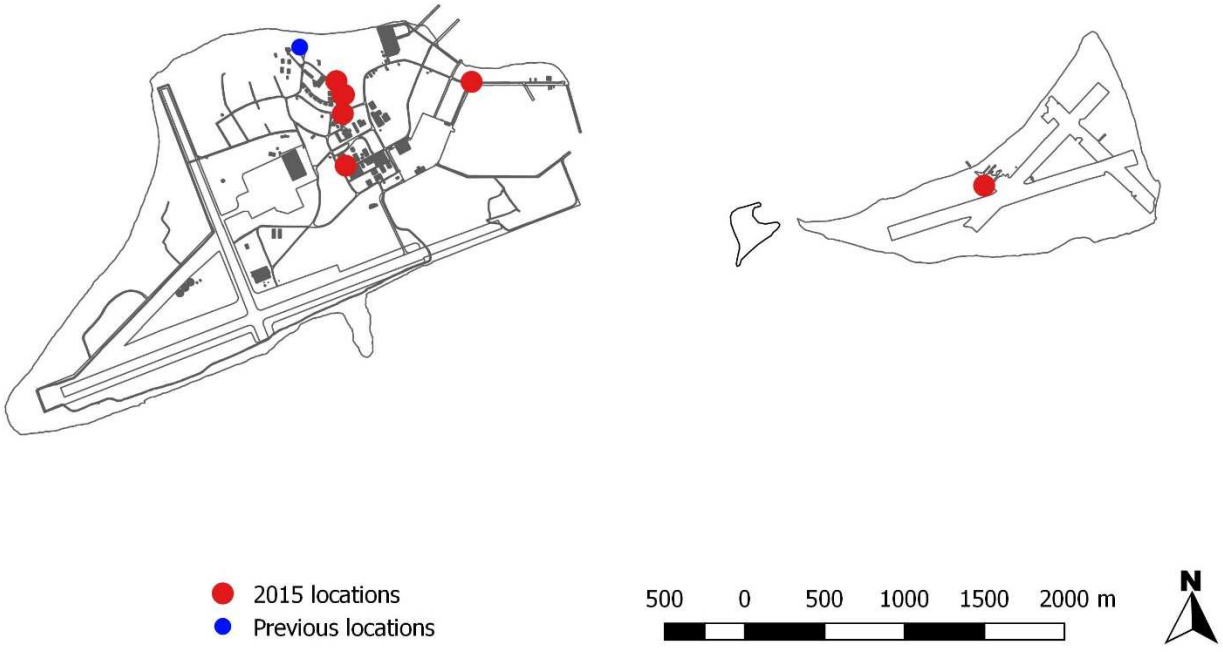
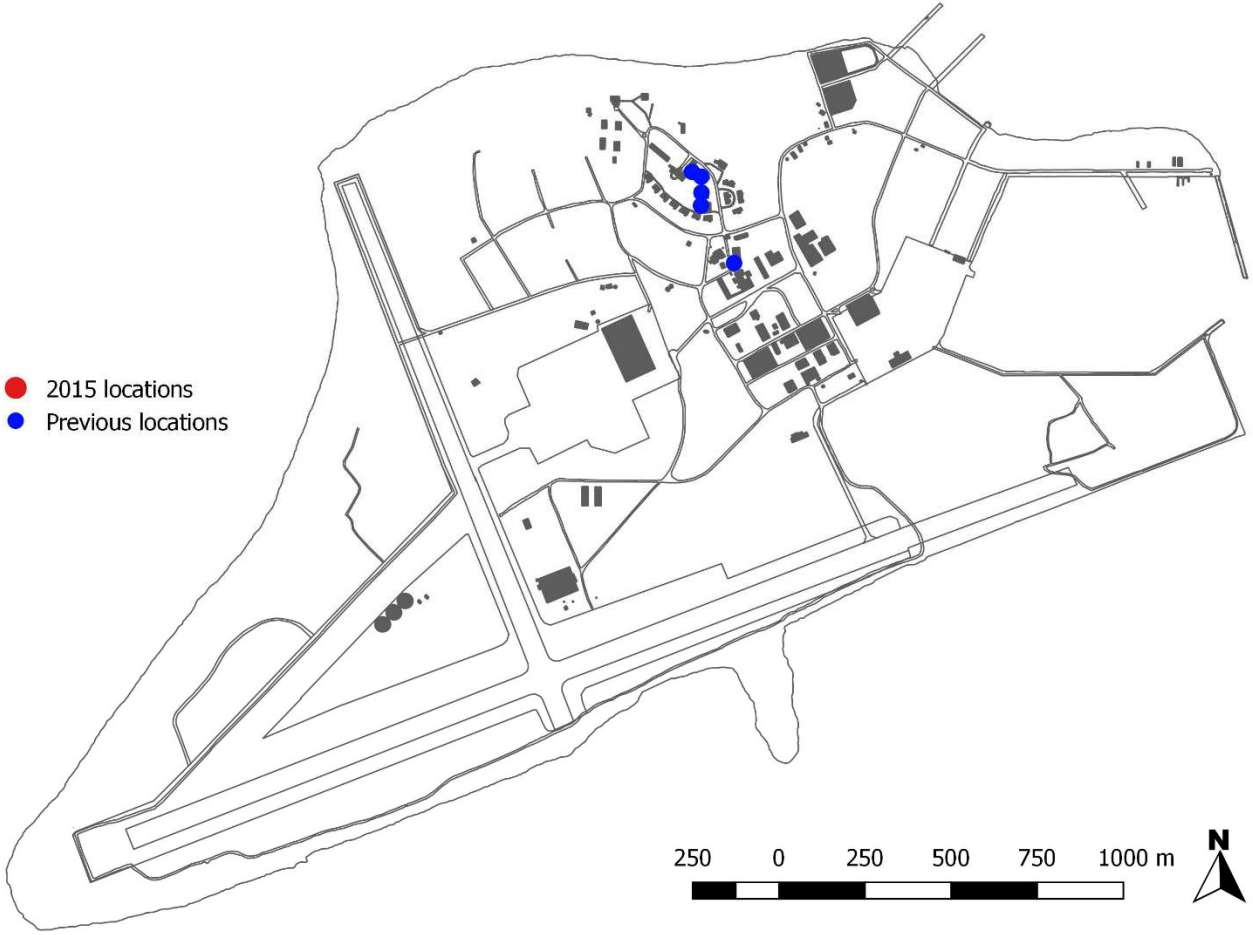


Chenopodium oahuense



Coccinia grandis



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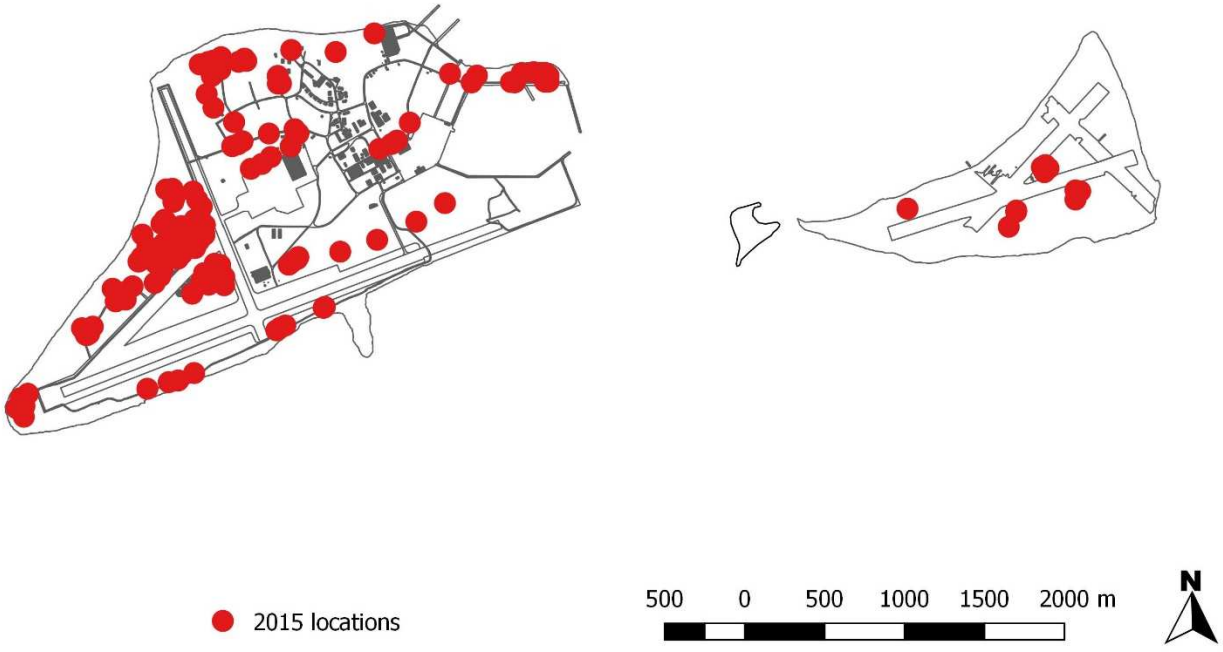
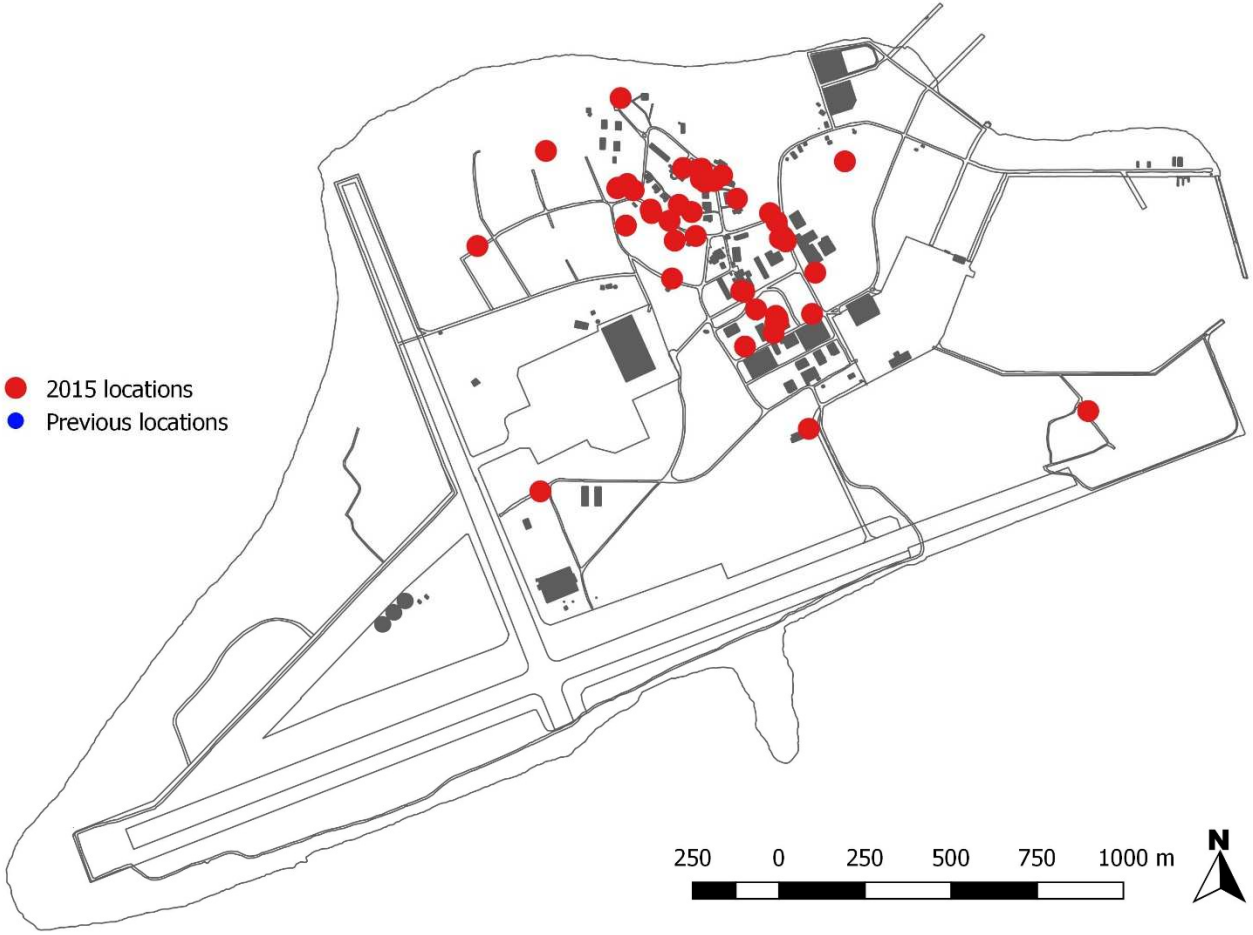
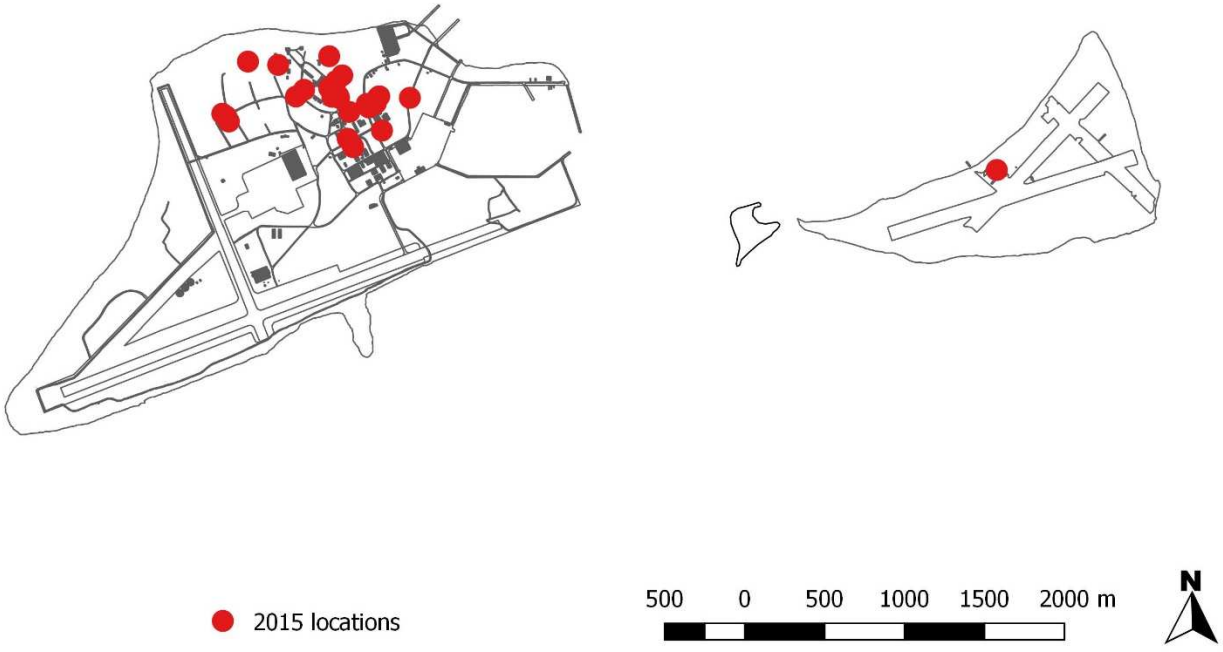
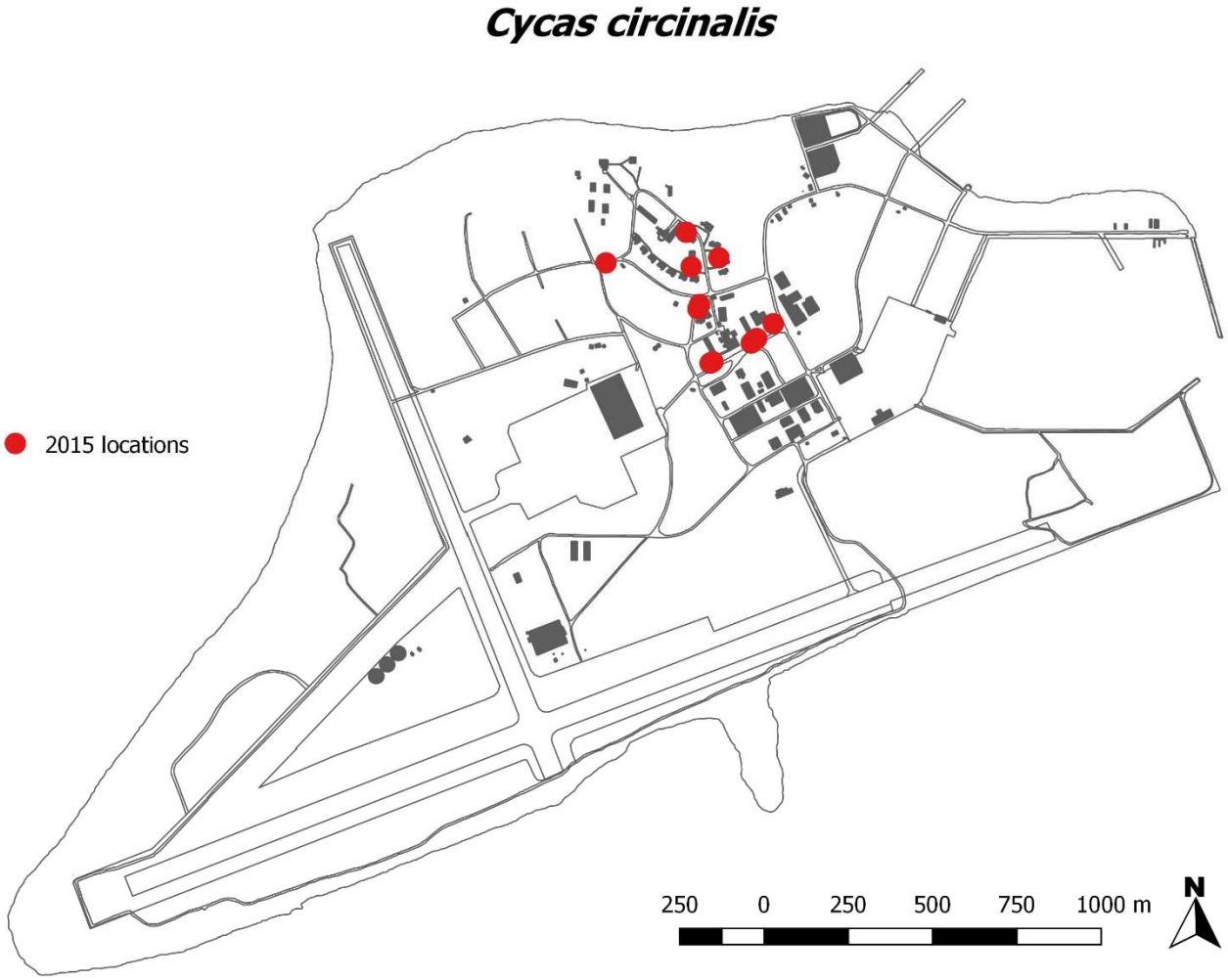


Cocos nucifera



Crinum asiaticum




Cycas circinalis
2015 locations
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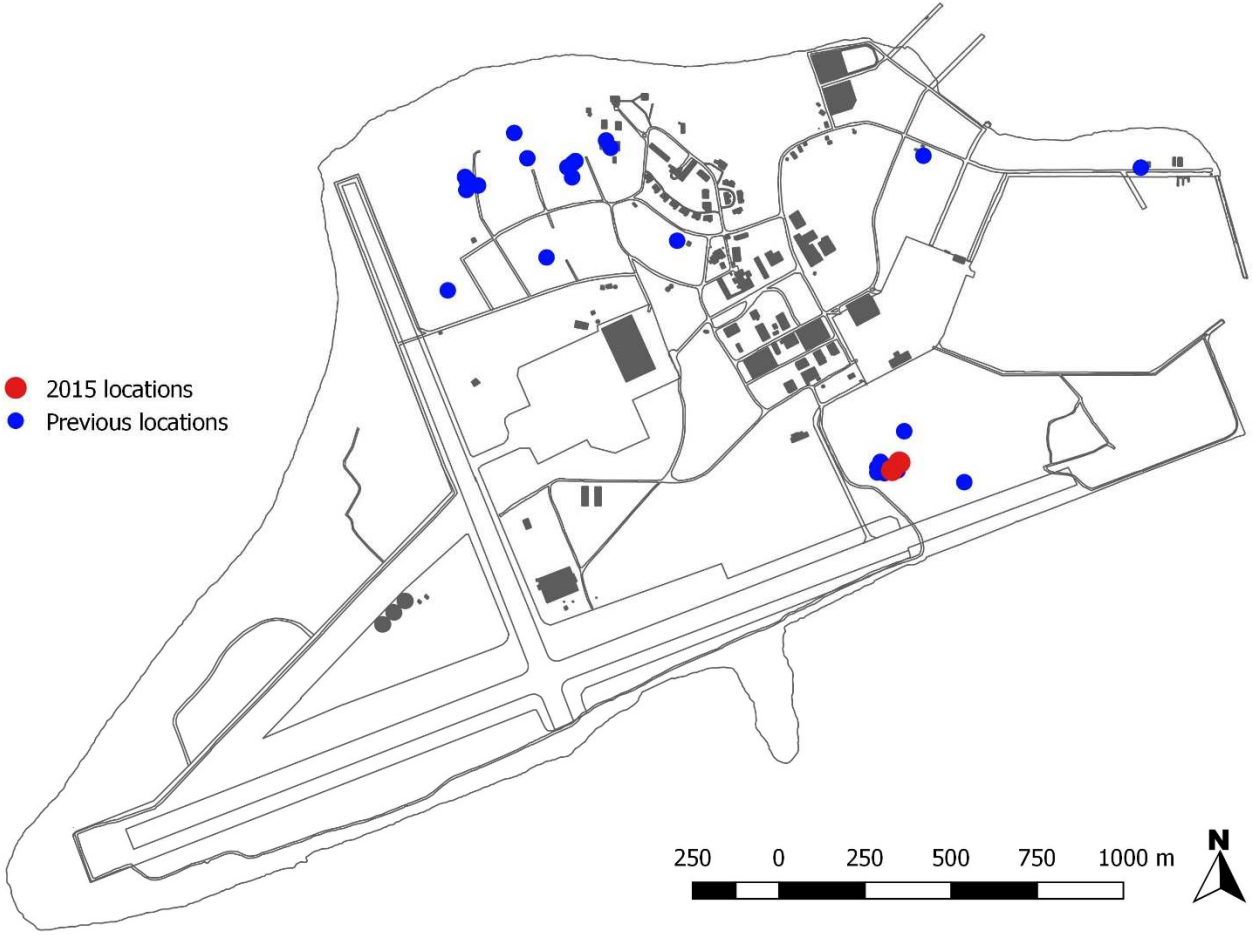
Cyperus involucratus



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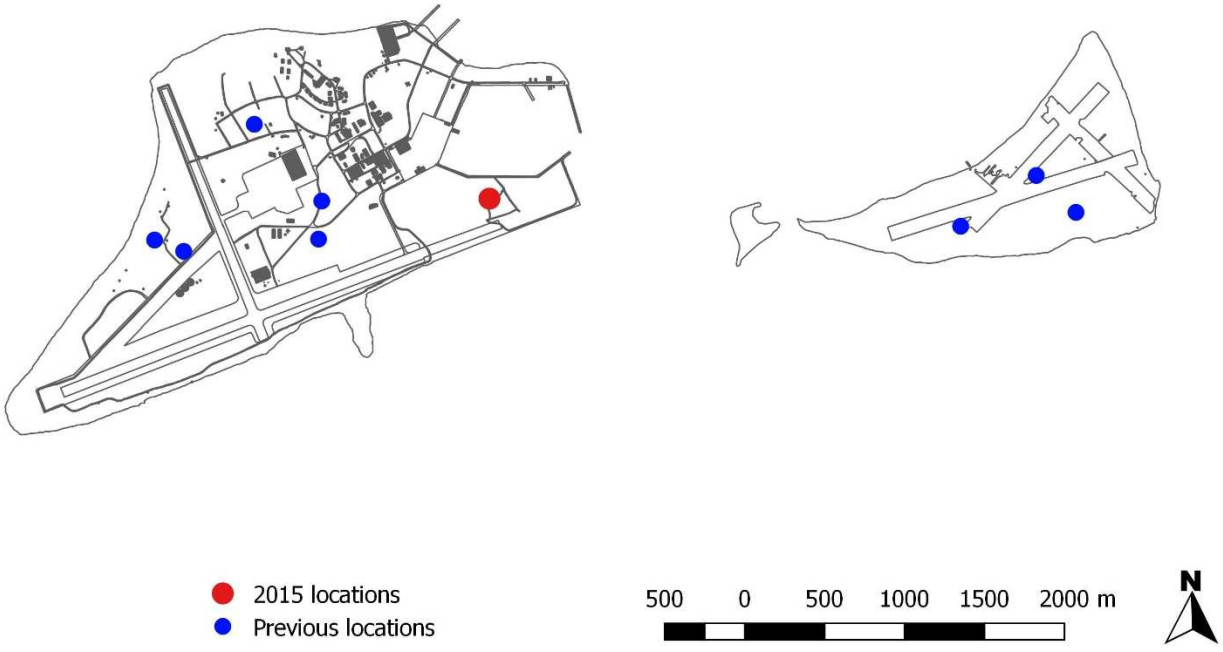

