BOTANICAL SURVEY OF MIDWAY ATOLL

2008

Prepared For:
United States Fish and Wildlife Service

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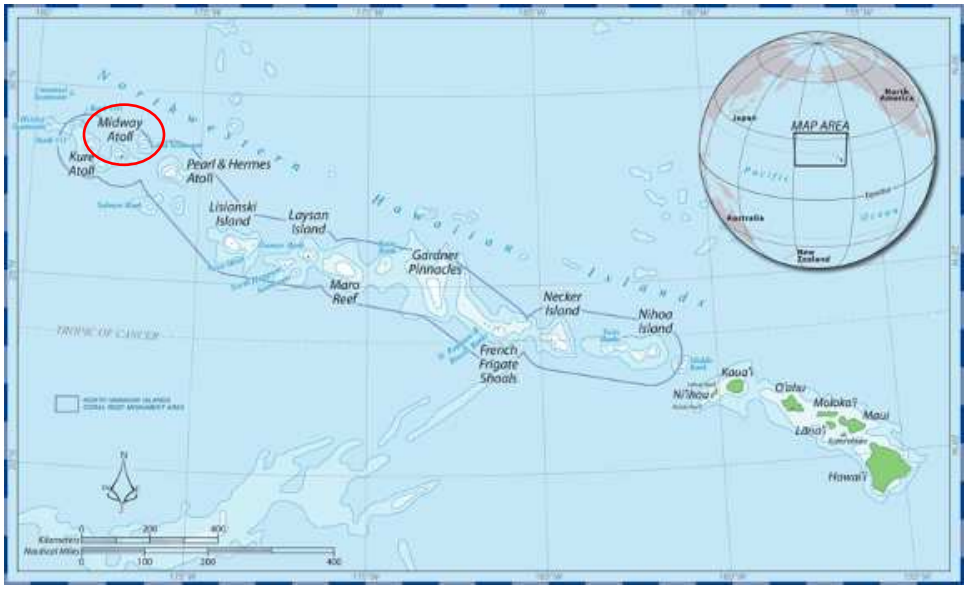
INTRODUCTION



Map of Northwestern Hawaiian Islands.

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.

Satellite image of Midway Atoll

Midway Atoll is made up of three islands, Sand (1117 acres), Eastern (336 acres), and Spit (14.8 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. Also unlike other Northwestern Hawaiian Islands, Midway's vegetation has been greatly increased and diversified. Some plant species have been intentionally introduced, while others have arrived as contaminants. Some species have not caused much of a problem, while others, such as golden crown-beard (*Verbesina encelioides*) and ironwood (*Casuarina equisetifolia*), take up vast resources to keep in check.

In order to keep a pulse on the status of plants on Midway, botanical surveys have been occasionally conducted. The first known botanical records are from W.A. Bryan in 1902. Botanical surveys have been conducted periodically since then with the last survey (Starr and Martz 1999) occurring in 1999. The goal of the 2008 survey was to update the list of plants known from the atoll with a focus on identifying and providing insights about incipient non-native species.

METHODOLOGY

Surveying plants near the abandoned Cable Company Buildings, Sand Island, Midway Atoll.

The survey was conducted by Forest Starr and Kim Starr from May 31, 2008 through June 14, 2008. Most of the survey time was spent on Sand Island, where the bulk of non-native plants reside. A half day was also spent on Spit Island on June 3, 2008, and two half day surveys were done on Eastern Island on June 5 and 6, 2008.

During surveys a walk-through method was used, noting plants as they were encountered, their relative abundance, and any interesting observations. When possible, folks on island were interviewed, especially Thai contract workers and others with an affinity for gardening, to help obtain the history and names of specific plants in gardens.

A Garmin global positioning system (GPS) unit was used to record GPS points when selected species were encountered, with a focus on those that had been previously mapped in 1999 (about 2 dozen), any new or unknown plant species, collection locations, and some of the more rare native plant species.

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

Photographs were taken of most of the plant species on Midway, to provide for identification of individual species, to create "electronic vouchers", and to capture a record of the status of the general vegetation.

RESULTS

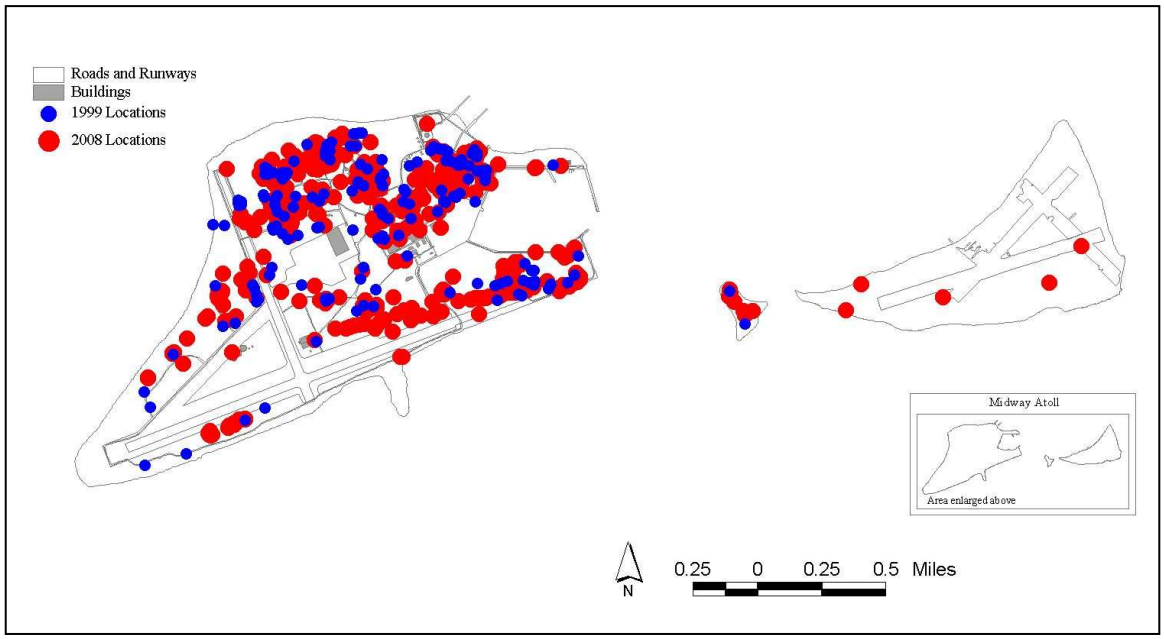
222 plant species were observed or reported. Of the 222 species, 28 (13%) were native, and 194 (87%) were non-native. In general there were more native species and less non-native species than in 1999. For comparison, in 1999, 264 plant species were observed, an all time maximum for the atoll. Of those 264 plant species, 12 (5%) were native, 248 (94%) were non-native, and 4 (1%) were unknown.

Some invasive plant species that were targeted for eradication in 1999 were not observed in 2008, such as Christmas berry (*Schinus terebinthifolius*) and Mexican creeper (*Antigonon leptopus*). However, other species that were eradicated in 1999, such as ivy gourd (*Coccinia grandis*) and guava (*Psidium guajava*), had been reintroduced and in 2008 were flourishing. Others had been locally controlled but had begun to rapidly expand in distribution island wide, such as lantana (*Lantana camara*) and haole koa (*Leucaena leucocephala*).

Some native plants had decreased in abundance since 1999, such as dwarf eragrostis (*Eragrostis paupera*), yet others like popolo (*Solanum nelsonii*) and emoloa (*Eragrostis variabilis*) had increased in abundance and were doing quite well.

GPS points

605 GPS points were collected for 102 species in 2008. These points recorded invasive species locations and documented new records. Most points were collected on Sand Island. 163 GPS points for 33 species were collected in 1999, and were used to help show change over time for a couple dozen species. A few of the 2008 and 1999 points were hand drawn in 2008 using high resolution satellite images and GIS base layers.



GPS points collected in 1999 and 2008 surveys of Midway Atoll.

New Records

31 plant species were observed on Midway for the first time in 2008. The vast majority of the new plant species found on Midway 21 (68%) were Asian plants recently introduced for use in gardens. 7 (22%) of the new records were native plants (*) that were introduced for both restoration and ornament. Only 3 (10 %) of the new records were apparently not intentionally introduced (!), one of which was native.

Species	**Common name**	**Family**
Allium tuberosum	Garlic chive	Liliaceae
Apium graveolens	Chinese celery, Khuen chai	Apiaceae
Artabotrys hexapetalus	Ylang ylang	Annonaceae
Averrhoa carambola	Star fruit	Oxalidaceae
Caesalpinia bonduc *!	Yellow knickers	Fabaceae
Cajanus cajan	Pigeon pea	Fabaceae
Chenopodium oahuense *	Aweoweo	Chenopodiaceae
Citrus aurantifolia	Lime	Rutaceae
Citrus hystrix	Kaffir lime	Rutaceae
Cyperus laevigatus *	Makaloa	Cyperaceae
*Cyperus pennatiformis var. bryanii**	Cyperus	Cyperaceae
Eriochloa sp. !	Cup grass	Poaceae
Eryngium foetidum	Long coriander	Apiaceae
Euphorbia milii	Crown of thorns	Euphorbiaceae
Gynura sp.	Asian spinach	Asteraceae
Hibiscus waimeae *	Kokio kea	Malvaceae
Indigofera hendecaphylla !	Creeping indigo	Fabaceae
Nama sandwicensis *	Nama	Boraginaceae
Oryza sp.	Rice	Poaceae
Pandanus amaryllifolius	Tea pandanus	Pandanaceae
Piper sarmentosum	Thai piper	Piperaceae
Plectranthus amboinicus	Mexican oregano	Lamiaceae
Psophocarpus tetragonolobus	Wing bean	Fabaceae
Senna siamea	Pheasant wood	Unknown
Sicyos pachycarpus	Anunu	Cucurbitaceae
Solanum torvum	Turkey berry	Solanaceae
Spondias sp.	Makok	Anacardiaceae
Vigna unguiculata ssp. sesquipedalis	Long bean	Fabaceae
Vitex rotundifolia *	Pohinahina	Verbenaceae
Wikstroemia uva-ursi *	Akia	Thymelaeaceae
Ziziphus sp.	Jujube	Rhamnaceae

Images

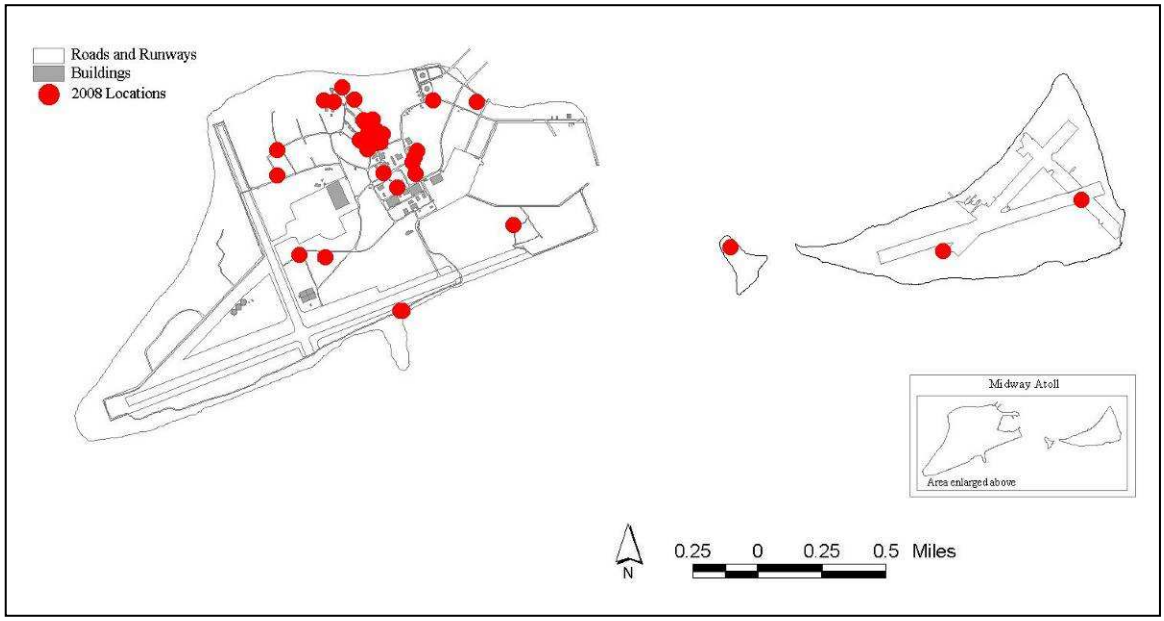
5021 images were taken of most plant species on Midway Atoll and posted at hear.org/starr/hiplants/images. Images were taken to get close up images useful for identification, as well as broad view images to document the current status of the vegetation on Midway. Many recent images of Midway were used in this report.

Collections

75 plant collections were made for 71 species. There were 26 new records found. Of these new records, 7 were new island or new naturalized records, defined as plants previously not documented as naturalized that were either known or new to the atoll and are now naturalized. The remainder, 19 of the new records, are new cultivated records, defined as plants now being cultivated that were previously not known from the atoll.

For comparison, in 1999, there were 83 new island records, a significantly higher number of new records. This could be due to several factors, such as more attention being paid to the harms of introducing non-native species and less people currently living on and visiting the atoll.

The rest of the plant collections included plants that were known to the atoll, but had not been collected before; unidentifiable plants or plants for which we needed further confirmation of identification; and a few second collections of plants that had already been collected that were collected by mistake.



Collections made during 2008 survey of Midway Atoll

This table shows the collections made during the 2008 survey. Significance codes include: 1st - First collection from Midway, may have already been known from Midway. 2nd - Second collection from Midway. ID - Collected to help with identification. New Cult - Collected and observed for first time on Midway. NIR - New island record, naturalized plant observed and collected for the first time on Midway. New Nat - New naturalized record, previously cultivated on Midway and now found to be naturalized.

Voucher #	Family	Scientific name	Status	Significance
080608-07	Liliaceae	*Allium schoenoprasm*	Cultivated	1st
080608-06	Apiaceae	*Anethum graveolens*	Cultivated	2nd
080601-16	Araucariaceae	*Araucaria heterophylla*	Cultivated	ID/1st
080607-12	Annonaceae	*Artobotrys sp.*	Cultivated	ID/New Cult
080607-02	Liliaceae	*Asparagus plumosus*	Cultivated	1st
080607-07	Nyctaginaceae	*Bougainvillea spectabilis*	Cultivated	1st
080610-10	Brassicaceae	*Brassica campestris var. chinensis*	Cultivated	1st
080608-02	Brassicaceae	*Brassica sp.*	Cultivated	ID/New Cult
080610-13	Fabaceae	*Caesalpinia bonduc*	Naturalized	NIR
080610-04	Fabaceae	*Cajanus cajan*	Cultivated	New Cult
080604-04	Clusiaceae	*Calophyllum inophyllum*	Cultivated	--
080607-09	Cannaceae	*Canna x generalis*	Cultivated	New Cult
080601-03	Caricaceae	*Carica papaya*	Cultivated	1st
080601-20	Chenopodiaceae	*Chenopodium oahuense*	Cultivated	1st/New Cult
080610-05	Rutaceae	*Citrus hystix*	Cultivated	New Cult
080601-01	Cucurbitaceae	*Coccinia grandis*	Naturalized	2nd
080607-10	Euphorbiaceae	*Codiaeum variegatum*	Cultivated	1st
080607-13	Agavaceae	*Cordyline fruticosa*	Cultivated	1st
080610-09	Cucurbitaceae	*Cucurbita pepo*	Cultivated	1st
080607-18	Cycadaceae	*Cycas circinalis*	Cultivated	1st
080605-03	Cyperaceae	*Cyperus laevigatus*	Cultivated	New Cult
080607-01	Fabaceae	*Delonix regia*	Cultivated	1st
080601-09	Araceae	*Epipremnum pinnatum*	Cultivated	1st
080601-18	Poaceae	*Eragrostis amabilis*	Naturalized	2nd
080611-01	Poaceae	*Eriochloa sp.*	Naturalized	ID/NIR
080604-03	Fabaceae	*Erythrina variegata*	Cultivated	1st
080608-09	Moraceae	*Ficus macrophylla*	Naturalized	New Nat
080601-10	Moraceae	*Ficus microcarpa*	Naturalized	2nd
080601-19	Moraceae	*Ficus microcarpa*	Naturalized	2nd
080611-04	Malvaceae	*Hibiscus rosa-sinensis*	Cultivated	1st
080607-04	Malvaceae	*Hibiscus waimeae*	Cultivated	New Cult
080605-01	Fabaceae	*Indigofera hendecaphylla*	Naturalized	NIR
080604-02	Cupressaceae	*Juniperus bermudiana*	Cultivated	ID/1st
080610-03	Cupressaceae	*Juniperus bermudiana*	Cultivated	ID/1st

080601-07	Crassulaceae	*Kalanchoe tubiflora*	Cultivated	1st
080601-13	Malvaceae	*Malvaviscus arboreus*	Cultivated	1st
080601-17	Fabaceae	*Medicago lupulina*	Naturalized	ID/2nd
080610-01	Araceae	*Monstera deliciosa*	Cultivated	1st
080601-11	Musaceae	*Musa x paradisiaca*	Cultivated	--
080604-01	Oleaceae	*Noronhia emarginata*	Cultivated	1st
080601-04	Oxalidaceae	*Oxalis debilis var. corymbosa*	Naturalized	NIR
080608-08	Pandanaceae	*Pandanus sp.*	Cultivated	ID/New Cult
080611-02	Pandanaceae	*Pandanus tectorius*	Cultivated	1st
080607-08	Geraniaceae	*Pelargonium x hortorum*	Cultivated	1st
080608-04	Apiaceae	*Petroselinum sp.*	Cultivated	ID/New Cult
080608-05	Piperaceae	*Piper sarmentosum*	Cultivated	ID/New Cult
080601-15	Apocynaceae	*Plumeria obtusa*	Cultivated	1st
080607-14	Araliaceae	*Polyscias guilfoylei*	Cultivated	2nd
080607-16	Portulacaceae	*Portulacaria afra*	Cultivated	1st
080610-06	Fabaceae	*Psophocarpus tetragonolobus*	Cultivated	New Cult
080607-11	Rosaceae	*Rosa sp.*	Cultivated	1st
080611-03	Fabaceae	*Samanea saman*	Cultivated	1st
080607-03	Agavaceae	*Sanseviera trifasciata*	Cultivated	1st
080601-14	Araliaceae	*Schefflera actinophylla*	Cultivated	1st
080610-11	Solanaceae	*Solanum lycopersicum var. lycopersicum*	Cultivated	1st
080601-02	Solanaceae	*Solanum torvum*	Naturalized	NIR
080601-12	Solanaceae	*Solanum torvum*	Naturalized	NIR
080610-12	Bignoniaceae	*Spathodea campanulata*	Cultivated	1st
080602-01	Poaceae	*Sporobolus pyramidatus*	Naturalized	NIR
080603-01	Poaceae	*Sporobolus pyramidatus*	Naturalized	NIR
080605-02	Poaceae	*Sporobolus pyramidatus*	Naturalized	NIR
080610-02	Araceae	*Syngonium podophyllum*	Cultivated	1st
080607-15	Malvaceae	*Thespesia populnea*	Cultivated	1st
080601-06	Commeliniaceae	*Tradescantia pallida*	Cultivated	2nd
080607-17	Commeliniaceae	*Tradescantia spathacea*	Cultivated	1st
080610-08	Fabaceae	*Unknown Fabaceae*	Cultivated	ID/New Cult
080608-01	Unknown	*Unknown sp.*	Cultivated	ID/New Cult
080608-03	Unknown	*Unknown sp.*	Cultivated	ID/New Cult
080610-07	Fabaceae	*Vigna sesquipedalis*	Cultivated	New Cult
080607-05	Verbenaceae	*Vitex rotundifolia*	Cultivated	New Cult
080601-08	Vitaceae	*Vitis vinifiera*	Cultivated	ID/1st
080607-06	Thymelaeaceae	*Wikstroemia uva-ursi*	Cultivated	New Cult
080607-19	Araceae	*Xanthosoma robustum*	Cultivated	ID/1st
080601-05	Rhamnaceae	*Zizyphus sp.*	Cultivated	ID/New Cult

SAND ISLAND

Satellite image of Sand Island, Midway Atoll

Sand Island is the largest island within Midway Atoll with 1117 acres of land mass. It is comprised of sand, coral rubble, and several tons of soil that were brought from the main islands of Hawaii and Guam to help make the island more habitable for humans. Likewise, numerous plant species have been introduced over the years.

Sand Island includes an airport facility with a main runway, abandoned runways, a hangar, and newly constructed fire station. Town is centrally located in the northeast section of the island and extends inland. The western and southern coastal areas are mostly devoid of development at this time and beaches there are off limits to humans, to increase habitat for turtles and seals. The northern beach is open to human use, except for turtle beach. There is a large harbor on the eastern end and a cargo pier on the northeast shore where large boats anchor. On the southern coast, a protrusion occurs called Bulky Dump and there is a dump located in the southeastern portion of the island. Several new seeps have been created about the island for Laysan Duck reintroduction and there is a fairly large water catchment on the runway where shorebirds and other fresh water birds are observed.

In 2008 222 species were observed or reported on Sand Island. Of the 222, 28 (13%) were native, and 194 (87%) were non-native. Even though we found fewer species, we found the islands much more vegetated. Areas that were sparsely vegetated are now filled with plants and there is much more biomass for both native and non-native species.

In general, there were still large areas of ironwood forests scattered about the island. Vegetation of town areas consisted of typical lawn weeds, such as goose grass (*Eleusine indica*), sweet alyssum (*Lobularia maritima*), and Bermuda grass (*Cynodon dactylon*); common ornamental species, such as plumeria (*Plumeria rubra*), hibiscus (*Hibiscus rosa-sinensis*), and oleander (*Nerium oleander*); and vegetable gardens with edible species, such as ivy gourd (*Coccinia grandis*), chili pepper (*Capsicum annuum*), and eggplant (*Solanum melongena*).

Large patches of golden crown-beard (*Verbesina encelioides*) can be observed almost anywhere on the island. Coastal areas are a mix of low growing herbs, such as alena (*Boerhavia repens*) and sweet alyssum (*Lobularia maritima*), along with shrubs, such as naupaka (*Scaevola taccada*) and tree heliotrope (*Tournefortia argentea*). Large trees can be found along the west beach trails, with hau (*Hibiscus tiliaceus*) and sea grape (*Coccoloba uvifera*) commonly planted on revetments. The native bunchgrass emoloa (*Eragrostis variabilis*) has been extensively planted around the Clipper House, on sand hills along roads, other areas around town, and near duck seeps.

Natives

The number of native species doubled since 1999 and some native species expanded in range, such as emoloa (*Eragrostis variabilis*) and naupaka (*Scaevola sericea*), largely due to out-planting efforts and natural regeneration.

Most of the new native species were intentionally introduced from Laysan Island during Laysan Duck relocation efforts, including makaloa (*Cyperus laevigatus*), which was well established around duck seeps, aweoweo (*Chenopodium oahuense*), known from a few plantings around duck seeps and town, and maia pilo (*Capparis sandwichiana*) which was not found. Other native species that were introduced from Laysan included nama (*Nama sandwicensis*), anunu (*Sicyos pachycarpus*), anaunau (*Lepidium bindentatum* var. *o-waihiense*), ihi (*Portulaca lutea*), nena (*Heliotropium currasavicum*), and *Cyperus pennatiformis* var. *bryanii*. Nama was found at one small planting outside the Midway House and in pots in the greenhouse. The anunu and *Cyperus pennatiformis* var. *bryanii* were propagated but not observed in the greenhouse and may not have sprouted yet or were overlooked. The ihi, anaunau, and nena apparently did not survive.

Some of new natives were recently introduced for ornamental purposes, including pohinahina (*Vitex rotundifolia*), akia (*Wikstroemia uva-ursi*), and kokio kea (*Hibiscus waimeae*). They were all apparently brought from Home Depot on Oahu and planted in front of the Midway House.

The only new native species to the atoll that presumably got to Midway on it's own was yellow knickers (*Caesalpinia bonduc*), which possibly arrived naturally via seabird, as seeds are known to float in the ocean for many years. A lone ilima (*Sida fallax*) plant was observed next to the Midway Mall, it's origin is unknown.

A few native species were observed in 1999 and not in 2008, including dwarf emoloa (*Eragrostis paupera*), which had disappeared in the places it used to reside and was restricted to a few specimens in pots in the FWS greenhouse that had been introduced from Kure Atoll. The uhaloa (*Waltheria indica*) plant which had a fence around it in 1999 was also missing in 2008.

Native species that have not been observed for a long time now, and are presumed extinct include *Phyllostegia variabilis*, *Achyranthes atollensis*, and *Cenchrus agrimonioides* var. *laysanensis*. Native relatives of these species still exist in the main Hawaiian islands.

Native species that have not been observed on Midway for some time, but still exist on the main Hawaiian Islands that could be re-introduced to Midway include akiaki (*Sporobolus virginicus*), aeae (*Bacopa monnieri*), and ahu awa (*Cyperus javanicus*). Akiaki is a low growing mat forming grass that could be an excellent replacement cover in areas where *Verbesina* is controlled. On the main Hawaiian Islands, it is a core restoration species at Kanaha Beach, Maui, and other coastal sites, where it is planted by the thousands on newly weeded sand dunes. It establishes quickly, keeps out weeds such as *Verbesina*, and provides good nesting sites for burrowing birds, such as wedge tailed shearwaters. Aeae is a mat forming herb in wetlands, and ahu awa is a prolific sedge in wetlands.

Non-Natives

The number of non-native species decreased since1999. The reason for the reduction in total species number may be due to the fact that some species were no longer cultivated, some have been removed through control efforts of the Fish and Wildlife Service, some may have disappeared on their own, some could have been obscure due to the dry season, and some could have been overlooked.

Some non-native species previously targeted for eradication were apparently eliminated, including Christmas berry (*Schinus terebinthifolius*), button mangrove (*Conocarpus erectus*) and New Zealand Spinach (*Tetragonia tetragonioides*). Some species were successfully eradicated, then reintroduced, such as ivy gourd (*Coccinia grandis*) and guava (*Psidium guajava*).

Several species were no longer cultivated, such as broccoli (*Brassica oleracea* var. *botrytis*), violets (*Viola* sp.), and marigolds (*Tagetes* sp.). Some non-native species expanded their range, such as Chinese banyan (*Ficus microcarpa*), lantana (*Lantana camara*), and haole koa (*Leucaena leucocephala*).

On Sand and Eastern Island vast stands of ironwood (*Casuarina*) were removed to create better bird habitat. On Sand Island the trees were disposed of by using an excavator to dig on either side of the tree, push the tree over, and stack it in a pile. The whole pile was then burned, leaving only the root balls. On Eastern Island the trees were originally treated with herbicide and left standing, but this created a snag hazards for birds, so they were cut down with chainsaws and either left in place or burned. The result was a

decrease in dense shady ironwood areas and an increase in open areas. These open areas were sometimes restored to virtually 100% native plant cover in some places, and in others had become dense *Verbesina* patches.

The infamous golden crown beard (*Verbesina encelioides*) seemed to be somewhat under control in the town area, but was still forming dense stands in areas not actively managed by FWS. The resources available for *Verbesina* management were much less than in previous years, and it showed, with vast fields of *Verbesina* over much of Sand and Eastern Islands. The reduction of mowing on Sand Island also seems to have resulted in more tall stands of *Verbesina* in areas that were previously short statured lawn. It seems that stepped up replanting in areas where *Verbesina* is controlled could help establish a cover that would prevent reinvasion. Perhaps a native ground cover, such as akiaki (*Sporobolus virginicus*) previously known from Midway, but no longer present, could be re-introduced and used as a native "lawn" like plant. This grass is used extensively in restoration projects on the main Hawaiian Islands, forming a dense cover on the land, which decreases seedling recruitment of *Verbesina* and other weeds greatly. Akiaki does not produce seeds, so cuttings would have to be re-introduced.

Gardens on Midway

Plants have been cultivated on Midway since the first human occupation of the atoll. Mr. Steadman, the gardener at Midway for Pan American Airways in 1936, is said to have fallen down in so many moaning bird holes that he had developed a chronic limp and always carried a cane. The introduced and cultivated plants have ranged through time from American in nature during the Pan Am era to Sri Lankan and Filipino, and most recently Thai. The change in plant preferences seems to be predominantly a function of the nationality of the workers hired, and can be seen in the high number of Asian plants observed on Midway for the first time in recent years.

In 2008 most new records of non-native plant species on Midway were found in the town area of Sand Island, particularly in gardens. Some of the new species do not pose a risk of spreading, while others do, and some have yet to be identified. Findings included the Hawaii State Noxious Weed ivy gourd (*Coccinia grandis*) and the Federal Noxious Weed turkeyberry (*Solanum torvum*). These well known invasive plants had been intentionally brought to Midway, from Hawaii and abroad. Though it was against Federal and State law to do this, there was no enforcement, or even realization this was occurring. Once the situation was brought to the attention of the FWS, swift action was taken. All parties involved were very cooperative and worked together to find the best way to allow approved plants to be safely cultivated on Midway. Because gardens on Midway are a proven vector for invasive plant species, it makes sense to have regular checks of gardens on Midway by island managers and occasional checks by plant professionals. It would also be wise to concentrate gardens in known locations, so gardens can be more easily maintained and monitored.

There was a marked decline in the number of gardens on Midway between 1999 and 2008. This decline was likely due to a decrease in the number of people on island and a

concerted effort by FWS to remove many of the smaller satellite gardens around the island. That said, there were still many gardens around residences and in town, and there were signs of very recent new plantings and gardens popping up again. This recent increase in gardens seemed to be a function of the island getting more people again, and a lack of a well known planting policy. Since the survey, an approved plant list was created. This list, along with other guidelines such as approved planting locations and best practices for plant debris disposal, were to be part of a packet to be distributed to all new employees.

Rats

Rats were unintentionally introduced to Midway during WWII, then were eradicated in 1997. Prior to rat eradication, the rat damage on plants was so bad that some surmised naupaka (*Scaevola taccada*) may go extinct on Midway. That idea seemed laughable in 2008 when flailing through virtually impenetrable thickets of naupaka. Nohu (*Tribulus cistoides*) has also made a remarkable comeback, from being quite rare to dominating large areas. Though conclusive evidence is lacking, many of the vegetation changes observed between 1999 and 2008 are likely attributable to the removal of rats from Midway.

BRAC

The 1999 survey was conducted shortly after the Base Realignment and Conversion (BRAC), when many of the buildings and structures around Midway Atoll were demolished, piled up, and covered with sand. As a result of the heavy equipment use and overall demobilization, the island was at a biomass minimum, with many areas barely more than bare sand. In 2008 many of these areas that had sparse vegetation in 1999 were overgrown with thick vegetation.

Tourism

In 1999 the Midway Phoenix Corporation was managing the island and wanted to mold the island to best suit tourists needs. As a result a variety ornamental flowers of various types were imported to Midway and planted across the island in places like the planter box in front of the Boathouse. Additionally the new Citrus Orchard was planted, the Community Garden set up to grow 2000 pounds of melons during peak summer production, and the Hydroponics Facility stocked with lettuce and tomatoes.

That federal-private business venture didn't work out, and between 2002 and 2008 there was a virtual disappearance of tourism on Midway. During that period most of the tourism facilities were abandoned. However by 2008 small-scale tourism had started up again on Midway and the pressure to grow more plants on Midway was again growing. A sign that the pendulum was swinging towards more plantings was a recent hire by the Chugach Alaska Corporation for an employee to revamp the Hydroponics Facility.

Island Services / Contractors

A big difference between 1999 and 2008 was the change in management of Midway, from a business-partnership between Midway Phoenix and FWS, to a hired-contractor relationship between FWS and Chugach. Though many of the employees were the same, the politics on the island went from Midway Phoenix paying all the bills and having basically equal say with FWS, to one where FWS paid all the bills and made all the decisions, in cooperation with the FAA. This had implications for many items, including which plants were allowed where. Since FWS took full control, decisions have been made with an increased emphasis on protecting wildlife.

Mowing

The refuge had cut back dramatically on the mowing of lawns and fields on Midway. This occurred as a result of an increase in seabird burrows following eradication of rats, a need to provide cover for the Laysan Duck, and a sharp decline in the resources available for vegetation management. The result was a change in the height of most lawns and fields from a couple inches to a couple feet. Sites with a thick mat of low growing grasses had shorter height, and sites with tall grasses or shrubs had taller vegetation. Many grasses that were inconspicuous in 1999 were quite prominent in 2008.

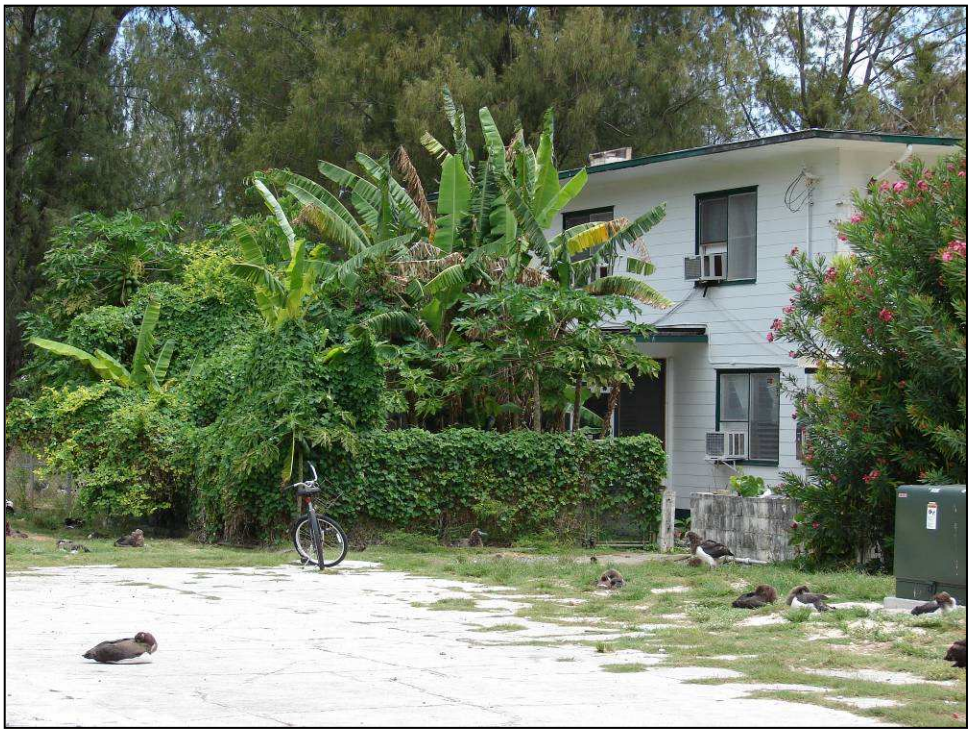
Duck Seeps

The endangered Laysan Duck was recently introduced to Midway from Laysan. As part of the introduction process a series of ponds or seeps were constructed on both Sand and Eastern Islands. The seeps were created by using a backhoe to dig through the crushed coral and sand down to the water table. Additionally, wetland plants from Laysan and Midway were planted in and near the seeps. The result was an increase in the number of native wetland species found on Midway, and in increase in the distribution of both native and non-native wetlands plants previously occurring on Midway.

A typical lawn in the Town area of Sand Island.

Recently planted naupaka (*Scaevola taccada*) on what was the Fuel Farm before the BRAC.

Town area of Sand Island showing common ornamentals on Midway.



Back yard of house showing private garden growing ivy gourd (*Coccinia grandis*).

Ironwood (*Casuarina*) forest on Midway Atoll

Field of *Verbesina* on Midway Atoll.

EASTERN ISLAND

Satellite image of Eastern Island, Midway Atoll.

Eastern Island, 336 acres in area, 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 were cut down, and none of the runways were being used as an emergency runway.

Two half day surveys (about 9am to noon) were conducted on Eastern Island on June 5 and 6, 2008. On June 5, 2008, we were accompanied by Greg Schubert and Pete Leary who showed us the Laysan Duck seeps, the golden gooney decoy site, and other areas where out-plantings had occurred, mostly visiting sites on the southeastern and central portions of the islands. On June 6, 2008 we surveyed the northeastern and western portions of the islands while John Klavitter and Leona Laniawe conducted seal work.

37 species were observed on Eastern Island. 11 (30%) were native, 26 (70%) were non-native. 2 collections were made on Eastern Island, dropseed (*Sporobolus pyramidatus*) and makaloa (*Cyperus laevigatus*), neither previously not known from the island.

With the discontinued maintenance, the abandoned runways were filling with vegetation. There seemed to be less button sedge (*Fimbristylis cymosa*) than in 1999, possibly due to overcrowding by other species, including an abundance of sweet alyssum (*Lobularia maritima*) and alena (*Boerhavia repens*), and to a lesser extent, golden crown beard (*Verbesina encelioides*) and nohu (*Tribulus cistoides*).

The newly created Laysan Duck seeps were a new feature on Eastern Island and were dominated by native species that had been recently out-planted, including naupaka (*Scaevola taccada*), emoloa (*Eragrostis variabilis*), makaloa (*Cyperus laevigatus*), and *Pycreus polystachyos*. A few popolo (*Solanum nelsonii*) and pohuehue (*Ipomoea pes-caprae* subsp. *brasiliensis*) were also observed near duck seeps. A few non-native species also occurred at seeps, including sweet alyssum and horseweed (*Conyza canadensis* var. *pusilla*). The sweet alyssum occurred on the steep slopes above makaloa with some bare sand in between plants. The horseweed occurred in small dense patches. A few non-native species appear to have been introduced from Sand Island as contaminants in plantings, including turkey tangle fogfruit (*Phyla nodiflora*) and artillery plant (*Pilea microphylla*).

Naupaka and nohu still dominated the eastern portions, with alena and nohu becoming dominant along the southern coast. On the western portions, naupaka was dominant near the coast with some *Lepturus repens* just makai.

One naturally occurring popolo plant was observed on the northwestern coast on the mauka side of the naupaka that forms along the coast. The plant was small in size and had a few ripe fruit on it.

All of the large ironwood (*Casuarina equisetifolia*) trees had been cut down. Some downed logs still remained and some seabirds (white terns, noddies) were beginning to use these areas for nesting. Only occasional small ironwoods (1-2 m tall) were observed mostly along the north eastern shore. Golden crown beard and black mustard (*Brassica nigra*) filled interior portions of the island.

There was one persistent patch of spider lily (*Crinum asiaticum*) left from former development, along with some wild poinsettia (*Euphorbia cyathophora*) just inland of the boat landing. There seemed to be less tree heliotrope (*Tournefortia argentea*) in 2008 than in 1999, and old dead trees were observed, possibly due to too much frigate bird guano and some erosion of shoreline along the southeast.

Areas under newly downed ironwoods along the north western shore appeared to have less alena than in 1999 and were now mostly comprised of sweet alyssum and scattered patches of bristly fox tail.

Spanish needles (*Bidens alba* var. *radiata*) was somewhat limited in the southwest part of Eastern Island and may be eradicable.

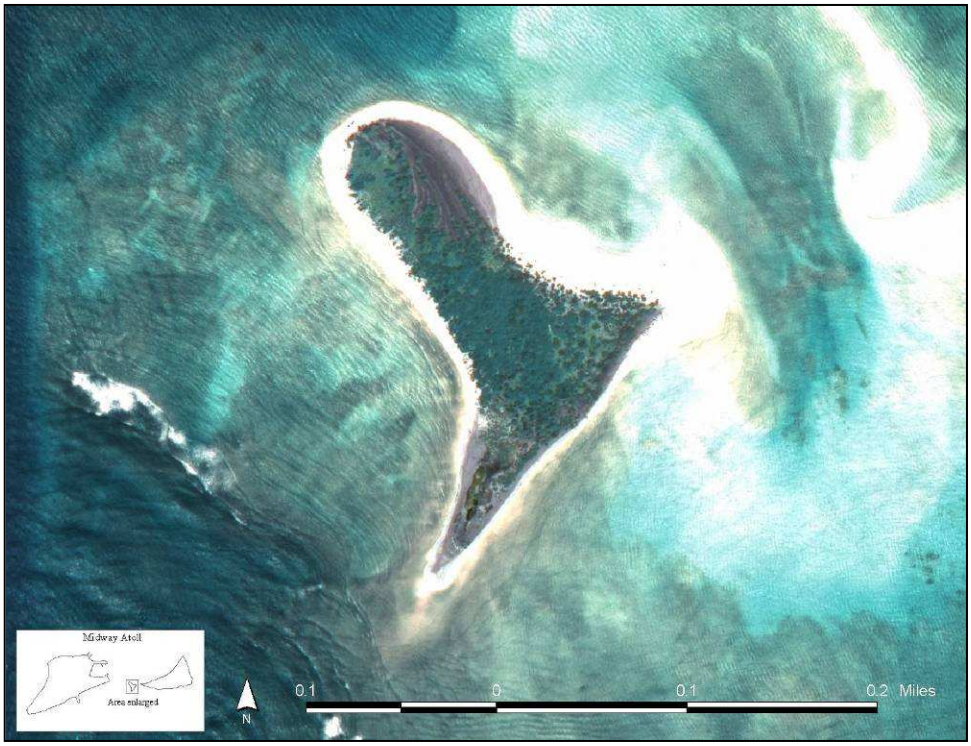
Sooty terns take flight over an abandoned runway on Eastern Island.

Black mustard (*Brassica nigra*) and *Verbesina* in close with naupaka in the distance.

Laysan albatross chicks in a field of nohu (*Tribulus cistoides*).

New duck seep fringed with makaloa (*Cyperus laevigatus*) and emoloa (*Eragrostis variabilis*).

SPIT ISLAND



Satellite image of Spit Island, Midway Atoll.

Spit Island is 14.8 acres in area. It is a small piece of coral rubble between Sand and Eastern Islands. One of the more interesting features on Spit Island is a unique saline lake on the southern tip. In recent times Spit Island had been composed of multiple islands. 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 of these trees were still present in 1999 the island was quickly revegetating and by 2008 the island was heavily vegetated to the point of becoming almost impenetrable.

A half day survey was conducted on Spit Island on June 3, 2008. We were accompanied by Greg Schubert and Pete Leary who took GPS points for significant weeds and controlled those found in small numbers.

26 species were found, 11 (42%) native, and 15 (58%) non-native. One grass was collected, dropseed (*Sporobolus pyramidatus*), which was previously not known from the island and was still limited to a few clumps on the north tip of the island.

The island was predominantly a ring of tree heliotrope (*Tournefortia argentea*) and naupaka (*Scaevola taccada*) on the coastal edges, extending inland, with akulikuli (*Sesuvium portulacastrum*) and button sedge (*Fimbristylis cymosa*) dominating the areas around the pond on the southern tip. The northern portion was a mix of natives, such as akulikuli, nohu (*Tribulus cistoides*), popolo (*Solanum nelsonii*), alena (*Boerhavia*

repens), and *Lepturus repens*, which also occurred nearest the ocean along the eastern coast, and non-natives, such as fingergrass (*Eustachys petraea*), sweet alyssum (*Lobularia maritima*), saltmarsh sand spurry (*Spergularia marina*), and golden crown-beard (*Verbesina encelioides*), which was also found in small patches in other parts of the island, all of which were pulled. A few small ironwood (*Casuarina equisetifolia*) seedlings and a small patch of beggartick (*Bidens alba* var. *radiata*) were also found and pulled. It appeared that sea grape (*Coccoloba uvifera*) had been previously controlled, as a small dead tree was found on the south tip.

Of note was the abundance of native popolo (*Solanum nelsonii*), previously known in 1999 from only a few plants near the northeast part of the island. There were now dozens of plants and the distribution extended inland and towards the central part of the island. There were also some out-planted popolo on the southern part of the island, along with aweoweo. There has also been a fair amount of emoloa out-planted throughout the island, which is doing well. Maia pilo (*Capparis sandwichiana*) was apparently planted on Spit, but did not survive.

Akulikuli (*Sesuvium portulacastrum*) and *Tournefortia* line the saline pond.

EXISTING ERADICATION AND CONTROL TARGETS

Because of Midway's small size, remote location, single land owner, and clear mandate, there is a unique opportunity to eradicate, or remove all the known individuals, of a species. In the 1999 survey 23 invasive plant species were identified on Midway in limited numbers. These same species were mapped in 2008, making special effort to re-visit all the 1999 locations.

Of the 23 species mapped and identified for control in 1999:

Five were not observed in 2008, and are presumed eradicated

Mexican creeper	(*Antigonon leptopus*)
Sprangletop	(*Leptochloa uninervia*)
Natal red top	(*Melinis repens*)
Christmas berry	(*Schinus terebinthifolius*)
New Zealand spinach	(*Tetragonia tetragonioid*es)

Two had fewer locations

Agave	(*Agave sisalana*)
Guava	(*Psidium guajava*)

Six had about the same number of locations

Black mustard	(*Brassica nigra*)
Longleaf ironwood	(*Casuarina glauca*)
Sandbur	(*Cenchrus echinatus*)
Octopus tree	(*Schefflera actinophylla*)
African tulip	(*Spathodea campanulata*)
Castor bean	(*Ricinus communis*)

Ten had more locations

Hoary abutilon	(*Abutilon grandifolium*)
Buffel grass	(*Cenchrus ciliaris*)
Ivy gourd	(*Coccinia grandis*)
Umbrella sedge	(*Cyperus involucratus*)
Sourgrass	(*Digitaria insularis*)
Chinese banyan	(*Ficus microcarpa*)
Lantana	(*Lantana camara*)
Haole koa	(*Leucaena leucocephala*)
Guinea grass	(*Panicum maximum*)
Sourbush	(*Pluchea carolinensis*)

Additionally, two species present but not mapped in 1999 were also eradicated.

Button mangrove	(*Conocarpus erectus*)
California grass	(*Urochloa mutica*)

MORE POTENTIAL ERADICATION AND CONTROL TARGETS

Though some species have thwarted control efforts, there were some successful eradications between 1999 and 2008, proving eradications are possible on Midway. The following list includes species that have histories of invasiveness and existed in limited numbers on Midway in 2008. Many of these consisted of a single plant, such as Surinam cherry (*Eugenia uniflora*), and Manila tamarind (*Pithecellobium dulce*), and should be relatively easy to get rid of. Others were a bit more established, such as klu (*Acacia farnesiana*) and golden pothos (*Epipremnum pinnatum*), but are still occupying just a fraction of their potential range on Midway. Each of these species is written up in the annotated checklist and has a map showing all known locations.

Additional species to add to potential control list

Klu	(*Acacia farnesiana*)
Asparagus fern	(*Asparagus densiflorus*)
Kamani	(*Calophyllum inophyllum*)
Night blooming jasmine	(*Cestrum nocturnum*)
Golden pothos	(*Epipremnum pinnatum*)
Cup grass	(*Eriochloa* sp.)
Surinam cherry	(*Eugenia uniflora*)
Moreton Bay fig	(*Ficus macrophylla*)
Chandelier plant	(*Kalanchoe tubiflora*)
Air plant	(*Kalanchoe pinnata*)
Creeping indigo	(*Indigofera hendecaphylla*)
swamp cabbage	(*Ipomoea aquatica*)
Bitter melon	(*Momordica charantia*)
Madagascar olive	(*Noronhia emarginata*)
African olive	(O*lea europaea* subsp. *cuspidata*)
Passion Vine	(*Passiflora edulis*)
Manila tamarind	(*Pithecellobium dulce*)
Turkeyberry	(S*olanum torvum*)
Nephthytis	(*Syngonium podophyllum*)
Tree vitex	(*Vitex trifolia*)
Jujube	(*Ziziphus* sp.)

