ʻUlu Agroforestry in Hawaiʻi

Farmer Profiles & Production Considerations

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ʻUlu Agroforestry in Hawaiʻi

TABLE OF CONTENTS

This publication was created by the **Hawaiʻi ʻUlu Producers Cooperative**, with contribution and factual review by:

- Andrew Trump, Island Harvest, Inc.
- Noa Lincoln, Ph.D., Indigenous Cropping Systems Laboratory, College of Tropical Agriculture & Human Resources, University of Hawaiʻi at Mānoa
- Noel Dickinson, Breadfruit Institute, National Tropical Botanical Garden
- Dave Sansone, Agroforestry Design, LLC
- Zach Mermel, Ola Design Group

Introduction

This guide to ʻulu (breadfruit) agroforestry in Hawaiʻi aims to build upon existing resources and address the lack of local, site-specific models. We describe five distinct agroforestry practices recognized by the United States Department of Agriculture (USDA):

- **Alley cropping**
- **Forest farming / multi-story cropping**
- **Riparian forest buffers**
- **Silvopasture,** and
- **Windbreaks**

We also highlight common criteria and benefits of agroforestry systems, and provide contextual background and terminology on other commonly referenced agroforestry techniques, such as *intercropping* and *successional agroforestry.* The guide then provides concrete examples illustrating how these techniques are employed by Hawaiʻi farmers on the ground, and discusses associated benefits and challenges.

We hope this information will help Hawaiʻi farmers better understand the benefits agroforestry can provide for them in order to successfully implement best practices – resulting in increased yields, efficiency, revenues, and natural resource conservation, while reducing on-farm costs and input needs.

An example of ʻulu silvopasture, Hāna Ranch, Hāna, Maui

Defining Agroforestry

Agroforestry is a form of agriculture integrating tree crops and other structural elements of forests to help farms *mimic nature*, fostering ecosystem services that can generate both environmental and economic benefits – as well as some unique challenges.

Multi-Story Cropping

A core concept of agroforestry, **multi-story cropping,** takes advantage of the different ecological niches and functions of crop types such as trees, shrubs, groundcovers, and vines. Across Oceania, breadfruit is a signature tree within traditional agroforestry systems, which vary in their diversity of plants and other factors based on environment and local preferences (Elevitch & Ragone 2018). Traditional breadfruit production in Hawai'i and elsewhere in the Pacific was done almost exclusively through agroforestry because it allowed for increased production, resilience, and sustainability across many different microclimates and geologies.

USDA Definition

Today, the USDA National Agroforestry Center recognizes a variety of agroforestry techniques, broadly defined as:

"the intentional combination of agriculture and forestry to create productive and sustainable land use practices. These practices take advantage of the interactive benefits from growing trees and shrubs together with crops and/or livestock."[1] The five agroforestry practices supported by the USDA are: **alley cropping, forest farming, riparian forest buffers, silvopasture, and windbreaks** – each of which are defined in detail on pages 9-14 of this guide.

Criteria of an Agroforestry System

It is important to distinguish between the simple combination of agriculture and forestry and their **intentional combination to create specific benefits** when identifying and evaluating agroforestry practices. For example, having a field of ʻulu next to a field of ʻuala (sweet potato) is an example of diversified agriculture and could lead to various positive outcomes, but it would not be considered agroforestry unless there were **intentional** benefits created through the design and implementation of integrated cropping systems. For instance, the design could include planting ʻulu trees downslope of the ʻuala to capture runoff and protect the adjacent stream – an example of a riparian buffer. Another example could include ʻuala planted in the inter-row of a young ʻulu orchard to create economic benefit prior to maturation of the trees – an example of alley cropping.

In order to determine whether a practice qualifies as agroforestry, a helpful set of criteria are **the Four "I"s**. Answer for yourself if the practice is *intentional*, *intensive*, *integrated*, and *interactive* according to the following definitions:

The Four "I"s

Intentional

Combinations of trees, crops, and/or livestock are intentionally designed, established, and/or managed to work together, rather than as individual elements which may occur together but are managed separately. Agroforestry is not a mixture of monocultures.

Intensive

Agroforestry practices are created and intensively managed to maintain their productive and protective functions, and often involve operations such as cultivation, fertilization, irrigation, pruning and thinning.[1]

Integrated

Components are structurally and functionally combined into a single, integrated management unit tailored to meet the objectives of the landowner. Integration may be horizontal or vertical, above- or below-ground, simultaneous or sequential. Integration of multiple crops utilizes more of the productive capacity of the land and helps to balance economic production with resource conservation.

Interactive

Agroforestry actively manipulates and utilizes the physical and biological interactions among components to optimize the efficiency and benefits of the system in both space and time.

