

A tropical sunset scene with palm trees and hibiscus flowers. The sun is low on the horizon, casting a golden glow over the ocean and sky. The foreground is filled with lush greenery and yellow hibiscus flowers. The background features several tall palm trees silhouetted against the bright sky. The entire image is framed by a white L-shaped border on the left and bottom.

# HAWAIIAN ISLANDS

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# Order of Events

1. General Overview
2. Geology
3. Soils
4. Forests
5. Silviculture
6. Forest Regions
7. Insects & Diseases
8. Disturbances
9. Conclusion

# GENERAL OVERVIEW



Humuhumunukunukuāpua'a



# Oahu



- Has Honolulu
- Most Populated
- North Shore Surfing
- 1,016,508



# Hawaii



- Largest Island
- Youngest Island
- Active Volcanoes
- 200,629



# Maui



- 2<sup>nd</sup> Largest
- Good Whale Watching
- No Native Snakes ☺
- 164,221





# Kauai

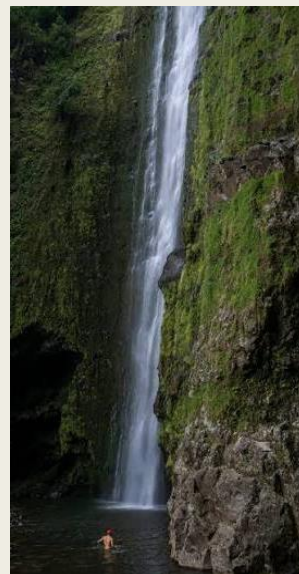
- Oldest Main Island
- “Garden Island”
- Lush Vegetation
- 73,298



# Molokai



- Rich History
- Worlds Highest Cliffs
- Birthplace of Hula Dancing
- 7,345



# Lanai



- Historic Pineapple Plantation
- No Traffic Lights
- 98% Privately Owned
- 3,367





# Niihau

- Privately Owned
- Purchased for \$10,000 in gold (1864)
- Descendants of Elizabeth Sinclair
- 84



# Kahoolawe



- Smallest Island
- Historic Military Practices
- Forest Restoration
- No Natural Fresh Water
- 0

