## A3.7 Vectors for dispersal

### *Traditional fishing boats*

Indonesian fishermen have a traditional and ongoing association with the islands and continue to visit the area regularly and probably in greater numbers than any other type of visitor (Commonwealth of Australia 2001). Their traditional sailing boats (perahus) appear to be the most numerous type of vessel to visit the islands, with many from the island of Roti in eastern Indonesia. Customs officers report that boats arrive during both the wet and dry seasons. Crew frequently land on West Island to collect water from the well, and occasionally perahus are careened on inter tidal parts of the sand spit at the southern end for emergency repairs or are wrecked. In addition, these boats may be a significant source of the refuse washed up on the islands beaches. During rubbish collections on several of the islands, no evidence was found that any of this refuse contained plant seeds. However, there is potential for burrs such as *Tribulus* to be embedded in any foot wear worn by fishermen and in the numerous thongs found washed up on the beaches. Viability of these seeds after immersion in seawater is not known, but for terrestrial plants not adapted to dispersal by sea is expected to be short.

Propagules of various food and other plants may form part of the refuse discarded from various types of boats. Although, seeds of most food plants could not be expected to survive salt water immersion for a significant length of time, those discarded from boats anchored within the reserve may still be viable when washed ashore. Conditions for establishment and growth on the islands would probably be too severe for most known food species, without human intervention. Exceptions may include the tamarind tree, *Tamarindus indicus* which has been widely planted by Makassans along the NT coast and has become naturalised in places (Macknight 1976). The Chinee apple, *Ziziphus mauritiana* is a hardy small tree naturalised in inland tropical NT and Qld. It can be found growing on coastal dunes at Darwin. Refuse from boats can also include non-food species such as the large tree *Ceiba pentandra*. Pike and Leach (1997) report that most traditional Indonesian sailing vessels carry fruit of this species to provide a supply of buoyant kapok fibres.

There is potential for wind-borne seed to be carried the short distance from a vessel moored at the inner anchorage across to West Island. Such seed (eg. of *Chromolaena odorata*) could for example be trapped in nets, folded sails or other equipment at the point of departure and later released when the equipment is disturbed on deck at Ashmore. Soil is potentially a major vector for the introduction of plant seeds. In the past, Indonesian fishermen have apparently grown maize and other food plants in pots on the islands, possibly accounting for the presence of *Cleome gynandra* on Middle Island (Pike and Leach 1997). Should access restrictions or enforcement be relaxed it is possible this undesirable practice could recommence. With vessels operating around the islands all year there is a risk of landings in unforeseen circumstances or of a vessel sinking or breaking up (say during a cyclone) with debris and possibly seeds reaching the islands.

### *Refugee boats*

The islands have been a destination for boats transporting illegal immigrants to Australia for some years with a rapid increase in activity since 1999 (Commonwealth of Australia 2001). Royal Australian Navy vessels have been stationed in the area to deal with such arrivals, and have probably minimised the risk of passengers and baggage disembarking on the islands. Although slight, the risk remains of landings in unforeseen circumstances or of a vessel sinking or breaking up (say during a cyclone) with debris and possibly seeds reaching the islands.

### *Yachts and other tourist and recreational vessels*

It is understood that yachts visit the area at the rate of about 12 per month, mostly arriving from Darwin or Broome on the prevailing south easterly winds during the dry season. Far fewer vessels risk cyclones by sailing from Asia during the wet season. Most 'yachties' apparently do not land on West Island to replenish water supplies although they may land on the beach for recreation. Little other tourist or recreational activity occurs in the area,

although occasionally tourist operators visit the reserve for diving or bird watching activities (Commonwealth of Australia 2001). Because of the small numbers involved and the restrictions on access to the islands, the potential for non-indigenous plant to arrive via these vectors is quite limited, with Australia a more likely source area than Asia. Again, the slight risk remains of landings in unforeseen circumstances or of a vessel sinking or breaking up (say during a cyclone) with debris and possibly seeds reaching the islands. Once again, there is potential for wind-borne seed to be carried the short distance from a vessel moored at the inner anchorage across to West Island.

### *Research and management activities*

From time to time, research and management staff visit the islands. There is some potential for this group to transport seeds or diaspores to the islands. Firstly, researchers and managers are likely to bring equipment or various materials, which are taken ashore (as discussed further below). Also, this group is likely to traverse the islands more extensively than any other group and is probably more likely than other groups to have spent time in the bush or weed infested areas prior to visiting the islands.

Probably the most important potential pathway for non-indigenous plant to reach the islands is as contaminants lodged in materials and equipment. Construction materials such as timber, fencing material, gravel, sand, bundles of steel, weed matting and associated machinery can be readily contaminated during storage by wind borne seed or seed from plants growing in proximity to stockpiles of materials. It is possible that such materials could be taken to the islands for construction of interpretative displays or other visitor facilities. Soil and mulching hay is frequently contaminated with seeds of native or weed species. These materials could be introduced for rehabilitation, landscaping or with potted plants. In the past, Indonesian fishermen have apparently grown maize plants in pots, and should access restrictions or enforcement be relaxed this practice could be recommenced (Pike and Leach 1997). Camping gear, scientific and management equipment or even boots are frequently used in the bush or in weed-infested areas and can be badly contaminated with seeds. This type of equipment could arrive with research and management personnel from a range of locations, both temperate and tropical. Darwin is likely to be a major point of supply and embarkation and hence non-indigenous plant from there could readily be introduced.

### *Birds*

Birds can be a significant vector of plant seeds. For example, Ridley (1930) thought about one quarter of the flora of Krakatau had been introduced by birds and bats. Dispersal can be either external or internal in the gut. It is known that remote islands can be colonised by plants producing viscid and barbed diaspores as a result of transportation by large sea birds (van der Pijl 1982). This author records that birds can be covered by the sticky seeds of *Pisonia*, a genus of plant commonly found on tropical islands. *Boerhavia* (also in Nyctaginaceae) and *Plumbago zeylanica* also have sticky 'seeds', are commonly found in coastal habitats and would also appear to have similar potential for transportation. Van der Pijl (1982) also records the dispersal of small seeds in the mud attached to the feet of water birds and in their gut. Guano attached to feathers could also carry seeds on nesting birds. The potential for plants to arrive in association with migratory waders using the Ashmore islands as a staging area must exist, although the significance of this pathway is difficult to evaluate.