GLOBAL COMPENDIUM OF WEEDS

This table includes plants present or recently present on Midway Atoll with ten or more references as an environmental weed in the Global Compendium of Weeds (GCW), hear.org/gcw. The GCW has been compiled from worldwide reference sources by Rod Randall of the Western Australia Department of Agriculture. Each species is scored based on the number of worldwide GCW references to it being a weed. Generally, the higher the score, the greater the potential for a species to be a weed. This list overlaps well with the species suggested for removal from Midway.

Species	GCW	Common name	Family
Schinus terebinthifolius	30	Christmas berry	Anacardiaceae
Lantana camara	28	Lantana	Verbenaceae
Ricinus communis	24	Castor bean	Euphorbiaceae
Psidium guajava	23	Guava	Myrtaceae
Leucaena leucocephala	20	Koa haole	Fabaceae
Casuarina equisetifolia	18	Ironwood	Casuarinaceae
Schefflera actinophylla	18	Octopus tree	Araliaceae
Spathodea campanulata	18	African tulip tree	Bignoniaceae
Cynodon dactylon	17	Bermuda grass	Poaceae
Passiflora edulis	16	Lilikoi	Passifloraceae
Stenotaphrum secundatum	16	St. Augustine grass	Poaceae
Andropogon virginicus	14	Broomsedge	Poaceae
Asparagus densiflorus	14	Asparagus fern	Liliaceae
Ipomoea aquatica	14	Swamp cabbage	Convolvulaceae
Eugenia uniflora	13	Surinam cherry	Myrtaceae
Olea europaea	13	African olive	Oleaceae
Albizia lebbeck	12	Siris tree	Fabaceae
Antigonon leptopus	12	Mexican creeper	Polygonaceae
Urochloa mutica	12	California grass	Poaceae
Ficus microcarpa	12	Chinese banyan	Moraceae
Plantago lanceolata	12	Narrow leaved plantain	Plantaginaceae
Poa annua	12	Blue grass	Poaceae
Sonchus oleraceus	12	Sow thistle	Asteraceae
Acacia farnesiana	11	Klu	Fabaceae
Agave sisalana	11	Sisal	Agavaceae
Bidens pilosa	11	Spanish needle	Asteraceae
Casuarina glauca	11	Longleaf ironwood	Casuarinaceae
Coccinia grandis	11	Ivy gourd	Cucurbitaceae
Morus alba	11	White mulberry	Moraceae
Cenchrus echinatus	10	Sand bur	Poaceae
Cestrum nocturnum	10	Night cestrum	Solanaceae
Panicum maximum	10	Guinea grass	Poaceae
Paspalum urvillei	10	Vasey grass	Poaceae
Polypogon monspeliensis	10	Rabbitfoot grass	Poaceae
Solanum torvum	10	Turkey berry	Solanaceae

MORE DETAIL

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

- **Appendix A: Annotated checklist of plants known from Midway**: A paragraph is included for each plant, with the plant's name, a picture if available, and historical and current botanical information. There are also a couple maps with location names.

- **Appendix B: Checklist of plants known from Midway**: A spreadsheet lists plants found on Midway, relative abundance (rare, occasional, common, or dominant) for each island within the atoll, historical information, collection data, status on Midway (cultivated or naturalized), and status in the Hawaiian Islands (native or alien).

- **Appendix C: Maps of selected species on Midway**: Distribution maps are provided for selected species showing 2008 distribution and, when available, 1999 distribution. Emphasis is on incipient invasive non-native species and rare native plants.

FUTURE SURVEYS

Some individuals on-island expressed interest in having us to come back every six months to check on progress and look for new species. Others suggested that perhaps a botanical survey every three years or so would suffice. Given the dramatic changes over the nine years between the 1999 and 2008 surveys, and the proven ability for some non-native species to get strong footholds during that period, it makes sense to have plant surveys done on some sort of regular schedule by on-island refuge staff, supplemented by occasional surveys by plant professionals. Twice-annual surveys would be the most proactive schedule, but a thorough plant survey every three years or so may be a more realistic goal. It would also be good to do surveys when there are major changes in management style or personnel. Surveys done in seasons other than late spring / early summer would also be beneficial.

ACKNOWLEDGEMENTS

We are grateful to the following people who helped make this report possible. Jason Hanley helped secure funding through the FWS Invasive Species program. On-island support was provided by the FWS, especially John Klavitter, Leona Laniawe, Greg Schubert, Pete Leary, Matt Brown, Barry Christenson, and Murray. On-island support was also made possible by Chugach, especially Chavengsak Phosri (Sak) and Thawal Sonchar (Tawan) who provided information on Thai plants and showed us their gardens, and Darlene who helped us with logistics. Alex Lau at Bishop Museum and Bob Hobdy helped us with plant identifications. Thanks also goes out to all the administrative support personnel at PCSU and USGS.

APPENDIX A: ANNOTATED CHECKLIST OF VASCULAR PLANTS KNOWN FROM MIDWAY ATOLL

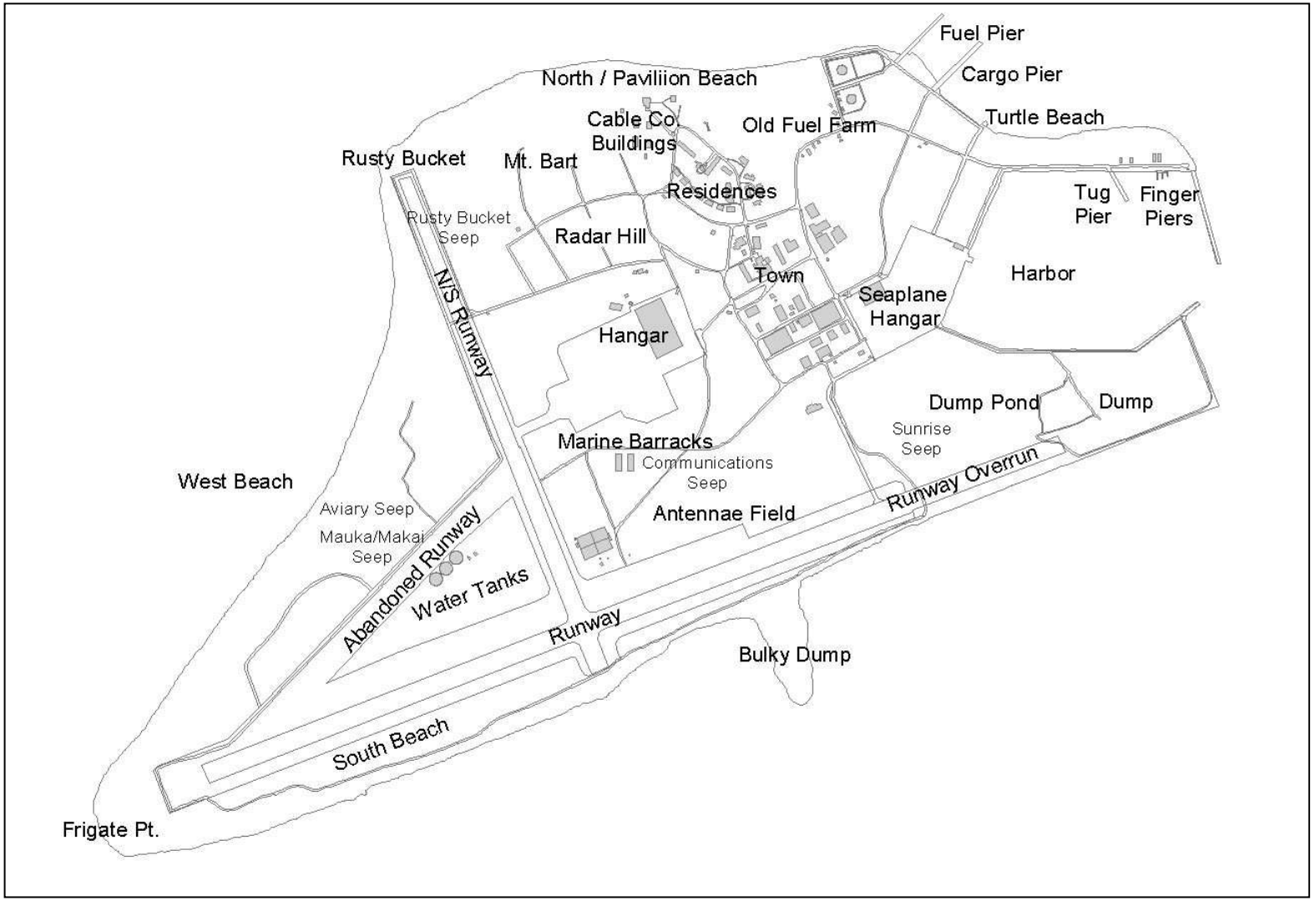
The following annotated checklist includes detailed information on all of the vascular plants known from Midway Atoll, Hawaii. This annotated checklist is a product of a botanical survey done by Forest Starr & Kim Starr from May 31, 2008 through June 14, 2008.

Wagner et al. (1999), Staples et al. (2005), and Imada et al. (2005) was used as the source for nomenclature, distribution, and status in Hawaii. Palmer (2003), Valier (1995), and Wilson (1996) were used for fern descriptions. Neal (1965) was also used, especially for information on cultivated species. Information specific to distribution on Midway was gathered from previous botanical surveys, including our survey in 1999, specimens at Bishop Museum, and from literature searches.

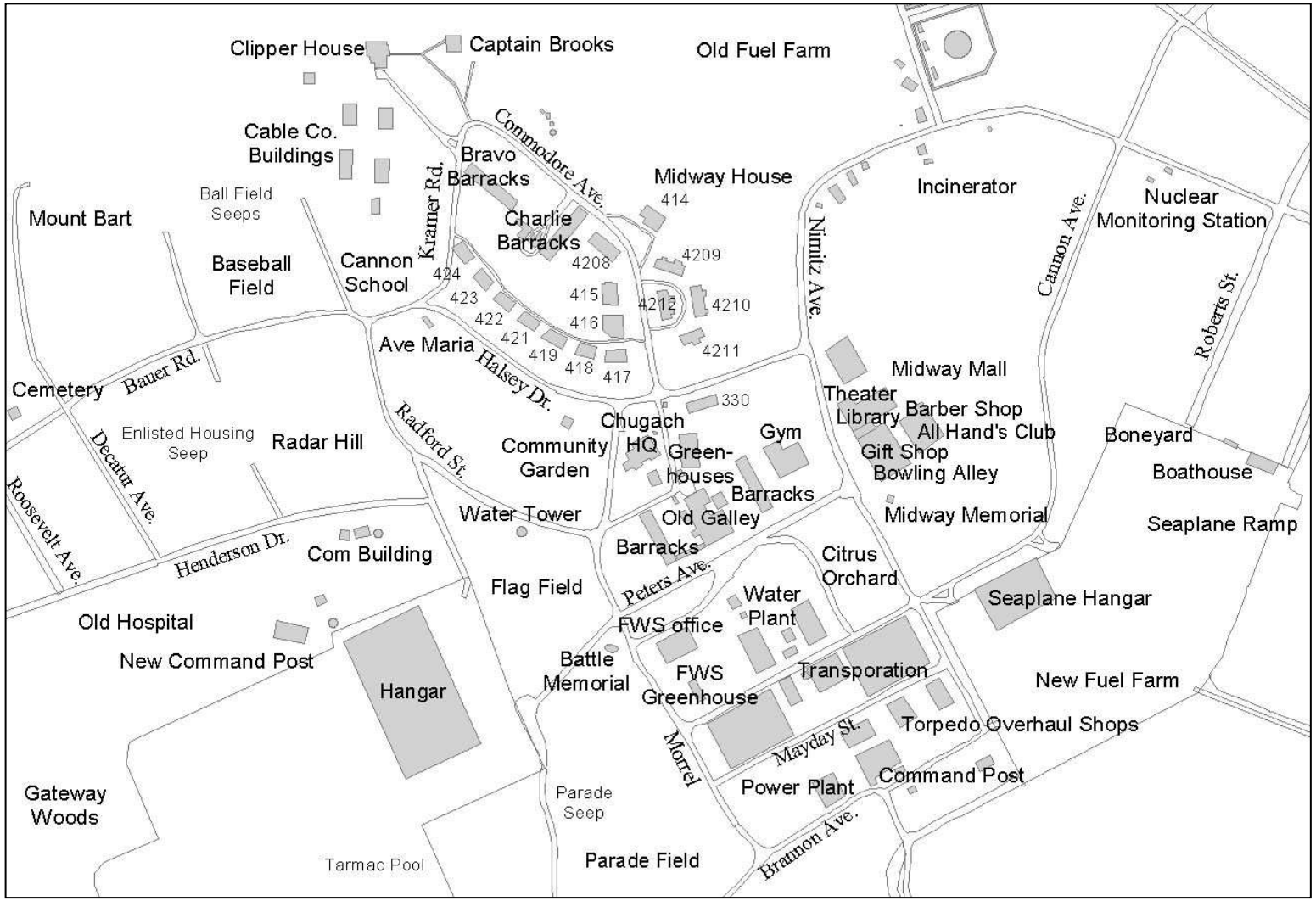
Included here in the following order are pteridophytes, gymnosperms, monocotyledons and dicotyledons. These are further broken down (in alphabetical order) by family name then by scientific name. A thumbnail image is given for each species. The scientific name is followed by a common and/or Hawaiian name. The status of the plant on Midway Atoll at the time of the survey is in parenthesis and is abbreviated as follows. Cultivated species are denoted as (cult). Naturalized species are denoted as (nat). Native species which are indigenous to the Hawaiian Islands are denoted as (ind). Native species which are endemic to the Hawaiian Islands are denoted as (end). Extinct species are denoted as (ex). Unknowns are denoted as (?).

Synonyms used in previous surveys of Midway Atoll are listed first. The next information included in the species account is place of origin, general distribution in the world, and distribution in Hawaii. This information is then followed by previous records of the species from Midway Atoll, beginning with the notes from the earliest records, ending with the notes from this survey (the most recent records). Cultivated species that were previously not recorded before this survey are denoted as "New cultivated record to Midway Atoll". Naturalized species that were previously not recorded before this survey denoted as "New island record to Midway Atoll" and are listed with a collection number and the publication source. Most of the new naturalized records were published in the *Bishop Museum Occasional Papers*. If the species was not published, it is noted as such. Lastly, any miscellaneous notes are listed. A couple of maps with location names are included to help folks unfamiliar with Midway.

This report and other information about the plants of Midway Atoll can be found at (www.hear.org/starr).



Map of location names on Sand Island, Midway Atoll.



Map of location names in the Town area of Sand Island, Midway Atoll.

PTERIDOPHYTES (Ferns and fern allies)

DICKSONIACEAE (Tree fern family)

***Cibotium sp*. -- Hawaiian tree fern, hapuu -- (cult)**

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 in the 1995 (Bruegmann 1998), 1999 (Starr and Martz 1999), or 2008 botanical surveys. Midway is probably too dry for hapuu to do well.

NEPHROLEPIDACEAE (Sword fern family)

***Nephrolepis hirsutula* (G. Forst) C. Presl 'Superba' -- Scaly sword fern -- (cult)**

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* (Roxb.) F.M. Jarrett ex C.V. Morton -- Sword fern -- (cult)**

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.

POLYPODIACEAE (Common fern family)

***Phymatosorus grossus* (Langsd. and Fisch.) Brownlie -- Lauae -- (cult)**

Also known as *Phymatosorus scolopendria* (J. Burm.) Ching. 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 was not observed in the 1995 (Bruegmann 1998), 1999 (Starr and Martz 1999), or 2008 botanical surveys.

PSILOTACEAE (Psilotum family)

***Psilotum nudum* (L.) P. Beauv. -- Moa -- (ind)**

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 Atoll since then.

GYMNOSPERMS (Conifers and cycads)

ARAUCARIACEAE (Araucaria family)

***Araucaria heterophylla* (Salisb.) Franco -- Norfolk Island pine -- (cult)**

Also known as *Araucaria excelsa* R. Br. Native to Norfolk Island (Neal 1965), and cultivated in Hawaii, Neff and Dumont (1955) 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 (Starr and Martz 1999) the trees were quite large, occurring in the same localities described by Neff and DuMont (1955). 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, as we have a hard time distinguishing between *A. heterophyll*a and *A. columnaris*.

CUPRESSACEAE (Cypress family)

Unknown Cupressaceae -- Cypress tree -- (cult)
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.

***Juniperus bermudiana* L. -- Bermuda juniper -- (cult)**

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 made from both trees (*Starr and Starr 080604-02, 080610-03* BISH) to further document the presence of this enigmatic conifer on Midway and to help pin down the identity.

CYCADACEAE (Cycad family)

***Cycas circinalis* L. -- Sago palm, cycad -- (cult)**

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 presenceof this species on Midway.

***Cycas revoluta* Thunb. -- Sago palm -- (cult)**

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 known from Midway (Herbst and Wagner 1992), but was not observed in 1995 (Bruegmann 1998), 1999 (Starr and Martz 1999), or 2008.

MONOCOTYLEDONS (Monocots)

AGAVACEAE (Agave family)

***Agave attenuata* Salm-Dyck. -- Agave -- (cult)**

Native to Central Mexico (Brickell and Zuk 1997), and cultivated in Hawaii, this soft, succulent, cactus-like plant was found to be cultivated in the residential area of Sand Island in 1999 (Starr and Martz 1999). This observation represented a new cultivated record for Midway Atoll. The plants were still on Midway in 2008 in the planters at the Midway House.

***Agave sisalana* Perrine -- Sisal, sisal hemp -- (nat)**

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 (Starr and Martz 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. 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.

***Cordyline fruticosa* (L.) A. Chev. -- Ti -- (cult)**

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. Collection were made (*Starr and Starr 080607-13, 080607-20* BISH) to document the presence on Midway.

***Cordyline* sp. -- (cult)**

Reported from Midway by Herbst and Wagner (1992). The only *Cordyline* species recorded from Midway is *C. fruticosa*.

***Dracaena fragrans* (L.) Ker-Gawl. -- Fragrant dracaena -- (cult)**

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.

***Dracaena marginata* Lam. -- Money tree -- (cult)**

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.

***Dracaena* sp. -- (cult)**

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. In 1999 (Starr and Martz 1999) an unidentified variety of *Dracaena* which has smaller leaves packed closely together, dubbed 'pineapple' dracaena, was observed in the hangar

entrance on Sand Island, perhaps this was *D. reflexa*. It was not observed in 2008.

***Sanseviera trifasciata* Prain. -- Mother in law tongue, snake plant -- (cult, nat)**

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.

ALOEACEAE (Aloe family)

***Aloe vera* (L.) Burm. -- Aloe -- (cult)**

Also known as *Aloe barbadensis* Mill. 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.

***Unknown* sp. -- (cult)**

In 1999 an unidentified succulent plant with spines similar to *Agave* or *Aloe aristata* was observed in the residential area of Sand Island. The determination still needs to be made, but this is probably a new cultivated record for Midway Atoll as nothing similar to this plant has been previously recorded from the atoll.

ARACEAE (Taro family)

***Alocasia cucullata* (Lour.) Schott -- Chinese taro -- (cult)**

From India (Neal 1965), this plant was recorded from Midway by Apfelbaum et al. (1983), but has not been seen before or since. We did not observe this species in 1999.

***Alocasia macrorrhiza* (L.) Schott -- Ape -- (nat)**

Occurring from India and Sri Lanka through southeastern Asia to Polynesia, cultivated widely in the tropics and used as a famine food in some areas (Wagner et al. 1999). In Hawaii, cultivated and now naturalized in low elevation mesic valleys, primarily along streams or in other wet sites (Wagner et al. 1999). This species was noted from Midway in 1999 (Starr and Martz 1999), but was a misidentification, and should have been *Xanthosoma robustum*. Photo by: Eric Guinther (Wikipedia 2008).

***Anthurium andraeanum* Lind. -- Anthurium -- (cult)**

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, including this one.

***Caladium bicolor* (Aiton) Vent. -- Caladium -- (cult)**

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.

***Colocasia esculenta* (L.) Schott -- Taro -- (cult)**

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 in 1999 (Starr and Martz 1999) or 2008.

***Dieffenbachia* sp. -- Dumb cane -- (cult)**

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 2008.

***Epipremnum pinnatum* (L.) -- Golden pothos, taro vine -- (cult)**

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 wouldnl't hurt to get rid of this species from Midway, given it's propensity to climb on and destroy buildings.

***Monstera deliciosa* Liebm. -- Monstera -- (cult)**

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 even 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.

***Philodendron* sp. -- Philodendron -- (cult)**

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 in 1999.

***Syngonium podophyllum* Schott -- Syngonium -- (cult)**

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 it's habit of climbing on structures.

***Xanthosoma* sp. -- Ape -- (cult)**

Native to tropical America and West Indies (Neal 1965), the tubers of this plant are used as food in native regions, and in Hawaii are cultivated mainly for ornament (Neal 1965). Noted by Apfelbaum et al. (1983). Not observed since.

***Xanthosoma robustum* -- Ape -- (cult)**

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 documented from Midway in 1999 (Starr and Martz 1999) where it was observed persisting in gardens and near the galley. In 2008 this plant was again found persisting in the gardens of the residence and on the west side of the recently abandoned galley. Collected (*Starr and Starr 080607-19* BISH) to document the presence on Midway. This is a very resilient plant. Be careful of moving soil from areas where this plant is, as any root fragments can regrow. It would be good to try and get rid of on Midway before it has a chance to spread.

ARECACEAE (Palm family)

***Cocos nucifera* L. -- Coconut -- (cult)**

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.

***Phoenix sp.* -- Date palm -- (cult)**

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 were observed by us in 1999 (Starr and Martz 1999) or 2008.

***Pritchardia sp.* -- Loulu -- (cult)**

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. It is not known which species of *Pritchardia* these palms may be. However we did see a reference in FWS files to *P. hillebrandii*.

***Roystonea* sp. -- Royal palm -- (cult)**

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.

***Veitchia merrillii* (Becc.) H. E. Moore -- Manila palm - (cult)**

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 represented 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.

BROMELIACEAE (Bromeliad family)

***Ananas comosus* (L.) Merr. -- Pineapple -- (cult)**

Native to tropical America and cultivated in Hawaii for its fruits (Neal 1965). Previously not recorded from Midway Atoll, 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.

CANNACEAE (Canna family)

***Canna indica* L. -- Canna -- (cult)**

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 looking at images from that survey, it now seems that *C. x generalis* is the canna on Midway.

***Canna x generalis* -- Garden canna -- (cult)**

Canna indica was hybridized and backcrossed with other Canna species, including *Canna flaccida*, a North American native, leading to hybirds and numerous cultivars that are now generally known as *Canna* x *generalis* (Floridata 2008). Based on review of images from 1999 (Starr and Martz 1999), it appears *C.* x *generalis* may have mistaken for *C. indica*. 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.

COMMELINACEAE (Spiderwort family)

***Commelina diffusa* N.L. Burm. -- Honohono -- (nat)**

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.

***Dichorisandra thyrsiflora* Mikan. -- Blue ginger -- (cult)**

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.

***Tradescantia pallida* (Rose) D. Hunt -- Day flower, purple heart -- (cult)**

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.

***Tradescantia spathacea* Sw. -- Oyster plant, Moses-in-the-cradle -- (cult)**

Also known as *Rhoeo spathacea* (Sw.) Stearn. 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.

***Tradescantia zebrina* Bosse -- Wandering jew -- (cult)**

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 in 2008.

CYPERACEAE (Sedge family)

***Cyperus involucratus* Rottb. -- Umbrella sedge -- (nat)**

Also known as *C. alternifolius* L. 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.

***Cyperus javanicus* Houtt. -- Ahu awa -- (ind)**

Also known as *Mariscus javanicus* (Houtt.) Merr. and Metcalfe. 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). Not observed in 1999 (Starr and Martz 1999) or in 2008.

***Cyperus laevigatus* -- Makaloa -- (ind / nat)**

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 furtherst 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.

***Cyperus papyrus* L. -- Papyrus -- (cult)**

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 perhaps Apfelbaum called the large sedge on Midway this species rather than *C. involucratus*.

Cyperus pennatiformis **Kük. var. *bryanii* Kük. -- Cyperus --- (end)**

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.

Cyperus polystachyos **Rottb. -- Sedge -- (ind)**

Also known as *Pycreus polystachyos* (Rottb.) P. Beauv. 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.

Cyperus rotundus **L. -- Nutgrass, purple nut sedge -- (nat)**

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 (Starr and Martz 1999) 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. In 2008 this hardy sedge was found in areas that received moderate levels of disturbance, especially in lawns in the town area.

***Fimbristylis cymosa* R. Br. -- Button sedge, mauu aki aki -- (ind)**

Also known as *F. c.* R. Br. ssp. *spathacea*, *F. c.* R. Br. ssp. *umbellata-capitata*, *F. pycnocephala* Hillebr. 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.

LILIACEAE (Lily family)

***Allium cepa* L. -- Onion -- (cult)**

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 or 2008.

***Allium fistulosum* L. -- Green onion -- (cult)**

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.

***Allium porrum* L. -- Leek -- (cult)**

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.

***Allium sativum* L. -- Garlic -- (cult)**

Cultivated in Hawaii. Observed to be cultivated in the residential area of Sand Island, Midway, in 1999. Not observed in 2008.

***Allium schoenoprasum* L. -- Chive -- (cult)**

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 (*Starr and Martz 990429-1* BISH) to document the presence on Midway.toll. Not observed in 2008.

***Allium tuberosum* Rottler ex Sprengel -- Garlic Chive -- (cult)**

A fast growing herb that spreads by rhizomes and self seeding, grown for it's 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 becuase 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.

***Asparagus densiflorus* (Kunth) Jessop -- Asparagus fern -- (cult)**

Also known as *Asparagus myriocladus* J.G. Baker. Spraling 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.

***Asparagus plumosus* J.G. Baker -- Asparagus fern -- (cult)**

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).

***Chlorophytum comosum* (Thunb.) -- Spider or bracket plant -- (cult)**

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.

***Crinum asiaticum* L. -- Crinum lily, spider lily -- (cult)**

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.

***Hemerocallis* sp. -- Day lily -- (cult)**

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 in 1999 (Starr and Martz 1999) or 2008.

***Hippeastrum* sp. -- Amaryllis -- (cult)**

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 in 1999 (Starr and Martz 1999) or 2008.

***Pancratium littorale* -- Spider lily -- (cult)**

Native to southern Europe and cultivated in Hawaii (Neal 1965). On Midway, previously known from literature (Herbst and Wagner 1992). Not observed in 1999 (Starr and Martz 1999) or 2008.

MUSACEAE (Banana family)

***Heliconia psittacorum* L. fil. -- Heliconia -- (cult)**

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 in 1999 (Starr and Martz 1999) or 2008

***Musa* x *paradisiaca* L. -- Banana -- (cult)**

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 didn't seem particularly exceptional, mostly an odd blue-ish 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.

***Strelitzia reginae* Banks -- Bird of paradise -- (cult)**

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 in 2008.

ORCHIDACEAE (Orchid family)

Unknown orchidaceae **-- Unknown orchids -- (cult)**

Recorded from Midway in 1979 (Apfelbaum et al. 1983). Not observed in 1999 (Starr and Martz 1999). In 2008 one unknown orchid observed growing in a coconut husk on the side of a *Schefflera actinophylla* tree at 4208 Commodore Ave.

Vanda **sp. -- Vanda orchid -- (cult)**

Recorded from Midway in 1979 (Apfelbaum et al. 1983). Not observed in 1999 (Starr and Martz 1999) or 2008.

PANDANACEAE (Screwpine family)

Pandanus amaryllifolius **Roxb. -- Tea pandanus, pandan, bai toey -- (cult)**

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). 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.

Pandanus tectorius **S. Parkinson ex Z. -- Hala, screwpine -- (cult)**

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 east of the Aviary Seep. Collected from plants near Midway Memorial (*Starr and Starr 080611-02* BISH) to document presence on Midway.

POACEAE [GRAMINAE] (Grass family)

***Ammophila arenaria* (L.) Link -- European beach grass, San Francisco grass -- (nat)**

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).

***Andropogon virginicus* L. -- Broomsedge, yellow bluestem -- (nat)**

Native to eastern North America (Wagner et al. 1999). A Hawaii State Noxious Weed. In Hawaii, common along roadsides and dry disturbed areas. Wagner et al. (1990) cite the distribution as Oahu and Hawaii. Also now naturalized on Kauai (Imada et al. 2000), Oahu, Lanai (Herbarium Pacificum Staff 1999), Molokai (Hughes 1995), E. Maui (Hughes 1995), W. Maui (Oppenheimer et al. 1999), and Hawaii ((Imada et al. 2000). On Midway, first collected in 1979 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.

***Bothriochloa pertusa* (L.) A. Camus -- Pitted beard grass -- (nat)**

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.

***Bromus catharticus* Vahl -- Prairie grass -- (nat)**

Also known as *B. willdenowii* Kunth, *B. unioloides* Raspail. 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.

***Cenchrus agrimonioides* var. *laysanensis* F. Brown -- Kamanomano -- (end, Ex)**

Also known as *C. calyculatus* Cav var. uniflorus Hillebr. 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 then. It is probably extinct on Midway. This variety of grass is also presumed extinct throughout it's entire range. However, there is another variety, *C. a. agrimonioides* that though endangered, it 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 apparently is fertile.

***Cenchrus ciliaris* L. -- Buffel grass -- (nat)**

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.)

***Cenchrus echinatus* L. -- Sand bur -- (nat)**

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.

***Chloris barbata* (L.) Sw. -- Swollen finger grass -- (nat)**

Also known as *C. inflata* Link. 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 coumpound. 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.

***Chloris divaricata* R. Br. -- Star grass -- (nat)**
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.

***Chloris virgata* Sw. -- Feather finger grass -- (nat)**

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.

***Cymbopogon citratus* (DC) Stapf -- Lemon grass -- (cult)**

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.

***Cynodon dactylon* (L.) Pers -- Bermuda grass -- (nat)**

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 Shallenberg 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, and anecdotally it appears there may be less burrows per unit area in Bermuda Grass dominated areas.

***Dactyloctenium aegyptium* (L.) Willd. -- Beach wiregrass -- (nat)**

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.

***Digitaria ciliaris* (Retz.) Koeler -- Henry's crab grass -- (nat)**

Also known as *D. sanguinalis* sensu Hawaiian botanists, non (L.) Scop. 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.

***Digitaria insularis* (L.) Mez ex Ekman -- Sour grass -- (nat)**

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.

***Echinochloa crus-galli* (L.) P. Beauv. -- Barnyard grass -- (nat)**

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 in 2008.

***Eleusine indica* (L.) Gaertn. -- Goose grass, wire grass -- (nat)**

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.

***Eragrostis amabilis* (L.) Wight and Arnott -- Love grass -- (nat)**

Also known as *Eragrostis tenella* (L.) P. Beauv. ex Roem. and Schult. 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.

***Eragrostis paupera* Jedwabn. -- Eragrostis -- (ind)**

Also known as *E. falcata* sensu Hawaiian botanists, non (Gaud.) Gaud; *E. whitneyi* Fosb.; *E. w.* var. *caumii* Fosb. 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. 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.

***Eragrostis variabilis* (Gaud.) Steud. -- Emoloa, Kawelu -- (end)**

Also known as *E. cynosuroides* Retz. 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* (Retz.). 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 out-planted en-mass 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.

***Eriochloa sp.* -- Cupgrass -- (nat)**

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.)

***Eustachys petraea* (Sw.) Desv. -- Finger grass -- (nat)**

Also known as *Chloris petraea* Sw. 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.

***Hordeum murinum* Huds. subsp. *leporinum* (Link) Arcang -- Barley -- (nat)**

Also known as *Hordeum leporinum* Link. *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 by other botanists since. Photo by: Rasbak (Wikipedia 2008).

***Leptochloa uninervia* (K. Presl) Hitchc. and Chase -- Sprangletop -- (nat)**

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. During 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 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.

***Lepturus repens* (G. Forster) R. Br. -- Lepturus -- (ind)**

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 island, 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 islands, growing closer than any other species to the ocean.

***Melinis repens* (Willd.) Zizka -- Natal red top -- (nat)**

Also known as *Rhynchelytrum repens* (Willd.) Hubbard, *R. roseum* Stapf and Hubbard ex Bews, *Tricholaena rosea* Nees, *T. repens* (Willd.) Hitchc. 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.

Oryza sp. -- Rice -- (cult)

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.

***Panicum maximum* Jacq. -- Guinea grass -- (nat)**

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.

***Paspalum setaceum* Michx. -- Paspalum -- (nat)**

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.

***Paspalum urvillei* Steud. -- Vasey grass -- (nat)**

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.

***Poa annua* L. -- Annual blue grass -- (nat)**

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.

***Polypogon interruptus* Kunth -- Ditch polypogon -- (nat)**

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). 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. In 1999 (Starr and Martz 1999) found to be locally common on Sand Island, growing in moist areas around the fuel farm, dump pond, and runway overrun. Collected near the abandoned marine barracks on Sand Island (*Starr and Martz 990511-2, 990511-3* BISH). In 2008 this grass was found in moist areas, such as the old fuel farm containment basins and around the newly created duck seeps. We were unable to distinguish between *P. interruptus* and *P. monspeliensis*, and are placing our sightings in this species, as that is the name Bishop Museum gave for the specimens we collected.

***Polypogon monspeliensis* (L.) Desf. -- Rabbit foot grass -- (nat)**

Native to Europe; in Hawaii documented from Midway, Kauai, Oahu, Maui, and Hawaii (Wagner et al. 1999). Collected in 1945 by G. C. Munro from Midway 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 (Starr and Martz 1999) and 2008 we were unable to distinguish between *P. interruptus* and *P. monspeliensis*. We are attributing our sightings for this genus to *P. interruptus*, as that is the name Bishop Museum placed on the specimens we collected. Photo by: Malcolm Storey (http://www.bioimages.org.uk/html/P2/P28335.php).

***Setaria verticillata* (L.) P. Beauv. -- Bristly foxtail, mauu pilipili -- (nat)**

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.

***Sporobolus africanus* (Poir.) Robyns and Tournay -- African dropseed -- (nat)**

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 we were unable to distinguish between *S. africanus* and *S. indicus*. Based on previous collections, we lumped the species observations under *S. indicus*, until the true identities can be better determined. In 1999 observed as common on Sand Island. In 2008 locally common on Sand Island, especially on the margins of roads.

***Sporobolus indicus* (L.) R. Br. -- Indian dropseed -- (nat)**

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 both the 1999 (Starr and Martz 1999) and 2008 surveys we were unable to distinguish between *S. africanus* and *S. indicus*. Based on previous collections, we lumped the species observations under *S. indicus*, until the true identities can be better determined. In 2008 common in lawn areas throughout Sand Island. Not observed on Eastern or Spit Islands.

***Sporobolus pyramidatus* (Lam.) Hitchc. -- Sporobolus -- (nat)**

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.

***Sporobolus virginicus* (L.) Kunth -- Akiaki, beach dropseed -- (ind)**

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.

***Stenotaphrum secundatum* (Walter) Kuntze -- St. Augustine grass -- (nat)**

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.

***Urochloa mutica* (Forssk.) T. Q. Nguyen -- California grass, Para grass (nat)**

Previously known as *Brachiaria mutica* (Forssk.) Stapf and *Panicum purpurascens* Raddi. 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.

***Vulpia myuros* (L.) C.C. Gmelin -- Foxtail fescue -- (nat)**

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 in 1995 (Bruegmann 1998), 1999(Starr and Martz 1999), or 2008.

***Zea mays* L. -- Corn -- (cult)**

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.

ZINGIBERACEAE (Ginger family)

***Alpinia zerumbet* (Pers.) Burtt and R.M. Sm. -- Shell ginger -- (cult)**

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). Not observed in 1999 or 2008.

***Hedychium gardnerianum* Ker-Gawl -- Kahili ginger -- (cult)**

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.

***Unknown zingiber* -- Galang -- (cult)**

In 1999 (Starr and Martz 1999) an unknown ginger like plant was cultivated in 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. Species attributed with this common name that looked similar to the plant include *Alpinia galanga* and *A. officinarum*. Not observed before or since.

DICOTYLEDONS (Dicots)

ACANTHACEAE (Acanthus family)

***Asystasia gangetica* (L.) T. Anderson -- Chinese violet -- (nat)**

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.

***Odontonema strictum* (Nees) Kuntze -- Odontonema -- (cult)**

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.

***Ruellia brittoniana* E. Leonard -- Ruellia -- (nat)**

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.

AIZOACEAE (Carpetweed family)

***Sesuvium portulacastrum* (L.) L. -- Akulikuli, sea purslane -- (ind)**

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 pretty 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).

***Tetragonia tetragonioides* (Pall.) Kuntze -- New Zealand spinach -- (nat)**

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.

AMARANTHACEAE (Amaranth family)

Achyranthes atollensis **St. John -- Achyranthes -- (end, Ex)**

Also known as *Achyranthes splendens* var. *reflexa* Hillebr. 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 had seeds and could potentially provide an opportunity to bring this species back from extinction, though it is uncertain if the seeds are viable or not. 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. Not observed on Midway in 1999 (Starr and Martz 1999). Also not observed on Laysan or Pearl and Hermes Atoll (Seal-Kittery and Green Islands not checked) in 1999 (Starr and Martz 1999b). Not observed in 2008. Presumed extinct on Midway. The related *A. splendens* from the main Hawaiian Islands still persists.

Alternanthera tenella **Colla -- Joyweed -- (nat)**

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 was not observed in 1999 (Starr and Martz 1999) or 2008.

Amaranthus dubius **Mart. ex Thell. -- Pakai, Spleen amaranth -- (nat)**

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 was not observed in 1999 (Starr and Martz 1999) or 2008.

***Amaranthus hybridus* L. -- Green amaranth -- (nat)**

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 in 1995 (Bruegmann 1998), 1999 (Starr and Martz 1999) or 2008.

***Amaranthus lividus* ssp. *polygonoides* (Moq.) Probst -- Slender amaranth -- (nat)**

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 (Bruegmann 1999). Noted as rare on Sand Island in 1995. It was not observed in 1999 (Starr and Martz 1999) or 2008.

***Amaranthus spinosus* L. -- Spiny amaranth -- (nat)**

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 (Starr and Martz 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. In 2008 this spiny shrub was observed around the residential housing, especially near 416 Commodore Ave. and around the Medical Clinic.

***Amaranthus viridis* L. -- Slender amaranth -- (nat)**

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 (Starr and Martz 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. 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.

***Gomphrena globosa* L. -- Globe amaranth -- (cult)**

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 in 2008.

ANACARDIACEAE (Mango family)

***Mangifera indica* L. -- Mango -- (cult)**

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.

***Schinus terebinthifolius* Raddi -- Christmas berry -- (cult)**

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.

ANNONACEAE (Custard-apple family)

***Artabotrys hexapetalus* (L.f.) Bhandari-- Climbing ylang-ylang -- (cult)**

Climbing shrub with fragrant flowers native to the moist forests of Sri Lanka, southern India, Bangladesh, Myanmar, China, and Taiwan (GRIN). In Hawaii, known from the islands of Oahu, Maui, and Hawaii (Nagata 1995; Starr et al. 2003). First observed on Midway in 2008 in the yard of 4208 Commodore Ave. where a large plant appeared like it had been severly 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.

APIACEAE (Carrot family)

***Anethum graveolens* L. -- Dill -- (nat)**

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. Collected (*Starr and Starr 080608-06* BISH) to further document the presence of dill on Midway.

***Ciclospermum leptophyllum* (Pers.) Sprague -- Fine leaved celery -- (nat)**

Also known as *Apium tenuifolium* (Moench) Thell. 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.

***Coriandrum sativum* L. -- Cilantro, Chinese parsley (cult)**

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.

***Daucus carota* L. -- Carrot -- (cult)**

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 in 2008.

***Eryngium foetidum* L. -- Long coriander, Pak chi farang -- (cult)**

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.

***Petroselinum crispum* Nym. -- Parsley -- (cult)**

Native to the Mediterranean region (Neal 1965). Cultivated for flavoring food. First recorded from Midway in 1999 when is was collected (*Starr and Martz 990421-15* BISH) from cultivated material in the residential area of Sand Island. Not observed in 2008.

Unknown Apiaceae -- Unknown parsley-like plant -- (cult)

In 2008 an unkown Apiaceae was found in the planters at the Water Plant. It was collected (Starr and Starr 080608-04) to help with determination.

APOCYNACEAE (Periwinkle family)

***Allamanda cathartica* L. -- Allamanda -- (cult)**

Native to Brazil (Neal 1965). Cultivated in Hawaii. Previously known from literature (Herbst and Wagner 1992). Not observed in 1999 (Starr and Martz 1999) or 2008.

***Carissa macrocarpa* (Ecklon) A.L.P.P. de Candolle -- Natal plum -- (cult)**

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.

***Catharanthus roseus* (L.) G. Don -- Rosy periwinkle, Madagascar periwinkle -- (cult)**

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.

***Ervatamia* sp. -- Crape jasmine -- (cult)**

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.

***Nerium oleander* L. -- Oleander -- (cult)**

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.) 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.

***Plumeria obtusa* L. -- Singapore plumeria -- (cult)**

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.

***Plumeria rubra* L. -- Plumeria, frangipani -- (cult)**

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.

***Thevetia peruviana* (Pers.) K. Schum -- Be still tree -- (nat)**

Also known as *Cascabela thevetia* (L.) Lippold. 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 didn't appear to be any more cultivated plants in town.

ARALIACEAE (Ginseng family)

***Polyscias guilfoylei* (Bull) Bailey -- Panax -- (cult)**

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.

***Schefflera actinophylla* (Endl.) Harms -- Octopus tree -- (nat)**

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.

ASTERACEAE [COMPOSITAE] (Daisy family)

***Arctium lappa* L. -- Gobo, burdock -- (cult)**

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: Bogdan (Wikipedia 2008).

***Bidens alba* L. var. *radiata* (Schultz-Bip.) Ballard ex Melchert -- Spanish needles -- (nat)**

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* 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.

***Bidens pilosa* L. -- Spanish needles -- (nat)**

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." The *Bidens* on Midway are taxonomically challenging. See *B. alba* var. *radiata* for more.

***Calendula officinalis* L. -- English marigold -- (cult)**

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 in 2008.

***Calyptocarpus vialis* Less. -- Calyptocarpus -- (nat)**

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.

***Chrysanthemum* sp. -- Chrysanthemum -- (cult)**

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 in 2008.

***Conyza bonariensis* (L.) Cronq. -- Hairy horseweed - (nat)**

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.

***Conyza canadensis* (L.) Cronq. var. *pusilla* (Natt.) Cronq. -- Horseweed -- (nat)**

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.

***Coreopsis grandiflora* Nutt. -- Coreopsis -- (cult)**

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 in 2008. Photo by: Jose Luis Galvez (Wikipedia 2008).

***Coreopsis tinctoria* Nutt. -- Golden tickseed -- (cult)**

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).

***Cosmos bipinnatus* -- Cosmos -- (cult)**

Native to Mexico and cultivated in Hawaii (Neal 1965). Observed for the 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*).

***Cynara scolymus* -- Artichoke -- (cult)**

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).

***Gamochaeta purpurea* (L.) Cabr. -- Purple cudweed -- (nat)**

Also known as *Gnaphalium purpureum* L. 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. Not observed in 1999 (Starr and Martz 1999) or 2008. This species could easily be mistaken for the native enaena (*Psuedognaphalium*).

***Gynura* sp. -- Asian spinach -- (cult)**

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 few tentative identifications to species have been proposed for this plant, including *Gynura bicolor*, *G. nepalensis*, and *G. procumbens*. A collection was made (*Starr and Starr 080608-03* BISH) to further identify this species and to document it's presence on Mdiway Atoll.

***Helianthus annuus* L. -- Sunflower -- (cult)**

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). Not observed by other surveys since then. In 2008 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).

***Lactuca sativa* L. -- Lettuce -- (cult)**

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 garden was just getting revamped and planned to cultivate lettuce again.

***Pluchea* x *fosbergii* Cooperr. and Galang -- Hybrid pluchea -- (nat)**

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 in any other surveys, including 1999 (Starr and Martz 1999) and 2008.

***Pluchea indica* (L.) Less. -- Indian pluchea -- (nat)**

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 in any other surveys, including 1999 (Starr and Martz 1999) and 2008.

***Pluchea carolinensis* (Jacq.) G. Don -- Sour bush -- (nat)**

Also known as *P. symphytifolia* (Mill.) Gillis, *P. odorata* sensu auct., non (L.) Cass. Recent taxonomic name change from *P. symphytifolia* to *P. carolinensis* (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.

***Pseudognaphalium sandwicensium* Gaudich. Anderb. var. *sandwicensium*-- Enaena -- (end)**

Also known as *Gnaphalium sandwicensium* Gaud., *G. sandwicensis* f. *canum* Sherff. 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. *sandwicensensium* 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.

***Sonchus oleraceus* L. -- Sow thistle -- (nat)**

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.

***Sphagneticola trilobata* (L.) Pruski -- Wedelia -- (nat)**

Also known as *Wedelia trilobata* (L.) Hitchc. 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.

***Tagetes erecta* L. -- Marigold -- (cult)**

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 not filled with the native pohuehue.

***Tridax procumbens* L. -- Coat buttons -- (nat)**

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.

***Verbesina encelioides* (Cav.) Benth. and Hook. -- Golden crown beard -- (nat)**

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.

***Xanthium strumarium* var. *canadense* (Mill.) Torr. and A. Gray -- Cocklebur -- (nat)**

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.

***Zinnia violacea* Cav. -- Zinnia -- (cult)**

Cultivated plants were observed for the first time in 1999 (Starr and Martz 1999) in the residential area of Sand Island. Collected (*Starr and Martz 990505-2, 990421-8* BISH). Not observed before or since. Photo by: Howard F. Schwartz, Colorado State University, (Bugwood.org 2008).

BALSAMINACEAE (Impatiens family)

***Impatiens balsamina* L. -- Garden balsam, candlestick plant -- (cult)**

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).

BASELLACEAE (Basella family)

***Basella alba* L. -- Ceylon spinach, Malabar spinach -- (cult)**

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.).

BIGNONIACEAE (Bignonia family)

Spathodea campanulata **P. Beauv. -- African tulip tree -- (cult)**

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.

Tabebuia heterophylla **(DC.) Britt. -- Pink tecoma -- (cult)**

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.

BOMBACEAE (Baobab family)

Adansonia digitata **L. -- Baobab tree -- (cult)**

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. The Baobab tree was not observed by Neff and DuMont in 1954 and has not been seen since.

BORAGINACEAE (Heliotrope family)

Cordia sebestena **L. -- Kou haole -- (cult)**

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.

Heliotropium curassavicum **L. -- Seaside heliotrope, nenea -- (ind)**

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 in 2008.

Heliotropium procumbens **var.** ***depressum*** **(Cham.) Fosb. -- Heliotrope -- (nat)**

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.

Nama sandwicensis **A. Gray -- Nama -- (end)**

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.

***Tournefortia argentea* L. fil. -- Tree heliotrope -- (nat)**

Also known as *Messerschmidia argentea* (L. fil.) I.M. Johnst. 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*.

BRASSICACEAE (Mustard family)

***Brassica* spp. -- (cult)**

A genus made up of about 40 species, native mainly to the Mediterranean region, and grown as food in Hawaii and elsewhere (Neal 1965). *Brassica nigra* is a serious weed on Eastern Island, yet is not established on Sand or Spit Islands. Because so many vegetables in the genus *Brassica* are desireable, yet at times almost indistinguishable from the invasive *B. nigra*, care should be taken to not let cultivated *Brassica* go to seed on Sand Island. Growing *Brassica* in enclosed areas may also help provide another layer of protection. In 2008, in addition to the *Brassica* species mentioned below, there were some unidentified species of Brassica observed on Sand Island. A collection was made (*Starr and Starr 080608-02* BISH), but likely won't yield an ID as it was pretty scrappy.

Further attention to the unknown cultivated members of this group on Midway would seem wise. Additional images, better collections, and further interviews of folks growing the mystery plants are obvious next steps.

