Agroforestry for Sustainable Resource Management—Pacifica Style

Keauhou, Kona, September 23, 2010

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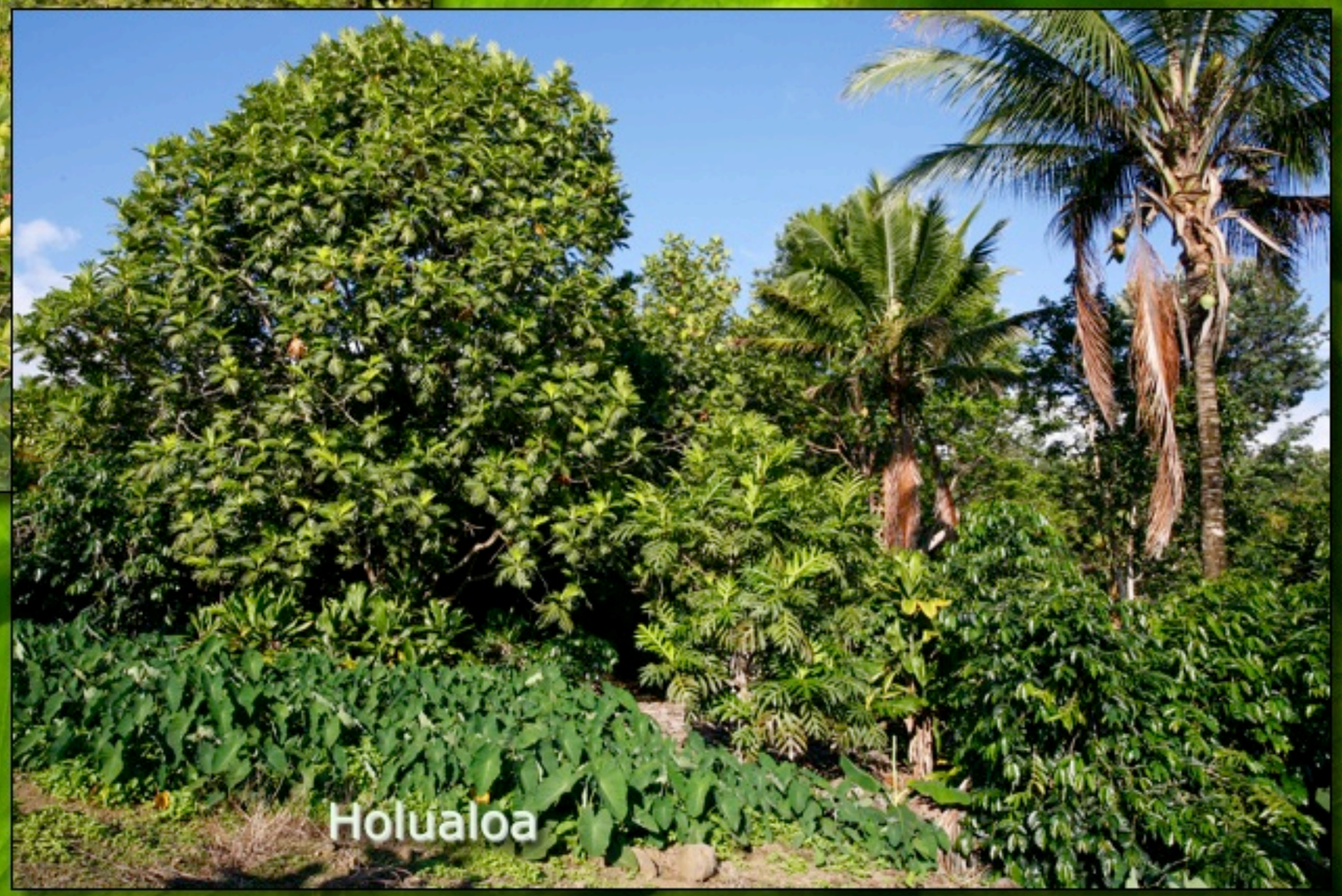
Traditional Kona family coffee farms

Avocados, papaya, macnuts, mango, banana, citrus, lychee, longan, persimmon, starfruit, lei flowers, etc.