### *Oceanic Drift*

There is potential for more species to colonise the island from littoral drift propagules and some of these could significantly modify the vegetation of islands. Propagules may arrive naturally or as refuse from various types of boats. The latter are discussed above. Propagules of strand species may originate naturally in either northern Australia or eastern Indonesia. Many strand species native to the region and with propagules dispersed by the sea are not recorded from the islands either as growing plants or as littoral drift propagules. Among these are the vines *Canavalia rosea*, *Clerodendrum inerme*, *Pisonia aculeata*, *Operculina browniana*, *Triumfetta repens*, and *Vitex rotundifolia*, the herbs *Euphorbia atoto*,

*Fimbristylis cymosa*, *Josephinia imperatricis* and *Sesuvium portulacastrum* and the shrubs *Colubrina asiatica*, *Premna odorata* and *Vitex trifoliata*. Although some species would appear to prefer more mesic conditions (based on experience elsewhere - eg. *Vigna marina*), a portion could be come established on the islands. A few could significantly alter the structure of the vegetation and abundance of other species. For some of these species, a lack of records from the islands may simply be a function of the small size and consequent difficulty of detection of propagules in the littoral drift.

## A3.8 Sources and Risk Species

### *Ashmore - Australian invasions*

At present, only two species of native plant recorded on the islands are not found on the Australian mainland. These are the perennial grass *Spinifex littoreus* and annual grass *Digitaria mariannensis*. Both species are specialist strand species in their native ranges. That these species are not already in northern Australia, especially the latter, is perhaps surprising as the distribution of *D. mariannensis* is 'throughout the NE Indian Ocean and W Pacific Oceans' (Du Puy *et al. 19*93). Although there is no indication that they would become serious weeds if introduced to Australia, it is probably better not to test such cases.

All non-indigenous plant species recorded on the Ashmore islands are already well established in northern Australia. Thus, they do not present an invasion risk there. However, there is potential for further accidental introductions of *Cleome gynandra* to significantly extend the range of this species in Australia. Although *Cleome gynandra* is widespread in Queensland, it is uncommon in the NT (at Katherine and Darwin) and is not known from mainland areas of the Kimberley Region (Staff of the Queensland Herbarium 1993, Wheeler *et al*. 1992). Given the large numbers of tourists and goods travelling overland from Queensland to the west each year, it appears likely that that this potential route would be far more significant than the very few people travelling from Ashmore to Australia. Present access prohibitions to Middle Island should ensure that the possibility of further accidental introduction to Australia is minimised. Thus, personnel accessing the island for research and management purposes would appear to present the main risk of spread of this plant.

*Digitaria mariannensis*, *Spinifex littoreus* and *Cleome gynandra* do not have propagules with spines, hooks or other obvious adaptations to aid dispersal. Although the seeds have no special mechanisms for attachment to clothing, those of *D. mariannensis* and *C. gynandra* are small, produced in abundance and could easily enter footwear. In addition, propagules could attach to foot ware, perhaps in the viscous oily deposits sometimes occurring on the beaches. As *D. mariannensis* is common in the public access corridor on West Island, it is likely to have the highest risk of introduction. In contrast, *S. littoreus* is found in only a small patch well to the south of the access corridor. *Cleome gynandra,* on Middle Island, is also well away from public access. The potential mechanisms for spread of these species are probably no different to many other plants in other parts of SE Asia accessed by tourists or expatriate workers using more conventional land and air transportation. Because of the low numbers of people landing on the islands (especially those travelling on to Australia) and restrictions to public access, the risk of transmission of these species is likely to be relatively low.

Of longer term importance is the possibility that major tropical weeds present in Asia such as *Chromolaena odorata* will be accidentally introduced to the islands. Although there appear to be few weeds that would thrive on the Ashmore Islands, there is a small risk that they could spread from there to Australia where growing conditions can be considerably more favourable. Under present management, the general public including personnel from foreign fishing vessels and yachts from overseas have access to the eastern beach and well on West Island. With this access, there is always the risk (although probably small) that another weed will be introduced.

### *Asia - Ashmore invasions*

A number of Asian weed species of potentially major significance in Australia have been identified by the Australian Quarantine and Inspection Service (Smith 2002). While some of these appear to be adapted to moist environments (eg. *Clidemia hirta*, *Piper aduncum*) or are aquatic (*Limnocharis flava*), others may successfully colonise in drier environments such as the Ashmore islands. Probably of greatest significance for the Ashmore islands are *Boerhavia erecta* (Nyctaginaceae), *Chromolaena odorata* (Asteraceae) and *Cleome rutidosperma* (Capparaceae). They could become a problem on the islands as well as posing a risk for further spread to the Australian mainland as discussed above.

*Boerhavia erecta* is an erect perennial herb to c 1 m tall which is native to the Americas but now widespread in Indonesia. The species is a weed of crops, pastures, disturbed places and can invade foreshore areas. It has sticky seeds attaching readily to birds and clothing but potentially could also spread in association with equipment or materials. Other *Boerhavia* species commonly thrive in this type of coastal environment in NT and several native species already occur on Ashmore islands.

*Chromolaena odorata* is a vigorous scrambling perennial shrub to 7 m tall, originally native to the Americas but now widespread in Indonesia including Timor and on Christmas Island. It produces large quantities of wind dispersed seeds, which can also be carried by vehicles, animals and water and could disperse to the islands with equipment or from boats anchored in the lagoon at Ashmore.

*Cleome rutidosperma* is an erect annual herb to 1 m tall reported as a weed of crops and the natural environment. It is native to Africa but is now widespread in many parts of SE Asia including Indonesia. Seed is spread short distances by ants or by explosive dehiscence of the pods but long-distance dispersal is by vehicles, machinery, foot ware and potentially also associated with equipment or materials.

*Mikania micrantha* is a fast-growing twining perennial vine invading a variety of situations but apparently preferring humid habitats. The seeds are wind dispersed and could disperse to the islands lodged in equipment or machinery or from boats anchored in the lagoon at Ashmore.

*Mucuna pruriens* (Fabaceae), *Paederia foetida* (Rubiaceae), *Striga asiatica* (Scrophulariaceae) are also listed as major Asian weeds, although the risk of introduction and colonisation is thought to be lower than for other species.

Some of the Asian *Indigofera* species are also considered potential colonisers of the Ashmore islands (A.A. Mitchell, pers. comm. ). Of the eight species known to occur on beaches and coasts in SE Asia, *I. zollingeriana* is potentially the most significant. Although native to the region, this shrub or small tree growing 2-12 m tall could have a considerable impact on the structure of vegetation on the Ashmore islands. It is a specialist species of sandy beaches and coral strands and is widespread in SE Asia, being indifferent to climate (de Kort and Thijsse 1984). It is not known how seed from the indehiscent pod is dispersed. Another species, *I. suffruticosa*, may also be of potential significance. This pantropical species can grow to 2.4 m and occurs in a variety of disturbed habitats as well as on beaches.

