

*This handbook is dedicated to
our dear friend and teacher,*

Miss Beatrice H. Krauss,

*who inspired us to appreciate and study
native Hawaiian plants.*

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Volunteer Reviewers and Contributors

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Photo Credits

Ray Baker (Loulou), Glen Fukunaga (Hala, Hāpu'u, Hau, Hinahina kūkahakai, Koa, Koki'o 'ula'ula, and Wiliwili), Suzan Harada ('Ōhi'a lehua), Burt Lum (Kulu'i, Naio, Naupaka kahakai, Naupaka kuahiwi, and Pā'ū o Hi'iaka), Kenneth Nagata (Nehe), and Ray Tabata ('Ilima, Kalo, Kukui, Ma'o, 'Ōhi'a lehua, Palapalai, Pōhuehue, and Wauke).

Illustration Credits

Susie Kelly (Waikiki Aquarium gardens) and Joan Yoshioka (Wauke).

PREFACE

This handbook is for educators, school administrators, students, parents, and community members who are interested in establishing a native Hawaiian garden in their school. Nurserymen, landscapers, and native Hawaiian plant gardeners also may find this useful.

A limited number of the handbook containing color copies of photographs of the plants are available in school and public libraries. Excellent photographs also can be found in several books listed in the references. The handbook is prepared for binders to accommodate additional information and future revisions.

Why was this handbook compiled?

The State Plan directs agencies to develop educational activities that increase awareness and understanding of Hawaii's limited environmental resources. The Office of Environmental Quality Control is mandated to focus attention on ecological and environmental problems.

On September 29, 1991, in the Sunday Honolulu Star-Bulletin and Advertiser, Jan Tenbruggencate, summarized the issues in this hypothetical conversation:

"The problem with saving Hawaii's environment is that not enough people care."

"No, it's that not enough people know enough to care."

"That's it. The people don't know how special it is. Why should they spend time and money trying to save what they don't understand?"

"So how do we change it?"

"We need to teach them. We need to educate the Legislature, the agencies, the decision-makers."

"Better than that, we need to teach the kids. If we do that, we look 20 years into the future and make sure that those decision-makers understand."

Tenbruggencate had described how the 'Ohi'a Project was probably conceived. The Project was developed by the Bishop Museum and Moanalua Gardens Foundation with financial assistance from the MacArthur Foundation. The Project was the first comprehensive environmental curriculum for students from kindergarten to eighth grade. Material for lectures, reading, classroom and field activities, illustrations, games, songs, and dances were developed to support the study of Hawaiian ecology in the classroom.

"How to Plant a Native Hawaiian Garden" was written to guide the establishment of native gardens in schools throughout the State to stimulate awareness and appreciation of Hawaii's rare and fragile environmental resources.

What is required for a native garden?

The following factors should be considered:

Commitment

Can the school dedicate staff and funds to support the planning, design, installation, and maintenance of the garden?

Recruitment

Is there support from students, parents, faculty, and staff?

Is there support from neighborhood Senior Citizens groups, community garden members, and business representatives?

Can the garden's supporters provide raw materials, tools, and plants?

Are there potential donors for purchasing plants?

Who are the potential leaders for funds and materials solicitation, manpower organization, landscape design, and propagation workshops?

Curriculum Integration

A native Hawaiian garden provides teaching material for integration with the educational curriculum: science, English composition, social studies, dance, music, and art.

Landscape Integration

A native Hawaiian garden is a primary element of a school's campus. Site selection should be based on a master landscape plan for the school's physical setting, including consideration of future building plans, outdoor assemblies, and other ceremonies.

Brian J. J. Choy, Director
Office of Environmental Quality Control

INTRODUCTION

Anthuriums, orchids, heliconias and gingers are commonly grown in a Hawaiian garden, but none of these tropical plants are native to Hawai'i. Ti, taro, sweet potatoes, breadfruit, and bananas were brought here by the Polynesians, but these also are not native.

What are native plants?

Native plants arrived without the aid of man by ocean waves, wind, and birds. Upon arrival, plants adapted to the specific growing conditions where they landed. Native plants are either endemic or indigenous to Hawai'i.

What are endemic plants?

Endemic plants adapted such distinctive characteristics that they became identified as new plants. These only are found in Hawai'i. They are endemic to Hawai'i. The 'āhinahina or silversword is endemic with four distinct species evolving from a California plant.

Hawai'i has over 1,000 plants that are endemic.

What are indigenous plants?

Other plants thrived without changing. These grow in Hawai'i and in other places. They are indigenous. "Pōhuehue or beach morning glory is indigenous," means that pōhuehue is naturally found in Hawai'i as well as in other Pacific islands.

What are endangered plants?

An endangered plant is any one in danger of extinction in its natural range. More than a quarter of our nation's endangered plant species exist in Hawai'i. Since February 1992, 63 Hawaiian plants were added to the endangered species list. Another 125 Hawaiian plants are expected to be added in the next two years.

How were native plants selected for this handbook?

Throughout the State, native species have evolved in highly specialized ecological niches which cannot be duplicated by man. We do not know how to propagate or care for many of these. Consequently, the selection of native plants for this handbook was based on the following factors:

- Propagation feasibility
- Cultivation feasibility
- Availability from plant nurseries or other sources

Kalo, kukui, and wauke are not native to Hawaii but are included because of their cultural significance. These plants were introduced by the early Polynesians who migrated to Hawai'i. No endangered or threatened native species were selected for this handbook.

Endangered or Threatened Plants

Be aware that you cannot take, possess, propagate, cultivate, landscape with, transport, sell, or export plants that are listed as either endangered or threatened species under section 195D-4, Hawai'i Revised Statutes.

Section 195D-4, Hawai'i Revised Statutes

Section 195D-4, Hawai'i Revised Statutes, also known as the Hawai'i State Law, provides protection for all plants listed as threatened and endangered species by State and Federal laws on lands within the State of Hawai'i. Collection or possession of any part(s) of these plants is prohibited under Hawai'i State Law. Exemptions can be obtained only as temporary licenses issued by the Hawai'i Department of Land and Natural Resources. These permits are issued only for scientific purposes or to enhance the propagation or survival of the threatened or endangered species. If you have any questions or would like to request a temporary license, please contact Ms. Carolyn A. Corn, botanist, Division of Forestry and Wildlife, Department of Land and Natural Resources, 1151 Punchbowl Street, Honolulu, Hawai'i, 96813, phone (587-0166).

U. S. Endangered Species Act

It is important to understand that the U. S. Endangered Species Act, also known as the Federal Act, is less stringent than the Hawai'i State Law. The Hawai'i State Law takes precedence over the Federal Act. See Appendix A for more information on the Act.

Why plant a native Hawaiian garden?

Many people cannot identify native plants and fewer have ever seen an endangered one. The establishment of native Hawaiian gardens would provide an opportunity for residents and visitors to see plants which no longer exist in Hawai'i's urban areas. Planning, planting, and maintaining a native Hawaiian garden in a school would provide vital hands-on experience for students, teachers, administrators, parents, and neighbors. Visiting other gardens and hiking in natural areas would expand this learning experience.

Landscaping with native Hawaiian plants of public facilities, residential streets, and highways would be another effective way to increase awareness and importance of Hawaiian flora.

GENERAL CARE OF NATIVE PLANTS

General Growth

Many native plants such as maile, alahe'e, and native hibiscus are very slow growers during seedling and sapling stages. The tendency to overwater and overfertilize these slow-growing plants to increase growth rate can severely damage roots and may result in secondary fungal infections or death. As a general rule, select the largest and healthiest but not potbound specimens. Saving a few dollars by selecting smaller, younger plants may result in a low rate of plant survival.

Soils and Amendments

Proper soil is essential for the successful growth of most native plants which perform poorly in hard pan, clay, or adobe soils. If natives are to be planted in these types of soil, it would be wise to dig planting holes several times the size of the rootball and backfill with 50-75% compost (see Planting Procedures). Test the texture of the soil by grabbing a handful and squeezing it. If it compresses into a clay-like ball which does not crumble when pricked, add more compost. Continue to add compost until the ball falls apart when pricked. Well-composted manure, compost, cinders, or similar products are suitable amendments. If soil is extremely poor, coarse cinder also may be added for increased aeration and drainage. As a general rule of thumb, add generous amounts of cinder for long term enhancement of the soil structure.

Sandy or calcareous soils in coastal areas present two problems: low organic matter content and high salt content. Most upland species will not tolerate the high salinity and may do poorly unless adequate amounts of amendments are used. To increase the organic matter content, the water-holding capacity, and neutralize the high salinity, add compost. Adding 50-75% compost will ensure reasonable growth for all but the most sensitive species.

Coastal species provided with adequate sunshine and drainage will perform adequately in mauka (upland) regions. The addition of crushed coral is recommended but not required.

Fertilizers

An all-purpose fertilizer, 10-10-10, is adequate for most species. Fertilizers should be applied at planting time, three months later, and every six months thereafter. Both slow-release and quick-release types have been used effectively. Special attention should be given to native ferns which are sensitive to strong fertilizers. Use half the dosage recommended for ornamentals. If possible, use organic composts and aged animal manures instead of chemical fertilizers. The use of cinders for providing trace minerals also is highly recommended.

Irrigation

Most natives do very poorly in waterlogged conditions. Do not water if the soil is damp and do water if the soil is dry and plants are wilting. Water daily until a good root system is established but do not drown the plant. Once established, a good soaking twice a week should suffice. Deep soaking encourages the development of stronger, deeper root systems. This is better than frequent and shallow waterings which encourage weaker, more shallow root systems. If your soil is very porous, watering daily may be necessary.

Plants such as palapalai and maile that thrive in shady, protected sites require more frequent watering or occasional hosing to increase humidity. On the other hand, coastal or lowland plants such as wiliwili, naupaka kahakai, and pōhuehue require much less water. Most drought-tolerant plants only need regular watering until they are established and then only under very dry conditions.

For each plant a water requirement is included, based on the following chart:

Watering Schedules

Soak for 20-30 minutes each time.

<u>Water Requirement</u>	<u>Watering Frequency</u>
Heavy	3 times a week
Moderate	2 times a week
Light	1 time a week

Weeds

Most native species, especially the mat-forming or ground cover types, cannot compete with weeds. Constant weeding is required to ensure their optimum growth and appearance. Special attention must be paid to persistent weeds such as nut grass and its relatives, Asiatic pennywort, grasses, and *Oxalis spp.*

Once weeds become established, it is nearly impossible to eradicate them. Native plants, especially ferns, are sensitive to herbicides. Using herbicides is not recommended.

Using mulch will discourage weeds and add to the beauty of the planting bed. Cinder, coral chips, macadamia hulls, or dried taro peel are effective mulch materials. Do not use redwood bark and other high acid mulch material such as chipped *Eucalyptus* and Christmas berry.

Insects and Disease

Scales, mealy bugs, and ants are the most common pests of cultivated native plants. Ants are the transporters and caretakers of scales and mealy bugs. Prompt attention to an ant infestation will prevent the spread of the other insects.

If ants are present, check plants for other insects and take action immediately. Small infestations can be treated with Safer's Soap or a warm mild solution of dishwashing detergent. Swabbing with alcohol also is effective but time consuming. Once these insects become firmly established more toxic pesticides such as Malathion or Diazinon may be required. Since native plants are sensitive to chemicals, use them only as a last resort.

The coffee twig borer infests many native species and also may be the cause of decline of several species in the wild. A tell-tale sign of infestation is dieback of the branch tips. If there are tiny holes below the dead portion an insect has probably bored into the twig, laid eggs, and its larvae have eaten out the interior. Cut branches back to clean wood. Check with a garden supply center for possible treatment methods. Koa and alahe'e often are affected by this insect.

A plant that always looks weak or wilted may be affected by soilborne nematodes. These plants slowly decline and die. Pull them up and examine the roots. If they appear malformed and knotted the problem is nematodes. Nothing much can be done, short of using toxic nematocides. Clandosan, a non-toxic shellfish byproduct, may be effective. The plants selected for inclusion in this handbook are not known to be overly susceptible to nematodes.

PLANTING PROCEDURES

Native plants have sensitive root systems. Use clay or plastic pots instead of cans to avoid root damage when extricating the plant. The planting hole should be twice the size of the rootball. If the soil is clay or shows poor drainage, dig a much larger hole. A large planting hole ensures the development of a strong root system. The plant will have a headstart before the roots penetrate the surrounding mediocre soil.

It is recommended that native plants not be planted in ground that is more dense than potting soil. If there is no alternative, dig a hole in a mound of soil augmented with volcanic cinder to encourage maximum root development. Next, fill the hole with water and observe the drainage. If the water tends to puddle or drain too slowly, dig a deeper hole and continue until the water does not puddle for more than a minute or two. Well-drained soil is important for most native plants and vital for species such as koa, milo, and wiliwili.

Backfill should consist of at least 50% compost and cinder if the soil is clay, less cinder if the soil is sandy. Do not use redwood compost. Add balanced fertilizer to the backfill. Place plant with the soil level of the rootball slightly below ground level. Sprinkle additional fertilizer and water well after replacing the backfill.

PLANTING STRATEGIES

Selection

Selecting native species for landscaping depends on the site and space. Mountain species such as koa, maile, and palapalai will not grow well in hot coastal areas exposed to strong, salty ocean breezes. Lowland and coastal species such as wiliwili and kou require abundant sunshine and porous soils and will not grow well with frequent cloud cover, high rainfall, and heavy soils. It is recommended that you select native plants which would have naturally grown on the garden site. Coastal native plants would be suitable for many schools located on or near the coasts or in dry lowlands.

Space is another factor. Consider the eventual size of the species to be used in the landscaping. It is not wise to plant trees that grow too large. Most backyards in Honolulu are too small for even one full-grown wiliwili.

A large, dense-canopied tree such as kukui is a good shade tree for a lawn. Its canopy size and density of the shade will limit what can be planted in the surrounding area. The shade cast by koa and 'ōhi'a lehua, on the other hand, is relatively light. In natural forest conditions, numerous species grow with them. Replicating those same conditions is possible.

Not all native plants look good all year around. Some plants such as 'ilima will look scraggly after they have flowered and formed seeds. Avoid planting large areas of your garden with only one native plant. Mixing plants which naturally grow together will ensure that the garden will look good all year around. For example, plant several species of coastal plants together to represent a coastal strand ecosystem. Plant patches of several plants of one species together not one plant of each species to replicate how they would naturally grow.

Natural Ecosystem Approach to Design

A native garden should emphasize a naturally-occurring plant community. While there are merits to planting the maximum number of species in the garden, such attempts result in a mixture of unrelated plants. It is much more practical and beneficial to plant species which naturally occur together, bearing in mind the size and ecological requirements of each. When planting a particular ecosystem, start with the hardest and most easily-grown species but allow space for fragile ones in subsequent plantings.

The following are groups of plants which can be planted together as naturally occurring communities:

Coastal community: hinahina kūkahakai, 'ilima papa, ma'o, naupaka kahakai, nehe, pā'ū o Hi'iaka, pōhuehue, pōhinahina, 'ākia, 'ena'ena, pua pilo, hala, loulu, and naio. See the cover and the next page for plot plans of the Waikīkī Aquarium gardens.

Dry forest community: wiliwili, loulu, kulu'ī, 'ilima, koa, koki'o 'ula'ula, 'alahe'e, naio, 'ōhi'a lehua, 'a'ali'i, 'ena'ena, koki'o ke'oke'o, 'ūlei, 'akia, and maile.

Wet forest community: koa, 'ōhi'a lehua, hāpu'u, koki'o 'ula'ula, naupaka kuahiwi, palapalai, and maile.

If there is space, plant more than one ecosystem by using transitional species such as koa, 'ōhi'a lehua, alahe'e, and naio. Do not plant a wet forest community contiguous to a coastal community because of vast differences in soil and water requirements. A transition must be made from one community to the other. A park or school complex has the space for this type of planting.

Plant wauke, kukui, and kalo as a group of plants introduced by the Polynesians.