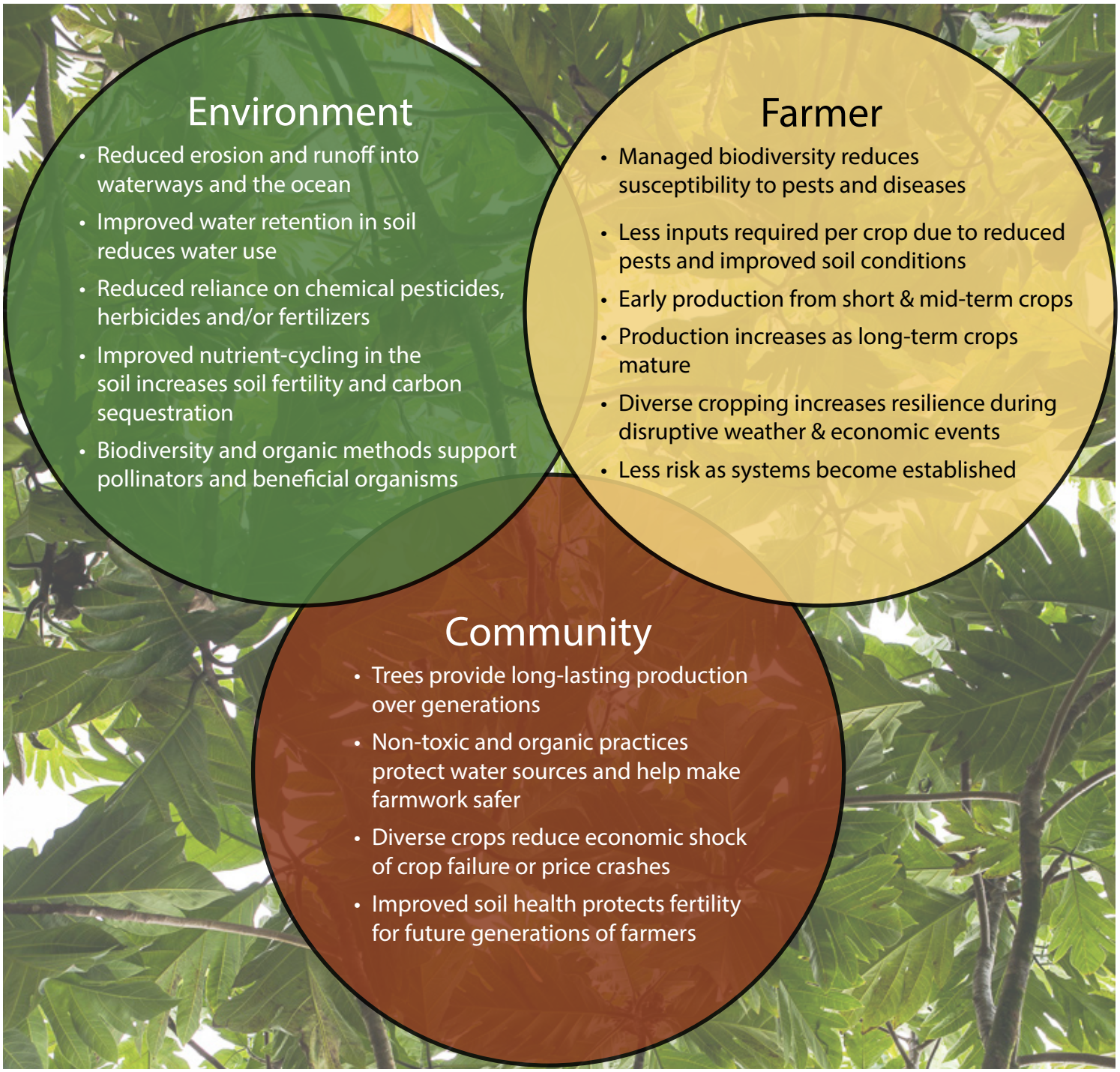
Allied Terms & Strategies

Some additional terms that may be used in this guide include:

- **Agroecology** – a whole systems approach to agriculture that views farmed areas as ecosystems and is concerned with the ecological impact of agricultural practices.
- **Cover Crops / Conservation Cover** – annual or perennial vegetation planted in order to cover the soil rather than for the purpose of being harvested, typically to manage soil erosion, soil fertility, soil quality, water, weeds, pests, diseases, biodiversity, and/or wildlife.[2]
- **Intercropping, Co-Cropping, Interplanting, or Polyculture** – planting two or more compatible species close enough within an area so that biological synergies can occur.[3]
- **Living Fence, Hedge, Hedgerow** – installing a line of diverse trees and/or shrubs at relatively close spacing; can also serve a windbreak function. Living fences can provide a diverse range of other products and functions including firewood, animal feed, habitat, and soil enrichment, depending on the suite of species.[4]
- **Regenerative Agriculture** – a system of farming principles and practices that increases biodiversity, enriches soils, and enhances ecosystem services. Regenerative agriculture aims to capture carbon in soil and aboveground biomass, reversing current global trends of atmospheric accumulation. Simultaneous to this, it offers increased yields, resilience to climate instability, and higher health and vitality for farming and ranching communities. The system draws from decades of scientific and applied research by the global communities of organic farming, agroecology, Holistic Management, and agroforestry.[5]
- **Sequential Cropping** – a pattern of timed rotational cropping in which one crop follows another on the same footprint of land.[6]
- **Successional Agroforestry / Syntropic Agroforestry** – refers to short, mid, and long term species interplanted in a way that mimics the regeneration of a forest, including fast growing biomass crops, ground covers, and green manure plants which improve the soil; succession occurs as one community of plant species replaces another based on its life cycle, coupled with time sequencing, in agroforestry establishment.[7]
- **Sustainable Agriculture** – a set of practices intended to protect the environment, expand the Earth's natural resource base, and maintain and improve soil fertility. Based on a multi-pronged goal, sustainable agriculture seeks to increase profitable farm income, promote environmental stewardship, enhance quality of life for farm families and communities, and increase production for human food and fiber needs.[8]