Our agroecosystems

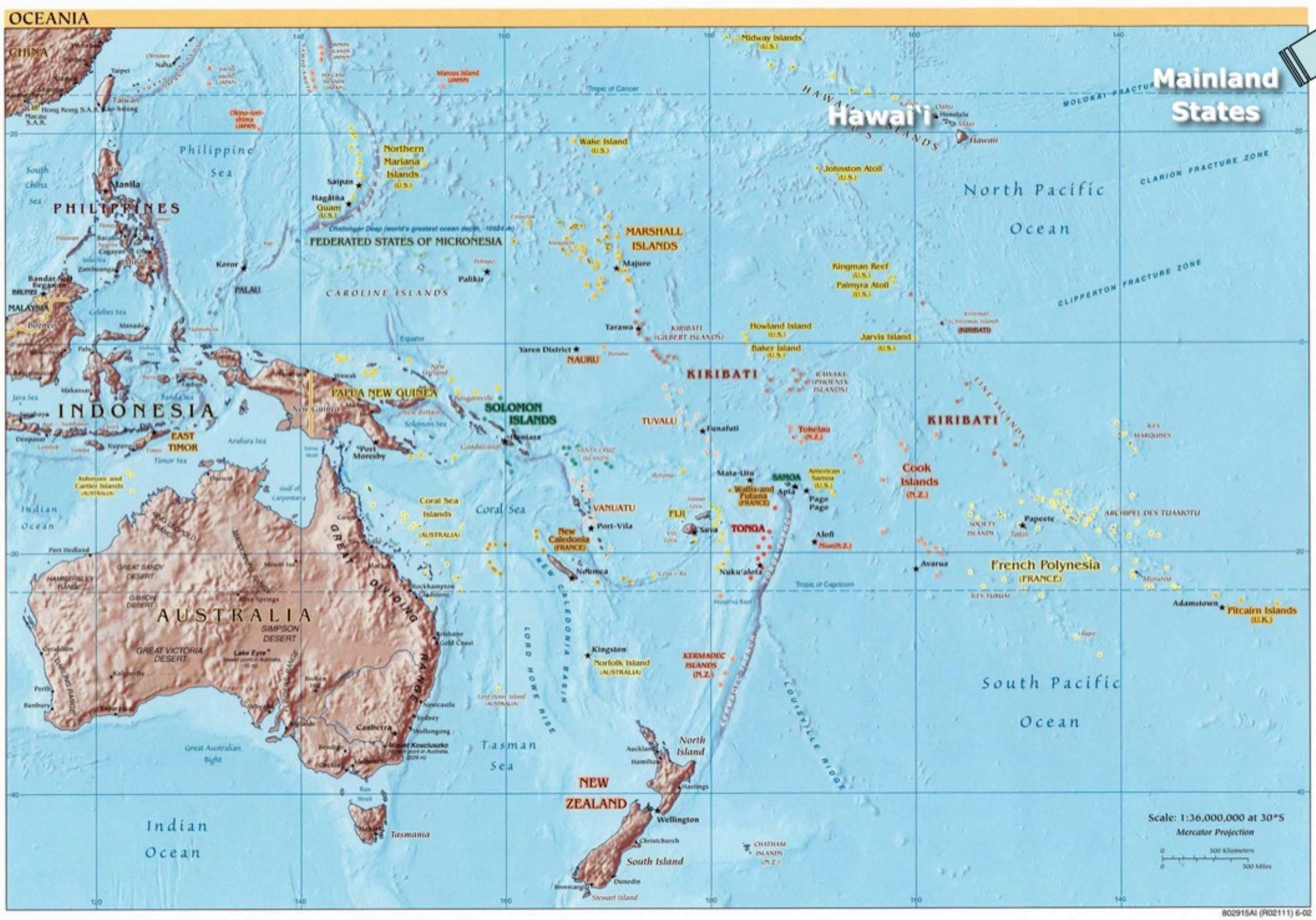
We are not managing them for ecologically stable and sustainable food and resource production.

