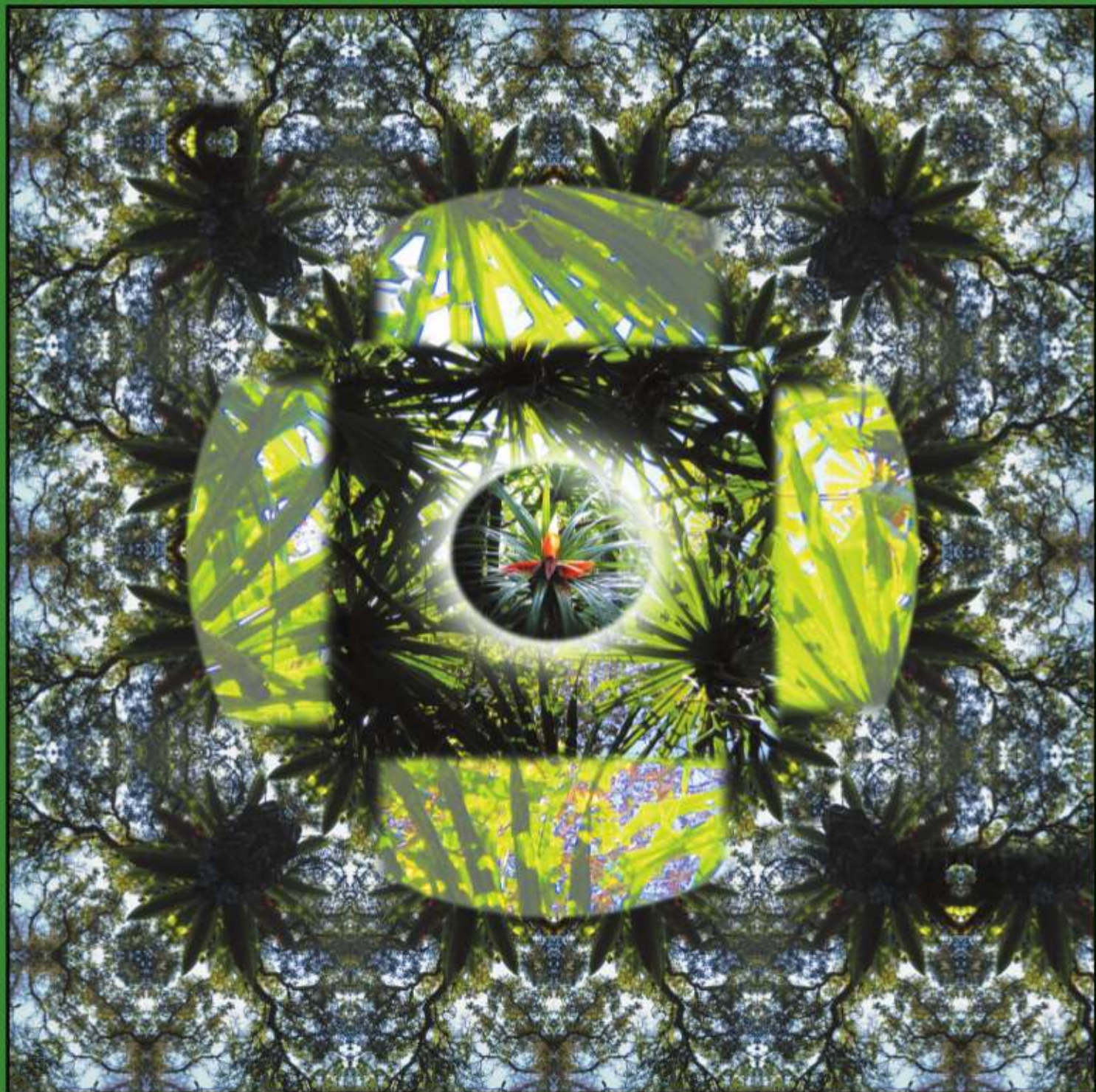


Hawai'i Plant World Essentials

A Guide to Wise Plant Choices



Jaya C. Dupuis

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Photography by author

Aloha,

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Mahalo Nui Loa!