Most of these eight species are low shrubs or herbs rarely exceeding 1 m and would do little to modify the structure of the vegetation on the islands. Three (*I. colutea*, *I. hirsuta* and *I. linifolia*) are also native to northern Australia while *I. tinctoria* and *I. cordifolia* are introduced in Australia (but of limited extent in the NT). *Indigofera oblongifolia*, *I. suffruticosa* and *I. zollingeriana* do not occur in Australia. No specialised dispersal mechanisms are know for these species, with all having typical leguminous dehiscent or indehiscent pods. In the many species with dehiscent pods, seed could become lodged in soil, equipment, machinery or foot ware.

A range of tropical weed species are present on other tropical cays in the NE Indian Ocean and western Pacific (Table 4). Although most of these species are minor, widespread tropical weeds that are found around settlements on Cocos (Keeling) Islands, the major tropical

weed *Chromolaena odorata* has established there behind one of the dunes (A.A. Mitchell, pers. comm. ). In considering risks of these species becoming weeds at Ashmore, the much higher and more equitable rainfall of the Cocos Islands needs to be kept in mind. In comparison, Ashmore has less than half the annual rainfall with a long dry season. For this reason alone, it is difficult to reach firm conclusions on the risks of particular species found on these islands.

***Australia - Ashmore invasions***

Experience in the NT suggests a number of non-indigenous weed species that could spread into relatively undisturbed vegetation on the Ashmore islands. *Cenchrus ciliaris* dominates coastal dunes at Lee Point and in Fannie Bay near Darwin forming a dense sward c. 40 cm high and probably displacing native species. The short annual grass *Dactyloctenium aegyptium,* and low herbs *Alysicarpus ovalifolius*, *Euphorbia hirta* and *Tridax procumbens* and vine *Passiflora foetida* are common on the exposed coastal dunes and chenier plains in NT (Cowie and Egan 1993). Both *Cenchrus ciliaris* and *Euphorbia hirta* are already present on West Island but are still limited in extent. Given the low stature of most of these species and experience in the NT, it appears that there would be little affect on the structure of the vegetation on the islands, should any of these species invade. *Cenchrus ciliaris* is the exception here. In addition, it is not known if invasion by these weed species has resulted in the displacement of any native species.

Many other common tropical weeds have also been recorded at outstations (both inhabited and abandoned) on coastal dunes in the NT (Table 5). In this habitat, these species have generally remained closely associated with sites of disturbance. However, in other habitats some have spread into relatively undisturbed natural ecosystems or can be serious weeds (eg. *Hyptis suaveolens*, *Pennisetum polystachion*, *Sida acuta*). Major weeds around Darwin such as Gamba grass (*Andropogon gayanus*) and Coffee Bush (*Leucaena leucocephala*) are also likely to be accidentally introduced. In addition, *Lantana camara* shows a preference for foreshore sites there. Some species could be favoured by specific conditions on the islands, for example the high soil nutrient concentrations associated with sea bird nesting sites. Data are lacking on responses of particular species to the particular conditions associated with nesting islands. These common tropical weeds do not have obvious adaptations for dispersing by sea, but may rely on human, avian or other mammalian vectors.

In addition, there are very many Australian native species occurring naturally on coastal sandy deposits that could potentially colonise the islands. Again, these species do not have obvious adaptations for dispersing by sea, but may rely on human, avian or other mammalian vectors. Examples can be found on the extensive marine deposits that have accreted at Cobourg Peninsula and at other places along the northern coast in the NT. They include the annual herbs *Amaranthus leptostachyus*, *Bidens bipinnata*, *Boerhavia* spp, *Cleome viscosa*, *Euphorbia tannensis*, *Indigofera linifolia*, *Ptilotus conicus*, *Spermacoce stenophylla, Zornia oligantha,* the grasses *Digitaria ctenantha*, *Enneapogon pallidus, Perotis rara* and the tree *Acacia auriculiformis* (Cowie 1995, 1996, 1998, Cowie and Dunlop 1992, Cowie and Egan 1993). However, even if these mostly low growing species were to be come established on the islands, it is unlikely that either the structure or utility if the vegetation as nesting habitat would change. In northern Australia, most of the species occurring naturally on Ashmore islands already coexist with these Australian native coastal species.

## A3.9 Acknowledgments

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**TABLE 1:** Terrestrial vascular plant species recorded on the Ashmore Islands (for each island, the life stage recorded during previous surveys is given in brackets, followed by the status during this survey. References: Pike and Leach 1997, NT Herbarium records, George *et al*. 1993, this survey).

| **SPECIES AND STATUS FOR EACH ISLAND** | |
|---|---|
| Status (Pike and Leach 1997) | status, current survey |
| **AMARANTHACEAE** | |
| *Amaranthus interruptus* R.Br. - native; application of the name to Ashmore material uncertain | |
| East (Adults) | abundant; apparently extent increased considerably since Pike and Leach |
| Middle (Adults) | abundant |
| West (Adults) | not relocated |
| **ARACEAE** | |
| *Amorphophallus paeoniifolius* (Dennst.) Nicolson - probably introduced | |
| East (not recorded) | not recorded |
| Middle (not recorded) | not recorded |
| West (died out) | not recorded |
| **ARECACEAE** | |
| *Cocos nucifera* L. - introduced | |
| East (not recorded) | not recorded |
| Middle (juveniles) | 3 plants recorded |
| West (Adults) | 2 plants recorded |
| **ASTERACEAE** | |
| *Melanthera biflora* (L.) Willd. - native | |
| East (not recorded) | not recorded |
| Middle (not recorded) | not recorded |
| West (not recorded, extinct) | not recorded |
| **BORAGINACEAE** | |
| *Argusia argentea* (L.f.) Heine - native | |
| East (Adults replanted) | 2 low adults seen |
| Middle (Adults) | on S side |
| West (Adults) | common on dunes |
| *Cordia subcordata* Lam. - native | |
| East (1 Adult) | now dead |
| Middle(not recorded) | not recorded |
| West (4 Adults) | several plants on dunes |
| **CAESALPINIACEAE** | |
| *Caesalpinia bonduc* (L.) Roxb. - native | |
| East (not recorded) | not recorded |
| Middle (not recorded) | not recorded |
| West (juveniles) | not recorded |
| **CAPPARACEAE** | |
| *Cleome gynandra* L. - probably introduced | |
| East (not recorded) | not recorded |
| Middle (Adults) | common; scattered for c 200 m E of coconuts, range extended considerably over Pike and Leach |
| West (not recorded) | not recorded |