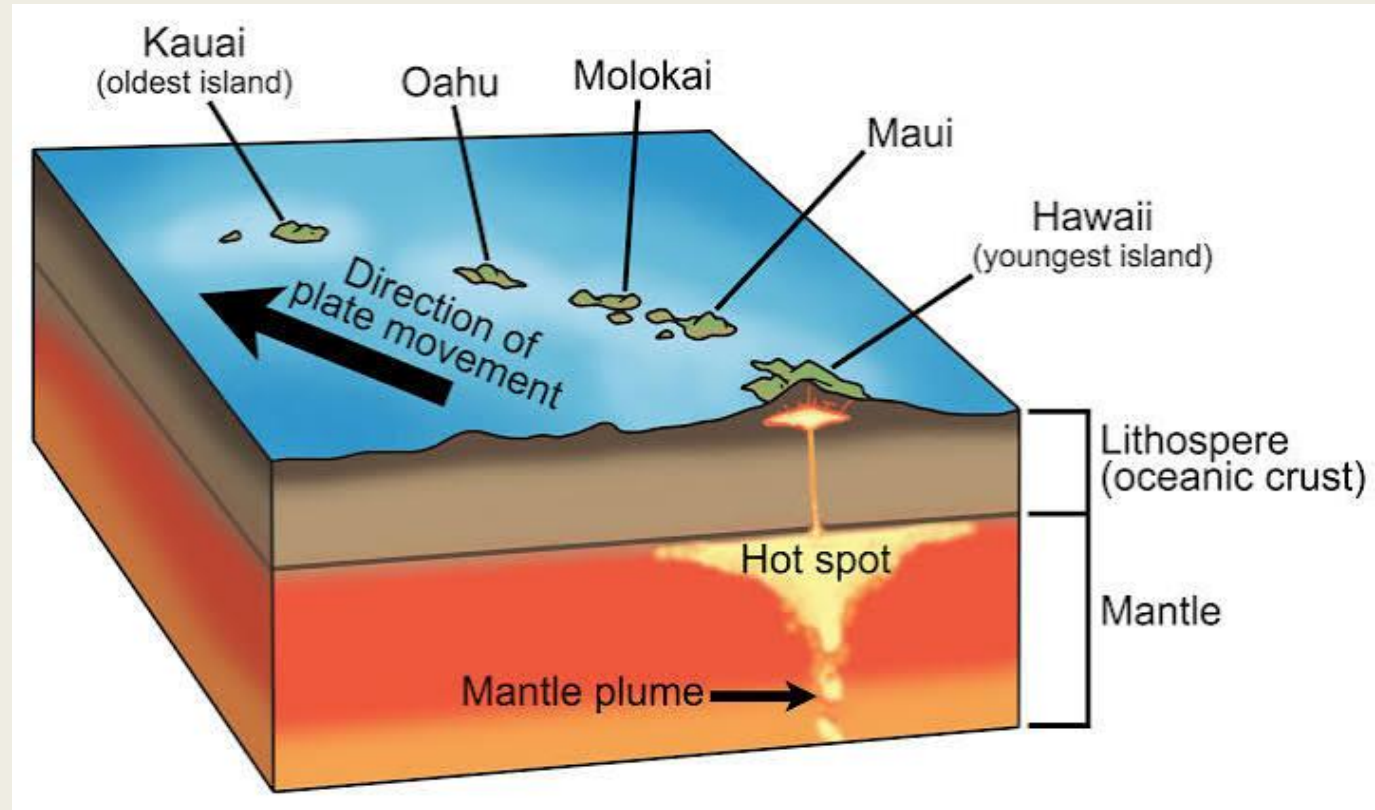


# GEOLOGY

# How the islands were formed

## Volcanic Hot Spots

- Mantle Plumes
- ↓
- Magma Formation
- ↓
- Volcanic Eruption  
(through earth's crust)
- ↓
- Volcanic Island Formed
- ↓
- Emperor Seamount Chain



**SOILS**

## Andisol



Kula Series, Maui Hilo Series, Hawaii

**Andisols** are soils derived from volcanic ash. The less weathered Kula soil on Maui is quite productive, while the Hilo soil on the Big Island is highly weathered and requires lots of fertilizers for crop production.

## Aridisol



Kawaihae Series, Hawaii

**Aridisols** are soils of the arid areas or soils with high salt content. The Kawaihae soil of the Big Island has features of an arid area of light color, low organic matter, and shallow depth.

## Entisol



Jaucas Series, Maui

**Entisols** are least-developed soils showing only a weak surface development. The calcareous Jaucas soil on Maui is an example with sandy texture, and excessive drainage.

## Histosol



Papai Series, Hawaii Alakai Series, Oahu

**Histosols** are organic soils with a high organic matter content in the surface horizon. The Papai soil on the Big Island has lost almost all of the surface organic matter (OM), but the Alakai soil atop Mt. Kaala on Oahu is high in OM.

## Inceptisol



Kolekole Series, Oahu

**Inceptisols** are soils showing minimal development of soil horizons. The Kolekole soil on Oahu is an example.

## Mollisol



Kawaihapai Series, Oahu Makawele Series, Kauai

**Mollisols** are fertile soils with high organic C and high base saturation. Although the Kawaihapai soil on Oahu is dark, the Makawele soil on Kauai is red because of Fe oxides.

## Oxisol



Hali Series, Kauai

**Oxisols** are the most weathered soils of the tropics with low nutrient holding capacity and high Fe and Al oxides. The Hali soil on Kauai is an example.

## Spodosol-like soil



Oahu

**Spodosols** are soils with leached Al, Fe, and organic materials in the subsoil, showing a distinct layer.

## Ultisol



Alaeola Series, Oahu Haiku Series, Maui

**Ultisols** are highly weathered infertile soils with clay accumulation in the subsoils. Examples are Alaeola soil on Oahu and Haiku soil on Maui.