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Table of Contents

1. Acknowledgments:.....	5
2. Preface	6
3. Introduction.....	9
4. Plant Distinctions	12
5. Plant Identification	16
Most common plant species	
A. Native Plant Species	18
1. Flowering plants.....	18
2. Rare Plants (or uncommon in lowland)	30
3. Fern and Fern Allies	38
B. Polynesian-introduced Species	46
C. Invasive Species	56
6. Control of Invasive Species	70
7. Treatment Solutions and Methods	74

Stands in Brilliant Composition

Stands in brilliant composition

The green growth entwined, by branch and by root

Forest pockets proclaim themselves in plain view

Uttering an ancient essence, and origin beyond human

A fragile glimpse, that in itself supersedes strife

A niche not nebulous to those embraced

Shaded in an order of diminishing grandeur

Far into the moss covered bottoms

So lovely is apportioned the diversity of lives

Beyond the appetite of impenetrable invasions

Lasting remains in lingering potency

Hover, between the likely, and the possible

C. J. Dupuis



Acknowledgments:

I offer my deepest appreciation to beloved family members and forest friends, who have shown enduring encouragement and support throughout my years of study and dedication to native lowland vegetation communities in Hawai'i. I give special thanks to Ann Kobsa, a treasured friend, mentor and most dedicated ally of native lowland vegetation species, for her kind generosity and support on 'all' levels, including the editing of this book. Sincere thanks to Jon Rathbun as well for his many contributions to the forest and to the book's development. *Mahalo nui loa*, much thanks, to all the wonderful volunteers who have contributed time and *Aloha* toward the restoration of our last remaining Hawaiian native lowland rainforest.

Preface

Born in North Ontario Canada, Jaya C. Dupuis has been developing a small subsistence farm on the Big Island of Hawai'i since 1989. Out of a particular interest in the conservation of remaining native forests and plant species in Hawai'i, Jaya obtained a master's degree in Tropical Conservation Biology and Environmental Science at the Hilo University of Hawai'i in 2012. To better understand lowland wet forests of East Hawai'i and the effect of invasive species throughout the region, Jaya's research took a landscape-level approach, surveying plant cover across five lowland Puna District Forest Reserves. This research examined plant distribution patterns for the development of effective restoration measures in remaining native plant communities of Hawai'i.

In June of 2014, Jaya launched Keau 'ohana Native Rainforest Restoration(KNRR), an intensive restoration project in the Keau'ohana Forest Reserve of East Hawai'i. The project strives to systematically control invasive species and propagate native species on over 30 acres in what is the largest and most intact biodiverse native lowland rainforest remaining below 1,000 feet in elevation in the State of Hawai'i. This project operates through the environmental nonprofit Malama O Puna, based in Pahoa town. It has thus far been supported by the State Legislature (Grant-in-Aid) through appropriations made by the Department of Land and Natural Resources; county contingency funds and other private donations have also been awarded. Community volunteer support has contributed a great deal to restoration efforts in Keau'ohana, as KNRR coordinates quarterly volunteer events and hands-on educational opportunity in the forest with many school groups and community member. The Keau'ohana Native Rainforest Restoration Project has greatly expanded upon community volunteer service events, offering school groups hands-on educational opportunities as well.



In developing this manual, Jaya's hope is to promote awareness of low elevation vegetation, to inspire the appreciation and re-integration of native species into our lowland environment for esthetic and natural history purposes, as well as to support the control of introduced species that threaten native forest integrity and environmental balance in general.

This guide offers a practical and fundamental approach to helping landowners and local

residents make informed decisions about plant control and propagation choices in Hawai'i. Despite some plant variations, the information provided in this booklet can generally be helpful to landscapes across the Hawaiian Islands. It offers simple direction to local community members interested in learning about Hawai'i's lowland native plant species and rainforests, and intends to support their restoration and conservation.

As we continue to lose many native ecosystems to urbanization, agriculture, and invasive species in Hawai'i, there is a growing need to restore and conserve a full range of native biodiversity and forest types across the entire elevation gradient. Though the process of invasion by exotic species at lower elevations cannot be entirely reversed, remaining native plant



species and communities can be supported in their re-establishment and resilience. With focused community awareness and intention, lowland vegetation communities, and the general lower elevation landscape, can be greatly improved in native biodiversity and ecosystem health.