Planting Several Plants and Thinning Later

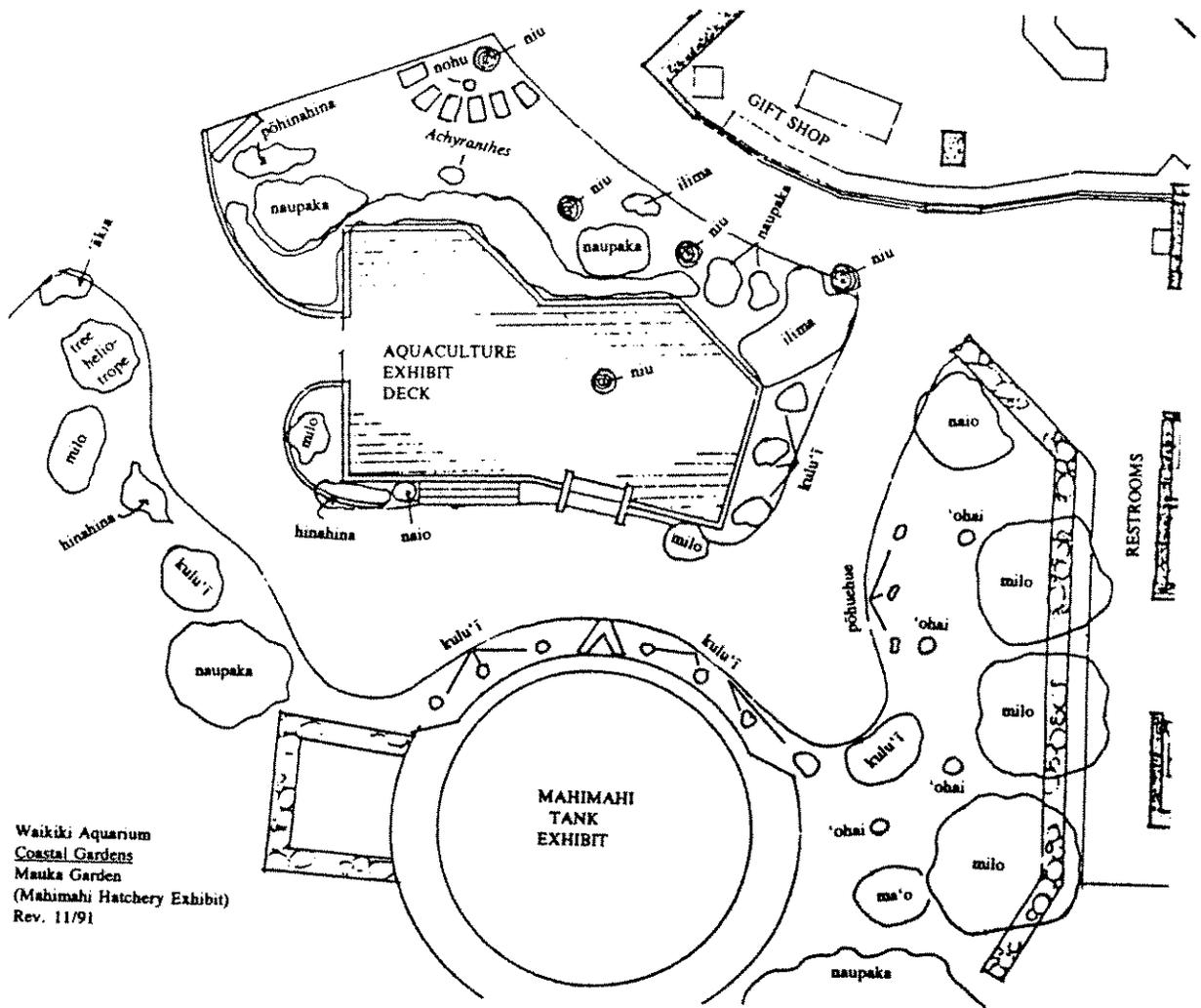
For quick cover, plant several of the same species close to each other then thin them out as they grow to ultimate size. Alahe'e is a shrub which ultimately will become a tree, however, it is a slow grower. Several can be planted as close as three feet apart. After several years they will crowd each other and can be thinned out. 'Ōhi'a lehua also can be used in this grove planting method.

Using Native Plants for General Landscaping

Native plants and Polynesian introductions also can be incorporated into any type of landscaping. There are native plants suitable for a wide range of functions and designs:

- **Specimen and shade trees:** koa, kukui, loulu, 'ōhi'a lehua, hau, naio, hala
- **Accent shrubs:** alahe'e, kulu'ī, naupaka kahakai, naupaka kuahiwi, wauke
- **Ornamental shrubs:** native hibiscus, 'ilima, ma'o, 'a'ali'i
- **Ground covers and fillers:** pōhuehue, 'ākia, 'ilima papa, pā'ū o Hi'iaka, nehe, hinahina kūkahakai, 'ūlei, kalo
- **Shade plants:** maile, palapalai, hāpu'u

- **Drought and heat tolerant plants:** pōhinahina, 'ākia, hinahina kūkahakai, ma'o, naupaka kahakai, nehe, wiliwili, 'ilima, 'a'ali'i, 'ūlei



Xeriscape

With the recent interest in xeriscaping, landscaping with plants that are drought resistant, native plants that are heat and drought tolerant have become increasingly important.

Integration

Native and Polynesian-introduced plants also can be integrated into the long-term landscaping of school grounds. Groves of kukui, 'ōhi'a, loulou, or hala can be planted for shade and visual effect and provide craft materials for a Hawaiian studies curriculum. A few hala trees could supply enough leaves for plaiting small mats or fans and fruit for making a lei. A small taro patch could provide taro for a lū'au project's poi, kūlolo, and laulau. Kī, lā'ī (tī), plants can provide leaves for hula skirts, leis, and laulau. Plants can provide a natural visual backdrop for an outdoor stage like Andrew's Amphitheater at the University of Hawai'i at Mānoa or the Moanalua Gardens' hula mound.

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SOURCES OF NATIVE PLANTS

Plants should not be collected from the wild. State of Hawaii Forestry and Wildlife Division regulations prohibit taking any plant or its part without written permission. The following sources have propagated native plants from seeds and cuttings without endangering wild populations. Please contact these sources. If these sources do not have a particular plant, ask for a referral. Sources also can accept requests to propagate plants or explain why a species is not offered for sale.

Plant Nurseries

O'ahu:

Charles Nii Nursery, 908 Kamilonui Place, Honolulu, 96825, Ph: 395-9959

R. & S. Nii Nursery, 938 Kamilonui Place, Honolulu, 96825, Ph: 395-9811

O'ahu District Forester, Ph: 587-0166, Forestry and Wildlife Division
(DOFAW), Department of Land and Natural Resources (DLNR)

SMI Nursery, 99-074 Ka'amilo Street, 'Aiea, Hawai'i, 96701, Ph: 488-6315

Plantland, 59-361 Alapi'o Road, Hale'iwa, Hawai'i, 96712, Ph: 638-7331

Greg Boyer - Hawaiian Landscapes, 47-410 Pūlama Road, Kāne'ohe, 96744,
Ph: 239-8264

Kaua'i:

The Native Landscape, 4560 J Kuawa Road, Kīlauea, 96754, Ph: 828-1454

Kaua'i Nursery and Landscaping Inc., P. O. Box 3013, Līhu'e, Hawai'i, 96766,
Ph: 245-7747

Kaua'i District Forester, Ph: 241-3433, DOFAW/DLNR

Maui:

Ho'olawa Farms, P. O. Box 731, Ha'ikū, Hawai'i, 96708, Ph: 572-4835

The Hawaiian Collection, 1127 Manu Street, Kula, Hawai'i, 96790, Ph: 878-1701

Kula Botanical Gardens, RR 2, Box 288, Kula, Hawai'i, 96790, Ph: 878-1715

Maui District Forester, Ph: 243-5352, DOFAW/DLNR

Hawai'i:

Aikane Nursery, P. O. Box 981, Kapa'au, 96755, Ph: 889-5906

Moeauoa Nursery, 75-0114 Māmalahoa Highway, Hōlualoa, Kona, Hawai'i,
Ph: 329-5777

Dianne Zink, 73-4445 Old Government Road, Kailua-Kona, Hawai'i, 96740,
Ph: 325-1003

Hawaiian Gardens, P. O. Box 1779, Kailua-Kona, Hawai'i, 96745. Ph: 329-5702

Godfrey Ching, P. O. Box 944, Mountain View, Hawai'i, 96771, Ph: 968-8437

Kapoho Kai Nursery, RR 2 Box 4024, Pāhoa, Hawai'i, 96778, Ph: 965-8839

Lehua Lena Nursery, Box 1479, Kea'au, Hawai'i, 96749, Ph: 966-7975

Laura Spiegel, Box 1709, Honoka'a, Hawai'i, 96727, Ph: 775-0806

Hawai'i District Forester, Ph: 933-4221, DOFAW/DLNR

Plant Sales

O'ahu:

Foster Botanic Garden Semi-annual Plant Sale, 180 North Vineyard Boulevard,
Honolulu, Hawai'i 96817, Ph: 531-1939

Wahiawā Botanic Garden Annual Plant Sale, 1396 California Avenue, Wahiawā,
Hawai'i 96786, Ph: 621-7321

Waimea Arboretum and Botanical Garden Plant Sale, 29-864 Kamehameha
Highway, Hale'iwa, Hawai'i 96712, Ph: 638-8655

Harold L. Lyon Arboretum Semi-annual Plant Sale, 3860 Mānoa Road,
Honolulu, Hawai'i 96822, Ph: 988-7378

Friends of Hālawa Xeriscape Garden Unthirsty Plant Sale, 99-1268 Iwaena
Street, Hālawa Industrial Park, 'Aiea, Hawai'i 96701

Hawaiian Botanical Society Semi-annual Plant Sale, c/o Department of Botany,
University of Hawai'i, 3190 Maile Way, Honolulu, Hawai'i 96822,
Ph: 956-8369

Hawai'i:

Amy B. H. Greenwell Ethnobotanical Garden, Bishop Museum, Captain Cook,
Ph:323-3318; June and December semi-annual plant sales, "open house"
on 2nd Saturday of every month, and Monday-Friday, 7 a.m. - 2:30 p.m.

Individual Growers

O'ahu:

Randy Mew, Honolulu, Ph: 373-2480

Heidi Bornhorst, Honolulu, c/o The Nature Conservancy, Ph: 537-4508

Burt Lum, P. O. Box 152, Honolulu, Hawai'i, 96810, Ph: 546-4919

OTHER SOURCES OF INFORMATION ON GROWING NATIVE PLANTS

In addition to its publications, the Hawaiian Plant Conservation Center (HPCC) of the National Tropical Botanical Garden provides information on the propagation and cultivation of Hawaiian native plants. Write to HPCC for their fact sheets on how to grow and use native Hawaiian plants in cultivation.

The HPCC also has published a *Directory of Sources for Native Hawaiian Plants*. It lists by island sources' mailing address, phone number, specific natives available, and shipping policy. To order, send \$4 per copy with name, mailing address, and also phone number to: Hawaiian Plant Conservation Center, NTBG, P. O. Box 340, Lawai, Kaua'i, Hawaii, 96765.

On most islands there are individuals and organizations who can provide technical advice on growing native plants. They cannot solve your budgetary and manpower problems but they can provide invaluable advice for establishing and maintaining the garden. On Maui, the following will provide information:

Native Plant Society, Eda Kinnear, Ph: 871-4891

Children's Gardening Project, 230 Hana Highway, Space #8, Kahului, Hawai'i,
96732, Ms. Denny Eymard, Ph: 244-9892

Oasis Maui, same address as Children's Gardening Project, Ph: 871-2634

GARDENS WITH NATIVE PLANTS

O'ahu:

- Bishop Museum, 1525 Bernice Street, Honolulu, Hawai'i 96817, Ph: 848-4129
- Foster Botanical Garden, 180 North Vineyard Street, Honolulu, Hawai'i 96817,
Ph: 522-7065
- 'Iolani Palace, 364 South King Street, Honolulu, Hawai'i, 96813
- Harold L. Lyon Arboretum, 3860 Mānoa Road, Honolulu, Hawai'i 96822,
Ph: 988-7378
- Harold St. John Plant Science Laboratory courtyard garden, corner of Maile Way
and East-West road, University of Hawai'i at Mānoa
- Ka Papa Lo'i o Kanewai, makai side of Dole Street, Diamond Head
of Mānoa Stream
- Honolulu Zoo, 151 Kapahulu Avenue, Honolulu, Hawai'i 96815,
Ph: 971-7171
- Waikīkī Aquarium, 2777 Kalākaua Avenue, Honolulu, Hawai'i 96815,
Ph: 923-9741
- Sea Life Park, Makapu'u Point, Ph: 259-7933
- Koko Crater Botanical Garden, off Kealahou Street, Kalama Valley, call
Foster Botanical Garden for information
- Ho'omaluhia Botanical Garden, 45-680 Luluku Road, P. O. Box 1116, Kāne'ohe,
Hawai'i 96744, Ph: 235-6636
- Waimea Arboretum and Botanical Garden, 29-864 Kamehameha Highway,
Haleiwa, Hawai'i 96712, Ph: 638-8655
- Wahiawā Botanical Garden, 1396 California Avenue, Wahiawā, Hawai'i 96786,
Ph: 621-7321
- Hālawa Xeriscape Garden, 99-1268 Iwaena Street, Hālawa Industrial Park, Aiea,
10:00 a.m.-2:00 p.m., Wednesday and Saturday; special tours of Hālawa
Shaft and garden on Thursdays by request, Ph: 527-6113
- Moanalua Gardens, entrance and parking lot along Pu'uloa Road off-ramp from
west bound Moanalua Freeway, Ph: 833-1944

Kaua'i:

National Tropical Botanical Garden, End of Ha'ilima Road, P. O.
Box 340, Lāwai, 96765, Ph: 332-7324

Keāhua Forestry Arboretum, Wailua Loop Road at the end of
Highway 580, call the Kaua'i District Forester for information,
Ph: 241-3433, Forestry and Wildlife Division, Department of Land and
Natural Resources

Maui:

Maui Zoo, Kanaloa Avenue makai of Ka'ahumanu Highway,
across from County Athletic Complex, Wailuku, Ph: 243-7337

Kula Forest Reserve, access road at the end of Waipouli Road, call the Maui
District Forester for information, Ph: 243-5352, Forestry and Wildlife
Division, Department of Land and Natural Resources

Wailea Point, private condominium residence at 4000 Wailea Alanui, call
Resident Manager, Ph: 879-6106
Visit the coastal garden by walking along the beach through public access
points at Four Seasons Resort or Polo Beach

Kahanu Gardens, National Tropical Botanical Garden, Alau Place, Hana, Hawaii
96713, Ph: 248-8912

Hawai'i:

Waiākea Arboretum, 1643 Kīlauea Avenue, Hilo, Hawai'i, 96720, call the
Hawai'i District Forester for information, Ph: 933-4221, Forestry and
Wildlife Division, Department of Land and Natural Resources

Manukā State Park, 19.3 miles west of Nā'ālehu Village, off Highway 11, call
the Maui State Parks Section for information, Ph: 243-5354

Pu'uhoonua o Hōnaunau, City of Refuge, National Historic Park, Highway 160,
Ph: 328-2288

Amy B. H. Greenwell Ethnobotanical Garden, Bishop Museum, 100 yards north
of Manago Hotel, Captain Cook, Ph: 323-3318

Sadie Seymour Botanical Garden, Kona Outdoor Circle Center, 76-6280
Kuakini Highway, Kailua-Kona, Hawai'i, Ph: 329-7286

More information on the U. S. Endangered Species Act:

1. The Federal Act prohibits removal of endangered or threatened plants from lands under federal jurisdiction and malicious damage of said plants. Lands under federal jurisdiction include, but are not limited to, National Park Service lands, U. S. Fish and Wildlife Service National Wildlife Refuge lands, and Department of Defense lands. A permit is required before removal of any endangered or threatened plant, or any part of such plants. Permits are obtained from the U. S. Fish and Wildlife Service, Office of Management Authority, 4401 North Fairfax Drive, Room 432, Arlington, Virginia, 22203, Ph: (703) 358-2104.
2. The Federal Act allows possession of lawfully acquired endangered or threatened plants. A federal permit is not required. These plants can be utilized as parent stock to propagate additional ones for landscaping purposes.
3. The Federal Act prohibits interstate and foreign commerce of endangered or threatened plants or any part of such plants. A permit is required from the U. S. Fish and Wildlife Service.
4. The Federal Act prohibits import and export of endangered or threatened plants. Whether or not commerce is involved, a permit must be obtained from the U. S. Fish and Wildlife Service.
5. The Federal Act applies to all parts and products of plants, including seeds, cuttings, and pollen. The Act applies equally to wild, cultivated, and introduced plants.

NATIVE HAWAIIAN PLANTS

Plants are first described by either their Hawaiian names, and/or by their scientific names. Hawaiian names also are followed by common names. Each description includes:

- Scientific name
- Family
- Description
- Botanical or ethnobotanical interest
- Horticultural/landscape use
- Care and maintenance
- Propagation
- Water requirements
- Places where specimens can be seen

The plant descriptions are presented in alphabetical order but the pages have been left unnumbered to facilitate future additions.