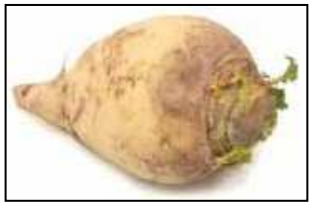
***Brassica campestris* var. *rapa* (L.) Hartm. -- Turnip -- (cult)**

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).

***Brassica campestris* L. var. *chinensis* (L.) W.D.J.Koch -- Pak-choi -- (cult)**

Previously called *Brassica napus* L. var. *chinensis* (L.) O.E. Schulz. 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).

***Brassica napus* var. *napobrassica* (L.) Reichenb. -- Rutabaga -- (cult)**



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).

***Brassica nigra* (L.) W. Koch -- Black mustard -- (nat)**

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. On Sand Island plants were found in vegetable gardens that looked very similar to *B. nigra*, but apparently didn't come from Eastern Island, 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 will likely not yield an exact identification. Similar plantings were found in the Community Greenhouse and the Barber Shop. Considering what *B. nigra* has done on Eastern Island, it would make sense to keep a close eye on an *Brassica*-like plants cultivated on Sand Island, and if possible not let them go to seed. Not observed on Spit.

***Brassica oleracea* L. var. *acephala* DC. -- Kale -- (cult)**

Kale is an edible vegetable that are 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 then. Photo by: Rasbak (Wikipedia 2008).

***Brassica oleracea* var. *botrytis* L. -- Broccoli, Cauliflower -- (cult)**

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.

***Brassica oleracea* var. *capitata* L. -- Cabbage -- (cult)**

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.

***Brassica oleracea* var. *gongylodes* L. -- Kohlrabi -- (cult)**

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 (Starr and Martz 1999) it was being cultivated in residential gardens on Sand

Island. Not observed in 2008. Photo by: C. Ford (Wikipedia 2008).

Capsella bursa-pastoris **(L.) Medik. -- Shepard's purse -- (nat)**

Also known as *Capsella rubella* Reut. 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.

Coronopus didymus **(L.) Sm. -- Swine cress -- (nat)**

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.

Lepidium bidentatum **var.** ***o-waihiense*** **(Cham. and Schlechtend.) -- Anaunau -- (end)**

Also known as *Lepidium o-waihiense* Montin. Two varieties 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.

***Lepidium virginicum* L. -- Pepper grass -- (nat)**

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.

***Lobularia maritima* L. Desv. -- Sweet alyssum -- (nat)**

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.

***Raphanus sativus* L. -- Radish -- (cult)**

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 in 2008.

CACTACEAE (Cactus family)

Epiphyllum oxypetalum **(DC.) -- Gooseneck cactus -- (nat)**

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 in 2008. Photo by: Samuel Wong (Wikipedia 2008).

Hylocereus undatus **(Haw.) Britton and Rose -- Night blooming cereus -- (cult)**

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 then.

Opuntia cochenillifera **(L.) Mill. -- Cochineal cactus -- (cult)**

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.

Unknown plant **-- (cult)**

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 in 2008.

CAPPARACEAE (Caper family)

***Capparis sandwichiana* DC -- Maia pilo, pua pilo -- (end)**

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.

CARICACEAE (Papaya family)

***Carica papaya* L. -- Papaya -- (cult)**

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 Miday 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 didn't 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.

CARYOPHYLLACEAE (Pink family)

***Cerastium fontanum* subsp. *triviale* (Link) Jalas -- Common mouse-ear chickweed -- (nat)**

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 in 2008.

***Dianthus caryophyllus* -- Pink carnation -- (cult)**

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 in 2008.

***Dianthus chinensis* L. -- Carnation -- (cult)**

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 in 2008.

***Sagina japonica* (Sw.) Ohwi -- Pearlwort -- (nat)**

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.

***Spergularia marina* (L.) Griseb. -- Saltmarsh sand spurry -- (nat)**

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.

***Stellaria media* (L.) Vill. -- Chickweed -- (nat)**

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) and 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). Not observed in 2008. Photo by: Hugo.arg (Wikipedia 2008).

CASUARINACEAE -- (Casuarina family)

Casuarina equisetifolia **L. -- Ironwood -- (nat)**

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 wasn't 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.

Casuarina glauca **Siebold ex Spreng. -- Longleaf ironwood -- (nat)**

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 it's longer leaves with more than ten teeth, suckering habit, and on some days the sound of the wind blowing through the canopy.

CHENOPODIACEAE -- (Goosefoot family)

Chenopodium murale **L. -- Goosefoot -- (nat)**

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.

Chenopodium oahuense **(Meyen) Aellen -- aweoweo -- (end)**

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.

***Spinacia oleracea* L. -- Spinach -- (cult)**

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. Photo by: Rasbak (Wikipedia 2008)

CLUSIACEAE (Mangosteen family)

***Calophyllum inophyllum* L. -- Kamani -- (cult)**

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.

***Clusia rosea* Jacq. -- Autograph tree -- (cult)**

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.

COMBRETACEAE (Indian almond family)

***Conocarpus erectus* L. -- Button mangrove -- (cult)**

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.).

***Terminalia catappa* L. -- False kamani, Tropical or Indian almond -- (nat)**

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 didn't 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.

CONVOLVULACEAE (Morning glory family)

***Ipomoea aquatica* Forssk. -- Swamp cabbage, ung choi -- (cult)**

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.

***Ipomoea batatas* (L.) Lam -- Sweet potato -- (cult)**

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*. Collected (*Starr and Martz 990510-2* BISH). In 2008 sweet potato was still cultivated on Sand Island, observed in the garden of 4208 Commodore Ave.

***Ipomoea indica* (J. Burm.) Merr. -- Koali awa, morning glory -- (ind)**

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 resembles the native form, and a very dark purple form that seems more like garden variety ornamentals that can be ordered through seed catalogs. 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.

***Ipomoea pes-caprae* ssp. *brasiliensis* (L.) R. Br. -- Beach morning glory -- (ind)**

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 Isalnd; 1964 (*Lamoureux 2812*) also from Eastern Isalnd, 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.

***Ipomoea triloba* L. -- Little bell -- (nat)**

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.

***Merremia tuberosa* (L.) Rendle -- Wood rose -- (cult)**

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.

CRASSULACEAE (Stonecrop family)

***Bryophyllum fedtschenkoi* (Hamet and Perrier) -- Air plant -- (cult)**

Also known as *Kalanchoe 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.

***Crassula* sp. -- Stonecrop -- (cult)**

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 in 2008.

***Kalanchoe daigremontiana* x *tubiflora* -- Kalanchoe hybrid -- (cult)**

Perhaps a hybrid of *K. tubiflora* (Harv.) Raym.-Hamet. Previously recorded as cultivated (Herbst and Wagner 1992). It has not been observed before or since.

***Kalanchoe pinnata* (Lam.) Pers. -- Air plant -- (nat)**

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.

***Kalanchoe tubiflora* (Harv.) Raym.-Hamet -- Chandelier plant -- (cult)**

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.

CUCURBITACEAE (Gourd family)

Coccinia grandis **(L.) Voigt -- Ivy gourd, tam leung -- (cult / nat)**

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 from 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. In 2008 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.).

***Citrullus vulgaris* Schrad. -- Watermelon -- (cult)**

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.

***Cucumis melo* L. -- Cantaloupe, canary melon -- (cult)**

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.

***Cucumis sativus* L. -- Cucumber -- (cult)**

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.

***Cucurbita pepo* L. -- Squash -- (cult)**

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 (Starr and Martz 1999) it was cultivated in the town area of Sand Island. 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.

***Momordica charantia* L. -- Balsam pear, bitter melon -- (nat)**

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.

***Sicyos pachycarpus* Hook. & Arn. -- Anunu -- (end)**

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.

***Trichosanthes cucumerina* L. var. *anguina* (L.) Haines -- Snake gourd -- (cult)**

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 in 2008. Photo by: Sangfroid (Wikipedia 2008).

EUPHORBIACEAE (Spurge family)

***Acalypha wilksiana* Muell.-Arg. -- Beefsteak plant, Copper leaf -- (cult)**

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 (Starr and Martz 1999) scattered plants were observed in the town area of Sand Island. In 2008 a few fine specimens were found scattered about the residential area and near the Midway House.

***Aleurites moluccana* (L.) Willd. -- Kukui -- (cult)**

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.

***Breynia disticha* J.R. Forster and J.G.A. Forster var. *rosi-picta* -- Snow bush -- (cult)**

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 was not observed in 1999 (Starr and Martz 1999) or 2008.

***Chamaesyce hirta* (L.) Millsp. -- Hairy spurge -- (nat)**

Also known as *Euphorbia hirta* L. 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 Isalnd (*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.

***Chamaesyce hypericifolia* (L.) Millsp. -- Graceful spurge -- (nat)**

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 on Sand Island. Note, we are basically unable to distinguish between *C. hypericifolia* and *C. hyssopifolia*, and have lumped our sightings for both under this species.

***Chamaesyce hyssopifolia* (L.) -- (nat)**

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). See *C. hypericifolia* for more.

***Chamaesyce maculata* (L.) Small -- (nat)**

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 the South Beach and Bulky Dump area.

***Chamaesyce prostrata* (Aiton) Small -- Prostrate spurge -- (nat)**

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.

***Codiaeum variegatum* (L.) Bl. var. *pictum* Muell.-Arg. -- Croton -- (cult)**

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.

***Euphorbia cyathophora* J.A. Murray -- Wild poinsettia -- (nat)**

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.

***Euphorbia heterophylla* L. -- Kaliko -- (nat)**

Also known as *E. geniculata* Ort. 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 peplus* L. -- Petty spurge -- (nat)**

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.

***Euphorbia milii* Des Moulins -- Crown of thorns -- (Cult)**

Succulent climbing plant to 6 ft. in height with densely spiny stems cultivated throughout the world, including Hawaii, for it's 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.

***Euphorbia pulcherrima* Willd. -- Poinsettia -- (cult)**

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.

***Pedilanthus tithymaloides* (L.) Poit. -- Slipper flower -- (cult)**

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.

***Ricinus communis* L. -- Castor bean, castor-oil bean -- (nat)**

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.

FABACEAE -- [LEGUMINOSAE] (Pea family)

***Acacia farnesiana* (L.) Willd. -- Klu -- (nat)**

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 haole koa (*Leucaena*) and covered an area of about 10m x 10m. The site was shown to FWS staff during a weed-tour done at the end of the survey.

***Albizia lebbeck* (L.) Benth. -- Siris tree -- (cult)**

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.

***Caesalpinia bonduc* (L.) Roxb. -- Yellow nickers -- (ind)**

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 areass 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 not known 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.

***Cajanus cajan* (L.) Huth -- Pigeon pea -- (cult)**

Shrub to 6 ft. in height cultivated in Hawaii and other tropical areas for it's 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.

***Crotalaria incana* L. -- Fuzzy rattle pod -- (nat)**

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.

***Crotalaria pallida* Aiton -- Smooth rattle pod -- (nat)**

Also known as *Crotalaria mucronata* Desv. 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 in 2008.

***Delonix regia* (Bojer ex Hook.) Raf. -- Royal poinciana, flame tree -- (cult)**

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 on Sand Island. 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.

***Desmanthus pernambucanus* -- Virgate mimosa, slender mimosa -- (nat)**

Also known as *D. virgatus* (L.) Willd. Taxonomic name change from *D. virgatus* to *D. pernambucanus* (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 (Starr and Martz 1999) observed as occasional in weedy areas on Sand Island, especially the northern part of the island. In 2008 occasionally observed on Sand Island, especially near residences and Cargo Pier.

***Desmodium sandwicense* E. Mey -- Spanish or chili clover -- (nat)**

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.

***Erythrina variegata* var. *orientalis* L. -- Tiger's claw -- (cult)**

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 Barraks (080604-03) to document thre presence on Midway.

***Glycine max* (L.) Merrill -- Soy bean -- (cult)**

Also known as *G. soya* (L.) Sieb. and Zucc. 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).

***Indigofera hendecaphylla* Jacq. -- Creeping indigo -- (nat)**

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 naturlaized in dry disturbed aseas 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.

***Lathyrus odoratus* L. -- Sweet pea -- (cult)**

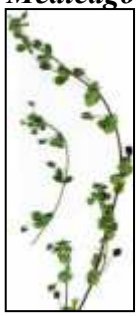
Native to northern temperate regions and also from South America and Africa, widely cultivated in Hawaii and elsewhere for ornament. First observed and collected on Midway in 1999 (Starr and Martz 1999) in the planter box at the Boathouse on Sand Island (*Starr and Martz 990421-5* BISH). This was one 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.

Leucaena leucocephala **(Lam.) de Wit -- Koa haole, haole koa -- (nat)**

Also known as *Leucaena glauca* (L. ex Willd.) Benth. 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 haole koa 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 haole koa forming a dog hair thicket over a pretty large area. Interestingly, haole koa was also intentionally cultivated on Midway. Sak, a Thai worker who has been on the island since 1982, was cultivating haole koa in his garden at the Water Plant. Sak showed us how he would eat the green haole koa 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 haole koa foliage makes when it is damaged. The eating of haole koa seeds or other plant parts should likely be done in moderation, or not at all, as apparently horses that eat too much haole koa will start loosing the hair in their manes and tails (Robert Hobdy pers. comm.). Getting rid of haole koa on Midway will take a long term effort, but is seemingly important for the seabirds given the proven ability of haole koa to dominate portions of the island and exclude albatrosses. The FWS currently controls haole koa 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.

Medicago lupulina **L.-- Black medick -- (nat)**



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 (Starr and Martz 1999) found to be common in grassy areas of Sand Island. 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.

***Medicago orbicularis* L. Bartal -- Blackdisk medick -- (nat)**
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 Captain W. Not observed since.

***Medicago polymorpha* L. -- Bur clover -- (nat)**

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.

***Medicago sativa* L. -- Alfalfa -- (nat)**

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).

***Melilotus alba* Medik. -- White sweet clover -- (nat)**

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 in 2008. Photo by: Bogdan (Wikipedia 2008).

***Melilotus indica* (L.) All. -- Sweet clover -- (nat)**

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*.

***Phaseolus vulgaris* L. -- Kidney bean, common bean -- (nat)**

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 in 2008.

***Pithecellobium dulce* (Roxb.) Benth. -- Manila tamarind -- (cult)**

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 if 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.

***Prosopis pallida* (Humb. and Bonpl. ex Willd.) Kunth -- Kiawe -- (cult)**

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.

***Psophocarpus tetragonolobus* (L.) A.P. de Candolle -- Wing bean -- (cult)**

High climbing twining vine with trifoliate leaves and winged pods, cultivated for it's 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.

Samanea saman **(Jacq.) Merr. -- Monkeypod -- (cult)**

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, reoprted 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 the size of the Midway Mall and was in slight flower. There were lots of fruit on the ground. No seedlings noted. Collected (*Starr and Starr 080611-03* BISH) to document the presence on Midway.

Senna siamea **(Lam.) Irwin & Barneby -- Pheasant wood, ki lek -- (cult)**

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.

Senna surattensis **(N.L. Burm.) H. Irwin and Barneby -- Kolomona -- (cult)**

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 was not observed in 1995 (Bruegmann 1998), 1999 (Starr and Martz 1999), or 2008.

Sesbania grandiflora **(L.) Poir. -- White flowered Sesbania, dok khae -- (cult)**

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 was growing there.

***Tamarindus indica* L. -- Tamarind -- (cult)**

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 isn't 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 doesn't 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.

***Vigna unguiculata* subsp. *sesquipedalis* (L.) Verdcourt -- Long bean, cow pea -- (cult)**

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 it's edible beans at the enclosed greenhouse behind the abandoned galley and at Sak's garden at the Water Plant.

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. This is an example of a plant that was able to make it to Midway and germinate, but unable to live long enough to perpetuate itself.

GENTIANACEAE (Gentian family)

Centaurium erythraea **Raf. subsp. *erythraea* -- Bitter herb -- (nat)**

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.

GERANIACEAE (Geranium family)

Pelargonium hortorum **Bailey -- Fish geranium -- (cult)**

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.

GOODENIACEAE (Goodenia family)

Scaevola taccada **Vahl -- Naupaka kahakai -- (ind)**

Also known as *S. frutescens* (Mill.) K. Krause; *S. koenigii* Vahl., and *S. sericea* Vahl. 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.

LAMIACEAE (Mint family)

***Majorana hortensis* Moench. -- Sweet marjoram -- (cult)**

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 in 2008. Photo by: Raul654 (Wikipedia 2008).

***Mentha* sp. -- Mint -- (cult)**

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.

***Ocimum basilicum* L. -- Basil -- (cult)**

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. A seed packet with the name *O. americanum* was found in the Greenhouse, but could not be attributed to a specific plant. More work could be done on the different basils varieties on Midway, by collecting fertile material from the myriad of forms found in gardens.

***Phyllostegia variabilis* Bitter -- Native mint -- (end, ex)**

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.

***Plectranthus amboinicus* (Loureiro) Sprengel -- Greek oregano -- (cult)**

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).

***Plectranthus scutellarioides* (L.) R. Br. -- Coleus -- (cult)**

Also known as *Solenostemon scutellarioides* (Linnaeus) Codd. 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.

***Stachys arvensis* L. -- Staggerweed -- (nat)**

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.

LAURACEAE (Laurel family)

***Persea americana* Mill. -- Avocado -- (cult)**

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 in 2008.

MALVACEAE (Mallow family)

***Abelmoschus esculentus* L. -- Okra -- (cult)**

Also known as *Hibiscus esculentus* (Linnaeus) Moench. 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.

***Abutilon grandifolium* (Willd.) Sweet -- Hairy abutilon -- (nat)**

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, Bruegmann listed this species as occasional on Sand Island (Bruegmann 1998). In 1999 (Starr and Martz 1999) it was naturalized in weedy areas near the 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 haole koa (*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.

***Hibiscus rosa-sinensis* L. -- Red Chinese hibiscus -- (cult)**

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.

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

***Hibiscus tiliaceus* L. -- Hau -- (nat)**

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 it's 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. Though 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.

***Hibiscus waimeae* A. Heller -- White Hawaiian hibiscus, kokio keokoe -- (cult / end)**

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 hibsicus 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.

***Malva parviflora* L. -- Cheese weed -- (nat)**

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 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.

***Malvastrum coromandelianum* (L.) Garcke subsp. *coromandelianum* -- False mallow -- (nat)**

Also known as*Malvastrum coromandelianum* (L.) Garcke. 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.

***Malvaviscus penduliflorus* Sessé & Moçiño ex A. P. de Candolle -- Turk's cap -- (nat)**

Plants on Midway had been referred to as *Malvaviscus arboreus* Cav. by previous authors, 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.

***Sida fallax* Walp. -- Ilima -- (ind)**

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 Islands 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 (Klavitter 2006). In 2008 a lone plant about a meter tall, on the north side of the Midway Mall, 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. Presumably the 2008 and 2004 plants are the same ones.

***Sida rhombifolia* L. -- Cuba jewt -- (nat)**

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 in 2008.

***Thespesia populnea* (L.) Sol. ex Correa -- Milo -- (cult)**

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.

MORACEAE (Mulberry family)

***Ficus benghalensis* L. -- Indian banyan -- (cult)**

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.

***Ficus benjamina* L. -- Benjamin tree -- (cult)**

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 it's location.

***Ficus elastica* Roxb. -- Indian rubber tree -- (cult)**

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. See *F. macrophylla* for more.

***Ficus macrophylla* Desf. -- Moreton Bay fig -- (cult)**

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.

***Ficus microcarpa* L. fil. -- Chinese banyan -- (nat)**

Also known as *Ficus retusa* sensu auct., non L. 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.

***Ficus* sp. -- Unknown fig -- (cult)**

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

***Morus alba* L. -- White mulberry -- (cult)**

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

MORINGACEAE (Moringa family)

***Moringa oleifera* Lam. -- Ben tree, drumstick tree -- (cult)**

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.

MYRTACEAE (Myrtle family)

***Eugenia uniflora* L. -- Surinam cherry -- (cult)**

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.

***Psidium guajava* L. -- Guava -- (cult)**

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 pretty easy to remove the one known tree from Midway, again and place it on the prohibited list.

***Punica granatum* L. -- Pomegranate -- (cult)**

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 was not observed in 1999 (Starr and Martz 1999) or 2008.

NYCTAGINACEAE (Four o'clock family)

***Boerhavia repens* -- Alena -- (ind)**

Also known as *B. diffusa* sensu Hawaiian botanists, pro parte, non L.; *B. diffusa* sensu auct., non G Forster var. *tetrandra*; *B. tetrandra* sensu auct., non G Forster. 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 (Starr and Martz 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. 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.

***Bougainvillea spectabilis* Willd. -- Bougainvillea -- (cult)**

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 yad 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.

***Mirabilis jalapa* L. -- Four o'clock -- (nat)**

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.

OLEACEAE (Olive family)

Jasminum sambac **(L.) Aiton -- Pikake, Arabian jasmine -- (cult)**

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 first and only time this species was observed or collected on Midway. Not observed in 1999 (Starr and Martz 1999) or 2008.

Noronhia emarginata **(Lam.) Poir. -- Madagascar olive -- (cult)**

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, lots 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 wouldn't be too hard to get rid of the two trees if folks were looking for something to do.

Olea europaea **ssp.** ***cuspidata*** **(Wall. ex G. Don) Ciferri -- African olive -- (cult)**

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 wouldn't be too hard to get rid of this olive.

ONAGRACEAE (Evening primrose family)

Oenothera laciniata **J. Hill -- Evening primrose -- (nat)**

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.

OXALIDACEAE (Wood sorrel family)

Averrhoa carambola **L.-- Star fruit -- (cult)**

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 it's edible star shaped fruit (Wikipedia 2008). First observed on Midway in 2008 where one young plant was observed in planter at Sak's garden at the Water Plant on Sand Island, having been brought in from the main islands of Hawaii. It wasn't looking so hot, it looked like it had died back and only had a few sets of leaves.

Oxalis corniculata **L. -- Yellow wood sorrel -- (nat)**

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.

Oxalis debilis **Kunth var.** ***corymbosa*** **(DC.) Lourteig-- Shamrock -- (nat)**

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.

PASSIFLORACEAE (Passion flower family)

Passiflora edulis **Sims -- Passion fruit, lilikoi -- (cult)**

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.

PIPERACEAE (Pepper family)

Peperomia obtusifolia **(L.) A. Dietr. -- Alien peperomia -- (cult)**

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 in 2008.

Piper sarmentosum **Roxburg -- Thai piper, Cha plu -- (cult)**

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.

PLANTAGINACEAE (Plantain family)

***Plantago lanceolata* L. -- English plantain, narrow leaved plantain -- (nat)**

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.

***Plantago major* L. -- Common plantain -- (nat)**

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. Collected from Eastern Island by . 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 in 2008.

PLUMBAGINACEAE (Leadwort family)

***Plumbago auriculata* Lam. -- Plumbago, cape leadwort -- (cult)**

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 in 1999 (Starr and Martz 1999) or 2008.

POLYGONACEAE (Buckwheat family)

Antigonon leptopus **Hook. and Arnott -- Hearts on a chain, Mexican creeper -- (nat)**

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.

Coccoloba uvifera **(L.) L. -- Sea grape -- (nat)**

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, 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 would probably wouldn't be too hard to continue removing seagrape when it arrives.

PORTULACACEAE (Purslane family)

***Portulaca lutea* Sol. ex G. Forster -- Ihi -- (ind)**

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*.

***Portulaca oleracea* -- Common purslane, pig weed -- (nat)**

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 *Boerhaavia 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.

***Portulacaria afra* Jacq. -- Jade tree -- (cult)**

Native to South Africa and cultivated as an ornamental in Hawaii and elsewhere (Neal 1965). On Midway, historically 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.

PRIMULACEAE (Primrose family)

***Anagallis arvensis* L. -- Scarlet pimpernel -- (nat)**

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.

RHAMNACEAE (Buckthorn family)

***Ziziphus* sp. -- Jujube -- (cult)**

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 *Zizphus* 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.

ROSACEAE (Rose family)

***Fragaria* x *ananassa* Duch. -- Strawberry -- (cult)**

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 in 2008.

***Rosa* sp. -- Rose -- (cult)**

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.

RUBIACEAE (Coffee family)

***Gardenia* sp. -- Gardenia -- (cult)**

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

RUTACEAE (Citrus family)

***Citrus* spp. -- Citrus -- (cult)**

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 didn't look overly productive / 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 a kaffir lime (*C. hystrix*) that had recently been planted in multiple spots.

***Citrus hystrix* A. P. de Candolle -- Kaffir lime -- (cult)**

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.

***Citrus limon* Osbeck. -- Lemon -- (cult)**

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 cut up lemon was a regular at the end of the self serve buffet line at the Clipper House, flown in from Hawaii.

***Citrus paradisi* Macf. -- Grapefruit -- (cult)**

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).

***Citrus sinensis* (L.) Osbeck -- Orange -- (cult)**

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).

***Murraya paniculata* (L.) Jack -- Mock orange -- (cult)**

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 in 1999 (Starr and Martz 1999) or 2008.

SCROPHULARIACEAE (Figwort family)

***Bacopa monnieri* (L.) Wettst. -- Aeae -- (ind)**

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 indigenouse species can be fairly aggressive.

***Russelia equisetiformis* Schlecht. and Cham. -- Coral plant, firecracker plant -- (cult)**

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.

SOLANACEAE (Tomato family)

***Capsicum annuum* L. -- Red pepper, chili pepper -- (cult)**

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.

***Capsicum annuum* L. var. *grossum* -- Bell pepper -- (cult)**

Native to tropical America and cultivated in Hawaii (Neal 1965). In 1999 (Starr and Martz 1999) bell peppers were cultivated on Sand Island. Collected in 1999 (*Starr and Martz 990510-4* BISH) to document the presence on Midway. Not observed in 2008.

***Cestrum nocturnum* L. -- Night blooming jasmine, night cestrum -- (cult)**

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 signs of spread on Midway yet. That said, it wouldn't be too hard to remove the lone tree, heading off any potential problems in the future.

***Solanum americanum* Mill. -- Glossy nightshade, popolo -- (ind?)**

Also known as *Solanum nigrum* sensu Hawaiian botanists, non L. 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 wouldn't worry about controlling plants in areas where they are unwanted, or letting them run wild in areas where they are doing no harm.

***Solanum linnaeanum* Hepper and P. Jaeger -- Apple of Sodom -- (cult)**

Native to Africa. In Hawaii this weedy, thorny species is widely established in warm temperate areas and is naturalized in dry areas of Hawaii and occurs on Oahu, Molokai, Lanai, Kahoolawe, Maui, and Hawaii (Wagner et al. 1999; Herbarium Pacificum Staff 1998). First and only observation in 1999 (Starr and Martz 1999) where it was cultivated on Sand Island. Not observed in 2008. Without a voucher specimen or photograph, it is uncertain whether *S. linnaeanum* was truly on Midway, or whether it was misidentified *S. melongena* or perhaps even *S. torvum*.

***Solanum lycopersicum* L. var. *lycopersicum* -- Tomato -- (cult)**

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 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 seems there to keep tomatoes in check on Midway, especially if grown indoors and done with hybrid tomatoes that don't have viable seeds.

***Solanum lycopersicum* L. var. *cerasiforme* (Dunal) D. M. Spooner, G. J. Anderson & R. K. Jansen -- Cherry tomato -- (cult)**

Native from Peru, cultivated and naturalized in Hawaii (Neal 1965). First observed on Midway in 1999 (Starr and Martz 1999) growing in the gardens of Sand Island. Not observed in 2008. Cherry tomatoes have a propensity to spread from where they are planted, and can even establish populations in the wild. See *S. lycopersicum* var. *lycopersicum* for more.

***Solanum melongena* L. -- Eggplant -- (cult)**

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.

***Solanum nelsonii* Dunal -- Popolo -- (end)**

Also known as *S. laysanense* Bitter; *S. nelsonii* var. *intermedium* F. Brown. 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.

***Solanum torvum* Swartz -- Turkeyberry, makhua phuang -- (nat)**

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. However, becuase *S. torvum* is a Federal Noxious Weed, it would be illegal to bring the specimens into Hawaii without special permits. So, the specimens are being housed in the FWS office until permits can be obtained to import the vouchers to Hawaii. 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.

STERCULIACEAE (Cocoa family)

***Waltheria indica* L. -- Uhaloa -- (ind?)**

Also known as *W. i.* var. *americana* (L.) Hosaka. 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.

TAMARICACEAE (Tamarix family)

***Tamarix* sp. -- Tamarix -- (cult)**

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.

THYMELACEAE (Akia family)

***Wikstroemia uva-ursi* A. Gray -- Akia -- (cult / end)**

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.

TROPAEOLACEAE (Nasturtium family)

***Tropaeolum majus* L. -- Garden nasturtium -- (cult)**

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.

URTICACEAE (Nettle family)

***Pilea microphylla* (L.) Liebm. -- Artillery plant -- (nat)**

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.

***Pilea serpyllacea* (Kunth) Liebmann -- Large artillery plant -- (cult)**

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 in 2008.

VERBENACEAE (Vervain family)

***Duranta erecta* L. -- Golden dewdrop -- (cult)**

Sprawling vinelike 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.

***Lantana camara* L. -- Lantana -- (nat)**

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 it's 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, as *Lantana* seems to mean business there. 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*.

***Phyla nodiflora* (L.) Greene -- Phyla, turkey tangle fogfruit -- (nat)**

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.

***Stachytarpheta dichotoma* (Ruiz and Pav.) Vahl -- Oi -- (nat)**
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 in 1995 (Bruegmann 1998), 1999 (Starr and Martz 1999), or 2008.

***Stachytarpheta jamaicensis* (L.) Vahl. -- Owi -- (nat)**

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.

***Verbena littoralis* Kunth -- Vervain, owi -- (nat)**

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.

***Vitex rotundifolia* L. f. -- Pohinahina -- (ind)**

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.

***Vitex trifolia* L. -- Tree vitex -- (cult)**

Previously recorded from Midway as *Vitex trifolia* var. *subtrisecta* (Kuntze) Mold. 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.

VIOLACEAE (Violet family)

***Viola odorata* L. -- Sweet violet -- (cult)**

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* L. as cultivated and known from literature. Not recorded since. Photo by: Strobilomyces (Wikipedia 2008).

***Viola* x *wittrockiana* Gams -- Violet, pansy -- (cult)**

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 plant of native beach morning glory (*Ipomoea pes-caprae* subsp. *brasiliensis*), and viola was nowhere to be seen. Photo by: Hardyplants (Wikipedia 2008).

VITACEAE (Grape family)

***Vitis* sp. -- Grape -- (cult)**

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.

ZYGOPHYLLACEAE (Tribulus family)

***Tribulus cistoides* L. -- Nohu -- (ind)**

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 Isalnd 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, which decimated the patches there within a matter of years after release of a stem-boring beetle. The *Tribulus* biocontrol beetle does not yet appear to be on Midway, making Midway a remote refugia for this spiny yet colorful native plant.

REFERENCES

Apfelbaum, S. I., J. P. Ludwig, and C. E. Ludwig. 1983. *Ecological Problems Associated with Disruption of Dune Vegetation Dynamics by Casuarina equisetifolia L. at Sand Island, Midway Atoll.* The Smithsonian Institution, Washington, DC.

Beardsley, J. W. 1999. Hymenoptera from Midway Atoll. *Bishop Mus. Occ. Pap.* 58(1): 37-50.

Brickell, C. and J. D. Zuk. 1997. *The American Horticultural Society A-Z Encyclopedia of Garden Plants*. DK Publishing, Inc., New York, NY.

Bryan, E. H. Jr. 1956. Plants Recorded From Laysan and Midway Islands. In: *Birds of Midway and Laysan*. A. M. Bailey. *Museum Pictorial No. 12*. Denver Museum of Natural History, Denver, CO.

Bryan, W. A. 1905. Report of a Visit to Midway Island. *Bishop Mus. Occ. Pap.*, Vol. II (4), Honolulu, HI.

Bruegmann, M. M. 1998. Report on a botanical survey of Midway Atoll, April 1-7, 1995. U. S. Fish and Wildlife Service, Honolulu, HI.

Bruegmann, M. M. 1999. New Records of Flowering Plants on Midway Atoll. *Bishop Mus. Occ. Pap.* 59(2): 1-2.

Bugwood.org. 2008. Forestry Images. Center for Invasive Species and Ecosystem Health Bugwood Network. Available: http://www.bugwood.org/index.cfm (Accessed: July 9, 2008).

Christophersen, E. and E. L. Caum. 1931. *Vascular Plants of the Leeward Island.* Hawaii. Bernice P. Bishop Museum Bull*et*in 81, Tanager Expedition Publication Number 7, Bishop Museum Press, Honolulu, HI.

Conant, S. July and August 1983. Trip Report on Expedition to Midway Atoll, Laysan, and Lisianski Islands, and Pearl and Hermes Reef. Department of General Science, University of Hawaii at Manoa.

Dehgan, B. 1998. *Landscape Plants For Subtropical Climates*. University of Florida Press, Miami, FL.

Earthcare Enterprises. 2007. Tropical Root Crops. Available: http://www.earthcare.com.au/other.htm (Accessed: July 8, 2008).

Floridata. 2008. Plant Encyclopedia. Available: http://www.floridata.com/index.cfm (Accessed: June 30, 2008).

Flynn, T. and D.H. Lorence. 2002. Additions to the flora of the Hawaiian Islands. *Bishop Mus. Occas. Pap*. 69(2): 14-16.

GRIN (Germplasm Resources Information Network). 2008. Online Database. United States Department of Agriculture, Agricultural Research Service, National Germplasm Resources Laboratory, Beltsville, MD. Available: http://www.ars-grin.gov/ (Accessed: June 30, 2008).

Hadden, F. C. 1941. Midway Islands. In: *The Hawaiian Planters Record*, Vol. XLV, No. 3, pp. 179-221. Hawaii Sugar Planters' Association.

Herbarium Pacificum Staff. 1998. New Hawaiian Plant Records for 1997. *Bishop Mus. Occ. Pap.* 56(2): 8-15.

Herbarium Pacificum Staff. 1999. New Hawaiian Plant Records for 1998. *Bishop Mus. Occ. Pap.* 58(1): 3-11.

Herbst, D. R. and W. D. Clayton. 1998. Notes on the Grasses of Hawaii: New Records, Corrections, and Name Changes. *Bishop Mus. Occ. Pap.* 41(1): 17-38.

Herbst, D. R. and W. L. Wagner. 1992. Aliens on the Northwestern Hawaiian Islands. In: *Alien Plant Invasions in Native Ecosystems of Hawaii*, C.P. Stone, C.W. Smith, and J.T. Tunison, eds. Cooperative National Park Resources Studies Unit and University of Hawaii Press, Honolulu, HI.

Herbst, D. R. and W. L. Wagner. 1996. Contributions to the Flora of Hawaii. V. *Bishop Mus. Occ. Pap.* 46(2): 8-12.

Herbst, D. R. and W. L. Wagner. 1999. Contributions to the Flora of Hawaii. VII. *Bishop Mus. Occ. Pap.* 58(1): 12-36.

Herbst, D.R., G.W. Staples, and C.T. Imada. 2004. New Hawaiian plant records for 2002-2003.. *Bishop Mus. Occas. Pap*. 78(1): 3-12.

Jones, D. L. 1995. *Palms Throughout the World.* Smithsonian Institute Press, Washington, DC.

Imada, C. T., G. W. Staples, and D. R. Herbst. 2000. New Hawaiian Plant Records for 1999. *Bishop Mus. Occ. Pap.* 63(1): 9-16.

Imada, C. T., G. W. Staples, and D. R. Herbst. 2005. Annotated Checklist of Cultivated Plants of Hawaii. Available: http://www2.bishopmuseum.org/HBS/botany/cultivatedplants/?pg=search (Accessed: June 30, 2008).

Klavitter, J. 2006. Midway Atoll NWR's Native Plants. Available: http://www.fws.gov/midway/wildlife/Midway%20Native%20Plants.pdf (Accessed: July 8, 2008).

Krauss, F. 2003. New records of alien plants and animals in Hawaii. *Bishop Mus. Occ. Pap.* 74(2): 76-78.

Lemke, C. 2008. Cal's Plant of the Week. University of Oklahoma Department of Botany & Microbiology. Available: http://www.plantoftheweek.org/week216.shtml (Accessed: July 8, 2008).

Lorence, D. H., T. W. Flynn, and W. L. Wagner. 1995. Contributions to the Flora of Hawaii. *Bishop Mus. Occ. Pap.* 41(1): 19-58.

Lorence, D. H. and T. Flynn. 1997. New Naturalized Plant Records for Kauai. *Bishop Mus. Occ. Pap.* 49(2): 9-13.

Nagata, K. M. 1995. New Hawaiian Plant Records. IV. *Bishop Mus. Occ. Pap.* 42(2): 10-13.

Neal, M. C. 1965. *In Gardens of Hawaii*. Revised Edition. Bernice P. Bishop Museum Special Publication 40. Bishop Museum Press, Honolulu, HI.

Neff, J.A. and P.A. DuMont. 1955. *A Partial List of the Plants of the Midway Islands. Atoll Research Bulletin, No. 45*. The Pacific Science Board, National Academy of Sciences, National Research Council, Washington, DC.

Nishida, G. M. 1994. *Hawaiian Terrestrial Arthropod Checklist.* 2nd edition. Bishop Museum Technical Report No. 4. Bishop Museum Press, Honolulu, HI.

Nishida, G. M. 1999. Midway Terrestrial Arthropod Survey. Report In: *1995-1999 Baseline Surveys for Alien Species in Marine and Terrestrial Habitats on Midway Atoll National Wildlife Refuge*. United States Fish and Wildlife Service, Honolulu, HI.

Oppenheimer, H. L., J. S. Meidell, and R. T. Bartlett. 1999. New Plant Records for Maui and Molokai. *Bishop Mus. Occas. Pap.* 59(2): 7-11.

Oppenheimer, H. L. and R. T. Bartlett. 2000. New Plant Records from Maui, Oahu, and Hawaii Islands. *Bishop Mus. Occas. Pap.* 64(2): 1-9.

Oppenheimer, H.L. and R.T. Bartlett. 2002. New plant records from the main Hawaiian Islands. *Bishop Mus. Occas. Pap.* 69(2): 1-14.

Oppenheimer, H.L.. 2002b. The spread of gymnosperms on Maui: a neglected element of the modern Hawaiian flora. *Bishop Mus. Occas. Pap.* 68(1): 19-23.

Oppenheimer, H.L. 2003. New plant records from Maui and Hawaii Counties. *Bishop Mus. Occas. Pap.* 73(1): 3-30.

Oppenheimer, H.L. 2004. New plant records for 2003. *Bishop Mus. Occas. Pap*. 79(2): 8-20.

Palmer, D.D. 2003. Hawaii's Ferns and Fern Allies. University of Hawaii Press, Honolulu, HI.

PIER (Pacifci Island Ecocystems at Risk). Plant Threats to Pacific Ecosystems. Institute of Pacific Islands Forestry. Available: http://www.hear.org/pier/index.html (Accessed: July 8, 2008).

Shannon, R. K. and W. L. Wagner. 1996. Contributions to the Flora of Hawaii. VI. *Bishop Mus. Occas. Pap.* 48(1): 51-65.

Staples, G.W. and K.R. Woolliams. 1997. An overlooked naturalized aroid for the Hawaiian flora. *Bishop Mus. Occas. Pap.* 49(2): 13-16.

Staples, G.W., C.T. Imada, and D.R. Herbst. 2003. New Hawaiian plant records for 2001. *Bishop Mus. Occas. Pap.* 74(2): 7-23.

Staples, G.W., C.T. Imada, and D.R. Herbst. 2005. *A Tropical Garden Flora*. Bishop Museum Press, Honolulu, HI.

Starr, F. and K. Martz. 1999. Botanical Survey of Midway Atoll: 1999 Update. In: 1995-1999 Baseline Surveys for Alien Species in Marine and Terrestrial Habitats on Midway Atoll National Wildlife Refuge. U.S. Fish and Wildlife Service, Honolulu, Hawaii.

Starr, F. and K. Martz. 1999b. *S.S. Midway Expedition*. Trip report prepared for the United States Fish and Wildlife Service, Honolulu, HI.

Starr, F. and K. Martz. 2000. New Plant Records for Midway Atoll. *Bishop Mus. Occas. Pap.* 64(2): 10-12.

Starr, F., K. Martz, and L. L. Loope. 1999. New Plant Records From East Maui. *Bishop Mus. Occas. Pap.* 59(2): 11-15.

Starr, F., K. Martz, and L.L. Loope. 2002. New plant records for the Hawaiian Archipelago. *Bishop Mus. Occ. Pap.* 69(2): 16-27.

Starr, F., K. Starr, and L.L. Loope. 2003. New plant records from the Hawaiian Archipelago. *Bishop Mus. Occ. Pap.* 74(2): 23-34.

Starr, F., K. Starr, and L.L. Loope. 2004. New plant records from the Hawaiian Archipelago. *Bishop Mus. Occ. Pap.* 79(2): 20-30.

Starr, F., K. Starr, and L.L. Loope. 2006. New plant records for the Hawaiian Archipelago. Bishop Mus. Occ. Pap. 87(1): 31-43.

Strong, M. T. and W. L. Wagner. 1997. New and Noteworthy Cyperaceae from the Hawaiian Islands. *Bishop Mus. Occas. Pap.* 48(1): 37-50.

Trade Winds Fruit. 2008. Online Catalog. Available: http://www.tradewindsfruit.com/ (Accessed: July 8, 2008).

Tucker, G. C. 1994. Revision of the Mexican species of *Cyperus. Syst. Bot. Monogr.* 43: 1-213.

Valier, K. 1995. *Ferns of Hawaii*. University of Hawaii Press, Honolulu, HI.

Wagner, W. L., M. M. Bruegmann, D. R. Herbst, and J.Q.C. Lau. 1999. Hawaiian Vascular Plants at Risk: 1999. *Bishop Mus. Occas. Pap.* 60: 1-58.

Wagner, W. L. and D. R. Herbst. 1995. Contributions to the Flora of Hawaii. IV. New Records and Name Changes. *Bishop Mus. Occas. Pap.* 42(2): 13-27.

Wagner, W. L., D. R. Herbst, and S. H. Sohmer. 1990. *Manual of the flowering plants of Hawaii*, 2 vols. Bishop Museum Special Publication 83. University of Hawaii Press and Bishop Museum Press, Honolulu, HI.

Wagner, W. L., D. R. Herbst, and S. H. Sohmer. 1999. *Manual of the Flowering Plants of Hawai`i*. Revised Edition. Bishop Museum Spec. Publ. 83. University of Hawaii Press and Bishop Museum Press, Honolulu, HI.

Wagner, W. L., R. K. Shannon, and D. R. Herbst. 1997. Contributions to the Flora of Hawaii. VI. *Bishop Mus. Occas. Pap.* 48(1): 51-65.

Whistler, W.A. 1995. *Wayside Plants of the Islands*. Isle Botanica, Honolulu, HI.

Whistler, W.A. 2000. *Tropical Ornamentals*. Timber Press, Portland, OR.

Wikipedia. 2008. The Free Encyclopedia. Available: http://www.wikipedia.org (Accessed: June 30, 2008).

Wilson, K. A. 1996. Alien Ferns in Hawaii. *Pacific Science*, vol.50, no.2.

APPENDIX B: CHECKLIST OF PLANTS KNOWN FROM MIDWAY

What follows is a checklist of plants known from Midway Atoll. It is in two general sections, one for the 2008 survey and another that includes all previously known surveys.

The checklist lists plants found on Midway, relative abundance (rare, occasional, common, or dominant) for each island within the atoll, historical information, collection data, status on Midway (cultivated or naturalized), and status in the Hawaiian Islands (native or alien).

ISLAND DISTRIBUTION
Distribution on islands during 2008 survey.
R = Rare
O = Occasional
C = Common
D = Dominant
Y = Reported, does not indicate presence or absence

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

BISH
Published as naturalized in Hawaii.
Nat = yes
Blank = no

STARR
Status during 2008 survey.
Cult = cultivated
Nat = naturalized

STATUS
Nativity in Hawaii.
Alien = Introduced by humans to Hawaii
Native = Naturally occurring in Hawaii
Native ? = Questionably native. History uncertain.
Pol = Polynesian introduced
Nat = Naturalized - Self sustaining populations
Cult = Cultivated - Generally staying within the confines of the garden

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

SURVEYS

Botanical surveys or other publications with Midway plant information.