Allow Us Ancestors

*Allow us ancestors, please
Bring special care
To this profound place*

*This profound place
Dwelling in the center
Of the great ocean*

*Of the great ocean
Allow us, rise into the heights
As each morning sun*

*As each morning sun
Spread the warm rays
Through to green forest floor*

*Through to green forest floor
Where our roots may gather
And tender shoots prosper*

*And tender shoots prosper
To towering tree
The air we breathe*

*The air we breathe
Allow us, attain ancestral insight
With wisdom to welcome*

*With wisdom to welcome
The joyful and Godly realms
Upon this earth*

Ho'oku'u Kākou

*'Olu'olu, ho'oku'u kākou
E hō mai mea I wae 'ia malama
Iō keia, hohonu wahi*

*Iō keia hohonu wahi
E noho I ka piko
O ka moana nui loa*

*O ka moana nui loa
Ho'oku'u kākou e ala I loko nā
Me kēlā mea kēia mea kakahiaka lā*

*Me kēlā mea kēia mea kakahiaka lā
Laha mahana nā wana
Ma ia ma'o nā ulu lā'au papa*

*Ma ia ma'o nā ulu lā'au papa
Ai hea ko kākou a'a paha hui
A me palupalu pana ho'owainai*

*A me palupalu pana ho'owainai
'Ia 'ale'o kumu lā'au
Ka papalani hanu kākou*

*Ka papalani hanu kākou
Ho'oku'u kākou, kū ike kūhohonu o nā kupuna
Me ka na'auo ia heahea mai*

*Me ka na'auo i heahea mai
Nā hau'oli a me ke akua aupuni ao
Maluna kēia honua*

C. J. Dupuis

Introduction

If we know Hawai'i's landscape history, we understand how the massive mountain slopes of Mauna Kea and Mauna Loa have been utterly denuded, largely by feral ungulates. An onslaught of invasive weeds has only exacerbated the environmental damage. Once the land was covered with native forests, ferns and flowers, carpeted with green mosses, bursting with life forms found nowhere else on the planet. Today many areas are a weedy mess of thorns and thickets, despite growing environmental awareness and restoration efforts island-wide.

As an isolated tropical archipelago, Hawai'i is home to over 1,000 native flowering plants, 90% of which are found nowhere else in the world. Yet on a day to day basis,



as people traverse the lower elevation landscape of Hawai'i, we do not have the privilege of seeing or enjoying many native species. Tourists, and even local residents, often assume that the exotic beauty we are surrounded by in Hawai'i is native. Very few native plant species are today scattered across Hawai'i's developed lowlands; and they are confined to increasingly compromised forest fragments. The most intact of these fragments is found in one of five Puna District Forest Reserves on the east side of the Big Island, Keau'ohana Forest Reserve, and only includes 30-35 acres of native biodiverse forest.

The damaging effects of certain post-contact animal and plant introductions on native forests and on the general lower elevation environment are well understood by few. There is a great difference between a forest that can sustain a biodiversity of life-forms and a forest that is depleted of richness and abundance, health and vitality. If some of the lowland forests are to be preserved, the public must become more aware of the vegetation dynamics that occur as a result of past and present practices.

Though finding solutions to invasive species problems is far from simple, among the most important measures to improving the situation are to increase public awareness and engagement. From that point, we as local community members can begin making the connection between our gardens and our forests, and taking a more conscious role in balancing our ongoing influence on the vegetation patterns. The choices that we make about which plants to propagate or control in our gardens have tremendous implications for the future of Hawai'i's environmental health and integrity. Our gardens, and therefore we as a people, are dependent on our local forest systems to draw in moisture from the clouds as they rise up the mountain slope. Our very survival requires this function of nature on a bioregional as well as global level. The connection between our forest and our belly has been missed, and this is a prominent factor in the dramatic climate fluctuations of our day. To help maintain the health of our native ecosystems is to ensure our own health as humans as well as that of many other living beings. The forest is our long-term sustenance; it is the air we breathe, the water we need to drink and to raise our food.

Remaining lowland wet forests of Hawai'i are today reservoirs of rare native biodiversity. It is a sacred responsibility to manage them as best we can, and this task is no longer possible without the concerted effort of people who reside on or visit these lands. Protection of this unique environment supports native communities, providing habitat for native bird species such as the 'amakihi, the 'apapane, and the Hawaiian hawk, and rare plant species, such as ha'iwaile (*Cyrtandra nanawaleensis*), which is largely restricted to lower Puna and federally listed as endangered. Its co-occurrence with rare species such as 'ohe (*Polyscias hawaiiensis*), ōpuhe (*Urera glabra*), 'ahakea (*Bohea timonioides*), and maua (*Xylosma hawaiiensis*) makes for a unique forest type. Aside from being aesthetically pleasing, native plants have many practical and cultural uses, as well as healing properties. By incorporating them into Hawai'i's lower elevation home gardens and general landscape, we honor the life-forms that have been in Hawai'i for millions of years before human arrival. Having an appreciation both of the history of this land's natural environment and of Hawaiian culture is fundamental to the experience of being in Hawai'i, of understanding and living 'Aloha'. It is a privilege to live in a place of such beauty! May we as lovers of Hawai'i's beauty, become conscientious stewards of its thriving natural environment.