<u>Hawaiian Name</u>	<u>Native Status</u>	<u>Scientific Name</u>
Hala	Probably Indigenous	<i>Pandanus tectorius</i> S. Parkinson ex Z
Hāpu'u	Endemic	<i>Cibotium splendens</i> (Gaud.) Krajina
Hau	Probably Indigenous	<i>Hibiscus tiliaceus</i> L.
Hinahina kūkahakai	Indigenous	<i>Heliotropium anomalum</i> Hook. & Arnott
'Ilima	Indigenous	<i>Sida fallax</i> Walp.
Kalo	Polynesian introduction	<i>Colocasia esculenta</i> (L.) Schott
Koa	Endemic	<i>Acacia koa</i> A. Gray
Koki'o 'ula'ula	Endemic	<i>Hibiscus kokio</i> Hillebr.
Kukui	Polynesian introduction	<i>Aleurites moluccana</i> (L.) Willd.
Kulu'i	Endemic	<i>Nototrichium sandwicense</i> (A. Gray) Hillebr.
Loulu	Endemic	<i>Pritchardia</i> spp.
Ma'o	Endemic	<i>Gossypium tomentosum</i> Nutt. ex Seem.
Naio	Indigenous	<i>Myoporum sandwicense</i> A. Gray
Naupaka kahakai	Indigenous	<i>Scaevola sericea</i> Vahl
Naupaka kuahiwi	Endemic	<i>Scaevola gaudichaudiana</i> Cham.
Nehe	Endemic	<i>Lipochaeta succulenta</i> (Hook. & Arnott) DC.
'Ōhi'a lehua	Endemic	<i>Metrosideros polymorpha</i> Gaud.
Palapalai	Endemic	<i>Microlepia strigosa</i> (Thunb.) Presl
Pā'u o Hi'iaka	Indigenous	<i>Jacquemontia ovalifolia</i> subsp. <i>sandwicensis</i> (A. Gray) K. Robertson
Pōhuehue	Indigenous	<i>Ipomoea pes-caprae</i> (L.) R. Br.
Wauke	Polynesian introduction	<i>Broussonetia papyrifera</i> (L.) Venten.
Wiliwili	Endemic	<i>Erythrina sandwicensis</i> Degener

Hala

SCIENTIFIC NAME: *Pandanus tectorius* S. Parkinson ex Z

FAMILY: Screw pine

DESCRIPTION: Trees 20-30 feet tall, with stilt-like prop roots. Canopy spread 20-40 feet. Trunk and branches ringed with leaf scars. Leaves plain green, strap-like, pointed, edged with prickles, tightly spiralled at branch tips. Composite fruit consisting of "drupes" or angular, wedge-shaped "keys" which may be yellow, bright orange, or red when ripe.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Hala was valued most for its tough pliable leaves for plaiting mats, canoe sails, baskets, and other domestic articles. Fleshy ends of the keys of ripe hala fruit are cut from the hard seed end and sewn into a lei. These fleshy ends also were cooked and eaten during famine, or eaten raw. Dried keys were used as brushes for decorating tapa. (See Ethnobotany of Hawai'i, Krauss, 1974.) Hala may have been brought to Hawai'i by early Polynesian ancestors of the Hawaiians. Since the keys are adapted for ocean dispersal, hala also may have arrived before the Polynesians.

HORTICULTURAL/LANDSCAPE USE: Hala is very attractive as a specimen tree in lawns or as an accent tree in a garden. The shade it casts is diffuse enough to allow plantings beneath it. It is tolerant of a wide range of ecological conditions and will grow in coastal areas as well as in the uplands. It is a rather quick-growing species and is tolerant of salty ocean breezes. Note that there are separate male and female hala trees. Male trees only have drooping clusters of very fragrant male flowers called hīnano. Only female trees have compact greenish heads of female flowers which mature into the pineapple-shaped composite fruit. Hala takes approximately ten years to mature and bear fruit.

CARE AND MAINTENANCE: The large prickly edged leaves also can be a yardman's nemesis. Old and dying leaves should occasionally be cleaned out of the canopy since rats are known to nest in the debris. No significant insects or diseases are known.

PROPAGATION: Large cuttings can be made from the branch tips. Seeds within the fruit sections germinate readily.

WATER REQUIREMENTS: Moderate.

PLACES WHERE SPECIMENS CAN BE SEEN:

- O'ahu: Bishop Museum, Foster Botanical Garden, 'Iolani Palace, Department of Transportation Building at Queen and Punchbowl Streets, University of Hawai'i at Mānoa, Lyon Arboretum, Kualoa Park, Waimea Arboretum and Botanical Garden
- Kaua'i: National Tropical Botanical Garden at Lāwa'i, Keāhua Forestry Arboretum
- Hawai'i: Richardson Center in Keukaha, Hilo, Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden

Hāpu'u

SCIENTIFIC NAME: *Cibotium splendens* (Gaud.) Krajiná

FAMILY: Dicksonia

DESCRIPTION: Large ferns with trunks reaching 20 feet in height. Fronds 3-9 feet long, pale green on lower surface, stalks and young unfurled fronds densely covered with tan colored wool-like fibers, pulu.

BOTANICAL OR ETHNOBOTANICAL INTEREST: *Cibotium splendens* is probably the most common endemic tree fern in Hawai'i. Found on most islands in semi-dry to wet forests, it is most conspicuous on Hawai'i where it grows in close association with 'ōhī'a lehua. During ancient times, pulu was used for dressing wounds and for embalming. More recently, pulu was used for pillow and mattress stuffing. The edible starch in the core of the trunk was eaten during famine.

HORTICULTURAL/LANDSCAPE USE: Hāpu'u is a landscaping favorite. On the island of Hawai'i, it is commonly used to shade anthuriums. Few other plants can create a more tropical effect than hāpu'u. In hot, sunny lowlands, it needs some protection from the intense mid-day sun. In cloudy, mauka, upland regions, it grows in full sun. It is somewhat tolerant of salty coastal conditions. Fronds may become very long even in young plants but the trunk grows very slowly. If your garden needs a hāpu'u fern with a 6 foot trunk, buy one already that height. Do not expect a hāpu'u with a 4 foot trunk to grow to 6 feet in your lifetime.

CARE AND MAINTENANCE: Hāpu'u is easily grown. In moist areas, it requires little or no irrigation. In dry areas, it requires occasional watering. Watering procedure should include drenching the entire plant and surroundings to create high humidity.

PROPAGATION: Side shoots can be removed and planted but because of slow growth it is best to purchase taller plants.

WATER REQUIREMENTS: Moderate.

PLACES WHERE SPECIMENS CAN BE SEEN:

- O'ahu: Bishop Museum, Foster Botanical Garden, Lyon Arboretum, Wahiawā Botanical Garden, Waimea Arboretum and Botanical Garden
- Hawai'i: Hilo Airport, Hawai'i Volcanos National Park, Waiākea Arboretum, Moeauoa Nursery, Amy B. H. Greenwell Ethnobotanical Garden

Hau

SCIENTIFIC NAME: *Hibiscus tiliaceus* L.

FAMILY: Hibiscus or mallow

DESCRIPTION: Widely spreading shrubs or small trees 7-35 feet tall, rarely taller, with light wood. Heart-shaped leaves. Yellow flowers with a reddish or purplish "eye," turning orange then dark red during one day. A single tree may have a canopy spread of 50 feet or more.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Ancient Hawaiians used the light but durable wood for floats, booms, canoe outriggers and for starting fires. Bast, or the inner bark fibers, were made into cordage. Probably indigenous.

HORTICULTURAL/LANDSCAPE USE: Typically, hau is a tree with sprawling branches. It forms dense tangles along streams, coastlines, and in wet areas. These characteristics make hau difficult to place in a garden. If properly pruned, it may be suitable as a specimen tree or border planting. If supported, hau can be developed into a cool and shady arbor. See a beautiful example at the Waikīkī Natatorium. Hau grows in almost any environment.

CARE AND MAINTENANCE: Intermittent pruning is required once the plant becomes established. Given adequate sun, space, and moisture hau will grow well under cultivation.

PROPAGATION: Cuttings, air-layers.

WATER REQUIREMENTS: Moderate.

PLACES WHERE SPECIMENS CAN BE SEEN:

- O'ahu: Waikīkī Natatorium, Honolulu Zoo, Tantalus, Lyon Arboretum, Waimea Arboretum and Botanical Garden
- Kaua'i: Keāhua Forestry Arboretum
- Hawai'i: Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden

Hinahina kūkahakai

Hinahina
Beach Heliotrope

SCIENTIFIC NAME: *Heliotropium anomalum* Hook. & Arnott

FAMILY: Borage

DESCRIPTION: Low, mat-forming "succulent-like" plant. Hairy, silvery leaves, densely clustered at branch tips forming small rosettes. White to pale purple flowers with a yellow "eye," fragrant, borne in terminal, simple, coiled clusters.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Hinahina is widely distributed throughout Polynesia. In Hawai'i, it occurs in rocky or sandy coastal areas on all islands except Lāna'i and Kaho'olawe. Designated as the island flower for Kaho'olawe, its silvery rosettes are prized as a lei material. Due to its relative scarcity in the wild, lei makers should grow hinahina.

HORTICULTURAL/LANDSCAPE USE: Hinahina is an excellent groundcover in sunny, well-drained sites. Well-suited for coastal or lowland regions it also will grow in mauka areas, if adequate sunshine and drainage is provided. With minimal care it will survive in arid, extremely rocky sites and is an excellent choice for xeriscape gardens, coastal gardens, and rock gardens.

CARE AND MAINTENANCE: Mealy bugs may cause occasional problems and overwatering or waterlogging may cause root problems and subsequent dieback. In mauka regions amending the soil with crushed coral or lime will enhance growth. An occasional application of salt water is also beneficial.

PROPAGATION: Hinahina is propagated by tip or leafy softwood cuttings.

WATER REQUIREMENTS: Moderate to light.

PLACES WHERE SPECIMENS CAN BE SEEN:

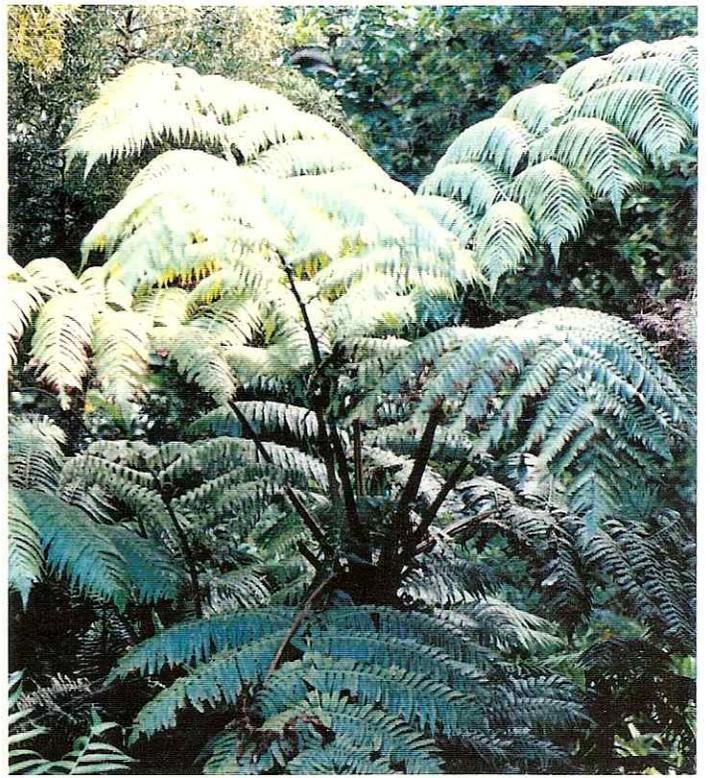
O'ahu: Waikīkī Aquarium, Hālawā Xeriscape Garden, Queen's Beach, Makapu'u Beach, Pounder's Beach, Waimea Arboretum and Botanical Garden, Ka'ena Point Natural Area Reserve

Maui: Maui Zoo

Hawai'i: Amy B. H. Greenwell Ethnobotanical Garden



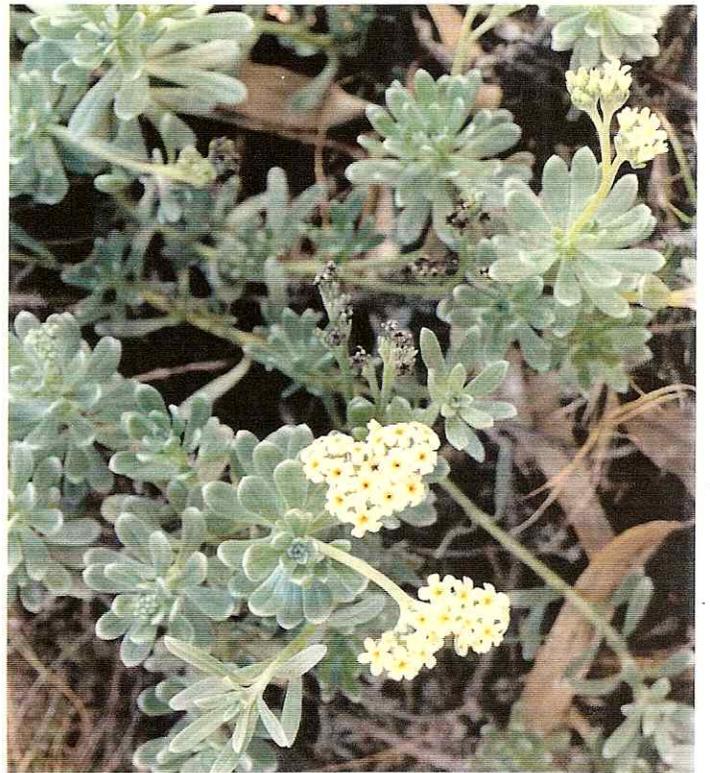
Hala
Pandanus tectorius



Hāpu'u
Cibotium splendens



Hau
Hibiscus tiliaceus



Hinahina kūkahakai
Heliotropium anomalum

'Ilima

SCIENTIFIC NAME: *Sida fallax* Walp.

FAMILY: Hibiscus or mallow

DESCRIPTION: A highly variable species in stature, hairiness, and flower color. Low growing, spreading or erect, dense or diffuse shrubs up to 10 feet tall. Leaves vary from bright green and smooth to silvery-green and densely hairy. Flowers are solitary or in small clusters, yellow or orange-yellow, occasionally with a maroon "eye".

BOTANICAL OR ETHNOBOTANICAL INTEREST: Numerous ecological types are known. Beach forms are low, mat-forming or erect but spreading shrubs. Upland types are erect and almost tree-like. Lowland forms tend to be densely silvery-haired. Mountain forms tend to be smooth. Indigenous to all the islands, 'ilima is the island flower of O'ahu. Parts of the 'ilima were used medicinally, flower buds as a mild laxative for children; bark of the roots mixed with other plants and water, strained and drunk as a kind of tonic.

HORTICULTURAL/LANDSCAPE USE: 'Ilima papa, the coastal mat-forming form of 'ilima, can be used as a groundcover in sunny sites. Upright forms of 'ilima can be used in other landscapes. Some forms of 'ilima are more attractive than others. Most 'ilima require abundant sunshine. Beach and lowland forms of 'ilima are more tolerant of sandy soils and salty air than upland ones and should be considered for xeriscapes.

CARE AND MAINTENANCE: 'Ilima grows well under cultivation. No special care is required for growing 'ilima. Upland forms of 'ilima may be susceptible to nematodes but beach forms appear to be resistant. The leaves may become somewhat chlorotic or splotched with yellow. 'Ilima responds well to applications of a fertilizer with added micronutrients.

PROPAGATION: Seeds germinate readily. Seedlings grow quickly. Low percentage of cuttings will root.

WATER REQUIREMENTS: Upland forms, moderate. Beach forms, light.

PLACES WHERE SPECIMENS CAN BE SEEN:

- O'ahu: Royal Hawaiian Shopping Center, Waikīkī; Waikīkī Aquarium, Lyon Arboretum, Bishop Museum, Hālawa Xeriscape Garden, Queen's Beach, Makapu'u Beach, Turtle Bay Hilton Hotel, Kuilima; Waimea Arboretum and Botanical Garden, Ka'ena Point Natural Area Reserve
- Hawai'i: Mauna Kea Beach Hotel, entrance to Kailua Town, intersection of Palani Road and Queen Ka'ahumanu Highway; Sadie Seymour Botanical Garden
- Maui: Wailea Point

Kalo

Taro

SCIENTIFIC NAME: *Colocasia esculenta* (L.) Schott

FAMILY: Philodendron or aroid

DESCRIPTION: Stemless herb 2-4 feet tall with large, heart-shaped leaves. Highly variable in color of the leaf stalk and skin, fiber color of the corm, size of the mother corm, and number of side shoots or cormlets.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Taro was the staple of the Hawaiian diet. All parts except the roots are edible but must be cooked thoroughly. The corm is an excellent source of non-allergenic carbohydrate and rich in minerals and vitamin A and B. The leaves are high in minerals and vitamins A, B, and C. There were approximately 100 Hawaiian varieties. Many varieties were given more than one name.

HORTICULTURAL/LANDSCAPE USE: Many Hawaiian varieties are decorative and can be used in general landscaping. Popular ornamental types include the manini group with striped leaf stalks, the 'ula'ula group with bright red to purple stalks, the 'ele'ele group with purple or black stalks, 'elepaio with white-freckled leaves and uahi a Pele with purple-mottled leaves and purplish stalk.