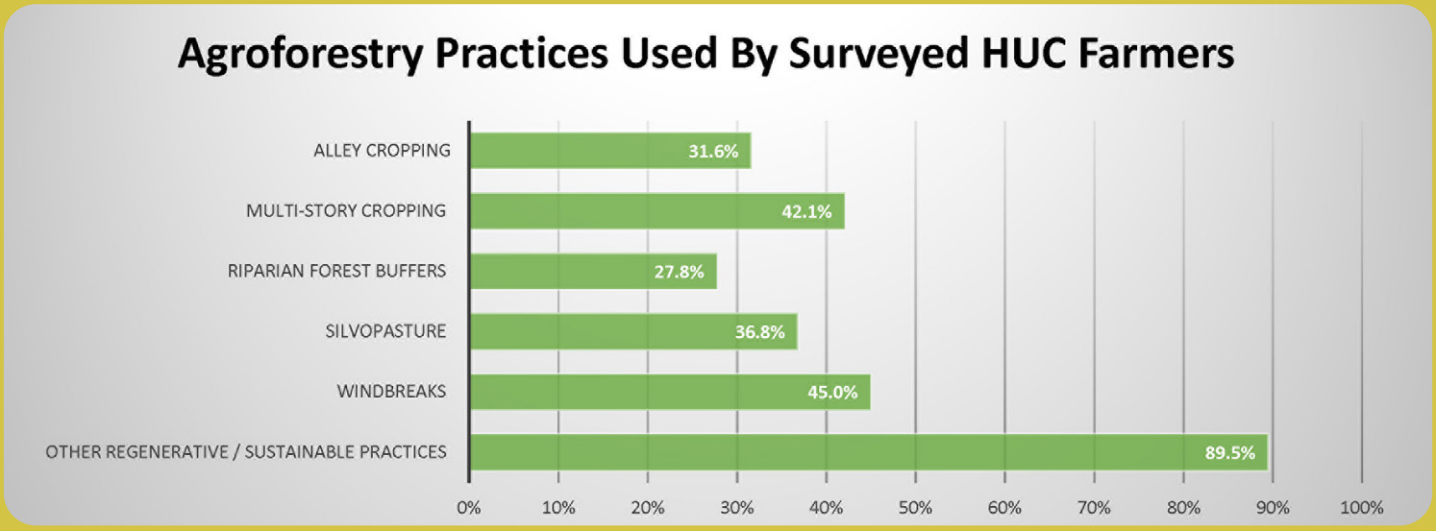
Benefits of Agroforestry

Agroforestry provides many potential benefits to the environment, farmers, and communities, though implementing agroforestry practices is not without its challenges. While monocrop systems may have higher productivity of a single crop than agroforestry systems of the same area, the total productivity (i.e., the yield of all crops growing together) of agroforests can exceed that of monocrop systems by 10-60% (Mead and Willey, 1980). For successful implementation, practices should be considered in the context of each unique farm, environment, and market.

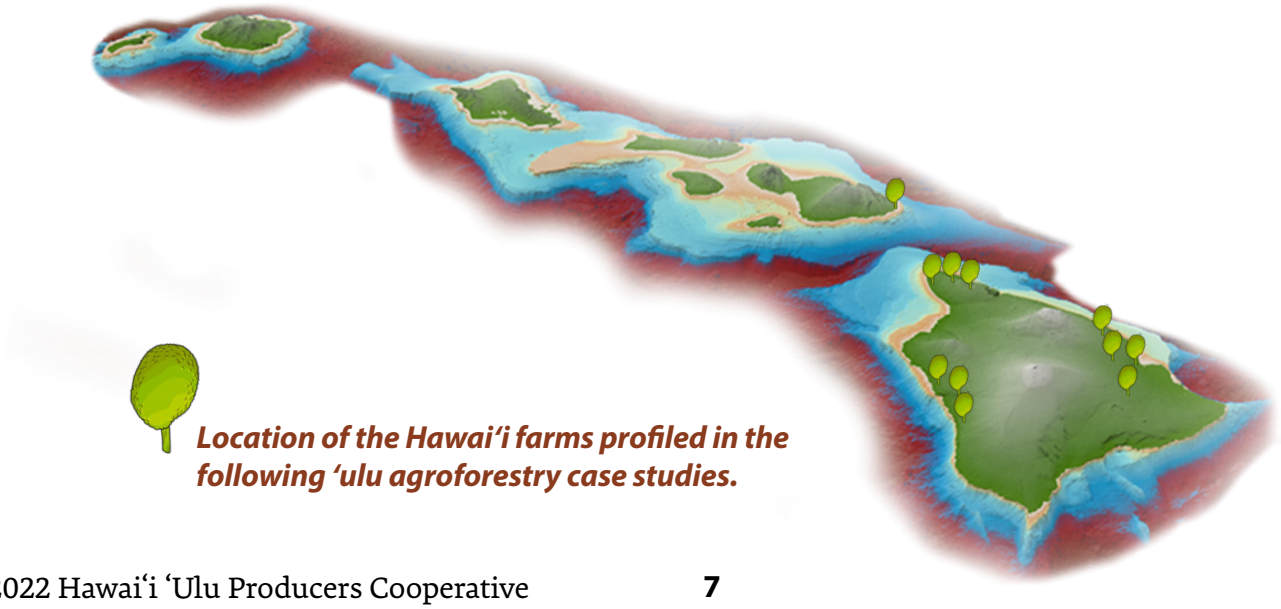


ʻUlu Agroforestry in Hawaiʻi: Case Studies by Practice

A range of agroforestry practices, including all five recognized by the USDA, are currently utilized by breadfruit farmers in Hawaiʻi. A survey of statewide farmers conducted by the University of Hawaiʻi in 2016 found that 86% of 56 farms utilized agroforestry practices, while a survey of Hawaiʻi ʻUlu Co-op (HUC) members in 2020 found that (according to self-reported practices) approximately 89% of respondents practice at least one type of agroforestry and 55% practice more than one in combination. The following case studies provide a detailed description of each of the five USDA-recognized agroforestry techniques, followed by an in-depth look at one farm using multiple practices in concert.

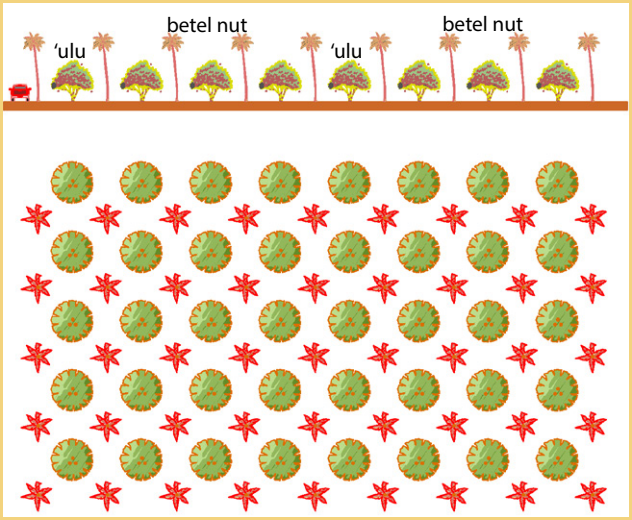


NOTE: This is not an exhaustive representation of current ʻulu farms in Hawaiʻi.



Location of the Hawaiʻi farms profiled in the following ʻulu agroforestry case studies.