Plant Distinctions

Clarifying the distinctions between *native*, *Polynesian-introduced*, *non-native*, and *invasive* plant species is key to preserving what little remains of Hawai'i's native lowland rainforests, and supporting the biodiversity and vitality of Hawai'i's low elevation landscape in general. A list of some of the more common lowland species found within these groups is provided in this manual, along with images to help with species identification.

Native plants comprise both endemic and indigenous species. They were not brought to Hawai'i by humans; other forces of nature such as the wind, ocean currents, and birds carried their seeds or propagules here. *Indigenous* plants are native to other places in addition to Hawai'i, but *endemic* plants exist nowhere else in the world. The Hawaiian Islands are unique regarding their endemic life because of their isolated location in the mid-Pacific Ocean. Because Hawai'i is so far removed from any continental mass, the relatively few species that did arrive on the Islands evolved over millions of years and speciated into countless new species we call endemic. With little competitive pressure, these species did not evolve to compete with the recently introduced, faster growing and better-



dispersed species. Native plants have tended to lose their defenses against predators, such as prickles and poisons, and they became more fragile and vulnerable. Today many Hawaiian endemic species have become extinct, and many more of them are endangered to become so. Endangered species are now strongly protected by the State and Federal Government, however there are many species of concern that are not yet listed or protected.

Polynesian-introduced plants, otherwise known as the ‘canoe plants’ (40 to 50 species), most of which are important to human survival and/or hold strong cultural value, arrived with the early Hawaiians as early as 300 A.D from Polynesia. Although most Polynesian plant introductions can be found in the wild, they have been relatively benign regarding their impact on the native plant communities.



Non-Native Introductions, also known as *exotic* or *alien* species, refers to all plants that were brought here by humans. Of well over 8,000 species introduced to the Hawaiian Islands since European contact, ~1,000 have become naturalized in the wild, but less than 100 of these are considered seriously invasive.

Invasive plants are introductions that are particularly aggressive, have a detrimental effect on native species, and have the potential to alter whole ecosystems. Many invasive species form monotypic stands (single species *vs* biodiverse), thereby decreasing biodiversity, a key component of a healthy ecosystem. They tend to replace rather than coexist with native species. Their effects on native plant communities include competition for water and nutrients, displacement through shading and seedling suppression, and toxicity to other species, called allelopathy. Invasive species are today a principal threat to native biodiversity throughout the Hawaiian Island chain.

Though present-day plant distribution patterns reflect a number of factors, the continual loss of habitat is a prominent threat to the survival of native species. Land conversion by agriculture and residential development is increasingly fragmenting the landscape and is rapidly degrading native plant communities. Numerous historical events have also impacted Hawai‘i’s ecosystems statewide. One example of this was a large scale out-planting of 948 exotic species into forest reserves between 1910 and 1960. Although



the purpose of this enterprise was to restore Hawai'i's deteriorating watersheds, it surely accelerated the spread of invasive species. Raising vast herds of cattle, and maintaining populations of feral ungulates over almost the entire Hawai'i landscape has had a devastating impact on native ecosystems. It is never too late for us to become accountable for our ancestors' mistakes, and for our current deficits in understanding and foresight regarding environmental choices.



Enduring Friendships

Where the forest floor finds

Delicate laces of fern

Drinking the moisture of moss

In golden hued shadows

Where magenta leaves of Kolea

Newly forming 'neath morning dew

Dance amid hala and hapu'u

To the slight breath of wind

Where the lovely lama

In gnarled and twisted reaches

And the spiraling 'ie'ie

Encounters always a greater 'ekaha

Where the thriving kopiko

Dwells below our beloved 'ohi'a

Splaying bright orange its berries

To root in regeneration

C. J. Dupuis

Plant Identification

The following lists and images provide a basic summary of some of the most common plant species found in lower elevation landscapes of Hawai'i. **Native** plants are classified into three categories. The first list represents native flowering plant species most commonly found in remaining native lowland wet forests, however individuals are sparsely scattered across the lowlands, apart from some of the most abundant species, such as the beloved native 'ōhi'a (*Metrosideros polymorpha*).