Taro may be incorporated into the general landscape or planted in the traditional style in wet and dry paddies. All taro can be planted in dry culture or non-flooded fields but not all taro can be planted in wet culture or flooded fields, lo'i. See Ethnobotany of Hawaii, Krauss, 1974, for details on culture. Well-grown taro can be the center of attention in any garden.

CARE AND MAINTENANCE: Taro must be harvested when mature; otherwise, the plants will decline and die. As maturity approaches, the leaves begin to diminish in size, flowering occurs and the cormlets reach maximum size for the season. Maturity rates vary. Performance in coastal sites with strong sea breeze may be marginal.

PROPAGATION: The seasonal harvesting of taro yields propagative material for the next planting. Harvesting and propagation are explained in detail in Ethnobotany of Hawaii.

WATER REQUIREMENTS: Heavy to moderate.

PLACES WHERE SPECIMENS CAN BE SEEN:

- O'ahu: Moanalua Gardens, Bishop Museum, Lyon Arboretum, Ka Papa Lo'i o Kanewai, Honolulu Zoo, Hawai'i Nature Center, Waipahu Cultural Garden, Waiāhole, Waimea Arboretum and Botanical Garden
- Kaua'i: Hanalei
- Maui: Ke'anae
- Hawaii: Amy B. H. Greenwell Ethnobotanical Garden

June 1, 1992

Koa

SCIENTIFIC NAME: *Acacia koa* A. Gray

FAMILY: Pea

DESCRIPTION: Large, spreading trees up to 100 feet tall and 40-80 feet spread. What appear to be sickle-shaped leaves are actually modified leaf stalks called phyllodes. True leaves are similar to those of koa-haole and generally occur during the seedling state and for a short time where branches have been broken. Flowers are pale yellow and clustered into "puff balls."

BOTANICAL OR ETHNOBOTANICAL INTEREST: Koa wood is hard, beautifully grained, and takes a good polish. It was the premier wood for canoes in ancient times. Hawaiians also used the wood for surfboards, containers (but not for food), weapons, house posts, and tools. Endemic to the dry and wet forests up to 6,000 feet on all the main islands except Kaho'olawe and Ni'ihau.

HORTICULTURAL/LANDSCAPE USE: Although the size and beauty of koa make it suitable as a specimen tree in large lawns, the shade cast is not very dense. Consequently, smaller shrubby species can be planted in close proximity in a garden situation. Koa is a fast-growing tree that requires deep rich soils and full sun. Performance in coastal areas subject to constant salt air may be marginal.

CARE AND MAINTENANCE: Koa will not do well in poor or poorly drained soils and is susceptible to coffee twig borers. Koa is easily cultivated and performs well.

PROPAGATION: Seeds germinate readily. Enhance germination by soaking seeds in hot water for 24 hours, or lightly file seed to thin the seed coat. Seedlings grow quickly.

WATER REQUIREMENTS: Moderate to light.

PLACES WHERE SPECIMENS CAN BE SEEN:

- O'ahu: Tantalus, Lyon Arboretum, Harold St. John Plant Science Laboratory courtyard, Foster Botanic Garden, Wahiawā Botanic Garden, Ho'omaluhia Botanic Garden, Waimea Arboretum and Botanical Garden
- Kaua'i: National Tropical Botanical Garden at Lāwa'i
- Maui: Kula Botanical Garden, Haleakalā National Park
- Hawai'i: Hawai'i Volcanoes National Park, Kīpukapuauulu (Bird Park) Trail, Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden

Koki'o 'ula'ula

SCIENTIFIC NAME: *Hibiscus koki'o* Hillebr.

FAMILY: Hibiscus or mallow

DESCRIPTION: Shrubs or small, columnar trees 10-12 feet tall with canopy spread 3-10 feet. Flowers dark red to orange, rarely yellow.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Two subspecies are recognized: Subspecies *koki'o*, a lanky or straggly shrub with red flowers, and subspecies *saintjohnianus*, a slender, tree-like shrub with red-orange to orange or yellow flowers. Endemic to the dry and wet forests of Kaua'i, O'ahu, Moloka'i, and Maui. Subspecies *saintjohnianus* is named in honor of Dr. Harold St. John of the Bishop Museum.

HORTICULTURAL/LANDSCAPE USE: A slow-growing ornamental species, *Hibiscus koki'o* will add beauty to any garden. Subspecies *koki'o* tends to produce long, slender, sparingly-branched upright or sometimes arching stems and is probably best-suited as a background plant. Subspecies *saintjohnianus* is a denser shrub and can be used as an accent plant. Cultivation of either subspecies in salty environments may be marginal.

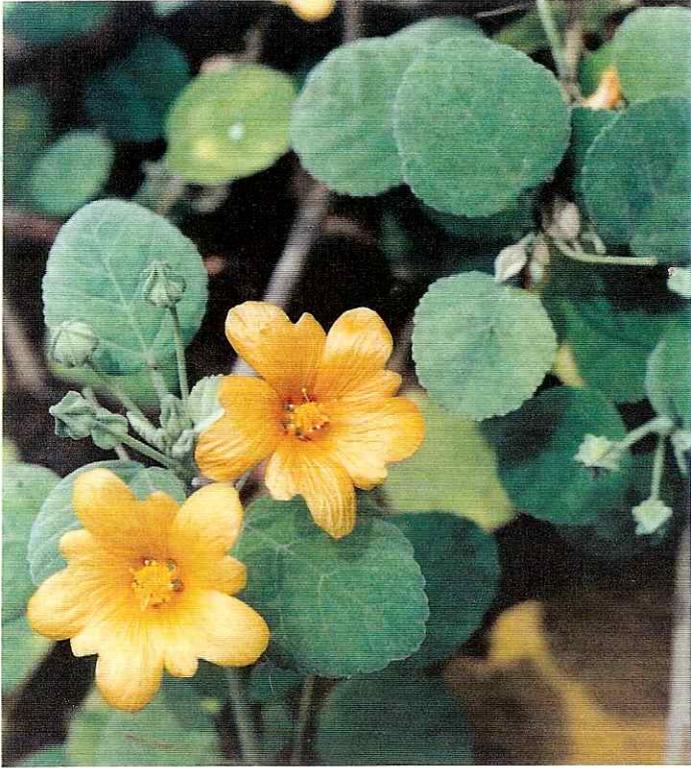
CARE AND MAINTENANCE: Susceptible to aphids, mealy bugs, scales, and white fly. Koki'o 'ula'ula does not respond especially well to pruning because it is a slow grower.

PROPAGATION: Terminal cuttings, grafting, air-layers. Rooting percentage for cuttings is probably 50% or less. Seeds will germinate but seedlings are slow growing.

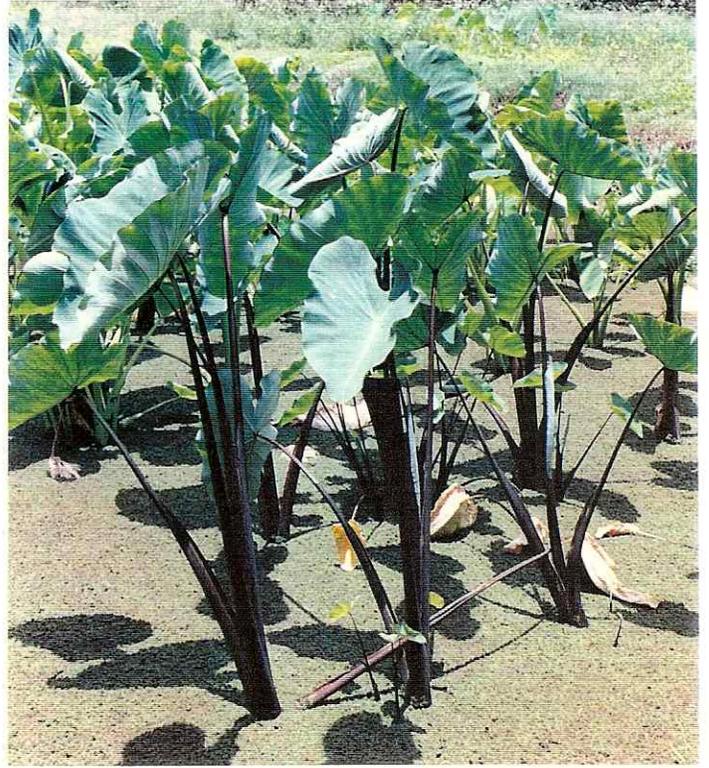
WATER REQUIREMENTS: Moderate.

PLACES WHERE SPECIMENS CAN BE SEEN:

- O'ahu: Lyon Arboretum, Hālawā Xeriscape Garden, Waimea Arboretum and Botanical Garden
- Kaua'i: National Tropical Botanical Garden at Lāwāi, Nāpali Trail
- Hawai'i: Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden, Moeauoa Nursery



'Ilima
Sida fallax



Kalo
Colocasia esculenta



Koa
Acacia koa



Koki'o 'ula'ula
Hibiscus kokio

Kukui
Candlenut Tree

SCIENTIFIC NAME: *Aleurites moluccana* (L.) Willd.

FAMILY: Spurge

DESCRIPTION: Well-canopied trees 30-70 feet tall with watery sap. Canopy spread 25-50 feet. Leaves variable in shape, light green. Flowers white, in large clusters. Fruits green, about 2 inches in diameter.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Polynesians who migrated to Hawai'i undoubtedly brought kukui for its many uses - medicine, food, dye, construction, illumination and decoration. It is the official State tree because of its beauty and ancient importance. Kukui is a conspicuous element in the lower forest zone in ravines and gulches and easily recognized by its pale green foliage.

HORTICULTURAL/LANDSCAPE USE: A fast-growing species, kukui is useful as a specimen or shade tree. Its canopy can be kept low with its lower branches just a few feet off the ground resulting in a bushy effect. Few plants will be able to grow in the resulting shade except for such shade loving plants as palapalai and maile. If its canopy is thinned out and kept high, the shade cast will be fairly bright allowing landscaping underneath.

The kukui photographed in this handbook was formerly identified as a distinct species, *Aleurites remyi* (Sherff), but is now identified as a variety of *Aleurites moluccana*. The leaves of variety *remyi* are distinctly more narrow lobed or maple-like than the more common form which has angularly pointed leaves.

CARE AND MAINTENANCE: No special requirements. Grows well under cultivation and under a wide range of climatic conditions. During season, fruits will fall in abundance, creating additional maintenance.

PROPAGATION: Easily propagated by seeds and seedlings grow quickly.

WATER REQUIREMENTS: Moderate.

PLACES WHERE SPECIMENS CAN BE SEEN:

- O'ahu: State Capitol, 'Iolani Palace, Foster Botanical Garden, Old Stadium Park, Ka Papa Lo'i o Kanewai, Lyon Arboretum, Tantalus, Hālawā Xeriscape Garden, Waimea Arboretum and Botanical Garden
- Kaua'i: Keāhua Forestry Arboretum
- Maui: Haleakalā National Park
- Hawai'i: Pu'uhonua o Hōnaunau (City of Refuge) National Historic Park, Hawai'i Volcanoes National Park, Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden.

June 1, 1992

Kulu'ī

SCIENTIFIC NAME: *Nototrichium sandwicense* (A. Gray) Hillebr.

FAMILY: Amaranth

DESCRIPTION: Shrubs or small trees, multi-stemmed and branched at the base, 3-12 feet tall with 3-9 foot spread. All parts covered with silky silvery hairs. Leaves densely hairy, elliptic to lance-shaped, 1-4 inches long, generally smaller on old branches and larger on young, vigorous stems. Flowers minute, borne on terminal spikes.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Kulu'ī is highly variable in leaf size and shape, density of hair, and length of spikes. More than 20 varieties have been described. It is endemic to dry foothills, exposed ridges and open, dry, lowland forests on all main islands. It is highly visible on the lava fields of North Kona, Hawai'i.

HORTICULTURAL/LANDSCAPE USE: Use kulu'ī as a silvery green accent in sunny, exposed sites. It will grow in arid, rocky areas and should be considered in xeriscape gardens. Use as an ornamental, background planting or informal hedge. It is tolerant of salty coastal conditions.

CARE AND MAINTENANCE: Kulu'ī requires maximum sunshine and well-drained soils. Clay or otherwise heavy soils should be avoided. If planting in clay soils, assure good drainage by adding cinder and sloping or mounding the planting bed. Older plants may become straggly but judicious pruning will stimulate vigorous new shoots. No serious pests or diseases are known.

PROPAGATION: Moderately easy propagation by cuttings. Use a rooting hormone to enhance success.

WATER REQUIREMENTS: Moderate to light.

PLACES WHERE SPECIMENS CAN BE SEEN:

O'ahu: Waikīkī Aquarium, Lyon Arboretum, Ho'omaluhia Botanic Garden, Waimea Arboretum and Botanical Garden

Hawai'i: Sadie Seymour Botanical Garden

Loulu

SCIENTIFIC NAME: *Pritchardia minor* Becc.
Pritchardia martii (Gaud.) H. A. Wendl.
Pritchardia hillebrandii (Kuntze) Becc.
Pritchardia glabrata Becc. & Rock
Pritchardia beccariana Rock

FAMILY: Palm

DESCRIPTION: Loululus have been selected for each major island. A total of 19 loululus have been tentatively identified as endemic to the Hawaiian Islands. Work is still being done on the identification of *Pritchardia lanaiensis* (Becc. & Rock) as a distinct species.

Pritchardia minor: Kaua'i. Medium-sized palms with trunks 19-39 feet tall. Leaves fan-shaped, lower surface of leaves yellowish gray or nearly golden. Small fruits somewhat egg-shaped, about 0.4-0.8 inches long and 0.5 inches wide.

Pritchardia martii: O'ahu. Small-sized palms with trunks 10-33 feet tall. Leaves fan-shaped, lower surface of leaves silvery gray. Small ellipsoid fruits, narrowed toward both ends, about 1.5-2 inches long and 1-1.5 inches wide.

Pritchardia hillebrandii: Moloka'i. Medium-sized palms with trunks 19-23 feet tall. Leaves fan-shaped, lower surface of leaves ashy-silvery along petioles and ridges of segment folds. Small globose fruits, yellowish or reddish brown, becoming intensely bluish or nearly black, about 0.75-0.86 inches long and as wide as long.

Pritchardia glabrata: Maui. Miniature palms with slender trunks 3.3-6.6 feet tall. Leaves are fan shaped, both surfaces of leaves green. Small globose-ovoid fruit about 0.9 inches long and 0.7 inches in diameter.

Pritchardia beccariana: Hawai'i. Medium-sized palms with trunks 52-62 feet tall. Leaves are fan shaped, lower surface of leaves green. Small, somewhat variable in shape, from ovoid to globose, fruit about 1-1.4 inches long and 1 inch in diameter.

BOTANICAL OR ETHNOBOTANICAL INTEREST: The leaves of native loulu were once used for thatching. Young bleached leaves were used for weaving hats, fans, and baskets. Marie C. Neal also reported that Hawaiians ate the unripe seeds, hāwane or wāhane, which tasted somewhat like coconut (In Gardens of Hawai'i, page 98).

HORTICULTURAL/LANDSCAPE USE: Plant a loulu which is native to your island. Loululus can be used as specimen trees and as a focal point of a small garden. If planted as a grove, loululus can be the focal point of an extensive landscape design. Loululus require sunshine and good drainage.

CARE AND MAINTENANCE: Native loulu should not be transplanted out of pots and planted in the garden until they develop at least 2-3 true, fan-shaped leaves. Good drainage is essential as the seedlings are sensitive to over-watering. Scales, mealy bugs and ants may cause occasional problems especially on unfurled leaves and among roots. A mild detergent solution is generally effective but if the problem persists, a garden supply center can recommend an appropriate insecticide.

PROPAGATION: Seed germination can be enhanced by first peeling off the pulpy covering and placing the seeds in damp sphagnum, peat or sterile potting mix and storing them in a sealed plastic bag in a dark place. Germination should begin in about a month.

WATER REQUIREMENTS: Moderate to light.

PLACES WHERE SPECIMENS CAN BE SEEN:

O'ahu: Foster Botanical Garden, Harold St. John Plant Science Laboratory courtyard, Ka Papa Lo'i o Kanewai, Lyon Arboretum, Wahiawā Botanic Garden, Ho'omaluhia Botanic Garden, Koko Crater Botanic Garden, Waimea Arboretum and Botanical Garden

Hawai'i: Sadie Seymour Botanical Garden, Amy B. H. Greenwell Ethnobotanical Garden

Ma'ō
Hawaiian Cotton

SCIENTIFIC NAME: *Gossypium tomentosum* Nutt. ex Seem.