## Vertisol



Luakalei Series, Oahu

**Vertisols** are soils that shrink when dry and swell when wet. They usually occur in valleys with poor drainage. They are fertile, but pose severe limitations for roads, housing, and related uses. The Luakalei soil on Oahu is an example.

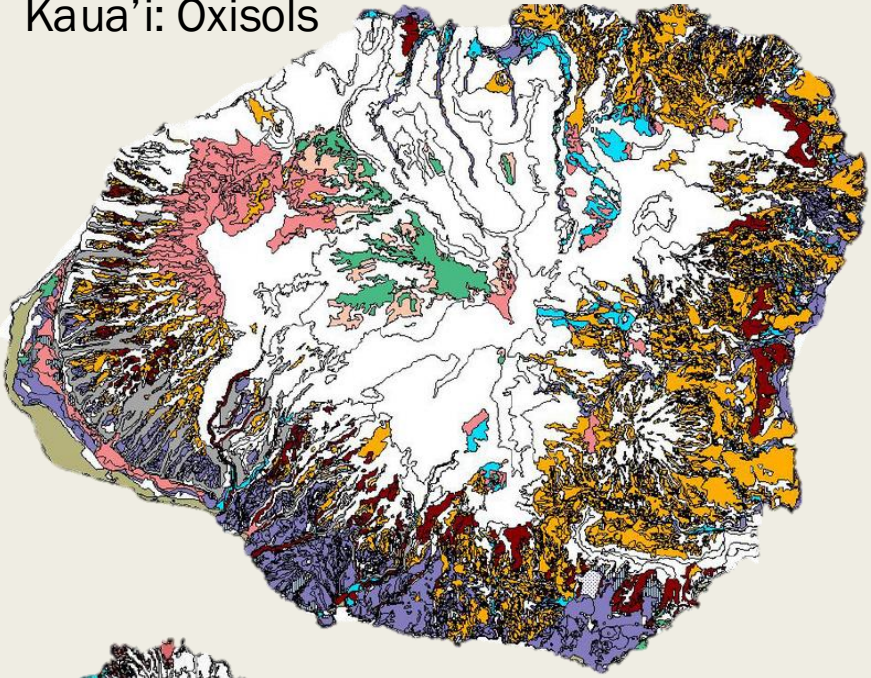


Gelisols

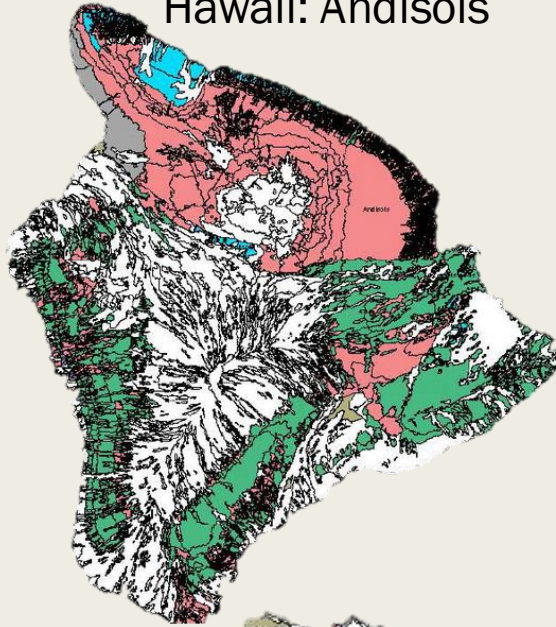
Alfisols



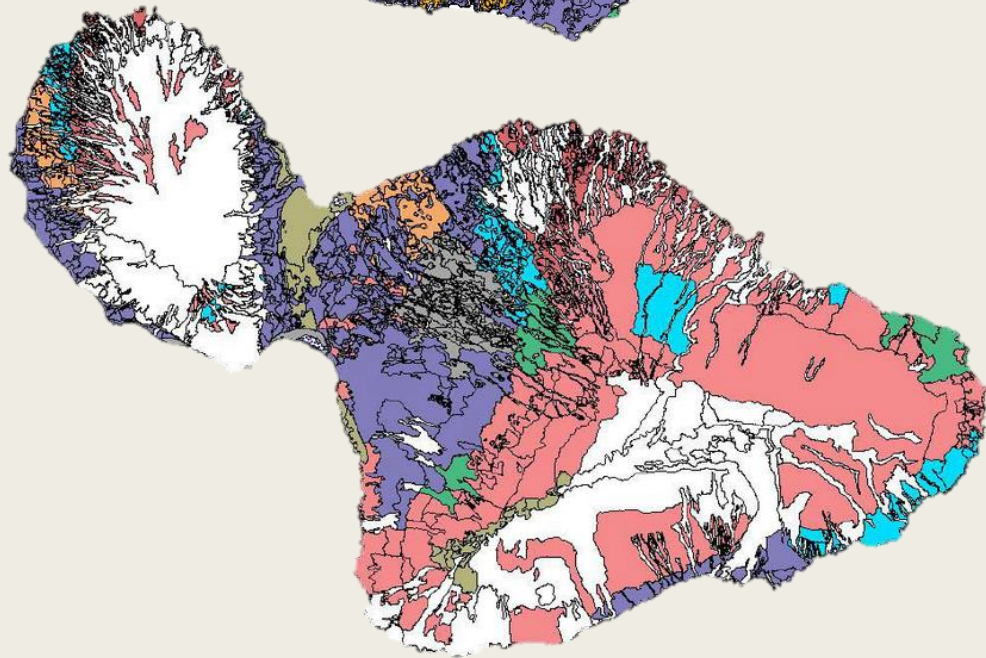
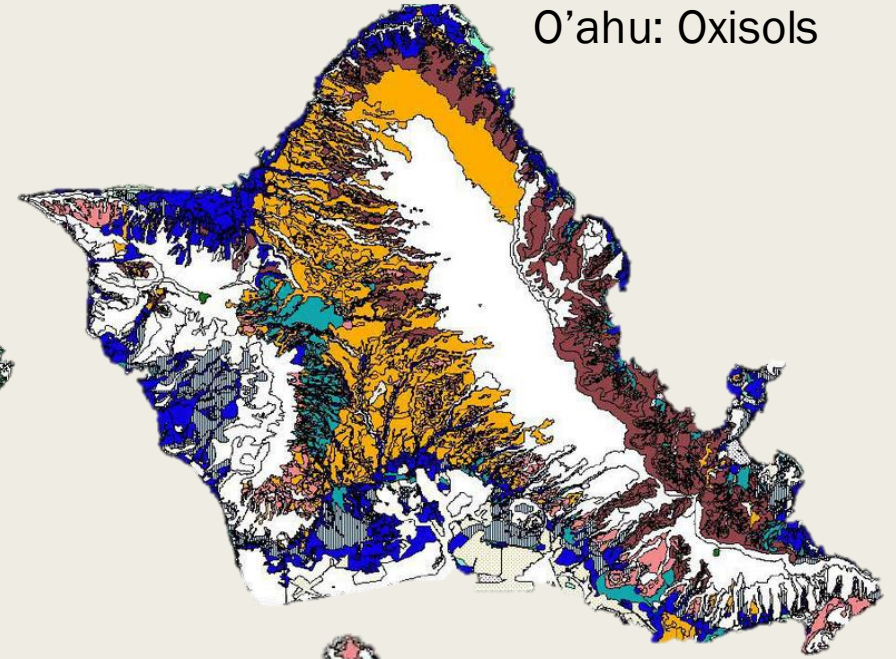
Kaua'i: Oxisols