The second native category includes rare and endangered flowering species to encourage awareness and protection of them. It is ideal to report and to preserve these species when found. It is illegal to uproot, to take from a plant, or even to plant an endangered species without a written permit by the Division of Forestry and Wildlife/ Department of Land and Natural Resources.

One of the reasons for this is because of their limited seed and propagule availability. A plant specialist who understands the best propagation techniques and locations can help ensure the species' highest potential for re-establishment. Rare or uncommon species on the other hand, can be planted by anyone. To preserve the natural mix of genes indigenous to each area, seeds should be sourced as locally as possible. For many of our disappearing endemic plant species, cultivation will be the only path to survival into the future. It is a gift to be able to perpetuate a species that is in decline. The third native list which completes the native category, includes some of the more common ferns and fern allies.

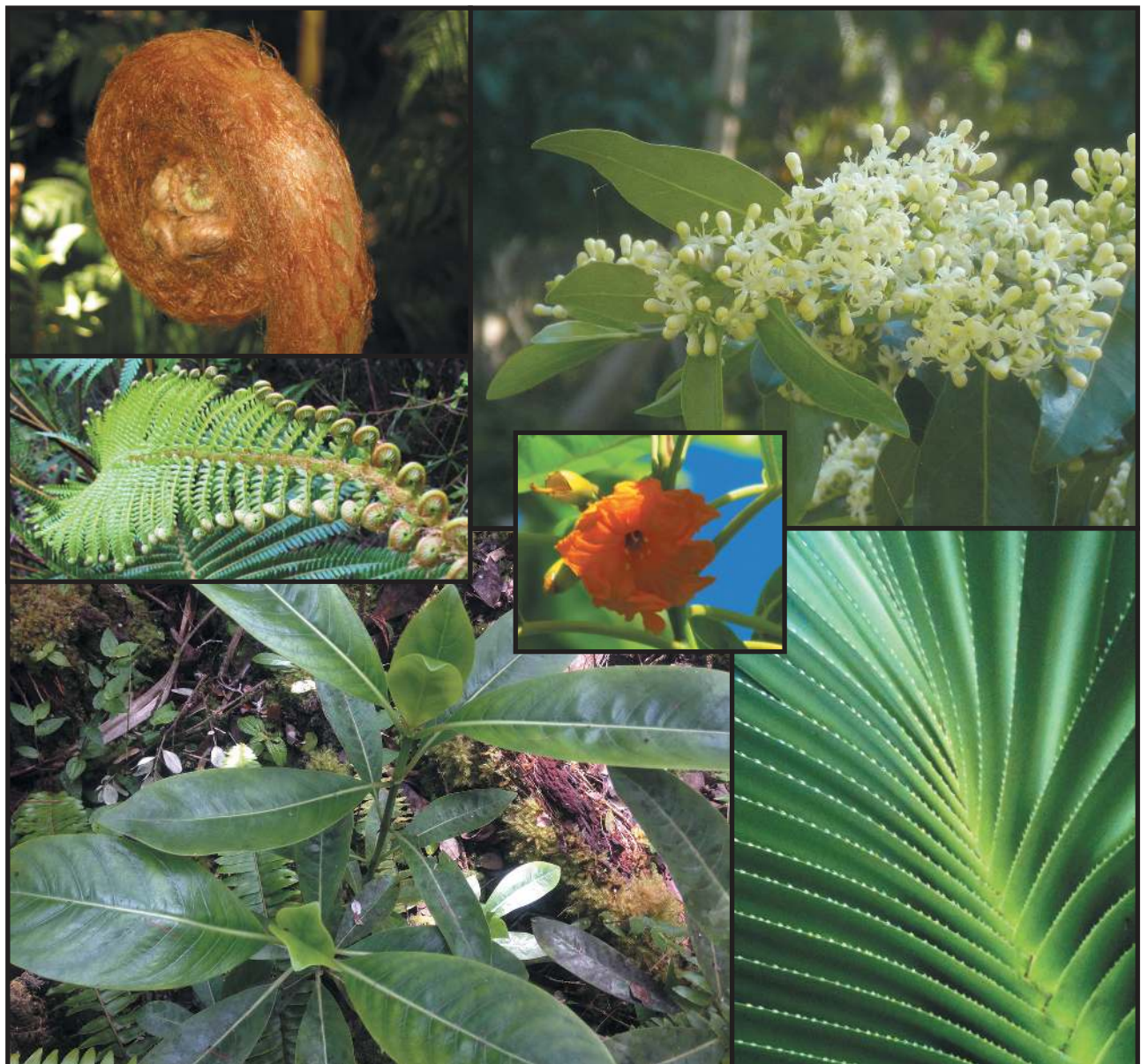


The more common **Polynesian-introduced** species distributed across the lower elevation landscape, and often found naturalized in the wild, are listed and portrayed next. These desirable subsistence plants are often mistaken for native species because they were brought in long ago by the Polynesian settlers, who in effect are the original, therefore native people of this land. The species they brought with them have been essential to human survival and culture