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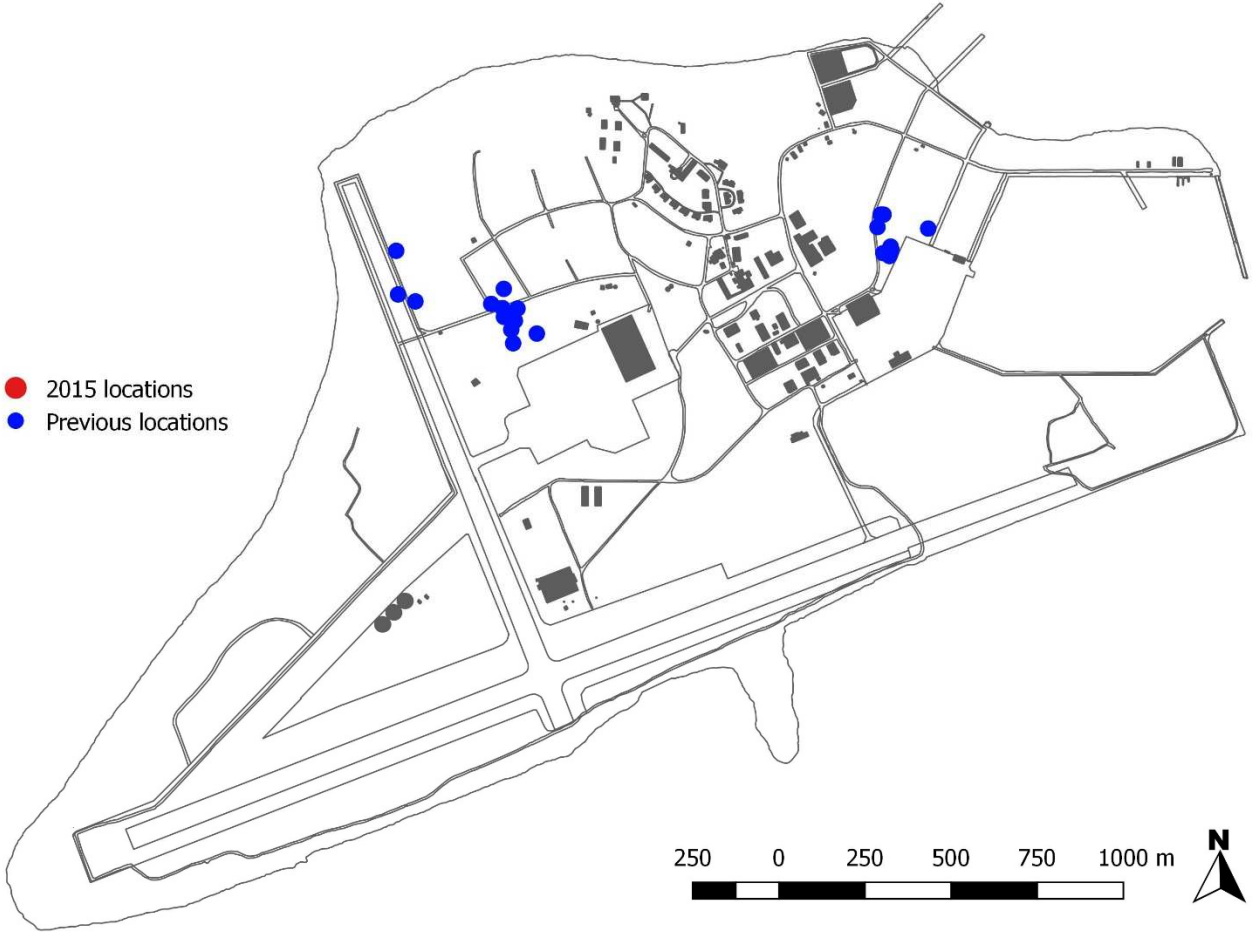

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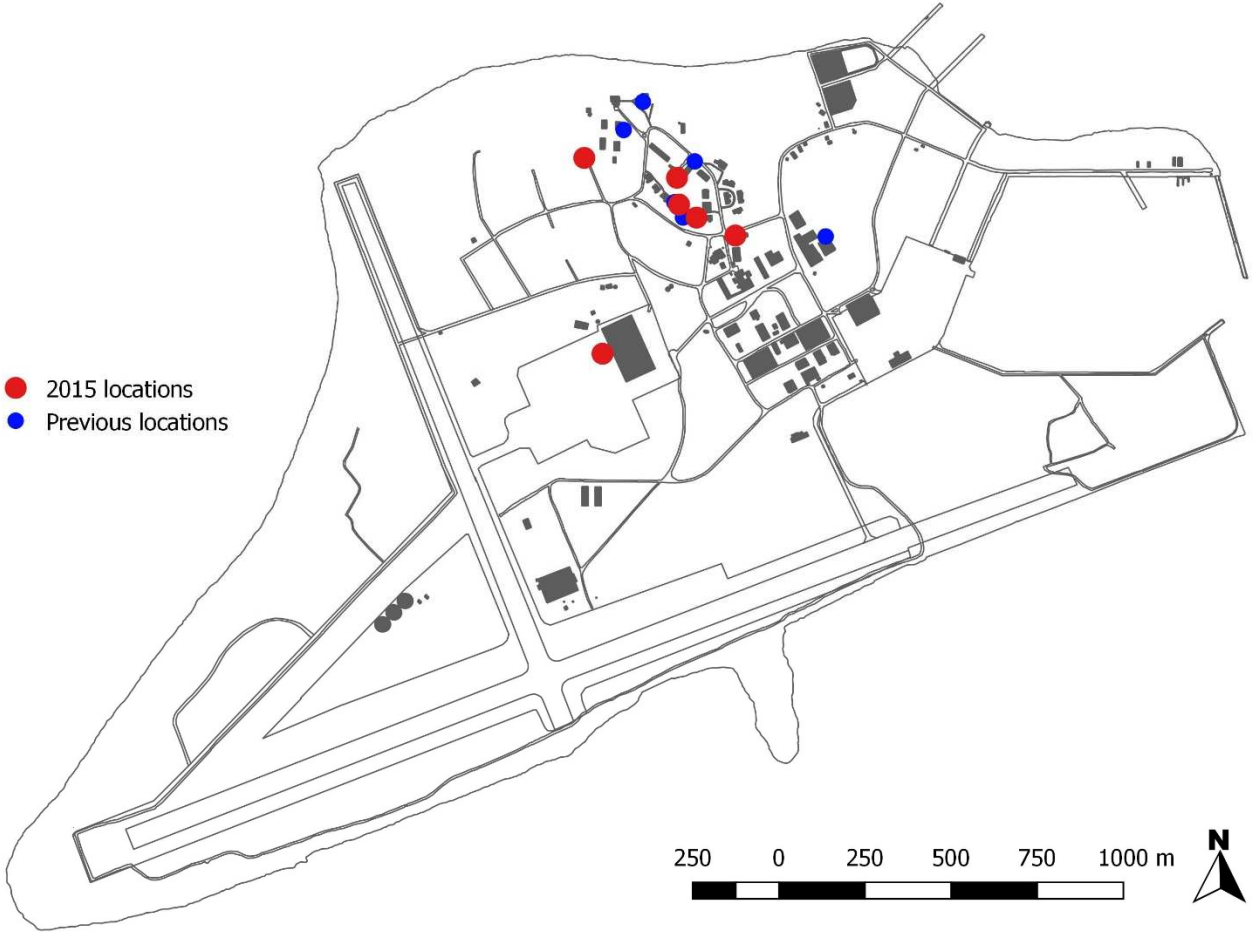

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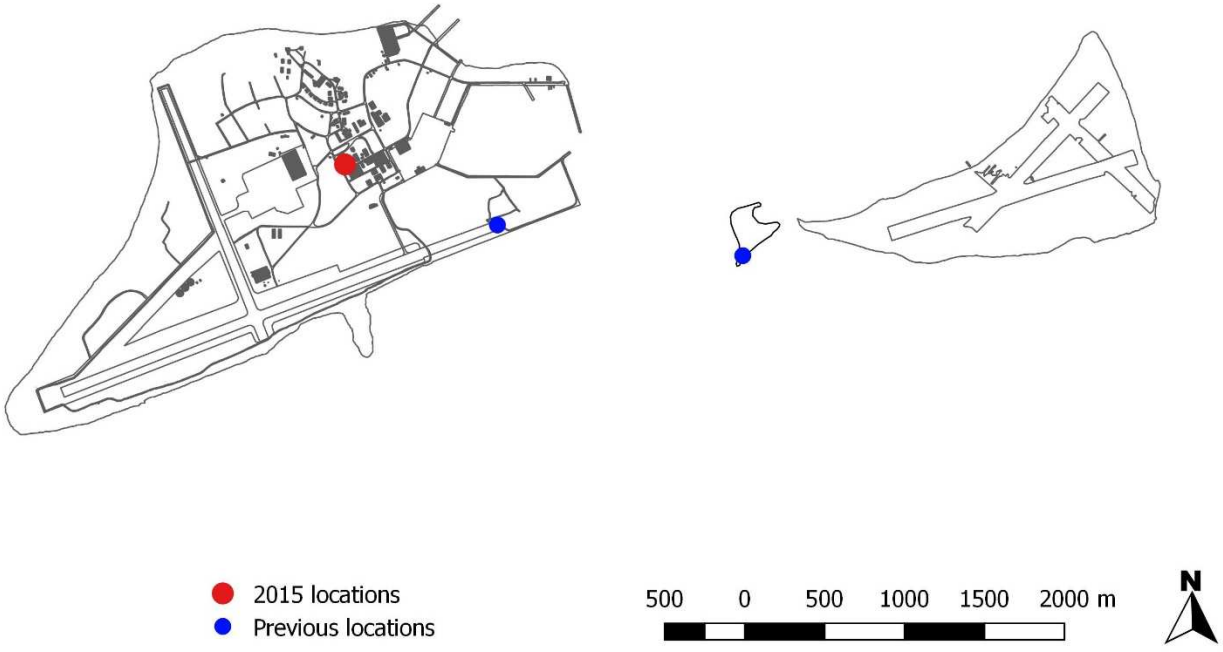

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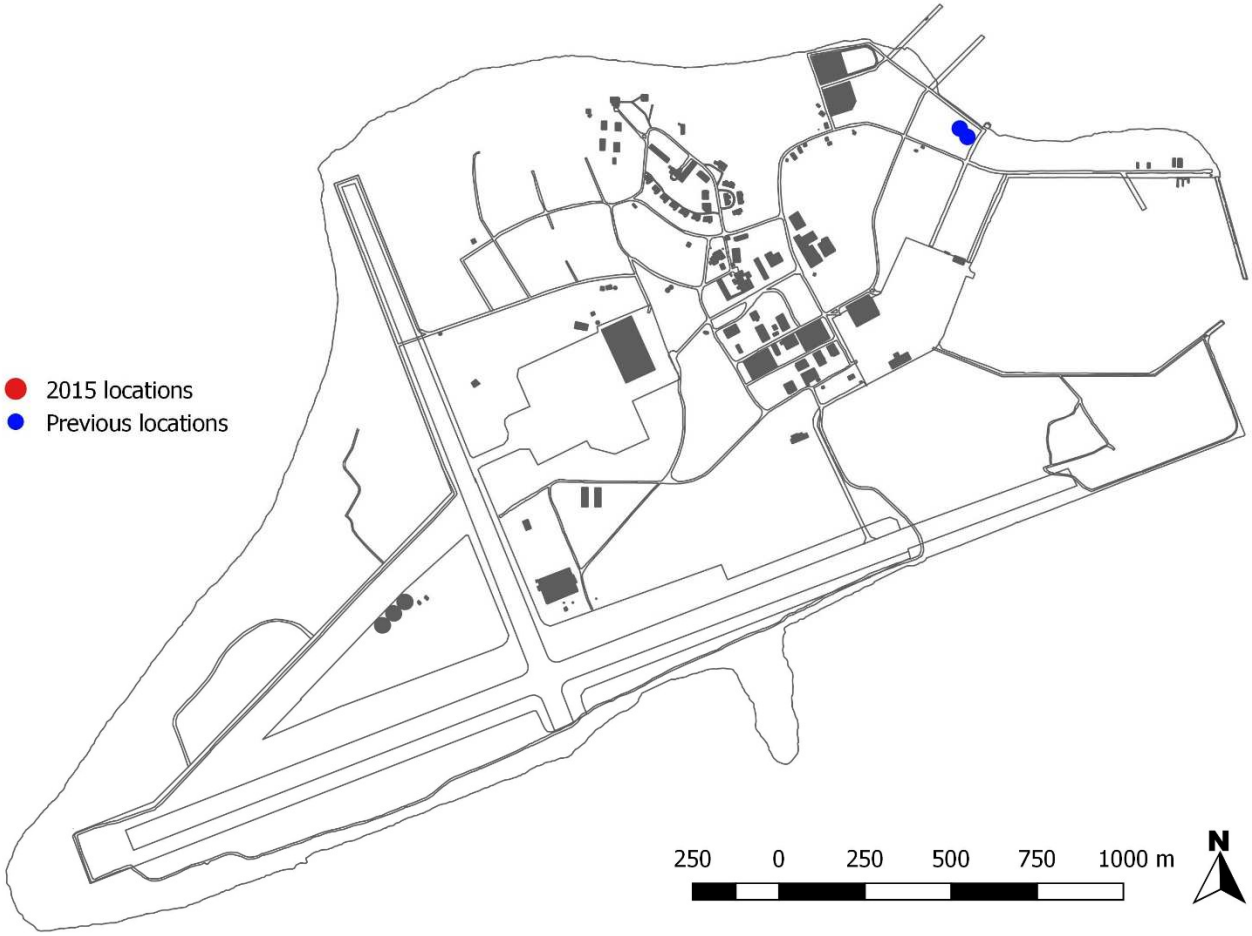
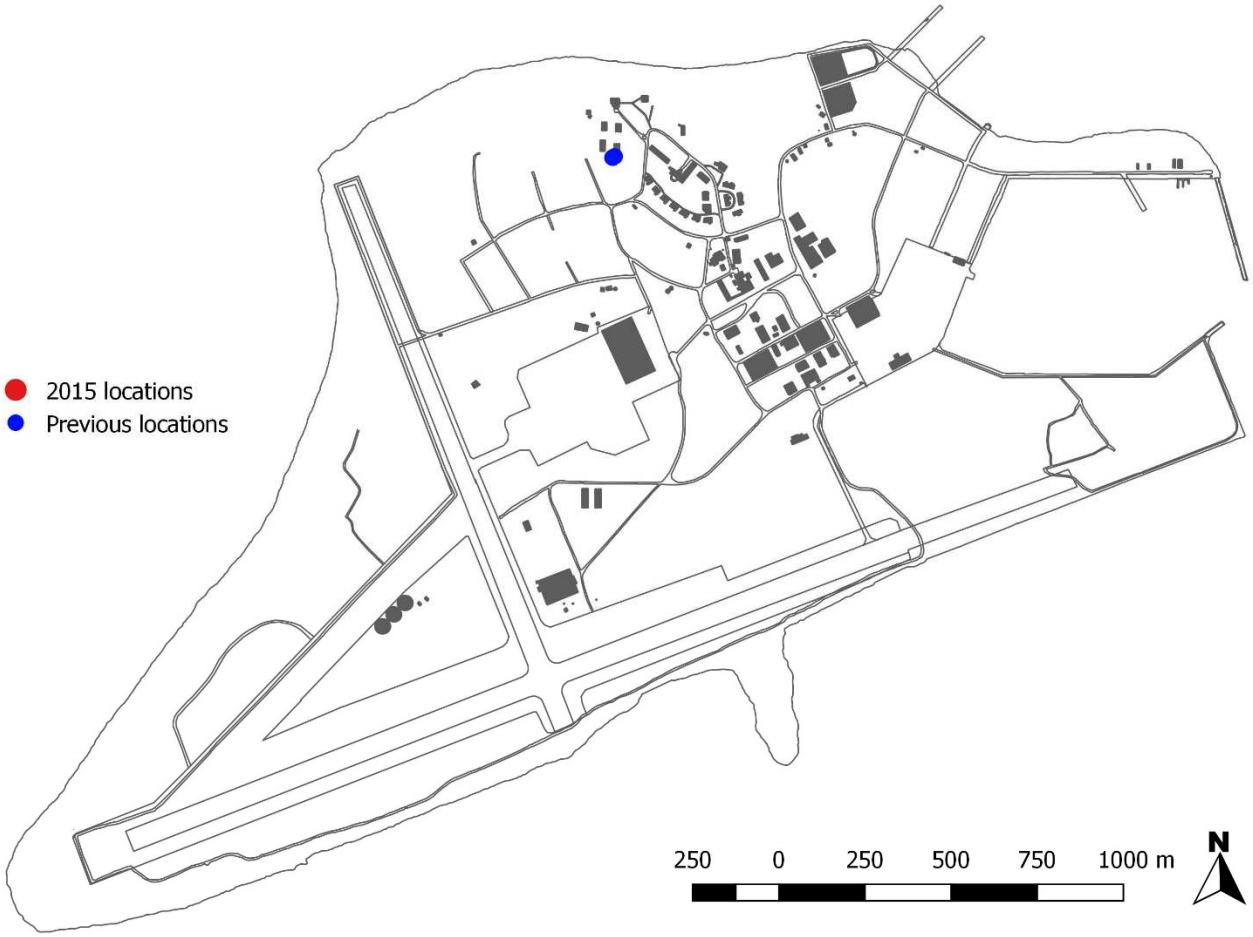
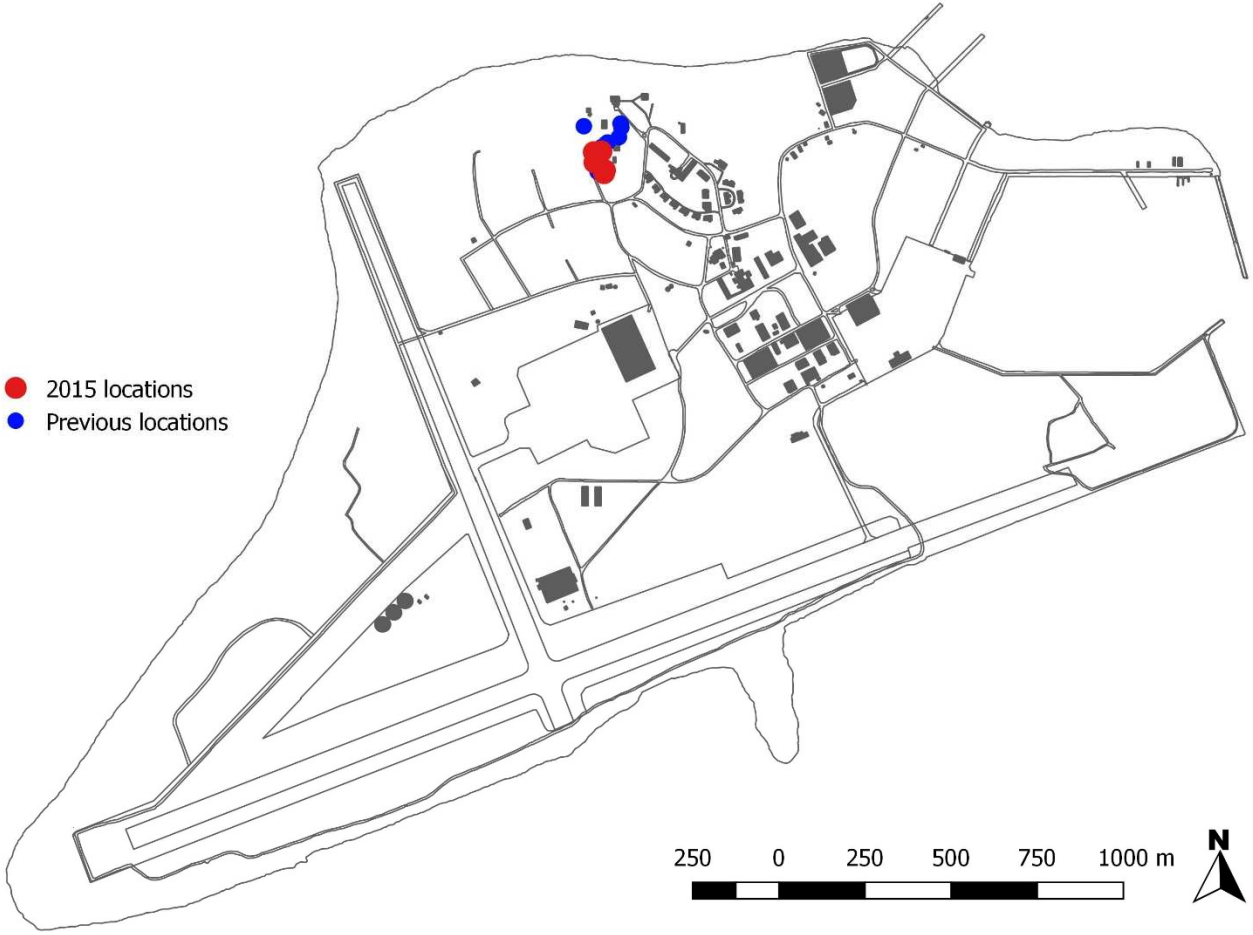


Eugenia uniflora



Ficus benghalensis



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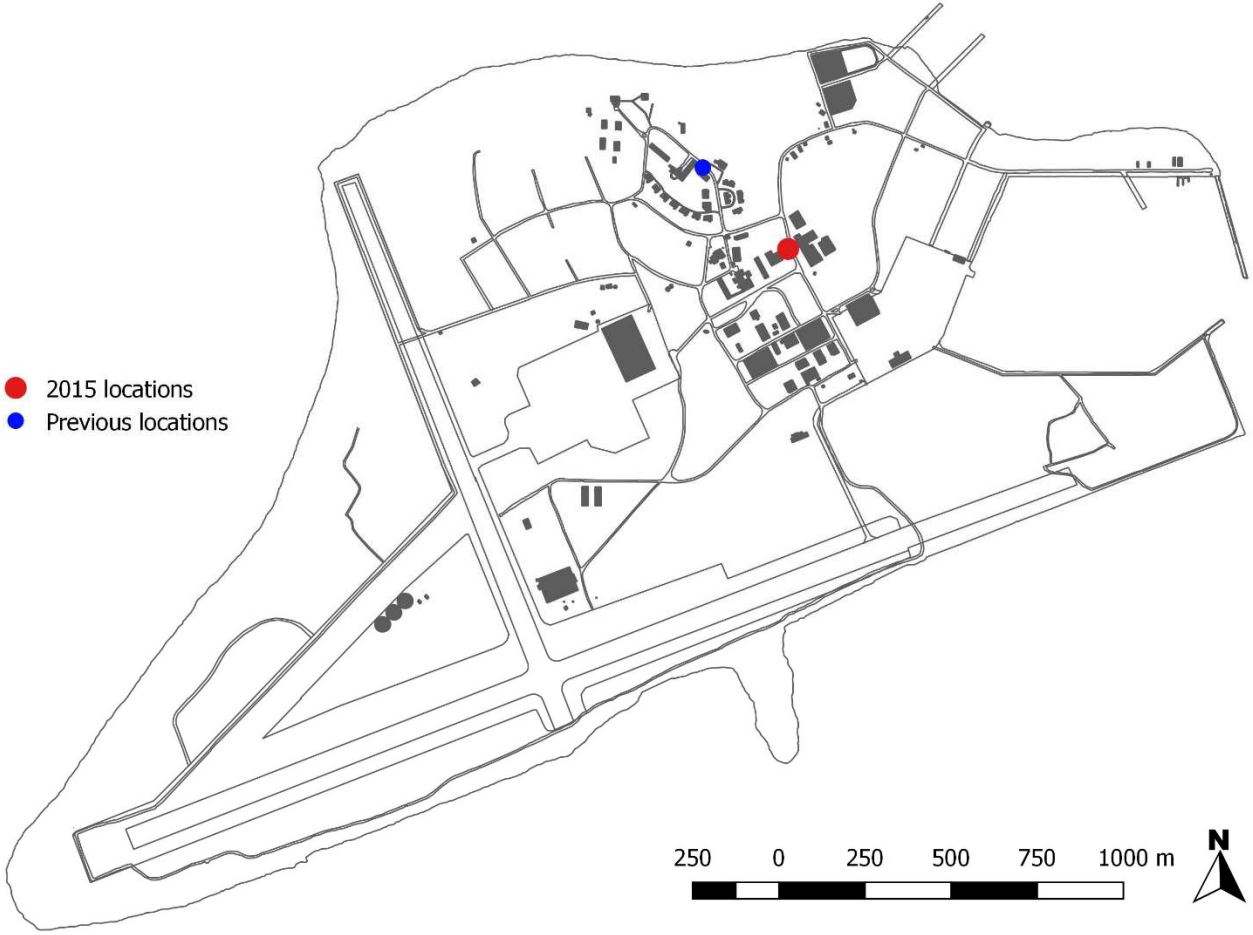

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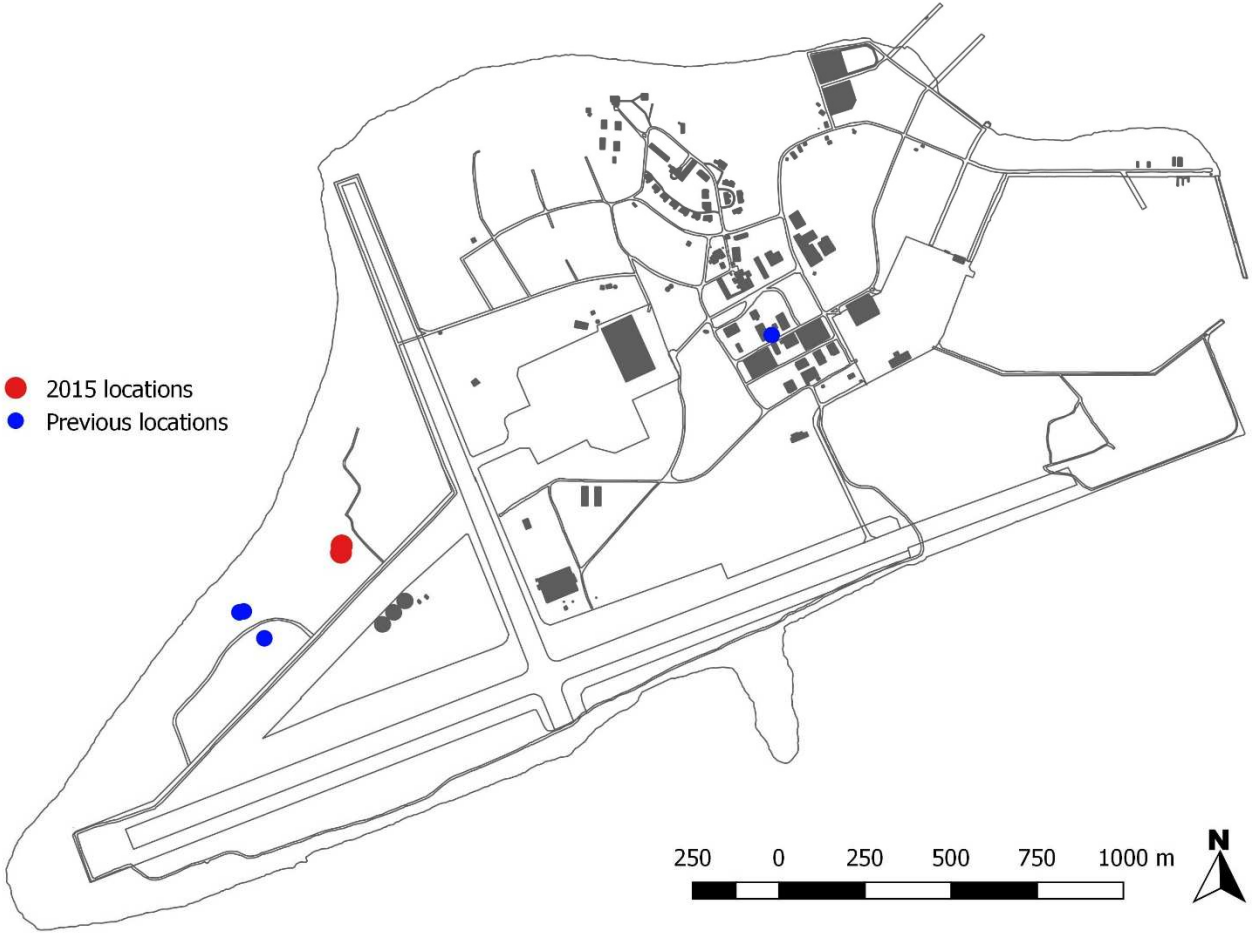
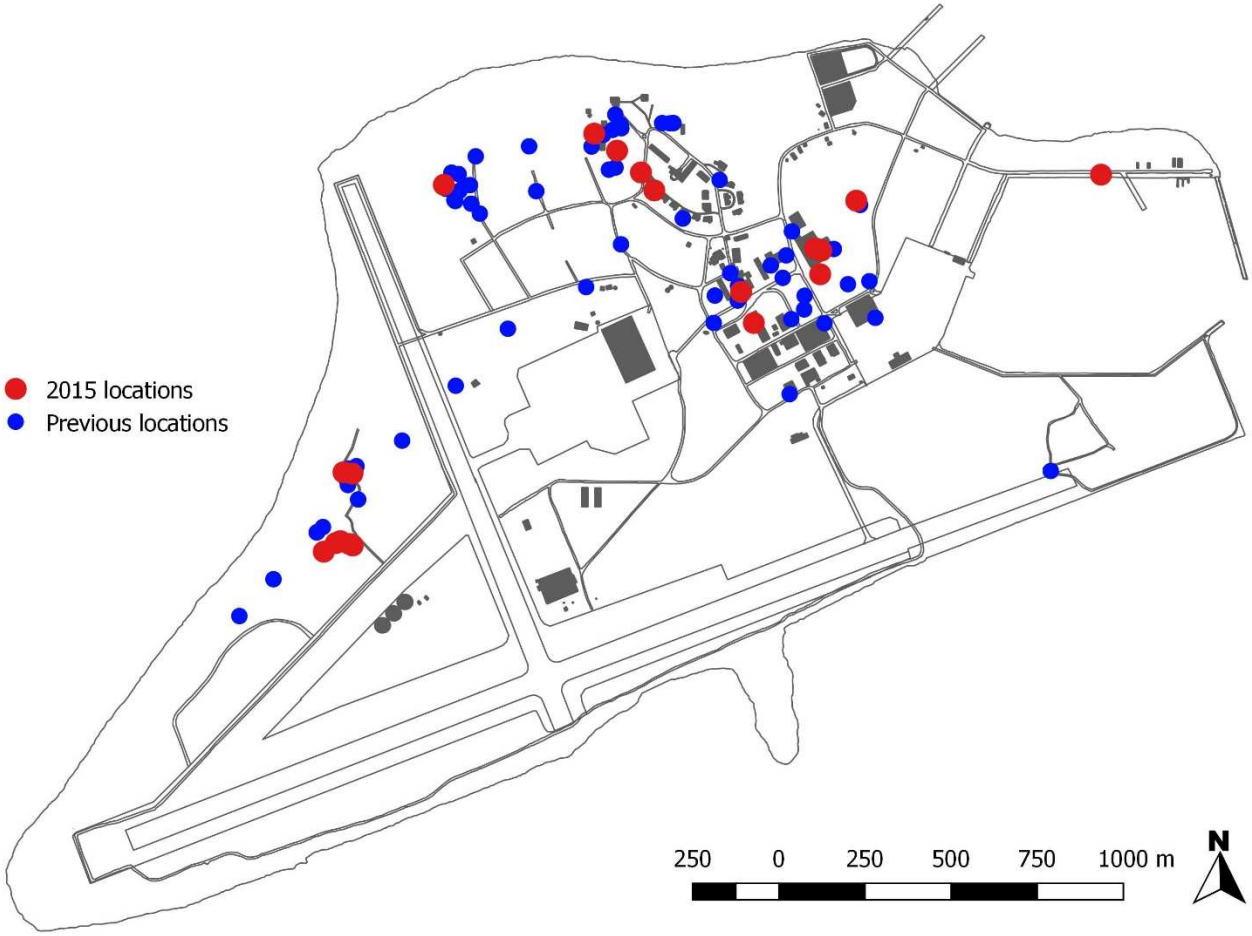