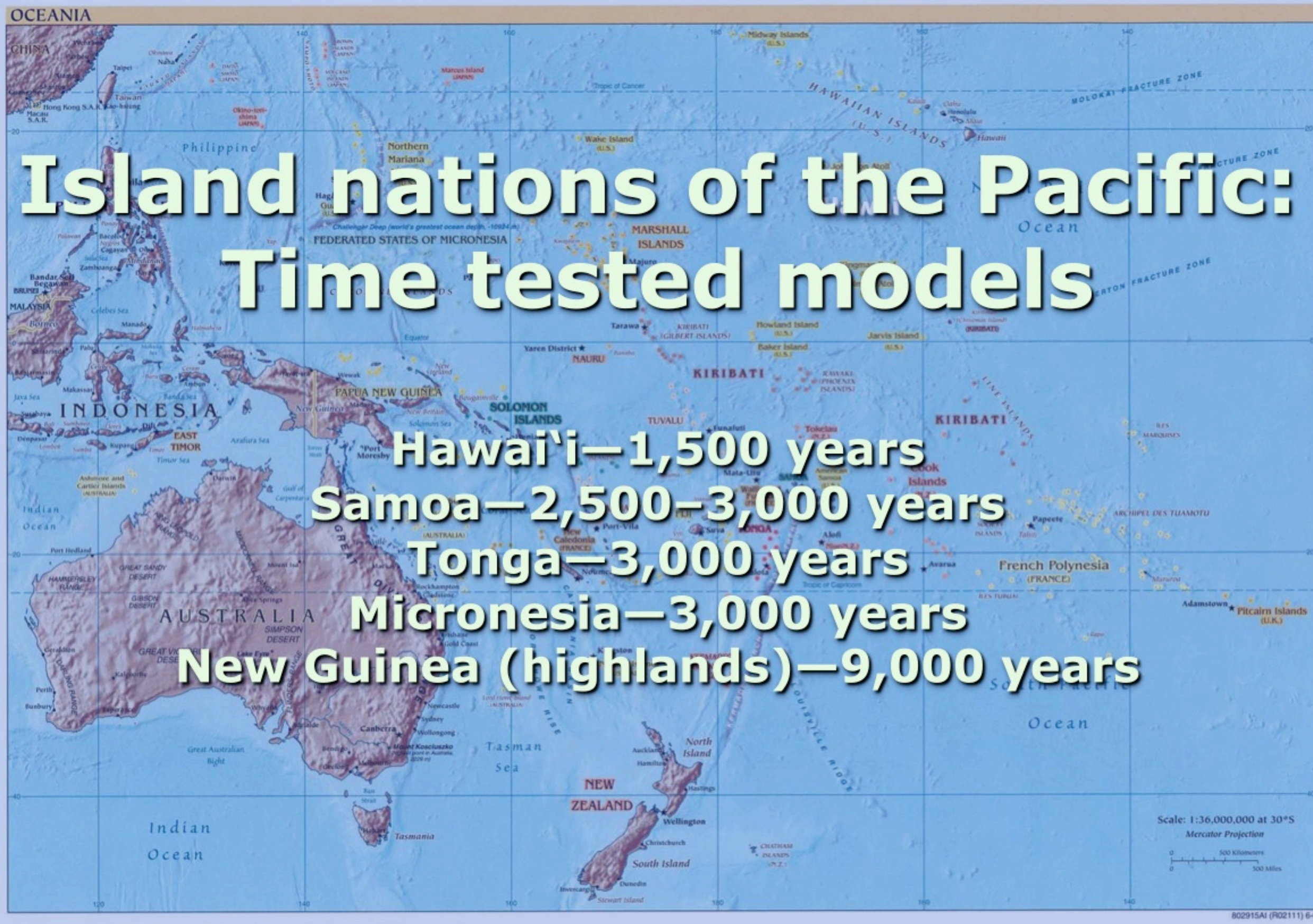
Our home ecosystems

Many people are not managing them for resource conservation or production

Paradigm shift

Hawai‘i’s bioregion




OCEANIA
Island nations of the Pacific:
Time tested models
Hawai'i—1,500 years
Samoa—2,500–3,000 years
Tonga—3,000 years
Micronesia—3,000 years
New Guinea (highlands)—9,000 years
CHINA
Philippine
FEDERATED STATES OF MICRONESIA
MARSHALL ISLANDS
HAWAIIAN ISLANDS (U.S.)
Wake Island (U.S.)
Midway Islands (U.S.)
Hawaii
MOLOKAI FRACTURE ZONE
Pacific Ocean
MALAYSIA
INDONESIA
PAPUA NEW GUINEA
SOLOMON ISLANDS
NAURU
KIRIBATI
TUVALU
EAST TIMOR
AUSTRALIA
Tasman Sea
NEW ZEALAND
North Island
South Island
Tasmania
French Polynesia (FRANCE)
Cook Islands
Indian Ocean
Scale: 1:36,000,000 at 30°S
Mercator Projection
802915AI (R02111) 6-02