since their time of arrival. They are thoroughly integrated into the local environment and, for the most part, coexist well with native plants. The kukui (*Aleurites moluccana*) and hau (*Hibiscus tiliaceus*) trees exhibit some invasive tendencies; the Polynesian yam (*Dioscorea pentaphylla*) and awapuhi (*Zingiber zerumbet*) may also disrupt native groundcover.

There are many common **non-native** species that co-exist relatively well with the native and Polynesian-introduced flora. In this manual our focus will be on the more threatening

invasive non-native plant introductions that make up a large part of our daily environment, and that threaten its native component and general balance. This constitutes the last of the plant categories represented in this book.

The following lists are ordered alphabetically according to the plant species' Hawaiian or common name, followed by the scientific name and family. All of the plant species listed herein are important to recognize, so that people can make informed plant propagation and control decisions in their home environment. Despite some plant variations, this guide can be of general use for people residing on the windward sides of all the main Hawaiian Islands. Choosing the right plants to grow in Hawai'i becomes more important with every new day. Informing the tourist population accurately about Hawai'i plant world essentials is a very important responsibility in terms of fostering the health of our islands.

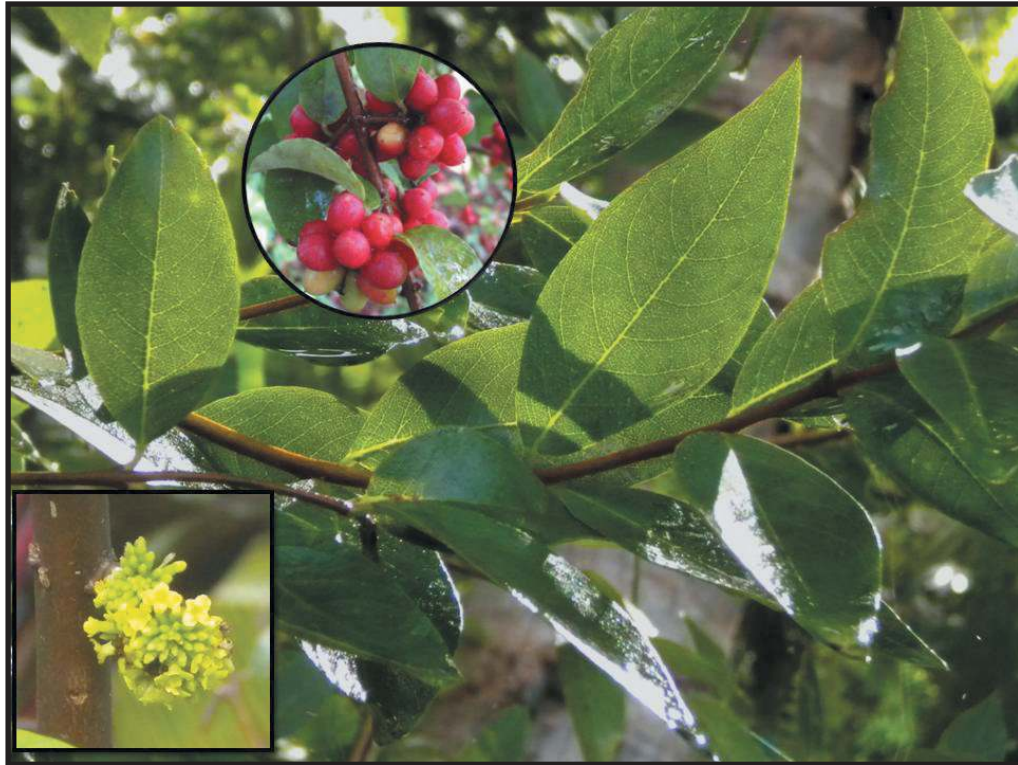


A. Native Plant Species

1. Flowering plants:

Endemic (e) / Indigenous (i)