FAMILY: Hibiscus or mallow

DESCRIPTION: Spreading shrubs 2-5 feet tall with silvery-green, 3-5-lobed leaves. Hibiscus-like flowers are yellow. The cotton bolls are small with tan-colored lint. A well-grown shrub may have a spread of 5-7 feet.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Endemic to arid coastal or lowland areas on all main islands except Hawai'i. It has been used to breed several desirable traits into commercial strains of cotton.

HORTICULTURAL/LANDSCAPE USE: Ma'ō requires full sun and room to spread out. It is tolerant of salt air and well-suited for hot, lowland or coastal sites. It will grow in mauka regions if given adequate sunshine and drainage. Ma'ō can be effective in rocky areas where it can be allowed to sprawl. It may also be appropriate for xeriscapes although it may become deciduous during times of severe drought.

CARE AND MAINTENANCE: Ma'ō is easily cultivated but may require pruning to keep it bushy. Scales and mealy bugs may cause minor problems. A fungus which causes dark spots on the leaves occasionally attacks ma'ō. It can be treated with a broad-spectrum fungicide.

PROPAGATION: Seeds will germinate and seedlings grow moderately quickly. Germination can be enhanced by scarification. Cuttings generally yield poor results.

WATER REQUIREMENTS: Light.

PLACES WHERE SPECIMENS CAN BE SEEN:

O'ahu: Queen's Beach, Waikīkī Aquarium, Lyon Arboretum, Harold St. John Plant Science Laboratory courtyard, Ka Papa Lo'i o Kanewai, Bishop Museum, Hālawa Xeriscape Garden, Waimea Arboretum and Botanical Garden, Kahe Point

Hawai'i: Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden



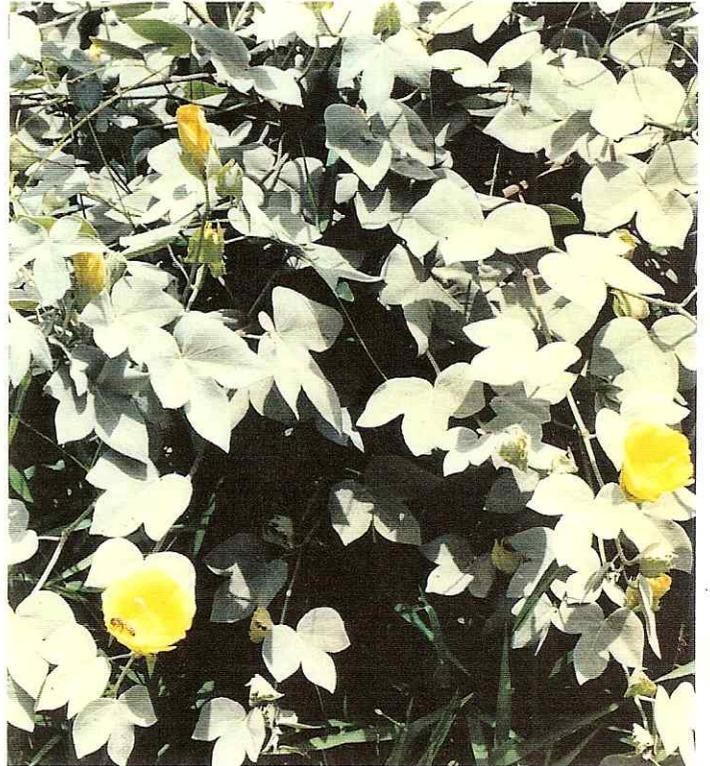
Kukui
Aleurites moluccana



Kulu'i
Nototrichium sandwicense



Loulu
Pritchardia spp.



Ma'o
Gossypium tomentosum

Naio

Bastard Sandalwood

SCIENTIFIC NAME: *Myoporum sandwicense* A. Gray

FAMILY: Myoporaceae

DESCRIPTION: Multi-stemmed shrubs to small trees 3-30 feet tall, rarely taller. Leaves leathery, variable in shape from elliptic to narrowly lance-shaped or ovate, the margins smooth or somewhat toothed. Flowers slightly fragrant, white, lilac or pinkish, in small clusters in leaf axils. Fruits white to pinkish, juicy.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Naio inhabits a wide range of ecological habitats: beaches, lowlands, dry forests, semi-dry forests, and subalpine forests up to 7500 feet elevation. Ancient Hawaiians used the hard, yellowish wood for house frames. It was unsuccessfully substituted for sandalwood during the waning days of the sandalwood trade. Indigenous to all the main islands of Hawai'i except for possibly Kaho'olawe.

HORTICULTURAL/LANDSCAPE USE: Although naio is typically a dryland species it will grow under a wide range of environmental conditions. A rather quick-growing species, it will grow to 5-6 feet in just a few years. Because the shade cast is usually not very dense, it can be planted in close proximity to other plants. It requires full sun and good drainage and is an excellent choice for xeriscapes, coastal gardens, and general landscaping. It will grow well in cloudy, rainy, mauka areas if ample sun and drainage is provided. Naio is an attractive shrub, resilient to heat and drought. The naio from Manini Gulch, O'ahu, is particularly attractive and long-lasting in cultivation.

CARE AND MAINTENANCE: Naio grows well under cultivation although it may be susceptible to nematodes. No special care is required.

PROPAGATION: Fruits are harvested when ripe, white, and juicy. Pulp must be removed from the seeds. Seeds germinate in approximately 18 months. Naio is also easy to grow from cuttings.

WATER REQUIREMENTS: Moderate to light.

PLACES WHERE SPECIMENS CAN BE SEEN:

- O'ahu: Harold St. John Plant Science Laboratory courtyard, Ka Papa Lo'i o Kanewai, Bishop Museum, Hawai'i Medical Association building on Beretania Street, Lyon Arboretum, Ka'ena Point Natural Area Reserve, Wahiawā Botanical Garden, Waimea Arboretum and Botanical Garden, Ho'omaluhia Botanic Garden, Koko Crater Botanic Garden
- Hawai'i: Hawai'i Volcanoes National Park, Kīpukapuauolu (Bird Park) Trail, Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden

June 1, 1992

Naupaka kahakai

Beach Naupaka

SCIENTIFIC NAME: *Scaevola sericea* Vahl

FAMILY: Naupaka

DESCRIPTION: Dense, spreading shrubs up to 10 feet tall, 6-15 feet spread, with large succulent leaves. Flowers occur in small clusters in the leaf axils and are generally white to lilac with purplish streaks. Fruits white, juicy.

BOTANICAL OR ETHNOBOTANICAL INTEREST: One of the most common beach plants in Hawai'i, this indigenous plant is the only non-endemic Hawaiian naupaka. There are eight other Hawaiian naupakas which are all endemic.

HORTICULTURAL/LANDSCAPE USE: This naupaka has long been used in landscaping in Hawai'i. Although best suited for coastal areas, it will grow well under a wide range of climatic conditions. It requires full sun and once established, minimal watering. It can be used as an informal hedge, a tall filler to occupy "dead space," as a border planting or as a windbreak against prevailing sea breeze. Tolerant of poor, calcareous soils, it will grow where most other plants will not. It is an excellent selection for xeriscapes.

CARE AND MAINTENANCE: Easily cultivated. No significant pests or diseases are known. A well-grown shrub will tend to sprawl considerably but unlike some native plants, beach naupaka responds well to pruning.

PROPAGATION: Easily propagated by seeds and seedlings grow quickly.

WATER REQUIREMENTS: Moderate to light.

PLACES WHERE SPECIMENS CAN BE SEEN:

O'ahu: Ala Moana Park, Lyon Arboretum, Harold St. John Plant Science Laboratory courtyard, Waikīkī Aquarium, Honolulu Zoo, Diamond Head Road, Sandy Beach, Makapu'u Beach, Ka'ena Point Natural Area Reserve, Waimea Arboretum and Botanical Garden, Pounder's Beach

Hawai'i: Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden

Naupaka kuahiwi
Mountain Naupaka

SCIENTIFIC NAME: *Scaevola gaudichaudiana* Cham.

FAMILY: Naupaka

DESCRIPTION: Shrubs to small trees 5-20 feet tall with a spread of 6-10 feet. Leaves shallowly toothed. Flowers white, fragrant, in spreading clusters and appear to be torn in half. Fruits juicy, dark purple.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Several species of naupaka are native to Hawai'i. All are characterized by the "half-flower," although the floral split in one species is not very conspicuous. Endemic to the mountains of O'ahu, this species hybridizes with another species with purple flowers resulting in interesting hybrid populations. Good examples can be found along the Mānoa Cliffs Trail and the Lanipō Trail.

HORTICULTURAL/LANDSCAPE USE: This naupaka is a dense, well-shaped shrub with unusual white flowers. It is well-suited for planting at the edge of taller shrubs or as an accent plant. This species generally grows along ridge tops or on upper slopes exposed to the sun in the wild. It requires at least half-a-day sun and can be grown in full sun in cloudy, rainy sites. It is probably intolerant of salty environments and excessive heat.

CARE AND MAINTENANCE: This naupaka is easily cultivated and requires no special care. Mealy bugs and scales are known pests of this plant.

PROPAGATION: Seeds sprout readily and seedlings grow moderately quickly.

WATER REQUIREMENTS: Moderate.

PLACES WHERE SPECIMENS CAN BE SEEN:

O'ahu: Lyon Arboretum, Mānoa Cliffs Trail, Lanipō Trail, 'Aiea Loop Trail, Waimea Arboretum and Botanical Garden

Nehe

SCIENTIFIC NAME: *Lipochaeta succulenta* (Hook. & Arnott) DC.

FAMILY: Sunflower

DESCRIPTION: Perennial, clump-forming subshrub up to 3-4 feet tall with lax, spreading stems which root at the nodes. Leaves glossy green, succulent, 2-5 inches long, somewhat resembling those of wedelia. Flower heads like wedelia, borne in simple or branched clusters.

BOTANICAL OR ETHNOBOTANICAL INTEREST: *Lipochaeta succulenta* is endemic to all the main islands except Lānaʻi. It is restricted to coastal areas below 300 feet elevation. It is common in the beach areas along the Nā Pali coast of Kauaʻi but is very rare on Oʻahu.

HORTICULTURAL/LANDSCAPE USE: This nehe resembles a shrubby wedelia. It is probably not suited as a groundcover because of its height but it can be useful as a filler, as a cover on moderate to steep slopes, or as a high border planting. It is best suited for lowland or coastal sites and is tolerant of salt spray. If adequate sunshine and drainage are provided it also will grow in mauka regions.

CARE AND MAINTENANCE: No significant insects or diseases are known. It can be pruned and shaped to maintain a certain size.

PROPAGATION: Very easily propagated from cuttings.

WATER REQUIREMENT: Moderate to light.

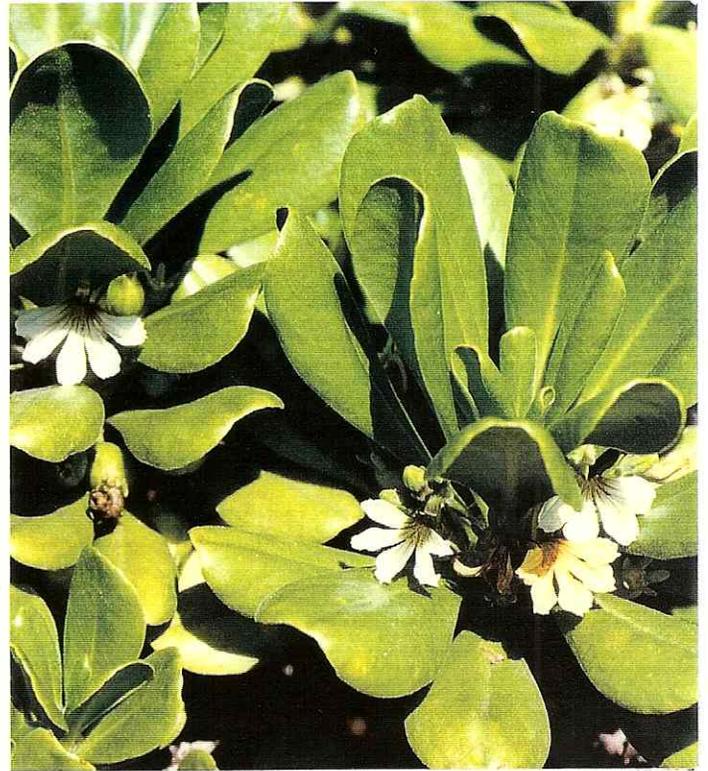
PLACES WHERE SPECIMENS CAN BE SEEN:

Oʻahu: Hālawa Xeriscape Garden, Waimea Arboretum and Botanical Garden

Maui: Maui Zoo



Naio
Myoporum sandwicense



Naupaka kahakai
Scaevola sericea



Naupaka kuahiwi
Scaevola gaudichaudiana



Nehe
Lipochaeta succulenta

'Ōhi'a lehua

SCIENTIFIC NAME: *Metrosideros polymorpha* Gaud.

FAMILY: Myrtle

DESCRIPTION: Species highly variable in stature, hairiness, leaf size and shape. Creeping to erect shrubs or spreading or tall trees up to 80 feet tall with a canopy spread of 15-40 feet or more. Leaves smooth to densely woolly on undersides. Young growth flesh-colored to red. Flowers typically red. Red-orange, orange, and yellow flowered forms are known.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Dozens of forms have been recognized based primarily on plant stature and leaf characters. 'Ōhi'a lehua inhabits a wide range of habitats from nearly sea level to nearly 7,000 feet, in lava fields, dry forests, wet forests and bogs. 'Ōhi'a lehua wood is extremely hard, reddish, takes a fine polish but is difficult to cure. Hawaiians used the wood for tools, weapons and images. Endemic to all the main islands except Kaho'olawe and Ni'ihau.

HORTICULTURAL/LANDSCAPE USE: 'Ōhi'a lehua is a quick-growing species but will not develop a significant canopy for many years. It will tolerate a fair amount of crowding. Several can be planted as close as 5 feet apart. They can be thinned out many years later as they develop into trees. 'Ōhi'a lehua can be the focal point of a garden or as a background planting. Recommended as a companion plant with hāpu'u. It requires abundant sunshine, regular irrigation, and rich porous soils. Performance in coastal sites may be marginal.

CARE AND MAINTENANCE: Performs well under cultivation. Plants that have become root-bound in pots tend to remain stunted for a long time. Consequently, it is best to plant 'ōhi'a lehua into the ground before it becomes pot-bound. Young growth may be susceptible to Chinese rose beetles.

PROPAGATION: 'Ōhi'a lehua has been propagated by cuttings and air-layers but results have been inconsistent. Seeds germinate readily. Seeds and seedlings are extremely small but grow rapidly. 'Ōhi'a lehua is often available in urban garden shops. Ask specifically for Hawaiian varieties.

WATER REQUIREMENTS: Moderate.

PLACES WHERE SPECIMENS CAN BE SEEN:

- O'ahu: Lyon Arboretum, Mānoa Cliffs Trail, Tantalus, Hālawa Xeriscape Garden, Wahiawā Botanic Garden, Waimea Arboretum and Botanical Garden, Ho'omaluhia Botanical Garden, Hawaiian Memorial Park
- Kaua'i: Kōke'e State Park
- Maui: Haleakalā National Park
- Hawai'i: Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden, Kalōpā State Park
'Ōhi'a is a common native plant on this island.

Palapalai

SCIENTIFIC NAME: *Microlepia strigosa* (Thunb.) Presl

FAMILY: Dennstaedtia

DESCRIPTION: Clumping, trunkless ferns 3-4 feet tall. Fronds somewhat triangular, thrice-divided, slightly hairy. Ultimate segments 4-sided, notched.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Endemic to semi-dry and wet forests of most of the main islands. Ancient Hawaiians used the fronds to decorate hula altars dedicated to Laka, the goddess of hula. Palapalai is a favored fern for lei-making.

HORTICULTURAL/LANDSCAPE USE: Palapalai grows well in partial or bright, open shade in moist, protected sites. It is well-suited for border planting or as a high groundcover. The clumps increase in size reasonably quickly. It is probably intolerant of salty coastal conditions and will do poorly in hot, exposed sites. Best suited for cooler mauka regions. Palapalai fronds resemble those of the leather leaf fern.

CARE AND MAINTENANCE: Palapalai is moderately easy to cultivate and maintain. Most of the difficulty in growing this species is finding a suitable location. It is sensitive to herbicides. No significant pests or diseases are known.

PROPAGATION: Division of clumps. Palapalai is sometimes available in urban garden shops. Ask for the source, since a similar fern from the Mainland also is often sold under the name palapalai.

WATER REQUIREMENTS: Moderate, keep soil moist but not waterlogged.