Example: Samoa

Small Samoan village

Uafato, ʻUpolu island

Typical landscapes

‘Upolu island

Samoan garden. `Upolu

Samoa sightings

Savai'i and Upolu islands

Other Pacific nations

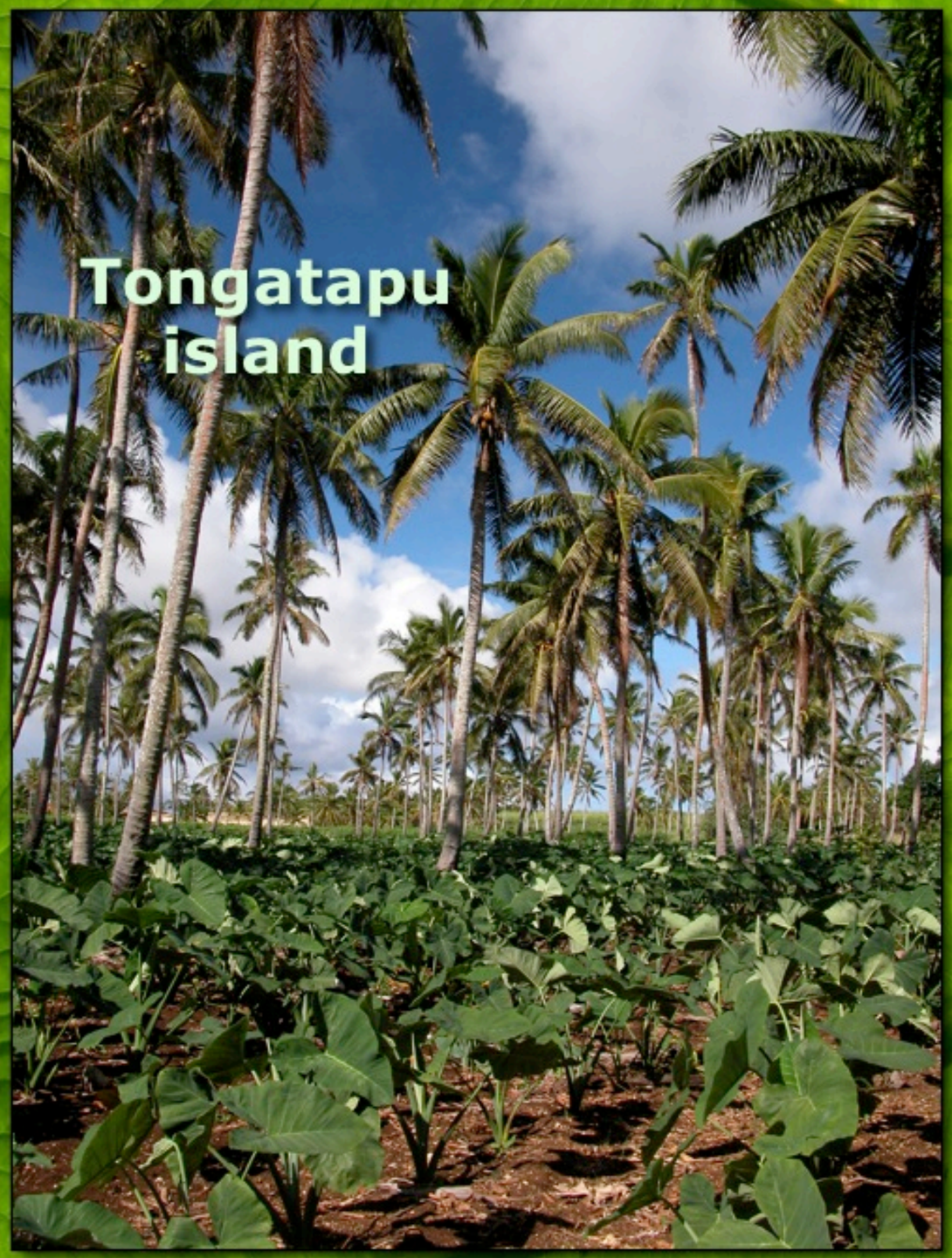

Palau


Yap


Tonga

Compare: Samoa & Hawai‘i

Compare: Tonga & Hawai‘i



Compare: Yap & Hawai'i

Proven resource managers

What do PI systems teach?