**CONVOLVULACEAE**

*Ipomoea macrantha* Roem. and Schult. - native

| | |
|---|---|
| East (Adults) | scattered around NE side |
| Middle (Adults) | a few plants near well |
| West (Adults) | abundant on most of island |

*Ipomoea pes-caprae* (L.) Sweet subsp. *brasiliensis* (L.) Ooststr. - native

| | |
|---|---|
| East (died out) | not recorded |
| Middle | not recorded |
| West (Adults) | common in southern part of Island |

**CUSCUTACEAE**

*Cuscuta australis* R.Br. - native

| | |
|---|---|
| East (not recorded) | patches near S end, on Tribulus |
| Middle (not recorded) | not recorded |
| West (not recorded) | not recorded |

**CYPERACEAE**

*Bulbostylis barbata* (Rottb.) C.B.Clarke - probably introduced

| | |
|---|---|
| East (not recorded) | not recorded |
| Middle(not recorded) | not recorded |
| West (Adults) | scattered plants near old Dept Territories Camp |

**EUPHORBIACEAE**

*Euphorbia hirta* L. - introduced

| | |
|---|---|
| East (not recorded) | not recorded |
| Middle (not recorded) | not recorded |
| West (Adults) | common near old weather station installations |

**FABACEAE**

*Sesbania cannabina* (Retz.) Poir. - native

| | |
|---|---|
| East (Adults) | on N side |
| Middle (Adults) | common |
| West (Adults) | common in drainage depressions towards centre of island |

**GOODENIACEAE**

*Scaevola taccada* Roxb. - native

| | |
|---|---|
| East (not recorded) | not recorded |
| Middle (Adults) | several plants on S side |
| West (Adults) | one large shrub on SW side |

**LAURACEAE**

*Cassytha filiformis* L. - native

| | |
|---|---|
| East (Adults) | not relocated |
| Middle (Adults) | not relocated |
| West (not recorded) | not recorded |

**MALVACEAE**

*Sida pusilla* Cav. - native

| | |
|---|---|
| East (Adults) | uncommon, on SE side |
| Middle (Adults) | scattered |
| West (Adults) | abundant over most of centre of island |

**NYCTAGINACEAE**

*Boerhavia burbidgeana* Hewson - native

| | |
|---|---|
| East (Adults) | not recorded |
| Middle (Adults) | not recorded |

West (Adults) occasional

*Boerhavia glabrata* Blume - native
East (not recorded) not recorded
Middle (not recorded) not recorded
West (Adults, occasional) not recorded

*Boerhavia repens* L. - native
East (Adults) patches towards S end
Middle (Adults) not relocated
West (Adults) abundant, widespread over most of interior of Island

**POACEAE**
*Cenchrus brownii* Roem. and Schult. - introduced
East (Adults) not relocated
Middle (Adults) not relocated
West (Adults) near old ONA camp, near old well, scattered through Sesbania

*Cenchrus ciliaris* L. - introduced
East (removed) not recorded
Middle (not recorded) not recorded
West (Adults) c. 65 tussocks recorded near site of old Dept. Territories camp

*Cenchrus echinatus* L. – introduced (probably eliminated)
East (not recorded) not recorded
Middle (not recorded) not recorded
West (Adults) not recorded (originally near site of old Dept Territories camp)

*Digitaria mariannensis* Merr. - native
East (Adults) abundant
Middle (Adults) abundant
West (Adults) abundant over most of island

*Eragrostis cumingii* Steud. - native
East (Adults) common
Middle (Adults) common
West (Adults) not relocated

*Eragrostis tenella* (L.) P.Beauv. ex Roem. and Schult. - probably introduced
East (not recorded) not recorded
Middle (not recorded) not recorded
West (Adults) not recorded, previously near path to well and behind SE dunes

*Lepturus repens* (G.Forst.) R.Br. - native
East (Adults) common on coastal margin
Middle (Adults) common on coastal fringe
West (Adults) common on dunes

*Pennisetum pedicellatum* - introduced
East (not recorded) not recorded
Middle (not recorded) not recorded
West (not recorded) approx 50 plants located near old ONA camp

*Setaria* sp. – native
East (not recorded) not recorded
Middle (not recorded) not recorded
West (adults) not relocated

*Spinifex littoreus* (Burm.f.) Merr. - native

| | |
|---|---|
| East (Adults) | not relocated; appears to have died out |
| Middle (not recorded) | not recorded |
| West (Adults) | small patch on E side |

*Spinifex longifolius* R.Br. - native

| | |
|---|---|
| East (not recorded) | not recorded |
| Middle (not recorded) | not recorded |
| West (Adults) | large patch on NE side, possibly increasing in extent |

*Sporobolus virginicus* (L.) Kunth. - native

| | |
|---|---|
| East (Adults) | common on coastal margin and near S end |
| Middle (Adults) | not relocated |
| West (not recorded) | not recorded |

*Zea mays* - introduced

| | |
|---|---|
| East (not recorded) | not recorded |
| Middle (removed) | not recorded |
| West (not recorded) | not recorded |

**PORTULACEAE**

*Portulaca oleracea* L. - native

| | |
|---|---|
| East (Adults) | occasional |
| Middle (Adults) | occasional patches |
| West (Adults) | not recorded |

*Portulaca tuberosa* Roxb. - native

| | |
|---|---|
| East (Adults) | not recorded |
| Middle (Adults) | one patch on coastal fringe |
| West (Adults) | occasional on dunes |

**RHIZOPHORACEAE**

*Rhizophora stylosa* Griff. - native

| | |
|---|---|
| East (not recorded) | not recorded |
| Middle (not recorded) | not recorded |
| West (propagules only) | not recorded |

**RUBIACEAE**

*Guettarda speciosa* L. - native

| | |
|---|---|
| East (not recorded) | not recorded |
| Middle (died out) | not recorded |
| West (Adults) | large shrubs on NE side |

**SURIANACEAE**

*Suriana maritima* L. - native

| | |
|---|---|
| East (juveniles) | 1 Adult recorded |
| Middle (Adults) | on SE side, many have died |
| West (juveniles) | not recorded |

**ZYGOPHYLLACEAE**

*Tribulus cistoides* L. - ?native

| | |
|---|---|
| East (Adults) | abundant, more towards south-centre of Island |
| Middle (Adults) | occasional plants on E side |
| West (Adults) | an area of c 3m x 4 m found at 12°14′31″S 122°57′53″E, towards N end |