Agroforestry Practice I
Alley Cropping



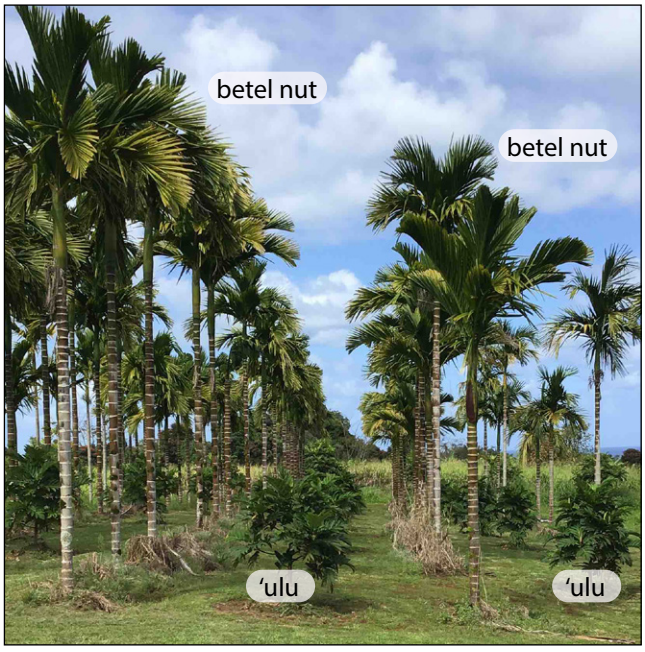
Alley cropping is *the planting of trees or shrubs in two or more sets of single or multiple rows with agronomic, horticultural, or forage crops cultivated in the alleys between the rows of woody plants.* Crop rows alternate with tree, shrub, or non-weedy vegetation rows to provide fertility, shade, mulch, and weed control, while also serving as weed barriers.

Hawai'i Farmer Profile: Richard Kodani (*RS Kodani Farms*) **Pauka'a, Hawai'i Island**

Richard uses the practice of alley cropping by planting 'ulu in the space between betel nut trees in order to maximize land use. In another part of the property, he plants 'olena (turmeric) between 'ulu trees. Typically, beneath the tall betel nut trees is a lot of underutilized space, while this agroforestry model fills that space with breadfruit. Richard shares that, although the alley cropping was a good idea in concept, anticipated growth of the breadfruit trees has been impeded due to light and nutrient competition. He is now considering cutting down the betel nut in order to give the 'ulu additional space to fill out.

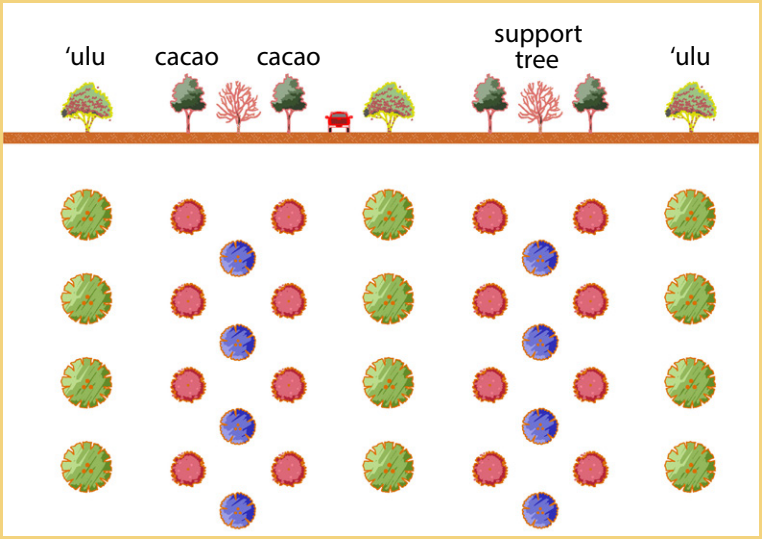
*"**Alley cropping** [efficiently] utilizes space compared to having things in separate areas; it is better for doing more production with less space."*

~ Richard Kodani



Agroforestry Practice I
Alley Cropping (cont'd)

Hawai'i Farmer Profile: Tom Menezes *(Hawaiian Crown Plantation)* **Hilo, Hawai'i Island**



Support trees can be integrated into an alley cropping agroforestry operation to yield specific functions. Within Tom Menezes' operation, the nitrogen fixing madre de cacao overstory trees assist in shading and passively fertilizing the understory cacao crop. The madre de cacao branches could also be seasonally chipped for mulch.

Tom planted cacao in between the rows of his 'ulu orchard as a method of alley cropping. He used 25' within-row spacing between breadfruit, and 90' wide alleys in order to install multiple rows of cacao in between. The 'ulu trees act as wind protection for the more sensitive cacao trees, and help to diversify his production. The broader spacing of breadfruit trees can also help reduce the spread of common fungal diseases, and increase sun exposure and therefore fruit set.

"In the long run, alley cropping is actually more profitable. It is cheaper than purchasing lots of inputs, for example insecticide or herbicide. I would add sheep if possible on this property."

~ Tom Menezes

Agroforestry Practice II
Forest Farming / Multi-Story Cropping

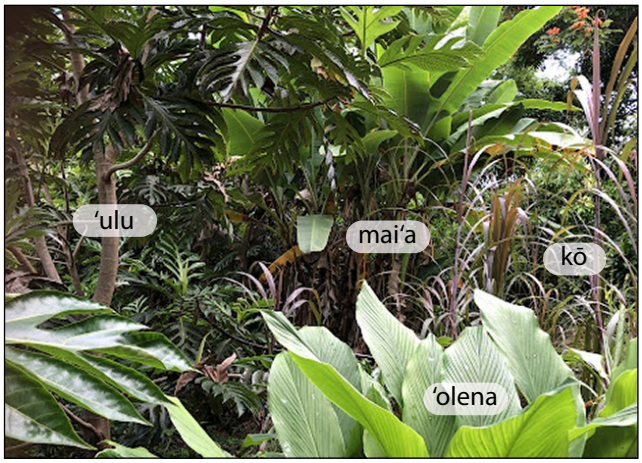
Forest farming or multi-story cropping is *the intentional cultivation of edible, medicinal, or decorative specialty crops beneath native or planted woodlands that are managed for overstory and understory crop production.* This diversified system fills different ecological niches with crops, which can increase production in both space and time. Forest farming is a distinct practice from wildcrafting (the gathering of endemic and indigenous plants from native forests). An example of multi-story cropping for an ʻulu farmer could be planting coconut trees as a productive overstory to an ʻulu orchard and planting ʻolena as a productive understory.