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, J.P. Ludwig, and C.E. Ludwig
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

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

Species	Sand	Eastern	Spit	Coll.	BISH	Starr	Status	Common name	Family
Antigonon leptopus				X	Nat	Nat	Alien	Mexican creeper	Polygonaceae
Apium graveolens	R			X		Cult	Alien	Chinese celery, Khuen chai	Apiaceae
Araucaria heterophylla	O			X		Cult	Alien	Norfolk island pine	Araucariaceae
Arctium lappa						Cult	Alien	Gobo, burdock	Asteraceae
Artabotrys hexapetalus	R			X		Cult	Alien	Ylang ylang	Annonaceae
Asparagus densiflorus	R			X		Cult	Alien	Asparagus fern	Liliaceae
Asparagus plumosus				X		Cult	Alien	Asparagus fern	Liliaceae
Asystasia gangetica					Nat	Nat	Alien	Chinese violet	Acanthaceae
Averrhoa carambola	R					Cult	Alien	Star fruit	Oxalidaceae
Bacopa monnieri				X	Nat	Nat	Native	Aeae	Schrophulariaceae
Basella alba				X		Cult	Alien	Ceylon spinach	Basellaceae
Bidens alba / pilosa				X		Nat	Alien	not sure which one	Asteraceae
Bidens alba var. radiata	C/D	R	R	X	Nat	Nat	Alien	Beggartick	Asteraceae
Bidens pilosa				X	Nat	Nat	Alien	Spanish needle	Asteraceae
Boerhavia repens	O/C	O/C	C/D	X	Nat	Nat	Native	Alena	Nyctaginaceae
Bothriochloa pertusa	R			X	Nat	Nat	Alien	Pitted beard grass	Poaceae
Bougainvillea spectabilis	O			X		Cult	Alien	Bougainvillea	Nyctaginaceae
Brassica campestris var. chinensis	R			X		Cult	Alien	Pak-choi	Brassicaceae
Brassica campestris var. napobrassica						Cult	Alien	Rutabaga	Brassicaceae
Brassica campestris var. rapa						Cult	Alien	Turnip	Brassicaceae
Brassica nigra	R	C/D		X	Nat	Nat	Alien	Black mustard	Brassicaceae
Brassica oleracea var. acephala						Cult	Alien	Kale	Brassicaceae
Brassica oleracea var. botrytis						Cult	Alien	Broccoli	Brassicaceae
Brassica oleracea var. botrytis						Cult	Alien	Cauliflower	Brassicaceae
Brassica oleracea var. capitata						Cult	Alien	Green leaved cabbage	Brassicaceae
Brassica oleracea var. capitata						Cult	Alien	Purple leaved cabbage	Brassicaceae
Brassica oleracea var. gongylodes						Cult	Alien	Kohlrabi	Brassicaceae

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

Species	Sand	Eastern	Spit	Coll.	BISH	Starr	Status	Common name	Family
Chamaesyce prostata	O	C		X	Nat	Nat	Alien	Small ground fig	Euphorbiaceae
Chenopodium murale	R			X	Nat	Nat	Alien	Goosefoot	Chenopodiaceae
Chenopodium oahuense	R		R	X		Cult	Native	Aweoweo	Chenopodiaceae
Chloris barbata	O			X	Nat	Nat	Alien	Swollen finger grass	Poaceae
Chloris divaricata var. divaricata				X	Nat	Nat	Alien	Star grass	Poaceae
Chloris virgata				X	Nat	Nat	Alien	Feather finger grass	Poaceae
Chlorophytum comosum	R					Cult	Alien	Spider plant	Liliaceae
Chrysanthemum sp.						Cult	Alien	Chrysanthemum	Asteraceae
Cibotium sp.						Cult	Alien	Tree fern	Dicksoniaceae
Ciclospermum leptophyllum	O			X	Nat	Nat	Alien	Fine leaved celery	Apiaceae
Citrullus lanatus	R					Cult	Alien	Watermelon	Cucurbitaceae
Citrus aurantifolia	R					Cult	Alien	Lime	Rutaceae
Citrus hystrix	R/O			X		Cult	Alien	Kaffir lime	Rutaceae
Citrus limon						Cult	Alien	Lemon, meyer	Rutaceae
Citrus paradisi						Cult	Alien	Grapefruit, star-ruby, white	Rutaceae
Citrus sinensis						Cult	Alien	Orange, valencia, navel, blood	Rutaceae
Citrus sp.	O					Cult	Alien	Unknown citrus	Rutaceae
Cleome gynandra				X		Cult	Alien	Wild spider flower	Brassicaceae
Clusea rosea						Cult	Alien	Autograph tree	Clusiaceae
Coccinia grandis	R			X		Nat	Alien	Ivy gourd	Cucurbitaceae
Coccoloba uvifera	C	O	R	X	Nat	Nat	Alien	Sea grape	Polygonaceae
Cocos nucifera	C					Cult	Alien	Coconut	Arecaceae
Codiaeum variegatum	O			X		Cult	Alien	Croton	Euphorbiaceae
Colocasia esculenta						Cult	Alien	Taro	Araceae
Commelina diffusa				X	Nat	Nat	Alien	Honohono	Commelinaceae
Conocarpus erectus					Nat	Cult	Alien	Buttonwood	Combretaceae
Conyza bonariensis	O/C			X	Nat	Nat	Alien	Hairy horseweed	Asteraceae
Conyza canadensis var. pusila	O/C	O/C	O/C	X	Nat	Nat	Alien	Horseweed	Asteraceae
Cordia sebestena	R			X		Cult	Alien	Kou haole	Boraginaceae
Cordyline fruticosa	O			X		Cult	Alien	Ti leaf	Agavaceae
Cordyline sp.						Cult	Alien	Cordyline	Agavaceae
Coreopsis grandiflora				X		Cult	Alien	Coreopsis	Asteraceae
Coreopsis tinctoria				X		Cult	Alien	Golden tickseed	Asteraceae

Species	Sand	Eastern	Spit	Coll.	BISH	Starr	Status	Common name	Family
Coriandrum sativum						Cult	Alien	Cilantro	Apiaceae
Coronopus didymus	O/C	O	R	X	Nat	Nat	Alien	Swine cress	Brassicaceae
Cosmos bipinnatus				X		Cult	Alien	Cosmos	Asteraceae
Cosmos sp.						Cult	Alien	Cosmos	Asteraceae
Crassula sp.						Cult	Alien	Stonecrop	Crassulaceae
Crinum asiaticum	C	R		X		Cult	Alien	Crinum lily	Liliaceae
Crotolaria incana	O			X	Nat	Nat	Alien	Fuzzy rattle pod	Fabaceae
Crotolaria pallida				X	Nat	Nat	Alien	Rattle pod	Fabaceae
Cucumis melo var. cantalupensis						Cult	Alien	Cantaloupe	Cucurbitaceae
Cucumis sativus						Cult	Alien	Cucumber	Cucurbitaceae
Cucurbita pepo	R			X		Cult	Alien	Squash, zucchini	Cucurbitaceae
Cycas circinalis	O			X		Cult	Alien	Sago palm	Cycadaceae
Cycas revoluta						Cult	Alien	Sago palm	Cycadaceae
Cymbopogon citratus	O			X		Cult	Alien	Lemon grass	Poaceae
Cynara scolymus						Cult	Alien	Artichoke	Asteraceae
Cynodon dactylon	C/D	C		X	Nat	Nat	Alien	Bermuda grass	Poaceae
Cyperus involucratus	C			X	Nat	Nat	Alien	Umbrella plant	Cyperaceae
Cyperus javanicus				X	Nat	Nat	Native	Ahu'awa	Cyperaceae
Cyperus laevigatus	O	O		X		Cult	Native	Makaloa	Cyperaceae
Cyperus papyrus						Cult	Alien	Papyrus	Cyperaceae
Cyperus pennatiformis var. bryanii	Y					Cult	Native	Cyperus	Cyperaceae
Cyperus polystachyos	C	R		X	Nat	Nat	Native	Pycreus	Cyperaceae
Cyperus rotundus	O			X	Nat	Nat	Alien	Purple nut sedge	Cyperaceae
Dactyloctenium aegyptium	C	C	C	X	Nat	Nat	Alien	Beach wire grass	Poaceae
Daucus carota						Cult	Alien	Carrot	Apiaceae
Delonix regia	O			X		Cult	Alien	Royal poinciana	Fabaceae
Desmanthus pernambucanus	O			X	Nat	Nat	Alien	Slender mimosa	Fabaceae
Desmodium sandwicense				X	Nat	Nat	Alien	Spanish clover	Fabaceae
Dianthus caryophyllus				X		Cult	Alien	Carnation	Caryophyllaceae
Dianthus chinensis				X		Cult	Alien	Carnation	Caryophyllaceae
Dichorisandra thyiflora						Cult	Alien	Blue ginger	Commelinaceae
Dieffenbachia sp.						Cult	Alien	Dumb cane	Araceae
Digitaria ciliaris	O	O		X	Nat	Nat	Alien	Henry's crab grass	Poaceae

Species	Sand	Eastern	Spit	Coll.	BISH	Starr	Status	Common name	Family
Digitaria insularis	O/C			X	Nat	Nat	Alien	Sour grass	Poaceae
Dracaena fragrans	O			X		Cult	Alien	Dracaena	Agavaceae
Dracaena marginata	O			X		Cult	Alien	Money tree	Agavaceae
Dracaena sp.						Cult	Alien	Pineapple draceana	Agavaceae
Duranta erecta				X		Cult	Alien	Golden dewdrop	Verbenaceae
Echinochloa crus-galli				X	Nat	Nat	Alien	Barnyard grass	Poaceae
Eleusine indica	C/D	C		X	Nat	Nat	Alien	Goose grass	Poaceae
Epiphyllum oxypetalum				X		Nat	Alien	Gooseneck cactus	Cactaceae
Epipremnum pinnatum	O			X		Cult	Alien	Golden pothos	Araceae
Eragrostis amabilis	O			X	Nat	Nat	Alien	Love grass	Poaceae
Eragrostis paupera	R			X	Nat	Nat	Native	Native bunch grass	Poaceae
Eragrostis variabilis	C	C	O/C	X	Nat	Nat	Native	Emaloa, Kawelu	Poaceae
Eriochloa sp.	R			X		Nat	Alien	Cupgrass	Poaceae
Ervatamia sp.						Cult	Alien	Crape jasmine	Apocynaceae
Eryngium foetidum	R			X		Cult	Alien	Long coriander	Apiaceae
Erythrina variegata	R			X		Cult	Alien	Tiger's claw	Fabaceae
Eugenia uniflora	R			X		Cult	Alien	Suriname cherry	Myrtaceae
Euphorbia cyathopora	C	O		X	Nat	Nat	Alien	Wild poinsettia	Euphorbiaceae
Euphorbia heterophylla				X	Nat	Nat	Alien	Fire plant	Euphorbiaceae
Euphorbia milii	R					Cult	Alien	Crown of thorns	Euphorbiaceae
Euphorbia peplus	O			X	Nat	Nat	Alien	Petty spurge	Euphorbiaceae
Euphorbia pulcherrima	R			X		Cult	Alien	Poinsettia	Euphorbiaceae
Eustachys petraea	C/D	O	D	X	Nat	Nat	Alien	Eustachys	Poaceae
Ficus benghalensis	R/O			X		Cult	Alien	Indian banyan	Moraceae
Ficus benjamina	R			X		Cult	Alien	Benjamin tree	Moraceae
Ficus elastica						Cult	Alien	Indian Rubber Tree	Moraceae
Ficus macrophylla	R			X		Nat	Alien	Moreton Bay Fig	Moraceae
Ficus microcarpa	C			X	Nat	Nat	Alien	Chinese banyan	Moraceae
Ficus sp.						Cult	Alien	Unknown ficus	Moraceae
Fimbristylis cymosa	O/C	R	O/C	X		Nat	Native	Button sedge	Cyperaceae
Fimbristylis cymosa spp. umbellato-capitata				X	Nat	Nat	Native	Button sedge	Cyperaceae
Fimbristylis cymosa subsp. spathacea				X	Nat	Nat	Native	Button sedge	Cyperaceae
Fragaria x ananassa				X		Cult	Alien	Strawberry	Rosaceae

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

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

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

Species	Sand	Eastern	Spit	Coll.	BISH	Starr	Status	Common name	Family
Pilea serpyllacea				X		Cult	Alien	Large artillery plant	Urticaceae
Piper sarmentosum	R			X		Cult	Alien	Thai Piper	Piperaceae
Pithecellobium dulce	R			X		Cult	Alien	Opiuma, Manila tamarind	Fabaceae
Plantago lanceolata	O/C			X	Nat	Nat	Alien	Narrow leaved plantian	Plantaginaceae
Plantago major				X	Nat	Nat	Alien	Common plantain	Plantaginaceae
Plectranthus amboinicus	R					Cult	Alien	Mexican oregano	Lamiaceae
Plectranthus scutellarioides						Cult	Alien	Coleus	Lamiaceae
Pluchea carolinensis	C			X	Nat	Nat	Alien	Sour bush	Asteraceae
Pluchea indica				X	Nat	Nat	Alien	Indian pluchea	Asteraceae
Pluchea x fosbergii				X	Nat	Nat	Alien	Hybrid pluchea	Asteraceae
Plumbago auriculata						Cult	Alien	Plumbago	Plumbaginaceae
Plumeria obtusa	R			X		Cult	Alien	Singapore plumeria	Apocynaceae
Plumeria rubra	O/C			X		Cult	Alien	Red plumeria, frangipani	Apocynaceae
Poa annua	R			X	Nat	Nat	Alien	Blue grass	Poaceae
Polypogon interruptus	O			X	Nat	Nat	Alien	Ditch polypogon	Poaceae
Polypogon monspeliensis				X	Nat	Nat	Alien	Rabbitfoot grass	Poaceae
Polyscias guilfoylei	R			X		Cult	Alien	Panax	Araliaceae
Portulaca lutea				X	Nat	Nat	Native	Ihi	Portulacaceae
Portulaca lutea/oleracea/hybrid						Nat	?	Portulaca hybrid	Portulacaceae
Portulaca oleracea	O/C	C	R	X	Nat	Nat	Alien	Common purslane	Portulacaceae
Portulacaria afra	R			X		Cult	Alien	Jade tree	Portulacaceae
Pritchardia sp.	R					Cult	Native	Loulu palm	Arecaceae
Prosopis pallida					Nat	Cult	Alien	Kiawe	Fabaceae
Pseudognaphalium sandwicensium var. sandwicensium	O/C	R		X	Nat	Nat	Native	Enaena	Asteraceae
Psidium guajava	R					Cult	Alien	Guava	Myrtaceae
Psilotum nudum				X		Nat	Native	Moa	Psilotaceae
Psophocarpus tetragonolobus	R			X		Cult	Alien	Wing bean	Fabaceae
Punica granatum						Cult	Alien	Pomegranite	Myrtaceae
Raphanus sativus				X		Cult	Alien	Radish	Brassicaceae
Ricinus communis	O					Nat	Alien	Castor bean	Euphorbiaceae
Rosa sp.	O			X		Cult	Alien	Rose	Rosaceae

Species	Sand	Eastern	Spit	Coll.	BISH	Starr	Status	Common name	Family
Roystonea sp.						Cult	Alien	Royal palm	Arecaceae
Ruellia brittoniana	O			X	Nat	Nat	Alien	Ruellia	Acanthaceae
Russelia equisetiformis	R			X		Cult	Alien	Coral / firecracker plant	Schrophulariaceae
Sagina japonica				X	Nat	Cult	Alien	Japanese pearlwort	Caryophyllaceae
Samanea saman	R			X		Cult	Alien	Monkey pod	Fabaceae
Sanseviera trifasciata	O			X		Cult	Alien	Mother in law tongue	Agavaceae
Scaevola taccada	C/D	C/D	D	X	Nat	Nat	Native	Naupaka kahakai	Goodeniaceae
Schefflera actinophylla	O			X		Cult	Alien	Octopus tree	Araliaceae
Schinus terebinthifolius				X	Nat	Cult	Alien	Christmas berry	Anacardiaceae
Senna siamea	R			X		Cult	Alien	Pheasant wood	Fabaceae
Senna surattensis						Cult	Alien	Kolomona	Fabaceae
Sesbania grandiflora	R			X		Cult	Alien	Sesban	Fabaceae
Sesuvium portulacastrum	O	R	C	X		Nat	Native	Akulikuli	Aizoaceae
Setaria verticillata	O	O		X	Nat	Nat	Alien	Bristly foxtail	Poaceae
Sicyos pachycarpus	Y					Cult	Native	Anunu	Cucurbitaceae
Sida fallax	R			X	Nat	Nat	Native	Ilima	Malvaceae
Sida rhombifolia				X	Nat	Nat	Alien	Cuba jewt	Malvaceae
Solanum americanum	O/C		R	X	Nat	Nat	Native	Popolo	Solanaceae
Solanum linnaeanum						Cult	Alien	Apple of Sodom	Solanaceae
Solanum lycopersicum var. cerasiforme						Cult	Alien	Cherry tomato	Solanaceae
Solanum lycopersicum var. lycopersicum	R			X		Cult	Alien	Tomato	Solanaceae
Solanum melongena	O			X		Cult	Alien	Eggplant	Solanaceae
Solanum nelsonii	R	R/O	C	X	Nat	Nat	Native	Popolo	Solanaceae
Solanum torvum	R			X		Nat	Alien	Turkey berry	Solanaceae
Sonchus oleraceus	O	R	R	X	Nat	Nat	Alien	Sow thistle	Asteraceae
Spathodea campanulata	R			X		Cult	Alien	African tulip tree	Bignonaceae
Spergularia marina	C	O/C	C	X	Nat	Nat	Alien	Saltmarsh sand spurry	Caryophyllaceae
Sphagneticola trilobata				X	Nat	Nat	Alien	Wedelia	Asteraceae
Spinacia oleracea						Cult	Alien	Spinach	Chenopodiaceae
Spondias sp.	O					Cult	Alien	Makok	Anacardiaceae
Sporobolus indicus	C			X	Nat	Nat	Alien	Indian dropseed	Poaceae
Sporobolus pyramidatus	C	O	R	X		Nat	Alien	Sporobolus	Poaceae
Sporobolus sp. africanus ?				X		Nat	Alien	African dropseed	Poaceae

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

Species	Sand	Eastern	Spit	Coll.	BISH	Starr	Status	Common name	Family
Unknown sp.						Nat	?	Vigna or Canavalia ?	Fabaceae
Unknown zingiberaceae						Cult	Alien	Galang ?	Zingiberaceae
Urochloa mutica				X	Nat	Nat	Alien	California grass	Poaceae
Veitchia merilii	R			X		Cult	Alien	Manilla palm	Arecaceae
Verbena litoralis	R			X	Nat	Nat	Alien	Vervain	Verbenaceae
Verbesina encelioides	D	D	O	X	Nat	Nat	Alien	Golden crown-beard	Asteraceae
Vigna unguiculata subsp. sesquipedalis	R			X		Cult	Alien	Long bean	Fabaceae
Viola odorata						Cult	Alien	Sweet violet	Violaceae
Viola x wittrockiana				X		Cult	Alien	Violet, pansy	Violaceae
Vitex rotundifolia	R			X		Cult	Native	Pohinahina	Verbenaceae
Vitex trifolia	O			X		Cult	Alien	Pohinahina	Verbenaceae
Vitis vinifera	R			X		Cult	Alien	Grape	Vitaceae
Vulpia myuros				X	Nat	Nat	Alien	Fox/rat tail fescue	Poaceae
Waltheria indica				X	Nat	Nat	Native	Uhaloa	Sterculiaceae
Wikstroemia uva-ursi	R			X		Cult	Native	Akia	Thymelaeaceae
Xanthium stumarium var. candense				X	Nat	Nat	Alien	Cocklebur	Asteraceae
Xanthosoma robustum	R			X		Cult	Alien	Ape	Araceae
Xanthosoma sp.						Cult	Alien	Ape	Araceae
Zea mays						Cult	Alien	Corn	Poaceae
Zinnia violacea				X		Cult	Alien	Zinnia	Asteraceae
Ziziphus sp.	R			X		Cult	Alien	Jujube	Rhamnaceae
Totals	222	37	26	272		Nat (165)	Alien (361)		
						Cult (239)	Native (41)		
						Cult/Nat (0)	? (2)		
						355	399		

Species	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																															
Abutilon grandifolium	X			X			X		Y					X	X																									
Acacia farnesiana	X						X		Y																	X									X					
Acalypha wilkesiana	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					Y			X			X											X														
Aleurites moluccana																																X								
Allamanda cathartica									Y																															
Allium cepa									Y																															
Allium fistulosum	X			X																																			
Allium porrum				X																																			
Allium sativum				X																																			
Allium schoenoprasum				X																																			
Allium tuberosum	X																																						
Alocasia cucullata									Y						X																									
Alocasia macrorrhiza				X																																			
Aloe vera	X			X			X		Y						X																									
Alpinia zerumbet															X																									
Alternanthera tenella							X		Y																															
Amaranthus dubius							X		Y																															
Amaranthus hybridus									Y																															
Amaranthus lividus subsp. polygonoides							X																																
Amaranthus spinosus	X			X					Y																															
Amaranthus viridis	X			X			X		Y		X																													
Ammophila arenaria									Y												X															X				
Anagalis arvensis	X			X			X		Y					X	X						X	X																		
Ananas comosus				X																																			
Andropogon virginicus	X			X	X			X								X																							
Anethum graveolens	X			X																																			
Anthurium andraeanum									Y						X																									

Species	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
Antigonon leptopus				X			X																																	
Apium graveolens	X																																							
Araucaria heterophylla	X			X			X		Y						X											X									?					
Arctium lappa									Y																															
Artabotrys hexapetalus	X																																						
Asparagus densiflorus	X																																						
Asparagus plumosus				X			X		Y						X																									
Asystasia gangetica									Y																															
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																										
Bidens pilosa														X							X	X					X													
Boerhavia repens	X			X			X		Y					X	X		X			X	X	X			X	X				X				X	X	X			X	X
Bothriochloa pertusa	X			X																																			
Bougainvillea spectabilis	X			X			X		Y						X											X				X									
Brassica campestris var. chinensis	X			X																										X									
Brassica campestris var. napobrassica																														X									
Brassica campestris var. rapa																														X									
Brassica nigra	X		X	X			X		Y						X																								
Brassica oleracea var. acephala																														X									
Brassica oleracea var. botrytis				X																										X									
Brassica oleracea var. botrytis				X																										X									
Brassica oleracea var. capitata				X																										X									
Brassica oleracea var. capitata				X			X																																	
Brassica oleracea var. gongylodes				X																										X									

Species	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																																							
Breynia disticha var. rosi-picta							X		Y																															
Bromus catharticus	X			X			X		Y					X	X																								
Caesalpinia bonduc	X																																						
Cajanus cajan	X																																						
Caladium bicolor	X						X		Y						X																								
Calendula officinalis				X																										X									
Calophyllum inophyllum	X			X			X		Y																					X									
Calyptocarpus vialis	X			X			X																																
Canna indica				X			X		Y						X																								
Canna x generalis	X																																						
Capparis sandwichiana		Y							Y																											X				X
Capsella bursa- pastoris				X			X		Y		X				X																								
Capsicum annuum	X			X			X		Y						X																								
Capsicum annuum var. grossum				X																																			
Carica papaya	X			X			X		Y						X															X									
Carissa macrocarpa									Y						X											X													
Casuarina equisetifolia	X			X			X		Y					X	X						X	X				X				X									
Casuarina glauca	X			X			X																																
Catharanthus roseus									Y						X											X				X					X					
Cenchrus agrimonioides var. laysanensis									Y																															X
Cenchrus ciliaris	X			X																																			
Cenchrus echinatus	X			X			X		Y					X	X					X	X					X										X				
Centaurium erythraea subsp. erythraea	X			X			X		Y					X																										
Cerastium fontanum var. triviale				X			X		Y						X																									
Cestrum nocturnum	X			X																																			
Chamaesyce hirta	X			X					Y					X						X		X				X										X				
Chamaesyce hypericifolia	X			X					Y					X					X	X	X															X				
Chamaesyce hyssopifolia							X		Y																															
Chamaesyce maculata	X			X					Y		X			X	X																									

Species	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
Chamaesyce prostata	X			X			X		Y					X												X													
Chenopodium murale	X			X			X		Y					X	X						X												X					
Chenopodium oahuense	X	Y																																						
Chloris barbata	X			X					Y					X	X						X					X													
Chloris divaricata var. divaricata				X																																			
Chloris virgata				X																																			
Chlorophytum comosum	X			X																																			
Chrysanthemum sp.				X																										X									
Cibotium sp.									Y																															
Ciclospermum leptophyllum	X			X			X		Y					X	X																									
Citrullus lanatus	X			X																																			
Citrus aurantifolia	X																																						
Citrus hystrix	X																																						
Citrus limon				X																																			
Citrus paradisi				X																																			
Citrus sinensis				X																																			
Citrus sp.	X			X			X		Y						X																									
Cleome gynandra				X																																			
Clusea rosea									Y																															
Coccinia grandis	X			X																																			
Coccoloba uvifera	X			X			X		Y					X	X						X					X				X									
Cocos nucifera	X			X			X		Y						X											X				X									
Codiaeum variegatum	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		Y					X	X				X	X	X	X				X	X			X				X	X				
Conyza canadensis var. pusila	X			X							X																												
Cordia sebestena	X			X			X		Y					X																X									
Cordyline fruticosa	X			X					Y						X															X									
Cordyline sp.									Y																															
Coreopsis grandiflora				X																																			
Coreopsis tinctoria																																		X					

Species	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
Coriandrum sativum				X																																				
Coronopus didymus	X			X			X		Y						X						X	X																		
Cosmos bipinnatus				X																																			
Cosmos sp.				X																																			
Crassula sp.				X			X		Y																														
Crinum asiaticum	X			X			X		Y						X						X					X													
Crotolaria incana	X			X			X		Y					X	X											X							X	X					
Crotolaria pallida				X					Y						X											X								X					
Cucumis melo var. cantalupensis				X																										X									
Cucumis sativus				X																																			
Cucurbita pepo	X			X			X		Y																														
Cycas circinalis	X			X			X		Y						X																								
Cycas revoluta									Y																														
Cymbopogon citratus	X			X																																			
Cynara scolymus				X																																			
Cynodon dactylon	X			X			X		Y					X	X						X	X				X		X											
Cyperus involucratus	X			X			X		Y					X	X						X					X								X					
Cyperus javanicus							X		Y					X												X									X					
Cyperus laevigatus	X																																						
Cyperus papyrus									Y						X																								
Cyperus pennatiformis var. bryanii	Y																																						
Cyperus polystachyos	X			X			X		Y					X																									
Cyperus rotundus	X			X					Y		X			X	X											X													
Dactyloctenium aegyptium	X			X			X			X	X																												
Daucus carota				X																										X									
Delonix regia	X			X					Y			X			X															X									
Desmanthus pernambucanus	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		Y					X	X				X		X			X		X	X												

Species	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
Digitaria insularis	X			X			X		Y					X																										
Dracaena fragrans	X			X											X															X										
Dracaena marginata	X			X																																				
Dracaena sp.				X					Y						X															X										
Duranta erecta																																		X						
Echinochloa crus-galli				X																																				
Eleusine indica	X			X			X		Y		X			X	X					X	X	X				X							X		X					
Epiphyllum oxypetalum				X					Y			X																												
Epipremnum pinnatum	X			X											X																									
Eragrostis amabilis	X			X			X		Y					X	X						X	X				X														
Eragrostis paupera	X			X			X		Y					X						X					X	X														X
Eragrostis variabilis	X			X			X		Y			X			X						X	X				X				X			X		X	X	X			X
Eriochloa sp.	X																																							
Ervatamia sp.									Y																															
Eryngium foetidum	X																																							
Erythrina variegata	X			X			X		Y						X																									
Eugenia uniflora	X			X			X		Y			X																												
Euphorbia cyathopora	X			X			X		Y					X	X						X	X				X														
Euphorbia heterophylla									Y																	X			X						X						
Euphorbia milii	X																																							
Euphorbia peplus	X			X			X		Y												X	X																		
Euphorbia pulcherrima	X			X			X		Y																	X				X										
Eustachys petraea	X			X			X		Y																															
Ficus benghalensis	X			X			X		Y						X						X									X									
Ficus benjamina	X			X																																				
Ficus elastica									Y						X																									
Ficus macrophylla	X			X										X																										
Ficus microcarpa	X			X			X		Y						X											X														
Ficus sp.									Y																															
Fimbristylis cymosa	X			X			X		Y						X																									
Fimbristylis cymosa spp. umbellato-capitata														X																										
Fimbristylis cymosa subsp. spathacea												X		X								X				X														
Fragaria x ananassa				X																																				

Species	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
Fragaria x ananassa 'Quinault'				X																																				
Gamochaeta purpurea									Y																	X															
Gardenia sp.									Y						X																									
Glycine max									Y																															
Gomphrena globosa				X																																			
Gynura sp.	X																																						
Hedychium gardnerianum									Y						X																									
Helianthus anuus	X								Y																					X										
Heliconia psittacorum							X		Y																															
Heliotropium currasavicum																																								
Heliotropium procumbens var. depressum	X			X			X		Y					X																										
Hemerocallis sp.									Y																															
Hibiscus rosa-sinensis	X			X			X		Y																															
Hibiscus sp.									Y						X											X				X										
Hibiscus tiliaceus	X			X			X		Y					X							X					X														
Hibiscus waimeae	X																																							
Hippeastrum sp.									Y																															
Hordeum murinum subsp. leporinum									Y																												X			
Hylocereus undatus									Y																															
Impatiens balsamina				X																																			
Indigofera hendecaphylla	X																																						
Ipomoea aquatica	X			X			X																																
Ipomoea batatas	X			X			X		Y						X															X									
Ipomoea indica	X			X			X		Y			X		X	X						X					X								X		X				X
Ipomoea pes-caprae subsp. brasiliensis	X			X			X		Y			X		X	X				X			X				X								X		X				
Ipomoea triloba									Y					X																										
Jasminum sambac												X																												
Juniperus bermudiana	X																				X																			
Kalanchoe daigremontiana x tubiflora									Y																															
Kalanchoe fedtschenkoi	X			X																																			

Species	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
Kalanchoe pinnata	X			X			X		Y						X						X																		
Kalanchoe tubiflora	X			X					Y																															
Lactuca sativa				X																																			
Lantana camara	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		Y					X	X				X		X	X				X				X			X						
Leptochloa uninervia				X																																			
Lepturus repens	X			X			X		Y					X	X					X	X																		X
Leucaena leucocephala	X			X			X		Y					X	X											X							X						
Lobularia maritima	X			X			X		Y			X		X	X					X	X	X				X	X			X									
Majorana hortensis				X																																			
Malva parviflora	X		X	X			X		Y		X				X																								
Malvastrum coromandelianum spp. coromandelianum	X			X			X		Y			X		X	X						X					X	X							X	X				
Malvaviscus arboreus							X		Y						X																								
Malvaviscus penduliflorus	X			X																																			
Mangifera indica	X								Y						X																								
Medicago lupulina	X			X			X		Y						X											X													
Medicago obicularis																																						X		
Medicago polymorpha				X			X																																	
Medicago sativa									Y																					X				X						
Melilotus alba				X					Y					X																										
Melilotus indica	X			X			X		Y																									X						
Melinis repens				X					Y					X	X						X					X														
Mentha sp.	X			X																																				
Merremia tuberosa									Y																															
Mirabilis jalapa	X			X			X		Y					X																										
Momordica charantia	X			X																																				
Monstera deliciosa				X			X		Y																															
Moringa oleifera	X			X																																				
Morus alba	X			X			X		Y																	X	X			X										
Murraya paniculata									Y						X											X				X										

Species	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
Musa x paradisiaca	X			X			X		Y																	X				X										
Nama sandwicensis	X	Y																																						
Nephrolepis hirsutula															X																									
Nephrolepis multiflora	X			X			X		Y			X																												
Nerium oleander	X			X			X		Y						X											X				X					X					
Noronhia emarginata	X			X			X		Y																															
Ocimum basilicum	X			X																																				
Odontonema strictum									Y																															
Oenothera laciniata	X			X			X		Y			X	X	X																										
Olea europaea subsp. cuspidata	X			X																																				
Opuntia cochenillifera	X			X			X																																	
Oryza sp.	X																																							
Oxalis corniculata	X			X			X		Y					X	X											X								X						
Oxalis debilis var. corymbosa	X			X			X		Y						X																									
Pancratium littorale									Y																															
Pandanus amaryllifolius	X																																							
Pandanus tectorius	X			X			X		Y						X											X				X										
Panicum maximum	X			X			X																																	
Paspalum setaceum	X			X																																				
Paspalum urvillei	X			X			X		Y					X																										
Passiflora edulis	X								Y			X																												
Pedilanthus tithymaloides	X			X			X		Y																															
Pelargonium x hortorum	X			X			X		Y						X															X										
Peperomia obtusifolia				X																																				
Persea americana				X																																				
Petroselinum crispum				X																																				
Petroselinum sp.																																								
Phaseolus vulgaris				X			X		Y																															
Philodendron sp.							X		Y																															
Phoenix sp.							X		Y						X											X				X										
Phyla nodiflora	X			X					Y					X																										
Phyllostegia variabilis									Y																												X				
Phymatosorus grossus									Y																															
Pilea microphylla	X			X			X		Y		X				X				X	X																				

Species	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
Pilea serpyllacea				X																																				
Piper sarmentosum	X																																							
Pithecellobium dulce	X			X																																				
Plantago lanceolata	X			X			X		Y					X	X					X	X								X	?				X	X					
Plantago major				X			X		Y					X	X					X	X									?				X						
Plectranthus amboinicus	X																																							
Plectranthus scutellarioides									Y						X																									
Pluchea carolinensis	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					Y																															
Plumeria rubra	X			X			X		Y						X															X									
Poa annua	X			X			X		Y					X	X						X																		
Polypogon interruptus	X			X					Y					X																										
Polypogon monspeliensis				X					Y					X						X		X						X												
Polyscias guilfoylei	X			X			X		Y																					X									
Portulaca lutea		Y					X		Y										X		X															X				X
Portulaca lutea/oleracea/hybrid				X																																			
Portulaca oleracea	X						X		Y			X		X	X			X				X				X														
Portulacaria afra	X			X					Y																															
Pritchardia sp.	X			X			X		Y						X																									
Prosopis pallida									Y																															
Pseudognaphalium sandwicensium var. sandwicensium	X			X			X		Y			X		X	X					X	X	X				X	X													
Psidium guajava	X			X			X		Y																															
Psilotum nudum									?																											X				
Psophocarpus tetragonolobus	X																																							
Punica granatum							X																																	
Raphanus sativus				X			X		Y																					X									
Ricinus communis	X			X			X		Y																	X														
Rosa sp.	X			X					Y						X															X									

Species	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		Y			X																												
Russelia equisetiformis	X			X																																			
Sagina japonica				X																																			
Samanea saman	X								Y						X																								
Sanseviera trifasciata	X			X			X		Y						X															X									
Scaevola taccada	X			X			X		Y			X		X	X		X			X		X				X									X				X
Schefflera actinophylla	X			X			X		Y						X																								
Schinus terebinthifolius				X			X		Y												X					X	X													
Senna siamea	X																																							
Senna surattensis									Y																															
Sesbania grandiflora	X			X			X																																
Sesuvium portulacastrum	X			X			X																																
Setaria verticillata	X			X			X		Y					X	X						X	X				X													
Sicyos pachycarpus	Y																																							
Sida fallax	X	Y							Y			X														X										X				
Sida rhombifolia				X																																			
Solanum americanum	X			X			X		Y			X		X	X				X	X	X					X	X								X	X			X	
Solanum linnaeanum				X																																			
Solanum lycopersicum var. cerasiforme				X																																			
Solanum lycopersicum var. lycopersicum	X			X																										X									
Solanum melongena	X			X																										X									
Solanum nelsonii	X			X			X		Y					X					X										X					X		X				X
Solanum torvum	X																																							
Sonchus oleraceus	X			X			X		Y					X	X					X	X	X				X	X							X					
Spathodea campanulata	X			X			X		Y																															
Spergularia marina	X			X			X		Y					X	X																									
Sphagneticola trilobata									Y			X																												
Spinacia oleracea				X																																			
Spondias sp.	X																																							
Sporobolus indicus	X						X		Y			X		X																										
Sporobolus pyramidatus	X								Y																															
Sporobolus sp. africanus ?				X										X	X						X																		

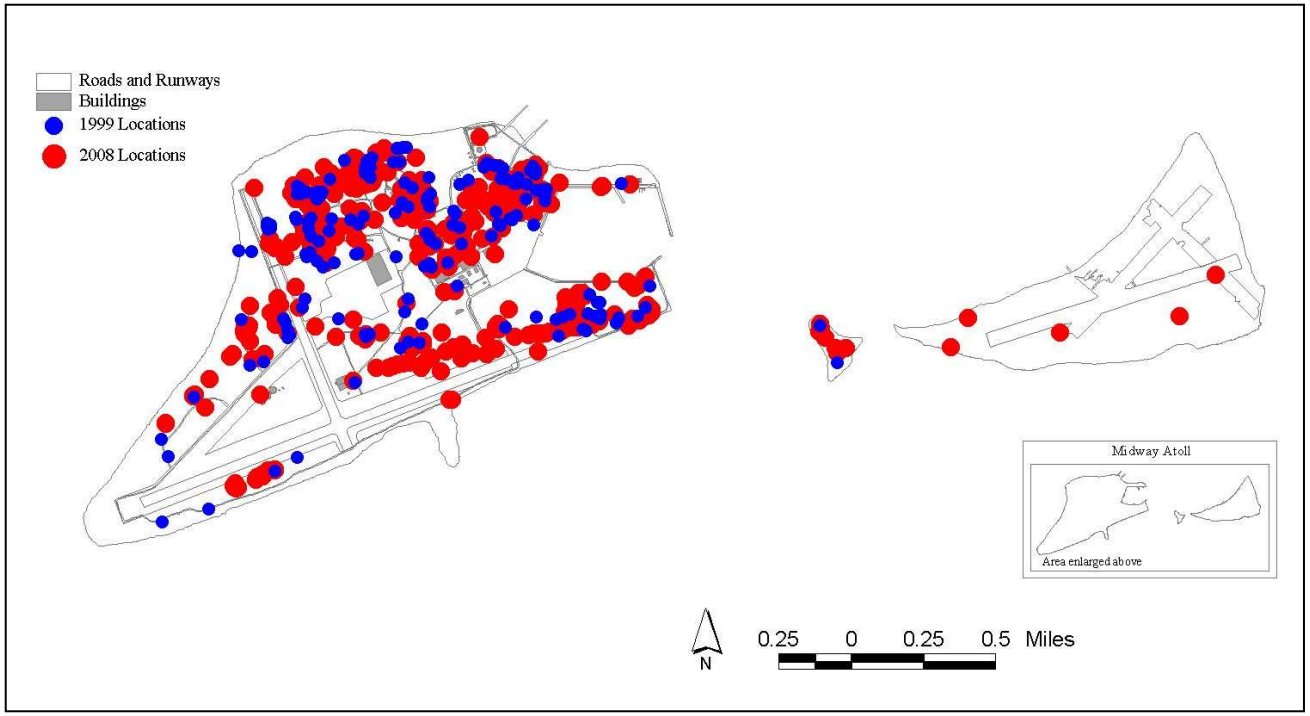
Species	2008	2006	2001	1999	1998	1998b	1995	1993	1992	1991	1988	1983	1983b	1980	1979	1979b	1970	1966	1964	1964b	1962	1962b	1960	1959	1955	1954	1954b	1945	1944	1941	1940	1936	1935	1933	1931	1923	1912	1911	1907	1902
Sporobolus virginicus									Y																	X									X					
Stachys arvensis					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

Species	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
Unknown sp.				X																																				
Unknown zingiberaceae				X																																				
Urochloa mutica				X					Y												X					X														
Veitchia merilii	X			X																																				
Verbena litoralis	X			X					Y					X																				X						
Verbesina encelioides	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																																							
Vitex trifolia	X			X			X		Y					X	X						X					X				X										
Vitis vinifera	X			X					Y			X																												
Vulpia myuros									Y																																
Waltheria indica				X			X		Y			X		X												X															
Wikstroemia uva-ursi	X																																							
Xanthium stumarium var. candense									Y																																
Xanthosoma robustum	X																																							
Xanthosoma sp.									Y						X																										
Zea mays				X																																				
Zinnia violacea				X																																				
Ziziphus sp.	X																																							
Totals	222	6	3	262	1	0	155	1	239	1	9	29	1	82	122	1	5	2	9	21	52	29	0	1	2	77	12	2	3	58	2	1	1	28	22	17	1	1	4	13

APPENDIX C: MAPS OF SELECTED SPECIES ON MIDWAY

Distribution maps for selected species showing 2008 distribution and, when available, 1999 distribution. Emphasis is on incipient invasive non-native plant species and rare native plants.

605 GPS points were collected for 102 species in 2008. These points recorded invasive species locations and documented new records. Most points were collected on Sand Island. 163 GPS points were collected for 33 species in 1999, and were used to help show change over time for a couple dozen species. A few of the 2008 and 1999 locations were hand drawn in 2008 using high resolution satellite images and GIS base layers.

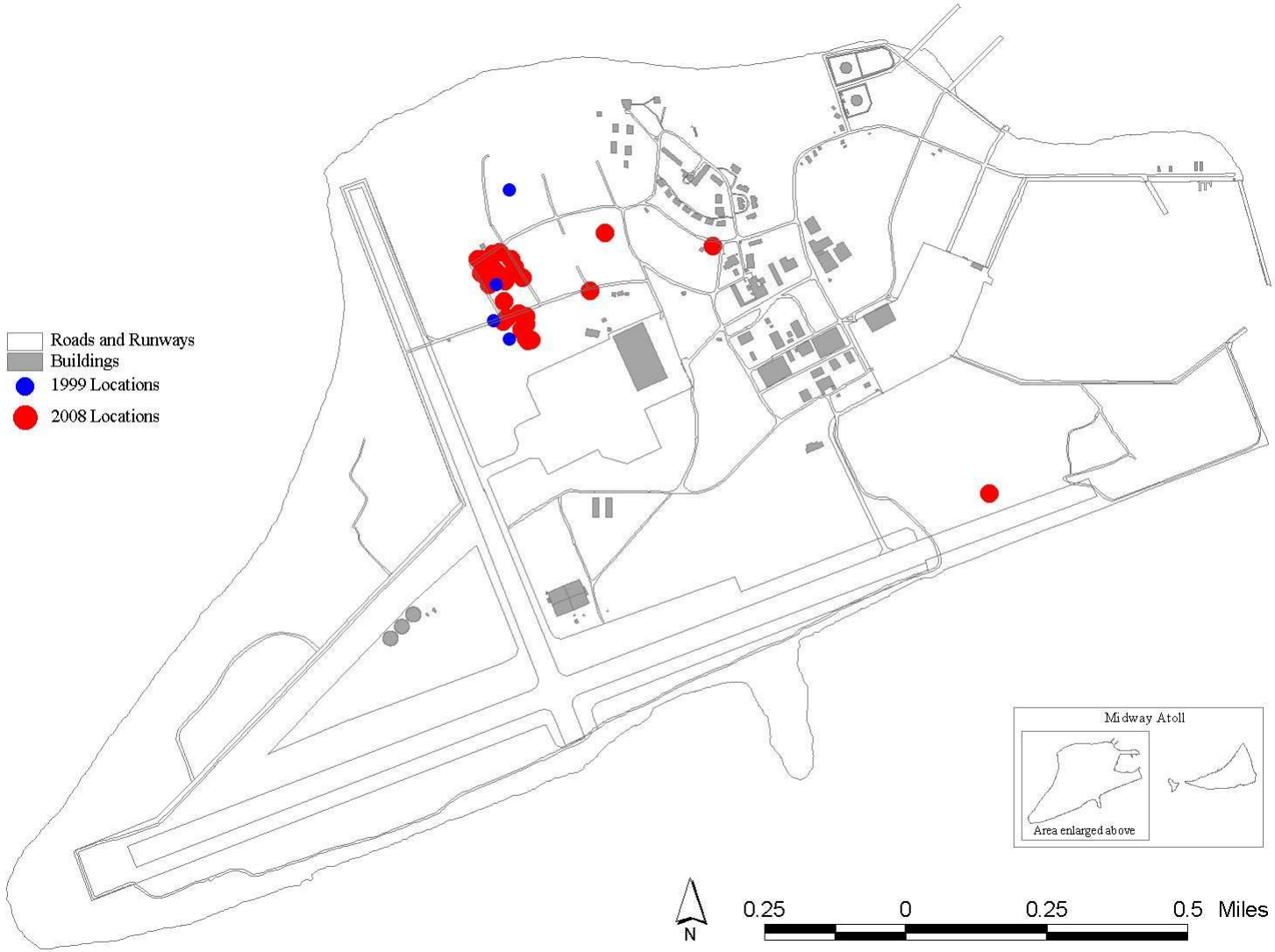


GPS points collected in 1999 and 2008 surveys of Midway Atoll.

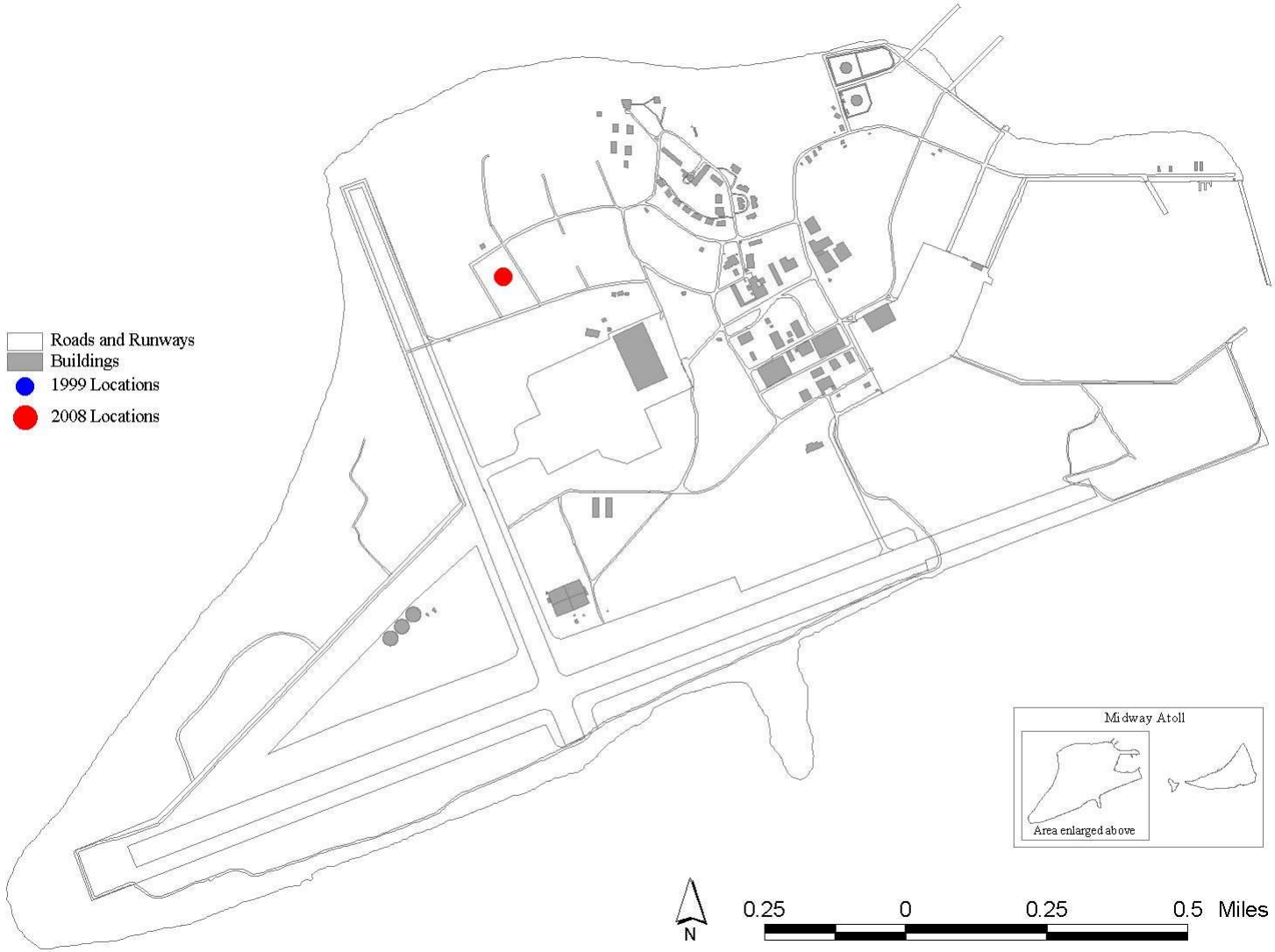
NON-NATIVES

Hoary abutilon	(*Abutilon grandifoliu*m)
Klu	(*Acacia farnesiana*)
Agave	(*Agave sisalana*)
Siris tree	(*Albizia lebbeck*)
Mexican creeper	(*Antigonon leptopus*)
Asparagus fern	(*Asparagus densiflorus*)
Black mustard	(*Brassica nigra*)
Kamani	(*Calophyllum inophyllum*)
Longleaf ironwood	(*Casuarina glauca*)
Buffel grass	(*Cenchrus ciliaris*)
Sandbur	(*Cenchrus echinatus*)
Night blooming jasmine	(*Cestrum nocturnum*)
Ivy gourd	(*Coccinia grandis*)
Umbrella sedge	(*Cyperus involucratus*)
Sourgrass	(*Digitaria insularis*)
Golden pothos	(*Epipremnum pinnatum*)
Cup grass	(*Eriochloa* sp.)
Surinam cherry	(*Eugenia uniflora*)
Weeping fig	(*Ficus benjamina*)
Banyan tree	(*Ficus benghalensis*)
Moreton Bay fig	(*Ficus macrophylla*)
Chinese banyan	(*Ficus microcarpa*)
Creeping indigo	(*Indigofera hendecaphylla*)
Swamp cabbage	(*Ipomoea aquatica*)
Air plant	(*Kalanchoe pinnata*)
Chandelier plant	(*Kalanchoe tubiflora*)
Lantana	(*Lantana camara*)
Sprangletop	(*Leptochloa uninervia*)
Haole koa	(*Leucaena leucocephala*)
Natal red top	(*Melinis repens*)
Bitter melon	(*Momordica charantia*)
Madagascar olive	(*Noronhia emarginata*)
African olive	(O*lea europaea cuspidata*)
Guinea grass	(*Panicum maximum*)
Passion vine	(*Passiflora edulis*)
Manila tamarind	(*Pithecellobium dulce*)
Sourbush	(*Pluchea carolinensis*)
Guava	(*Psidium guajava*)
Castor bean	(*Ricinus communis*)
Octopus tree	(*Schefflera actinophylla*)
Christmas berry	(*Schinus terebinthifolius*)
Turkeyberry	(S*olanum torvum*)
African tulip	(*Spathodea campanulata*)
Nephthytis	(*Syngonium podophyllum*)
New Zealand spinach	(*Tetragonia tetragonioides*)
California grass	(*Urochloa mutica*)
Tree vitex	(*Vitex trifolia*)
Jujube	(*Ziziphus* sp.)