PLACES WHERE SPECIMENS CAN BE SEEN:

O'ahu: Lyon Arboretum, Wai'anae Kai Trail, Moanalua Valley

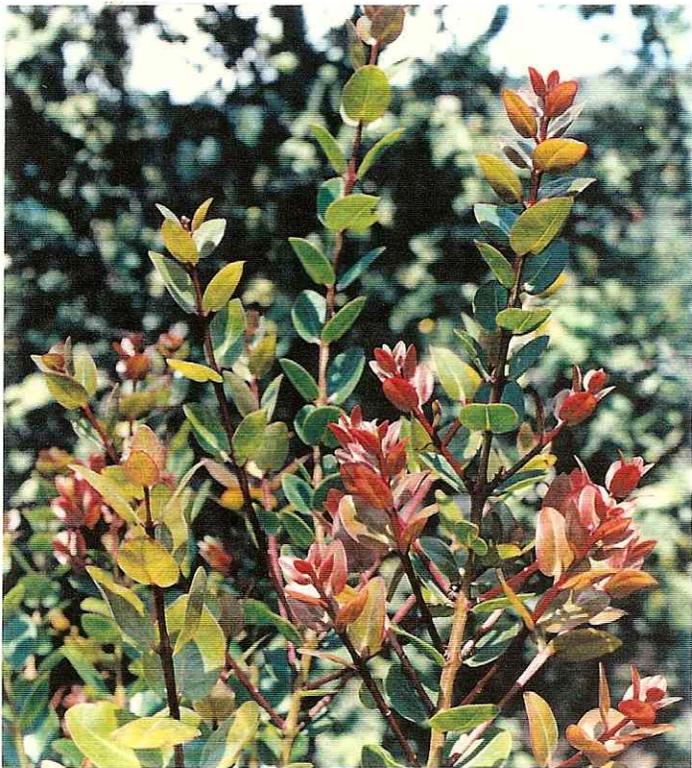
Hawai'i: Sadie Seymour Botanical Garden



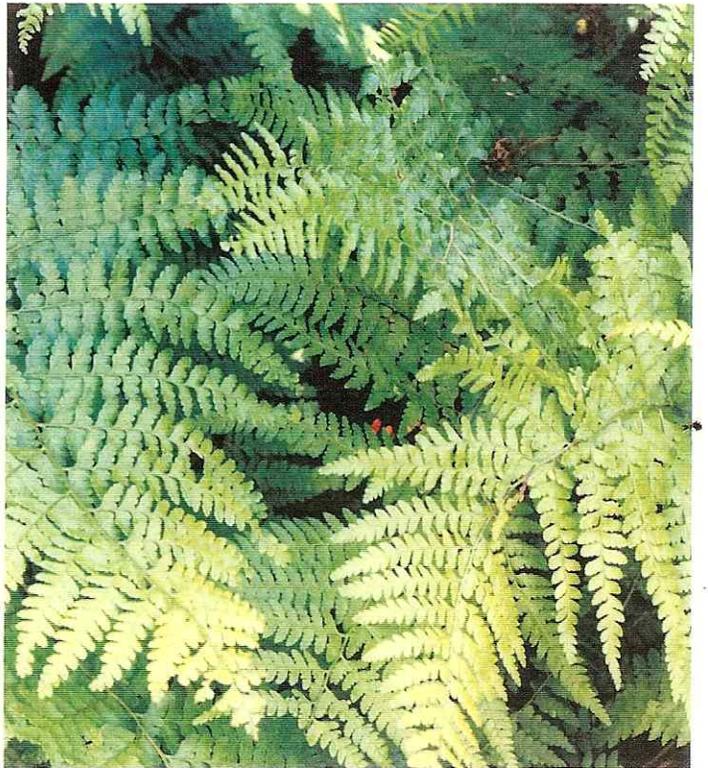
'Ōhi'a
Metrosideros polymorpha



'Ōhi'a
Metrosideros polymorpha



'Ōhi'a
Metrosideros polymorpha



Palapalai
Microlepia strigosa

Pā'ū o Hi'iaka

SCIENTIFIC NAME: *Jacquemontia ovalifolia* subsp. *sandwicensis* (A Gray) K. Robertson

FAMILY: Morning glory

DESCRIPTION: Creeping vines up to 10 feet long. Stems and leaves densely covered with silver-hairs or smooth. Leaves leathery, elliptic to nearly orbicular, 0.5-2.5 inches long. Flowers blue to white, on slender stalks in axils of the leaves.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Ancient Hawaiians used the leaves and stems medicinally as a cathartic and to treat thrush. Pā'ū o Hi'iaka is indigenous to all main Hawaiian Islands in leeward coastal habitats.

HORTICULTURAL/LANDSCAPE USE: Pā'ū o Hi'iaka is an excellent choice for coastal gardens or xeriscapes. It will grow in almost any sunny, well-drained situation. Although best adapted to sandy or gravelly substrates, it will also grow reasonably well in heavier soils including clays. The vines do not form dense mats. Used as a groundcover, it should be planted in beds of cinder or sand. It does well in extremely rocky sites with only small pockets of soil. If ample sun is provided, it will grow well in mauka regions.

CARE AND MAINTENANCE: Very easily cultivated. No major pests or diseases are known.

PROPAGATION: Easily propagated by seeds or cuttings.

WATER REQUIREMENTS: Moderate to light.

PLACES WHERE SPECIMENS CAN BE SEEN:

O'ahu: Bishop Museum, Waikīkī Aquarium, Queen's Beach, Hālawā Xeriscape Garden, Ka'ena Point Natural Area Reserve, Waimea Arboretum and Botanical Garden, Ho'omaluhia Botanic Garden

Hawai'i: Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden

Pōhuehue
Beach Morning Glory

SCIENTIFIC NAME: *Ipomoea pes-caprae* (L.) R. Br.

FAMILY: Morning Glory

DESCRIPTION: Creeping vines with stems up to 15 feet long and a deep, fleshy tap-root. Leaves leathery, typically kidney-shaped or notched at the tip and resembling the shape of a goat's foot. Flowers trumpet-shaped, pink to purple.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Ancient Hawaiians used the seeds, roots, and leaves as a cathartic and as a poultice for skin ailments and broken bones. Indigenous to beach areas on all the main islands. Pōhuehue is often a host for kauna'oa (*Cuscuta sandwichiana*) which is the plant designated as the "flower" for the Island of Lāna'i.

HORTICULTURAL/LANDSCAPE USE: Pōhuehue is suitable as a groundcover in sunny, well-drained sites. It is intolerant of shade and well-adapted to salty coastal areas. It can be planted in areas of prevailing sea breezes and in sandy or stony soils. The cover it provides is not very dense and for best results it should be planted over a mulch. Given enough drainage and exposure to sun, it will grow reasonably well in mauka regions as well.

CARE AND MAINTENANCE: No special care is required. Performs well under cultivation. Slugs and snails may be potential pests.

PROPAGATION: Easily propagated by cuttings.

WATER REQUIREMENTS: Moderate to light.

PLACES WHERE SPECIMENS CAN BE SEEN:

O'ahu: Waikīkī Aquarium, Makapu'u Beach, Waimānalo Beach, Mā'ili Beach, Waimea Arboretum and Botanical Garden

Wauke

SCIENTIFIC NAME: *Broussonetia papyrifera* (L.) Venten.

FAMILY: Mulberry

DESCRIPTION: Trees 15-40 feet tall with canopy spread of 10-35 feet. Leaves sand-papery on upper surface, heart-shaped or 3-lobed, rarely 5-lobed.

BOTANICAL OR ETHNOBOTANICAL INTEREST: A Polynesian introduction, wauke was the main source of high quality fiber for tapa or bark cloth for the ancient Hawaiians. Formerly cultivated in plantations on the uplands, it can still be found persisting in certain areas especially along streams.

HORTICULTURAL/LANDSCAPE USE: Wauke is a fast-growing tree and might be useful as a shade or specimen tree but has a habit of sending up many shoots away from the mother plant, or root suckering. For instructional purposes, it should be planted as close as 2 feet apart in the plantation style as done by the Hawaiians. Prefers cool, moist, mauka regions but may also grow in lowlands if adequate water is provided.

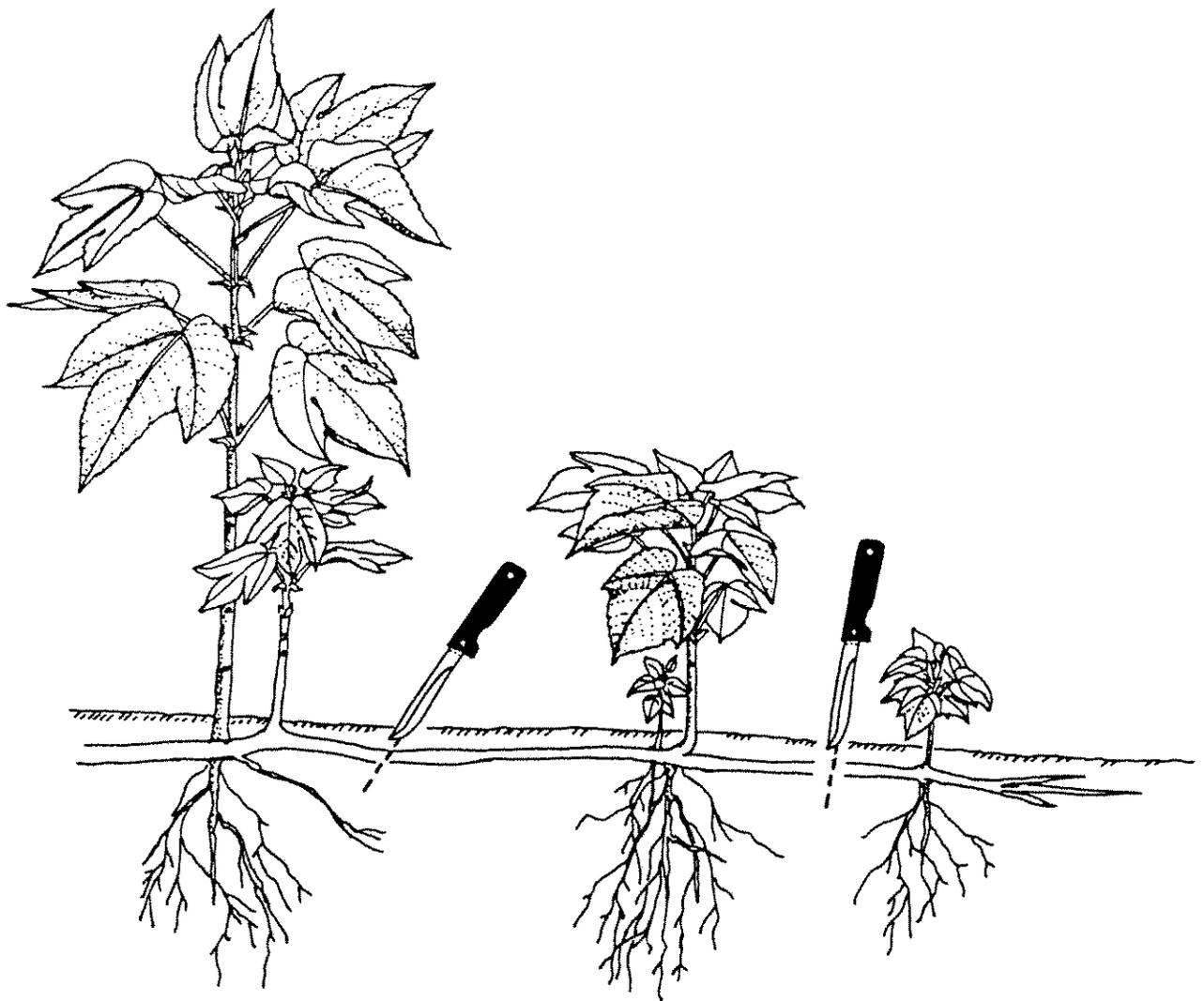
CARE AND MAINTENANCE: If the wauke is to be harvested for making tapa, then it must be constantly maintained to prevent scarring of the bark. All lateral buds should be constantly pinched off, at least once a week, to discourage branching which would create scars in the bark. Leaves beneath the top two feet of the plant should also be pinched off, leave enough leaves to support the growth of the plant. The wauke will grow to almost 12 feet before it is harvested. Bend the plant down to remove buds and leaves.

Most tapa makers do not let wauke grow more than 1 - 1.5 inches in diameter since the fiber becomes coarse if allowed to grow larger. Be careful not to strip the bark when pinching off lateral buds and leaves. Water consistently. If drought conditions are maintained, the bark will split and form scars when watering is resumed. Do not plant in windy areas since the stalks will scar if they rub against each other.

If wauke is planted as an ornamental, then it can be allowed to grow out. It produces aggressive surface roots which readily produce suckers when bruised. These roots may grow under nearby sidewalks and driveways and may persist long after the mother plant has died. Suckering may become a chronic maintenance problem.

PROPAGATION: Transplanting root suckers is the easiest method. Suckers are readily produced when the mother plant is harvested. When the sucker plant, or keiki, is approximately 12-18 inches high, cut the lateral root from the mother plant with a sharp blade. Let the keiki "harden" for about a month and then transplant into a pot or directly into the field. Provide shade for the transplanted keiki. See illustration on next page.

Rooting stem cuttings is also an easy method of propagation. Place cuttings in a pot of a light medium, like perlite, and cover the pot with a clear plastic bag supported by a wire frame. Keep medium damp by adding water once or twice a week.



Propagating wauke by cutting lateral root suckers.

WATER REQUIREMENTS: Moderate.

PLACES WHERE SPECIMENS CAN BE SEEN:

O'ahu: Harold St. John Plant Science Laboratory courtyard, Ka Papa Lo'i o Kanewai, Bishop Museum, Royal Mausoleum, Mauna'ala, Nu'uau; Waimea Arboretum and Botanical Garden

Hawai'i: Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden

June 1, 1992

Wiliwili

SCIENTIFIC NAME: *Erythrina sandwicensis* Degener

FAMILY: Pea

DESCRIPTION: Thorny trees 20-30 feet high but rarely 50 feet with yellowish, often reddish bark. Canopy spread 10-25 feet. Leaves in 3's, typically absent during flowering. Flowers in dense clusters, red, yellow-orange or chartreuse. Hairy seed pod, containing 2-3 red seeds.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Ancient Hawaiians used the light wood for fish net floats, surfboards, and canoe outrigger floats, ama. Endemic to arid lowlands and dry forests on all main islands.

HORTICULTURAL/LANDSCAPE USE: Wiliwili can be used as a specimen tree because of its size and beautiful flowers. The flowers are enhanced by the absence of leaves during the August to September flowering season. It is a rather quick-growing species. Wiliwili tends to have a spreading canopy. Its branches which twist in all directions is probably the source of its Hawaiian name. It is drought tolerant, suited for dry, hot lowland or coastal sites, and an obvious choice in xeriscapes. Wiliwili will not perform well in cloudy, wet mauka regions.

CARE AND MAINTENANCE: Watch for thorny fallen branches and heavy leaf fall during flowering season. Easy to plant and cultivate. Maximum sunshine and well-drained soils are essential. Chinese rose beetles may pose some problems. Wiliwili needs some pruning to maintain its shape.

PROPAGATION: Seeds are hard and need to be soaked in water overnight or nicked with a file or knife to assist germination. Seedlings grow quickly. Wiliwili may also be propagated from tip cuttings.

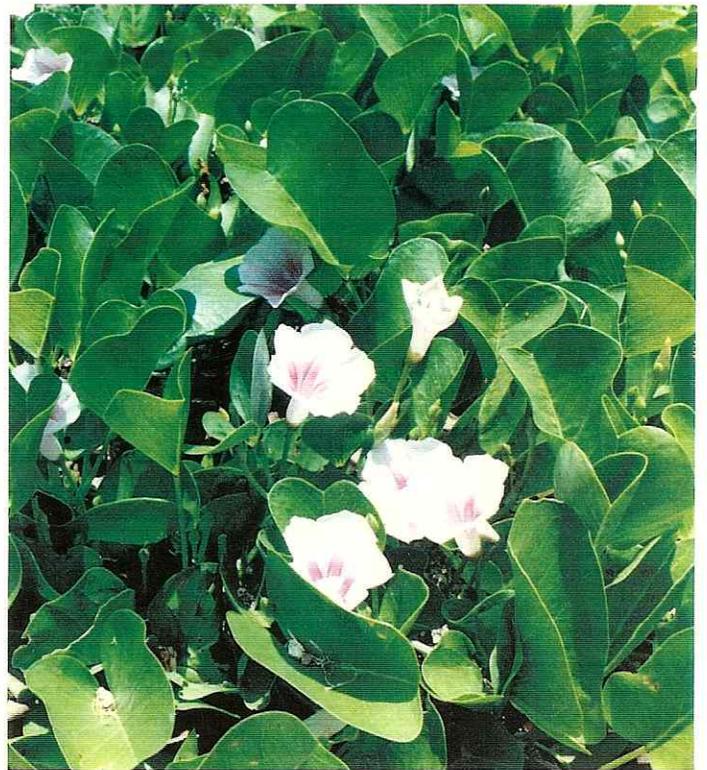
WATER REQUIREMENTS: Light.