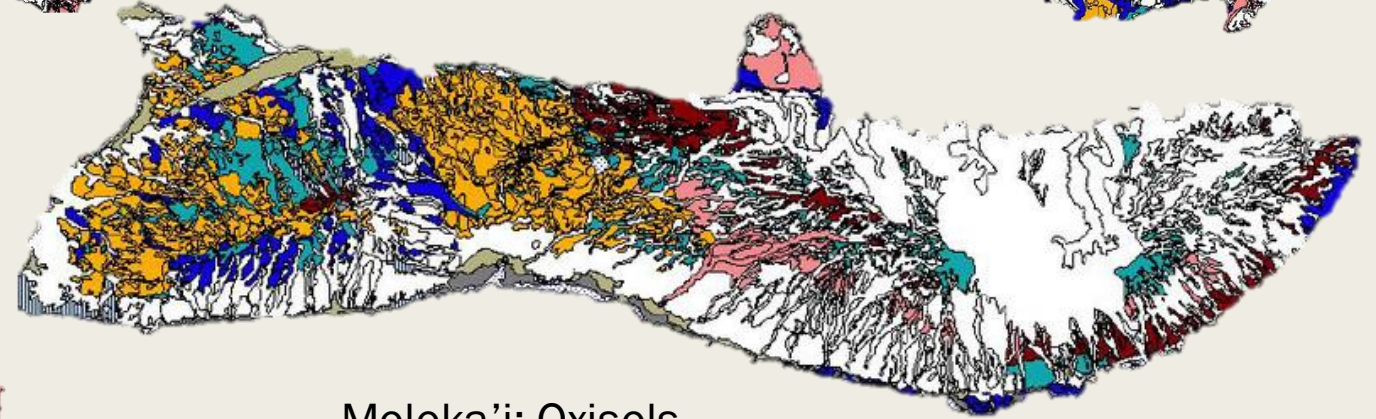
Hawaii: Andisols



O'ahu: Oxisols



Maui: Andisols

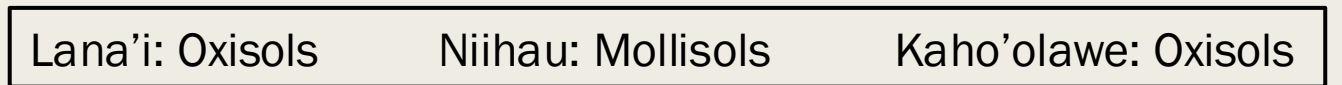


Moloka'i: Oxisols

Lana'i: Oxisols

Niihau: Mollisols

Kaho'olawe: Oxisols

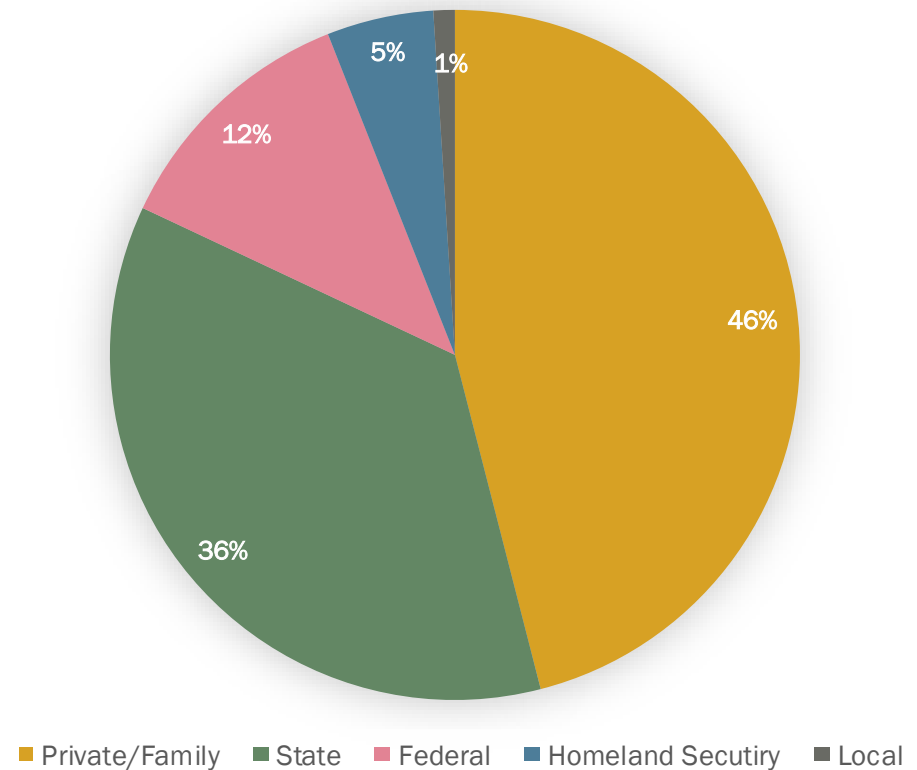


**FORESTS**



## Forests

- 2 million acres (half of the land area)
- 50,000 ac specified for forest management practices with potential for harvesting
- A lot of area for re-establishing native trees
- ~56% of all forests are dominated by non-native species