Ficus microcarpa



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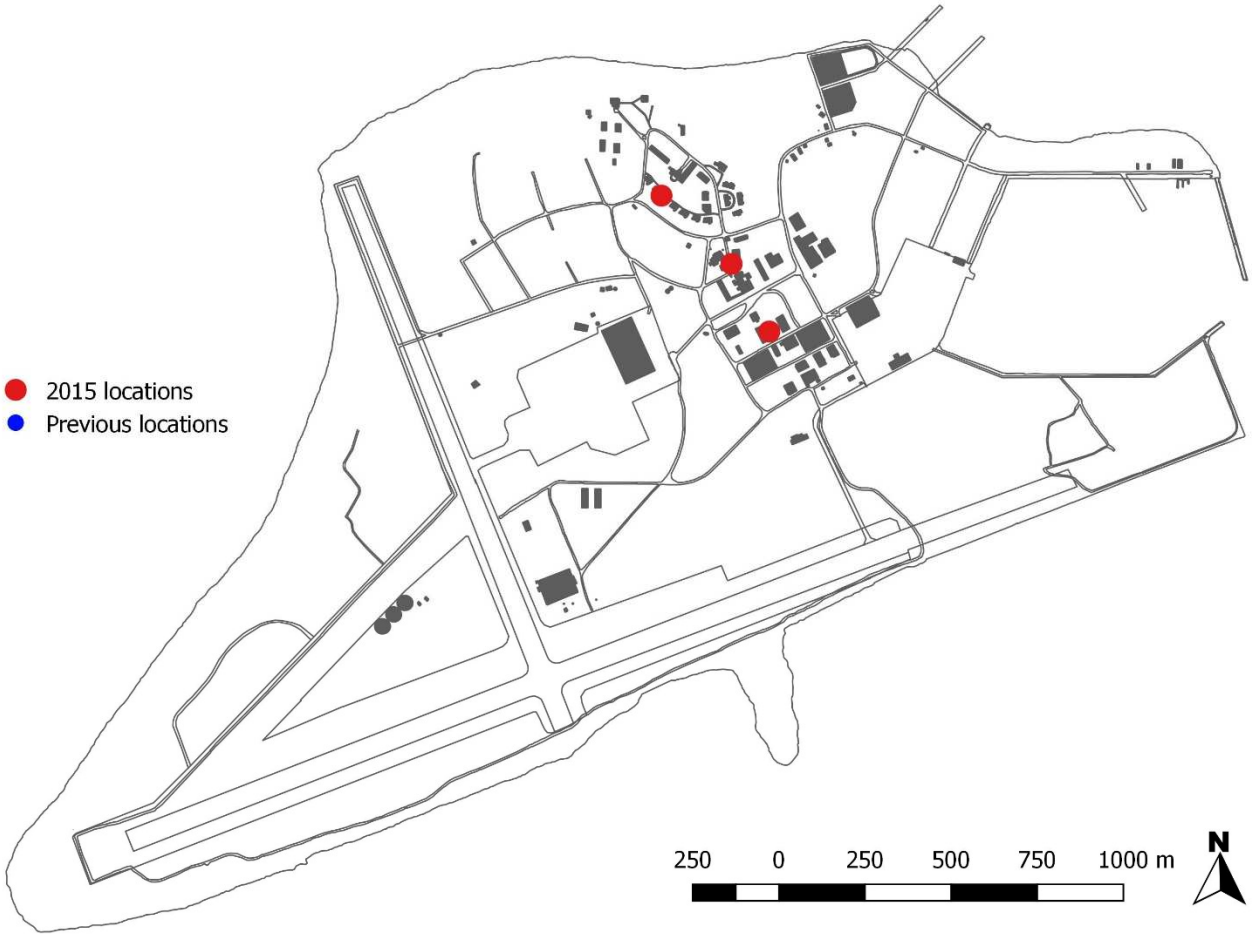

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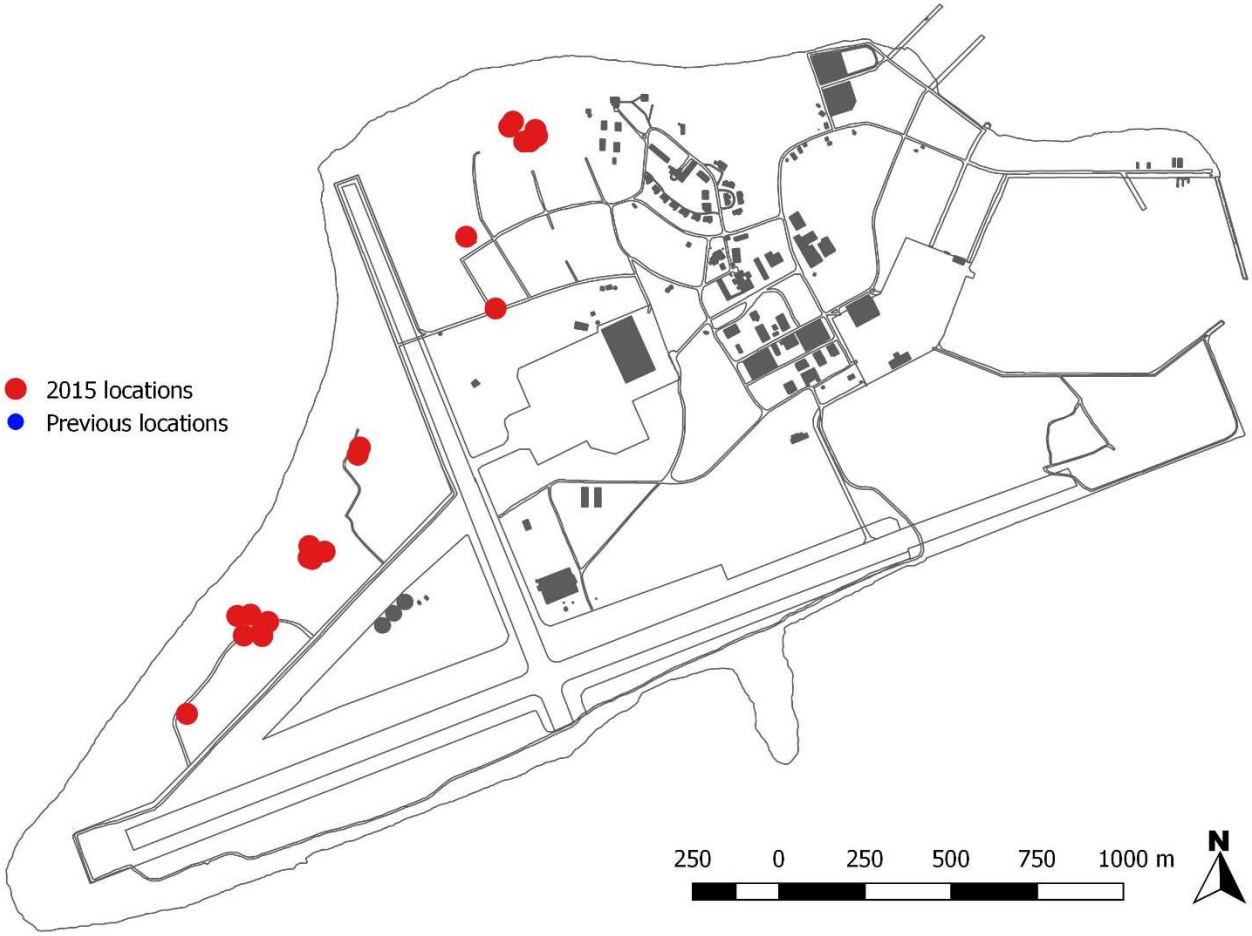
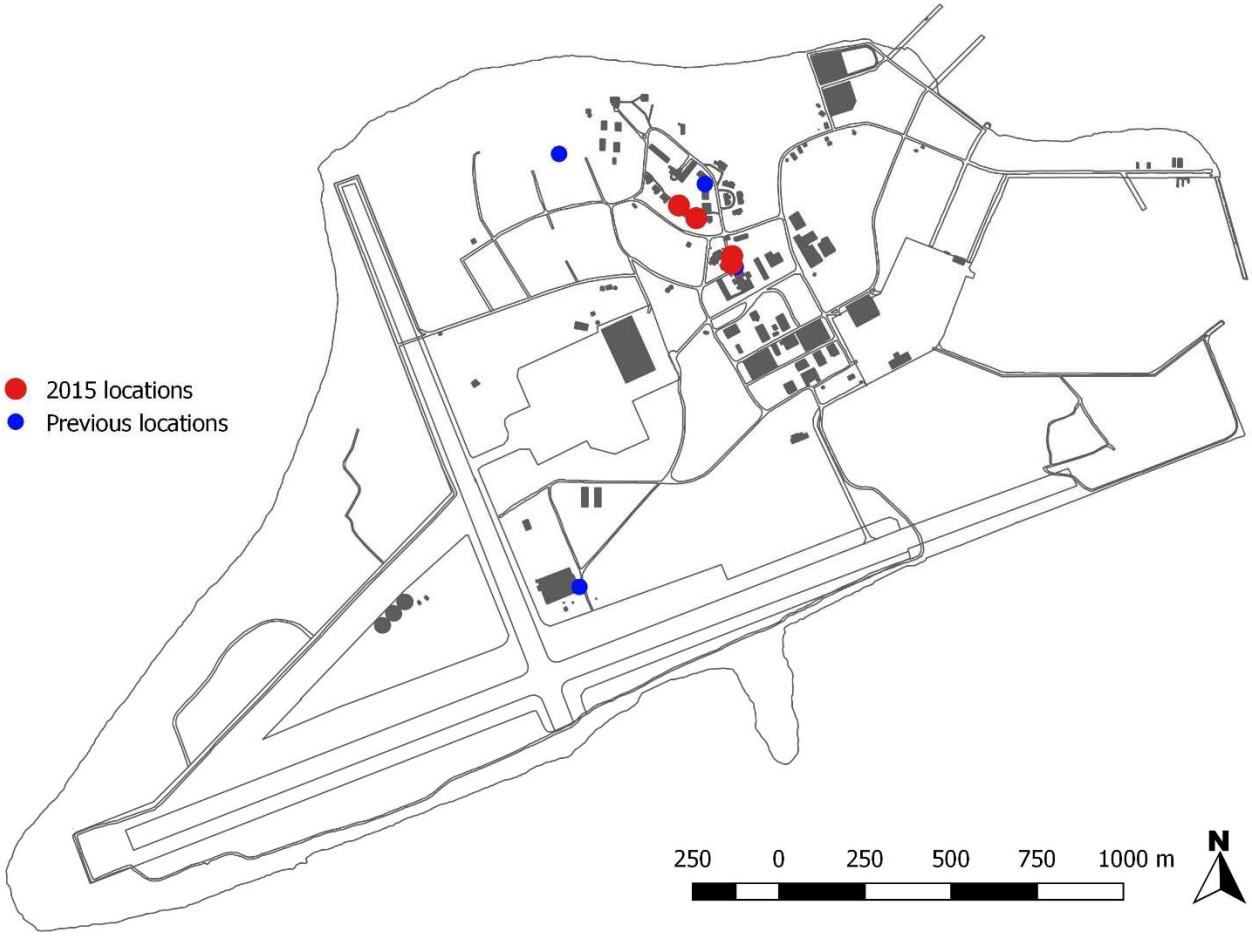
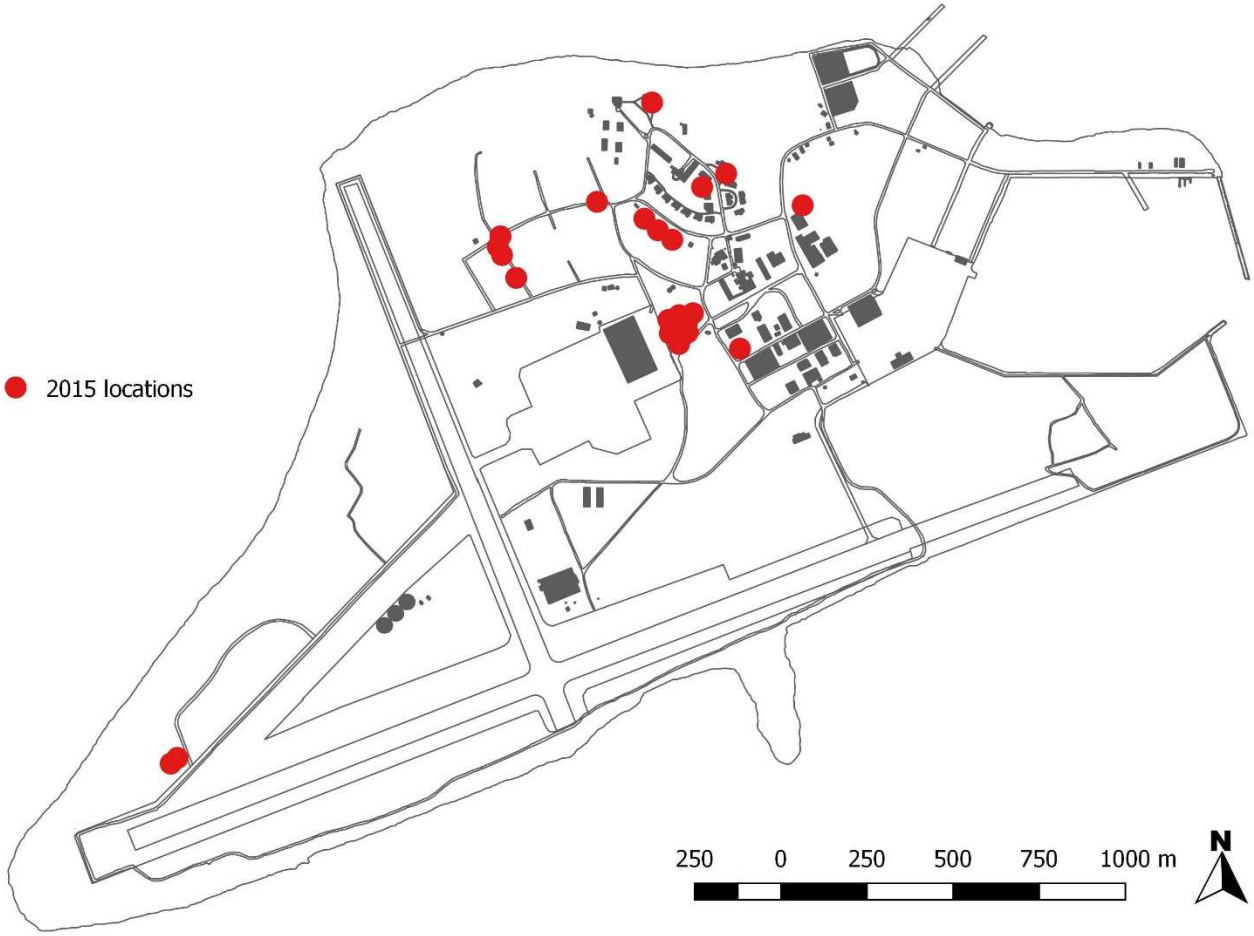