**TABLE 2: Plant collections from Ashmore Reef National Nature Reserve held at the NT Herbarium, Darwin (both terrestrial and marine plants are included)**

| TAXON NAME | ACCESSION NO | COLLECTOR | NO | COLLECTION DATE | LATITUDE | LONGITUDE | LOCALITY DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| AMARANTHACEAE *Amaranthus interruptus* R.Br. | D0072085 | Pike, D. | | 13/03/1994 | 121430 | 1225800 | Ashmore Islands, West Islet. | Erect herb to 30cm high. |
| AMARANTHACEAE *Amaranthus interruptus* R.Br. | D0070775 | Pike, D. | | 12/04/1993 | 121430 | 1225830 | Ashmore Reef; West Island. | Found around Brown Booby resting area; SW Point. |
| AMARANTHACEAE *Amaranthus interruptus* R.Br. | D0126670 | Pike, D. | | | 121600 | 1230240 | Ashmore Reef; Middle Island | Collected 1995 [ note original collection date was 00000000] |
| AMARANTHACEAE *Amaranthus interruptus* R.Br. | D0151859 | Cowie, I.D. | 9620 | 15/06/2002 | 121538 | 1230537 | East Island; Ashmore Islands | perennial herb c 30 cm tall; dominant over large areas, on calcareous sand and guano |
| AMARANTHACEAE *Amaranthus interruptus* R.Br. | D0126672 | Pike, D. | | | 121550 | 1230630 | Ashmore Reef; East Island | Collected 1995 [ note original collection date was 00000000] |
| BORAGINACEAE *Argusia argentea* (L.f.) Heine | D0151865 | Cowie, I.D. | 9627 | 19/06/2002 | 121436 | 1225812 | West Island; Ashmore Islands | shrub, c 4 m tall, c 8 m diameter; common on calcareous sand around outside of island |
| CAESALPINIACEAE *Caesalpinia bonduc* (L.) Roxb. | D0072089 | Pike, D. | | 16/03/1994 | 121430 | 1225800 | Ashmore Islands, West Islet. | Small erect herb to 10cm high. |
| CAPPARACEAE *Cleome gynandra* L. | D0072096 | Pike, D. | | 16/04/1994 | 121600 | 1230140 | Ashmore Islands, Middle Island. | Herb with yellow flowers. |
| CAPPARACEAE *Cleome gynandra* L. | D0151860 | Cowie, I.D. | 9621 | 16/06/2002 | 121555 | 1230156 | Middle Island; Ashmore Islands | erect herb c 50 cm tall; stamens dark maroon; with dead *Amaranthus*, live *Sesbania*; on calcareous sand and guano |
| CAPPARACEAE *Cleome gynandra* L. | D0050010 | Pike, D. | | 23/05/1990 | 121600 | 1230200 | Ashmore Reef; Middle Isle. | Growing near well. |
| CONVOLVULACEAE *Ipomoea macrantha* Roem. and Schult. | D0151866 | Cowie, I.D. | 9628 | 19/06/2002 | 121430 | 1225807 | West Island; Ashmore Islands | vine, flowers white; common on calcareous sand in grassland or on *Argusia* |
| CONVOLVULACEAE *Ipomoea pes-caprae* (L.) Sweet | D0072097 | Pike, D. | | 13/03/1994 | 121430 | 1225800 | Ashmore Islands, West Islet. | Trailing herb. |
| CUSCUTACEAE *Cuscuta australis* R.Br. | D0151863 | Cowie, I.D. | 9624 | 17/06/2002 | 121540 | 1230548 | East Island; Ashmore Islands | parasitic vine, yellowish; on *Tribulus cistoides*; on calcareous sand |
| CYMODOCEACEAE *Halodule pinifolia* (Miki) Den Hartog | D0125500 | Pike, D. | | 15/09/1995 | 121600 | 1230525 | Ashmore Reef, East Island. | Seagrass exposed at low tide. In pool in beach rock. |
| CYMODOCEACEAE *Thalassodendron ciliatum* (Forssk.) Hartog | D0070777 | Pike, D. | | 06/04/1993 | 121430 | 1225830 | Ashmore Reef; West Island. | Sea grass. |
| CYPERACEAE *Bulbostylis barbata* (Rottb.) C.B.Clarke | D0071277 | Pike, D. | | 13/03/1994 | 121400 | 1225800 | Ashmore Reef; West Island | Found near Territories Camp. |
| FABACEAE *Sesbania cannabina* (Retz.) Poir. var. cannabina | D0151864 | Cowie, I.D. | 9626 | 18/06/2002 | 121552 | 1230159 | Middle Island; Ashmore Islands | annual herb, corolla yellow; with Cleome, *Amaranthus, Tribulus cistoides*; on calcareous sand and guano |
| FABACEAE *Sesbania cannabina* (Retz.) Poir. var. cannabina | D0072095 | Pike, D. | | 15/03/1994 | 121430 | 1225800 | Ashmore Islands, West Islet. | Shrub with cream flowers. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| HYDROCHARITACEAE *Halophila decipiens* Ostenf. | D0131212 | Pike, D. | | 07/09/1996 | 121500 | 1230000 | Ashmore Reef | Marine plant. 30m seaward of reef crest, 23m depth. Coral rubble. |
| HYDROCHARITACEAE *Halophila ovalis* (R.Br.) Hook.f. | D0131210 | Pike, D. | | 07/09/1996 | 121500 | 1230000 | Ashmore Reef | Marine plant. |
| HYDROCHARITACEAE *Halophila ovalis* (R.Br.) Hook.f. | D0131211 | Pike, D. | | 07/09/1996 | 121500 | 1230000 | Ashmore Reef | Marine plant. 30m seaward of reef crest, 23m depth. |
| HYDROCHARITACEAE *Halophila ovalis* (R.Br.) Hook.f. | D0131214 | Willan, R.C | | 06/09/1996 | 121500 | 1230000 | Ashmore Reef | Marine plant. 24m outride entrance to lagoon. |
| MALVACEAE *Sida pusilla* Cav. | D0151853 | Cowie, I.D. | 9614 | 13/06/2002 | 121438 | 1225813 | West Island; Ashmore Islands | prostrate perennial herb; flowers yellow; on calcareous sand; abundant over most of island |
| NYCTAGINACEAE *Boerhavia burbidgeana* Hewson | D0072083 | Pike, D. | | 21/03/1994 | 121430 | 1225800 | Ashmore Islands, West Islet. | Sprawling herb. |
| NYCTAGINACEAE *Boerhavia burbidgeana* Hewson | D0072086 | Pike, D. | | 21/03/1994 | 121430 | 1225800 | Ashmore Islands, West Islet. | Herb with white flowers. |
| NYCTAGINACEAE *Boerhavia burbidgeana* Hewson | D0050004 | Pike, D. | | 23/05/1990 | 121600 | 1230600 | Ashmore Reef; East Isle. | Eastern bend. |
| NYCTAGINACEAE *Boerhavia burbidgeana* Hewson | D0126673 | Pike, D. | | | 121550 | 1230630 | Ashmore Reef; East Island | Collected 1995 3 stamens [ note original collection date was 00000000] |
| NYCTAGINACEAE *Boerhavia glabrata* Blume | D0072098 | Pike, D. | | 21/03/1994 | 121430 | 1225800 | Ashmore Islands, West Islet. | Erect herb to 18cm high. |
| NYCTAGINACEAE *Boerhavia repens* L. | D0151856 | Cowie, I.D. | 9617 | 12/06/2002 | 121431 | 1225802 | West Island; Ashmore Islands | prostrate perennial; corolla mauve; on calcareous sand; common on island with *Sida pusilla, Digitaria mariannensis* |
| NYCTAGINACEAE *Boerhavia repens* L. | D0151862 | Cowie, I.D. | 9623 | 17/06/2002 | 121540 | 1230548 | East Island; Ashmore Islands | prostrate perennial, corolla mauve; in patches with *Digitaria mariannensis, Tribulus cistoides*; on calcareous sand and guano |
| POACEAE *Cenchrus brownii* Roem. and Schult. | D0151855 | Cowie, I.D. | 9616 | 12/06/2002 | 121430 | 1225807 | West Island; Ashmore Islands | annual grass; on calcareous sand; common in centre of island around sites of former disturbance |