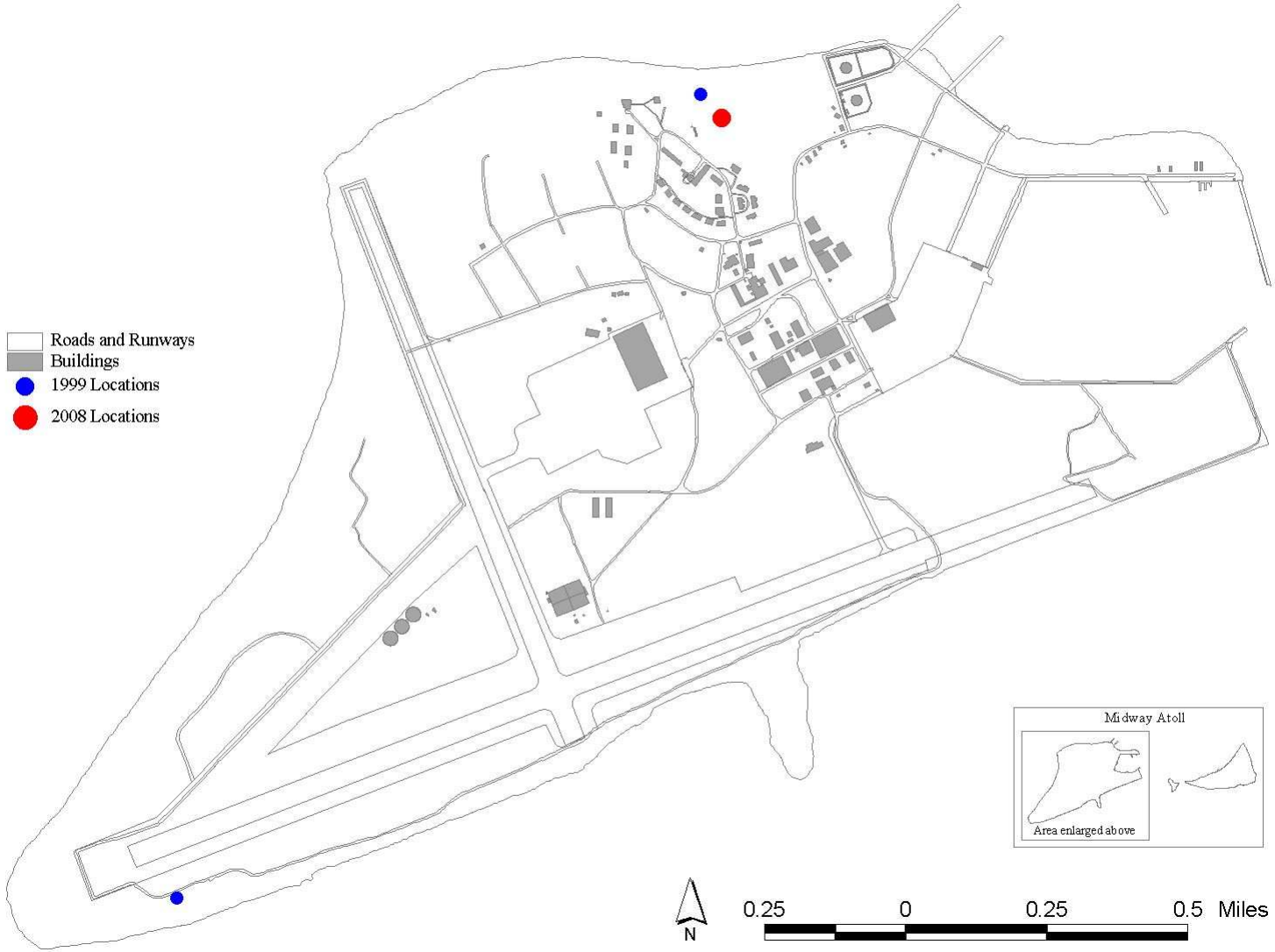
Known distribution of hoary abutilon (*Abutilon grandifolium*) on Midway Atoll in 1999 and 2008



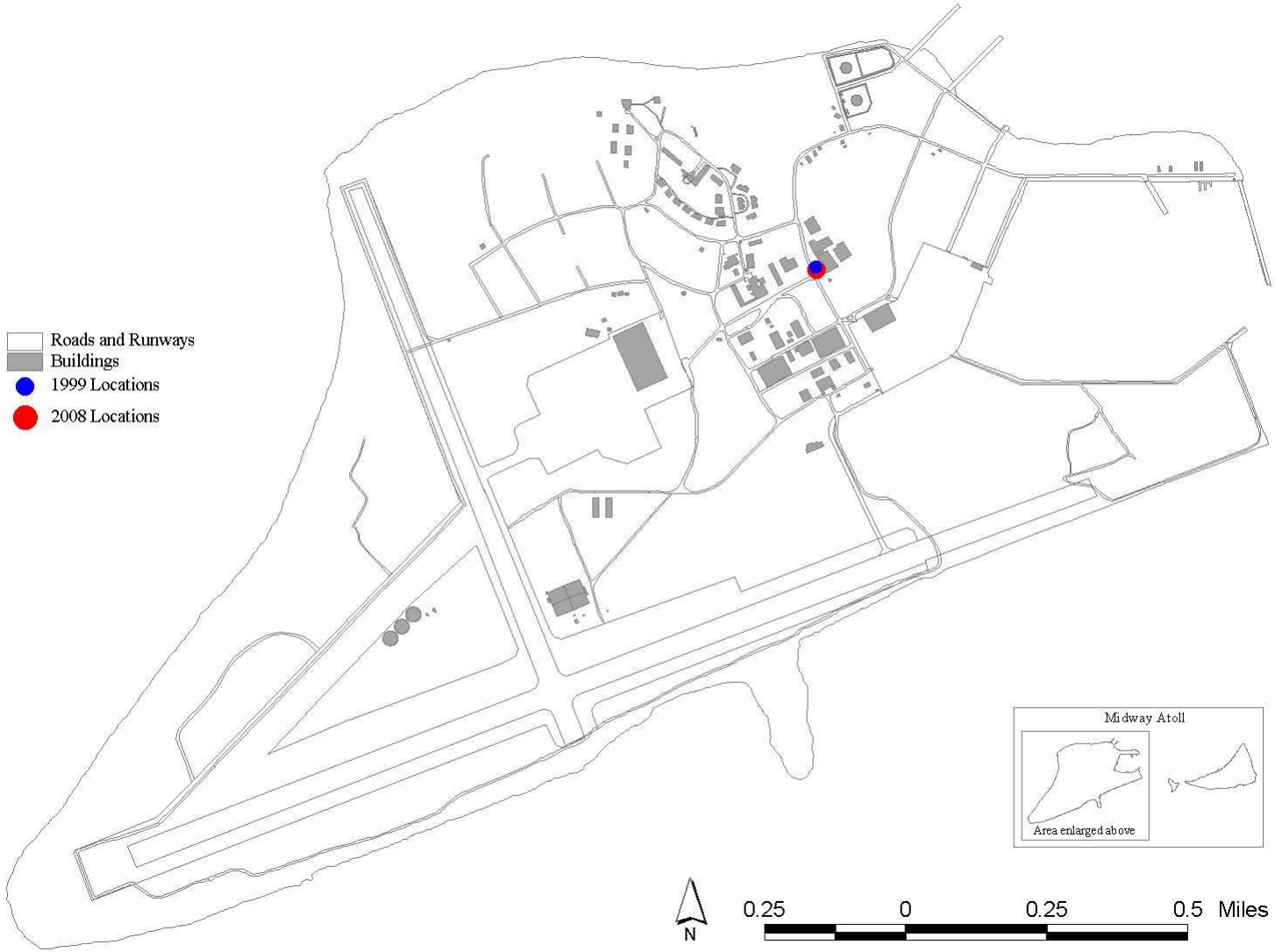
Known distribution of klu (*Acacia farnesiana*) on Midway Atoll in 1999 and 2008



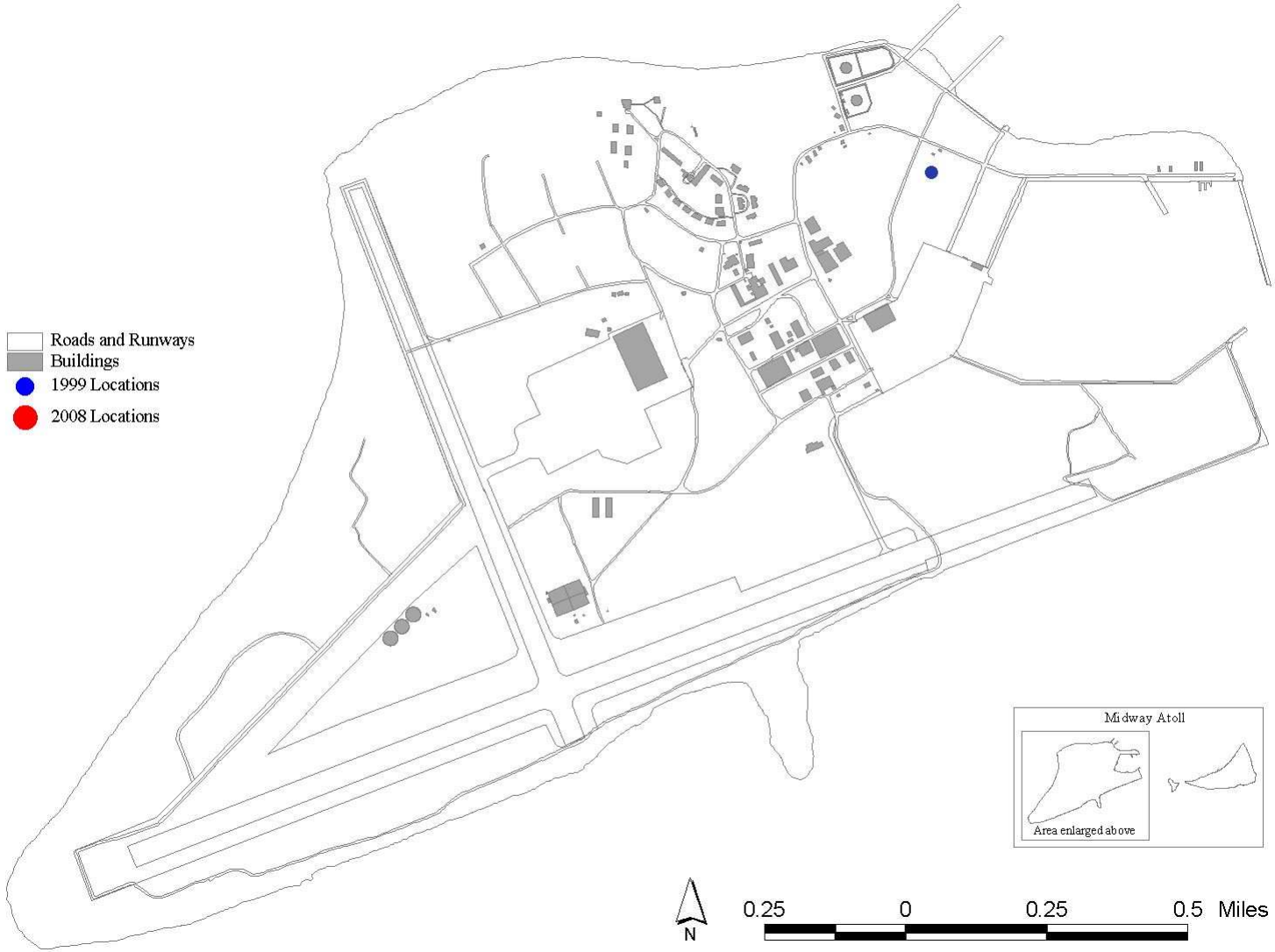
Known distribution of agave (*Agave sisalana*) on Midway Atoll in 1999 and 2008



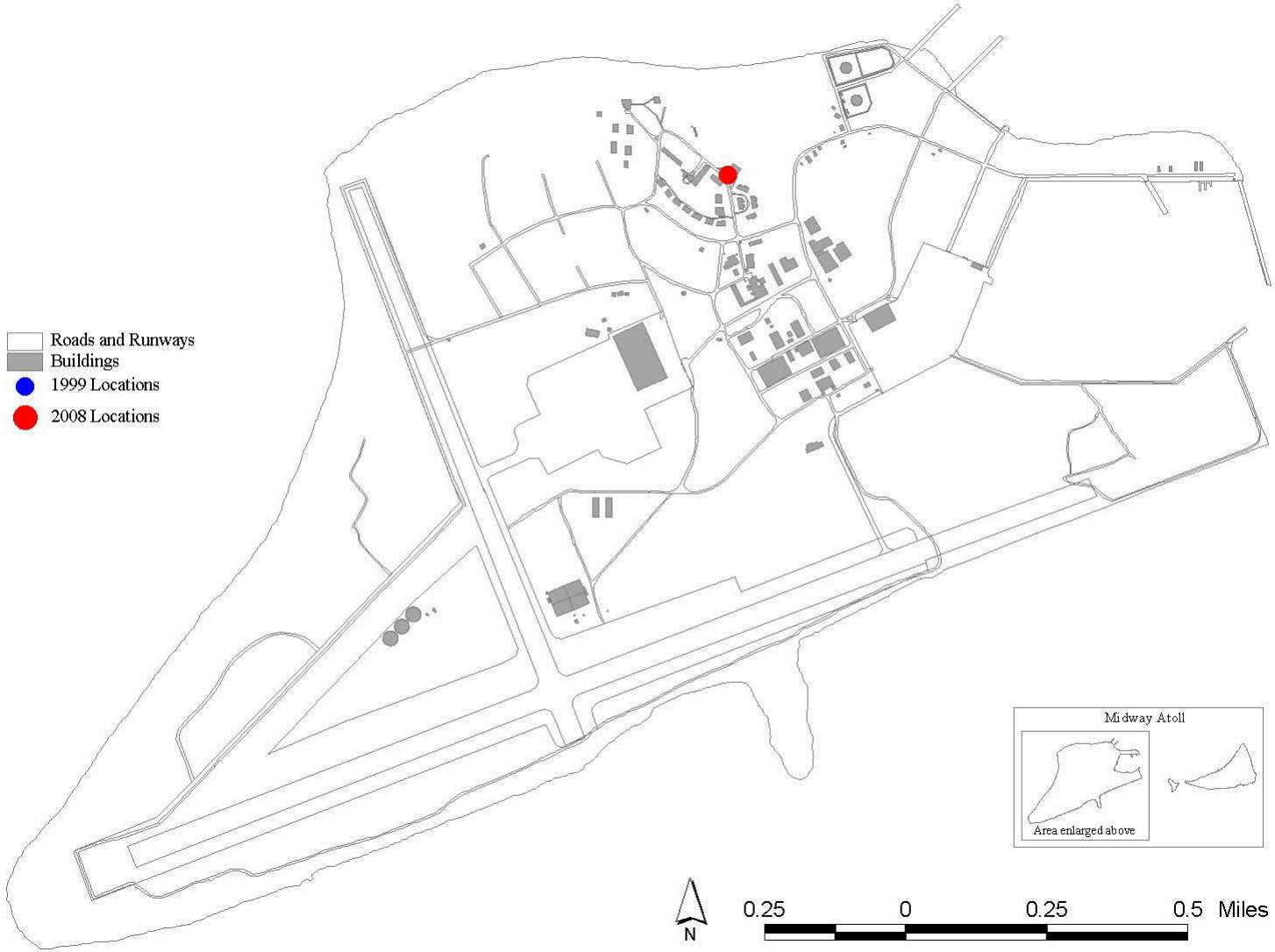
Known distribution of Siris tree (*Albizia lebbeck*) on Midway Atoll in 1999 and 2008



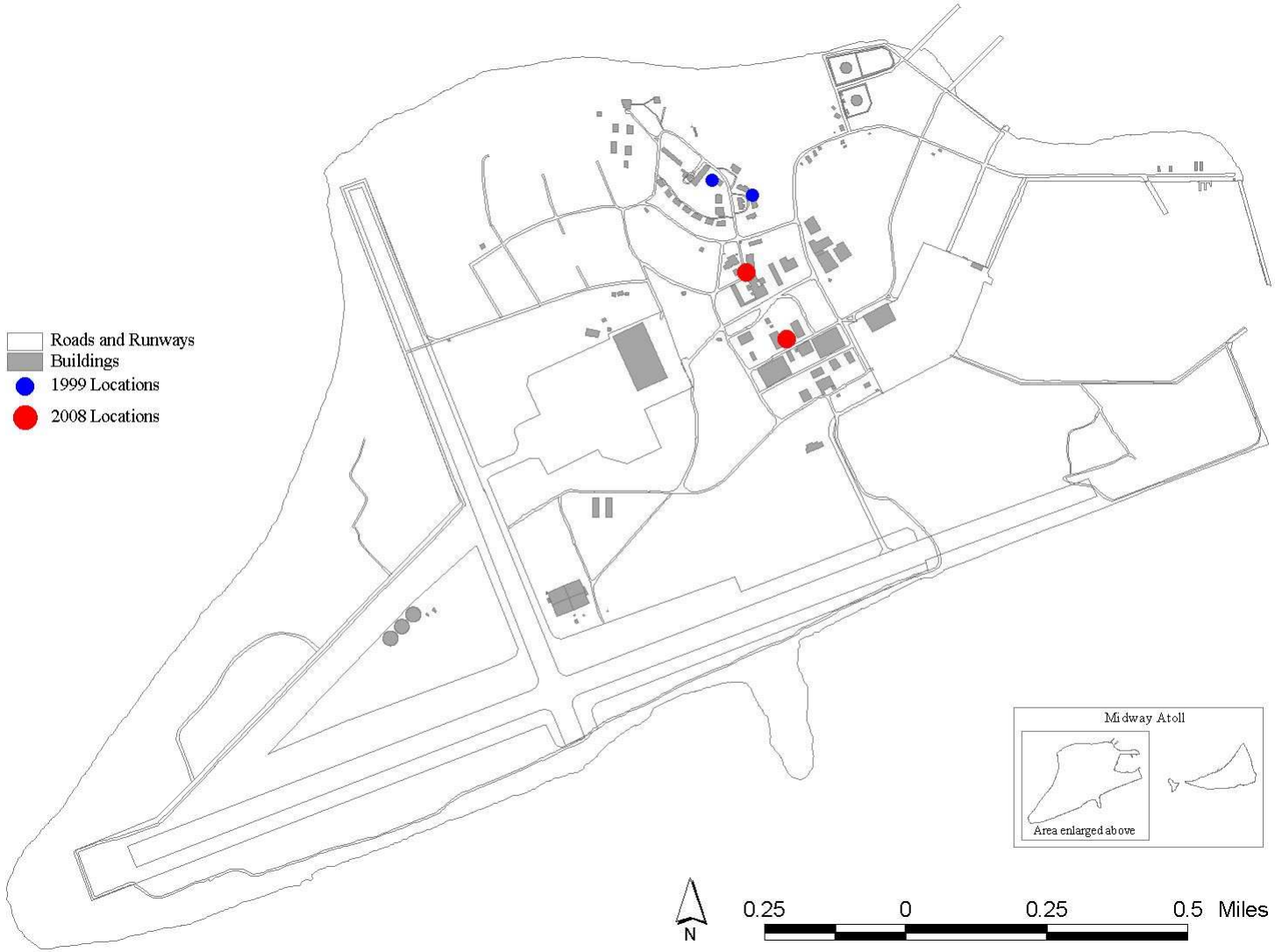
Known distribution of Mexican creeper (*Antigonon leptopus*) on Midway Atoll in 1999 and 2008



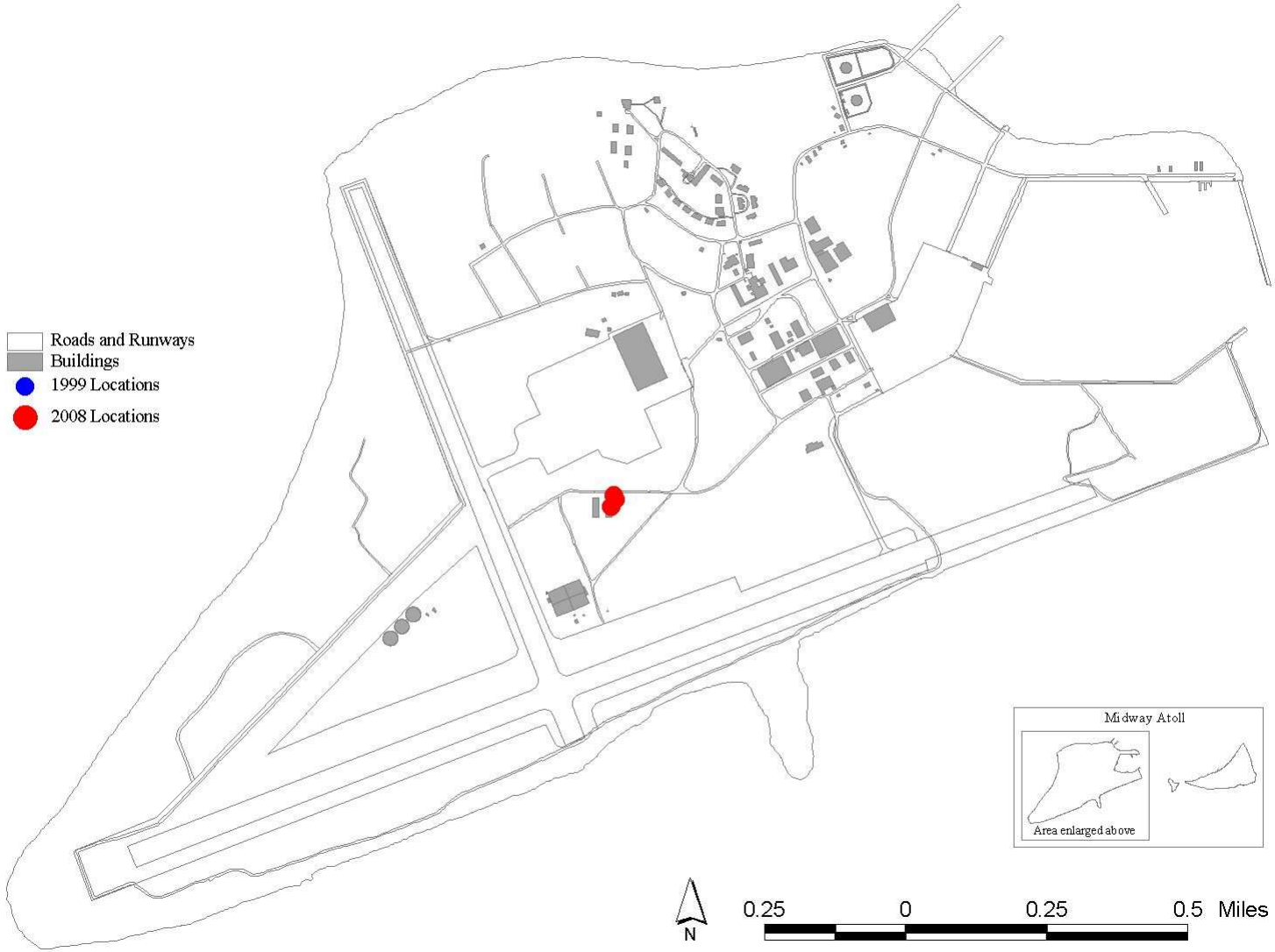
Known distribution of asparagus fern (*Asparagus densiflorus*) on Midway Atoll in 1999 and 2008



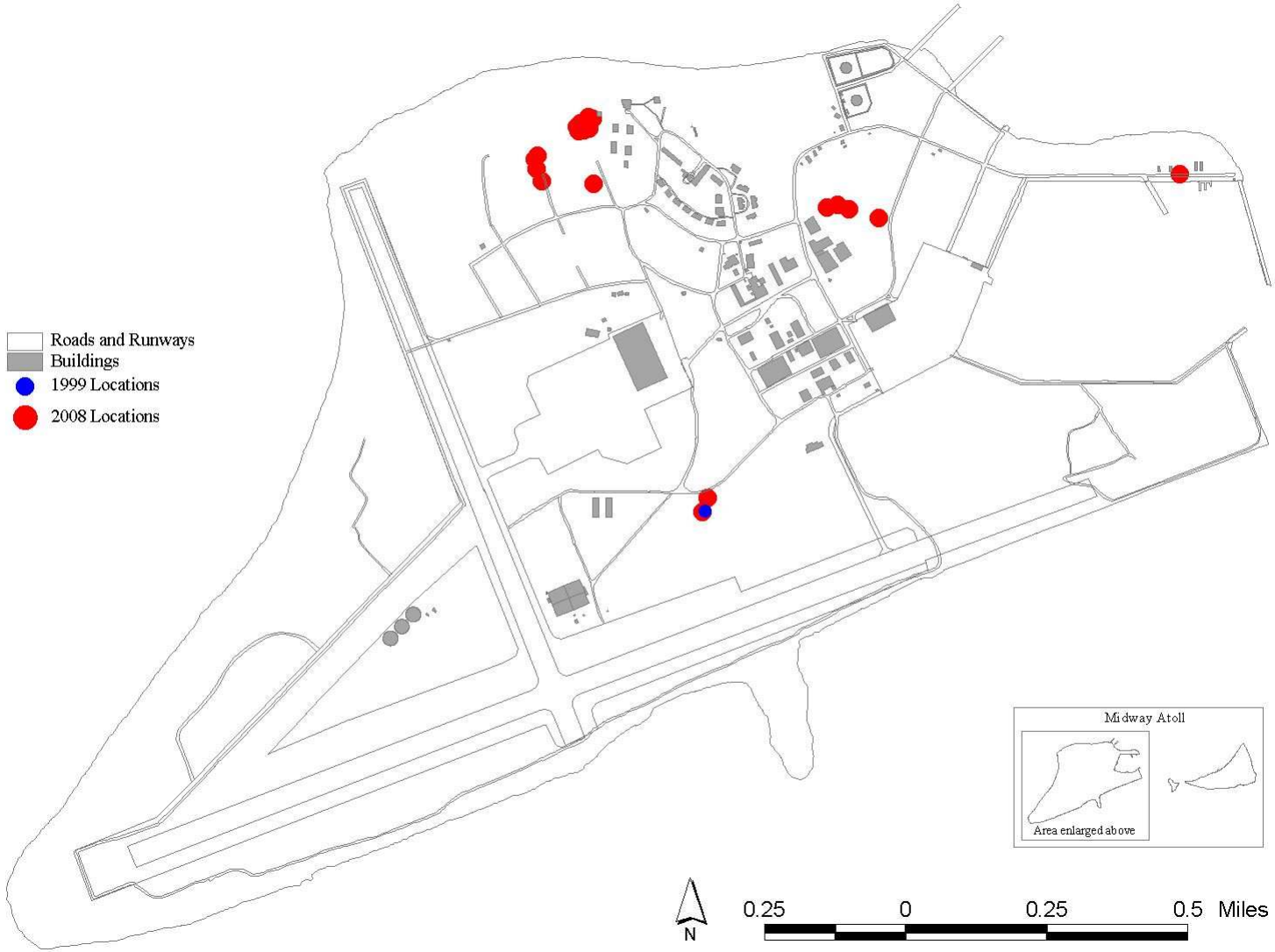
Known distribution of black mustard (*Brassica nigra*) on Sand Island, Midway Atoll in 1999 and 2008



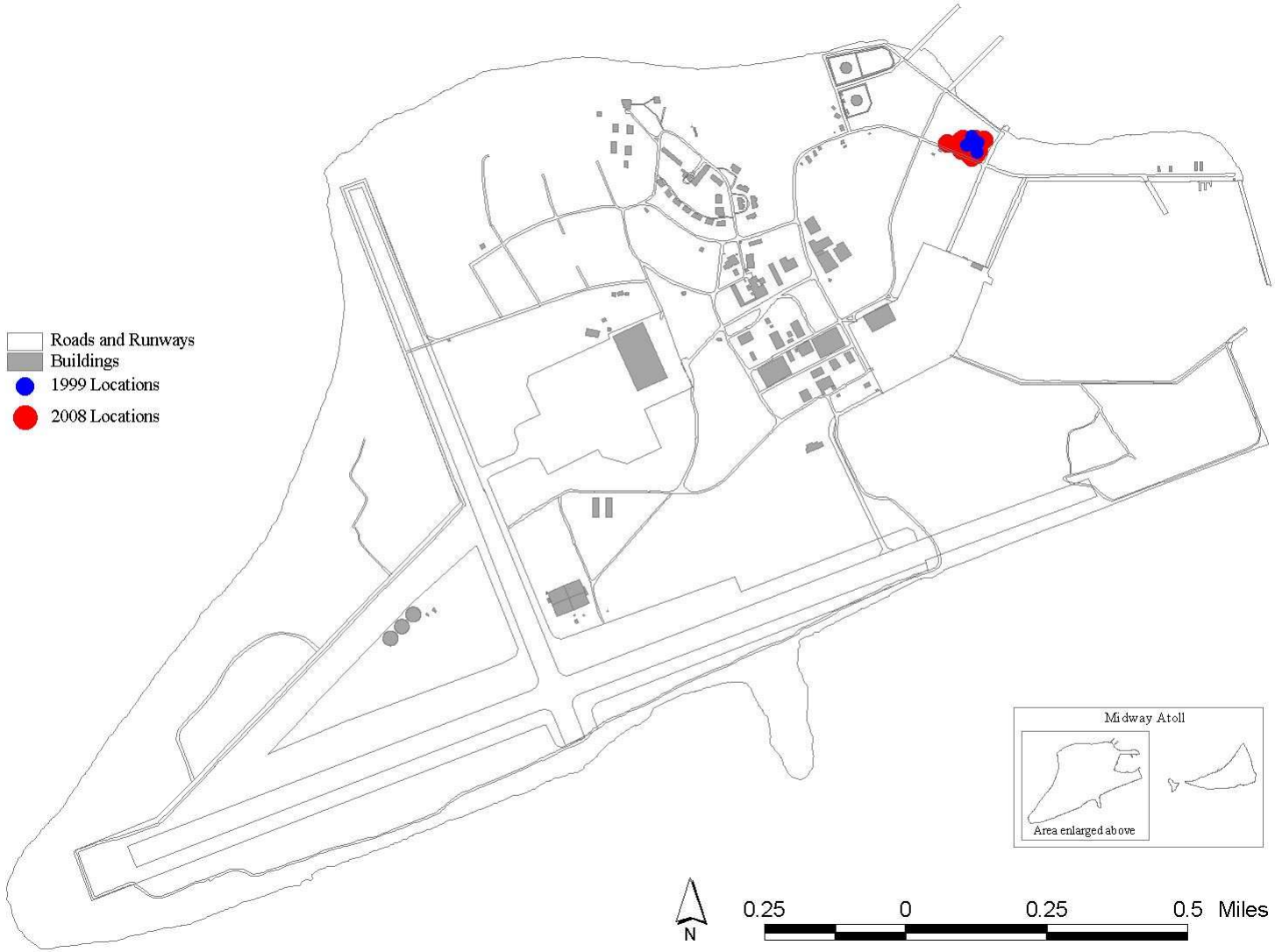
Known distribution of kamani (*Calophyllum inophyllum*) on Midway Atoll in 1999 and 2008



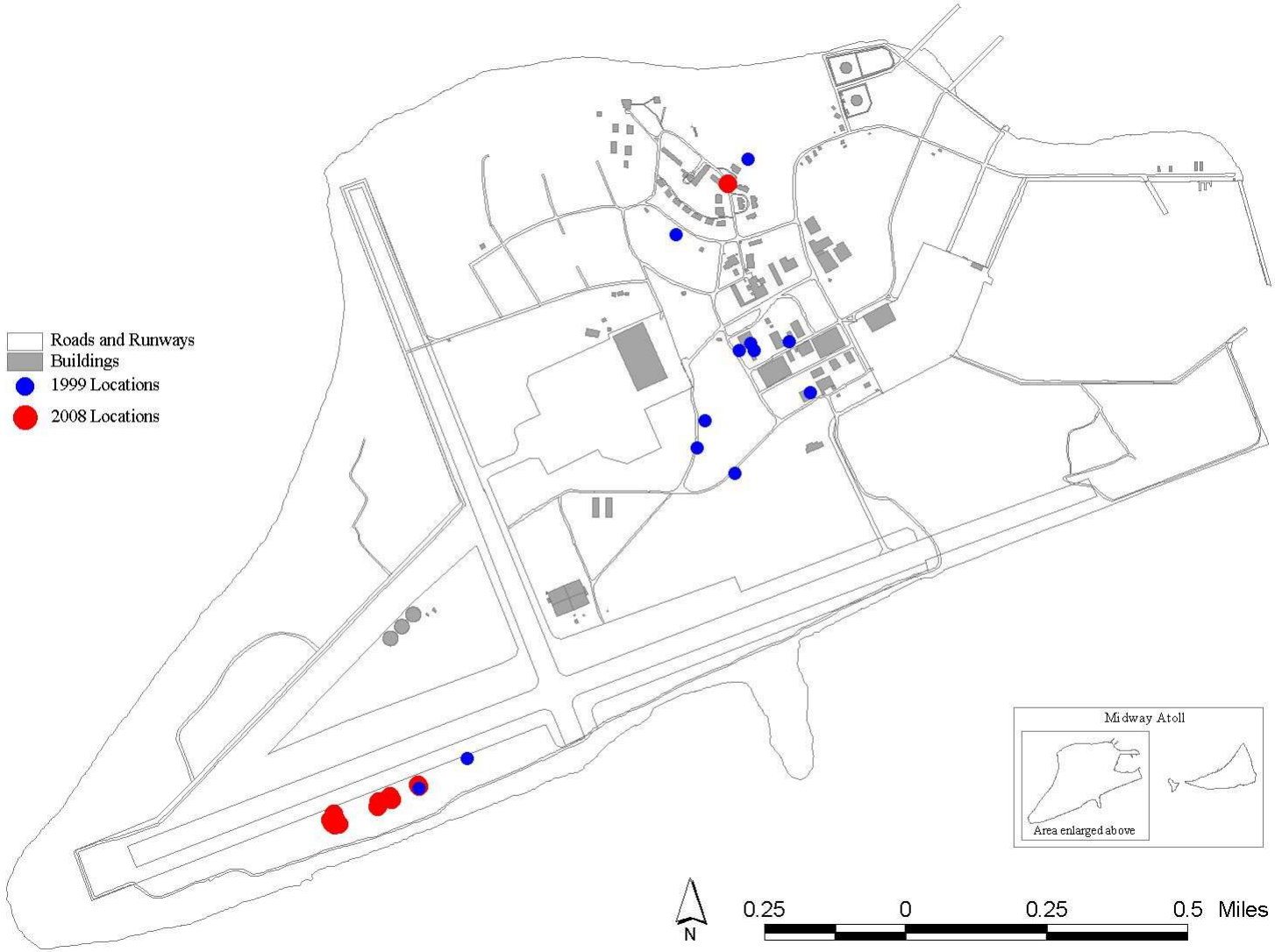
Known distribution of longleaf ironwood (*Casuarina glauca*) on Midway Atoll in 1999 and 2008



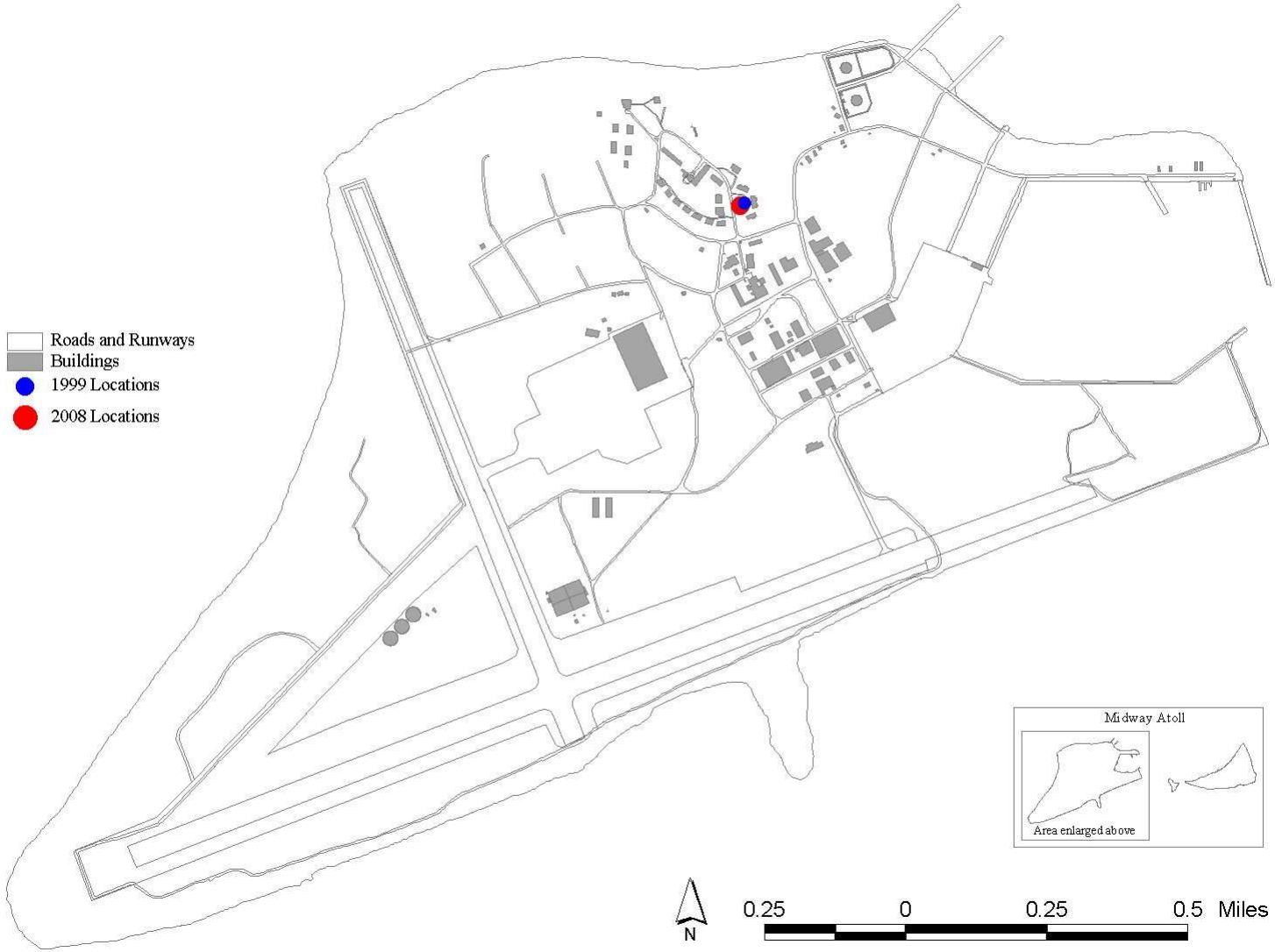
Known distribution of buffel grass (*Cenchrus ciliaris*) on Midway Atoll in 1999 and 2008



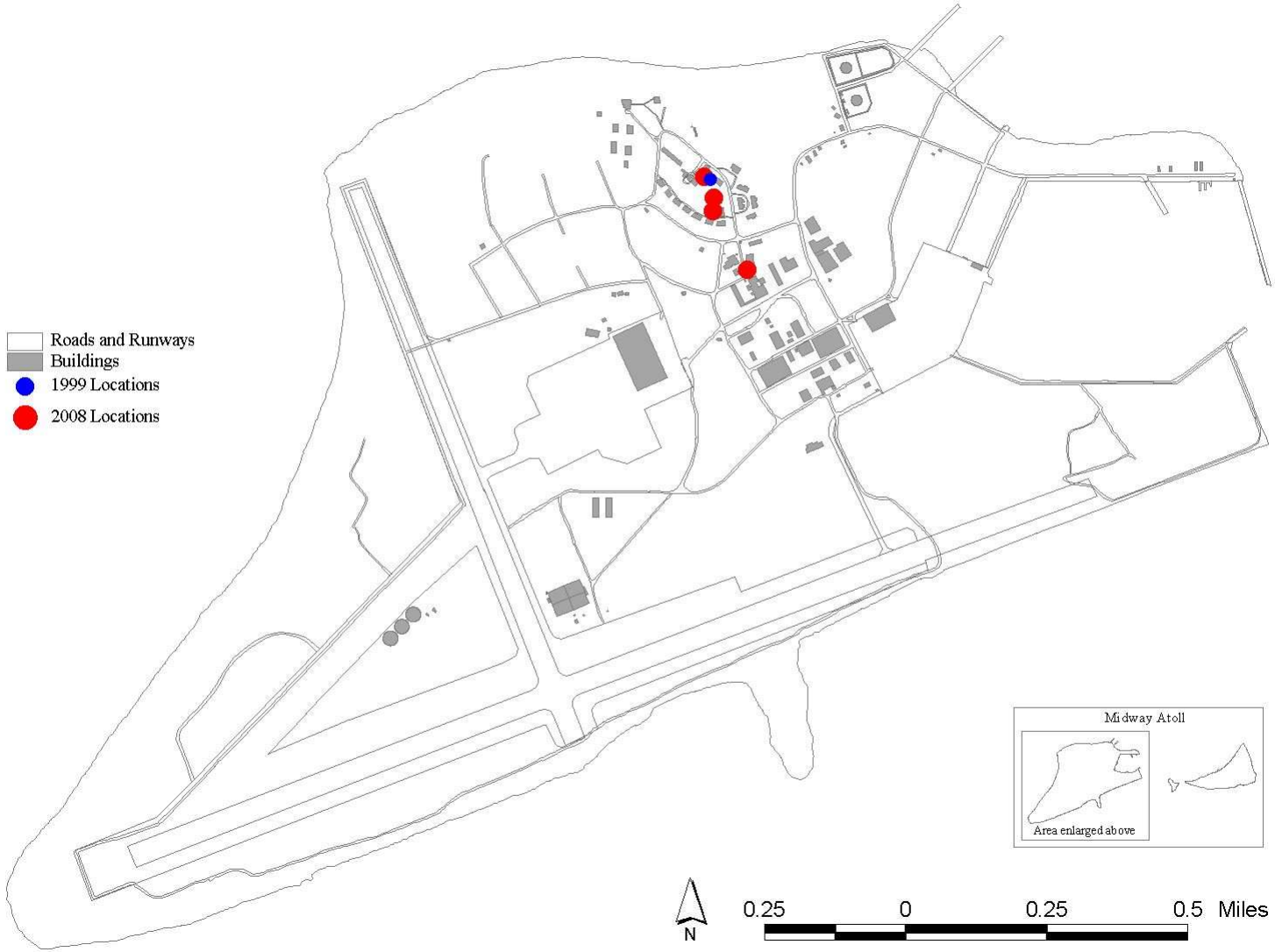
Known distribution of sandbur (*Cenchrus echinatus*) on Midway Atoll in 1999 and 2008



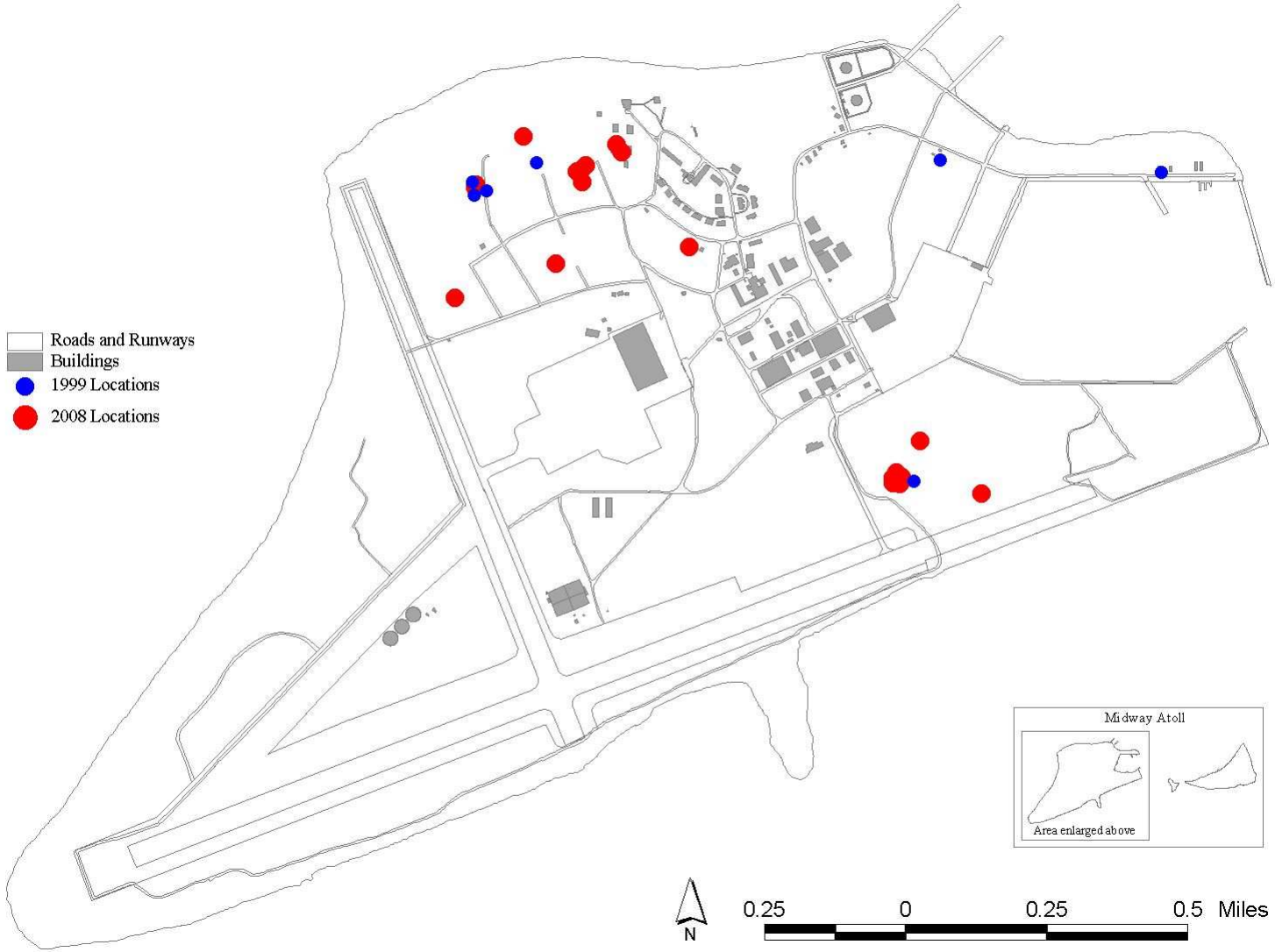
Known distribution of night blooming jasmine (*Cestrum nocturnum*) on Midway Atoll in 1999 and 2008



Known distribution of ivy gourd (*Coccinia grandis*) on Midway Atoll in 1999 and 2008