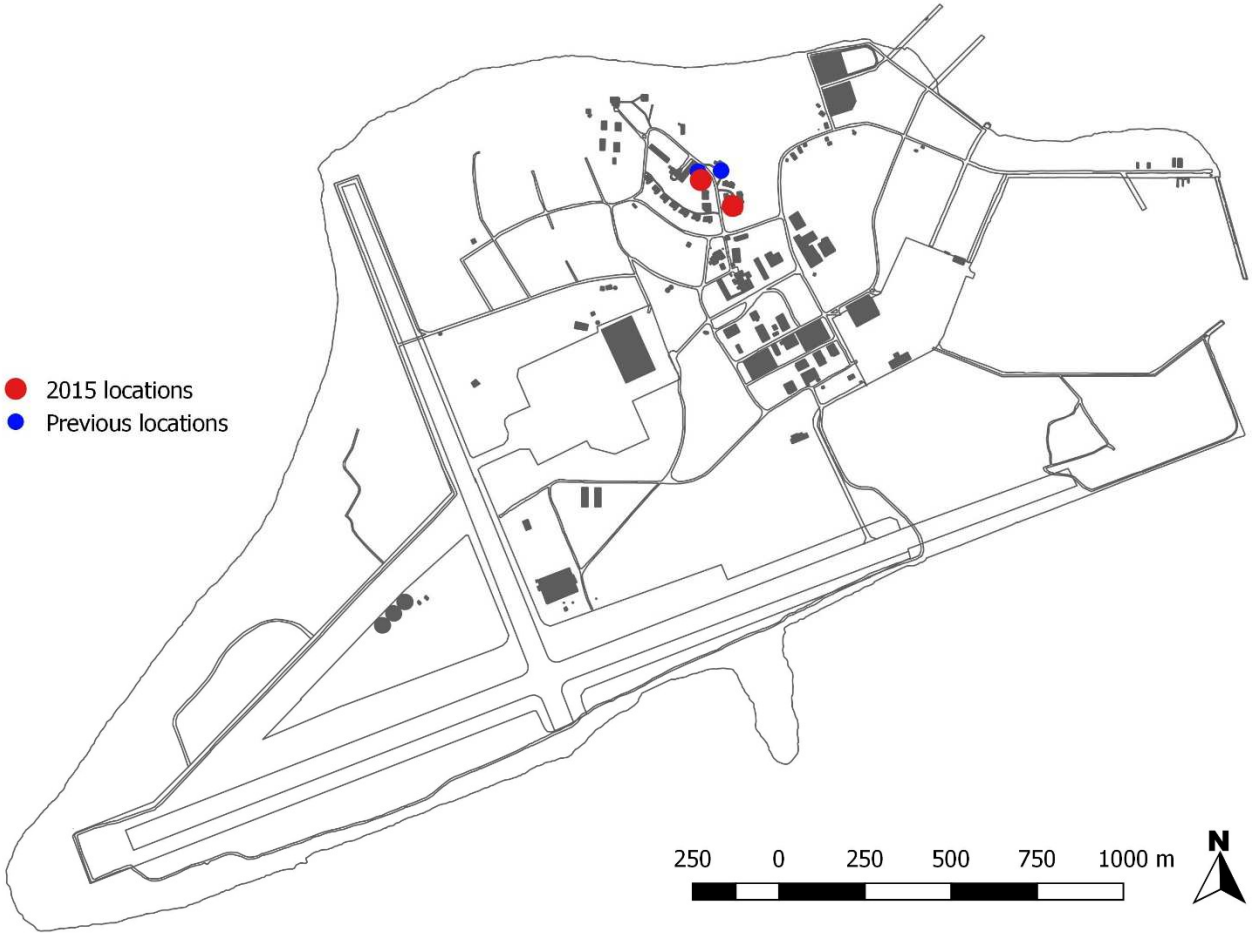
Ipomoea aquatica



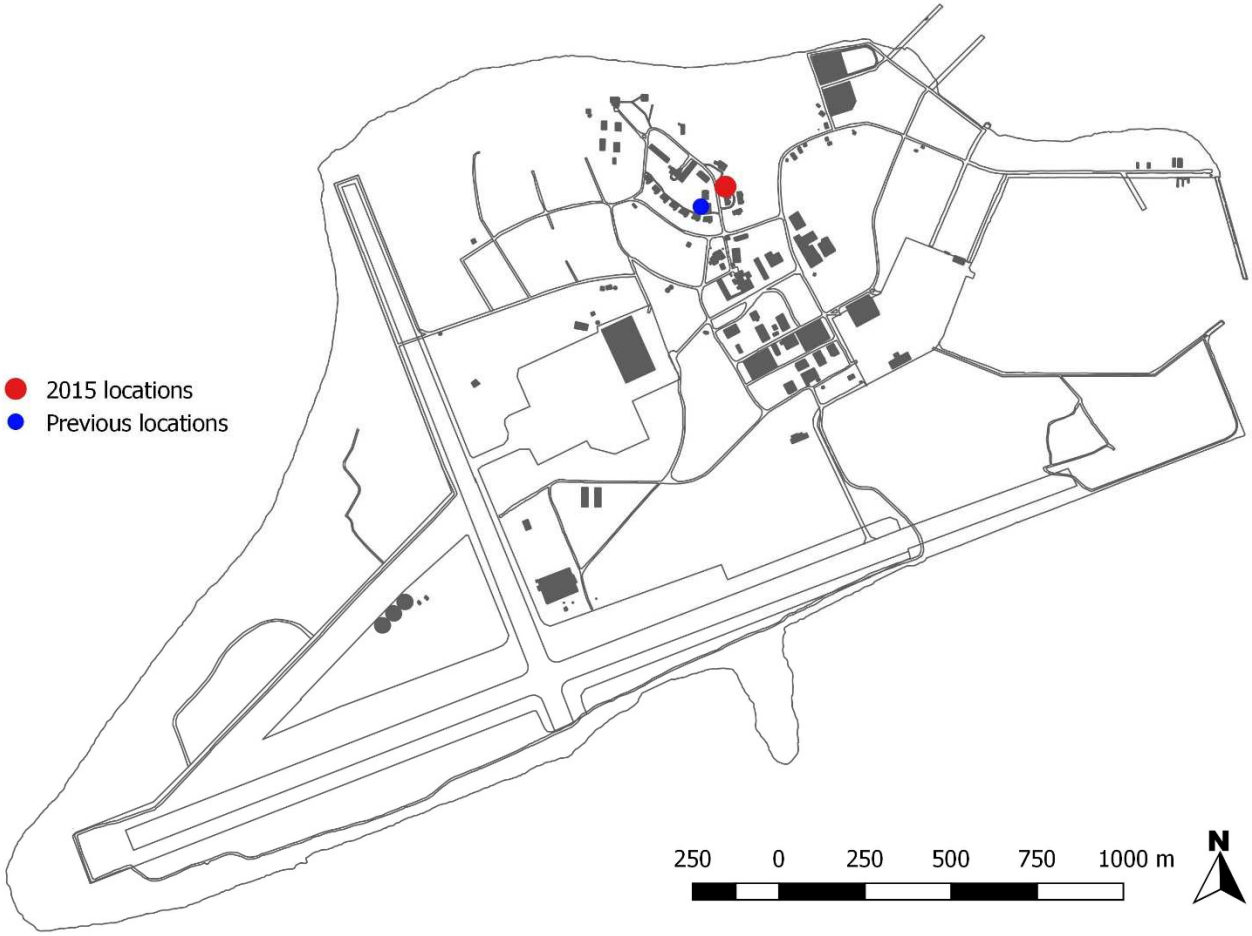
Ipomoea indica

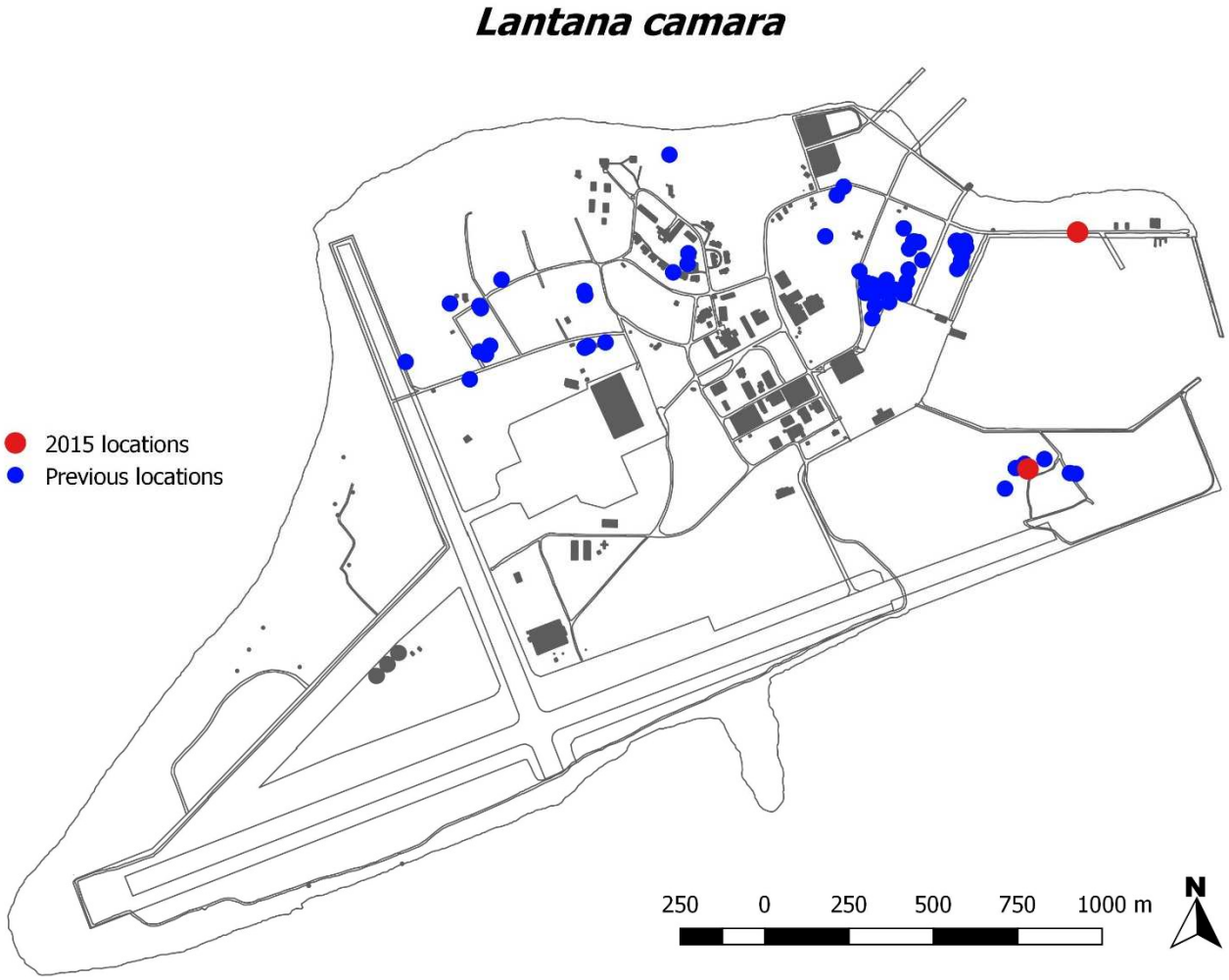


Kalanchoe pinnata



Kalanchoe tubiflora




Lantana camara
2015 locations
Previous locations
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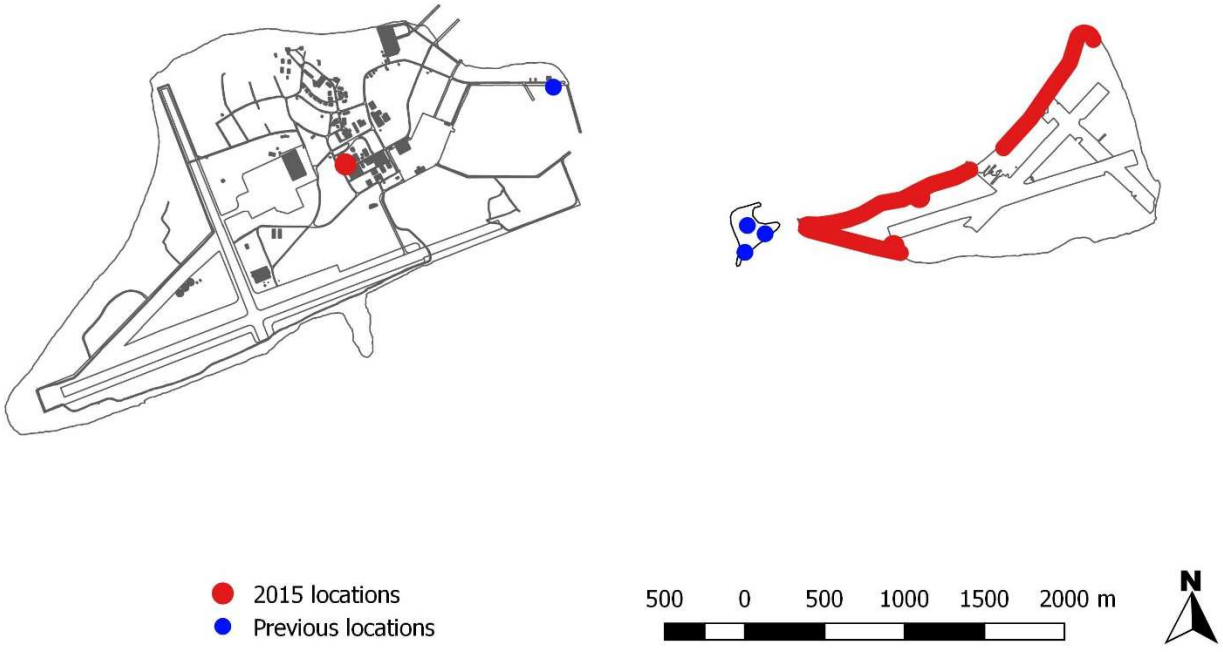
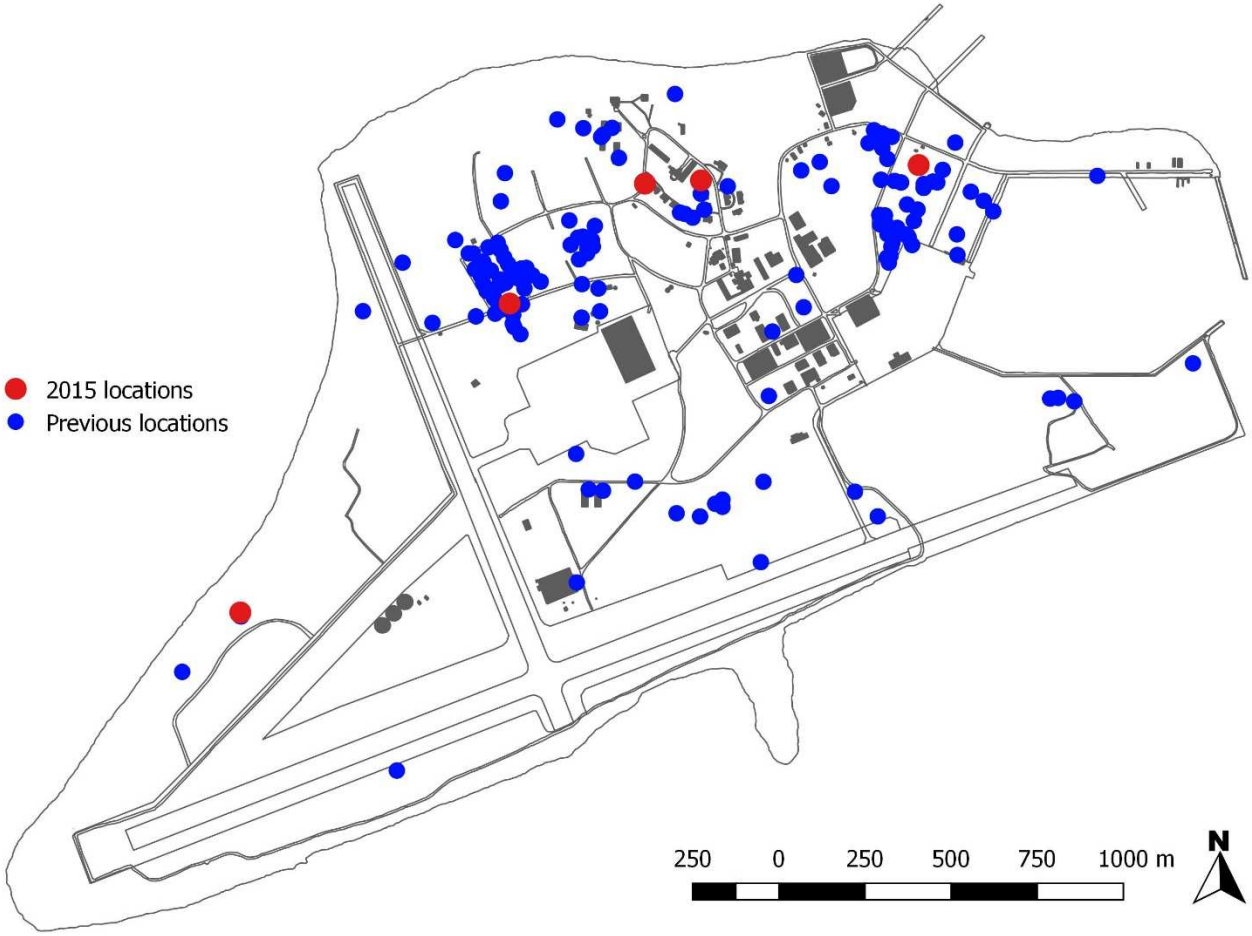
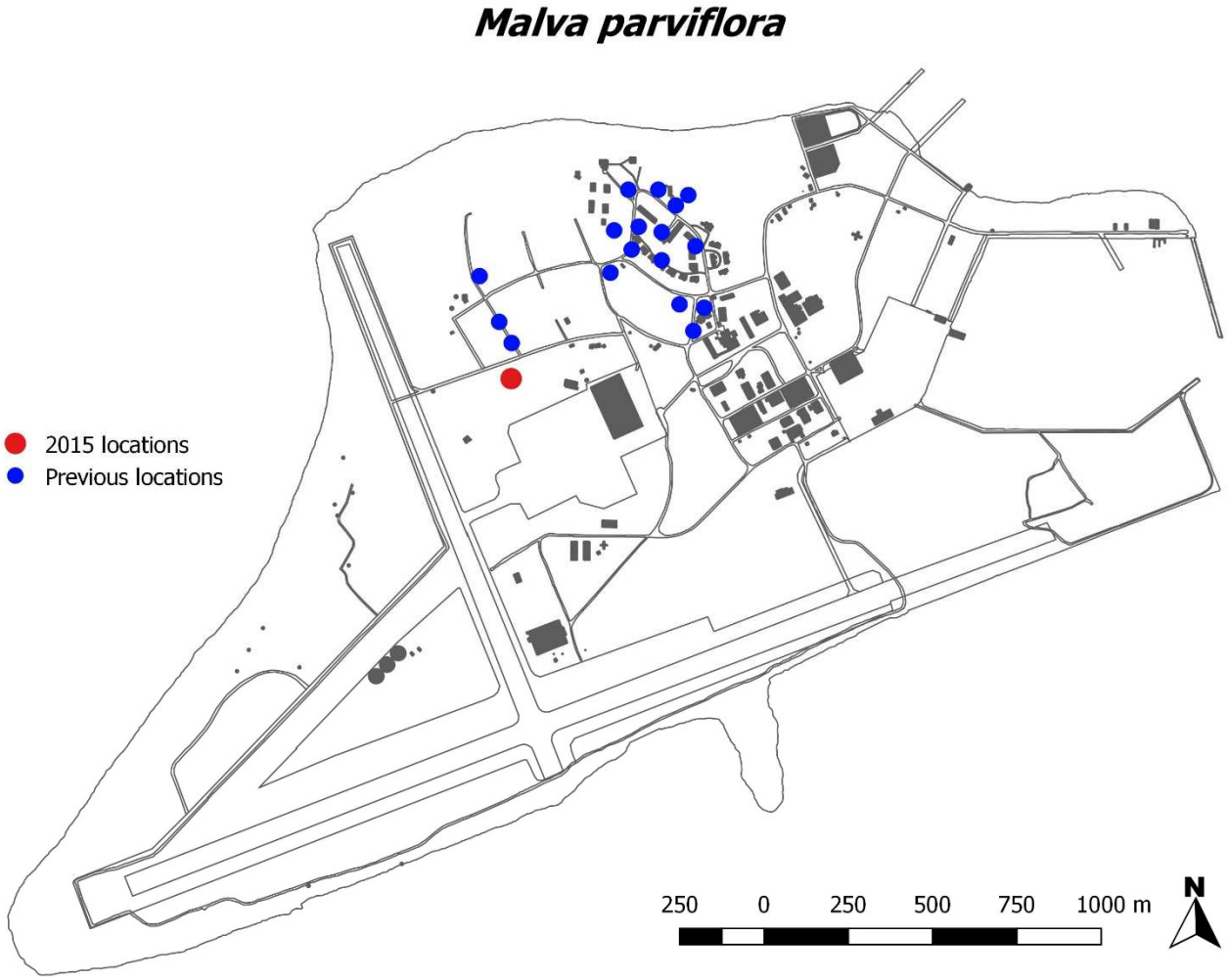
N

Lepturus repens



Leucaena leucocephala




Malva parviflora
2015 locations
Previous locations
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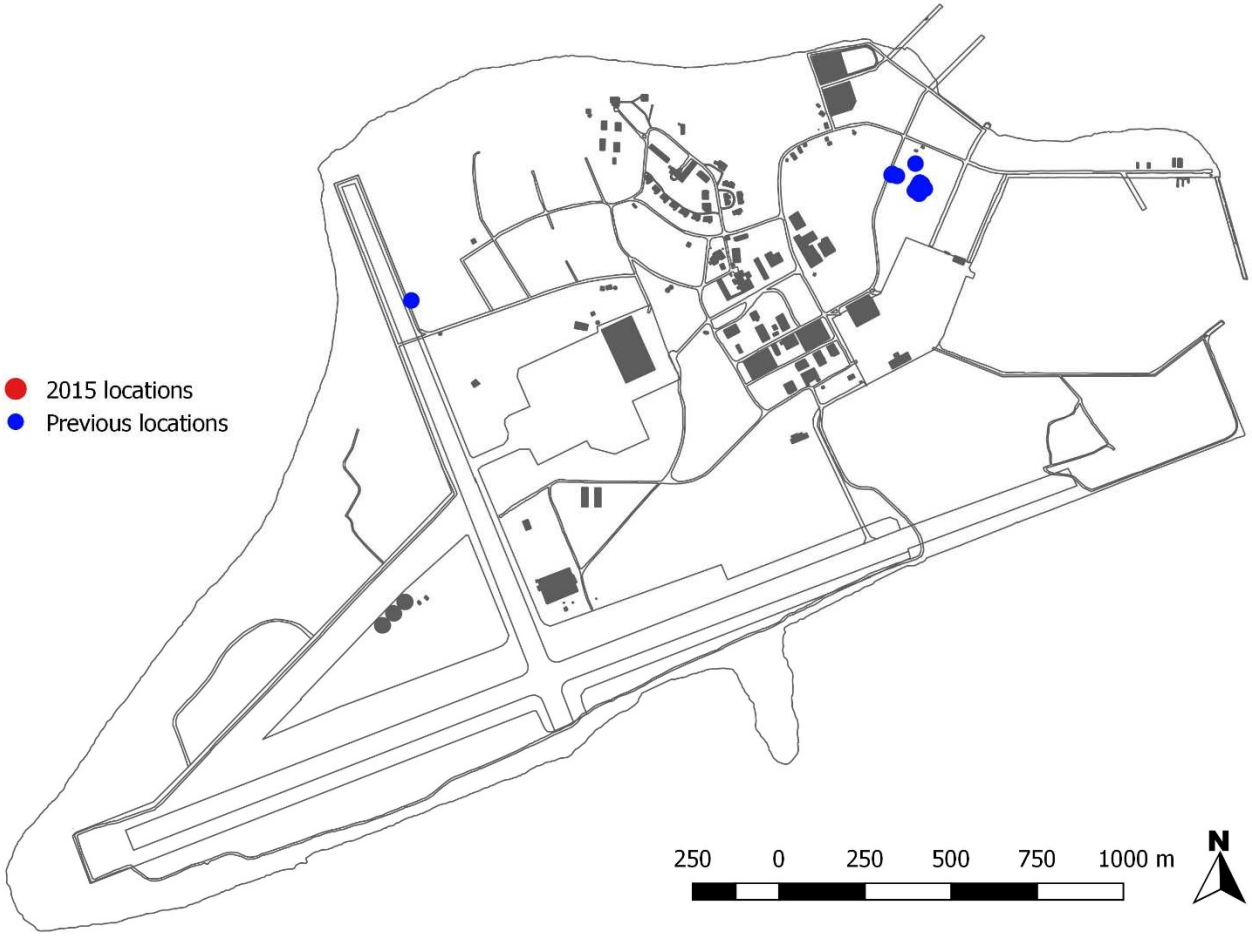
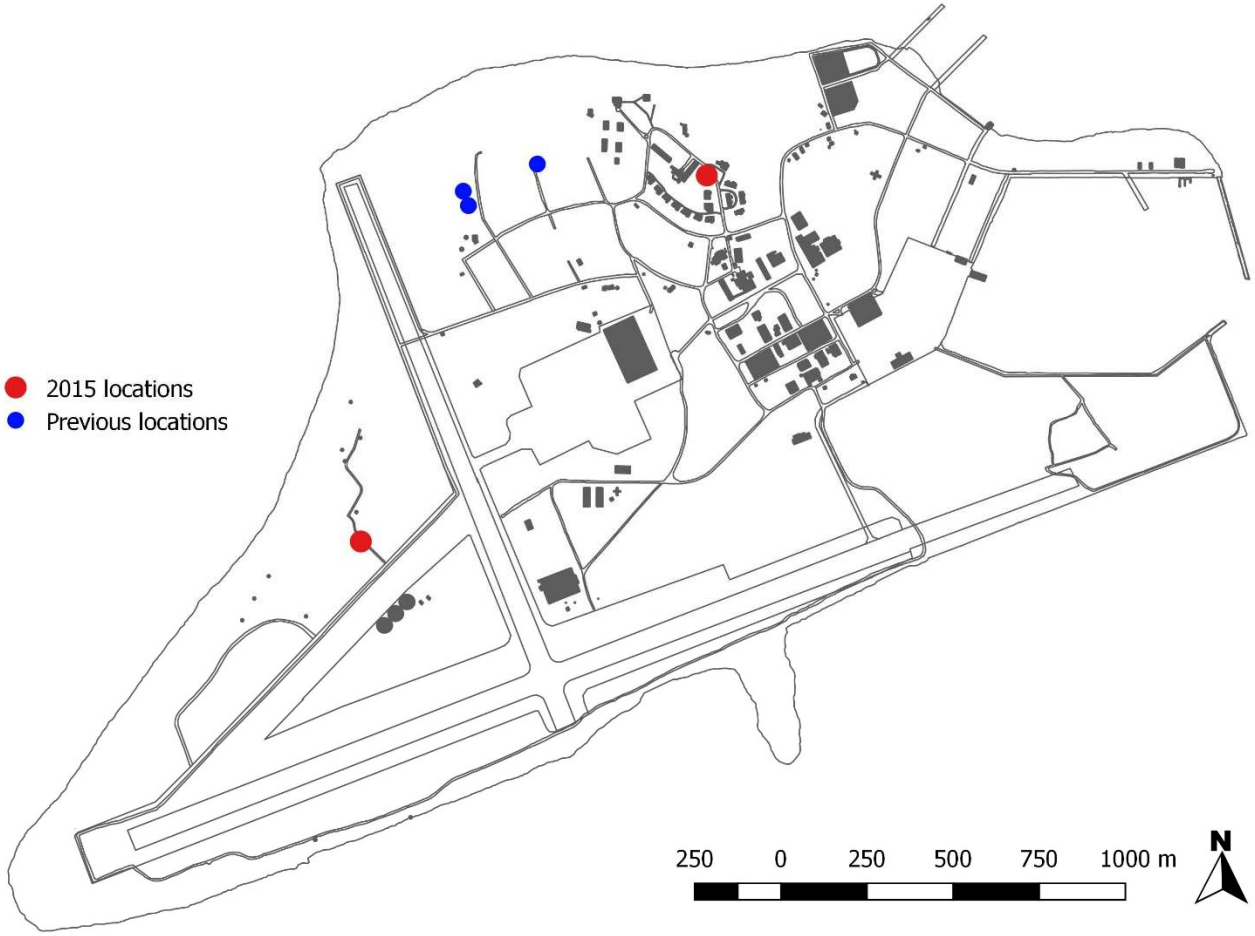
N