# Tree Species

## Native

- Koa
- Sandalwood
- Ohi'a Lehua
- Kou

~ 175 Species

## Introduced

- Banyan Trees
- Many fruit trees
- Many palm trees
- Candlenut (candies)
- Eucalyptus

1,000s of Species

## Invasives

- Strawberry guava (most abundant)
- Miconia
- Albizia
- Octopus tree
- Koa Haole
- Brazilian Pepper (Christmas Berry)

~200 species

# Timber



Koa (*Acacia koa*)

Sandalwood (*Santalum paniculatum*)

Ohi'a lehua (*Metrosideros polymorpha*)



# Banyan Trees



# SILVICULTURE

# It's not East Texas...



## Main Focus

- Watershed Protection
- Grasslands ➡ Forests
- Conserving/restoring native species
- Ecosystem Restoration
- Preventing Invasives & Disturbances
- Agroforestry/Silvopasture

# Silviculture For Dummies: Hawaii Edition

## SILVICULTURE PRESCRIPTIONS FOR DUMMIES

HAWAII EDITION ■ Regeneration • Establishment • Intermediate Treatments

### REGENERATION METHODS

|                                                     |                                                                                                                                                                   |
|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CLEARCUT</b><br>Even-aged                        | Koa is shade intolerant, so light is your friend. Use as an example for a managed koa plantation/restoration site—not an excuse to clearcut intact native forest. |
| <b>SEED-TREE / SHELTERWOOD</b>                      | Possible where retained trees and desired regeneration make sense. Do <b>not</b> blindly copy southern yellow pine timing, spacing, or stocking rules.            |
| <b>PATCH / GROUP OPENINGS</b><br>Uneven-aged option | Create openings large enough to provide regeneration light while retaining surrounding forest structure. A nice option when 'remove everything' is not the goal.  |

### ESTABLISHMENT TREATMENTS

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SITE PREP</b>               | <ul style="list-style-type: none"><li>• <b>Slash:</b> remove/redistribute only where it interferes with planting, access, or establishment.</li><li>• <b>Soil:</b> minimize unnecessary mechanical disturbance, especially on steep/erosion-prone sites.</li><li>• <b>Competitions:</b> control invasive grasses and other vegetation that can overwhelm koa seedlings.</li><li>• <b>Herbicide:</b> targeted use when appropriate—not 'because East Texas does it.'</li><li>• <b>Fertilizer:</b> site-specific. Don't fertilize just because your forestry brain says TPA.</li></ul> |
| <b>ARTIFICIAL REGENERATION</b> | <ul style="list-style-type: none"><li>• <b>Planting:</b> establish koa using an appropriate seed/seedling source.</li><li>• Hand planting may be appropriate where terrain limits machines.</li><li>• <b>Spacing/density:</b> site- and objective-dependent. There is no magical Hawaiian 10 x 10 ft rule.</li></ul>                                                                                                                                                                                                                                                                 |

### INTERMEDIATE TREATMENTS

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PRECOMMERCIAL / RELEASE</b> | <ul style="list-style-type: none"><li>• <b>Weeding:</b> suppress undesirable vegetation around young koa.</li><li>• <b>Cleaning:</b> favor desirable koa over less desirable same-age competitors.</li><li>• <b>Liberation:</b> release young koa from older, overtopping competitors when appropriate.</li><li>• <b>Invasive species:</b> monitor and control throughout establishment.</li></ul>                                                               |
| <b>COMMERCIAL THINNING</b>     | <ul style="list-style-type: none"><li>• <b>Free thinning:</b> control spacing and favor desired crop trees using multiple criteria.</li><li>• Prioritize form, health, crown development, diameter growth, and potential timber quality.</li><li>• Don't automatically copy the East Texas 'first thin = access, second thin = low thin' recipe.</li><li>• <b>Selection thinning?</b> Still bad if you're doing it just because the name sounds fancy.</li></ul> |
| <b>SITE RESOURCES</b>          | <ul style="list-style-type: none"><li>• <b>Fire:</b> wildfire prevention/fuel management are major considerations; don't casually substitute East Texas prescribed burning.</li><li>• <b>Watershed:</b> minimize erosion and protect streams/sensitive areas.</li><li>• <b>Wildlife &amp; culture:</b> retain native habitat features and recognize koa's cultural importance.</li></ul>                                                                         |