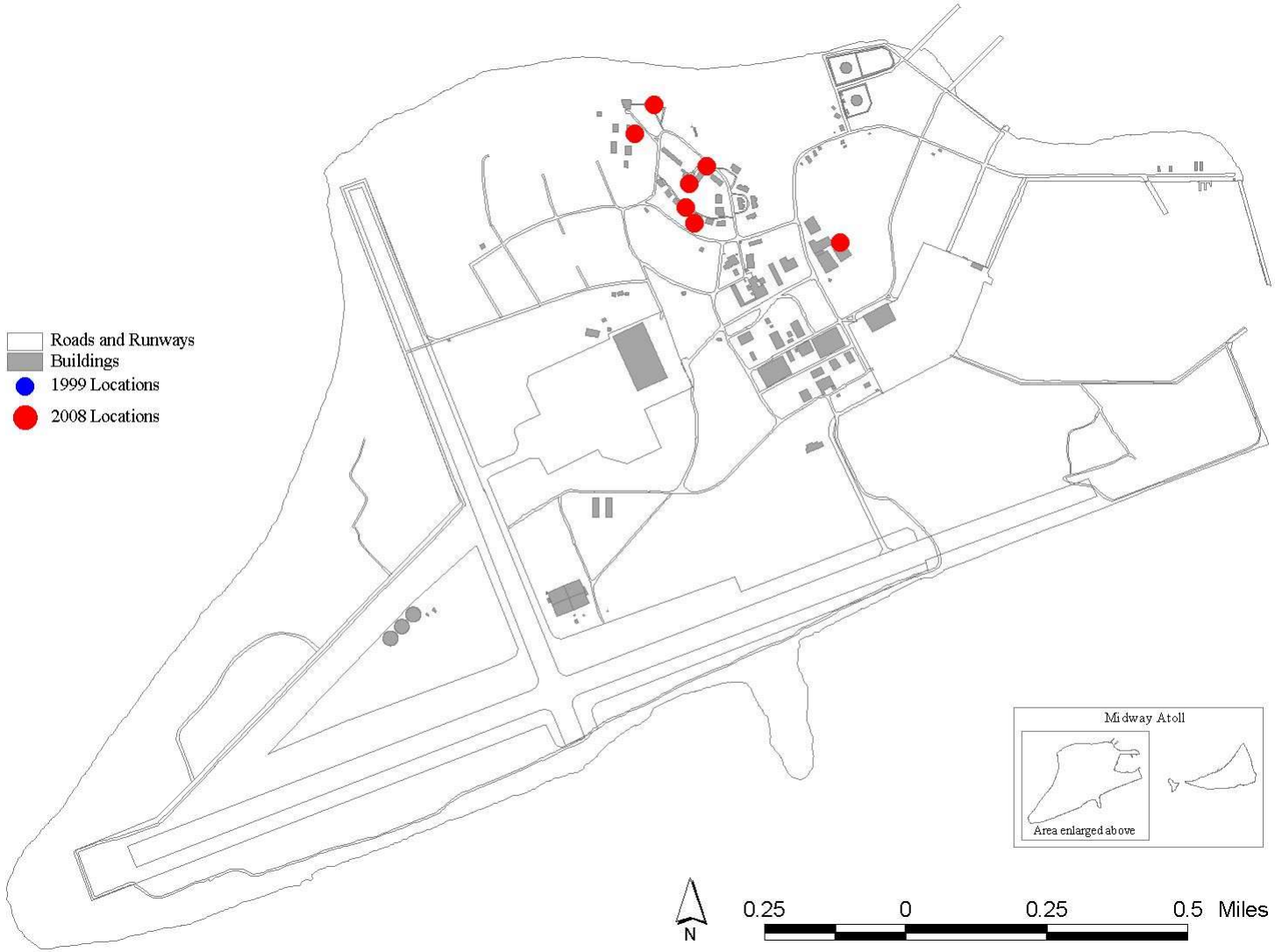


Known distribution of umbrella sedge (*Cyperus involucratus*) on Midway Atoll in 1999 and 2008

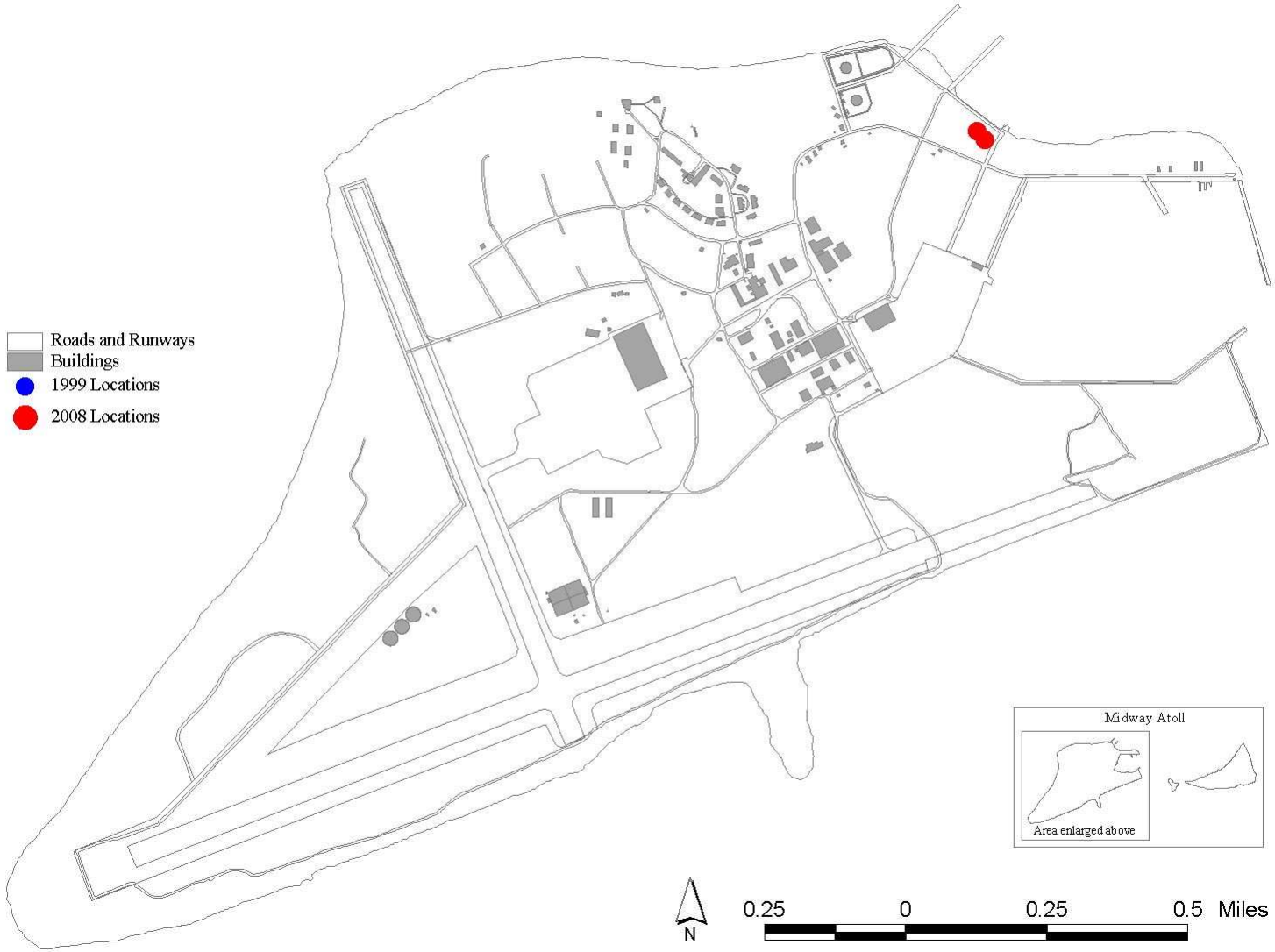


Known distribution of sourgrass (*Digitaria insularis*) on Midway Atoll in 1999 and 2008

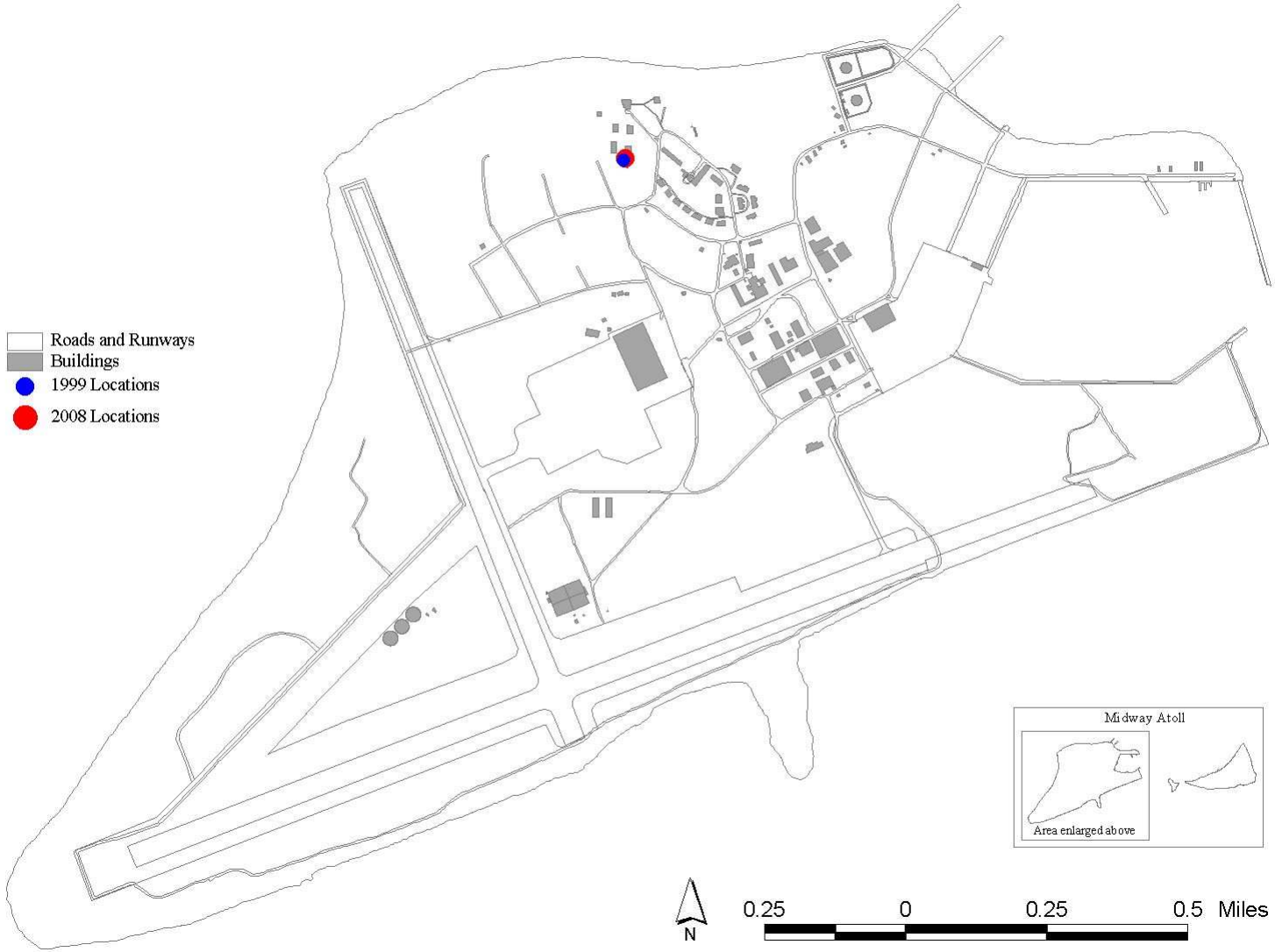
Known distribution of golden pothos (*Epipremnum pinnatum*) on Midway Atoll in 1999 and 2008



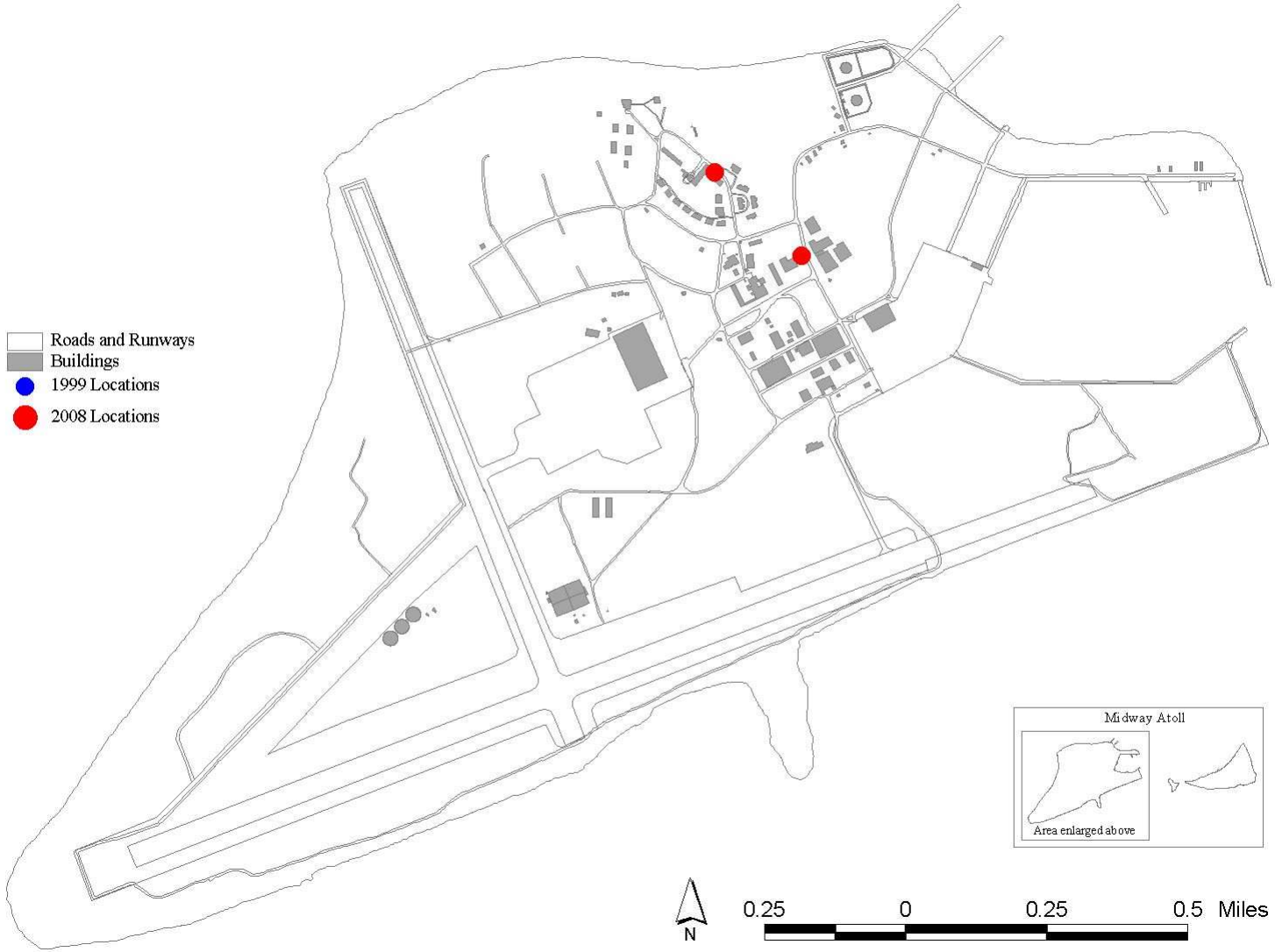
Known distribution of cup grass (*Eriochloa* sp.) on Midway Atoll in 1999 and 2008



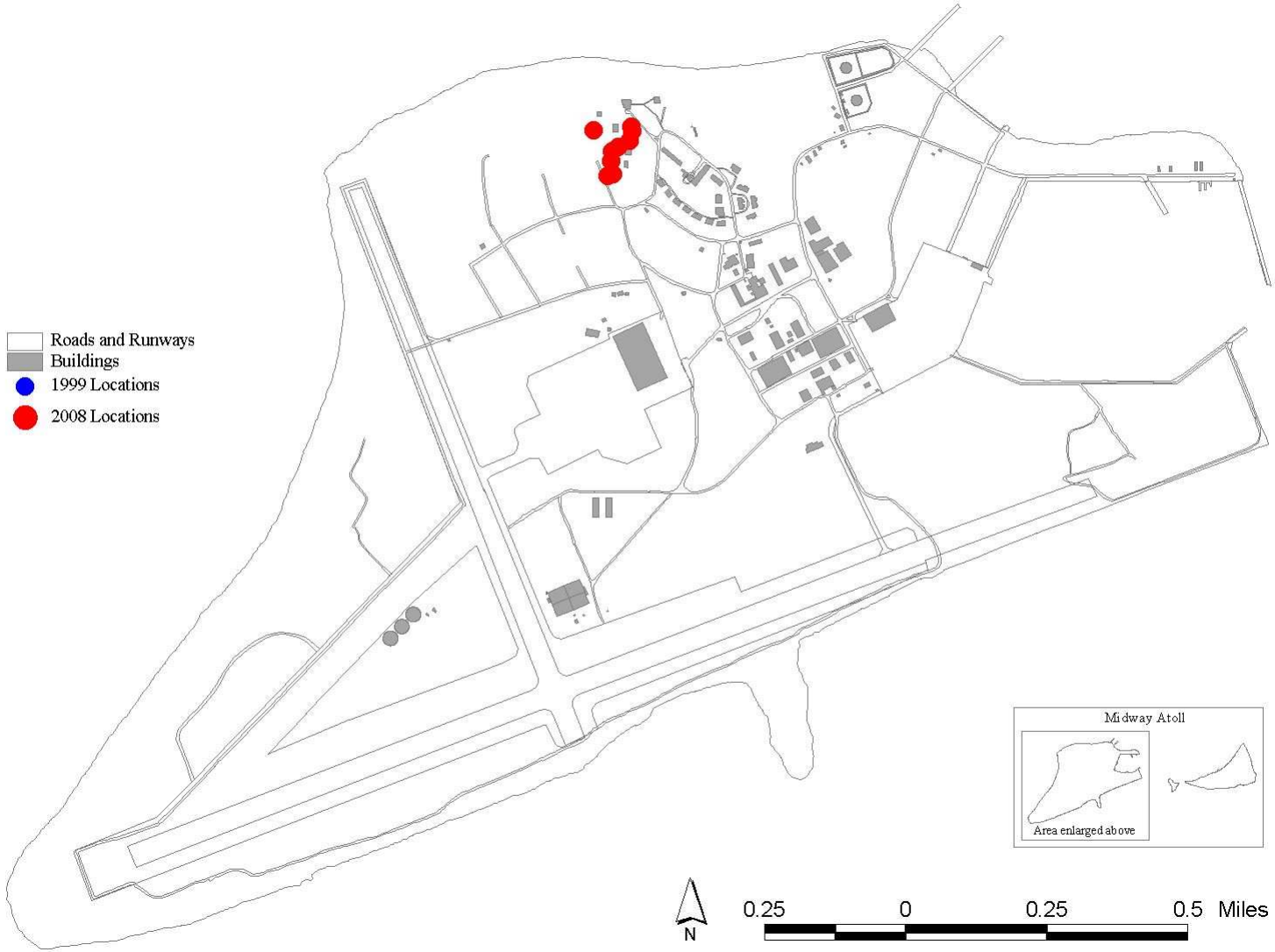
Known distribution of Surinam cherry (*Eugenia uniflora*) on Midway Atoll in 1999 and 2008



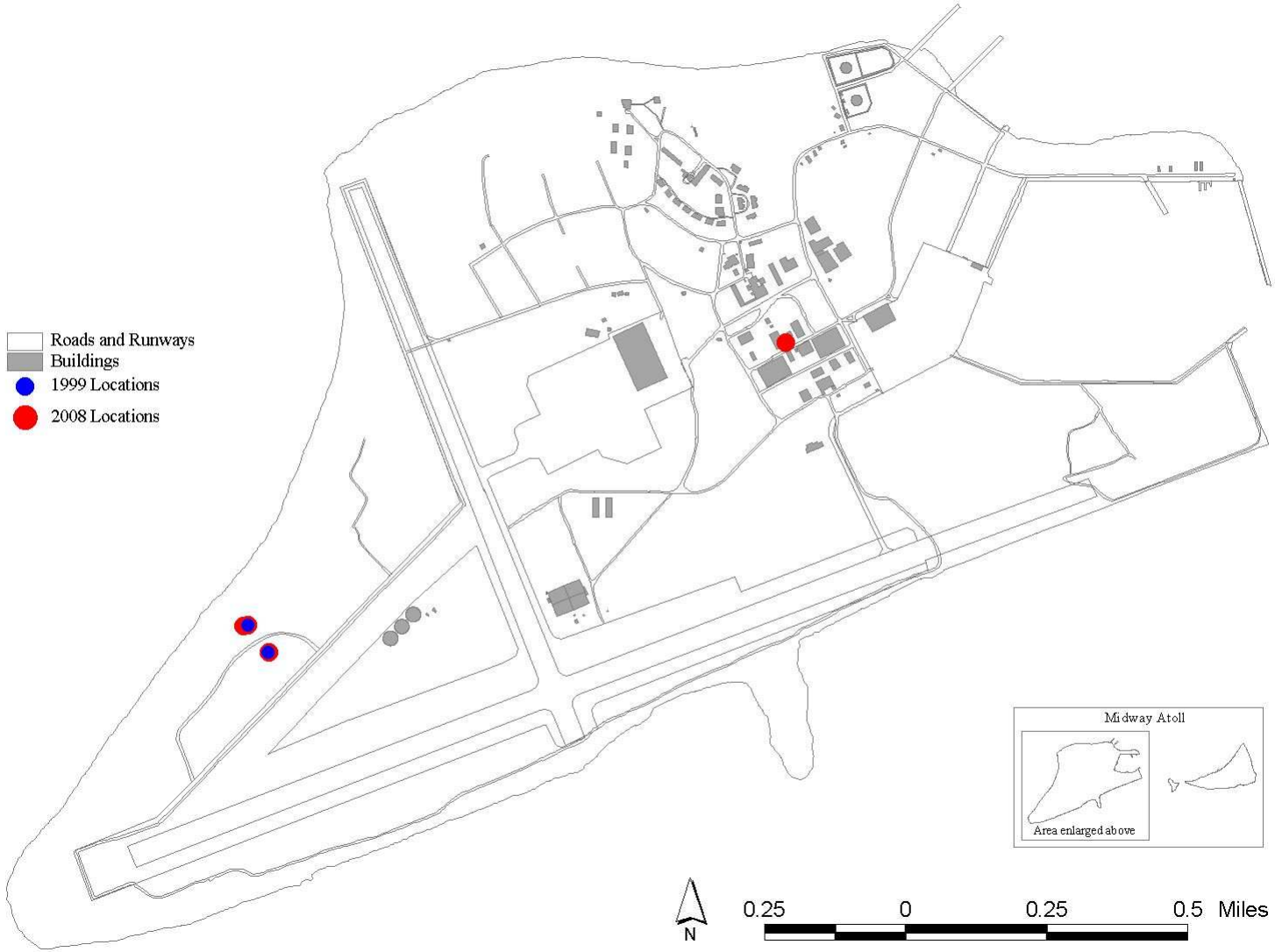
Known distribution of weeping fig (*Ficus benjamina*) on Midway Atoll in 1999 and 2008



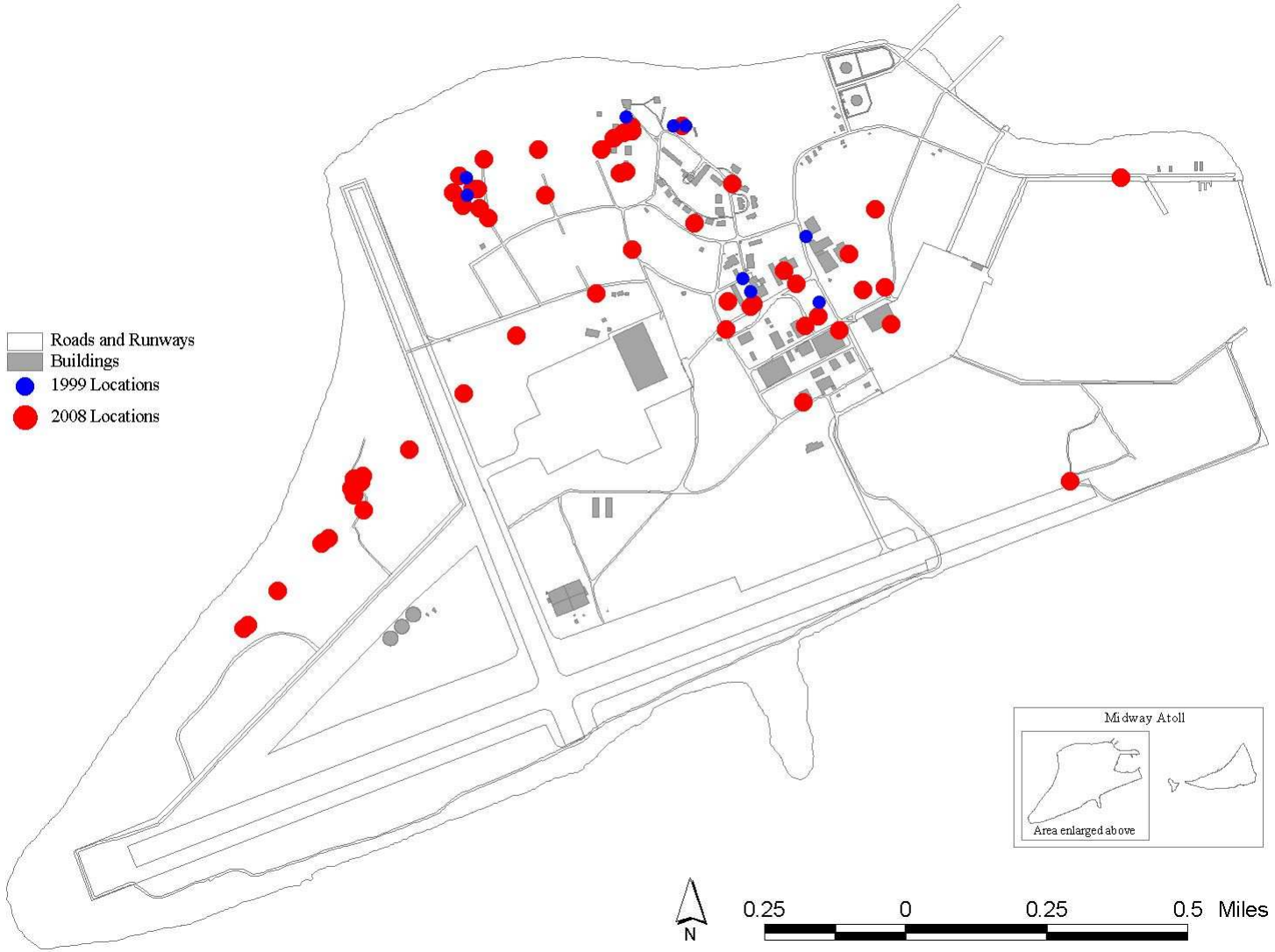
Known distribution of banyan tree (*Ficus benghalensis*) on Midway Atoll in 1999 and 2008



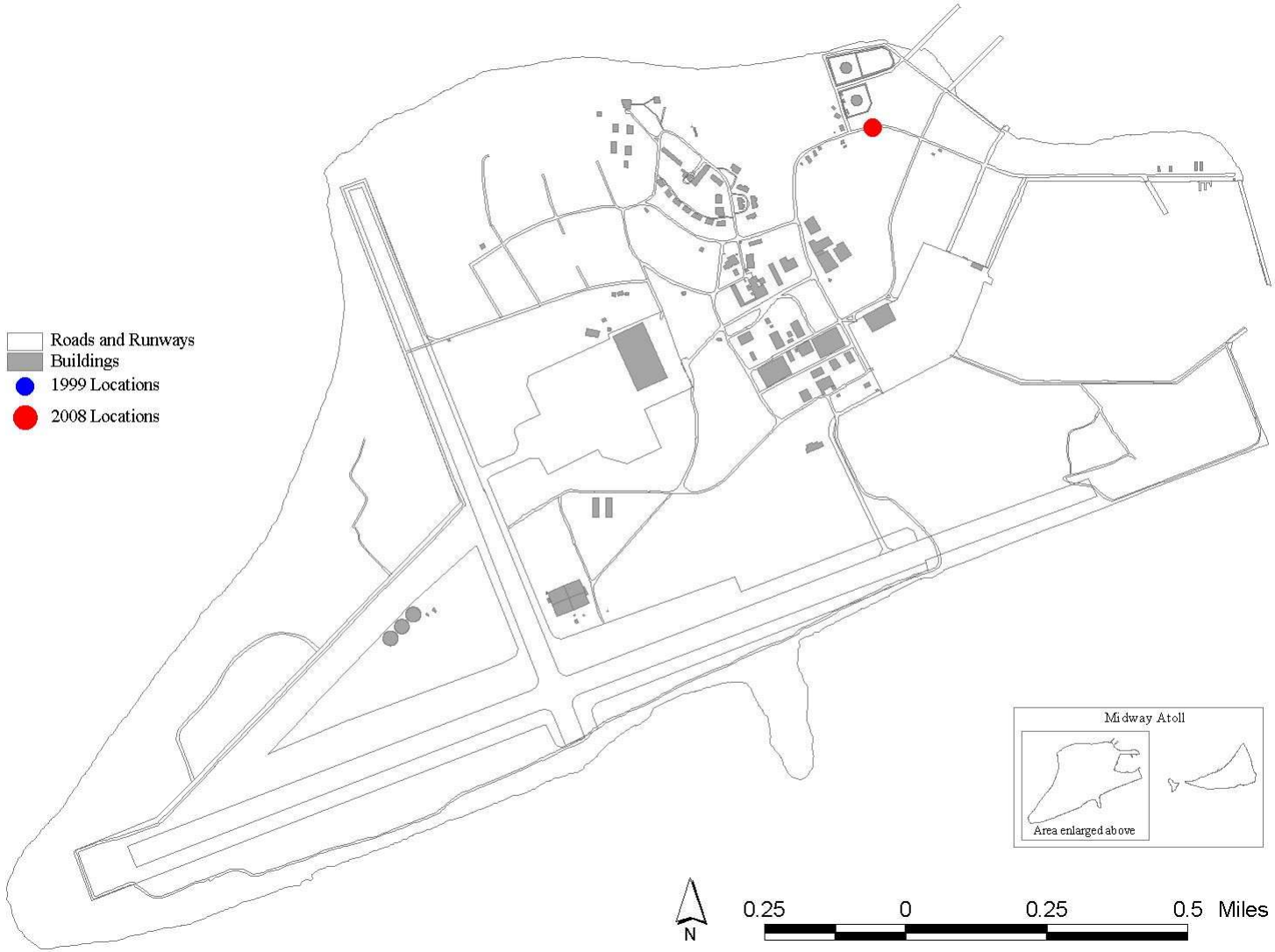
Known distribution of Moreton Bay fig (*Ficus macrophylla*) on Midway Atoll in 1999 and 2008



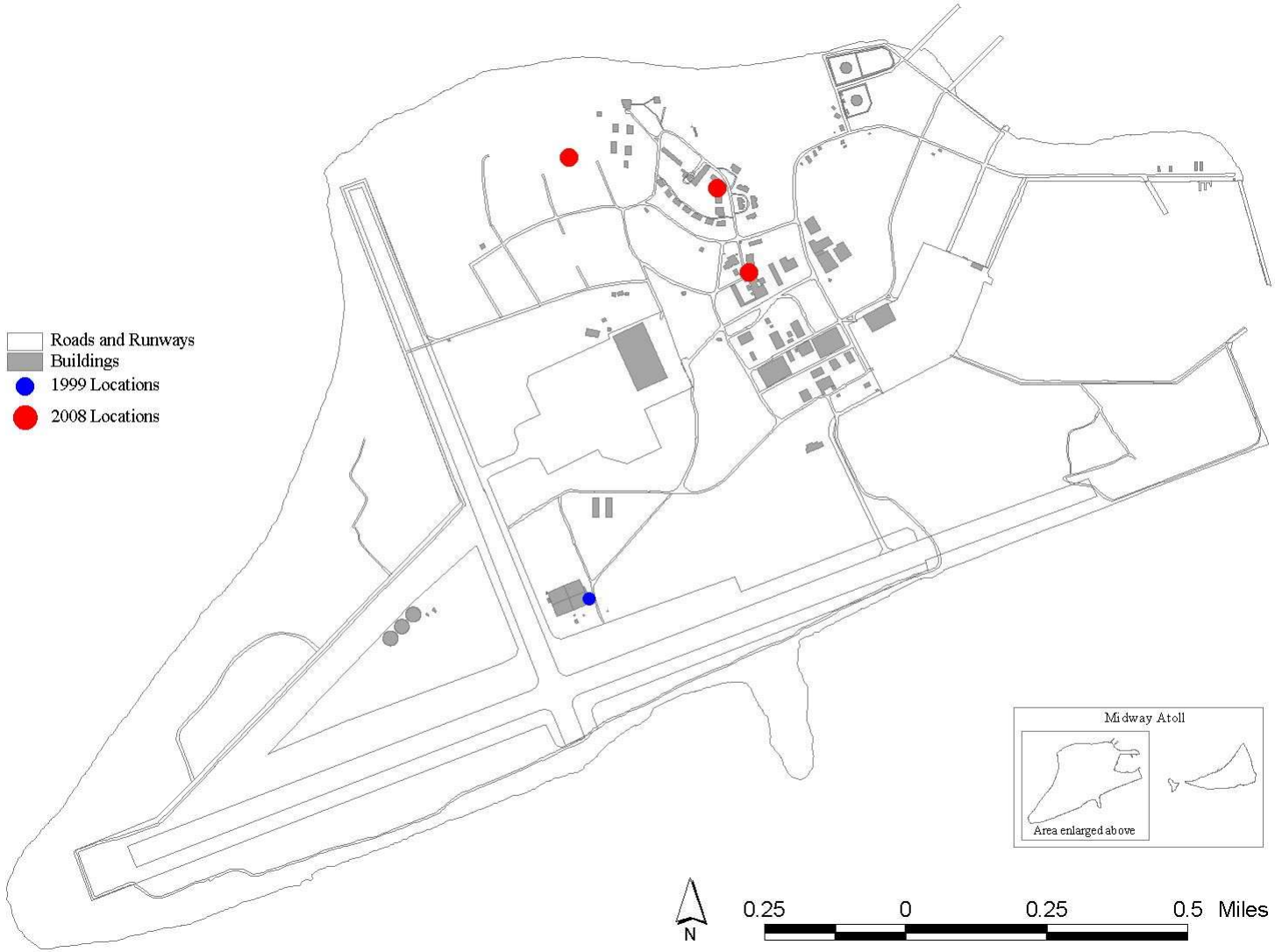
Known distribution of Chinese banyan (*Ficus microcarpa*) on Midway Atoll in 1999 and 2008



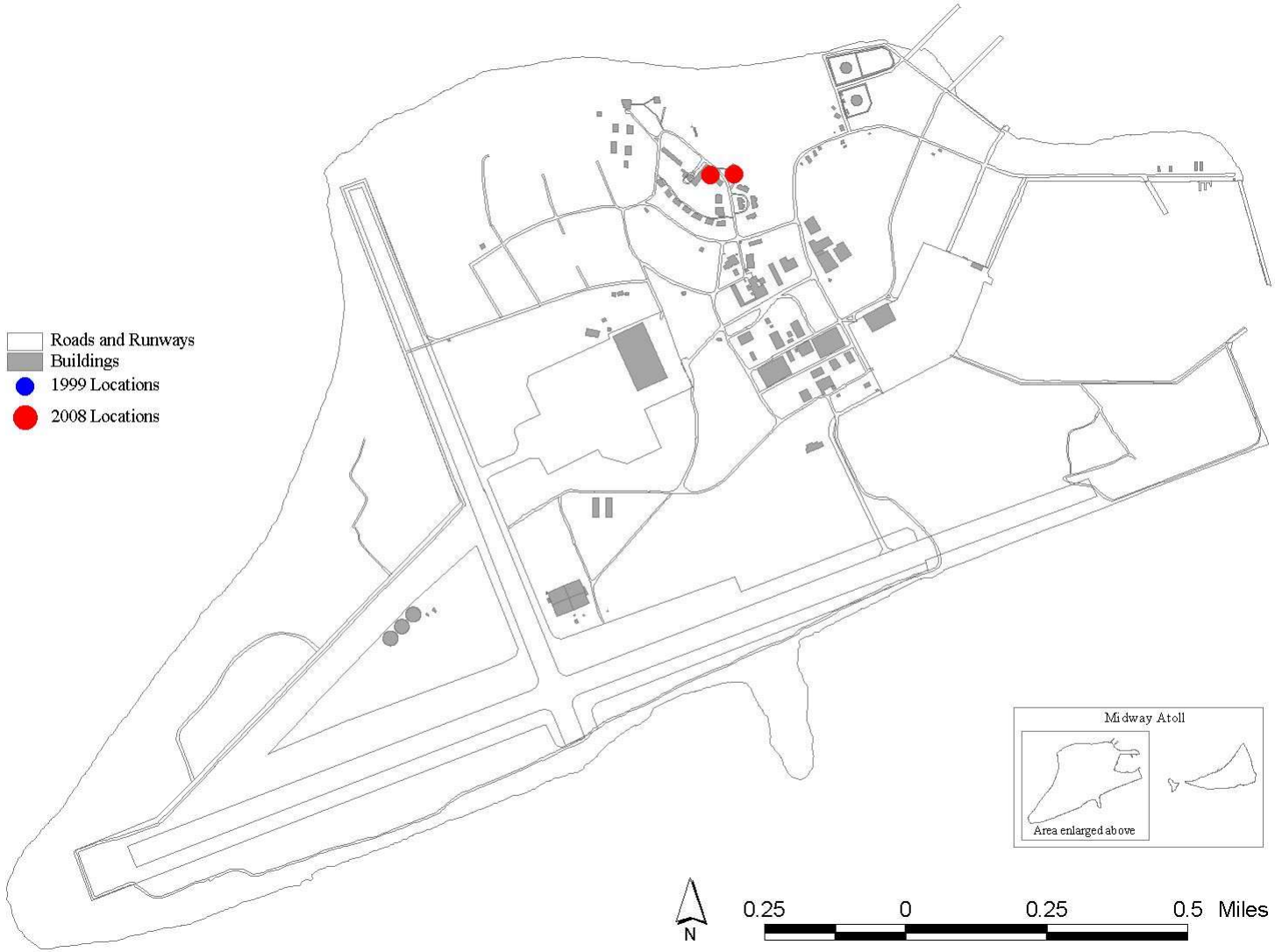
Known distribution of creeping indigo (*Indigofera hendecaphylla*) on Midway Atoll in 1999 and 2008



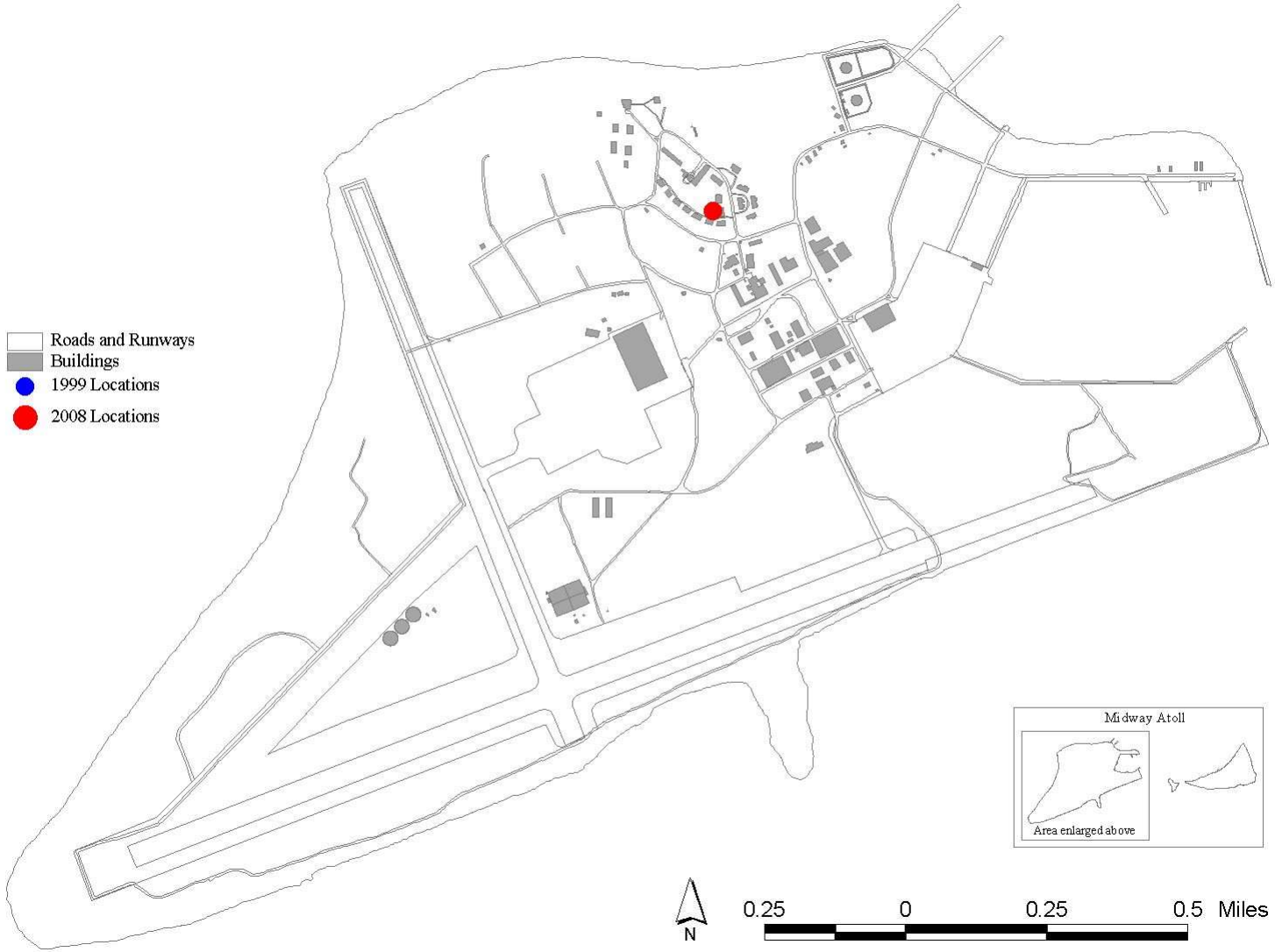
Known distribution of swamp cabbage (*Ipomoea aquatica*) on Midway Atoll in 1999 and 2008



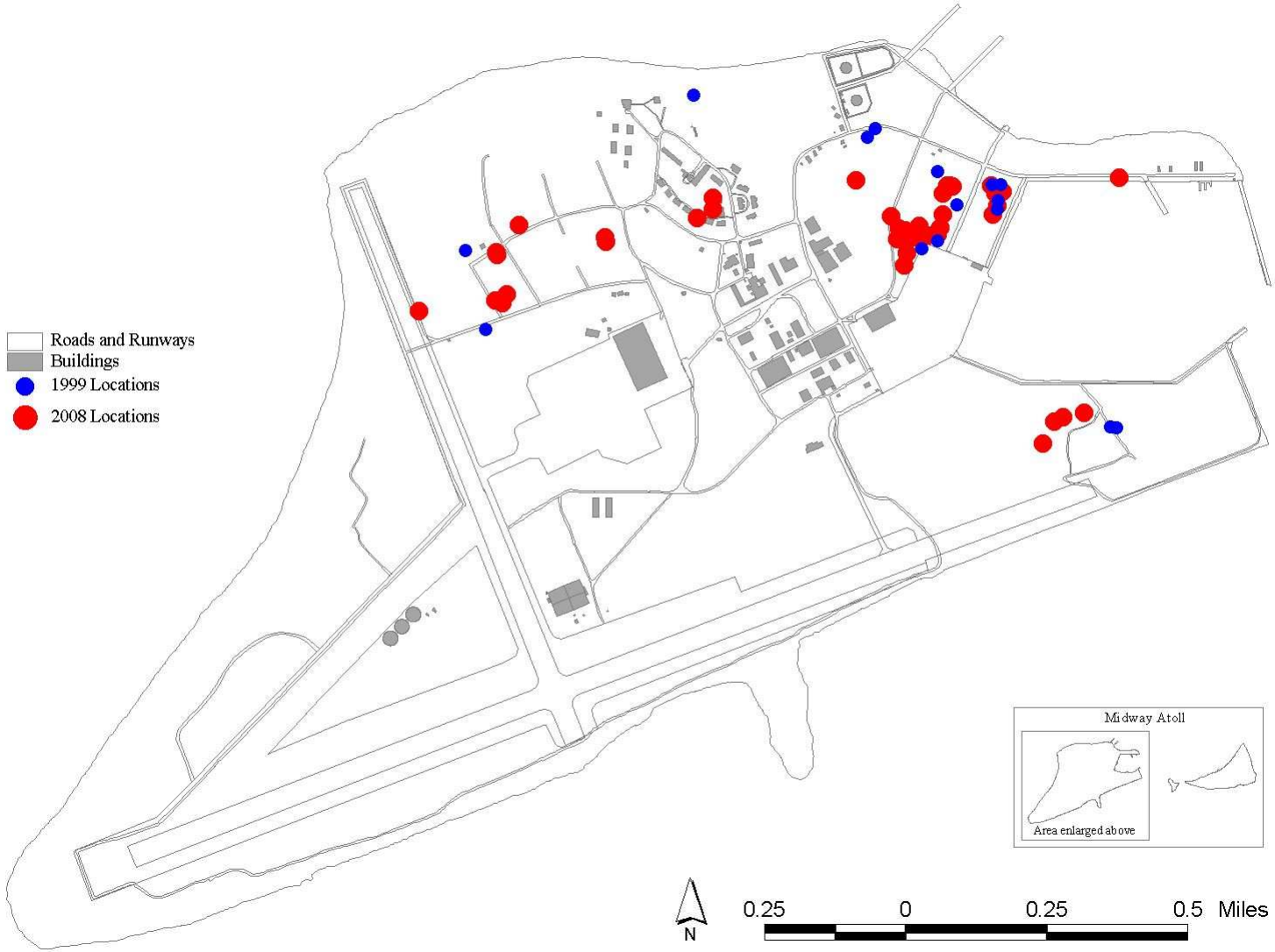
Known distribution of air plant (*Kalanchoe pinnata*) on Midway Atoll in 1999 and 2008



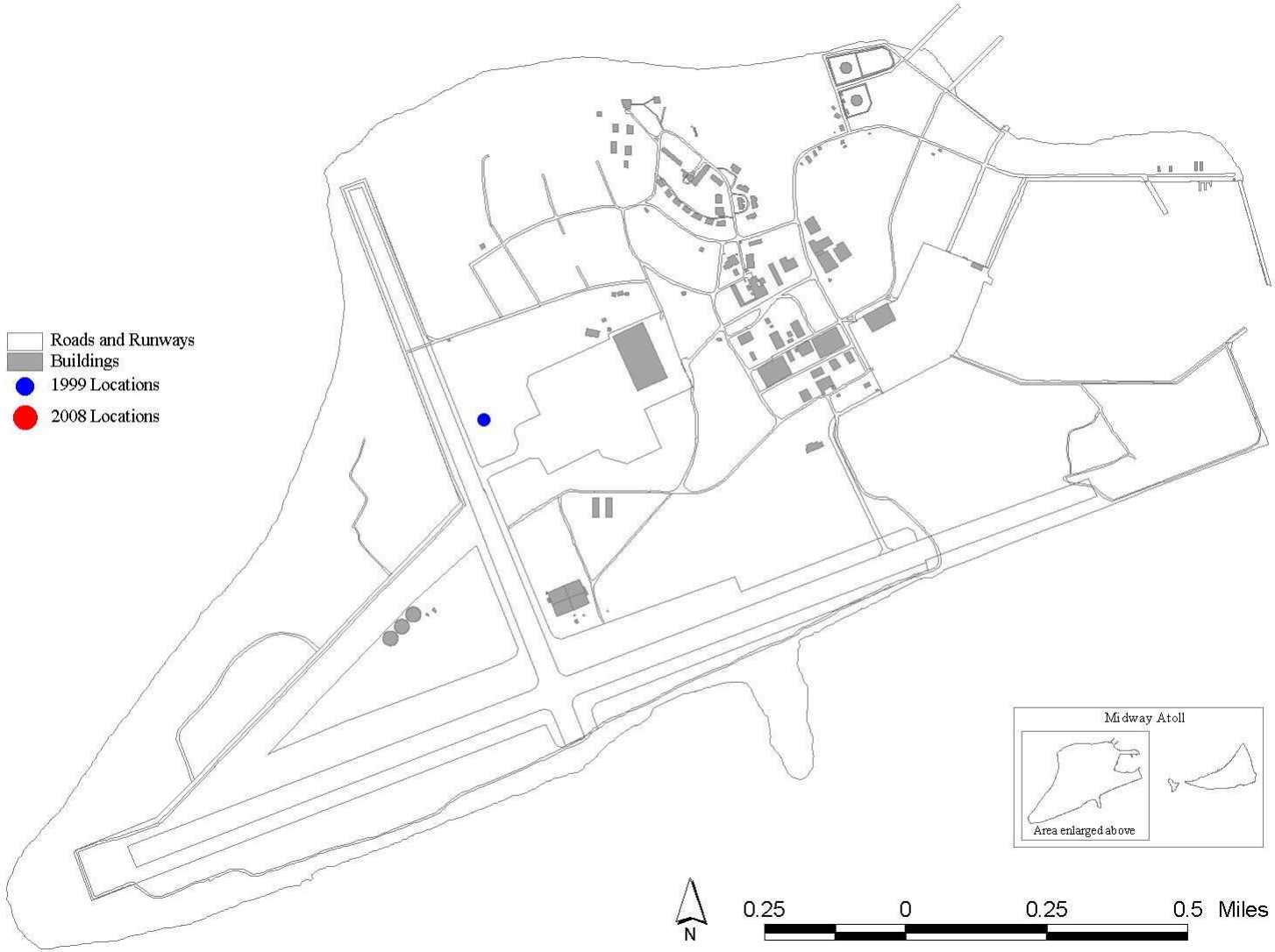
Known distribution of chandelier plant (*Kalanchoe tubiflora*) on Midway Atoll in 1999 and 2008