Hawaiʻi Farmer Profile: *Māla Kaluʻulu Cooperative* Keʻei, Hawaiʻi Island

Noa Lincoln and fellow cooperative members modeled their farm planting at Māla Kalu ʻulu on the traditional agroforestry system that existed in the Kona region, which utilized a breadfruit overstory with multiple crop layers underneath. Here the mid-story plantings are dominantly maiʻa (banana) and māmaki, while ground covers like kalo and ʻolena are grown below. While the system is productive and requires little inputs or weed management, the tall breadfruit trees make for very difficult harvesting, and the disparate layout generally makes harvesting other crops challenging, as well.

"We love what we've done for its value in understanding what is possible, and what our ancestors have done. And while some costs, like weed management, have been minimized, other costs, such as harvest, have become extremely high. Also, there is almost too much diversity, making it harder to focus on doing any one crop very well."

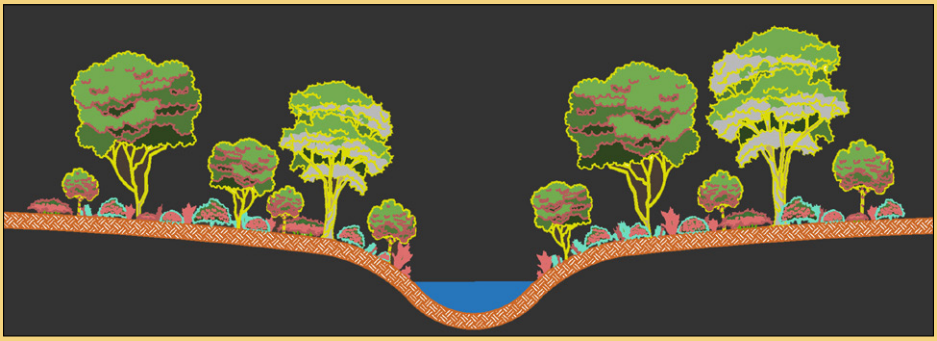
~ Dr. Noa Lincoln



Agroforestry Practice III
Riparian Forest Buffers

Riparian forest buffers *are installed plantings of trees, shrubs, and herbaceous vegetation established and/or managed adjacent to streams, lakes, ponds, and wetlands.*[1]

An example of a riparian forest buffer for an ʻulu farmer might be planting ʻulu trees and other shrubs along a stream bank to buffer and filter potential farm runoff of fertilizers while stabilizing the stream bank. In such a system, shade tolerant shrub and groundcover crops – such as ʻawapuhi and black pepper – could fill the lower niches beneath the ʻulu overstory.

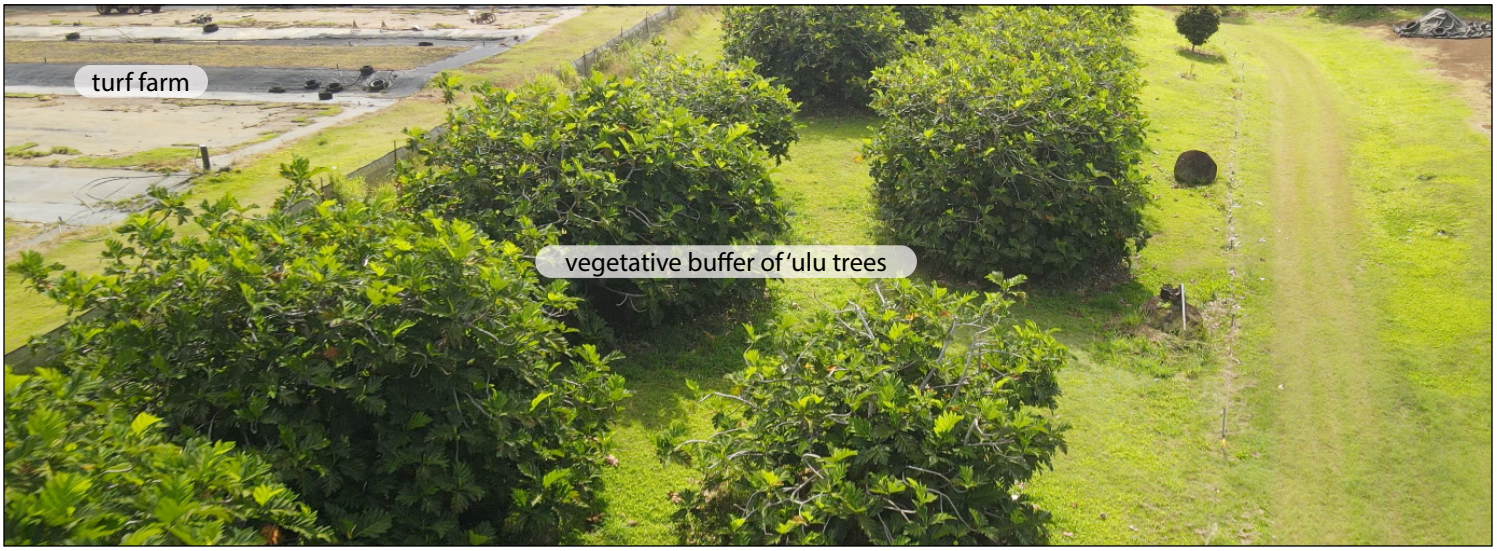


Hawaiʻi Farmer Profile: Lani Eubank *(E-Scape Enterprises)* **Hawi, Hawaiʻi Island**

Lani has a turf farm that is dependent on irrigation and fertilizer inputs. She planted ʻulu trees in the buffer between her turf fields and a waterway so the ʻulu trees could catch any potential water or nutrient run-off from the turf farm.