PLACES WHERE SPECIMENS CAN BE SEEN:

- O'ahu: Foster Botanical Garden, Koko Crater Botanic Garden, Ho'omaluhia Botanic Garden, Moanalua Gardens, Hālawā Xeriscape Garden, Wahiawā Botanical Garden, Waimea Arboretum and Botanical Garden
- Hawai'i: Hawai'i Volcanoes National Park, Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden



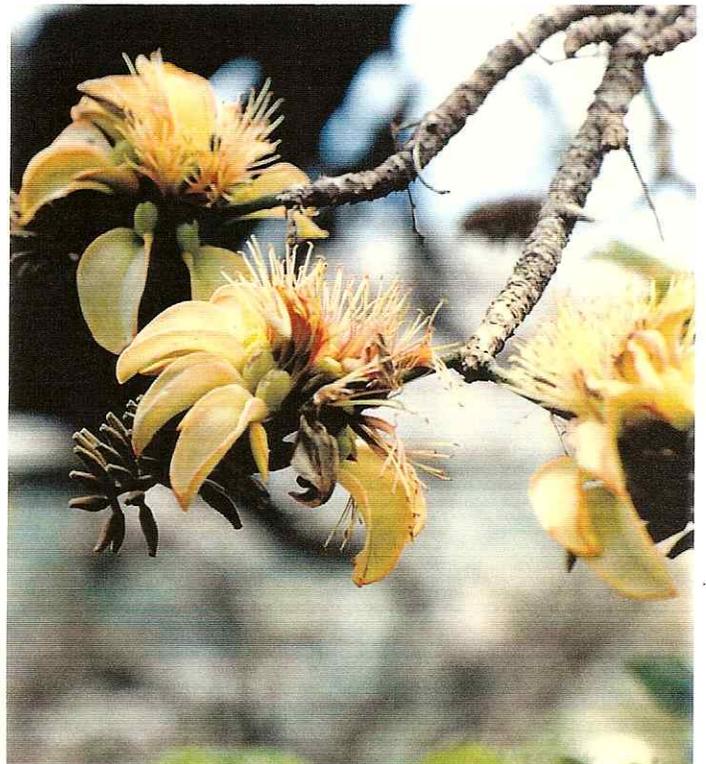
Pā'ū o Hi'iaka
Jacquemontia ovalifolia subsq. *sandwicensis*



Pōhuehue
Ipomoea pes-caprae



Wauke
Broussonetia papyrifera



Wiliwili
Erythrina sandwicensis

ADDITIONAL PLANTS

<u>Hawaiian Name</u>	<u>Native Status</u>	<u>Scientific Name</u>
'A'ali'i	Indigenous	<i>Dodonaea viscosa</i> Jacq.
'Ākia	Endemic	<i>Wikstroemia uva-ursi</i> A. Gray
Alahe'e	Indigenous	<i>Canthium odoratum</i> (G. Forster) Seem.
'Ena'ena	Endemic	<i>Gnaphalium sandwicense</i> Gaud.
Koki'o ke'oke'o	Endemic	<i>Hibiscus arnottianus</i> A. Gray
Ko'oko'olau	Endemic	<i>Bidens</i> spp.
Mānele	Indigenous	<i>Sapindus saponaria</i> L.
Nanea	Indigenous	<i>Vigna marina</i> (J. Burm.) Merr.
Pōhinahina	Indigenous	<i>Vitex rotundifolia</i> L. f.
'Ūlei	Indigenous	<i>Osteomeles anthyllidifolia</i> (Sm.) Lindl.

Notes:

1. In addition to the plants listed above, photographs of the orange-colored subspecies of koki'o 'ula'ula (*Hibiscus kokiio* Hillebr. subspecies *saintjohnianus*) and moa (*Psilotum nudum* (L.) Griseb.) also have been included.
2. Problems in propagation and cultivation of 'ena'ena and pōhuehue have been reported.

Photo Credits

Heidi Bornhorst (Mānele), Glen Fukunaga (Moa), Suzan Harada (*Hibiscus kokiio* Hillebr. subspecies *saintjohnianus*), Burt Lum (Ūlei), Kenneth Nagata ('A'ali'i, 'Ena'ena, Ko'oko'olau), and Ray Tabata ('Ākia, Alahe'e, Koki'o ke'oke'o, Nanea, Pōhinahina).

'A'ali'i

SCIENTIFIC NAME: *Dodonaea viscosa* Jacq.

FAMILY: Soapberry

DESCRIPTION: Many-branched trees or shrubs 6-30 feet tall with dark brown, finely-fissured bark and hard, heavy wood. Leaves resinous when young, varying in shape, elliptic, spoon-shaped, lance-shaped or reverse lance-shaped, and pointed or blunt at the tip. Flowers unisexual, reddish, inconspicuous, are borne in terminal clusters. Pink, red, red-purple, yellowish-green or straw-colored fruit are papery capsules with 2 to 4 wings.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Indigenous to all the main islands except Kaho'olawe, 'A'ali'i inhabits a wide range of habitats including lava fields, exposed ridge crests, dry, semi-dry to wet forests and from sea level to nearly 8,000 feet elevation. 'A'ali'i is an extremely variable species which was once spilt into four species and about 35 varieties and forms. Hawaiians used the wood for house posts and spears. Its leaves and flowers were used for medicine. The colorful capsules are used in lei.

HORTICULTURAL/LANDSCAPE USE: Given abundant sunlight 'a'ali'i will grow well. It can be planted in close proximity to other plants. 'A'ali'i is quick-growing and can attain a height of 5 to 7 feet in a few years. Although it is drought-tolerant 'a'ali'i will shed its leaves and become unattractive during periods of extreme drought. 'A'ali'i can be used as a filler, specimen, accent or hedge plant.

CARE AND MAINTENANCE: Easily cultivated and pruned, 'a'ali'i does not have any significant insect pests.

PROPAGATION: 'A'ali'i is easily propagated from seed. Soak the seed in hot water overnight to enhance germination.

WATER REQUIREMENTS: Moderate to light.

PLACES WHERE SPECIMENS CAN BE SEEN:

- O'ahu: Ka Papa Lo'i o Kānewai, Waikīkī Aquarium, Lanipō Trail, Hālawa Xeriscape Garden, Waimea Arboretum and Botanical Garden
- Kaua'i: Waimea Canyon Road, Kōke'e
- Maui: Maui Zoo, Haleakalā National Park
- Hawai'i: Kīpukanēnē and Hilina Pali in Hawai'i Volcanoes National Park, Waimea, Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden

'Ākia

SCIENTIFIC NAME: *Wikstroemia uva-ursi* A. Gray

FAMILY: 'Ākia

DESCRIPTION: Dense, spreading or sprawling shrubs up to 4 feet tall. Leaves pale green, leathery, oval, elliptic or orbicular, are oppositely arranged along the stem. Flowers are small, tubular, yellow or greenish-yellow, borne in small terminal or axillary clusters. Fruits are juicy, red, ellipsoid, and approximately 0.4 inches long.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Twelve species of *Wikstroemia* are endemic to Hawai'i. *Wikstroemia uva-ursi* is endemic to the arid lowlands and foothills of Kaua'i, O'ahu, Maui, and Moloka'i. The fiber from various species of *Wikstroemia* has been used for making cordage. Other species of *Wikstroemia* have been used for making medicine and stupifying fish.

HORTICULTURAL/LANDSCAPE USE: *Wikstroemia uva-ursi* has been used effectively as a high ground cover or border planting in public parks, commercial landscaping, and private gardens. It requires full sun. Although it grows best in coastal or hot lowland areas, it also will grow well almost anywhere. When planted on top of a slope, 'ākia will cascade with its deep roots stabilizing the soil. Since it tolerates salt, drought, and wind, it is an excellent plant for xeriscapes.

Wikstroemia uva-ursi may be toxic although no cases of poisoning have been reported to the Poison Center. In Hawai'i, only the toxicity of *Wikstroemia pulcherrima* Skotts. has been studied extensively by Dr. Frank Tabrah. *W. pulcherrima* has caused mice to go to sleep. The toxicity of *W. pulcherrima* varies from high to zero toxicity even in the same plant at different times. Many people have eaten the berries for years without ill effects.

CARE AND MAINTENANCE: This 'ākia requires little care and grows well under cultivation; including pruning. More vigorous growth may be encouraged by occasional drenching with ocean water. No serious insect pests are known.

PROPAGATION: Seeds germinate within a month. Propagation by cuttings can be enhanced with the use of a rooting hormone.

WATER REQUIREMENTS: Moderate to low.

PLACES WHERE SPECIMENS CAN BE SEEN:

O'ahu: Bishop Museum; Queen Lili'uokalani Statue, State Capitol; Ala Moana Park, Lyon Arboretum, near Kapi'olani Park fountain on Kalākaua Avenue, Honolulu Zoo, Waikīkī Aquarium, Hālawā Xeriscape Garden, Waimea Arboretum and Botanical Garden

Kaua'i: National Tropical Botanical Garden at Lāwā'i Maui: Maui Zoo

Hawai'i: Sadie Seymour Botanical Garden

February 10, 1993

Alahe'e

SCIENTIFIC NAME: *Canthium odoratum* (G. Forster) Seem.

FAMILY: Coffee

DESCRIPTION: Shrubs or small to medium-sized trees usually 10-20 feet tall, rarely exceeding 50 feet. Gray or whitish trunk and small, glossy, dark green leaves. Flowers white, fragrant, in small, dense clusters in the axils of the leaves. Fruits obovoid, juicy, about 0.2 inches long, black when ripe.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Indigenous to lowlands and dry to semi-dry forests on all islands except Kaho'olawe and Ni'ihau. Hawaiians used the hard wood for digging sticks and extracted a black dye from the leaves.

HORTICULTURAL/LANDSCAPE USE: Alahe'e is an attractive shrub; occasionally used in commercial landscaping. Although slow growing during the seedling and sapling stages, it would be an attractive addition to any garden. Several alahe'e can be grouped closely together and thinned out as they begin to crowd each other. Although alahe'e requires full sun and is well-suited for coastal or hot, lowland areas, it also will grow well in wetter mauka environments. Its dark, glossy-green leaves and white flowers superficially resemble those of mock orange.

CARE AND MAINTENANCE: Alahe'e grows well in cultivation but is susceptible to green coffee scale and coffee twig borers.

PROPAGATION: Alahe'e is easily propagated from seed. Finding good seed may be difficult since the fruits are often attacked by a boring insect.

WATER REQUIREMENTS: Moderate

PLACES WHERE SPECIMENS CAN BE SEEN:

- O'ahu: Bishop Museum, Lyon Arboretum, Waimea Arboretum and Botanical Garden, 'Aiea Loop Trail, talus slopes between Ka'ena Point and Mokolē'ia
- Kaua'i: National Tropical Botanical Garden at Lāwa'i
- Hawai'i: Palani Road mauka of Queen Ka'ahumanu Highway and Kailua-Kona, Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden

'Ena'ena

SCIENTIFIC NAME: *Gnaphalium sandwicense* Gaud.

FAMILY: Sunflower

DESCRIPTION: Highly variable, unbranched or many-branched, perennial, often fragrant or resinous-smelling herb 4-25 inches tall. Stems are erect or creeping, olive-green, gray or white, moderately or densely hairy. Leaves are narrow or broad spoon-shaped, moderately or densely hairy, with lower leaves often forming a rosette. Flower heads are in dense terminal clusters.

BOTANICAL OR ETHNOBOTANICAL INTEREST: 'Ena'ena is an extremely variable species. Four varieties are currently recognized because of their distinct plant stature, density of hairs, shape of leaves, and size and color of flower heads. 'Ena'ena is endemic to mostly dry regions on all the main islands except Kaho'olawe from sea level to 9,000 feet elevation. It can be found on sand dunes and coastal habitats to high elevation lava fields. The dried fragrant leaves were stored with feather standards, kāhili, to repel insects.

HORTICULTURAL/LANDSCAPE USE: 'Ena'ena can be used wherever a small plant with silvery or gray foliage is desirable. Varieties range from a tall herb with a few upright stems to a smaller, denser rosette-form. The different varieties offer options for meeting specific landscape requirements. All varieties are suitable for rock gardens and xeriscapes.

CARE AND MAINTENANCE: 'Ena'ena requires abundant sunshine and good drainage. It is best suited for coastal or lowland areas and will do poorly in cloudy, wet, mauka areas. A root fungus may attack 'ena'ena. Consult a local garden shop for an appropriate fungicide. The Painted Lady Butterfly caterpillar may also be a pest. Hand-remove the caterpillars.

PROPAGATION: 'Ena'ena is easily propagated from green wood tip cuttings.

WATER REQUIREMENTS: Moderate to light

PLACES WHERE SPECIMENS CAN BE SEEN:

O'ahu: *Gnaphalium sandwicense* Gaud. var. *sandwicense*, coastal sites between Waimānalo and Hanauma Bay

Kaua'i: National Tropical Botanical Garden at Lāwa'i

Hawai'i: Saddle Road near Pōhakuloa, Sadie Seymour Botanical Garden



'A'ali'i
Dodonaea viscosa Jacq.



'Ākia
Wikstroemia uva-ursi A. Gray



Alahe'e
Canthium odoratum (G. Forster) Seem.



'Ena'ena
Gnaphalium sandwicense Gaud.

Koki'o ke'oke'o

SCIENTIFIC NAME: *Hibiscus arnottianus* A. Gray

FAMILY: Hibiscus or mallow

DESCRIPTION: Shrubs or small trees rarely 40 feet tall. Canopy spread 6-30 feet. Leaves narrow to broad heart-shaped, smooth or densely hairy on their lower surface. Flowers slightly fragrant, white, rarely tinted with red. The staminal column is usually red, rarely white.

BOTANICAL OR ETHNOBOTANICAL INTEREST: *Hibiscus arnottianus* is endemic to the Ko'olau and Wai'anae Mountains, O'ahu; and Wailau, Waihānau, and Pāpalaua Valleys, Moloka'i. *Hibiscus arnottianus* plants from the Ko'olau Mountains have flowers which are typically white with a red staminal column and leaves with green veins. *Hibiscus arnottianus* plants from the Wai'anae Mountains have flowers which are slightly smaller often with reddish streaks and leaves with red veins. While those from Moloka'i are very rare and have pure white flowers with a white staminal column.

HORTICULTURAL/LANDSCAPE USE: Koki'o ke'oke'o will ultimately become a small to medium size tree. It is a slow grower and will remain a shrub for many years. Koki'o ke'oke'o with its large, white flowers is a spectacular shrub during its flowering season. It can be used as an accent shrub or background planting. It requires full sun and will probably grow well even in coastal areas. It can be pruned and trained into an informal hedge.

CARE AND MAINTENANCE: No special care is required. It has no significant insect pests or diseases although Chinese rose beetles and white flies may cause minor damage.

PROPAGATION: Rooting terminal cuttings is recommended. *Hibiscus arnottianus* also can be propagated by air-layering or grafting onto other *Hibiscus* species. Seeds will germinate but seedlings are slow-growing.

WATER REQUIREMENTS: Moderate.

PLACES WHERE SPECIMENS CAN BE SEEN:

- O'ahu: Moanalua Gardens, Bishop Museum, Kawaia Ha'o Plaza, Lyon Arboretum, Mānoa Cliffs Trail, upper part of Niu Valley stream, Wahiawā Botanic Gardens, Hālawa Xeriscape Garden, Waimea Arboretum and Botanical Garden
- Kaua'i: National Tropical Botanical Garden at Lāwa'i
- Maui: Maui Zoo
- Hawai'i: Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden

Ko'oko'olau

SCIENTIFIC NAME: *Bidens sandvicensis* Less.
Bidens torta Sherff
Bidens hillebrandiana (Drake) Degener
Bidens mauiensis (A. Gray) Sherff
Bidens menziesii subsp. *filiformis* (Sherff) Ganders & Nagata

FAMILY: Sunflower

DESCRIPTION: Highly variable annual or perennial herbs or shrubs 4 inches to nearly 15 feet tall. Leaves simple or compound, the leaflets leathery, papery or succulent, smooth-edged, toothed or lobed. Flower heads are solitary or, more often, in few to many-flowered terminal clusters. Flower heads 0.5-3.0 inches in diameter, consisting of 8-100 disc florets and 3-20 yellow ray florets. Fruits, achenes, are brown, gray or black, slender, twisted, coiled or winged. Unlike its mainland relatives, endemic *Bidens* species are barbless.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Nineteen species and 8 subspecies of ko'oko'olau are endemic to Hawai'i. Half are endemic to single islands and half are found on two or three islands. Some species are fairly common and a few are restricted to small populations. *Bidens micrantha* Gaud. ssp. *kalealaha* Nagata & Ganders will be designated as endangered species by Federal and State laws, joining *Bidens molokaiensis* (Hillebr.) Sherff. The leaves of some species were used for medicinal tea by Hawaiians.