**THE HAWAIIAN SILVICULTURE RULE:** You can use the same silvicultural toolbox as East Texas—but you probably shouldn't use the same prescription. Different species + different climate + different objectives = different prescription.

Based on the terminology and organization of the uploaded FORS 3347 Silviculture Prescriptions for Dummies handout, Hawaiian-specific examples are an illustrative presentation aid, not an operational prescription.

## Key Points

- Little slash
- Little herbicide, fertilizer, or burning
- Control for shrubs not HW
- No geometric thinning
- Try for natural regeneration

# Department of Land and Natural Resources

Forest  
Action Plans

Landowner  
Assistant  
Programs

Forest  
Reserve  
Plans

Forestry  
Projects



# FOREST REGIONS



## Hawaii

Montane Rainforest / a little bit of everything

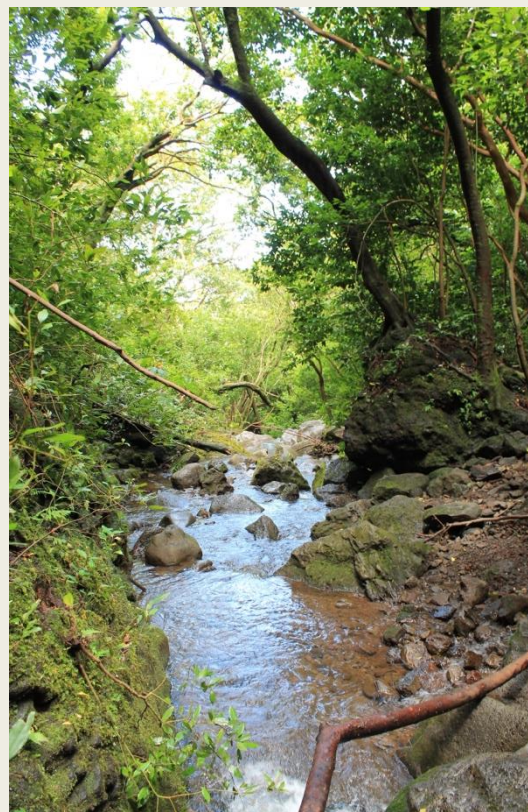
- High elevations | wet
- 34% Forest

## Maui

Montane Rainforest

- High elevations | wet
- 39% Forest





## O'ahu

### Lowland Tropical Rainforest

- Warm | wet | lowland
- So many invasives
- 48% Forest



## Moloka'i

### Lowland Tropical & Montane

- High elevations | wet
- 39% Forest



## Lana'i

Dry Forest

- Very Dry
- 49% Forest



## Kaho'olawe

Dry Vegetation & grasslands

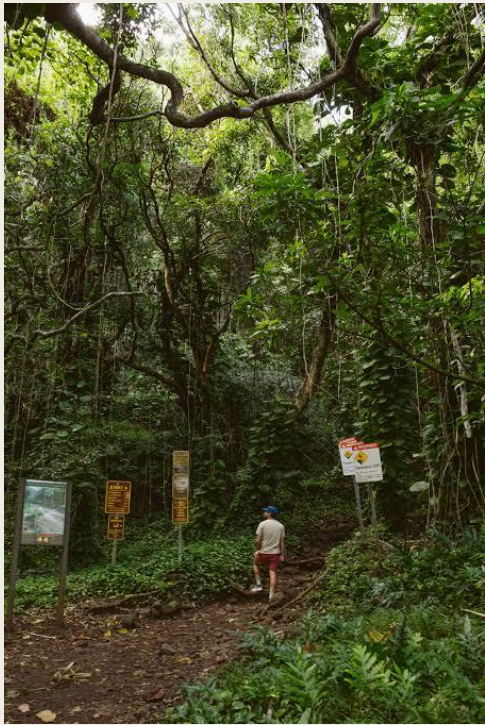
- Heavily degraded
- 0% Forest



## Ni'ihau

Dry Forest & Woodlands

- Shrublands
- 1% Forest