"The largest benefit of this system is that the buffer of ʻulu roots protects the soil and absorbs some of the nutrients released by the excessive water. We've also learned that monocropping decreases vitality while agroforestry approaches include diversity, which increases resilience and balance in the system. There are economic benefits associated with diversification as well as benefits related to nitrogen fixing and maintaining native plant populations."

~ Lani Eubank



Agroforestry Practice IV
Silvopasture

Silvopasture *is the intentional combination of trees, forage plants, and livestock in an integrated, intensively managed system.*[1] An example of silvopasture for an ʻulu farmer could be integrating sheep or chickens on the orchard floor for efficient land use, adding nutrition to soil through manure deposition, while decreasing weed control costs through grazing.

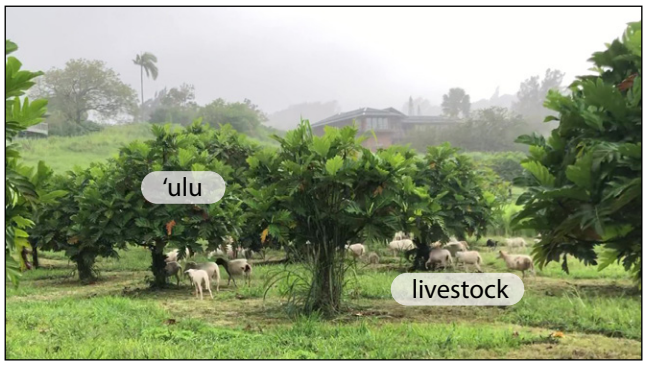
Hawaiʻi Farmer Profile: Andrew Trump *(Island Harvest)* **Kapaʻau, Hawaiʻi Island**

Island Harvest uses tropical hair sheep to help with weed control and nutrient cycling in their ʻulu orchard. Although the sheep do reduce the amount of mowing required, some mowing is still necessary. Additionally, Island Harvest had to prune the lower branches on their trees and put protective cages around the trunks to prevent the sheep from debarking the trunks. When the trees are young, it isn't possible to do silvopasture unless the trees have a physical barrier of protection. The loss of productive canopy on lower branches due to this pruning is a drawback for Island Harvest.

"Sheep provide the benefits of nutrient cycling and reduced mowing cost. Sheep convert forage to manure and urine (digestion) improving the availability of nutrients, including micronutrients and trace elements. Manure feeds soil microorganisms in a different manner than decomposing forage through mowing. They also help our breadfruit production system to provide a sustainable fruit crop, as well as providing meat to consume – not only diversifying our production system but our plate as well."

~ Andrew Trump

Island Harvest's sheep being intentionally (& intensively) grazed within the ʻulu silvopasture system.



Agroforestry Practice IV
Silvopasture (cont'd)

Hawai'i Farmer Profile: *Hāna Ranch Agriculture, LLC* — Hāna, Island of Maui

Hāna Ranch grazes cattle on a rotation in between their 'ulu orchard trees in a conventional silvopasture arrangement on their farm in Hāna, Maui. Cows rotate through orchard areas mowing the grass and contributing organic matter to the soil, and thus, the trees. Getting the trees to size is the largest challenge of this system – cows need to be left out of a newly planted field for up to four years to allow hardening of the young trees. Otherwise, cattle can debark or destroy the tree in a short time.

"The most tangible benefit of the system is sequestering carbon in the ground while optimizing maintenance costs by utilizing the grazing habit of the cattle to provide solar generated protein to the community."

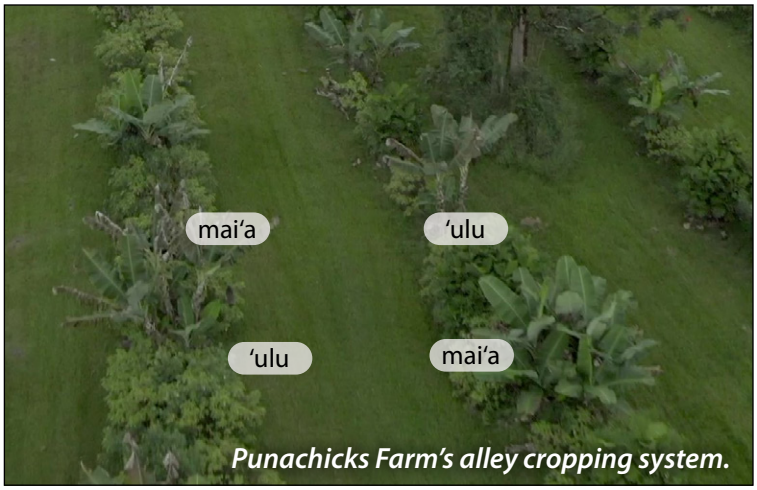
~ Duane Lammers

Hawai'i Farmer Profile: *Punachicks Farm, LLC* — 'Ōla'a / Kurtistown, Hawai'i Island

Punachicks Farm is a small family operation run by the Taaroa 'ohana. They are committed to raising the highest quality pastured poultry and eggs possible, utilizing rotational chicken tractor systems. In recent years, Punachicks has integrated 'ulu alley cropping and silvopasture into their poultry farm, to further diversify their operation.

"Rotating chicken tractors were a good way to supply our freshly planted 'ulu and banana trees with nutrients, but after filling out with an understory of māmaki it became less practical to run the tractors through. We now incorporate our composted manure and chicken processing wastes to fertilize the trees."

~ Emily Taaroa



Punachicks Farm's alley cropping system.

Agroforestry Practice V
Windbreaks

Island Harvest's silvopasture and 'ulu alley crop system, using Guinea grass as windbreaks in interrow.

Windbreaks *are single rows or multiple rows of trees and/or shrubs that are established for environmental protection purposes.*[1] Plants, often trees, are installed in strategic swaths across a farm to buffer the effects of strong winds upon farm crops and livestock. The shelter afforded by windbreaks to farm animals often enables livestock to gain more weight when protected by the windbreak. For 'ulu grown in gusty areas, windbreaks can substantially reduce wind induced fruit damage. Windbreaks can also serve as buffers against pests and pesticide drift; for this reason, windbreaks are not usually planted using food crops.