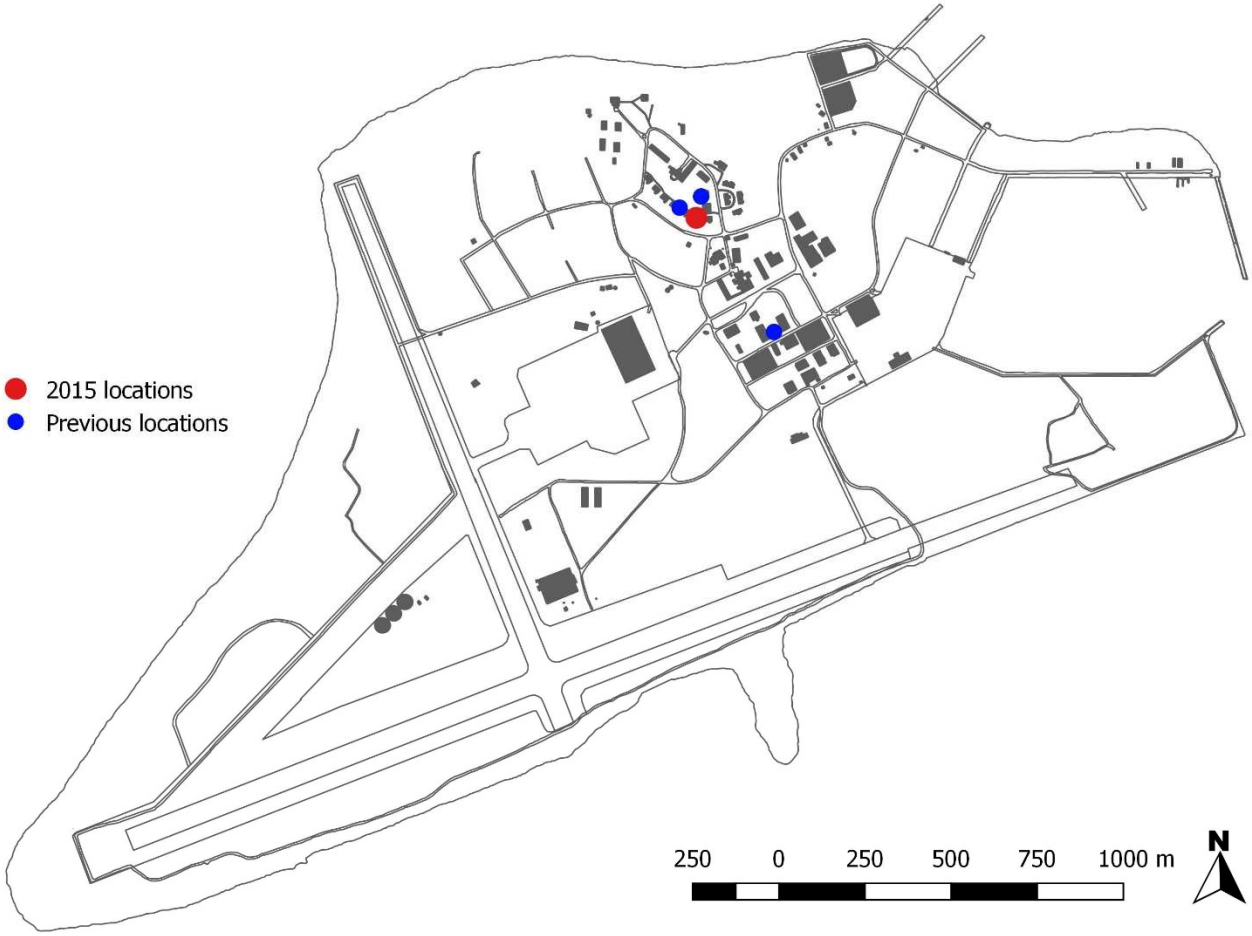
Megathyrsus maximus



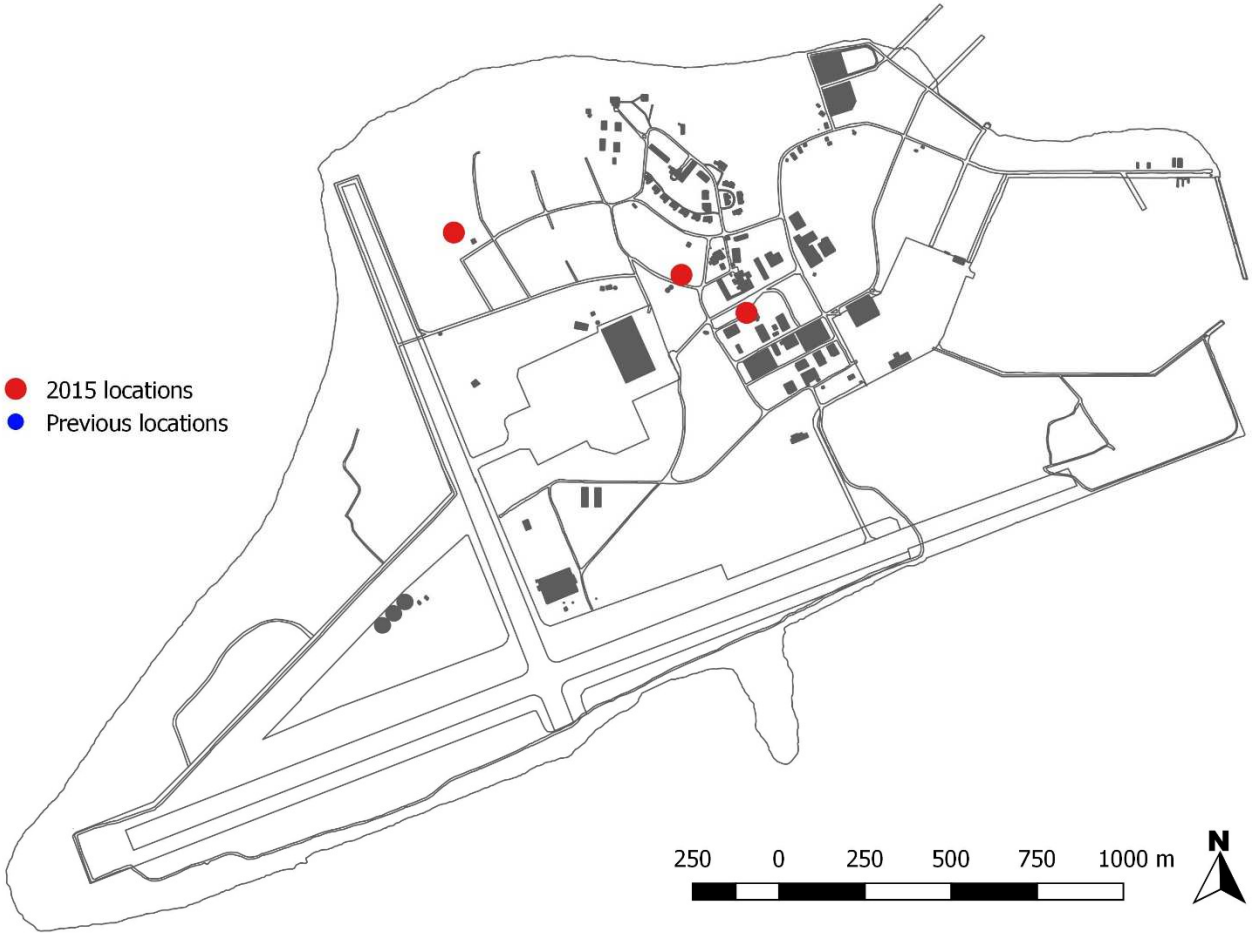
Mirabilis jalapa



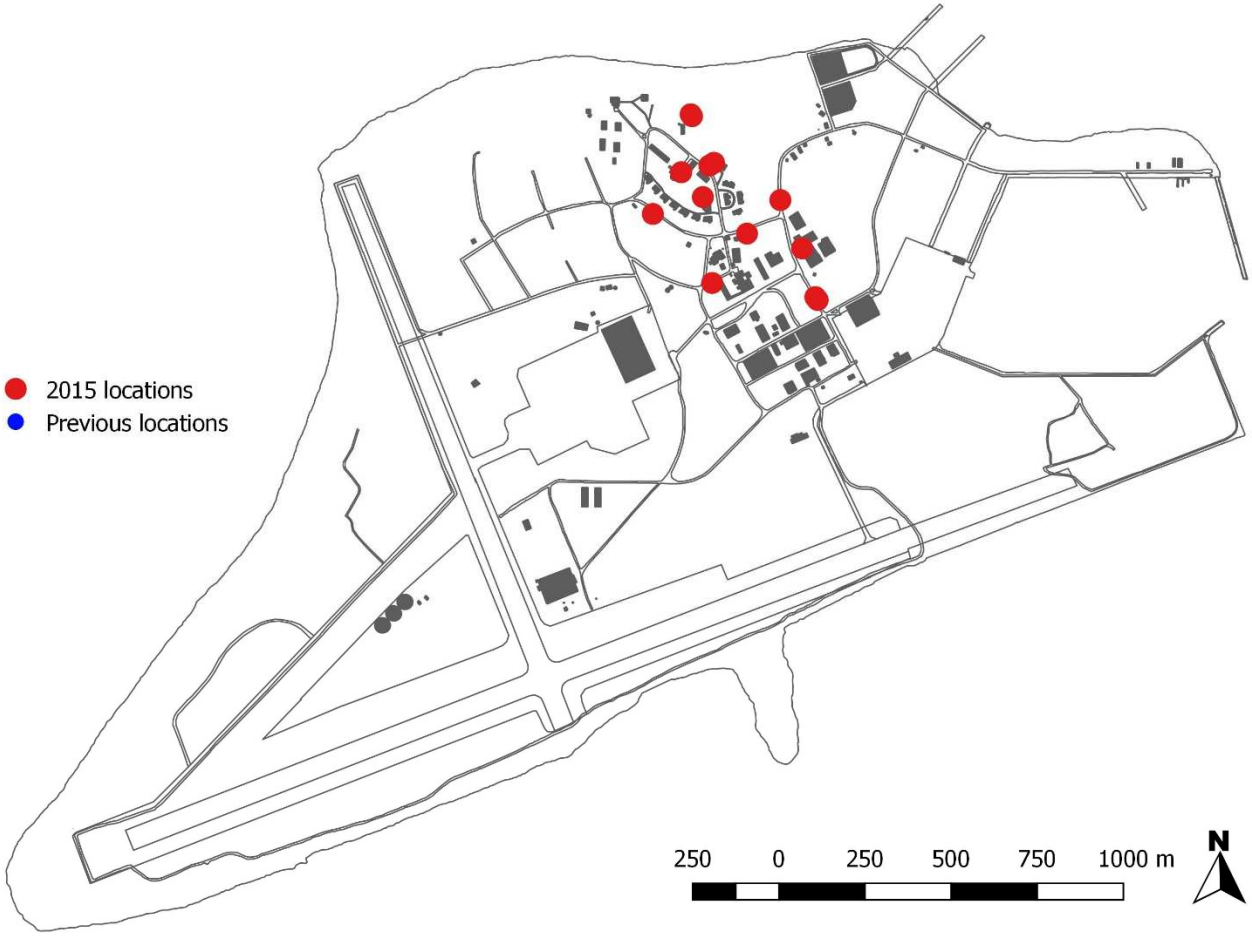
Momordica charantia



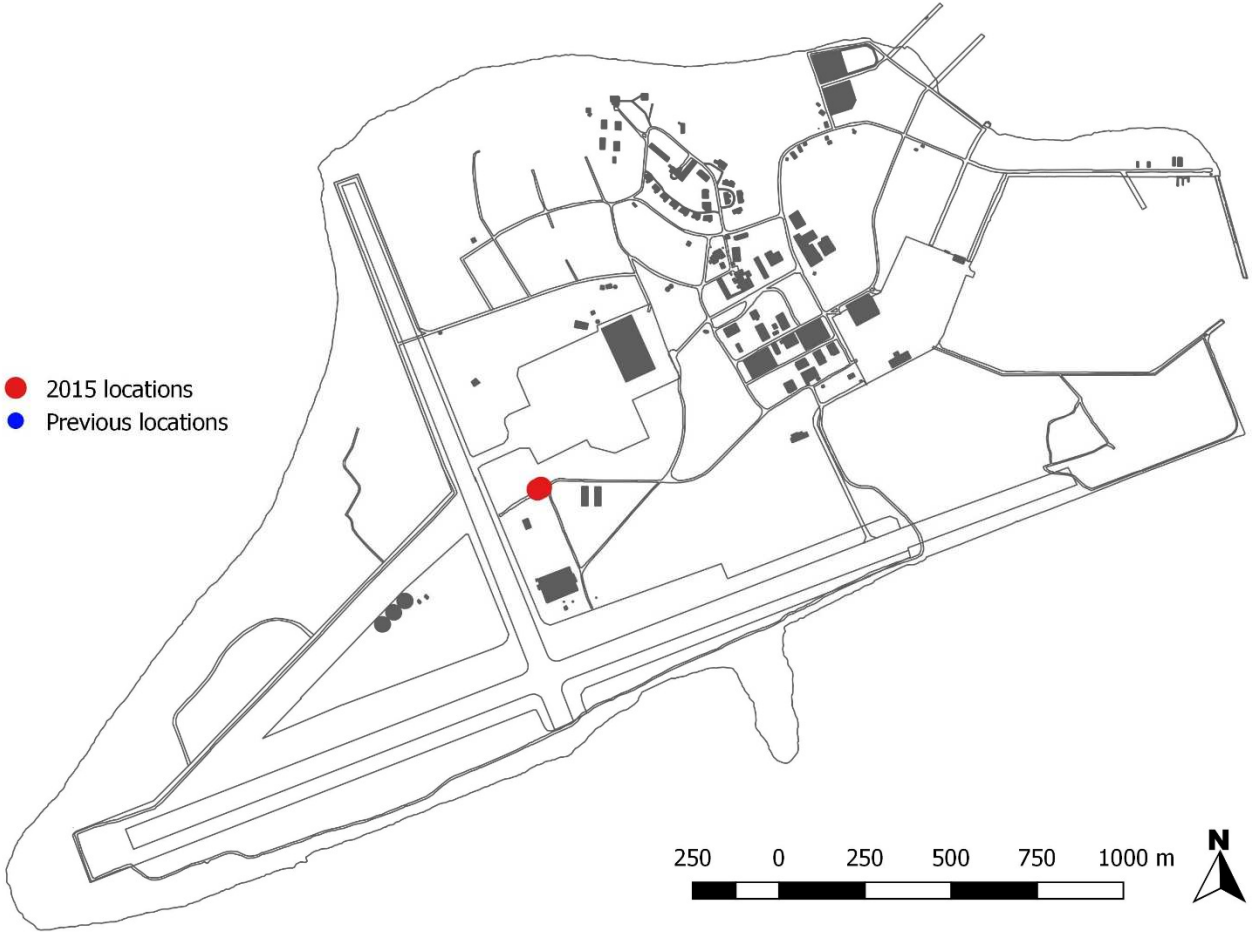
Morus alba



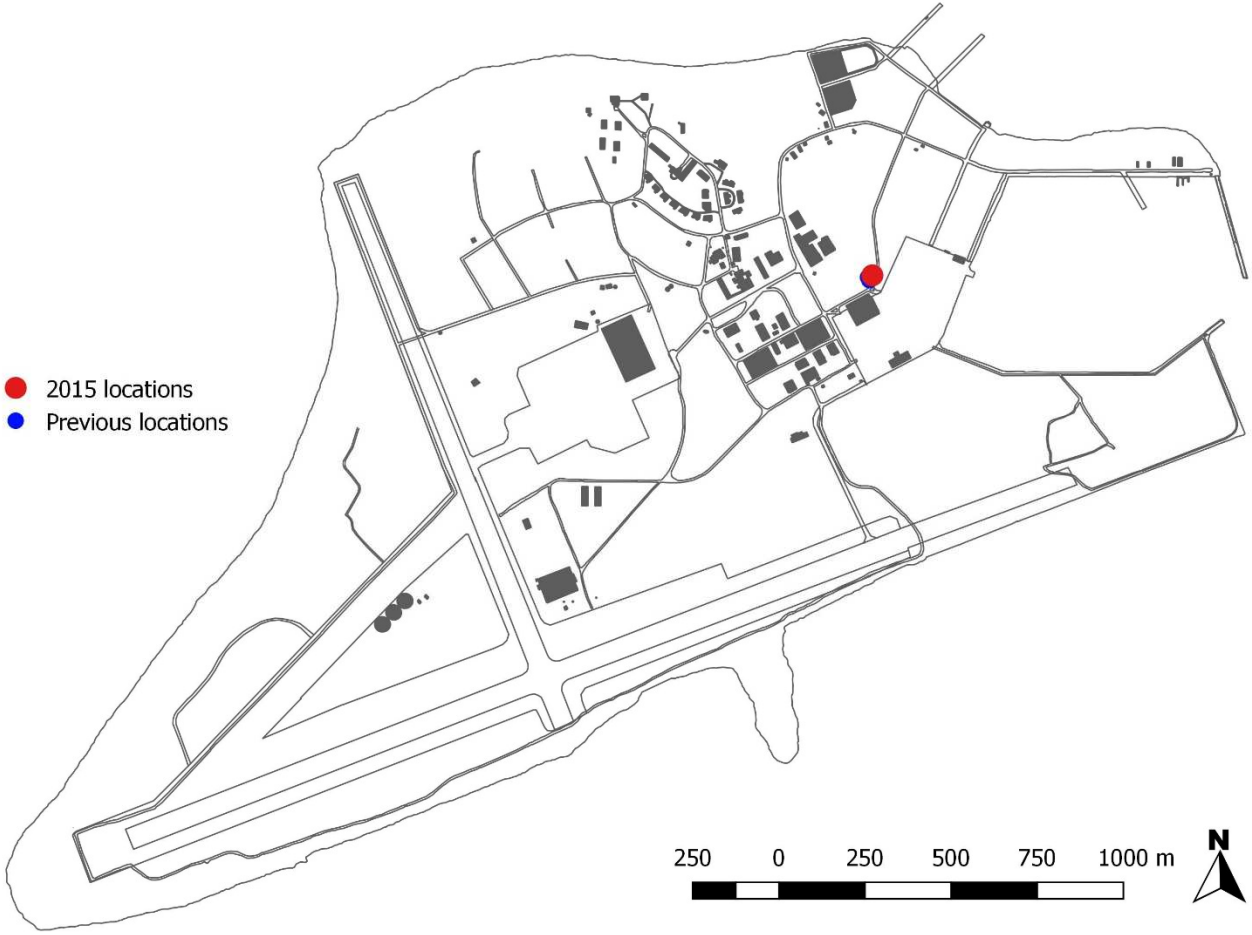
Nerium oleander



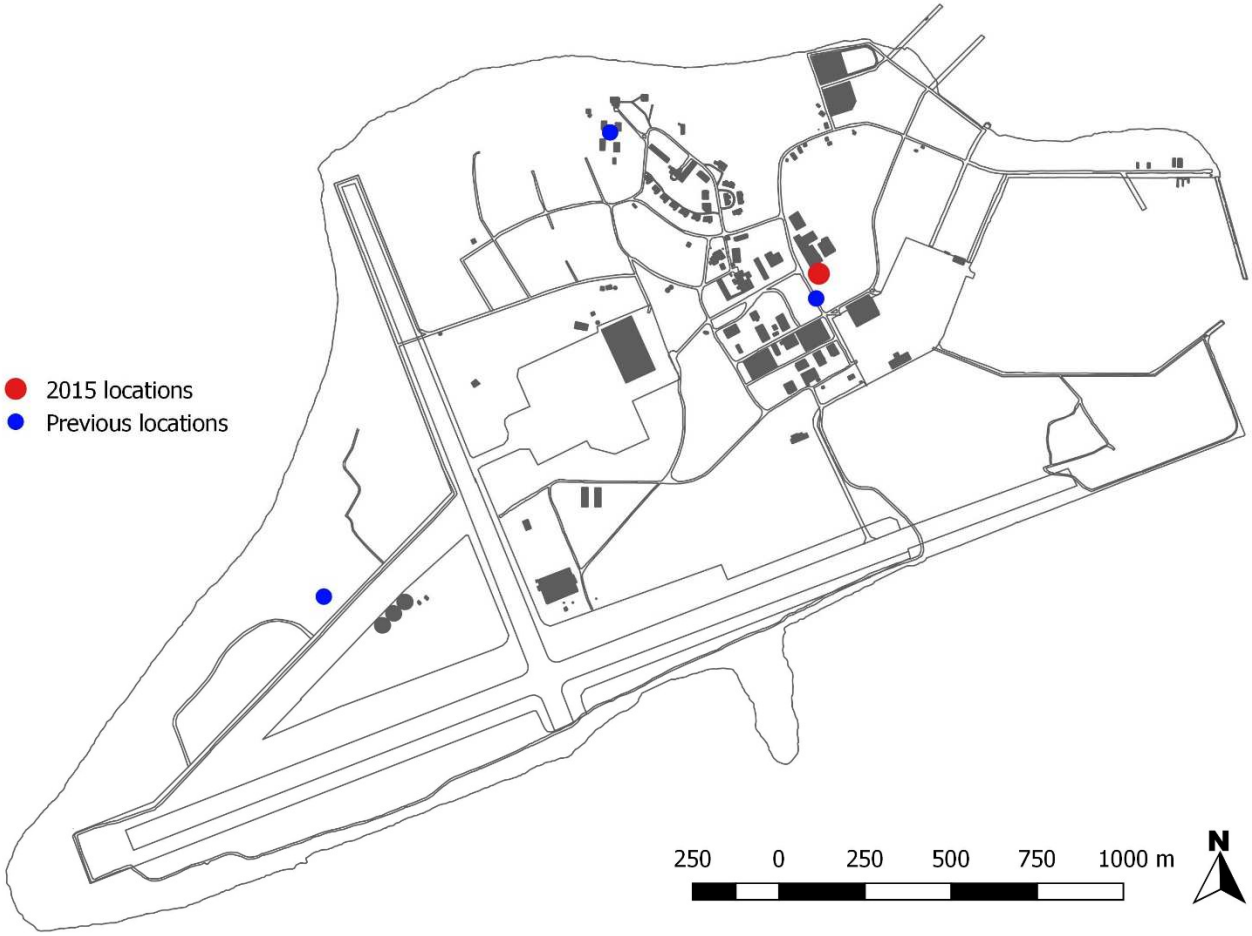
Noronhia emarginata



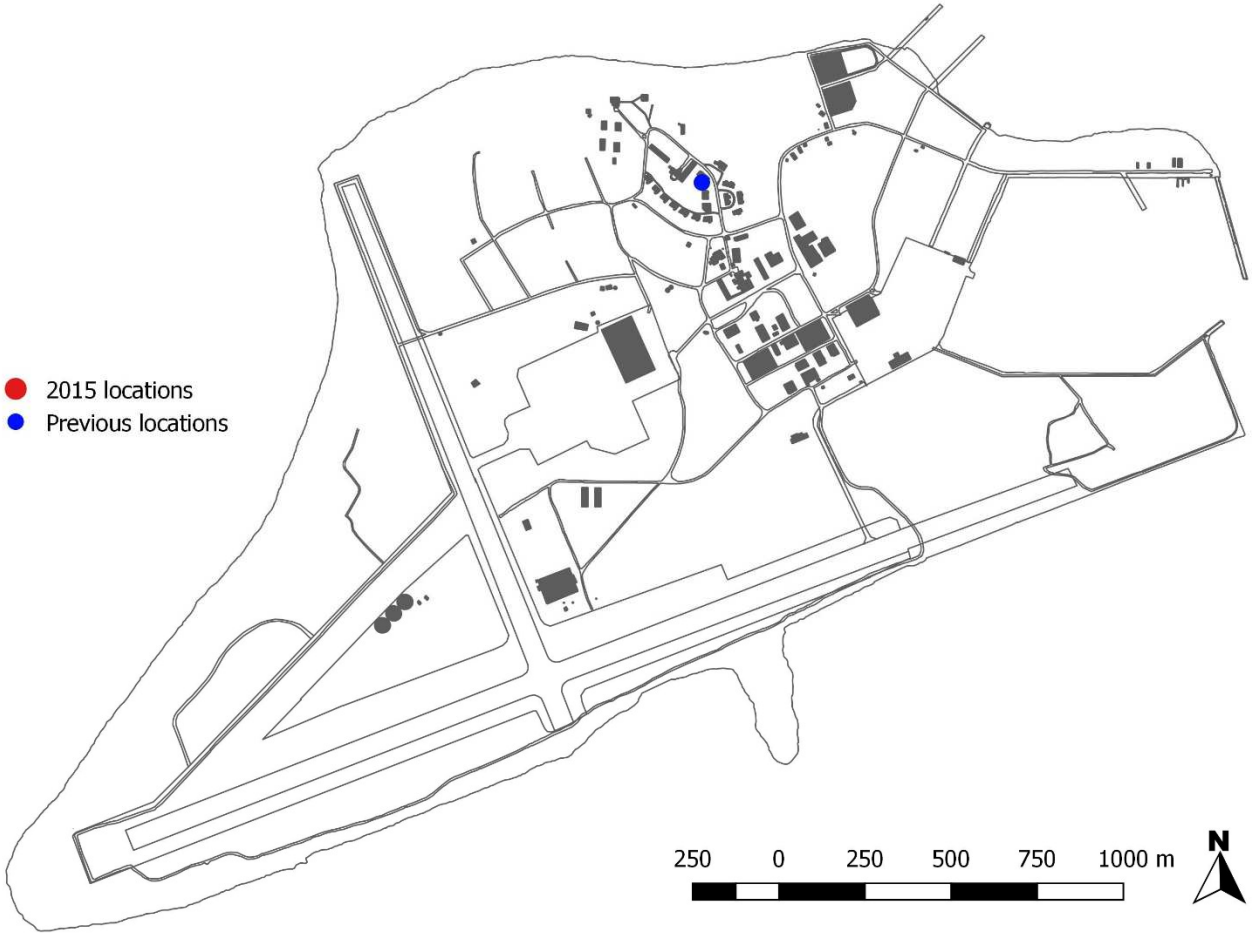
Olea europaea subsp. cuspidata



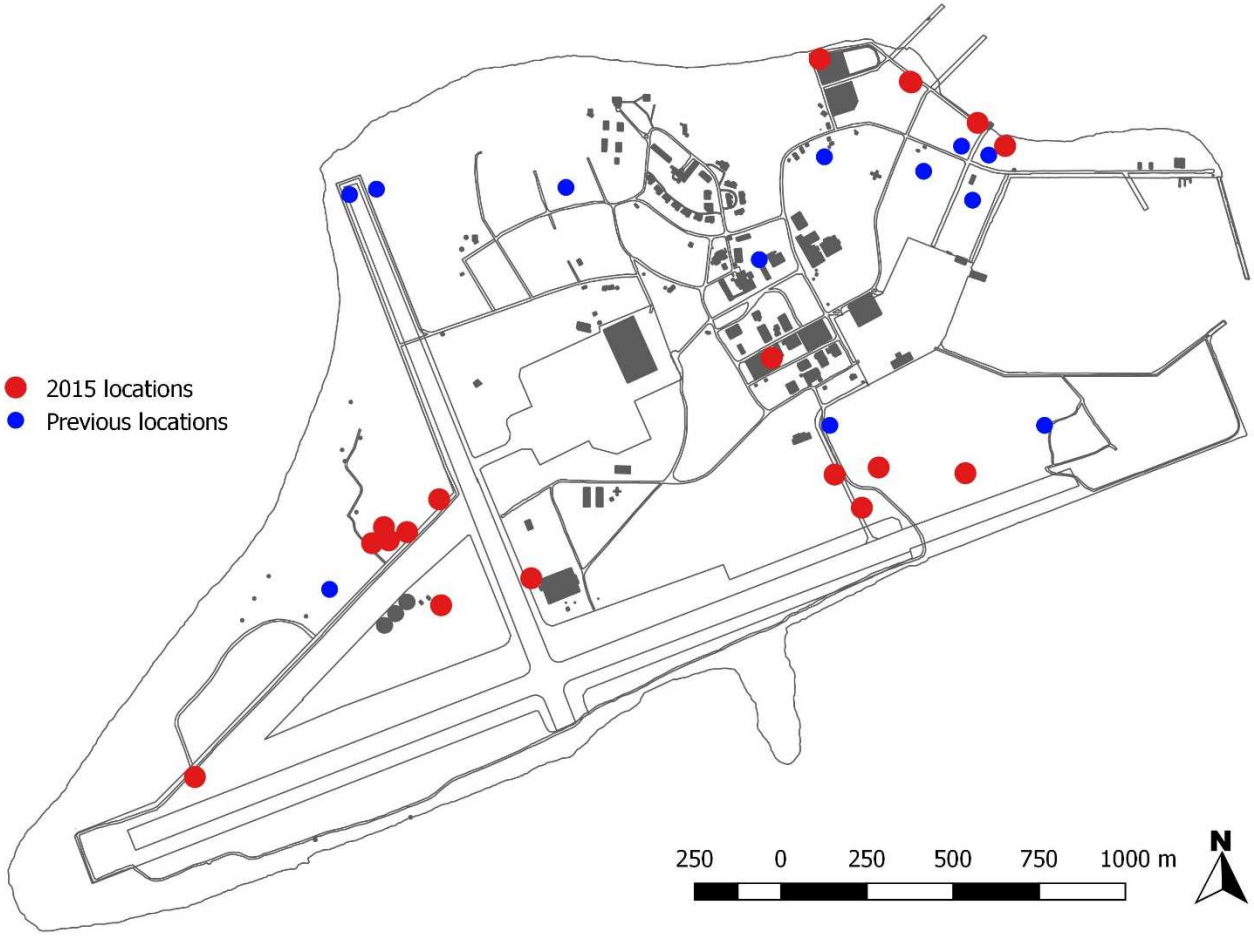
Pandanus tectorius



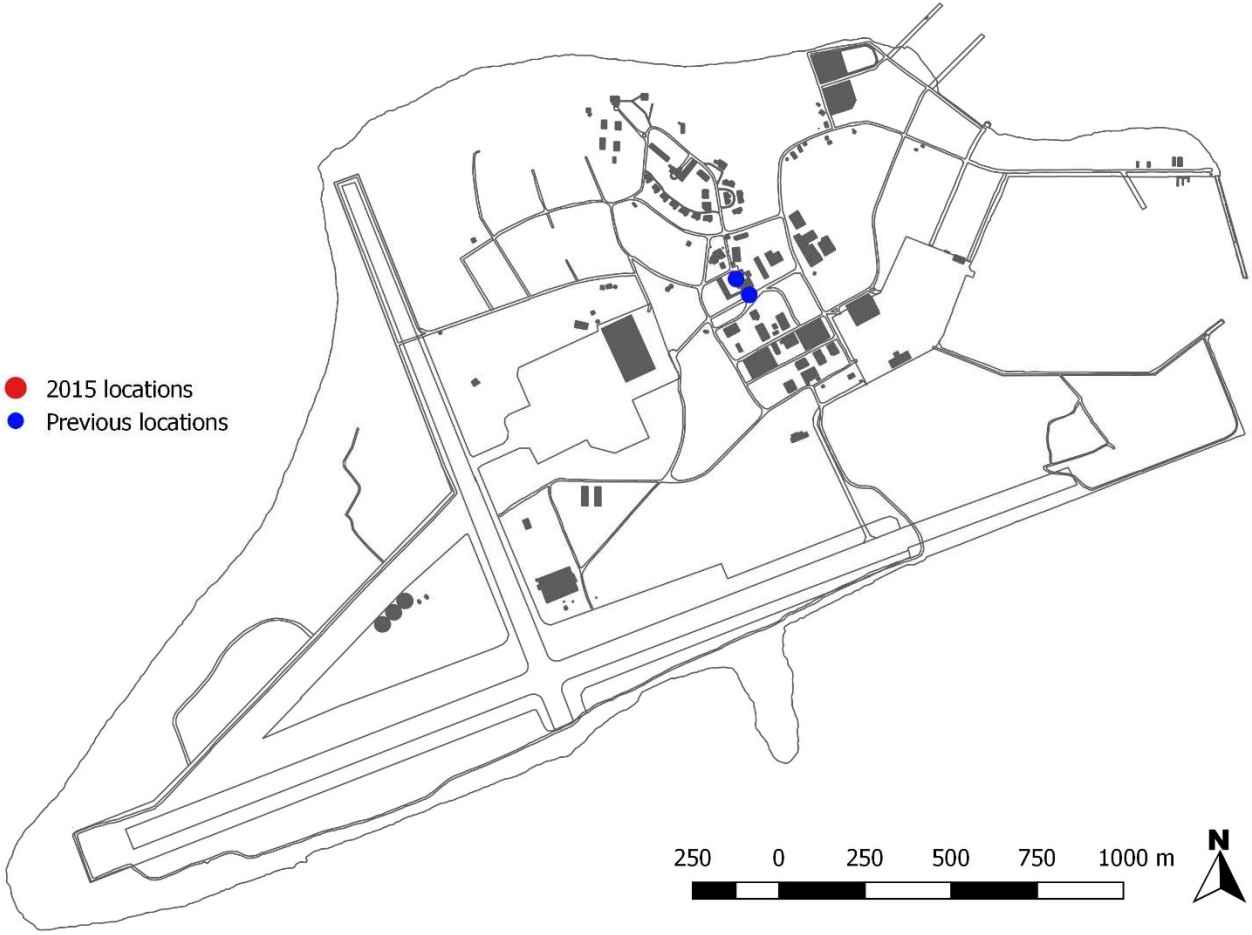
Passiflora edulis