We can manage the landscape for food, medicine, fuel, and fiber, while preserving watershed, biodiversity, etc.

What do PI systems teach?

- Nutrients recycled on site
- Natural ecosystem processes preserved
- Everything accomplished within locally available energy budget

What do PI systems teach?

Include animals in agricultural systems in ways that enhance nutrient cycling

What do PI systems teach?

Most of the landscape is planted in perennials, with small scattered patches in annual crops.

Ag—Pacifica style

- Tropical model
- Slow rotation

- Temperate model
- Fast rotation

Definition: Agroforestry

"Agroforestry is a dynamic, ecologically based natural resources management system that, through the integration of trees in farms and in the agricultural landscape, diversifies and sustains production for increased social, economic, and environmental benefits for land users at all levels."—R. Leakey

Mixed coffee farm, Kona, Hawai'i

Why integrate trees from a systems perspective?

- Add vertical and time dimensions
- Increase biodiversity
- Trees can fill many functions
- Functions filled by many elements
- Tend to weather environmental perturbations

Mixed agroforest, Yap

Why integrate trees from an agricultural perspective?

- Diversify resource "portfolio"
- Increase income from add'l products
- Decrease expenditures by providing materials
- Increase resilience to market fluctuations
- Provide household needs for food, medicine, materials, etc.
- Reach specialty markets ("bird friendly," locally grown, etc.)
- Make use of difficult or marginal lands
- Generate income during the off-season
- Create "bank account" for the next generation
- Perpetuate cultural resources

Mixed cropping/agroforestry: pros

- multiple crops and markets
- short, medium, and long term crops
- food and resources for home and local use
- innovative products
- spatial efficiency
- makes use of natural fertility cycles

Homegarden, Apia

Mixed cropping/agroforestry: cons

Mixed orchard, Babeldaob, Palau

- management complexity
- knowledge intensive
- labor intensive: difficult to mechanize
- more “expensive” to operate

Kona shade coffee study

Pros

- Yields were not reduced under 40% shade or less
- Fruit, nut, and timber trees provide additional resources for use or income
- Enjoy working in shade
- Significant carbon stored

Cons

- Shade trees require management to maintain shade levels

Role of trees on farms

- Products
- Environmental services
- Intangible values

Mixed agroforest, ʻUpolu, Samoa

Products: commercial crops

Coffee and macadamia nuts, Kona, Hawai‘i

Products: botanicals

Kava under bananas, Kona, Hawai'i

Noni in forest garden, 'Upolu, Samoa

Products: specialty crops

Culinary herbs under fruit trees, Chanthaburi, Thailand

Products: timber and other wood

Flueggea flexuosa (poumuli), homegarden, American Samoa

Quercus spp. (oak) and nursery stock, Florida

Products: organic matter

Nitrogen fixing hedgerows in jackfruit orchard, Kona, Hawai'i

Mulching young trees

Products: fodder

Brahman cattle with leucaena hedgerows, Australia (Photo: M. Shelton)