	<u>Common Name</u>	<u>Genus</u>	<u>Species</u>	<u>Family</u>
1.	‘Ākia (e)	<i>Wikstroemia</i>	<i>sandwicensis</i>	Thymelaeaceae
2.	‘Ala‘ala wai nui(e)	<i>Peperomia</i>	<i>spp.</i>	Piperaceae
3.	Alahe‘e (i)	<i>Psydrax</i>	<i>odorata</i>	Rubiaceae
4.	Hala (i)	<i>Pandanus</i>	<i>tectorius</i>	Pandaneceae
5.	‘Ie‘ie (i)	<i>Freycinetia</i>	<i>arborea</i>	Pandanaceae
6.	‘Ilima (i)	<i>Sida</i>	<i>fallax</i>	Malvaceae
7.	Kāmanamana (i)	<i>Adenostemma</i>	<i>lavenia</i>	Asteraceae
8.	Koali‘awa (i)	<i>Ipomoea</i>	<i>indica</i>	Convolvulaceae
9.	Kōlea (e)	<i>Myrsine</i>	<i>lessertiana</i>	Myrsinaceae
10.	Ko‘oko‘olau (e)	<i>Bidens</i>	<i>hawaiiensis</i>	Asteraceae
11.	Kōpiko (e)	<i>Psychotria</i>	<i>hawaiiensis</i>	Rubiaceae
12.	Kou (i)	<i>Cordia</i>	<i>subcordata</i>	Boraginaceae
13.	Lama (e)	<i>Diospyros</i>	<i>sandwicensis</i>	Ebenaceae
14.	Maile (e)	<i>Alyxia</i>	<i>stellata</i>	Apocynaceae
15.	Māmaki (e)	<i>Pipturus</i>	<i>albidus</i>	Urticaceae
16.	Milo (i)	<i>Thespesia</i>	<i>populnea</i>	Malvaceae
17.	Naupaka (i)	<i>Scaevola</i>	<i>sericea</i>	Goodeniaceae
18.	‘Ōhi‘a (e)	<i>Metrosideros</i>	<i>polymorpha</i>	Myrtaceae
19.	Pōhinahina (i)	<i>Vitex</i>	<i>rotundifolia</i>	Verbenaceae
20.	Pūkiawe (i)	<i>Styphelia</i>	<i>tameiameiae</i>	Epacridaceae
21.	‘Uki (i)	<i>Machaerina</i>	<i>angustifolia</i>	Cyperaceae
22.	‘Ulei (i)	<i>Osteomeles</i>	<i>anthyllidifolia</i>	Rosaceae



1. ʻĀkia (*Wikstroemia sandwicensis*)



2. ʻAlaʻala wai nui (*Peperomia* spp.)



3. **Alahe'e** (*Psychodora odorata*)