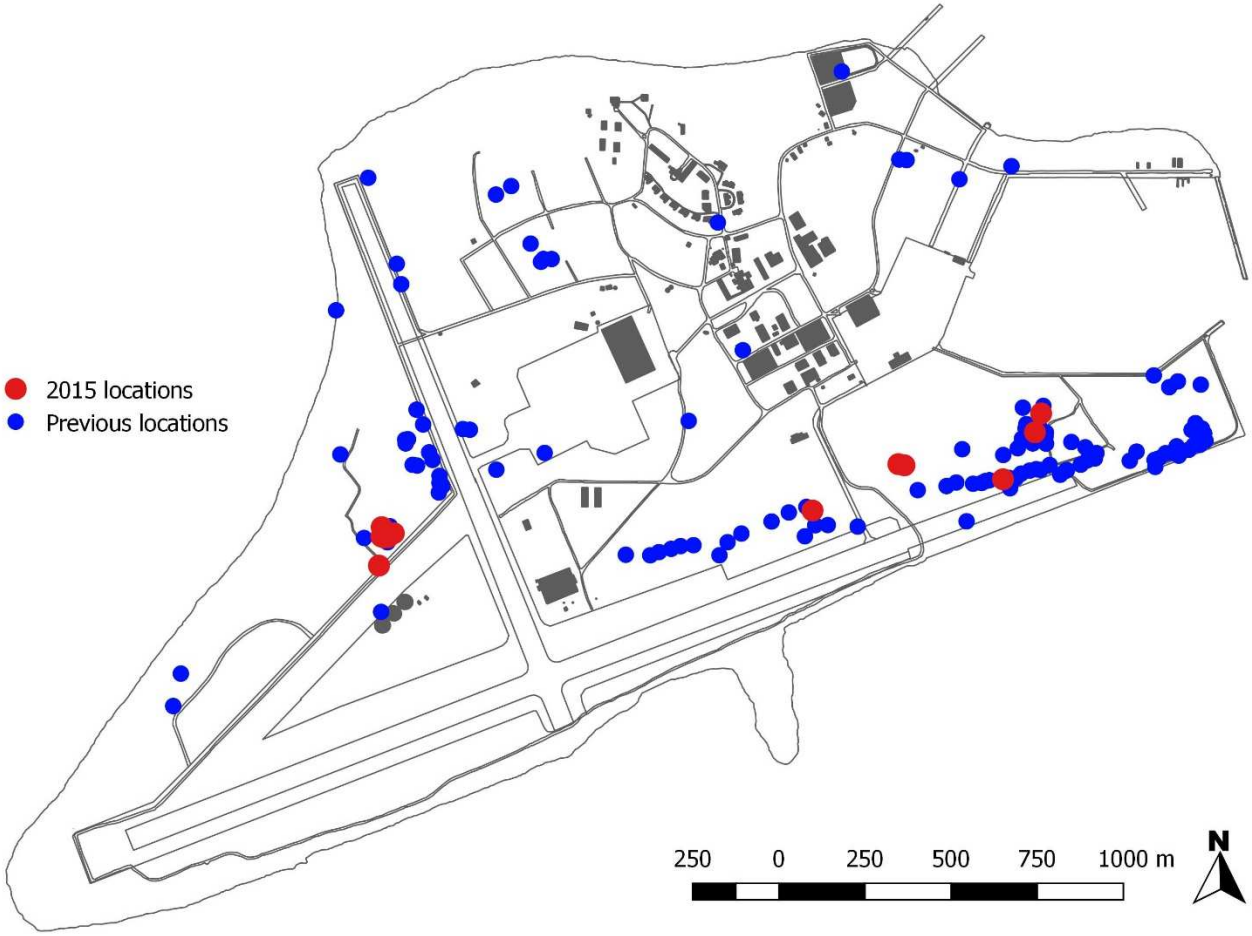
Phyla nodiflora



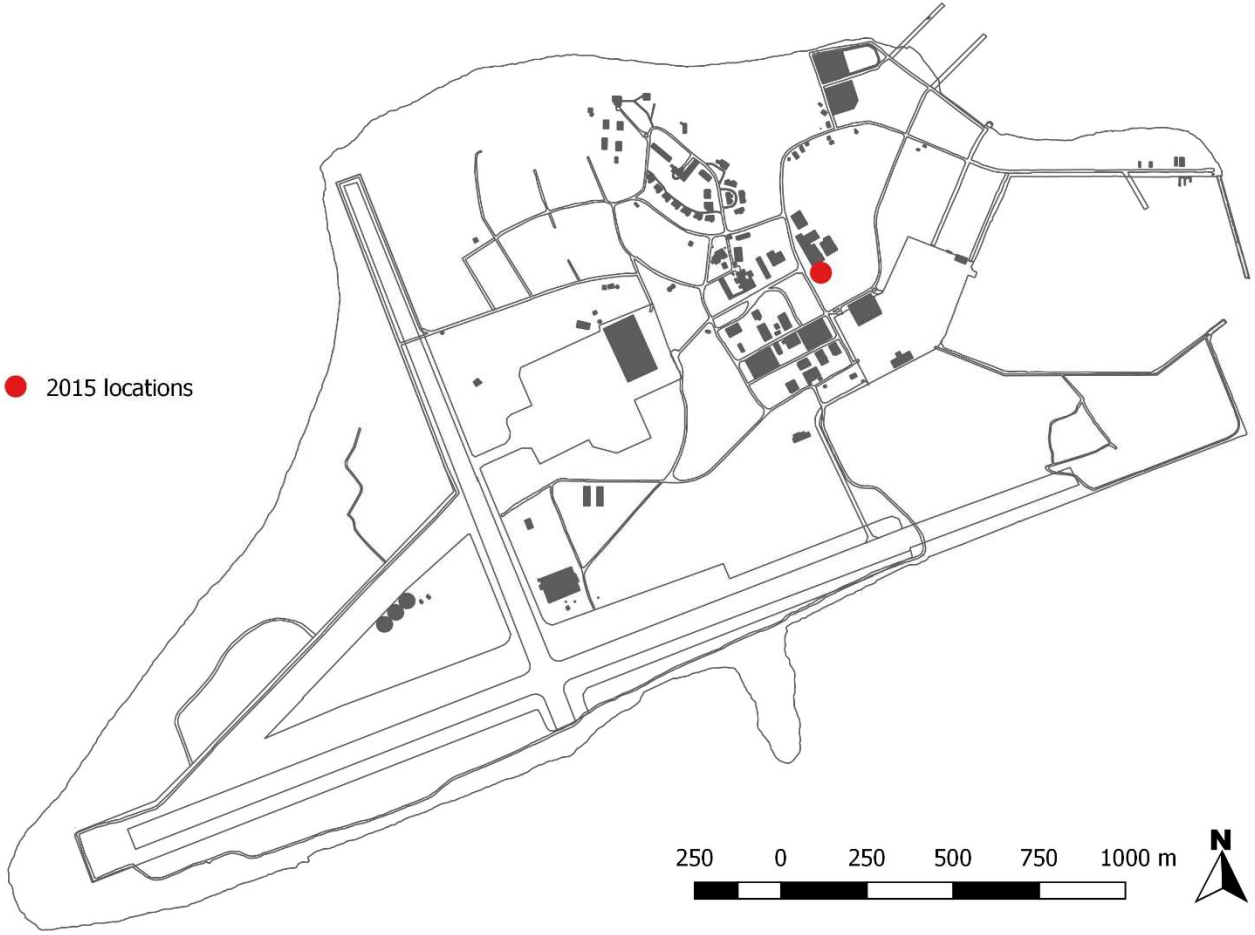
Pithecellobium dulce



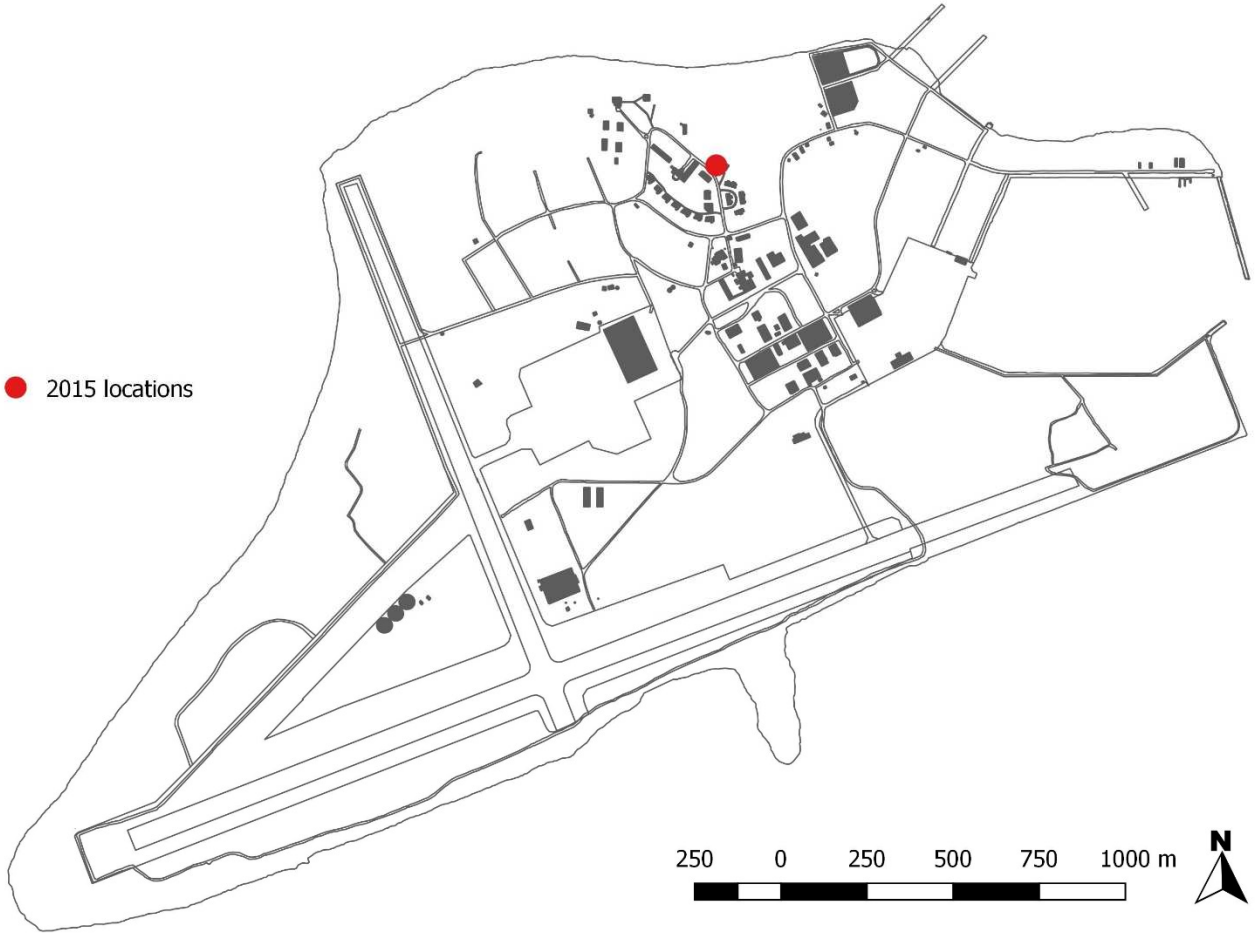
Pluchea carolinensis



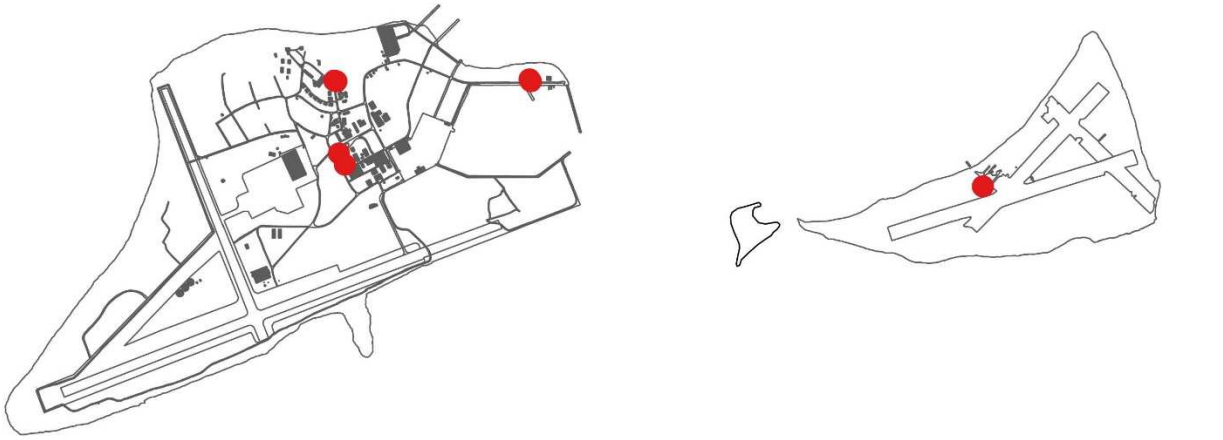
Pritchardia hillebrandii



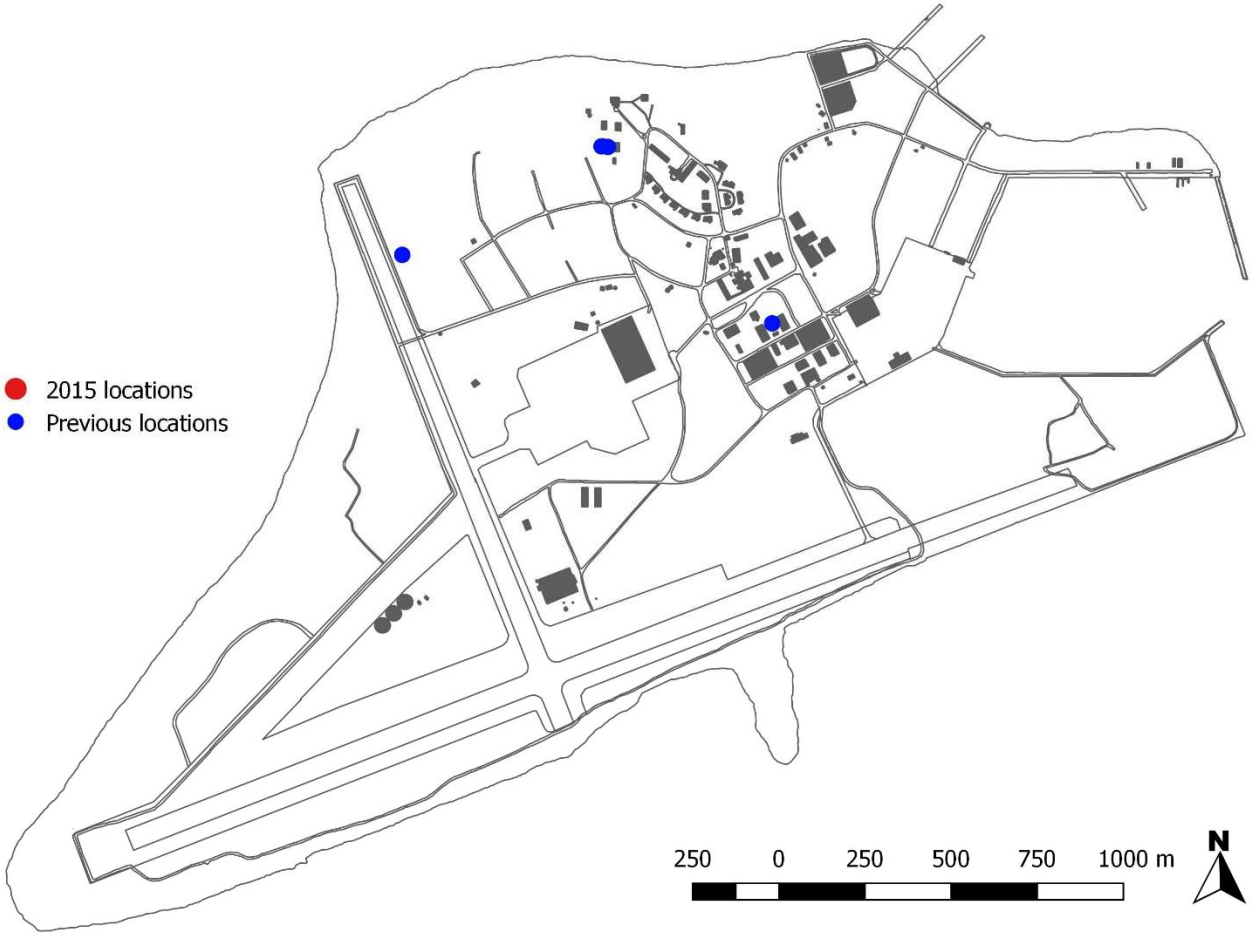
Pritchardia pacifica



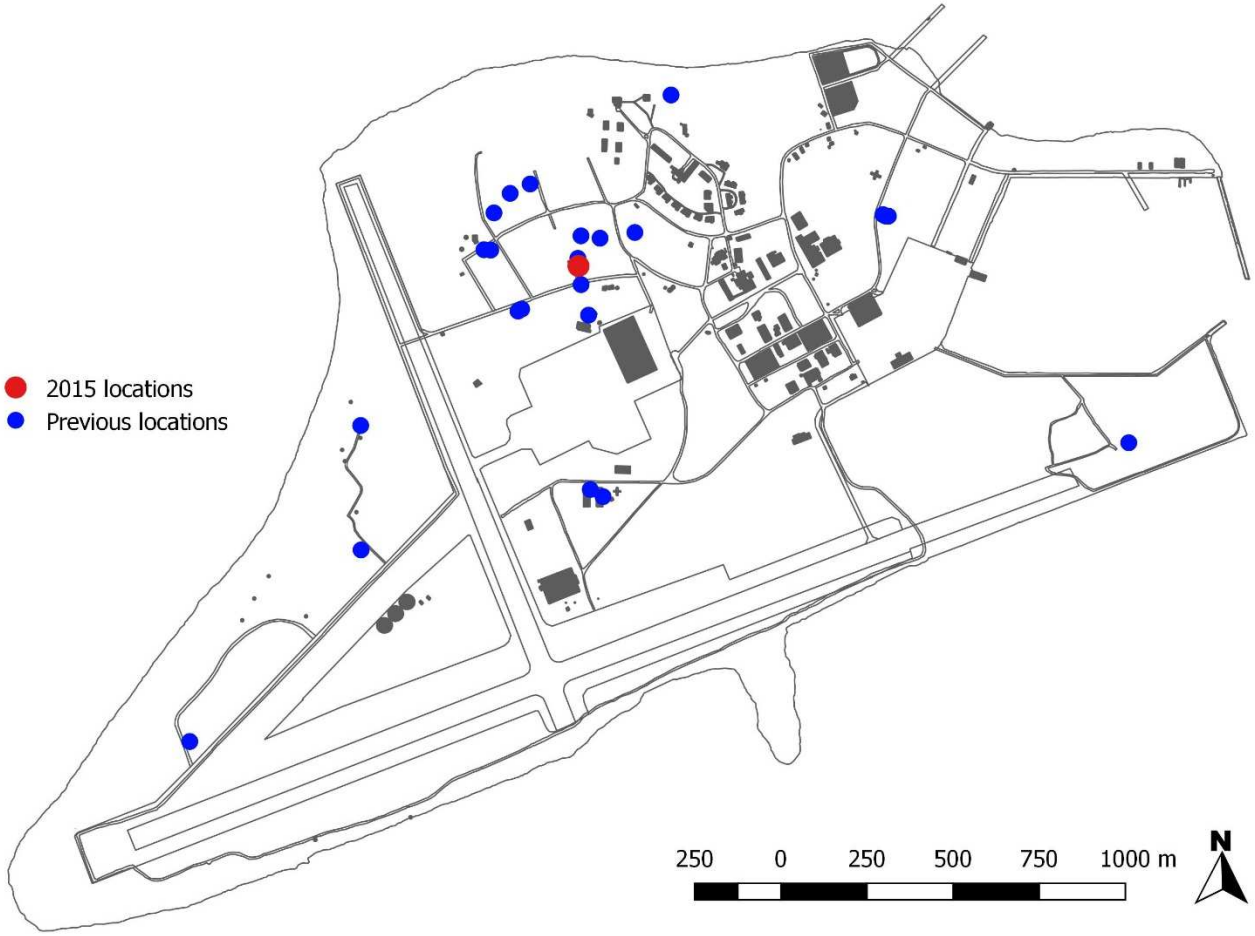
Pritchardia remota



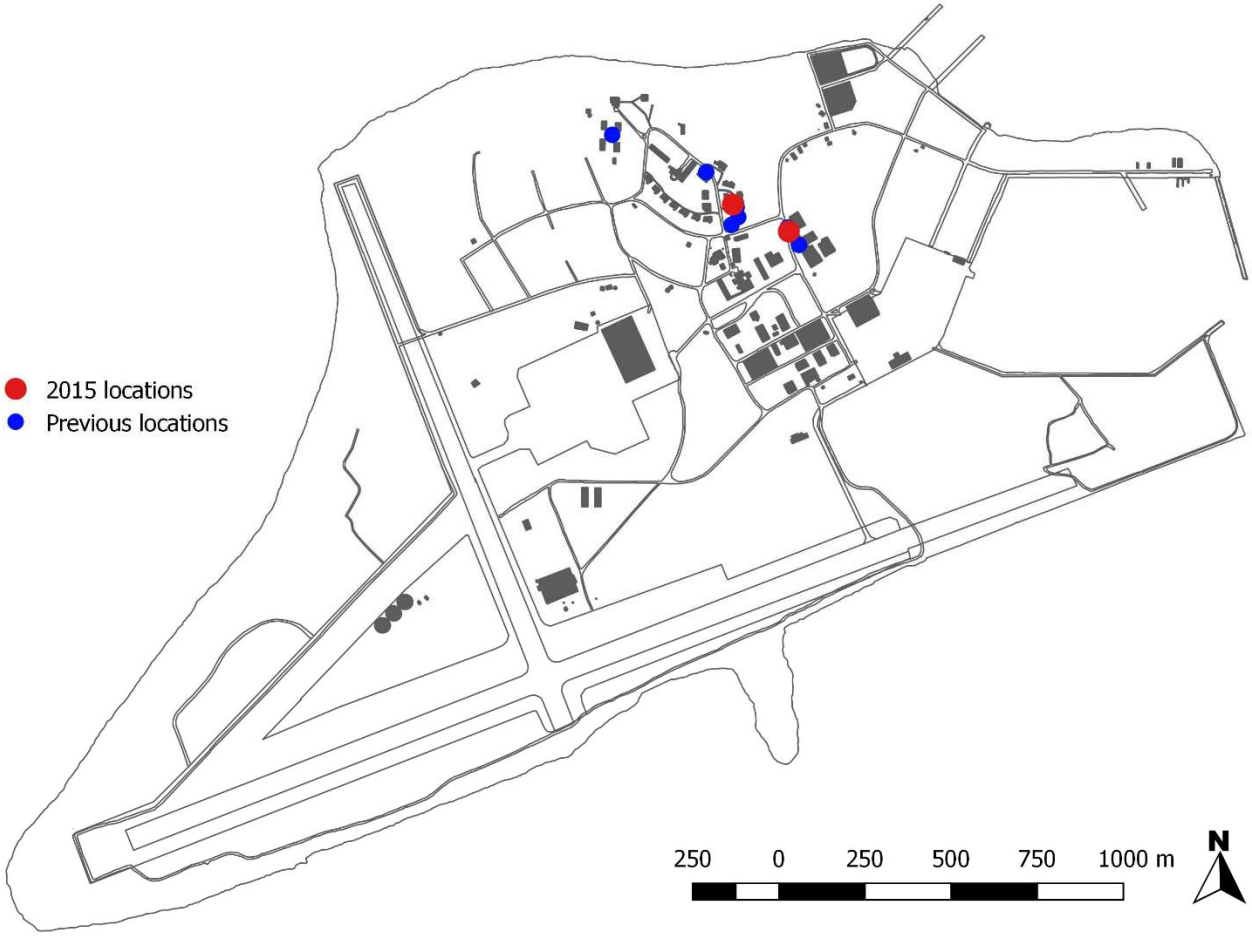
Psidium guajava



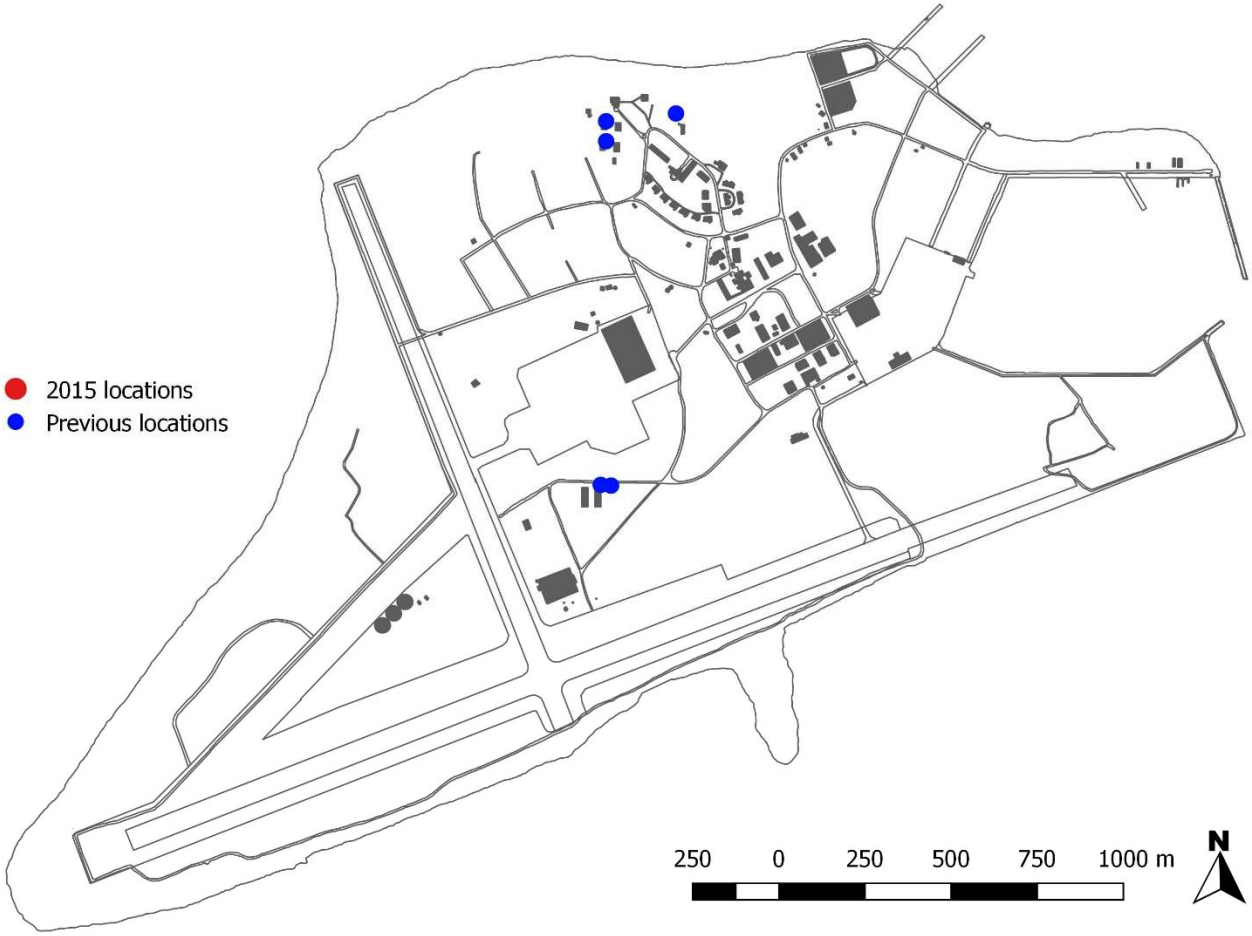
Ricinus communis



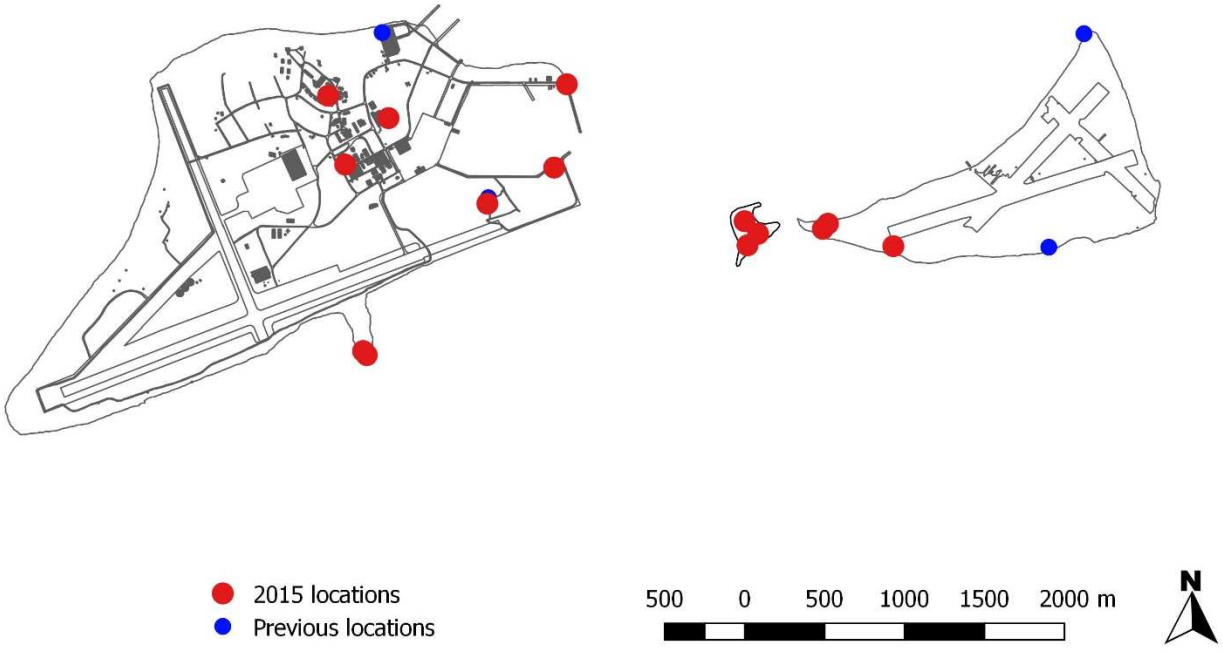