Mixed fruit orchard, Kona, Hawai'i

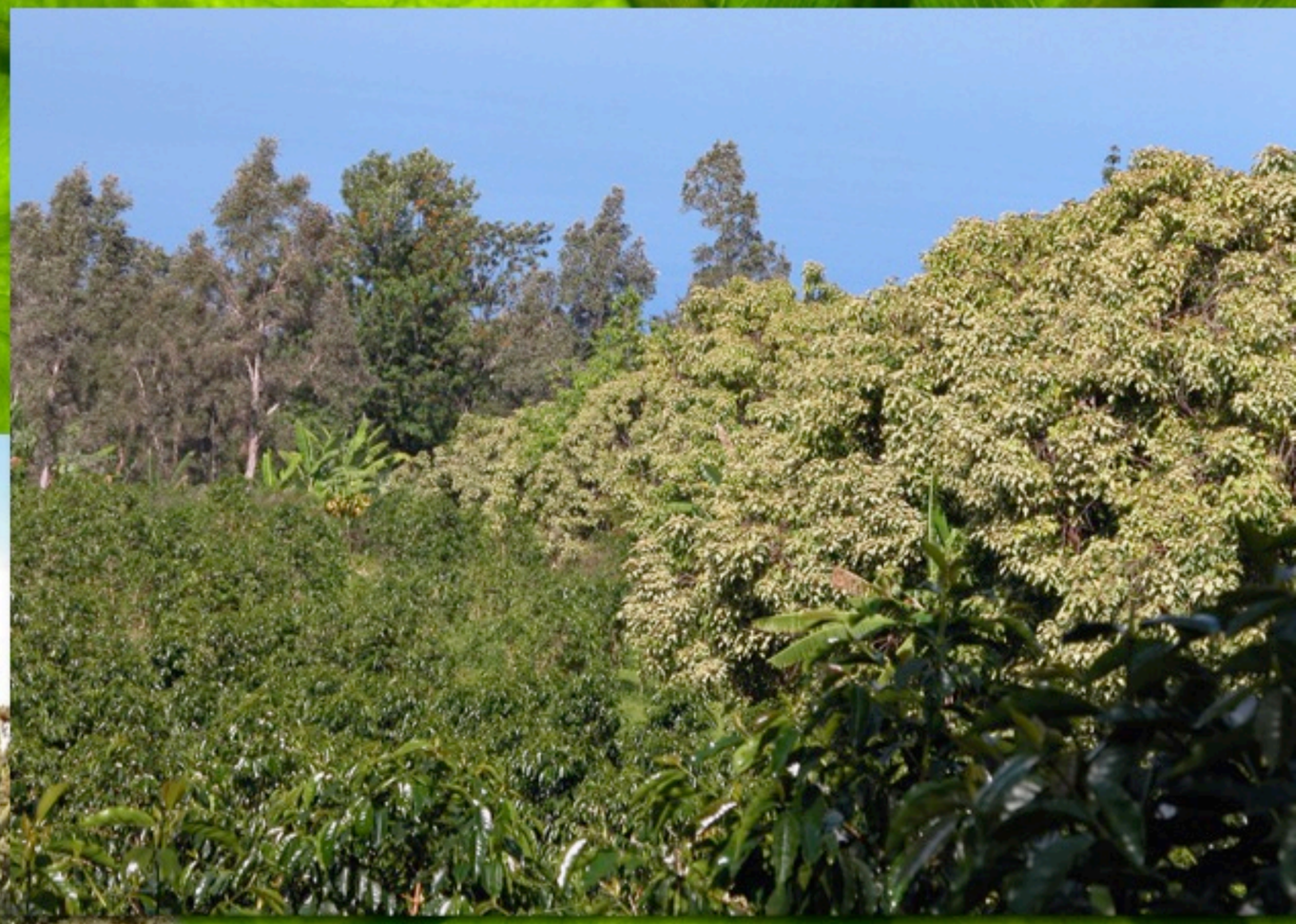
Products: household needs

Coffee agroforest, Kona, Hawai‘i

NRCS Practice standards

- Multi-Story Cropping (Code 379)
- Tree/Shrub Establishment (Code 612)
- Alley Cropping (Code 311)—Contour plantings of trees for shade and organic matter
- Streambank and Shoreline Protection (code 580)
- Windbreak/Shelterbelt Establishment (code 380)
- Silvopasture Establishment (Ac.) (381)