HORTICULTURAL/LANDSCAPE USE: Do not transport and cultivate *Bidens* not endemic to an island to prevent the possibility of accidental cross-pollination. The following species are recommended for specific islands:

Bidens sandvicensis Less.: Kaua'i and O'ahu. Upright, bushy shrubs 1.5-3.0 feet tall. Leaves compound, the leaflets extremely variable in shape. Flower heads 1.0-2.0 inches in diameter, in few to many-flowered clusters. One of the most variable of all native ko'oko'olau. Native to semi-dry forests, foothills, and lowland ridges. Use as a low ornamental.

Bidens torta Sherff: O'ahu. Upright, bushy or rarely tree-like shrubs 1.0-8.0 feet tall with horizontal to ascending side branches. Leaves compound. Flower heads 0.75-1.5 inches in diameter, are grouped in many-flowered clusters on side branches. Achenes are twisted or coiled. Found mostly in dry forests but also in wet forests and bogs. Use as an accent plant.

Bidens hillebrandiana (Drake) Degener: Moloka'i and Maui. Sprawling perennial herbs 6-12 inches tall with succulent, compound or rarely simple leaves. Flower heads 0.75-1.0 inches in diameter are solitary or in few to several-flowered terminal clusters. A coastal species found on sea cliffs. Use as a ground cover or in rock gardens.

Bidens mauiensis (A. Gray) Sherff: Lānai and Maui. Sprawling perennial herbs 4-12 inches tall with leathery or succulent, simple or compound leaves. Flower heads 1.0-2.0 inches in diameter are solitary on a stalk up to 10 inches long. Native to coastal sites in rocky or sandy substrates. Use as a ground cover or in rock gardens.

Bidens menziesii subsp. *filiformis* (Sherff) Ganders & Nagata: Hawai'i. Upright shrubs 2-12 inches tall with slender, willow-like compound leaves and ascending stems. Flower heads are small but numerous in large clusters. Native to the high elevation semi-desert lava fields of Mauna Loa and Mauna Kea and in the saddle between the two mountains. Use as an accent shrub.

CARE AND MAINTENANCE: Most ko'oko'olau are easily cultivated. All of the recommended species require abundant sunshine. Coastal species are tolerant of saline conditions and wind and need more porous soils than upland species. No significant insect pests or diseases are known. *Bidens* can be mass planted and even crowded to some extent.

PROPAGATION: All *Bidens* can be easily grown from seeds. Seedlings grow quickly and can be brought to flower during the first season. Most can also be grown from terminal cuttings. Use a rooting hormone to enhance success.

WATER REQUIREMENTS: Light to moderate.

PLACES WHERE SPECIMENS CAN BE SEEN:

- O'ahu: Lyon Arboretum, Ka'ena Point Satellite Tracking Station and adjacent ridges, Waimea Arboretum and Botanical Garden
- Kaua'i: National Tropical Botanical Garden at Lāwa'i
- Hawai'i: Sadie Seymour Botanical Garden

Mānele

SCIENTIFIC NAME: *Sapindus saponaria* L.

FAMILY: Soapberry

DESCRIPTION: Small to large deciduous trees up to 80 feet tall. Mature trees are characterized by bark which becomes finely fissured and falling in large pieces and exposing a smooth, dark, underlying layer. Leaves compound with 3-6 pairs of leaflets are often hairy on the undersides. The central stalk of the young leaves is winged. Flowers are insignificant, in terminal or lateral clusters. Fruits globose, shiny brown, about 0.75 inches in diameter, containing a single, round, black to reddish-brown seed.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Mānele is indigenous to the middle forest zone of Hualālai, Mauna Loa, and Kīlauea on the island of Hawai'i. It is a highly variable species with respect to leaflet number, the size of the wings of the leaf stalk, flower size, and fruit size. The seeds are used in lei and other seed jewelry in Hawai'i. In other parts of the world the wood is used in carpentry, the leaves and roots are used medicinally, the crushed seeds as fish poison and insecticide, and the fruits as a substitute for soap.

HORTICULTURAL/LANDSCAPE USE: Mānele is an attractive, quick-growing tree with a fairly compact crown. It can be used as a specimen or shade tree and is especially effective in grove plantings.

The fruit was once used like soap by local kids. The fruit contains a saponin which may cause gastroenteritis if eaten or dermatitis upon contact with your skin. Actual poisonings are rare.

CARE AND MAINTENANCE: Mānele will grow well in poorly-drained soils. Coffee twig borers are known to damage mānele.

PROPAGATION: Propagation is by seed. Scarifying seeds will enhance germination.

WATER REQUIREMENTS: Moderate.

PLACES WHERE SPECIMENS CAN BE SEEN:

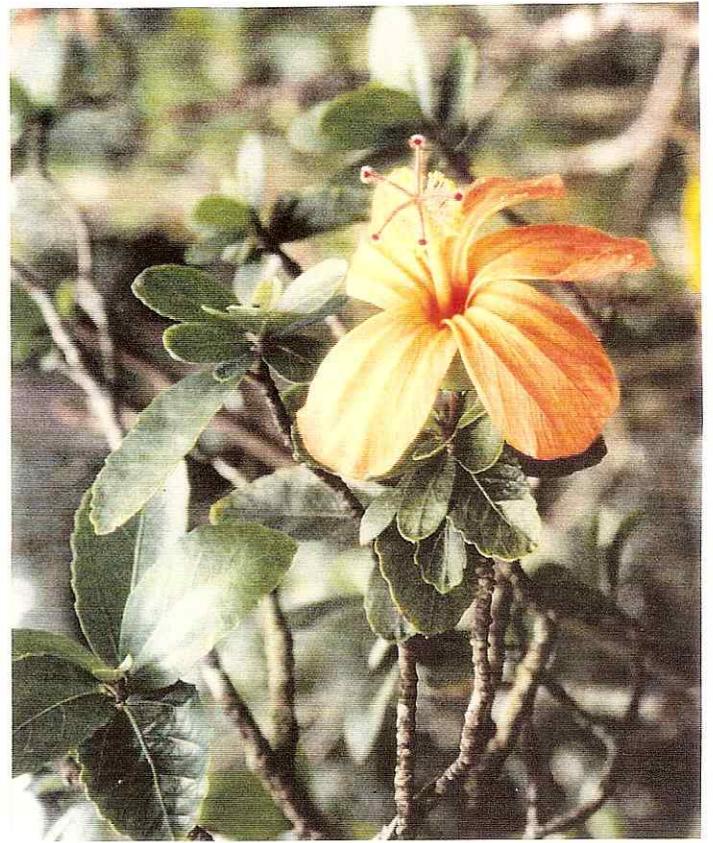
O'ahu: Bishop Museum, Ala Moana Park, Lyon Arboretum, Waimea Arboretum and Botanical Garden, Hālawā Xeriscape Garden

Kaua'i: National Tropical Botanical Garden at Lāwa'i, Keāhua Forestry Arboretum

Hawai'i: Kīpukapuāulu, Volcanoes National Park; Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden



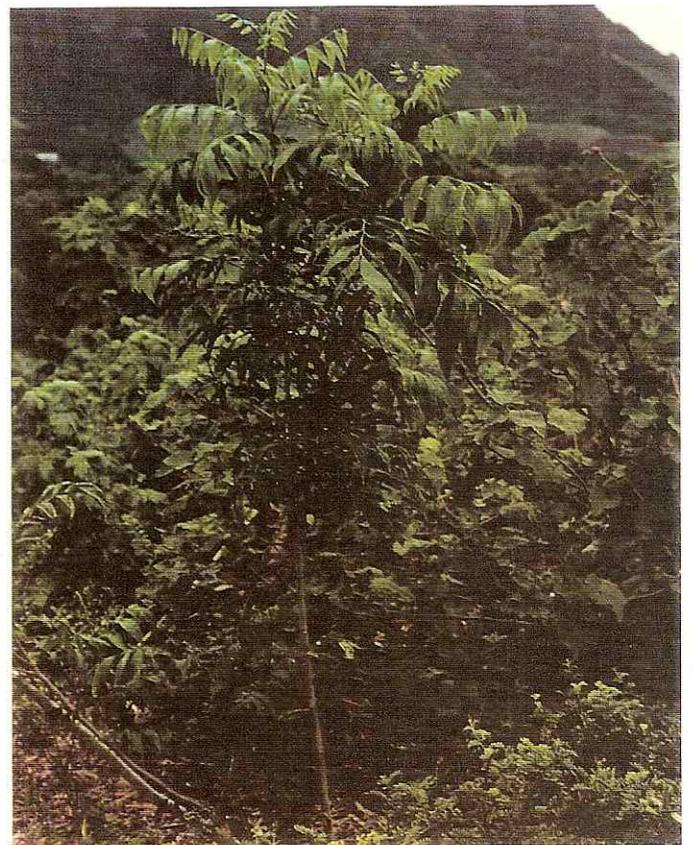
Koki'o ke'oke'o
Hibiscus arnottianus A. Gray



Koki'o 'ula'ula
Hibiscus kokio Hillebr. subspecies *saintjohnianus*



Ko'oko'olau
Bidens spp.



Mānele
Sapindus saponaria L.

Nanea

SCIENTIFIC NAME: *Vigna marina* (J. Burm.) Merr.

FAMILY: Pea

DESCRIPTION: Creeping or climbing vine with sparsely to densely hairy stems several feet long. Leaves consists of 3 oval, broadly elliptic or reverse-oval leaflets. Flowers are greenish when young becoming yellow with age, 0.5-0.75 inches long, borne in erect spikes, and emerging from leaf axils. Seed pods 1-2.5 inches long, containing 2-10 yellowish or reddish brown seeds.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Nanea is indigenous to the coastal regions in Hawai'i and other tropical areas. Frequently found on sandy beaches, it grows along with other common plants such as naupaka kahakai and pōhuehue.

HORTICULTURAL/LANDSCAPE USE: Nanea is well-suited for sunny, exposed, rocky or sandy coastal areas. It also will grow well in mauka areas with full sun and good drainage. It can be used as an accent plant in a rock garden or as a ground cover. Nanea should be planted over a mulch of cinder, coral chips or sand since it is not a dense ground cover.

CARE AND MAINTENANCE: Nanea is easily cultivated in areas with full sun and good drainage. No special care is required and no serious insect pests are known.

PROPAGATION: Nanea is easily grown from seeds. Soaking the seeds in water overnight enhances germination which should occur in 6 days. Seedlings grow quickly.

WATER REQUIREMENTS: Moderate to light.

PLACES WHERE SPECIMENS CAN BE SEEN:

- O'ahu: Bishop Museum, Waimea Arboretum and Botanical Garden, North Shore between Pounders Beach and Kahuku, Kahana Bay
- Kaua'i: National Tropical Botanical Garden at Lāwa'i
- Hawai'i: Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden

Pōhinahina

Beach Vitex

SCIENTIFIC NAME: *Vitex rotundifolia* L. f.

FAMILY: Verbena

DESCRIPTION: Low-growing, mat-forming shrubs 1-3 feet tall with long, trailing stems. Leaves silvery-green and aromatic when bruised. Flowers are blue and occur in small clusters at the branch tips.

BOTANICAL OR ETHNOBOTANICAL INTEREST: Pōhinahina is indigenous to coastal areas of all the main islands except Kaho'olawe. It was used medicinally in ancient times.

HORTICULTURAL/LANDSCAPE USE: Pōhinahina can be used as a high groundcover in sunny, coastal areas. It will cover extensive areas including moderate slopes and rocky areas. Adapted to calcareous soils and salty conditions, it also will grow well in mauka areas with full sun and good drainage. It is an excellent choice for xeriscapes and an effective beach sand stabilizer.

CARE AND MAINTENANCE: Pōhinahina is one of the easiest native plants to cultivate. It roots easily and forms a dense mat which does not require mulching and weeding once it is well established. No serious insect pests or diseases are known.

PROPAGATION: Pōhinahina is easily propagated by seeds or cuttings. The rooting of tip cuttings can be encouraged with a rooting hormone.

WATER REQUIREMENTS: Moderate to light.

PLACES WHERE SPECIMENS CAN BE SEEN:

- O'ahu: Bishop Museum, Waikīkī Aquarium, Ka Papa Lo'i o Kānewai, shoreline between Makapu'u and Waimānalo, Waimea Arboretum and Botanical Garden, shoreline between Mokulē'ia and Ka'ena Point
- Kaua'i: National Tropical Botanical Garden at Lāwa'i
- Hawai'i: Sadie Seymour Botanical Garden

February 10, 1993

'Ūlei

SCIENTIFIC NAME: *Osteomeles anthyllidifolia* (Sm.) Lindl.

FAMILY: Rose

DESCRIPTION: Low, rambling shrub about 2 feet tall with arching or sprawling stems, or more rarely, an upright tree-like shrub up to 10 feet tall. Stems long, gray, very resilient. Leaves 1-3 inches long, with numerous dark-green, shiny leaflets that are hairy on the undersides. Flowers white, in loose terminal clusters. Fruits white, sometimes tinted with pink, juicy, subglobose, about 0.5 inches in diameter, usually containing 5 hard seeds.

BOTANICAL OR ETHNOBOTANICAL INTEREST: 'Ūlei is indigenous to Hawai'i. It occurs in a wide range of habitats from sea level to 7,500 feet elevation in dry to semi-dry forests, on exposed ridges and foothills in semi-dry regions, in lava fields and on coastal cliffs. Its tough, resilient stems were made into hoops for fishnets. Its strong wood was made into digging sticks, weapons, and the musical instrument, 'ūkēkē.

HORTICULTURAL/LANDSCAPE USE: 'Ūlei is a dense, sprawling, mat-forming shrub which can be used as a filler in rocky sites. It is a slow grower taking several years to grow as many feet. It can be trained by constant pruning into a hedge up to 4 feet tall or an erect shrub. Adapted for exposed conditions 'ūlei will tolerate strong winds and a fair amount of salt spray.

CARE AND MAINTENANCE: 'Ūlei requires good drainage and full sun but will tolerate bright shade. Do not over-water or over-fertilize 'ūlei since it is slow-growing. No significant insect pests or diseases are known.

PROPAGATION: Propagation is from seed. Germination rate is about 50%.

WATER REQUIREMENTS: Moderate to light.

PLACES WHERE SPECIMENS CAN BE SEEN:

- | | |
|----------|--|
| O'ahu: | Kamehameha Schools, Punahou School, Lyon Arboretum, Lanipō Trail, Waimea Arboretum and Botanical Garden, Punalu'u side of Kahana Bay |
| Kaua'i: | National Tropical Botanical Garden at Lāwa'i |
| Hawai'i: | Amy B. H. Greenwell Ethnobotanical Garden, Sadie Seymour Botanical Garden, Hāpuna Beach parking lot |



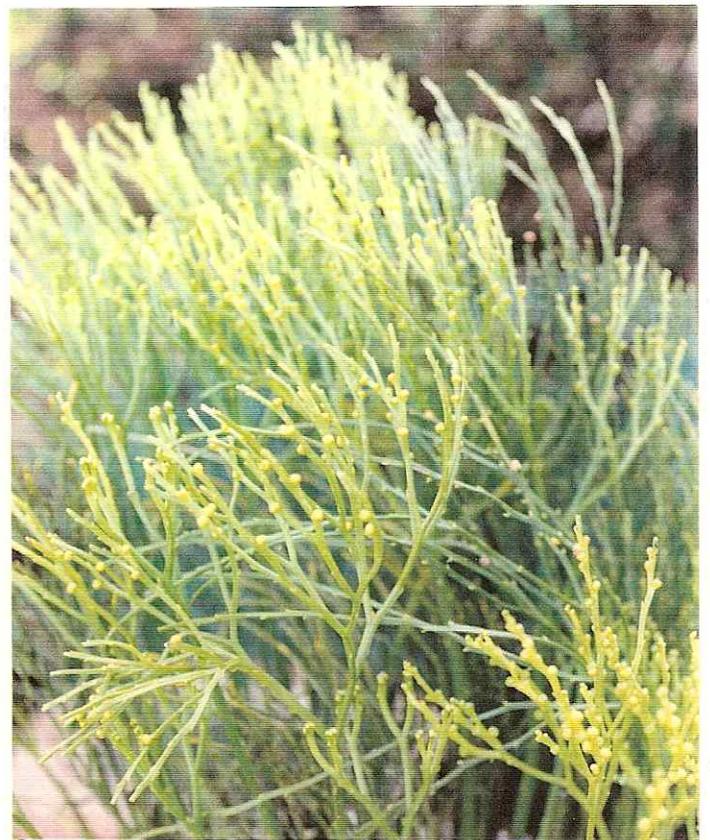
Nanea
Vigna marina (J. Burm.) Merr.



Pōhinahina
Vitex rotundifolia L. f.



'Ūlei
Osteomeles anthyllidifolia (Sm.) Lindl.



Moa
Psilotum nudum (L.) Griseb.
Not described in this handbook, this native plant is more primitive than ferns. It often appears as a volunteer in urban gardens and is easily transplanted.