Schefflera actinophylla



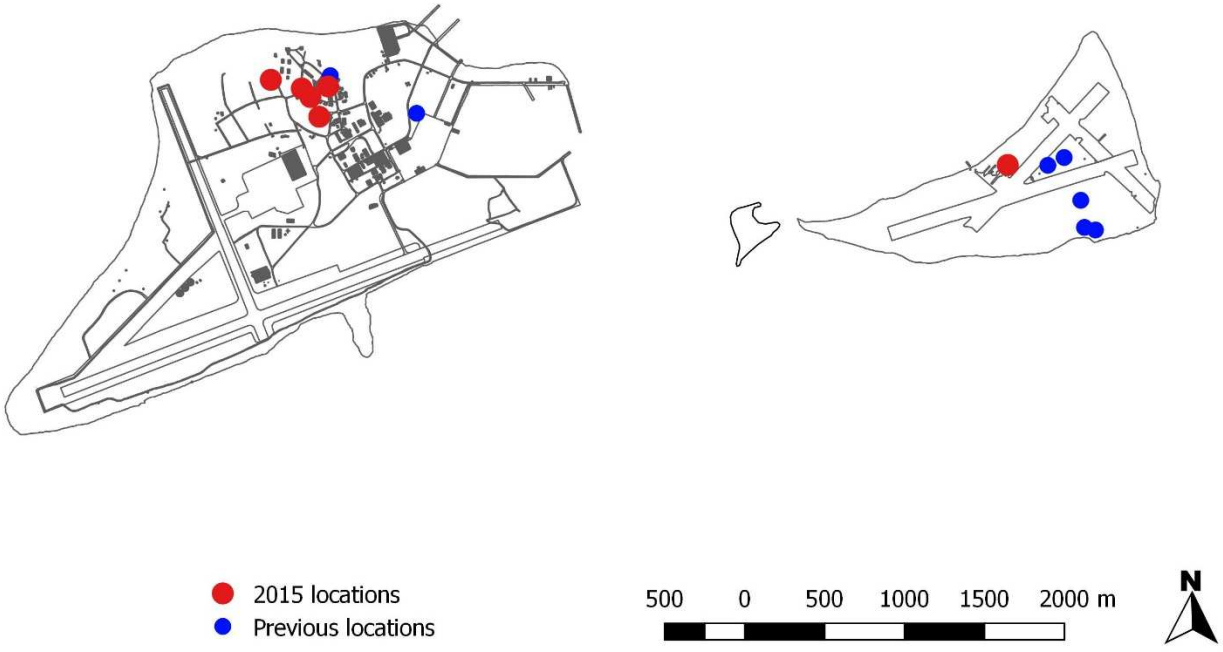
Schinus terebinthifolius



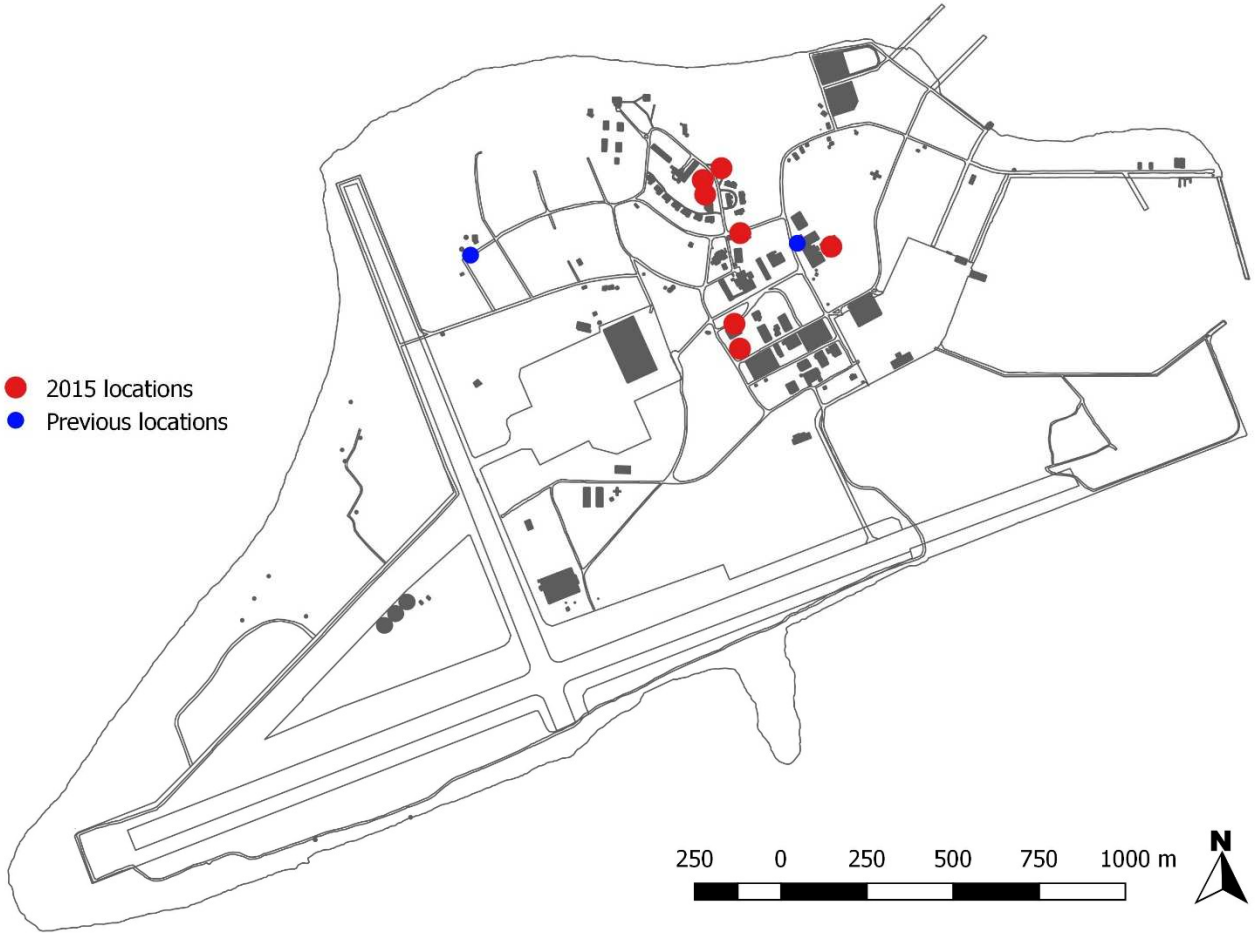
Sesuvium portulacastrum



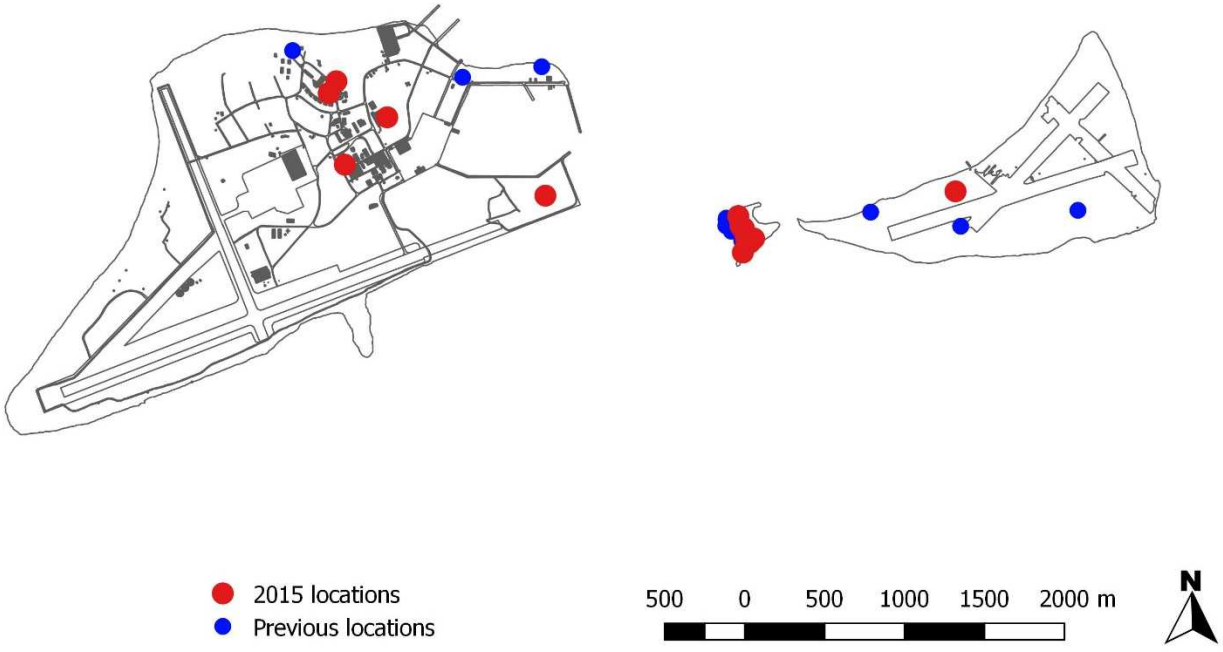
Setaria verticillata



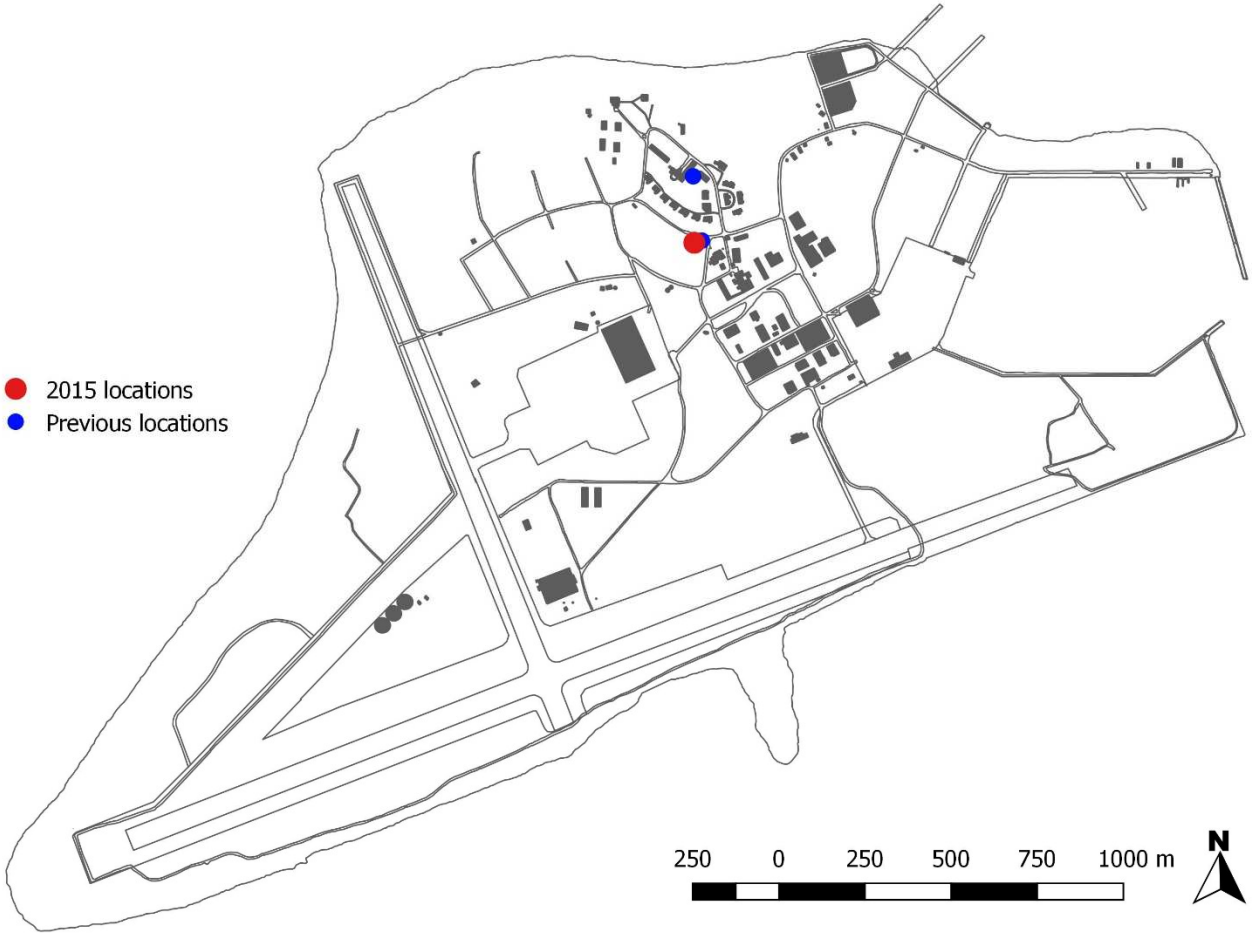
Sida fallax



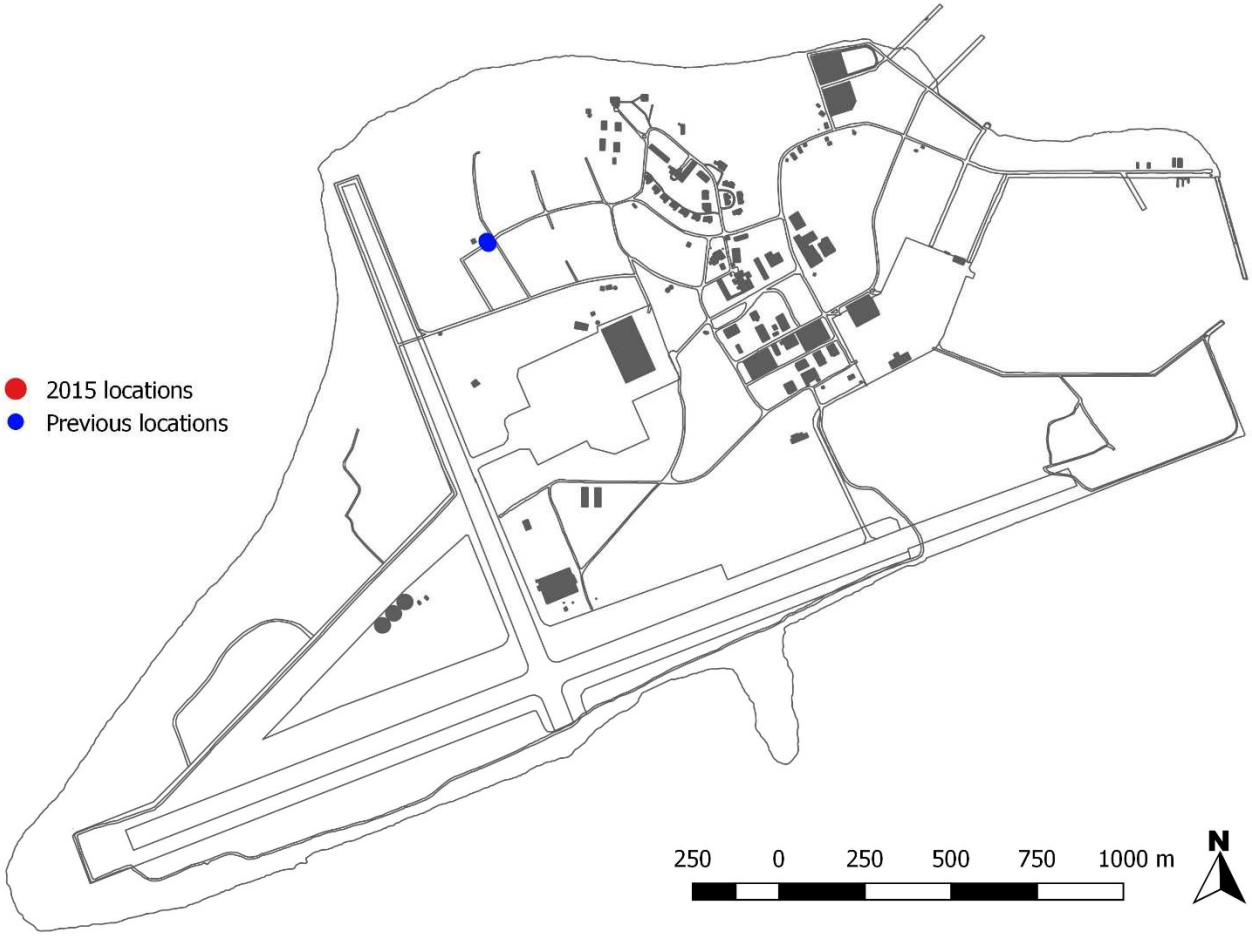
Solanum nelsonii



Solanum torvum



Spathodea campanulata



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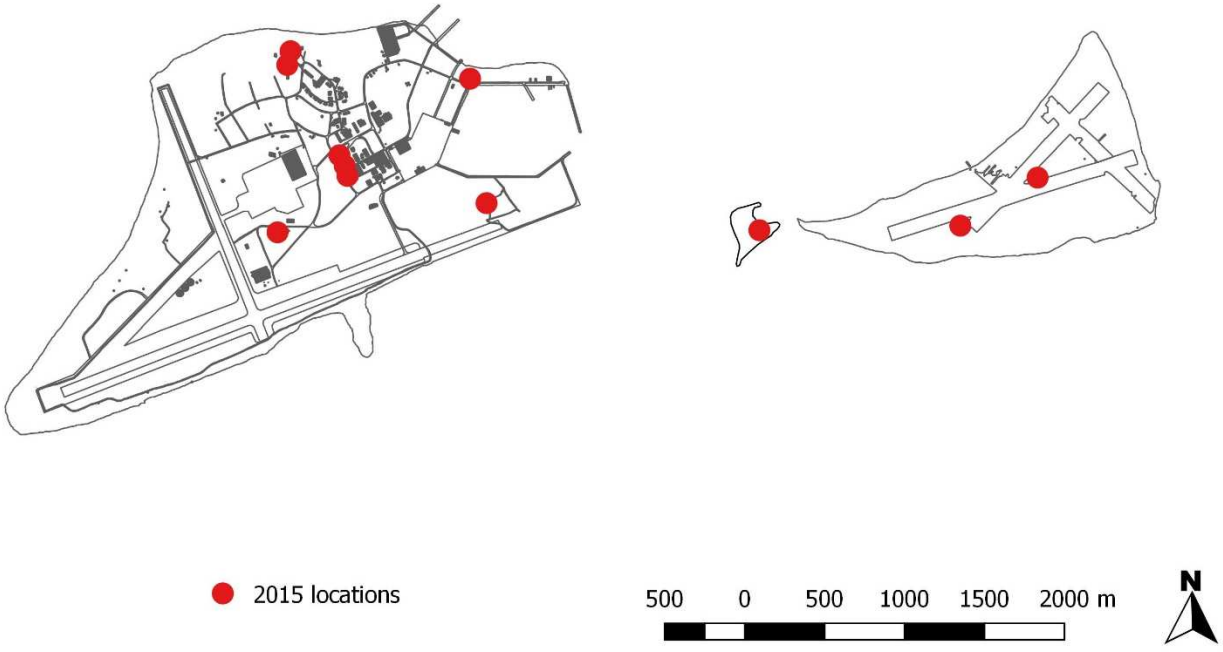
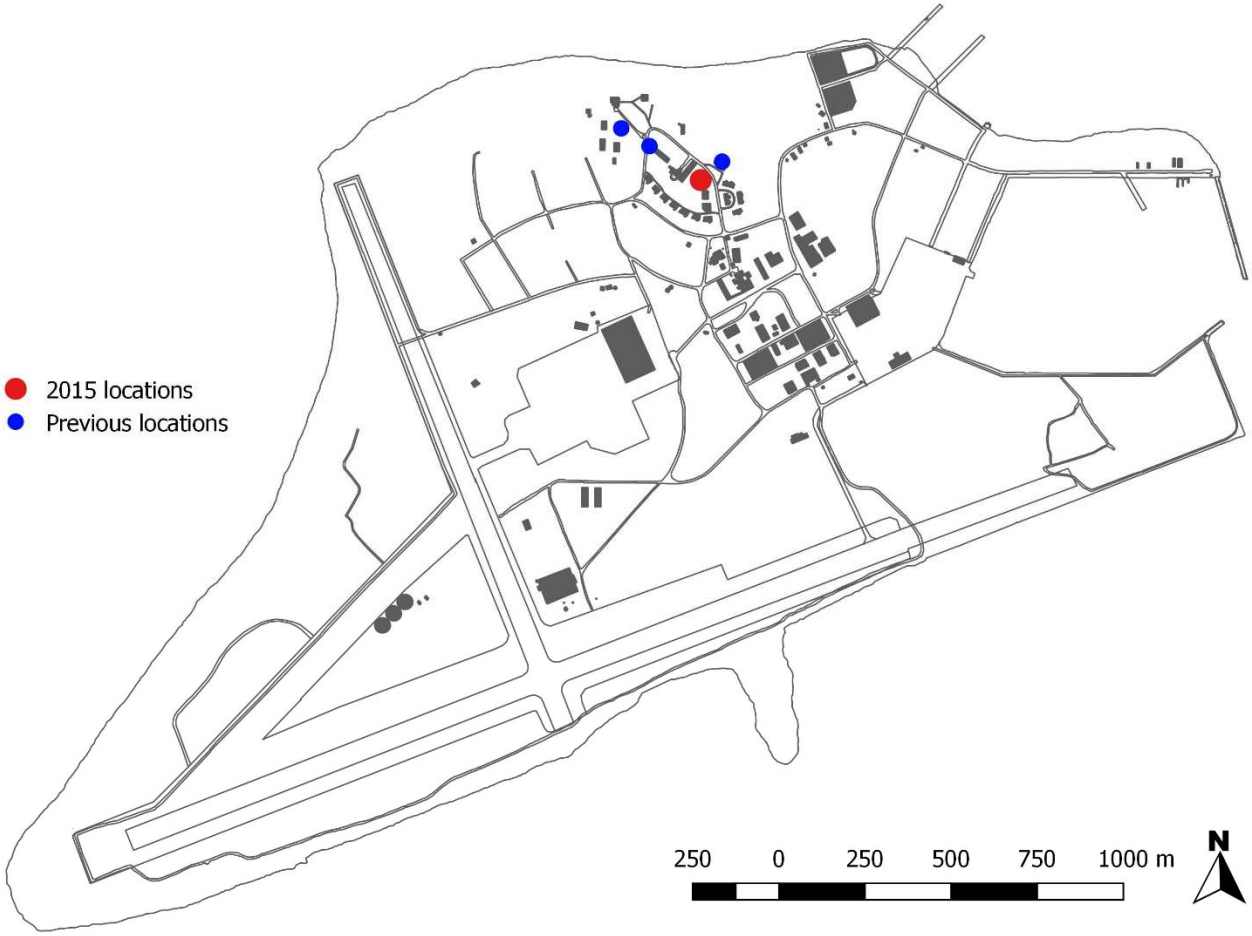
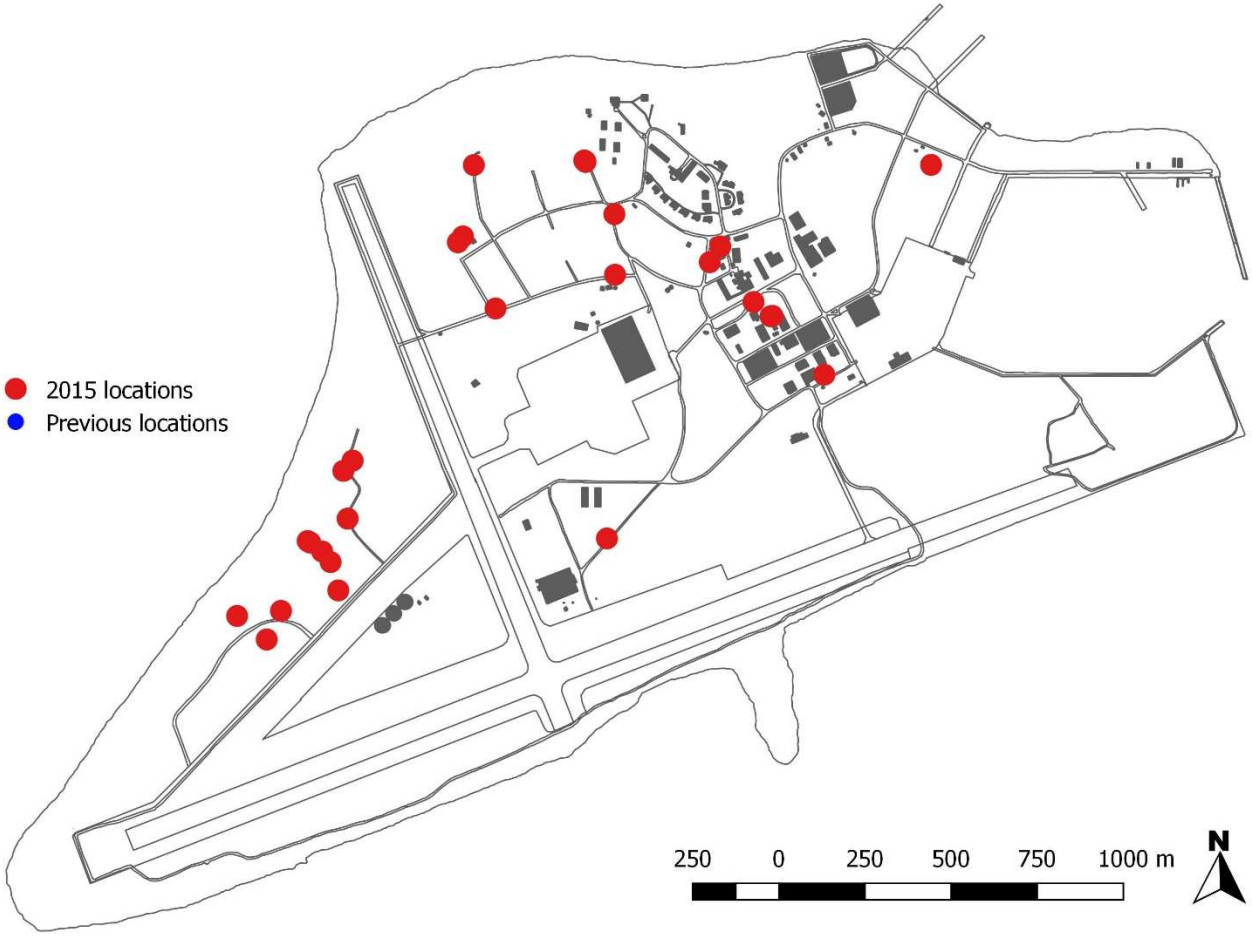