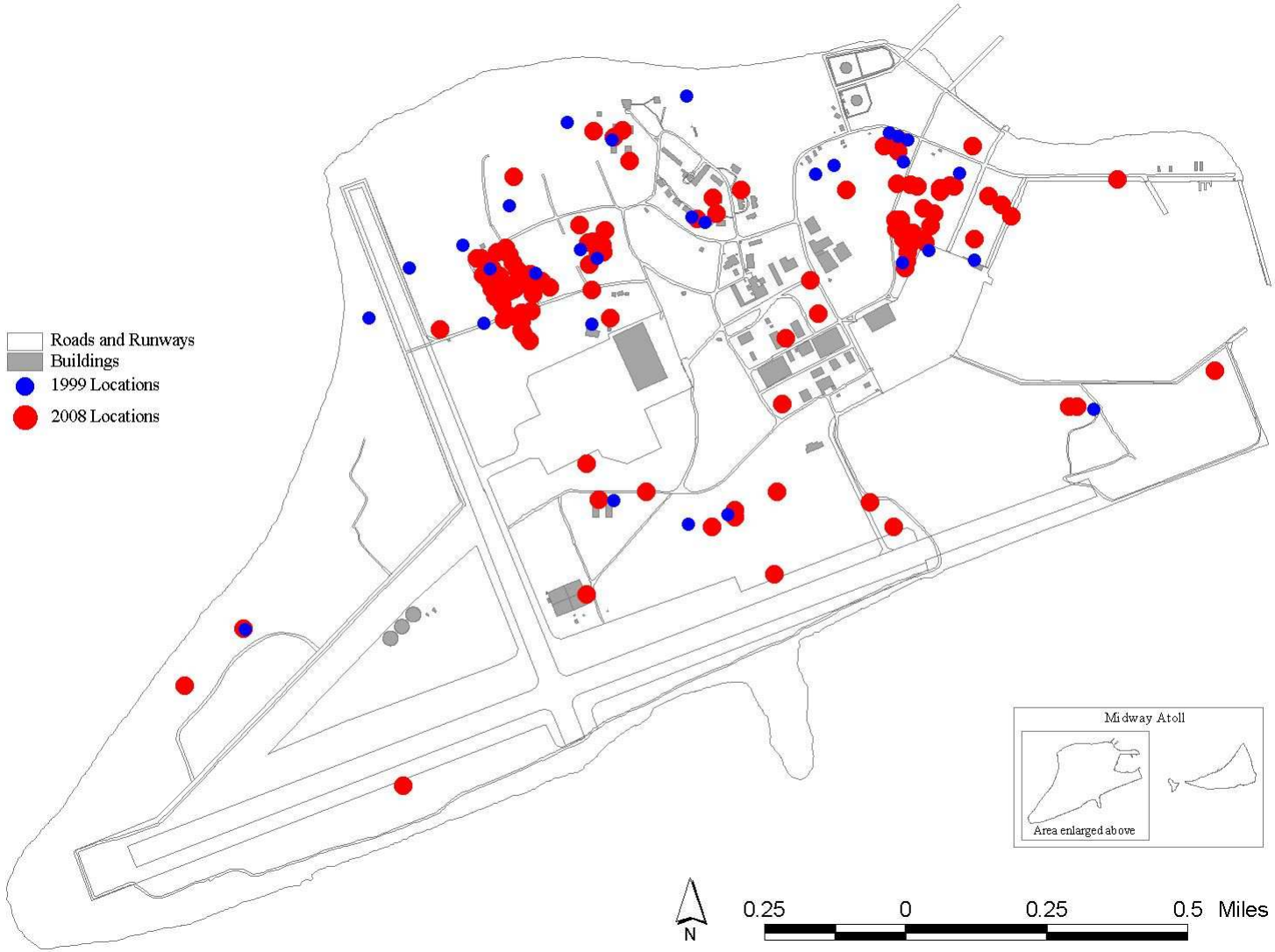
Known distribution of lantana (*Lantana camara*) on Midway Atoll in 1999 and 2008



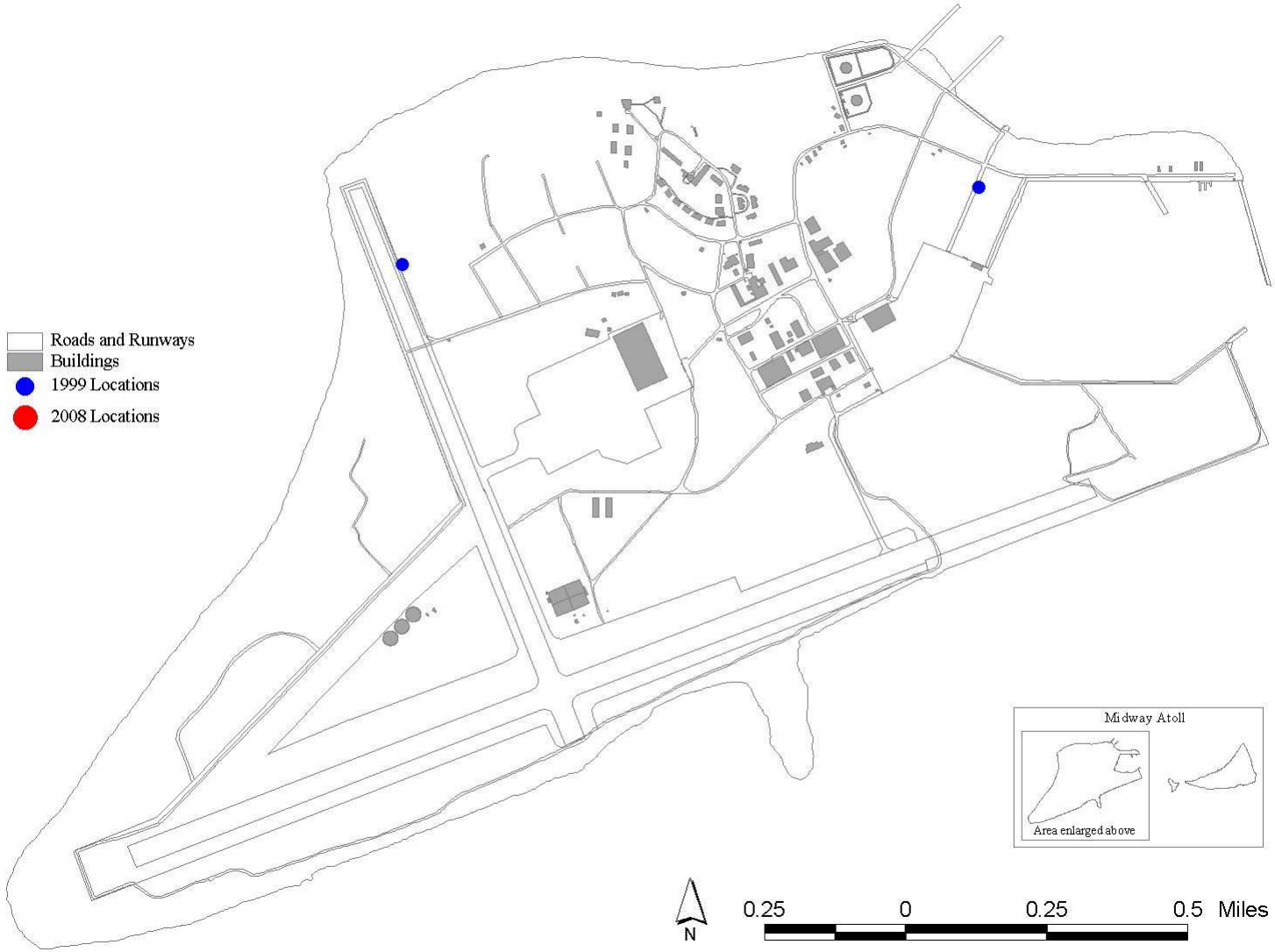
Known distribution of sprangletop (*Leptochloa uninervia*) on Midway Atoll in 1999 and 2008



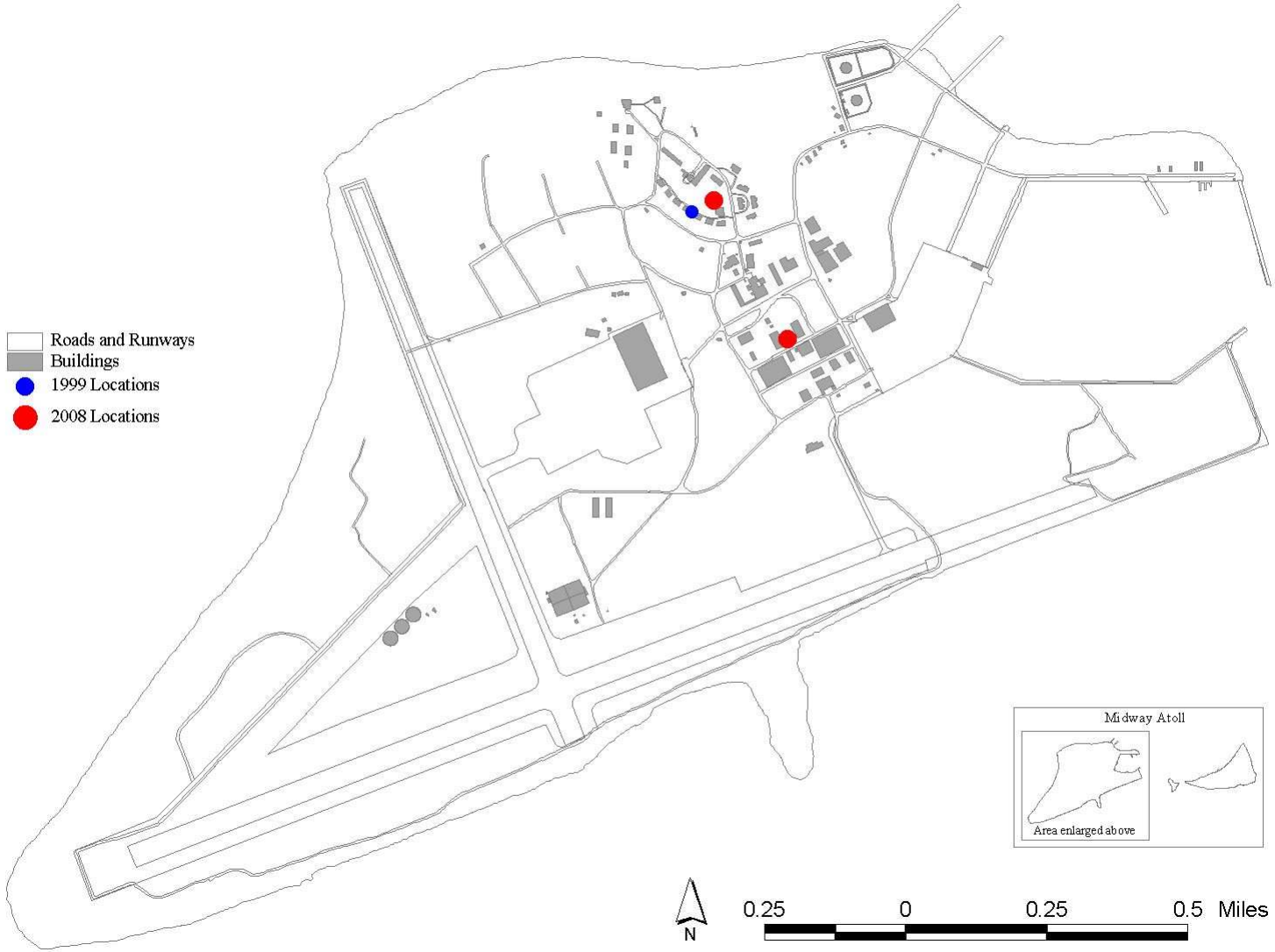
Known distribution of haole koa (*Leucaena leucocephala*) on Midway Atoll in 1999 and 2008



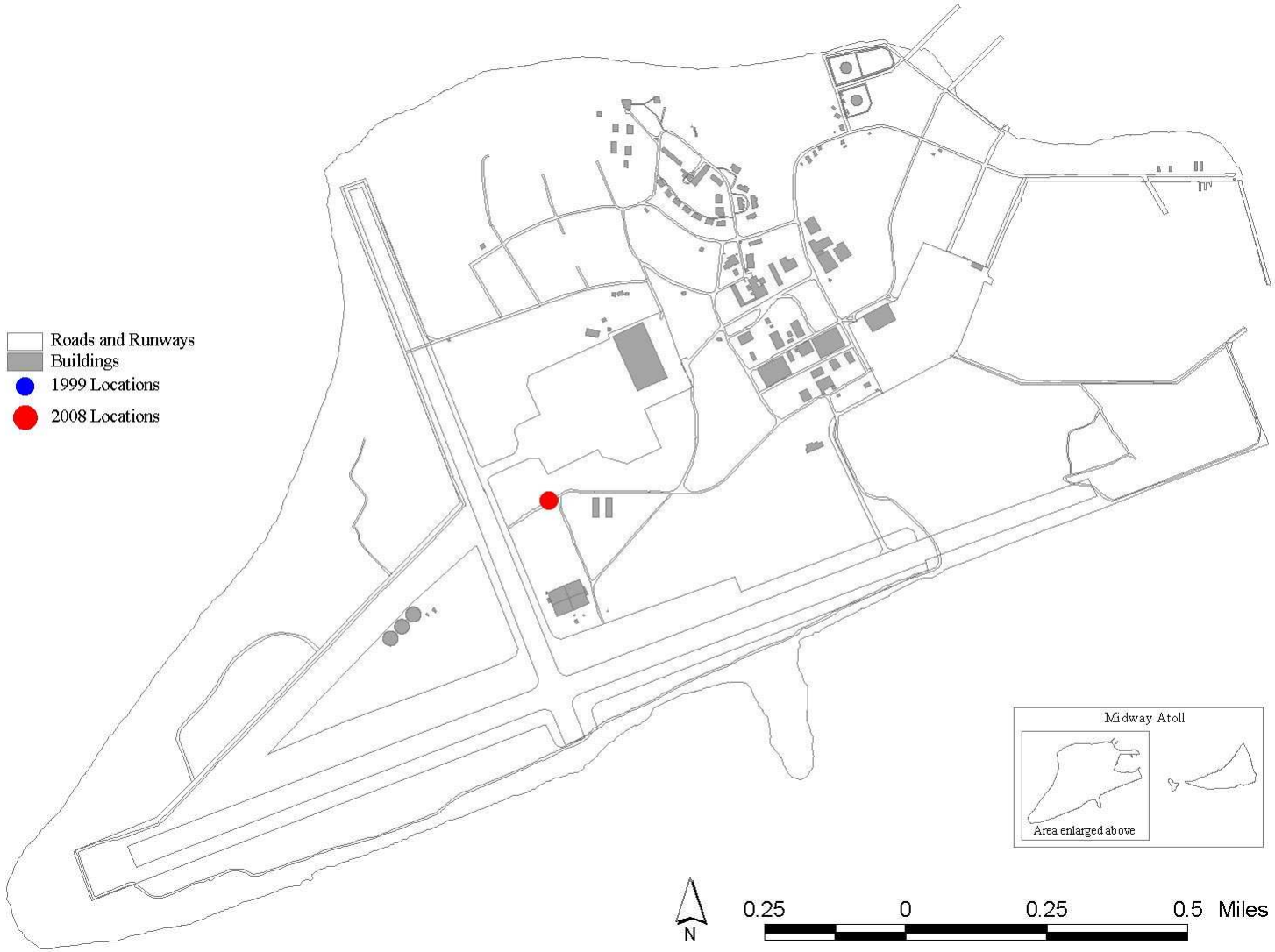
Known distribution of Natal red top (*Melinis repens*) on Midway Atoll in 1999 and 2008



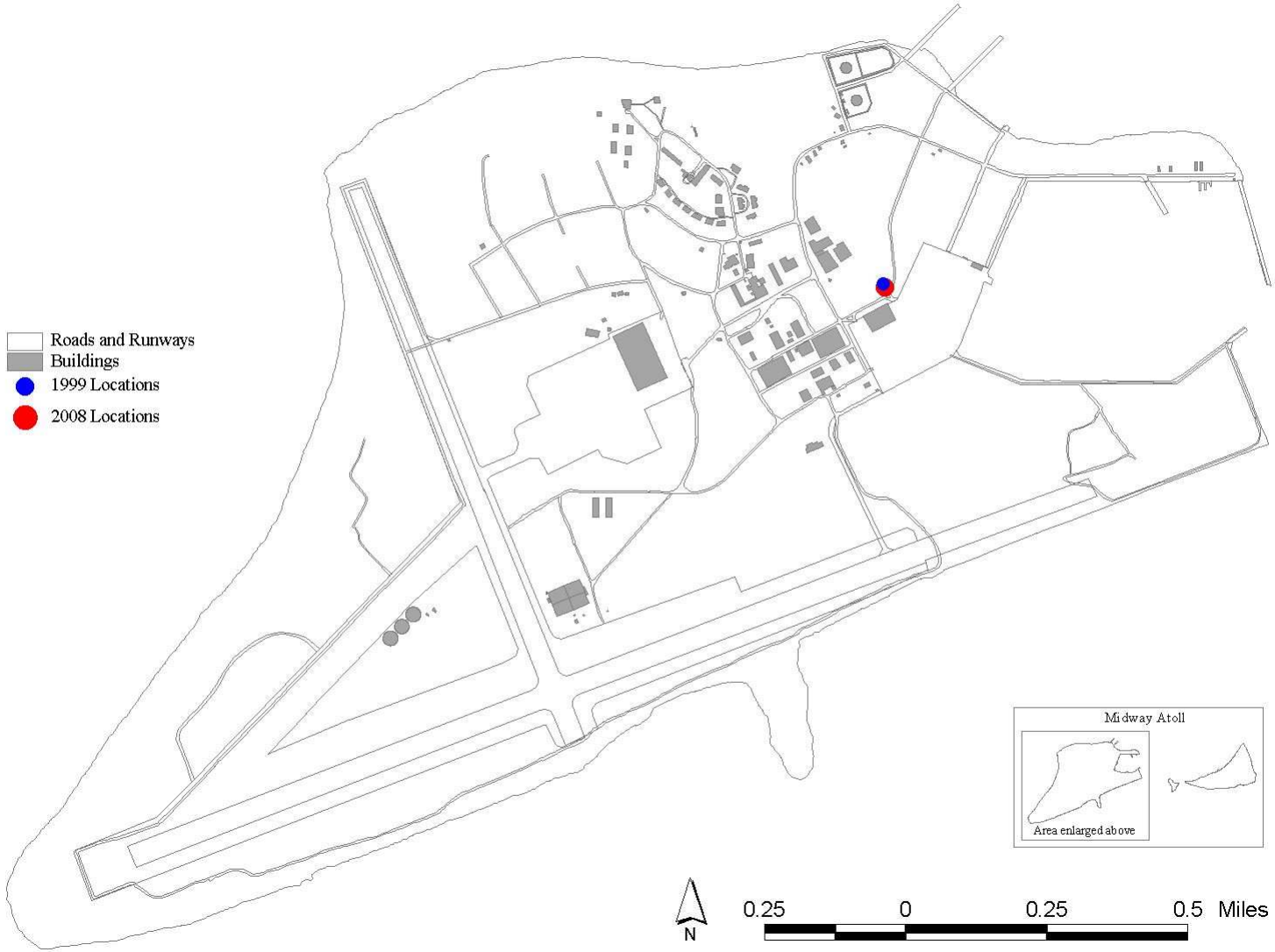
Known distribution of bitter melon (*Momordica charantia*) on Midway Atoll in 1999 and 2008



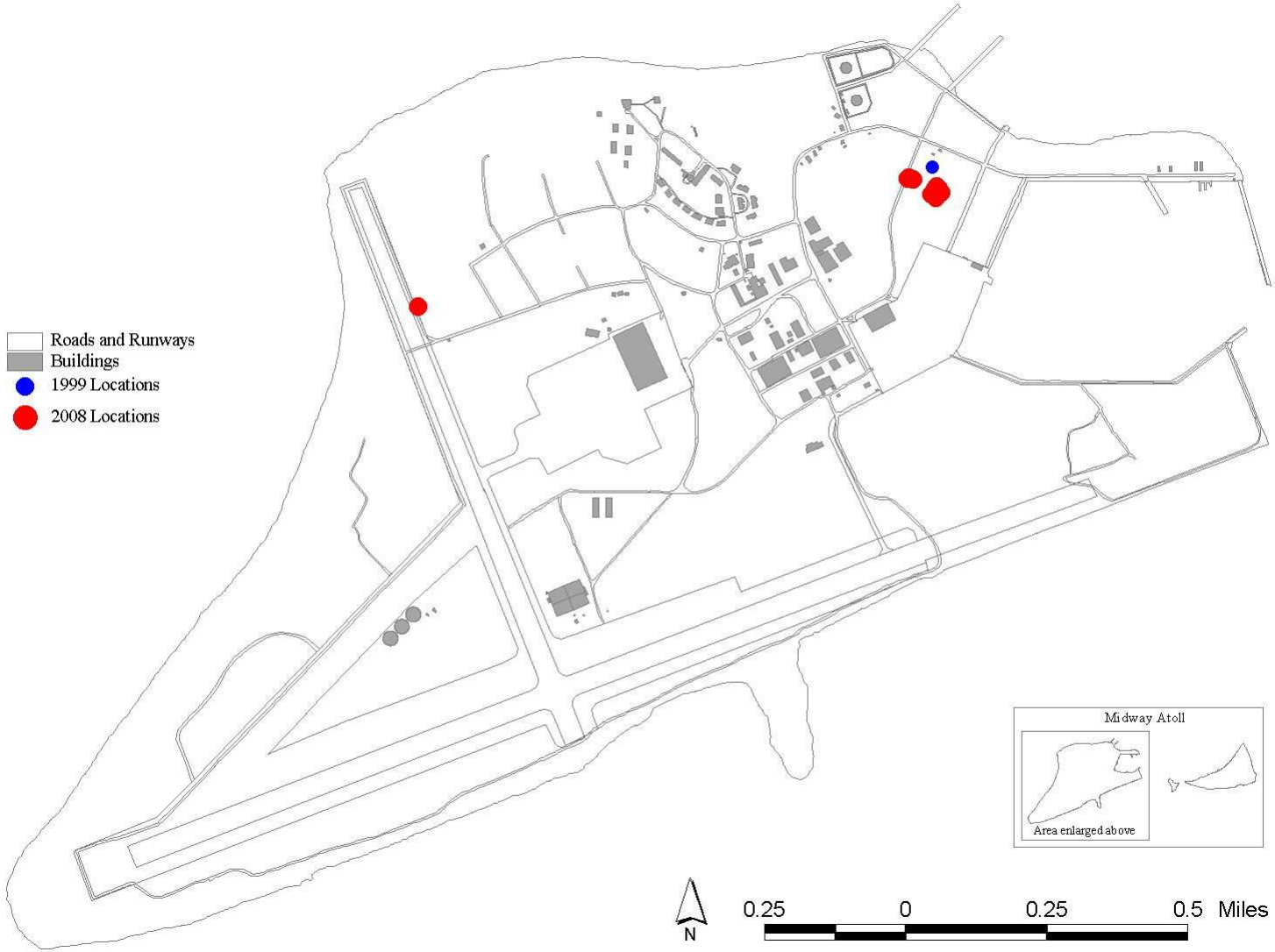
Known distribution of Madagascar olive (*Noronhia emarginata*) on Midway Atoll in 1999 and 2008



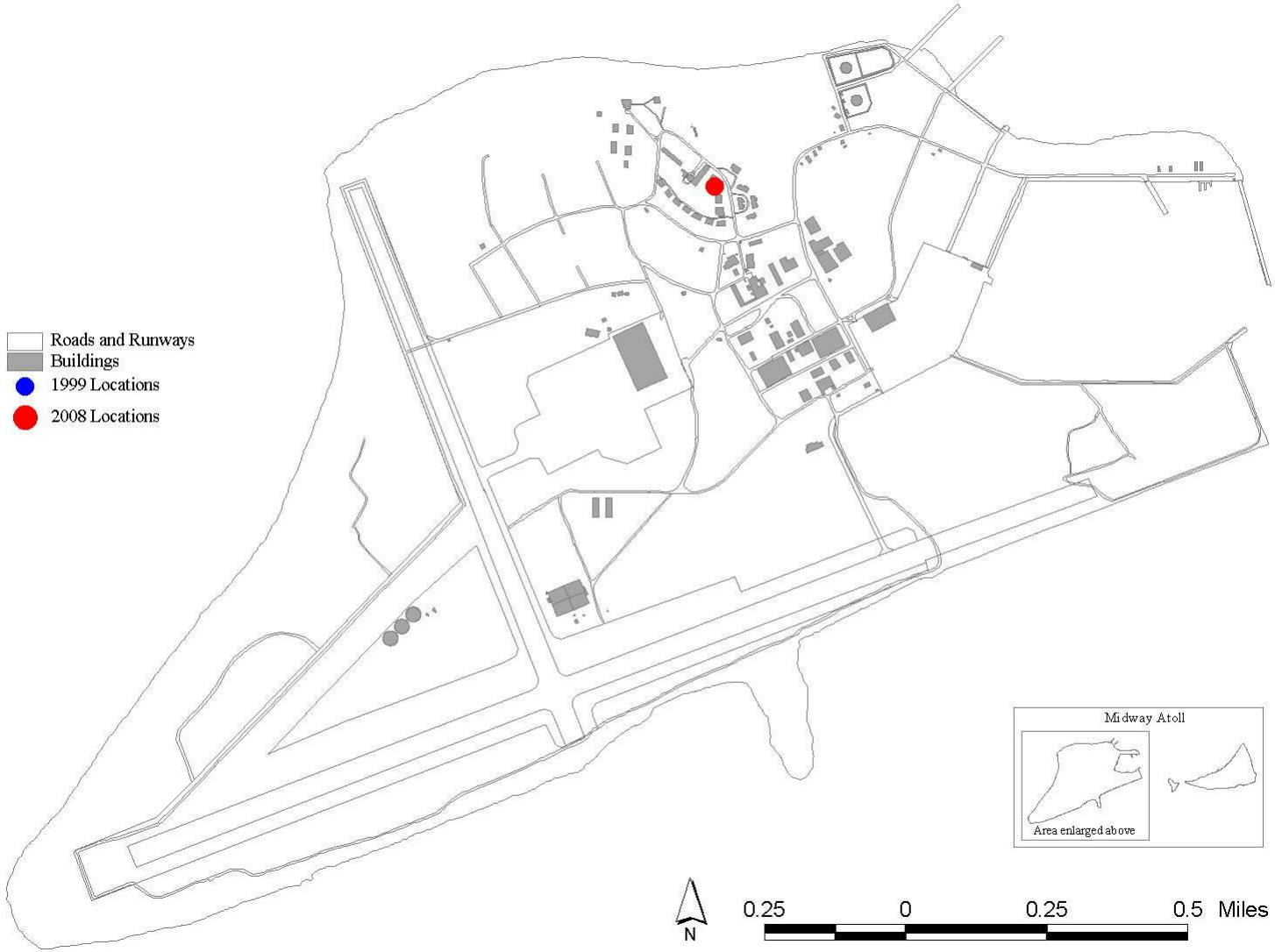
Known distribution of African olive (O*lea europaea* subsp. *cuspidata*) on Midway Atoll in 1999 and 2008



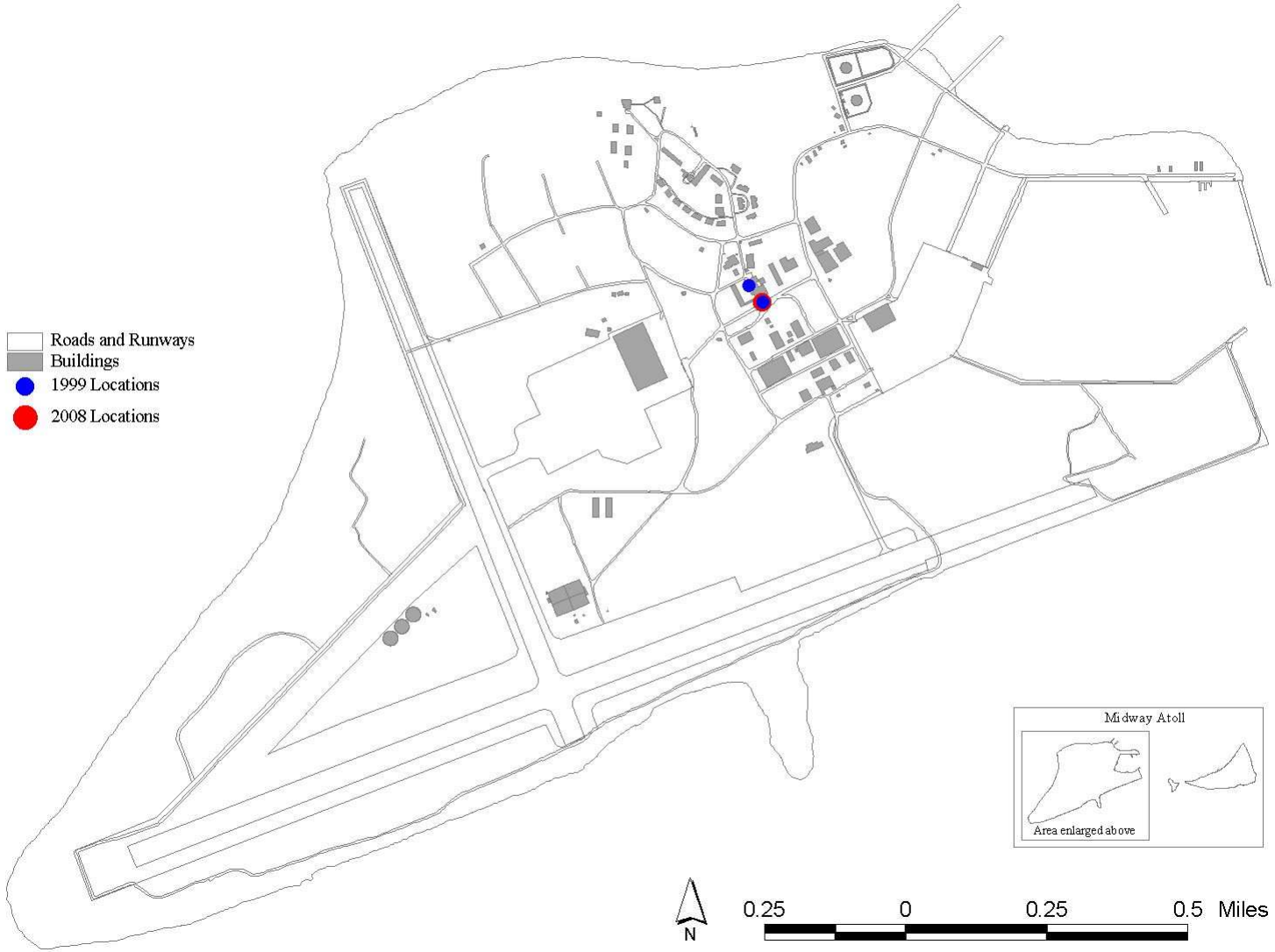
Known distribution of Guinea grass (*Panicum maximum*) on Midway Atoll in 1999 and 2008



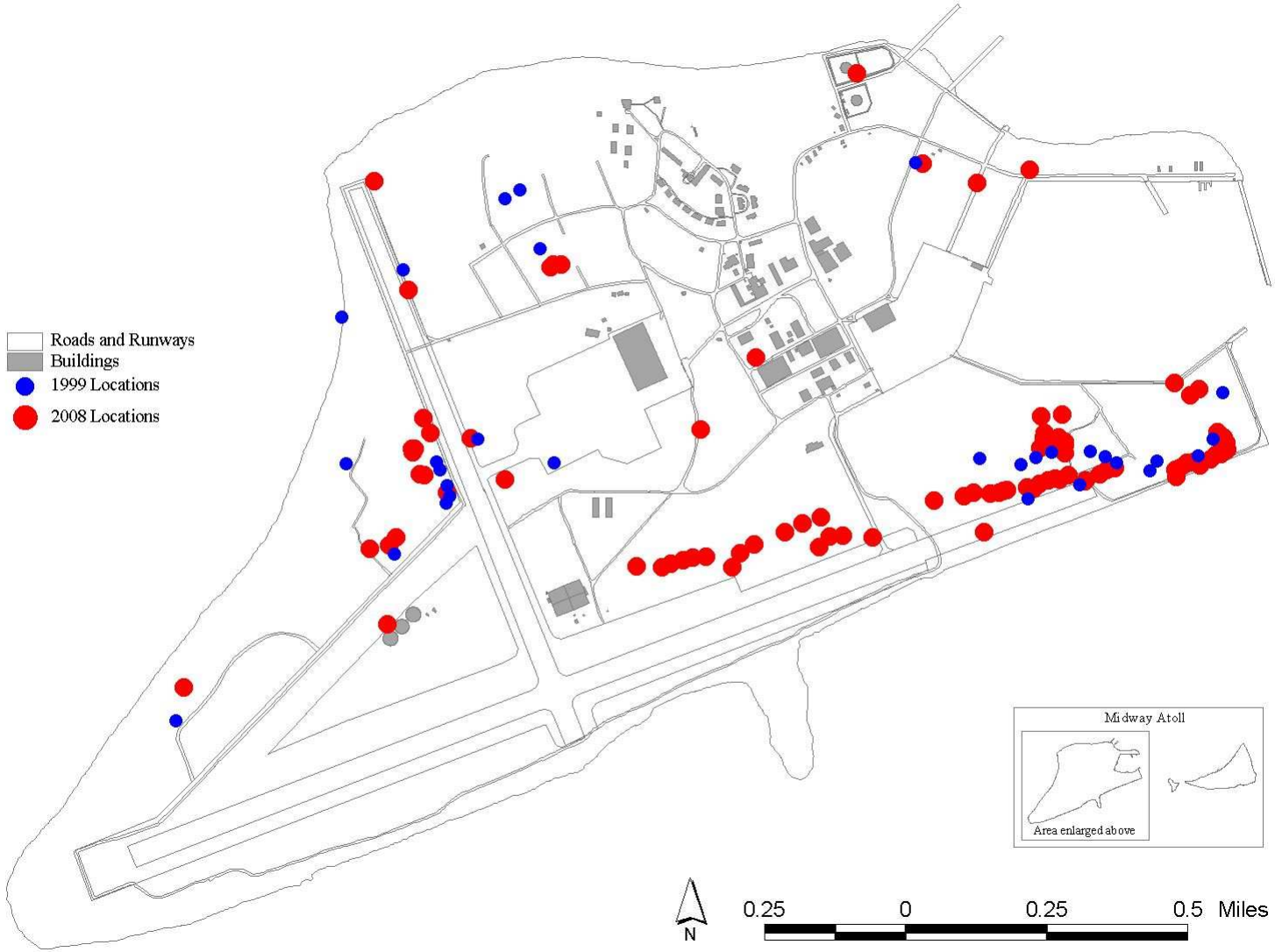
Known distribution of passion vine (*Passiflora edulis*) on Midway Atoll in 1999 and 2008



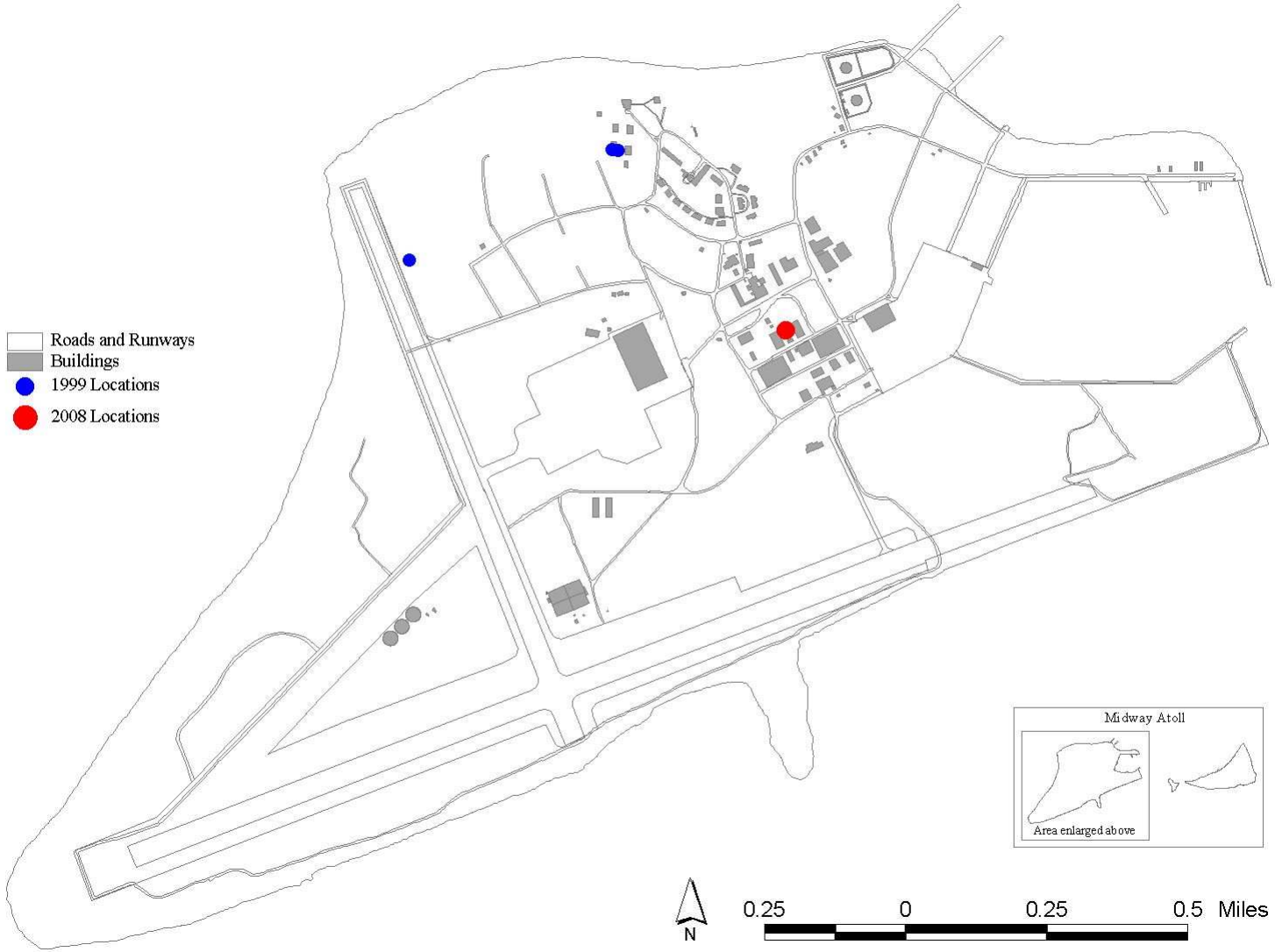
Known distribution of Manila tamarind (*Pithecellobium dulce*) on Midway Atoll in 1999 and 2008



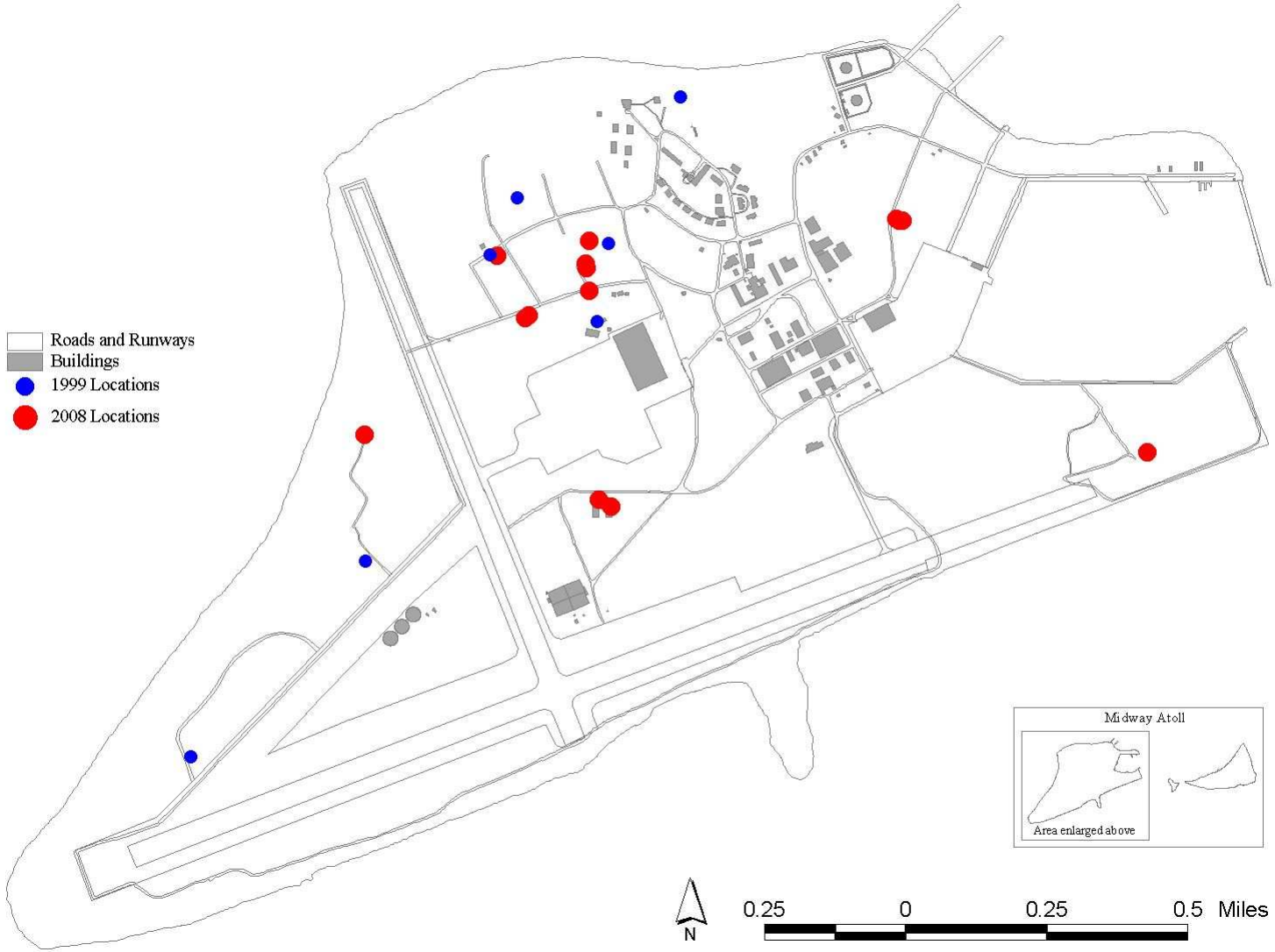
Known distribution of sourbush (*Pluchea carolinensis*) on Midway Atoll in 1999 and 2008



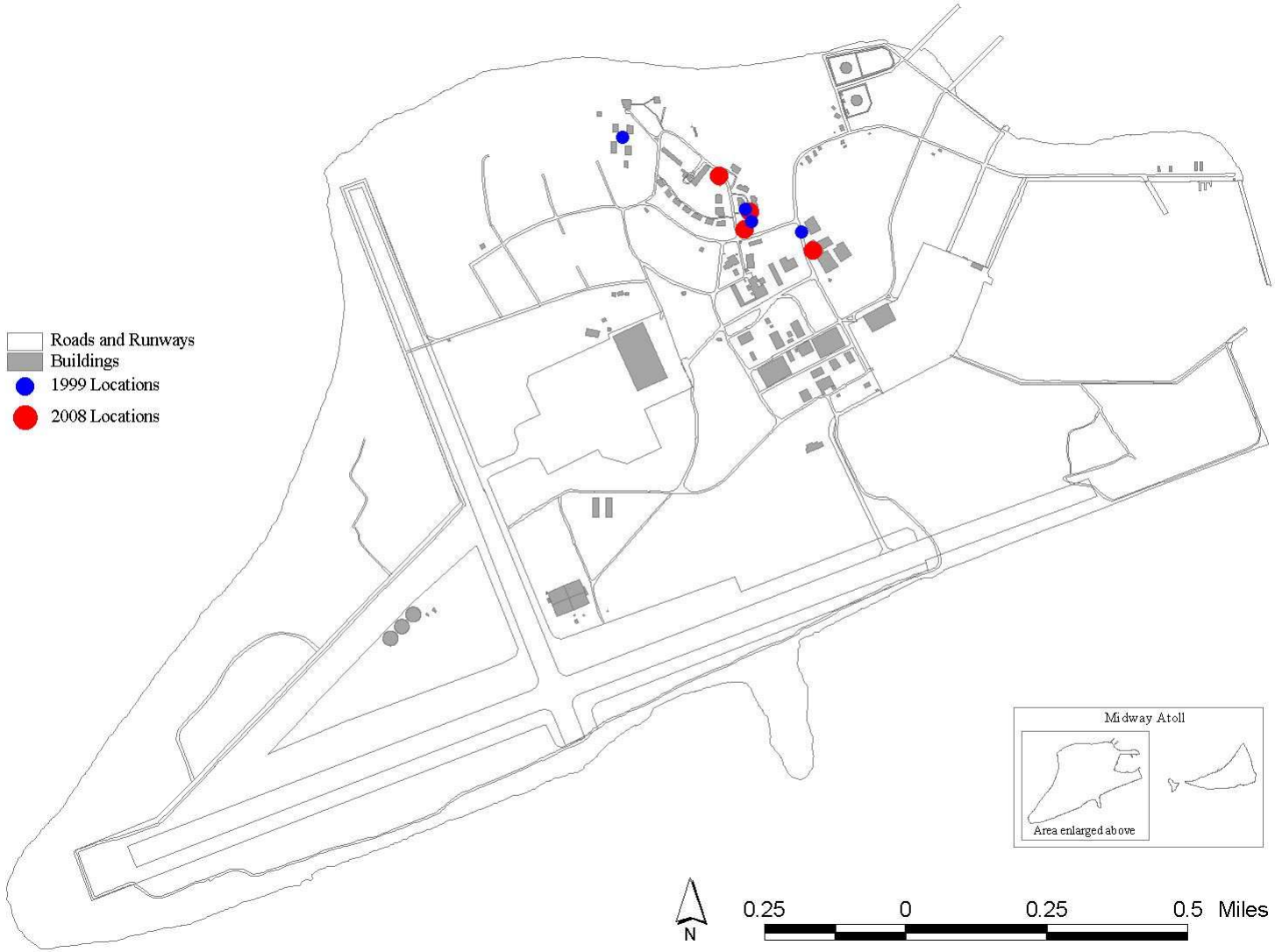
Known distribution of guava (*Psidium guajava*) on Midway Atoll in 1999 and 2008