| POACEAE *Cenchrus ciliaris* (Kuntze) L. | D0070774 | Pike, D. | | 08/04/1993 | 121430 | 1225830 | Ashmore Reef; West Island. | Grass from near Old Territories Camp. |
| POACEAE *Cenchrus ciliaris* (Kuntze) L. | D0151854 | Cowie, I.D. | 9615 | 13/06/2002 | 121438 | 1225813 | West Island; Ashmore Islands | perennial grass; on calcareous sand; c. 65 clumps at S end of island |
| POACEAE *Digitaria mariannensis* Merr. | D0151849 | Cowie, I.D. | 9612 | 13/06/2002 | 121435 | 1225757 | West Island; Ashmore Islands | annual grass in slight depression with *Sesbania, Sida*; on calcareous sand; widespread on island |
| POACEAE *Digitaria mariannensis* Merr. | D0048759 | Pike, D. | | 23/05/1990 | 121500 | 1225800 | Ashmore Reef; West Isle. | Major species of grass on West Island. |
| POACEAE *Eragrostis amabilis* (L.) Wight and Arn. ex Nees | D0048732 | Pike, D. | | 23/05/1990 | 121500 | 1225800 | Ashmore Reef; West Isle. | Near old weather Station. |
| POACEAE *Eragrostis amabilis* (L.) Wight and Arn. ex Nees | D0072073 | Pike, D. | | 21/03/1994 | 121430 | 1225800 | Ashmore Islands, West Islet. | Small grass to 15cm high. |
| POACEAE *Eragrostis amabilis* (L.) Wight and Arn. ex Nees | D0072082 | Pike, D. | | 14/03/1994 | 121430 | 1225800 | Ashmore Islands, West Islet. | Grass in central herb field near well. |
| POACEAE *Eragrostis cumingii* Steud. | D0048729 | Pike, D. | | 23/05/1990 | 121500 | 1225800 | Ashmore Reef; West Isle. | Near old radio aerial. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| POACEAE *Eragrostis cumingii* Steud. | D0072077 | Pike, D. | | 21/03/1994 | 121430 | 1225800 | Ashmore Islands, West Islet. | Grass. |
| POACEAE *Eragrostis cumingii* Steud. | D0072088 | Pike, D. | | 13/03/1994 | 121430 | 1225800 | Ashmore Islands, West Islet. | Erect grass occasional in patches in amongst plants in central herb field. |
| POACEAE *Eragrostis cumingii* Steud. | D0077156 | Pike, D. | | 09/04/1993 | 121430 | 1225830 | West Island, Ashmore Reef, Indian Ocean. | Grass. |
| POACEAE *Eragrostis cumingii* Steud. | D0077175 | Pike, M. | | 09/04/1993 | 121430 | 1225830 | West Island, Ashmore Reef, Indian Ocean. | Grass in herb field. |
| POACEAE *Eragrostis cumingii* Steud. | D0077181 | Pike, D. | | 09/04/1993 | 121430 | 1225830 | West Island, Ashmore Reef, Indian Ocean. Between well and weather station. | Grass in herb field. |
| POACEAE *Eragrostis cumingii* Steud. | D0151861 | Cowie, I.D. | 9622 | 16/06/2002 | 121552 | 1230155 | Middle Island; Ashmore Islands | annual grass; common in patches with *Amaranthus, Digitaria mariannensis*; on calcareous sand and guano |
| POACEAE *Eragrostis cumingii* Steud. | D0077159 | Pike, D. | | 29/03/1993 | 121600 | 1230240 | Middle Island, Ashmore Reef, Indian Ocean. | Grass with inflorescences extended radially not laterally. |
| POACEAE *Eragrostis cumingii* Steud. | D0070749 | Pike, D. | | 09/03/1993 | 121430 | 1230630 | Ashmore Reef; West Island. | SW Point. |
| POACEAE *Lepturus repens* (G.Forst.) R.Br. | D0072087 | Pike, D. | | 22/03/1994 | 121430 | 1225800 | Ashmore Islands, West Islet. | Grass with creeping growth. |
| POACEAE *Pennisetum pedicellatum* Trin. subsp. *pedicellatum* | D0151857 | Cowie, I.D. | 9618 | 12/06/2002 | 121430 | 1225805 | West Island; Ashmore Islands | annual grass; on calcareous sand; limited to site of former disturbance on island |
| POACEAE *Pennisetum pedicellatum* Trin. subsp. *unispiculum* Brunken | D0070776 | Pike, D. | | 18/04/1993 | 121430 | 1225830 | Ashmore Reef; West Island. | Grass from behind ONA shed. |
| POACEAE Setaria | D0077162 | Pike, D. | | 14/04/1993 | 121430 | 1225830 | West Island, Ashmore Reef, Indian Ocean. | Grass in *Cenchrus* and *Sesbania* stand. |
| POACEAE *Spinifex littoreus* (Burm.f.) Merr. | D0072091 | Pike, D. | | 13/03/1994 | 121430 | 1225800 | Ashmore Islands, West Islet. | Grass. |
| POACEAE *Spinifex littoreus* (Burm.f.) Merr. | D0151868 | Cowie, I.D. | 9630 | 19/06/2002 | 121433 | 1225810 | West Island; Ashmore Islands | perennial grass, patch of several square metres in lee of *Argusia* bushes; on calcareous sand on fore dune |
| POACEAE *Spinifex littoreus* (Burm.f.) Merr. | D0072094 | Pike, D. | | 14/04/1994 | 121600 | 1230525 | Ashmore Islands, East Islet. | Grass. |
| POACEAE *Spinifex longifolius* R.Br. | D0151847 | Cowie, I.D. | 9611 | 13/06/2002 | 121426 | 1225757 | West Island; Ashmore Islands | Perennial grass producing long stolons; in extensive monospecific patch; on calcareous sand on NW side of island |
| POACEAE *Sporobolus virginicus* (L.) Kunth | D0072093 | Pike, D. | | 17/04/1994 | 121600 | 1230525 | Ashmore Islands, East Islet. | Grass to 45cm high. |
| POACEAE *Sporobolus virginicus* (L.) Kunth | D0151858 | Cowie, I.D. | 9619 | 15/06/2002 | 121542 | 1230542 | East Island; Ashmore Islands | perennial grass; on calcareous sand on fore dune, outside of *Lepturus repens* zone |
| PORTULACACEAE *Portulaca oleracea* L. | D0072092 | Pike, D. | | 17/03/1994 | 121430 | 1225800 | Ashmore Islands, West Islet. | Small herb to 8cm high. |
| PORTULACACEAE *Portulaca tuberosa* Roxb. | D0072080 | Pike, D. | | 21/03/1994 | 121430 | 1225800 | Ashmore Islands, West Islet. | Small herb. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PORTULACACEAE *Portulaca tuberosa* Roxb. | D0072090 | Pike, D. | | 21/03/1994 | 121430 | 1225800 | Ashmore Islands, West Islet. | Small herb to 8cm high. |
| PORTULACACEAE *Portulaca tuberosa* Roxb. | D0126671 | Pike, D. | | | 121430 | 1225830 | Ashmore Reef; West Island; SW beach | Yellow flower Collected 1995 [ note original collection date was 00000000] |
| RUBIACEAE *Guettarda speciosa* L. | D0151867 | Cowie, I.D. | 9629 | 19/06/2002 | 121426 | 1225801 | West Island; Ashmore Islands | shrub, c 5 m tall, 8 m diameter, branching to ground level, flowers white, fruit white; uncommon, on calcareous sand on fore dune |
| ZYGOPHYLLACEAE *Tribulus cistoides* L. | D0151851 | Cowie, I.D. | 9613 | 13/06/2002 | 121431 | 1225753 | West Island; Ashmore Islands | prostrate perennial herb; flowers yellow; on calcareous sand; towards N end of island |