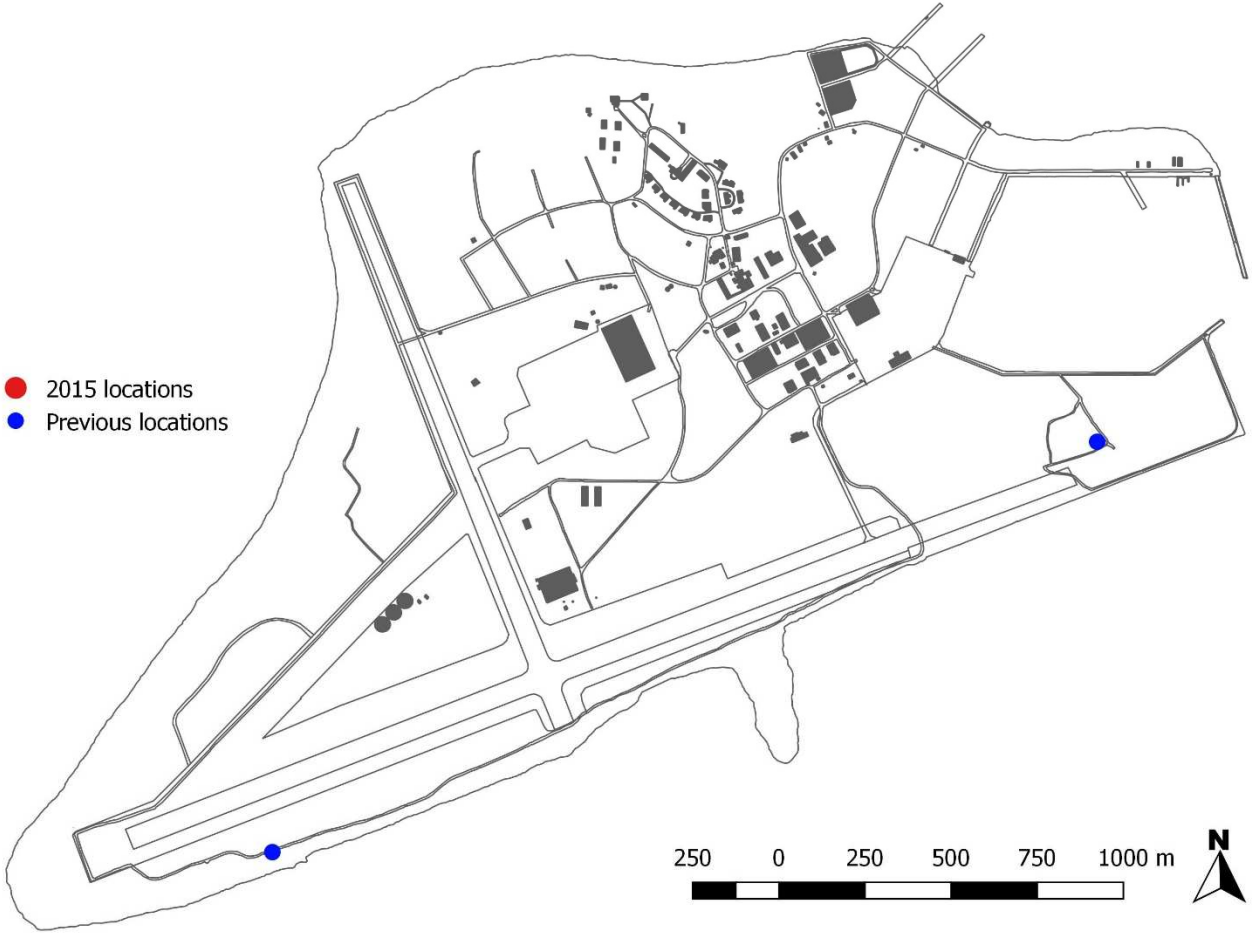
Syngonium podophyllum



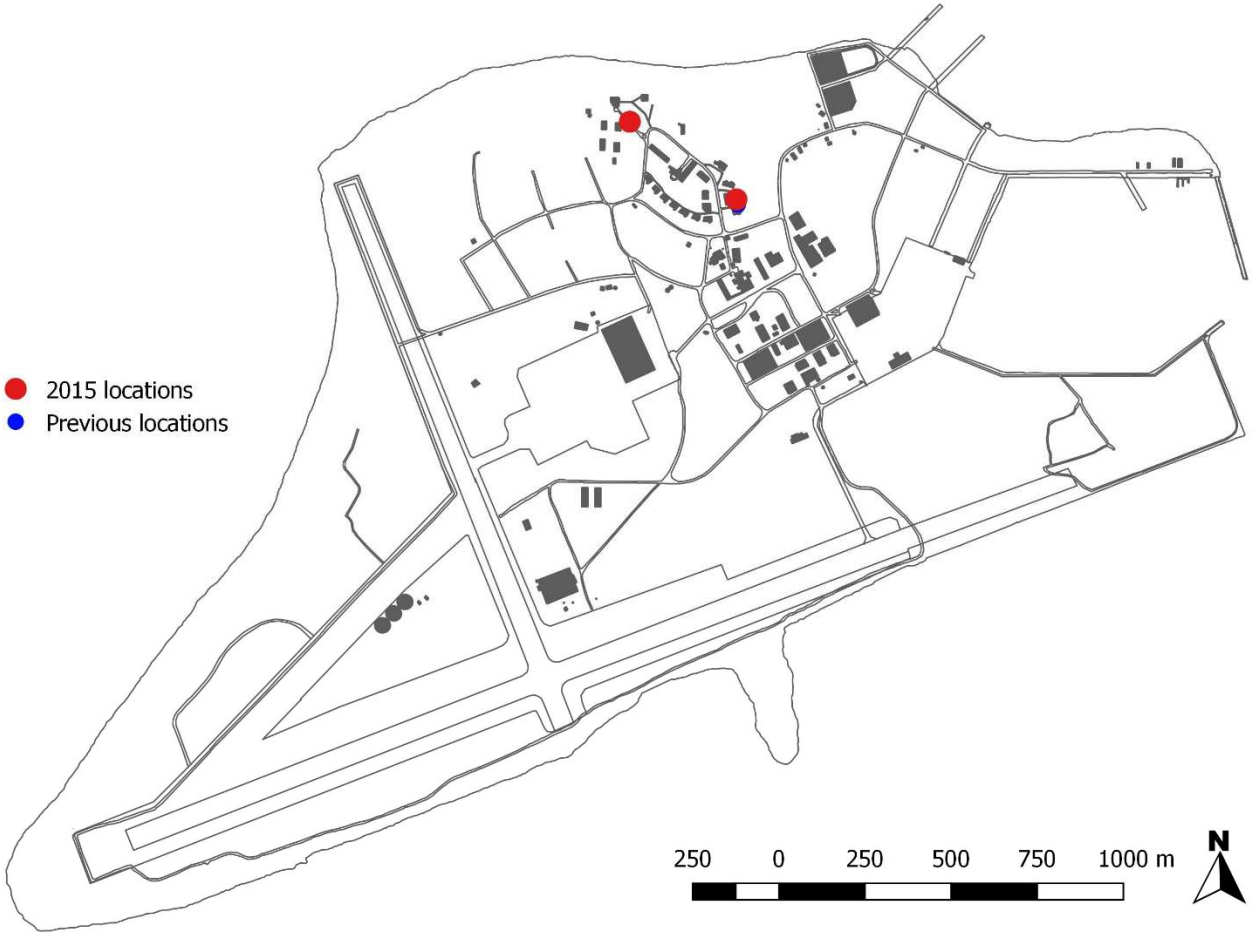
Terminalia catappa



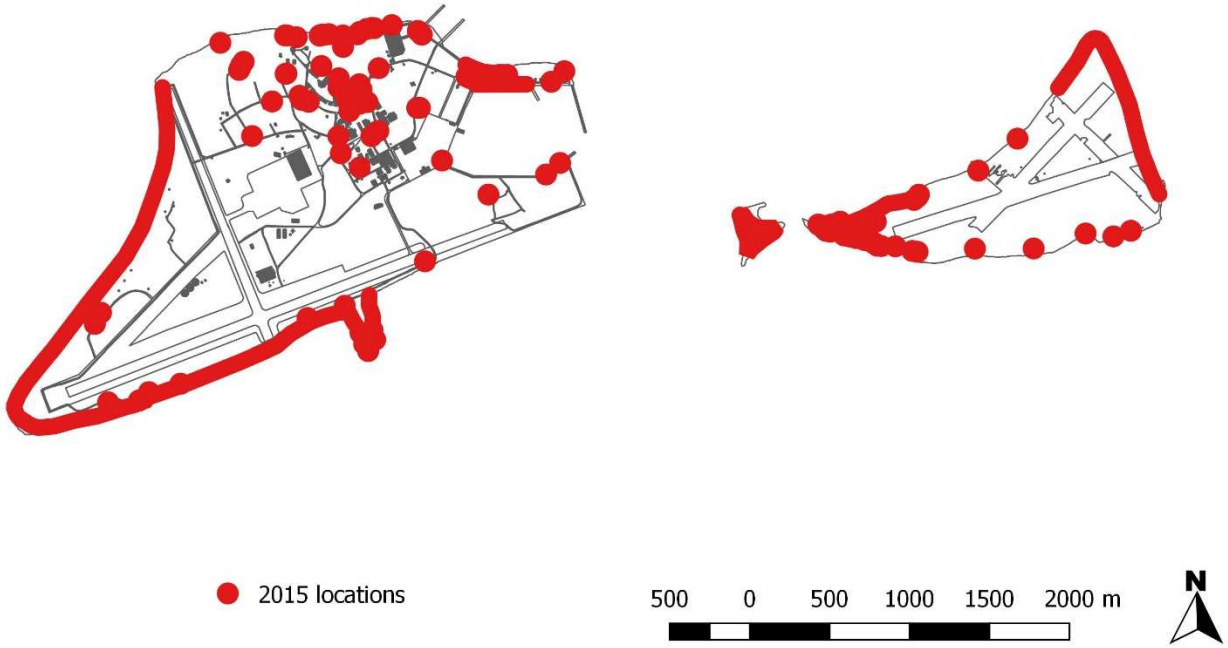
Tetragonia tetragonioides



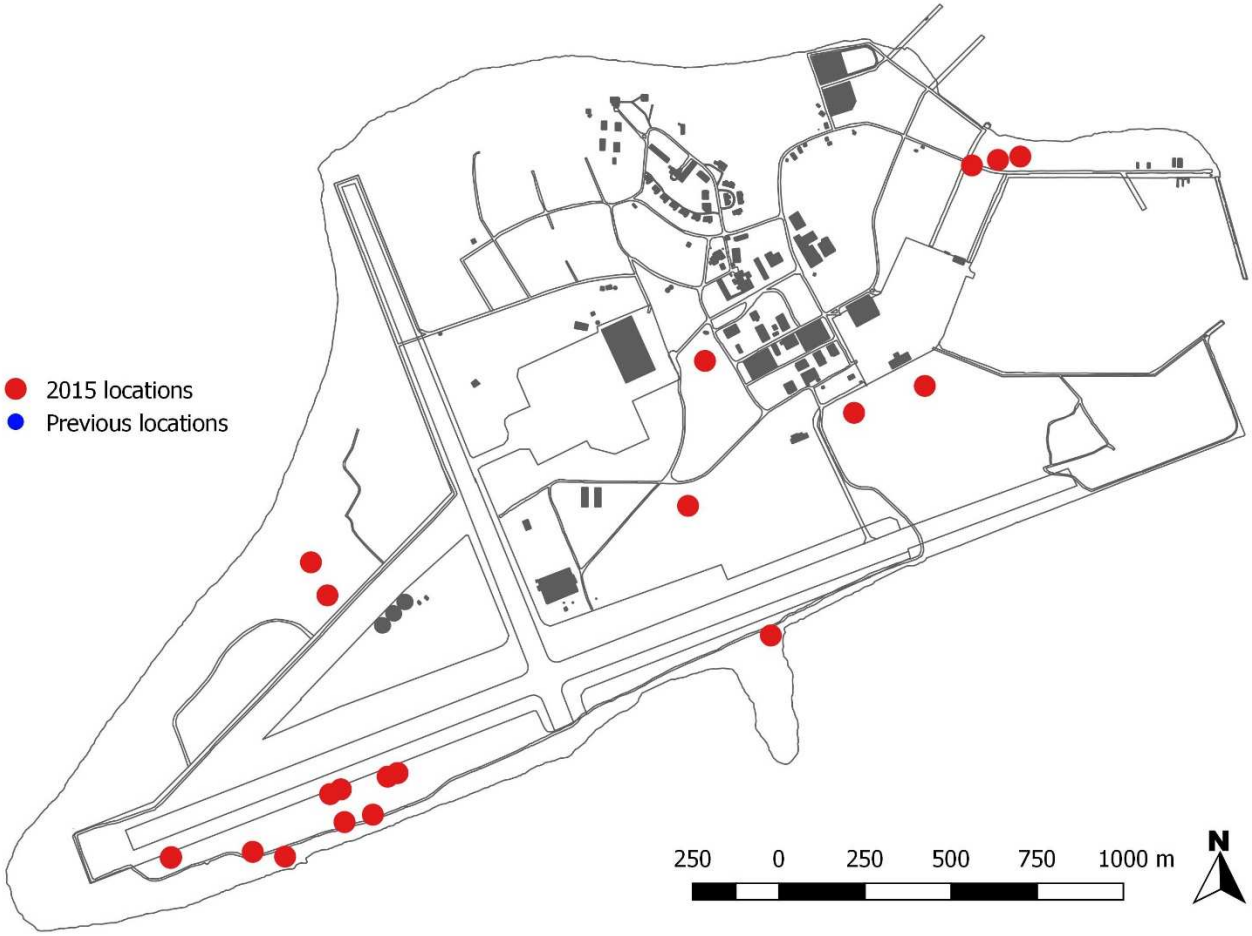
Thespesia populnea



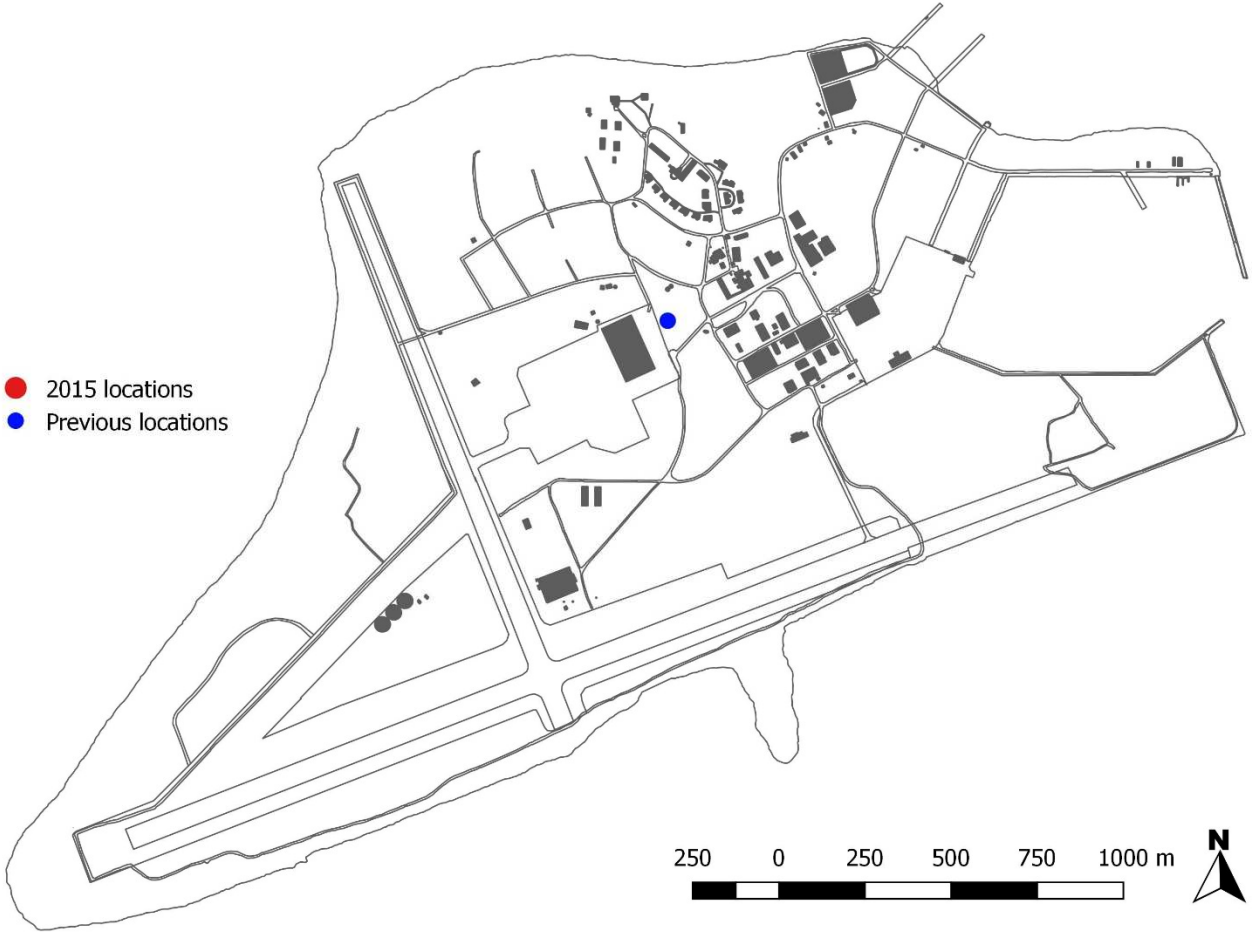
Tournefortia argentea



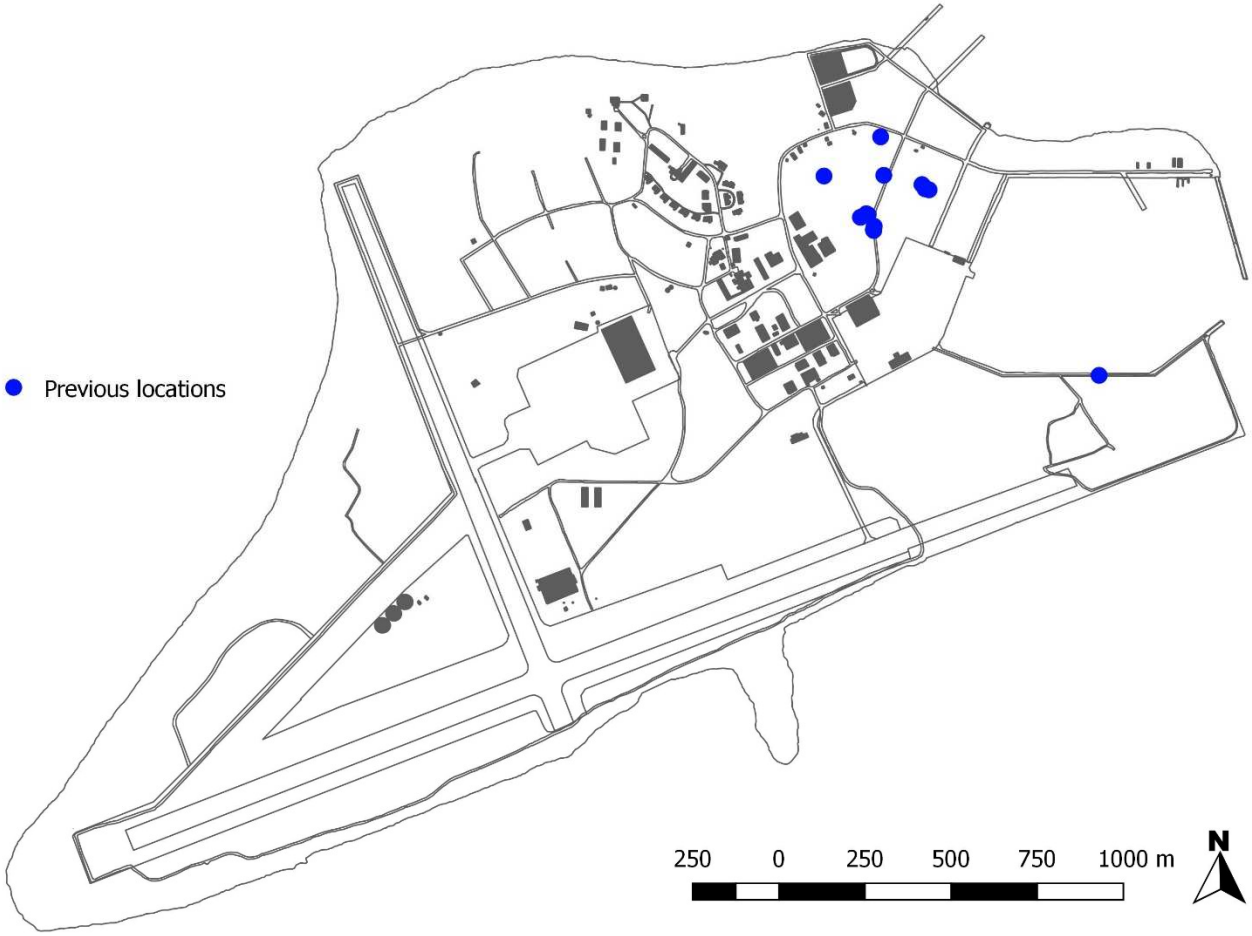
Tribulus cistoides



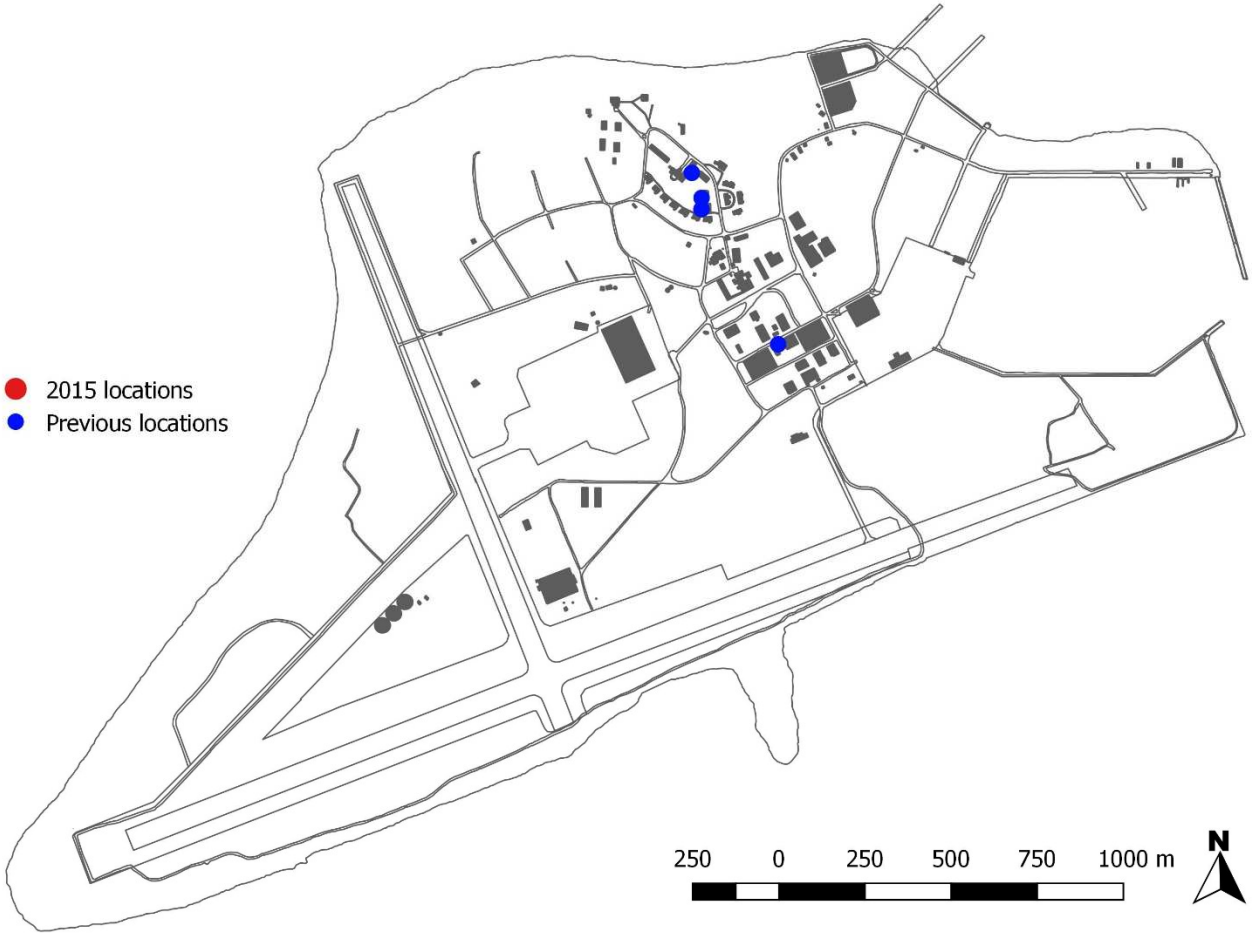
Urochloa mutica



Vitex trifolia



Ziziphus sp.



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