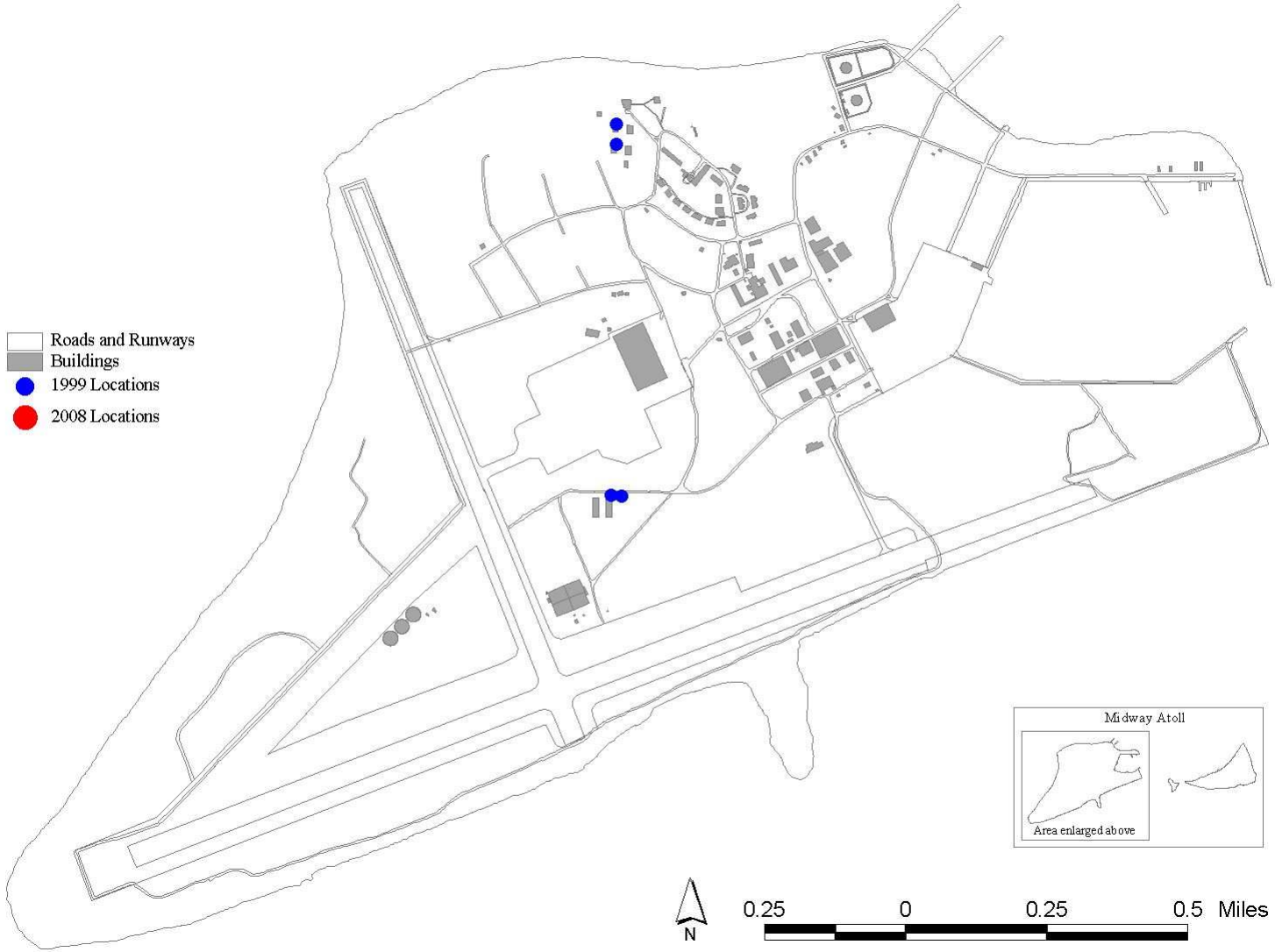
Known distribution of castor bean (*Ricinus communis*) on Midway Atoll in 1999 and 2008



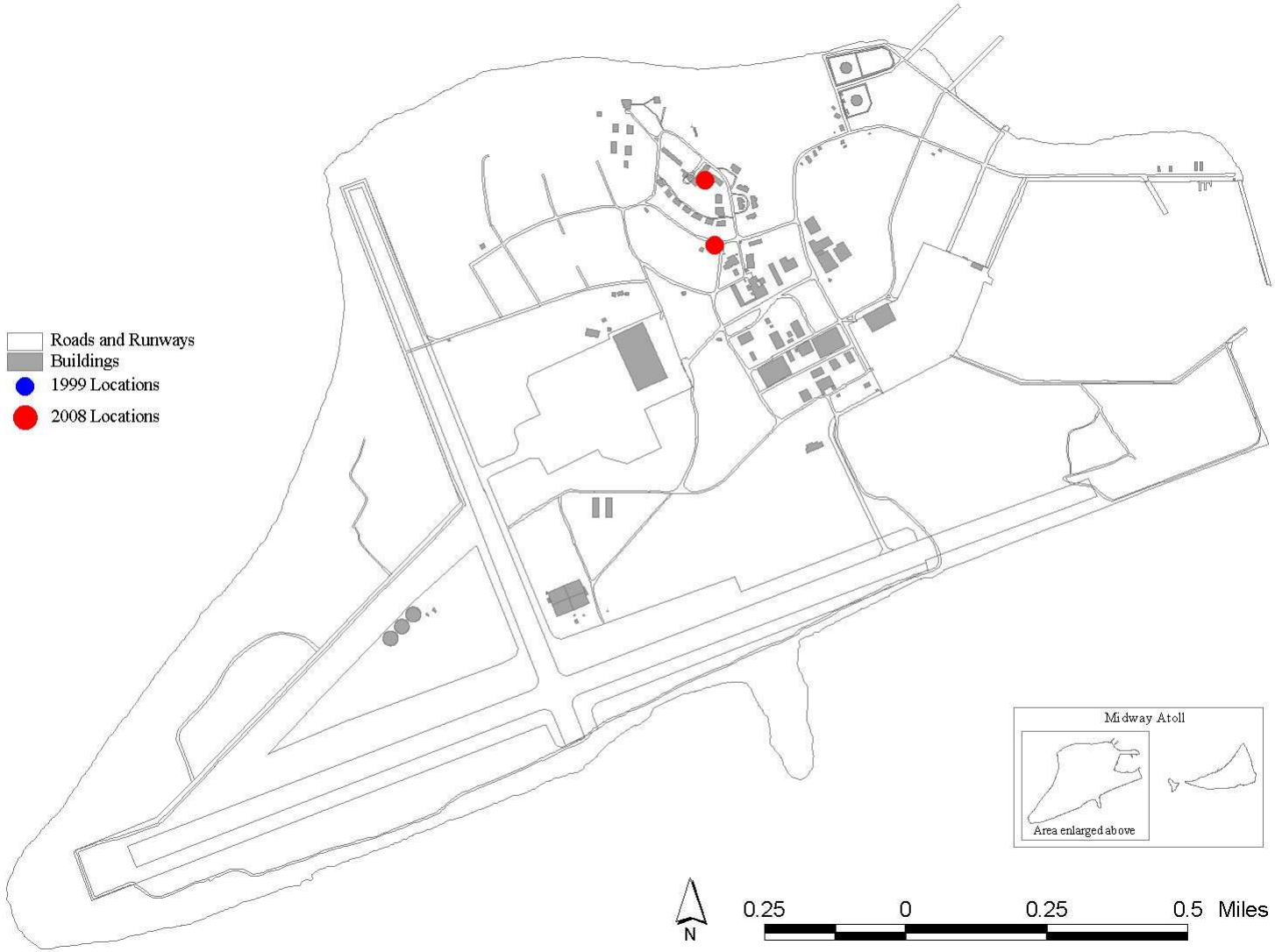
Known distribution of octopus tree (*Schefflera actinophylla*) on Midway Atoll in 1999 and 2008



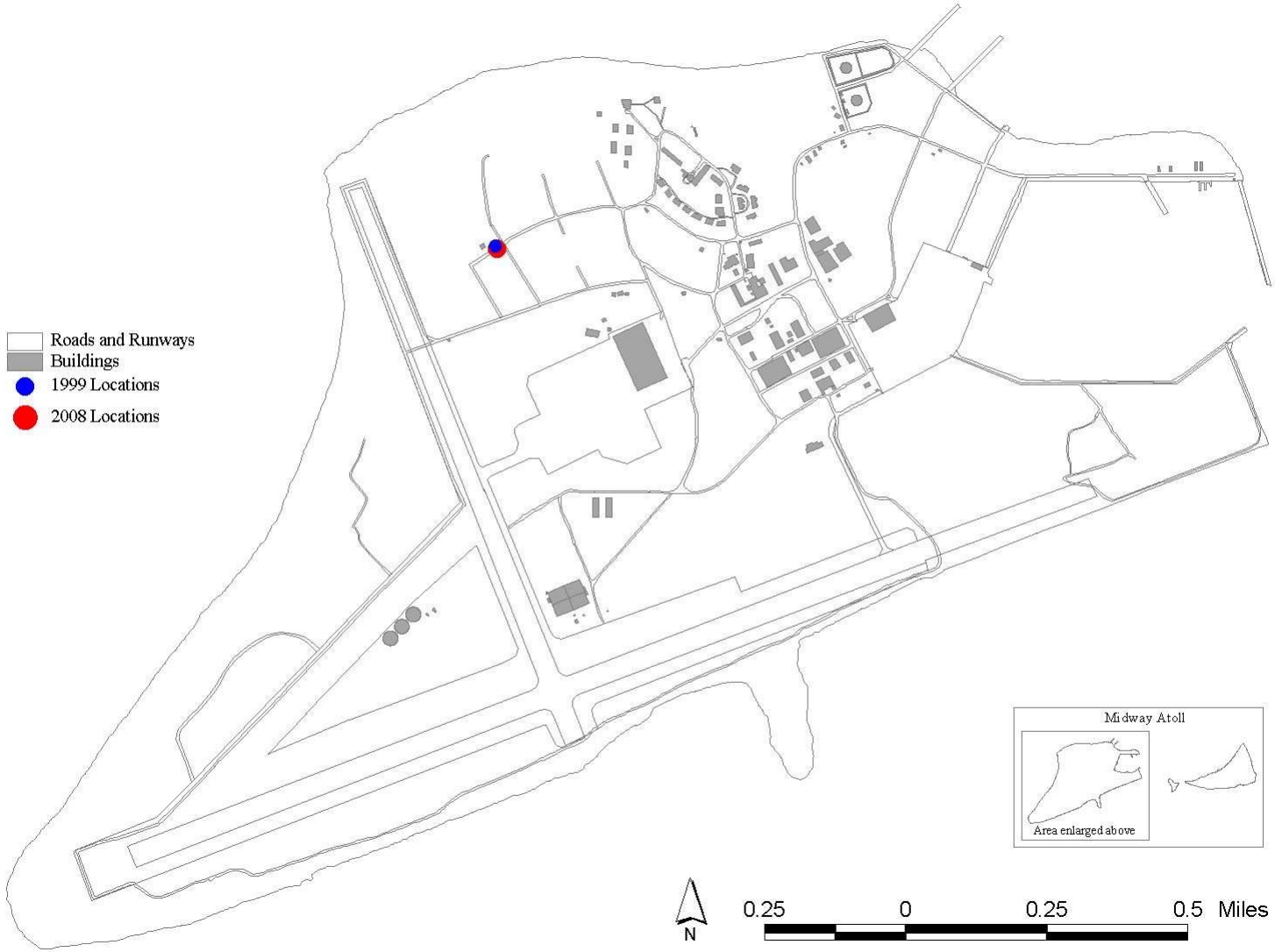
Known distribution of Christmas berry (*Schinus terebinthifolius*) on Midway Atoll in 1999 and 2008



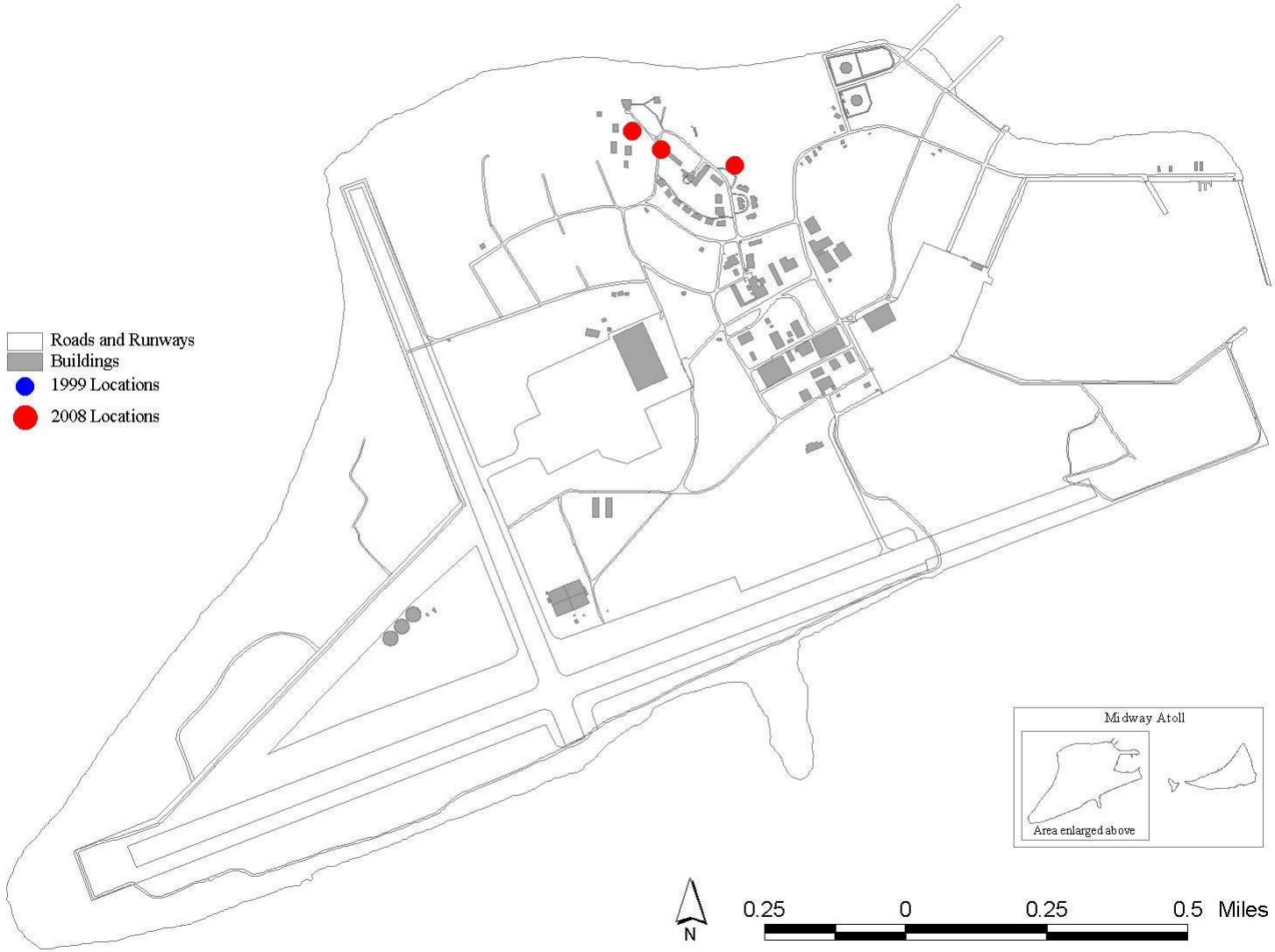
Known distribution of turkeyberry (S*olanum torvum*) on Midway Atoll in 1999 and 2008



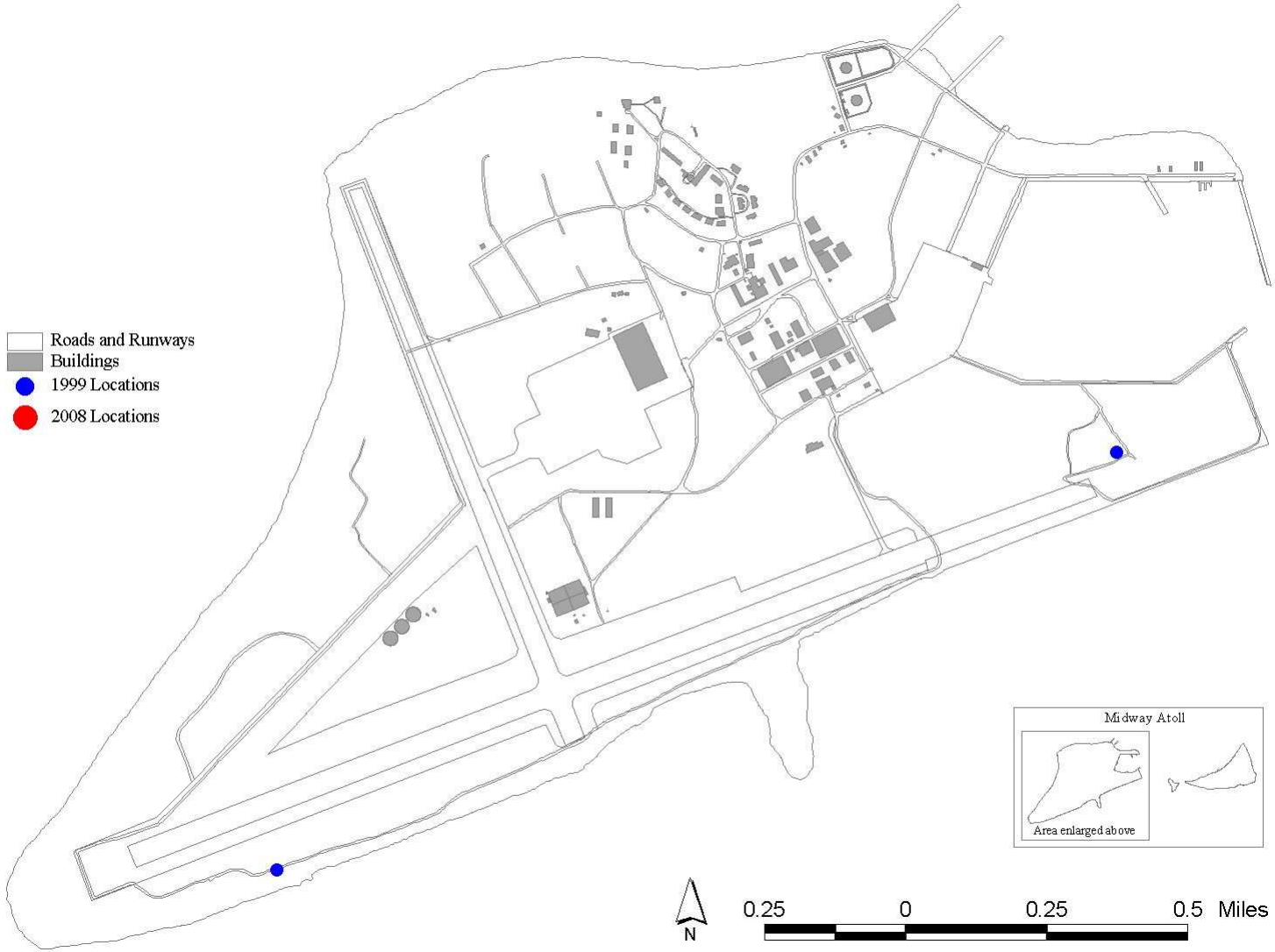
Known distribution of African tulip (*Spathodea campanulata*) on Midway Atoll in 1999 and 2008



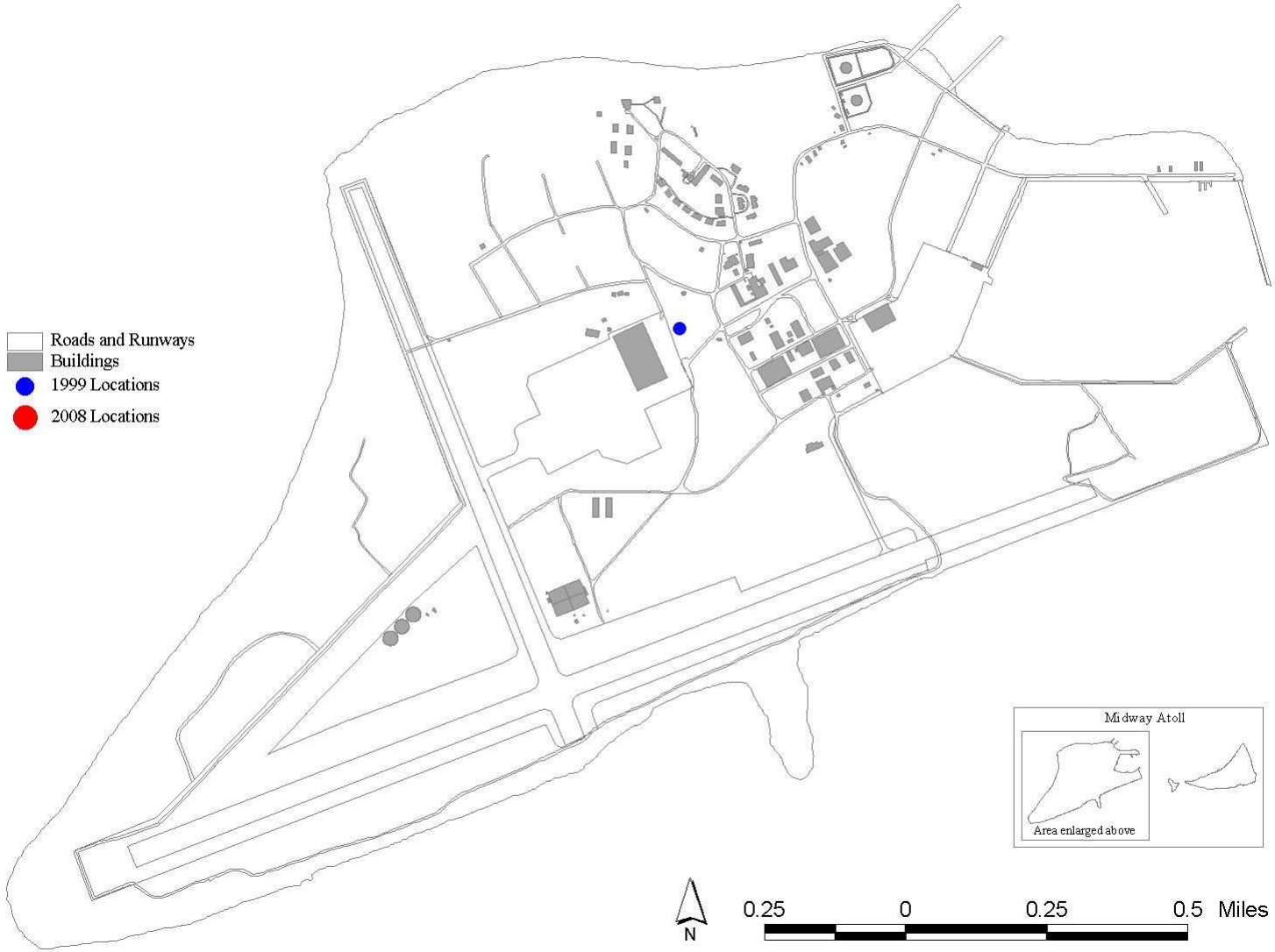
Known distribution of nephthytis (*Syngonium podophyllum*) on Midway Atoll in 1999 and 2008



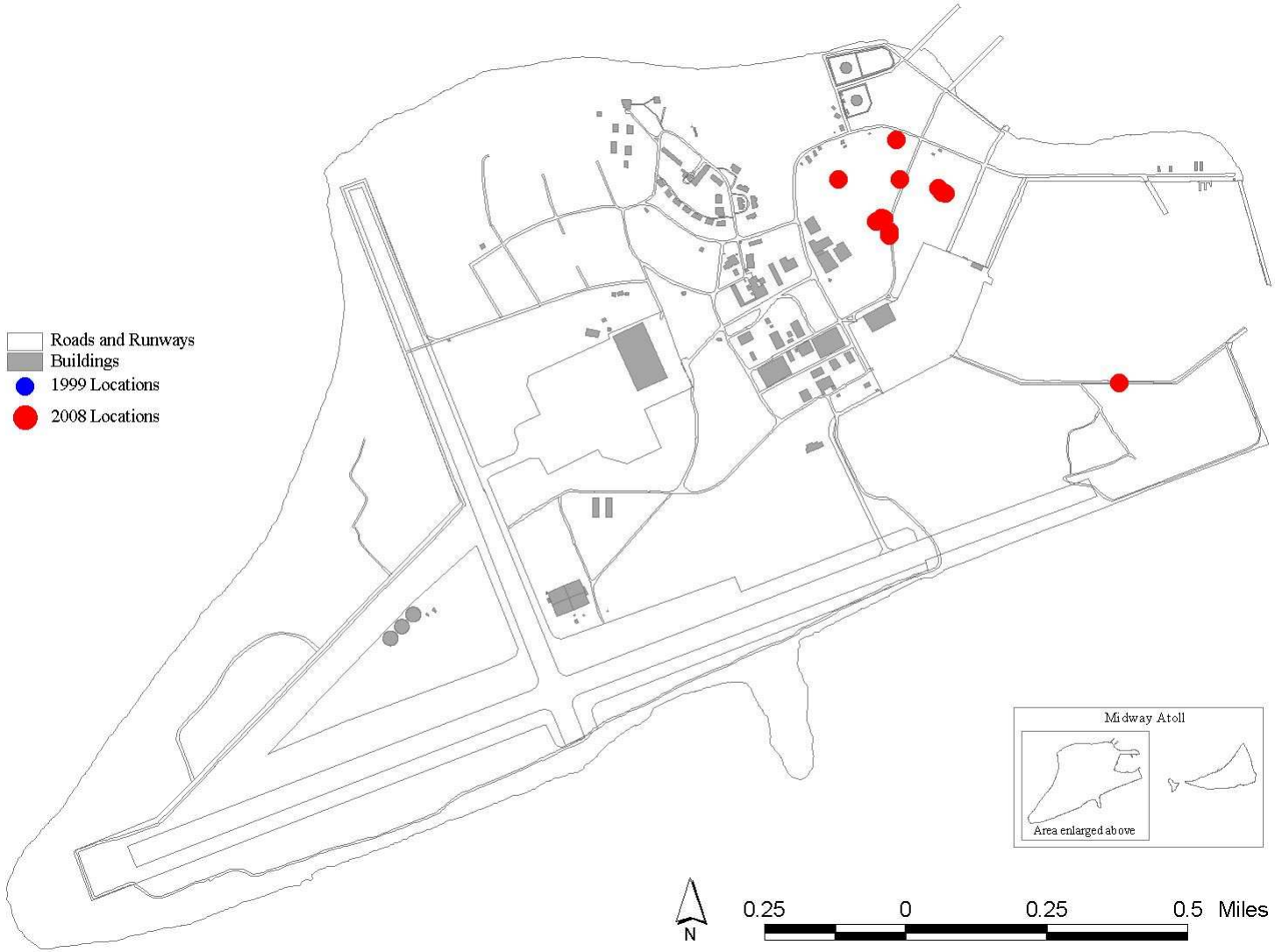
Known distribution of New Zealand spinach (*Tetragonia tetragonioides*) on Midway Atoll in 1999 and 2008



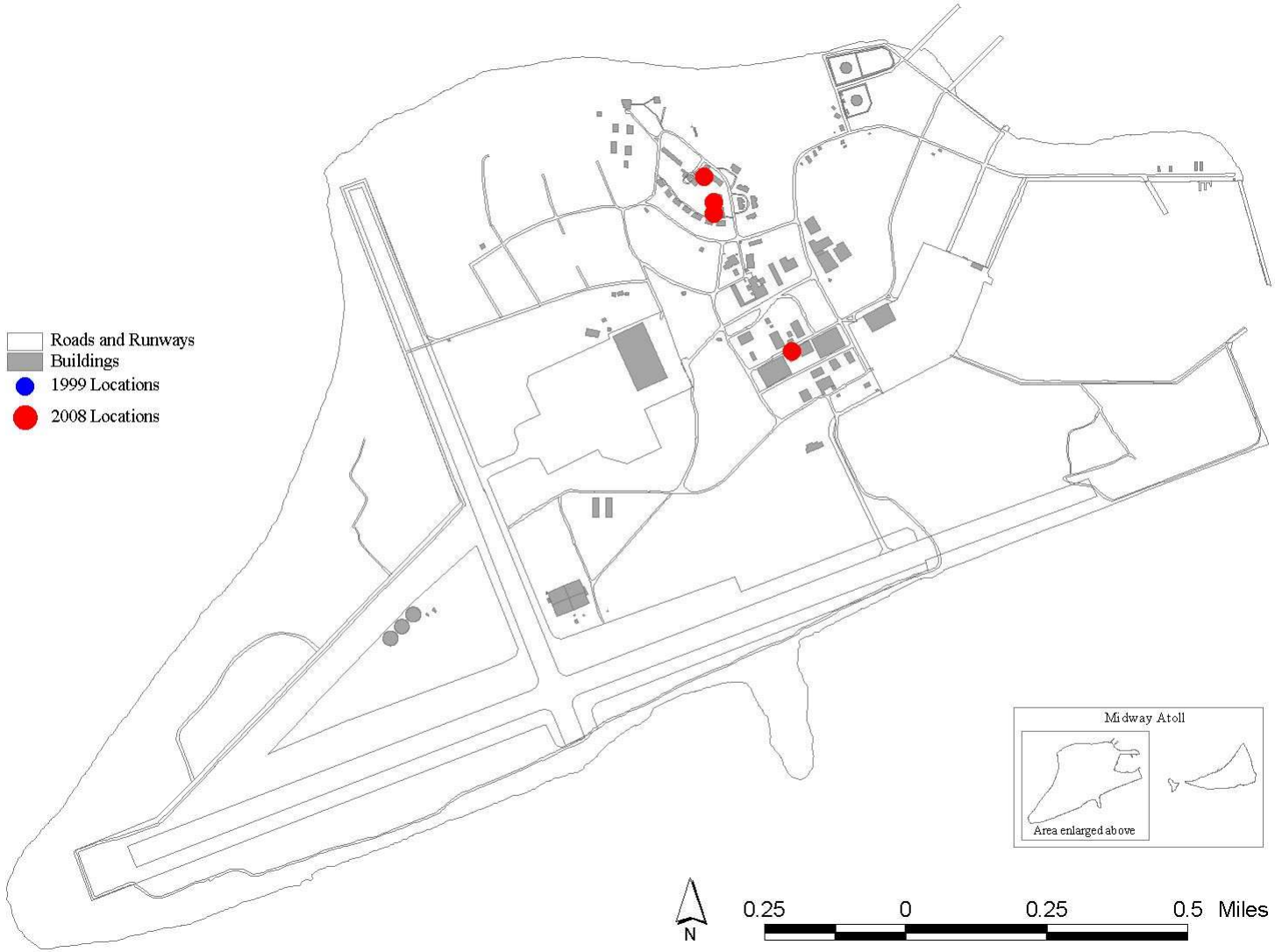
Known distribution of California grass (*Urochloa mutica*) on Midway Atoll in 1999 and 2008



Known distribution of tree vitex (*Vitex trifolia*) on Midway Atoll in 2008



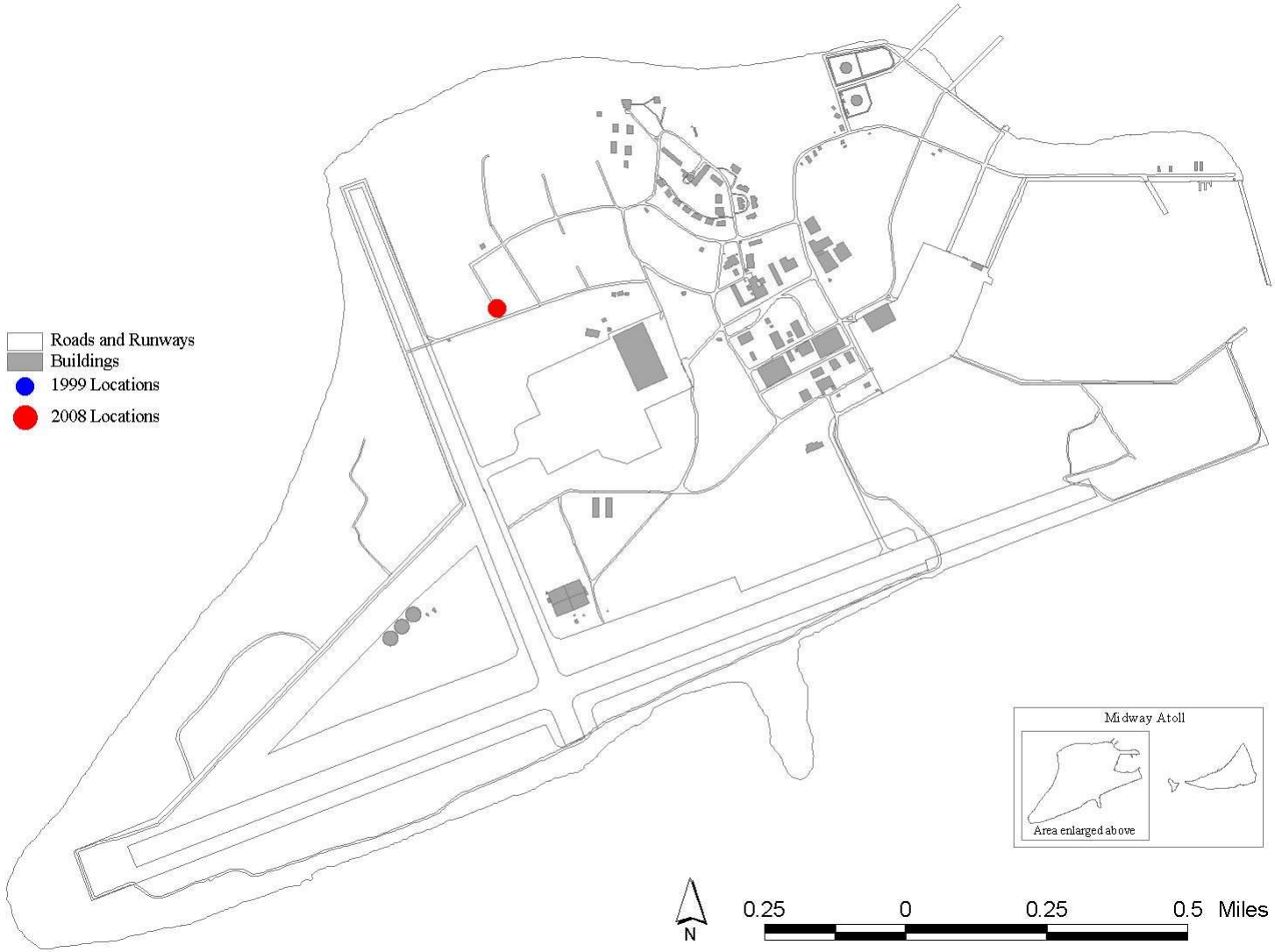
Known distribution of jujube (*Ziziphus* sp.) on Midway Atoll in 1999 and 2008



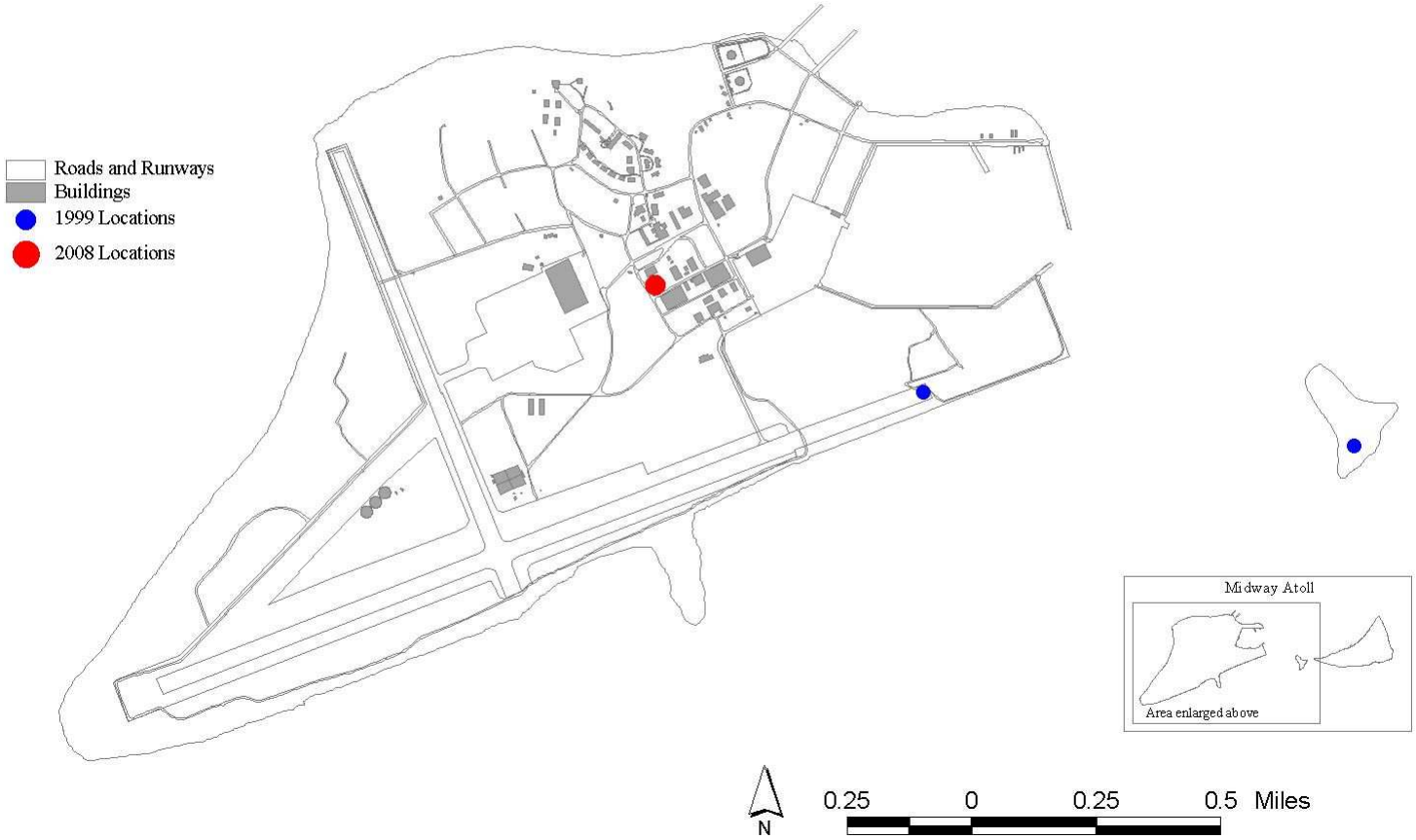
NATIVES

Yellow nickers	(*Caesalpinia bonduc*)
Dwarf eragrostis	(*Eragrostis paupera*)
Ilima	(*Sida fallax*)
Popolo	(*Solanum nelsonii*)
Uhaloa	(*Waltheria indica*)

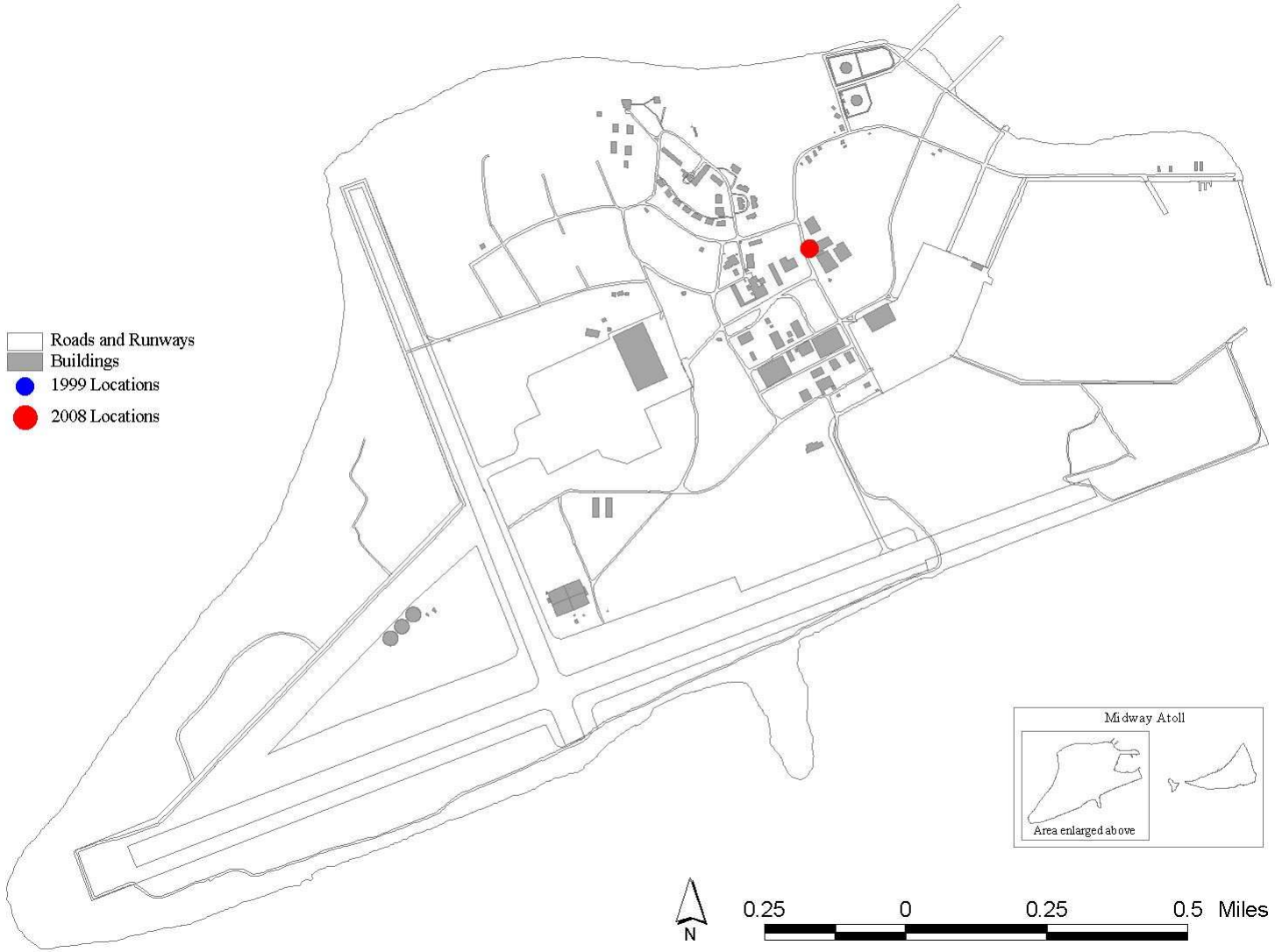
Known distribution of yellow nickers (*Caesalpinia bonduc*) on Midway Atoll in 1999 and 2008



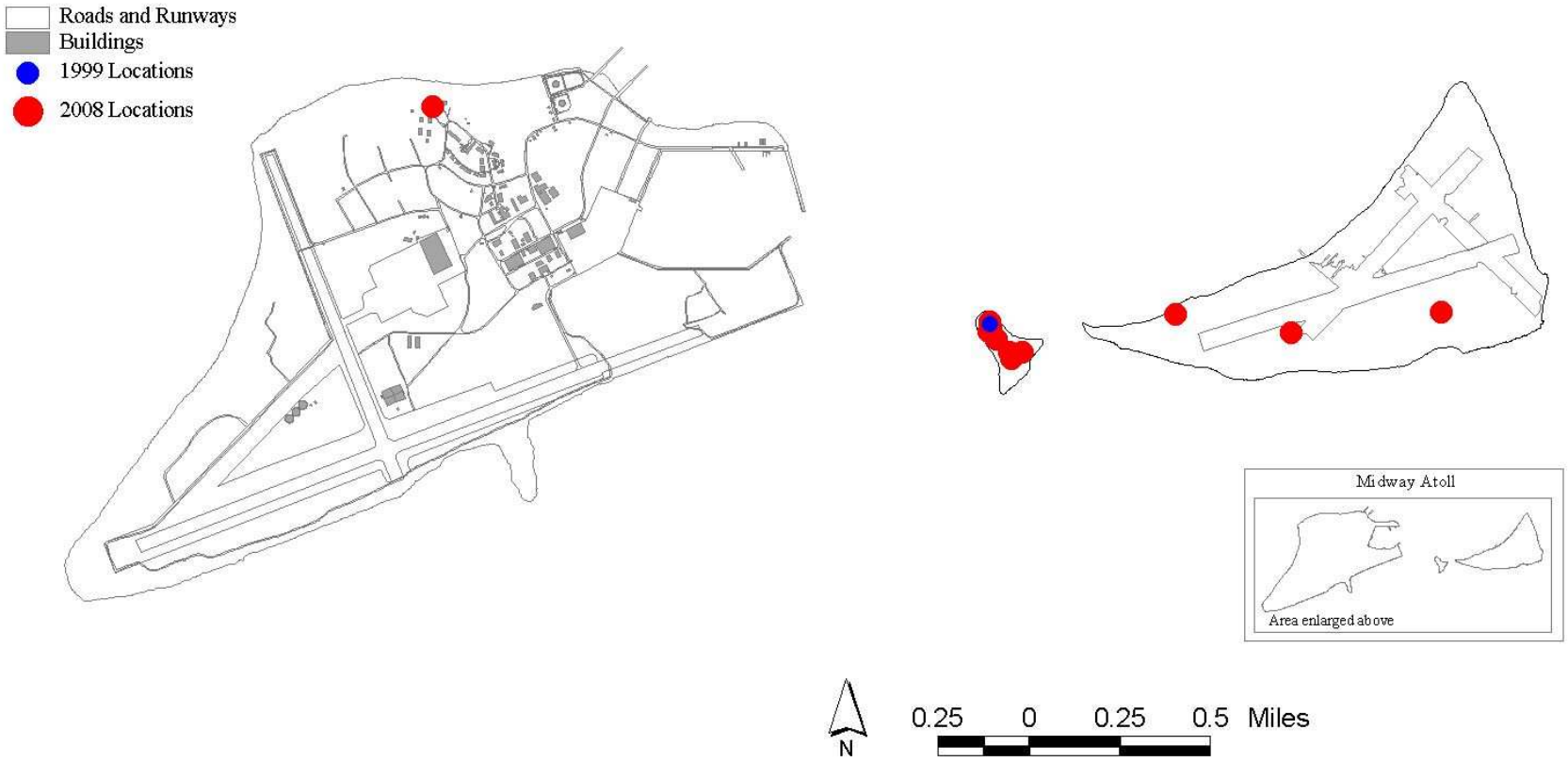
Known distribution of dwarf eragrostis (*Eragrostis paupera*) on Midway Atoll in 1999 and 2008



Known distribution of ilima (*Sida fallax*) on Midway Atoll in 1999 and 2008



Known distribution of popolo (*Solanum nelsonii*) on Midway Atoll in 1999 and 2008



Known distribution of uhaloa (*Waltheria indica*) on Midway Atoll in 1999 and 2008