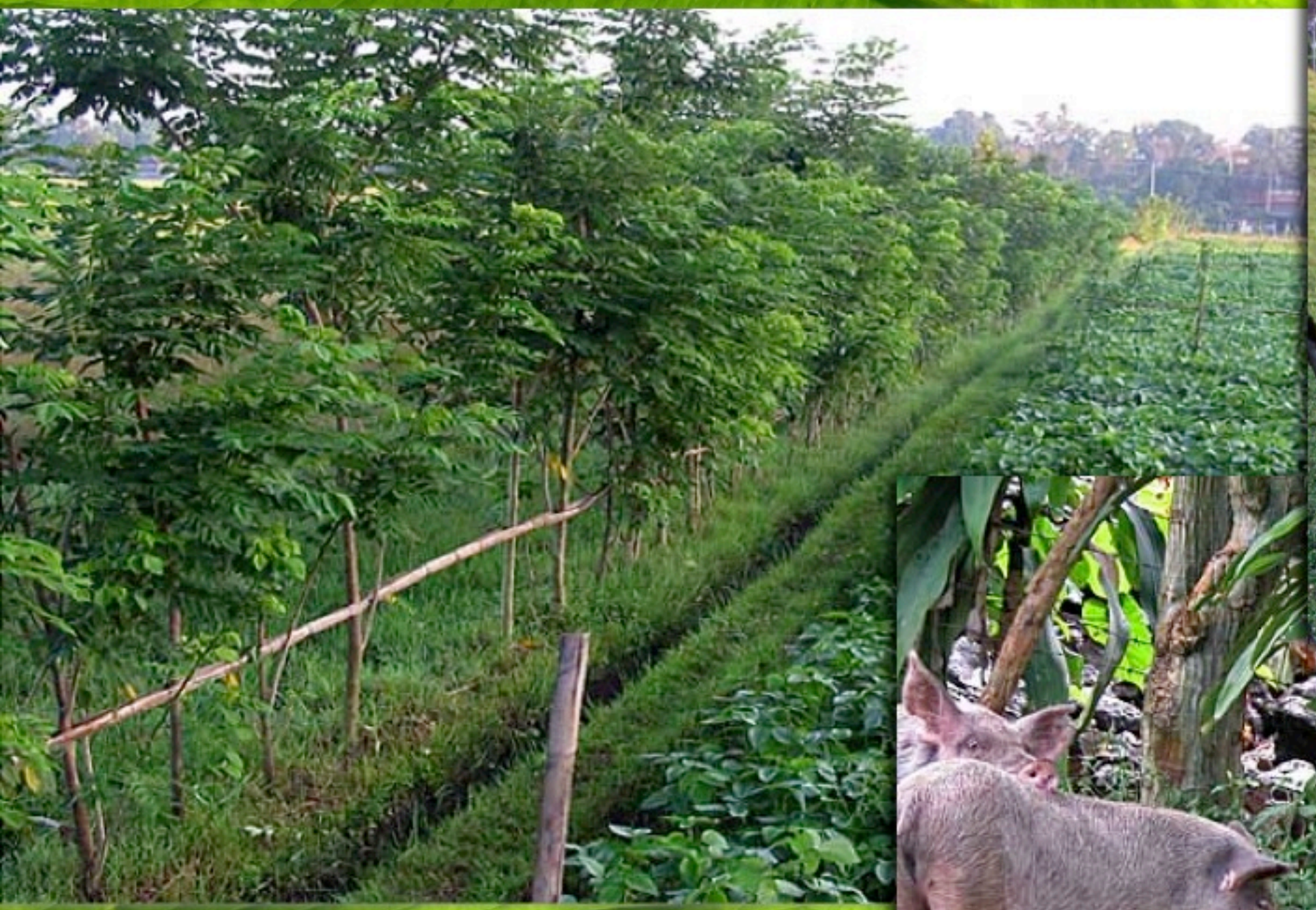
Services: windbreaks



Aleurites moluccana, Kona, Hawai'i

Casuarina cunninghamiana (river she-oak), Waimea, Hawai'i

Services: living fence



Field fence, *Gliricidia sepium*, Bali

Stockade, *Gliricidia sepium*, Costa Rica

Pig fence, *Erythrina variegata*, Samoa

Services: visual barriers

Roadside hedge, Samoa; parking lot, Kona

Services: erosion control/riparian buffer

Intermittent stream, Kona, Hawai'i

Kohala stream, Hawai'i

Services: shade

Above: mangosteen under rambutan, Thailand

Right: coffee under shade, Kona

Services: livestock habitat

Hair sheep in coffee, Kona

Cattle under coconuts, Tongatapu

Services: Carbon sequestration

Coffee growing under native forest, South Kona

Tree-based land-use systems

- natural forest
- forest plantations
- agroforestry systems

Services: utilize difficult sites

Noni on pahoehoe lava, Kona

Papaya on rocky slope, Kona

Values: cultural

Dancers, Kona

Paper mulberry, Tonga

Pounding paper mulberry at Pu‘uhonua o Honaunau, Kona

Values: healthy ecosystem

Coffee agroforest, Kona

Degraded pasture, Hilo, Hawai‘i

Values: biodiversity conservation

Coffee orchard, South Kona

Coffee agroforestry, Turrialba, Costa Rica

Values: food security

Palau

Homegardens, Apia

Values: beauty, livability

Forest canopy

Values: meeting places/sacred sites

Kukui (candlenut) meeting area, Kealakekua, Hawai'i

Jacaranda, Kealakekua, Hawai'i

Values: leave a legacy

Right: Acacia koa, South Kona

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