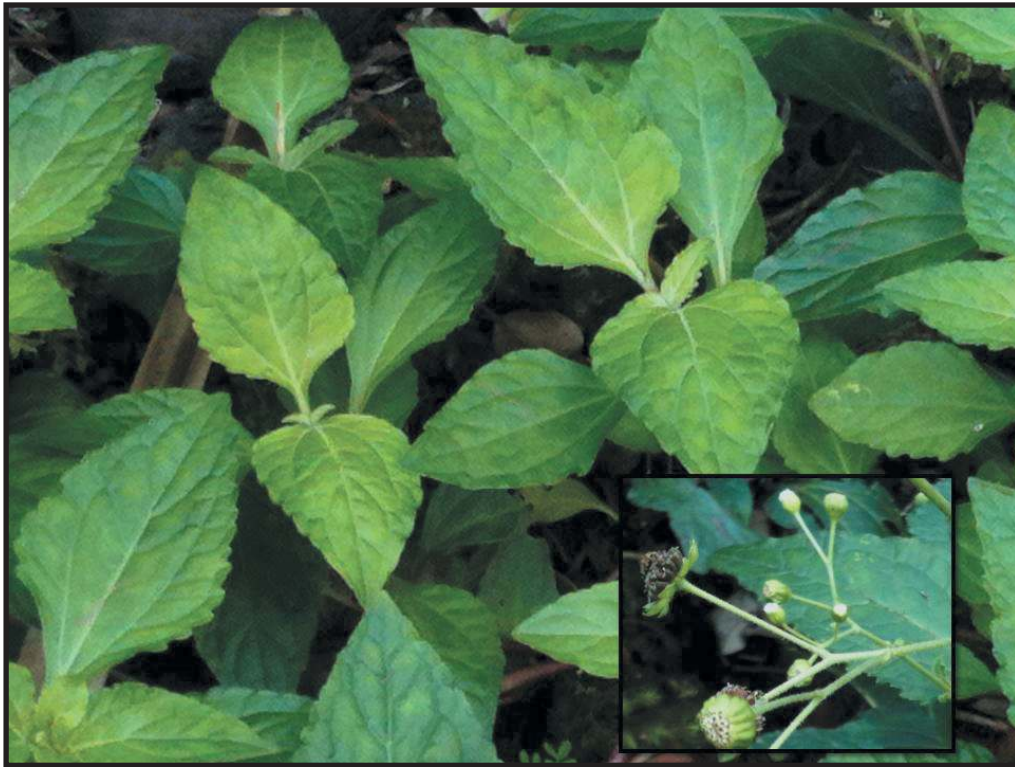
4. **Hala** (*Pandanus tectorius*)



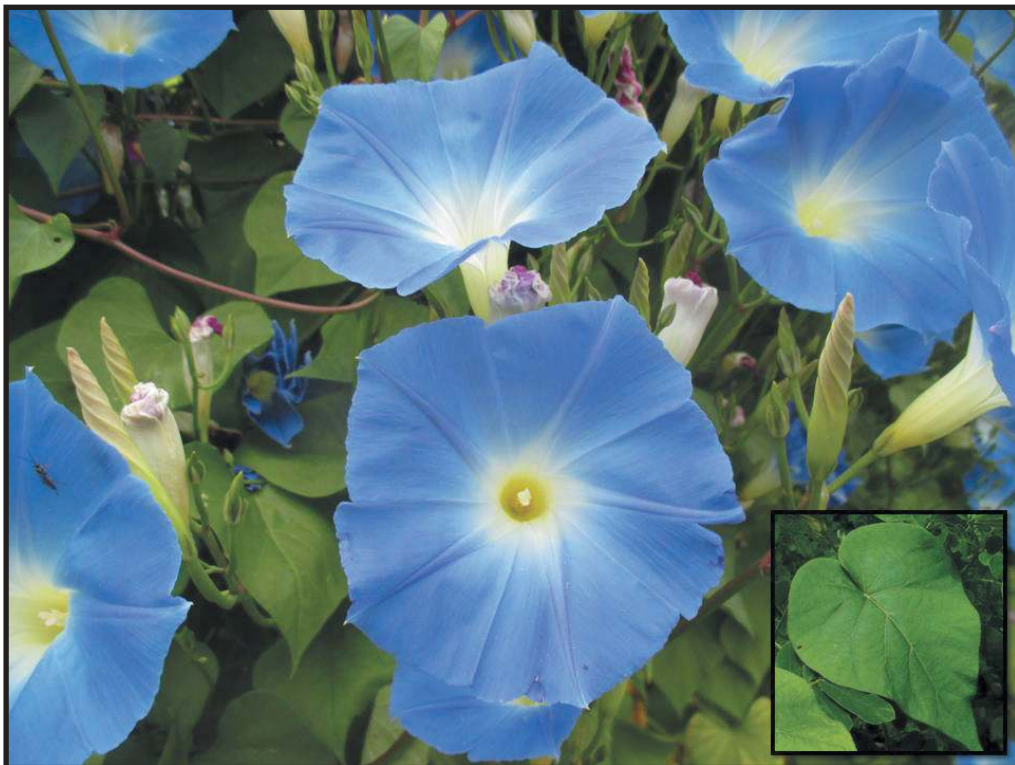
5. 'Ie'ie (*Freycinetia arborea*)



6. 'Ilima (*Sida fallax*)



7. **Kāmanamana** (*Adenostemma lavenia*)



8. **Koali'awa** (*Ipomoea indica*)

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