Hawai'i Farmer Profile: Tom Menezes *(Hawaiian Crown Plantation)* **Hilo, Hawai'i Island**

Tom interplanted 'ulu with niu (coconut), using the coconut as a windbreak with the hope that it will provide a multi-story production system as the coconut grows. The coconut provides a strong barrier on the windward side of the orchard, thereby protecting the young 'ulu and cacao trees.

Some HUC members have used interior rows to encourage fast growing grasses, such as Guinea grass or Sudan grass, as windbreak protection for the young 'ulu trees (see photo at top left). This allows for easy removal once the 'ulu trees mature to maximize acreage that can be planted with 'ulu, rather than sacrificing space to more permanent windbreaks.

"Agroforestry is a more sustainable system which utilizes plants and microorganisms and less inorganic inputs. More natural systems with increased root and soil interactions are more resilient. Windbreaks have been an important part of this system by providing protection as well as income from the cash crop produced; if we didn't have the windbreak the trees would be injured in high winds; leaves can be ripped off and trees can be knocked over. I would encourage traditional agroforestry methods to other farmers because it is more profitable in the long run - cheaper than purchasing lots of inputs."

~ Tom Menezes

Tom Menezes' niu & 'ulu windbreak system.

Three Agroforestry Practices in Combination

Hawai'i Farmer Profile: *One Village Farm* **Kapa'au, Hawai'i Island**

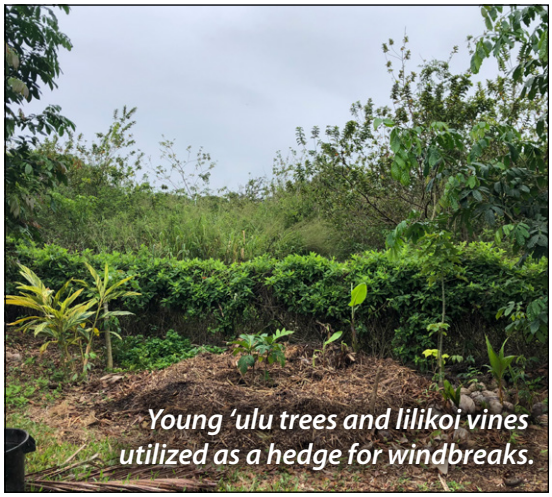
One Village Farm employs a combination of integrated agroforestry practices, centered on **multi-story cropping** of 'ulu and other crops on their farm in North Kohala, Hawai'i Island. Other practices employed include **riparian forest buffers** and **windbreaks**. Their system provides a holistic example of what 'ulu agroforestry can look like in Hawai'i today, and highlights some of the associated benefits and drawbacks of the methods used.

"It's important to diversify our agroforestry systems in case one crop fails or succumbs to factors out of our control. And just like us, plants thrive in diverse communities. The more diversity, the more resilience in our systems. Agroforestry has the ability to rehabilitate degraded landscapes into healthy and productive living food banks. Our island soils are overly capable of bearing abundance; agroforestry rides the synergy of what the land already wants to do – cover its soils in diverse plant growth."

~ Travis Dodson, One Village Farm

One Village Farm's Multi-Story Cropping System

- **Overstory:** niu, 'ulu, madre de cacao
- **Midstory:** popo'ulu mai'a (banana) tangelo, kō (sugarcane)
- **Understory:** 'olena, Brazilian spinach, kalo, 'uala, roselle hibiscus, comfrey, perennial collard


Young 'ulu trees and lilikoi vines utilized as a hedge for windbreaks.

Three Agroforestry Practices in Combination *(cont'd)*

Realized Benefits: Many benefits are realized by One Village Farm from using these three agroforestry systems in combination, including increased overall farm yield and improved soil fertility over time. Added organic matter and reduced chemical application (fertilizers, pesticides, herbicides) has increased the physical properties of the soil as well as soil biological activity. Over time, increased biodiversity has also led to a reduction in management costs, diseases and pests, nutrient competition, erosion and water loss. The farm has also seen economic benefits related to crop diversification at times when one crop fails. The more diversity, the more resilience in the system – including from a market perspective.

Realized Drawbacks: Some realized drawbacks of incorporating this type of agroforestry system are to be expected in comparison with a "profit first" model. The largest drawback for One Village Farm has been lower crop yield (on a per crop basis) and reduced light reception due to allowing a mix of species to thrive instead of focusing solely on immediate production maximization. The establishment cost has been high as well, due to labor and the fact that some plants need to be replanted or replaced in the system as practical site-specific needs are determined. Pruning needs have also been high, and as plants find their established position in the system, it is important to use pruning as a holistic tool in order to increase light penetration and establish efficient branch structures for harvesting.

Complementary Agroecological Practices

There are additional applications that incorporate the use of agroecological strategies to help solve special concerns. For example, planting a "sacrificial crop" on the border of your more valued food crops can encourage pests to reside and feed on the more susceptible border plants, leaving the desired crop intact. Another example is intercropping with nitrogen fixing plants such as beans and other legumes, which helps to increase soil fertility and can add an extra boost of nutrition to an adjacent planted area. In this section we highlight one complementary practice that is commonly used in Hawai'i, *companion planting*.

Companion Planting is the practice of growing distinct species of crops in close proximity for a healthier harvest and more resilient environment. Various plants complement one another by assisting their companions with pest control, soil nutrition, pollination, beneficial insects, shading, and the efficient use of space. Overall, companion planting may add the benefit of an increased net harvest, decreased disease on valued crops, and improved soil health and biodiversity.