**TABLE 3: Propagules (seeds, fruits and hypocotyls) recorded in littoral drift on the Ashmore Islands** (references for likely viability are Pike and Leach 1997, Green 1999, Gunn and Dennis 1999, Smith 1999)

*Aleurites moluccana* L. (EUPHORBIACEAE) [PandL; this survey] inviable
*Annona squamosa* L. (ANNONACEAE) [PandL] inviable
*Areca catechu* L. (ARECACEAE) [PandL] inviable
*Atuna racemosa* Rafin. (CHRYSOBALANACEAE) [PandL] ?inviable
*Barringtonia asiatica* (L.) Kurz. (LECYTHIDACEAE) [PandL; this survey] viable
*Barringtonia racemosa* L. (LECYTHIDACEAE) [PandL; this survey] ?inviable
*Borassus flabellifer* L. (ARECACEAE) [PandL] inviable
*Caesalpinia bonduc* (L.) Roxb. (CAESALPINIACEAE ) [PandL; this survey] viable
*Caesalpinia* sp. (CAESALPINIACEAE ) [PandL; this survey] viable
*Canavalia* sp. (FABACEAE) [this survey] viable
*Cassia fistula* L. (CAESALPINIACEAE ) [PandL] ?viable
*Ceiba pentandra* (L.) Gaertn. (BOMBACEAE) [PandL] inviable
*Cerbera manghas* L. (APOCYANACEAE) [PandL; this survey] viable
*Cocos nucifera* L. (ARECACEAE) [PandL; this survey] viable
*Cordia subcordata* Lam. (BORAGINACEAE) [PandL; this survey] viable
*Corypha utan* Lam. (ARECACEAE) [PandL; this survey] inviable
*Cycas rumphii* Miq. (CYCADACEAE) [PandL] ?inviable
*Cynometra ramiflora* L. (CAESALPINIACEAE ) [PandL] viable
*Derris trifoliata* Lour. (FABACEAE) [PandL] viable
*Dioclea javanica* Benth. (FABACEAE) [PandL; this survey] viable
*Elaeocarpus grandis* F.Muell. (ELAEOCARPACEAE) [PandL] inviable
*Entada phaseoloides* (L.) Merr. (MIMOSACEAE) [PandL; this survey] viable
*Erythrina variegata* L. (FABACEAE) [PandL; this survey] viable
*Guettarda speciosa* L. (RUBIACEAE) [PandL; this survey] viable
*Hernandia ovigera* L. (HERNANDIACEAE) viable
*Heritiera littoralis* Aiton (STERCULIACEAE) [PandL; this survey] viable
*Inocarpos fagifer* (Parkinson) Fosberg (FABACEAE) [PandL] inviable
*Intsia bijuga* (Colebr.) O.Kuntze (CAESALPINIACEAE ) [PandL; this survey] viable
*Mangifera indica* L. (ANACARDIACEAE) [PandL] inviable
*Mucuna gigantea* (Willd.) DC. (FABACEAE) [PandL; this survey] viable
*Neisosperma oppositifolium* (Lam.) Fosb. and Sach. (APOCYANACEAE) [PandL; this survey] viable
*Nypa fruticans* Wurmb. (ARECACEAE) [PandL; this survey] viable
*Pandanus* sp. (PANDANACEAE) [PandL] viable
*Pangium edule* Reinwardt (FLACOURTIACEAE) [PandL; this survey] inviable
*Pleiogynium timorense* (DC.) Leenh. (ANNACARDIACEAE) [PandL] inviable
*Pongamia pinnata* L. (FABACEAE) [PandL] viable
*Rhizophora stylosa* Griff. (RHIZOPHORACEAE) [PandL] viable
*Sophora tomentosa* (FABACEAE) [this survey] viable
*Sterculia foetida* (STERCULIACEAE) [PandL] inviable
*Strongylodon siderospermus* Cordemoy (FABACEAE) [PandL; this survey] viable
*Terminalia arenicola* Byrnes (COMBRETACEAE) [PandL; this survey] viable
Terminalia catappa L. (COMBRETACEAE) [PandL; this survey] viable
*Ximenia americana* L. (OLACACEAE) [PandL; this survey] viable
*Xylocarpus granatum* Koenig. (MELIACEAE) [PandL; this survey] viable

**TABLE 4: Non-indigenous plants of coral islands in the region (Cocos Keeling Islands) and islands of western Pacific (George *et al.* 1993)** (for the most part, these are common tropical weeds and include species known as garden weeds. The impact of most species is not known. For authors of plant names see George *et al.* 1993).