## Kua'i

### Cloud Forest

- One of the world's rainiest areas
- High elevation | Mountain forests
- No commercial native forests
- Constant low hanging cloud coverage
- 53% Forest



# **INSECTS/DISEASES**

# Insects

- Coconut Rhinoceros Beetle
- Myoporum thrips
- Erythrina Gall Wasp
- Black Twig Borer



# Diseases

- Rapid Ohia Death
- Ohia Rust
- Koa Wilt
- Cycad Aulacapis Scale



# Management

- Monitor/Early Detection
- Prevention
- Remove the Source
- Biological Control
- Targeted Treatments



# Disturbances

# Fire



- 15% slower water infiltration rates
- Removes the desired species

## Recovery:

- Replant native species
  - *where natural regen is unsuccessful*
- Control/remove invasives
- Stabilize soils

# Volcanoes



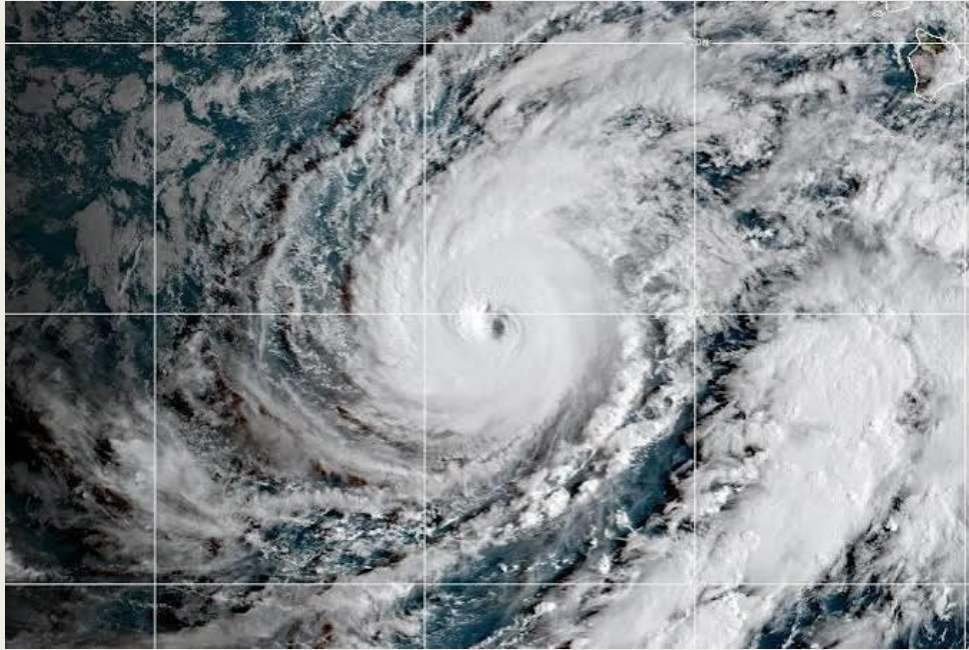
- Lava destroys everything in its path
- Not always big eruptions

## Recovery:

- Allow for cooling
- Let early succession happen
- Take advantage of soil pockets
- ~150yrs before mature forests
  - *In wet environments*



# Hurricanes



- More DWD
- Canopy Loss
- Stem Breakage/Windthrow
- Litter distribution

## Recovery:

- Many areas naturally survive
- Salvage timber
- Remove hazardous trees
- Control invasives/monitor



# Conclusion

# Mahalo For Listening

Forestry on the islands is very different than in East Texas.

They focus on restoration and protecting the cultural value for generations to come.