Groundcovers and Cover Crops as "Living Mulch" Systems

One type of companion planting commonly practiced by Hawai'i 'ulu farmers includes utilizing groundcovers or cover crops to slow erosion, improve soil health, enhance water availability, smother weeds, help control pests and diseases, and/or increase on-farm biodiversity.[9] These companion crops can serve as "living mulch" systems that sequester carbon and minimize levels of conventional controls like chemical herbicides, mowing, and weed mats. Well-selected cover crops can provide further benefits, income, or cost reduction, to your farming operation. Note: In an agroforestry system, ground covers should be selected for shade tolerance and low growth to reduce maintenance costs; many ground covers used in landscaping may be poor choices for the understory of an agroforest if they require too much sunlight and maintenance (Elevitch & Ragone, 2018).

Companion Planting Case Studies

Hawai'i Farmer Profile: Dan Mahalak *(Kaiwiki Food Forest)* **Hilo, Hawai'i Island**

Dan used perennial peanut as a nitrogen-fixing ground cover around the base of his young 'ulu trees. Although it requires intensive weeding to establish, he has found that the perennial peanut is a net benefit for the tree, as compared with grassy ground covers, which often compete with the tree for nutrients.

"For our operation, perennial peanut is certainly on the list of must haves regarding weed suppression, organic material, tilth, and ungulate mitigation. Cover crops and root crops form symbiotic relationships with the young trees; our farm plants cover crops directly into developing tree pots. This way when transplanted into the ground the system has had time to strengthen (or so we like to believe)."

~Dan Mahalak

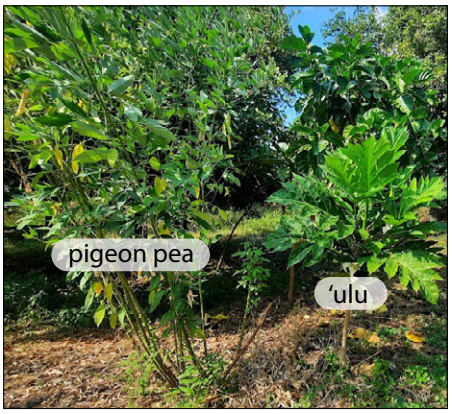
Hawai'i Farmer Profile: Howard Ling *(The Big Web Farm)* **Ka'awaloa, Hawai'i Island**

The Big Web Farm, managed by HUC member Howard Ling, has incorporated planting pigeon pea *(Cajanus cajan)* in his 'ulu orchard, which serves both as a companion plant and a living mulch. Pigeon pea provides four beneficial functions to the system as a whole:

- A **"chop-and-drop" living mulch** style amendment to surrounding trees and crops — as it grows and branches out, the bush shape can be cut to drop foliage as a soil amendment and mulch.
- As a perennial legume, it **fixes atmospheric nitrogen** over a period of several years, which further improves soil fertility.
- The fast growing pigeon pea also provides interim shade for the maturing breadfruit
- The final benefit is that the peas can actually be harvested for food and prepared either green as a vegetable or browned and dried as a grain style crop.

"Having diversity in your system and taking the time to see how things are working and growing together are a vital part of implementing agroforestry. Improved health from the land trickles out to community and is inspiring. Using pigeon pea specifically as a companion plant is beneficial as it provides nitrogen fixing capabilities/living mulch material, food production, and is easy to relocate or eradicate from areas when you want to move it."

~ Howard Ling



Summary & Tips

Implementing effective agroforestry techniques into a new or established commercial farm can be initially challenging, but over the long term will provide benefits to the overall health, resilience, and maintenance of your farm. While it can be more efficient to design a system from the ground up, modifying existing farm operations is an attainable and attractive goal for many current producers.

A few consistent benefits reported from ʻulu farmers implementing these practices:

- Improved soil health
- Increased biodiversity
- Potential for lower time and money spent on weed management, once system is fully established
- Functional and sustainable solutions to external issues (e.g., riparian buffers to protect waterways and windbreaks to protect against wind damage)
- Increased productive capabilities for system as a whole (higher gross yield across all species)

The main drawbacks that most ʻulu producers encountered:

- High initial establishment costs
- Replanting, pruning, maintenance, and harvesting efforts are more labor intensive and costly
- Decreased production output on a per crop basis
- Decreased overall efficiency resulting from inability to utilize mechanized tools

After considering the benefits and drawbacks of ʻulu agroforestry as they relate to your operation, begin by designing a plan with the appropriate plants. Keep in mind that a plan for a new farm will have different considerations than a plan that retrofits an established farm; see these considerations below.

New Farms

- Base systems around the Four I's (Intentional + Integrative + Interactive + Intensive).
- Consider initial maintenance time and costs, including site-specific adaptation to environmental factors and the possibility of persistent replanting to maintain establishment.
- Consider shorter term cash crops in the maturing (i.e., non-producing) years of your ʻulu operation.
- Incorporate regenerative practices to make the most of your on-site resources.

Established Farms

- Incorporate realistic design implementation strategies for your specific crop and farm.
- Consider cost-benefit relationship to making changes; for instance, cover crops versus mowing, adding alley cropping between existing rows of trees, incorporating silvopasture by introducing livestock to established systems.
- Consider incorporating successive crops that can be harvested in different seasons; this reduces workloads and increases sustained income generation.
- Focus on making changes that can lead to reduced reliance on chemical inputs (e.g., fertilizer/herbicide/pesticides, gas use, and any other outsourced feed, mulch, or amendments).

Reach out to extension agents, HUC staff, and agroforestry consultants with specific queries.

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Additional Resources

NRCS provides specification sheets (respective links below) for the **five USDA-defined agroforestry practices** that expand on their criteria and definitions.

- **Alley Cropping**
- **Forest Farming/Multi-Story Cropping**
- **Riparian Forest Buffer**
- **Silvopasture**
- **Windbreaks**

UH-CTAHR's Forestry & Agroforestry Extension Program

Hawai'i-Based Agroforestry Consultancy Firms:

- Mr. Dave Sansone, Agroforestry Design, LLC
  agroforestrydesigner@gmail.com; 808.464.3657
- Mr. Zach Mermel, Ola Design Group
  www.oladesigngroup.com; 808.987.1816

Mahalo to our contributing photographers:
Erik Dodson, Kyle Jackson, Noa Lincoln, Anissa Lucero, Ronit Pfal, Andrew Trump.