*Acacia farnesiana* (MIMOSACEAE)
*Acalypha indica* (EUPHORBIACEAE)
*Acalypha lanceolata* (EUPHORBIACEAE)
*Alysicarpus vaginalis* (FABACEAE)
*Boerhavia diffusa* (NYCTAGINACEAE)
*Bothriochloa bladhii* (POACEAE)
*Brachiaria brizantha* (POACEAE)
*Bryophyllum pinnatum* (CRASSULACEAE)
*Carica papaya* (CARICACEAE)
*Casuarina equisetifolia* (CASUARINACEAE)
*Cenchrus ciliaris* (POACEAE)
*Cenchrus echinatus* (POACEAE)
*Chloris barbata* (POACEAE)
*Chrysopogon aciculatus* (POACEAE)
*Conyza bonariensis* (ASTERACEAE)
*Crotalaria retusa* (FABACEAE)
*Cyanthillium cinereum* (ASTERACEAE)
*Cynodon dactylon* (POACEAE)
*Cynodon radiatus* (POACEAE)
*Dactyloctenium aegyptium* (POACEAE)
*Desmostachys bipinnata* (POACEAE)
*Eleusine indica* (POACEAE)
*Eleutheranthera ruderalis* (ASTERACEAE)
*Eriochloa meyeriana* (POACEAE)
*Euphorbia cyathophora* (EUPHORBIACEAE)
*Euphorbia hirta* (EUPHORBIACEAE)
*Euphorbia prostrata* (EUPHORBIACEAE)
*Hippobroma longiflora* (CAMPANULACEAE)
*Imperata cylindrica* (POACEAE)
*Lepidium virginicum* (BRASSICACEAE)
*Leucaena leucocephala* (MIMOSACEAE)
*Macroptilium atropurpureum* (FABACEAE)
*Muntingia calabura* (FLACOURTIACEAE)
*Oldenlandia corymbosa* (RUBIACEAE)
*Passiflora foetida* (PASSIFLORACEAE)
*Phyla nodiflora* (VERBENACEAE)
*Phyllanthus amarus* (EUPHORBIACEAE)
*Physalis minima* (SOLANACEAE)
*Portulaca oleracea* (PORTULACACEAE)
*Rhoeo spathacea* (COMMELINACEAE)
*Ricinus communis* (EUPHORBIACEAE)
*Rivina humilis* (PHYTOLACCACEAE)
*Sauropus androgynus* (EUPHORBIACEAE)
*Scoparia dulcis* (SCROPHULARIACEAE)
*Senna occidentalis* (CAESALPINIACEAE)
*Sesbania cannabina* var *cannabina* (FABACEAE)
*Solanum americanum* (SOLANACEAE)
*Spermacoce assurgens* (RUBIACEAE)
*Stachytarpheta jamaicensis* (VERBENACEAE)
*Striga angustifolia* (SCROPHULARIACEAE)
*Synedrella nodiflora* (ASTERACEAE)
*Tridax procumbens* (ASTERACEAE)
*Triphasia trifolia* (RUTACEAE)
*Turnera ulmifolia* (TURNERACEAE)
*Vitex trifolia* (VERBENACEAE)
*Zephyranthes rosea* (LILIACEAE)

**TABLE 5: Non-indigenous plants of coastal sand dunes in the Northern Territory**
(plants known to colonise coastal, sandy environments have been listed. These species are not obviously dispersed by the sea. References: Cowie 1995, 1996, 1998, Cowie and Dunlop 1992, Cowie and Egan 1993, NT Herbarium database)

*Alternanthera dentata* (Moench) Stuchl. cv *rubra* AMARANTHACEAE
*Alysicarpus ovalifolius* FABACEAE
*Bidens pilosa* L. ASTERACEAE
*Calopogonium mucunoides* Desv. FABACEAE
*Catharanthus roseus* (L.) G.Don APOCYNACEAE
*Cenchrus echinatus* L. POACEAE
*Centrosema pubescens* Benth. FABACEAE
*Chloris inflata* Link POACEAE
*Crotalaria pallida* Aiton FABACEAE
*Cynodon dactylon* (L.) Pers. POACEAE
*Dactyloctenium aegyptium* (L.) Beauv. POACEAE
*Digitaria ciliaris* (Retz.) Koeler POACEAE
*Eleusine indica* (L.) Gaertner POACEAE
*Euphorbia heterophylla* L. EUPHORBIACEAE
*Euphorbia hirta* L. EUPHORBIACEAE
*Gossypium hirsutum* L. MALVACEAE
*Hyptis suaveolens* (L.) Poit. LAMIACEAE
Indi*gofera cordifolia* Heyne ex Roth FABACEAE
*Leucaena leucocephala* (Lam.) de Wit MIMOSACEAE
*Melinis repens* (Willd.) Zizka POACEAE
*Mitracarpus hirtus* (L.) DC. RUBIACEAE
*Opuntia* sp. CACTACEAE
*Passiflora foetida* L. PASSIFLORACEAE
*Pennisetum pedicellatum* Trin. POACEAE
*Pennisetum polystachion* (L.) Schultes POACEAE
*Phyllanthus amarus* Schum. and Thonn. EUPHORBIACEAE
*Portulaca pilosa* PORTULACACEAE
*Senna occidentalis* (L.) Link CAESALPINIACEAE
*Sida acuta* Burm. f. MALVACEAE
*Sorghum almum* Parodi POACEAE
*Stachytarpheta cayennensis* (A.Rich.) Vahl VERBENACEAE
*Tamarindus indica* L. CAESALPINIACEAE
*Tridax procumbens* L. ASTERACEAE
*Triumfetta pentandra* A.Rich TILIACEAE