# Farming and Energy: Sustainability in America

National Association of State Energy Officials
Minneapolis, MN
September 11, 2012

UNIVERSITY of HAWAI'I MĀNOA
WESTERN INSULAR PACIFIC SUN GRANT SUBCENTER
SunGrant INITIATIVE

# Presentation Outline

- Hawaii's Situation
- Project Goals
- Aspects of Sustainability
- Project Approach
- Preliminary Project Results
  - Feedstock
  - Conversion
  - Environment
  - Community
- Summary

# Hawaii's Situation

>90% of Hawaii's energy needs depend upon fossil fuels (88% petroleum, 5% coal).

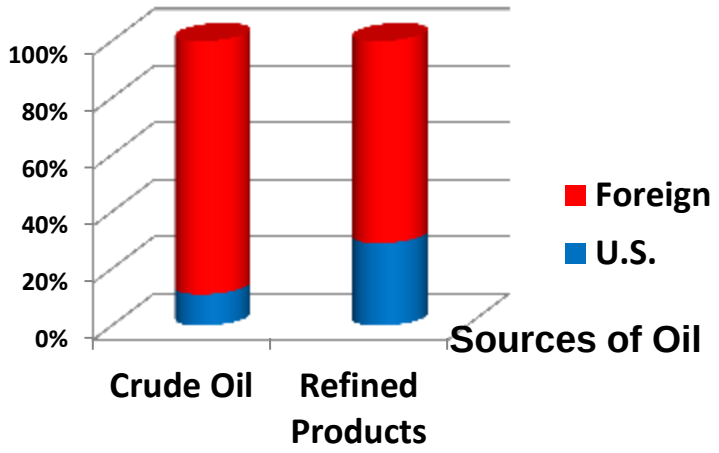
Most geographically isolated population mass in the world.

Year round growing season.

Excellent growing conditions for desired crops and associated pests and diseases.

Most of the world's microenvironments (10 of 14 climatic zones, and 10 of 12 soil orders of the world).

Hawaii Clean Energy Initiative.


STATE OF HAWAII

Hawai'i Powered
Hawai'i Clean Energy Initiative

U.S. DEPARTMENT OF ENERGY

University of Hawai'i Mānoa

WESTERN INSULAR PACIFIC SUN GRANT SUBCENTER

SunGrant Initiative

# Project Goals

Develop sustainable renewable energy production in Hawaii and the tropics by addressing the following critical questions:

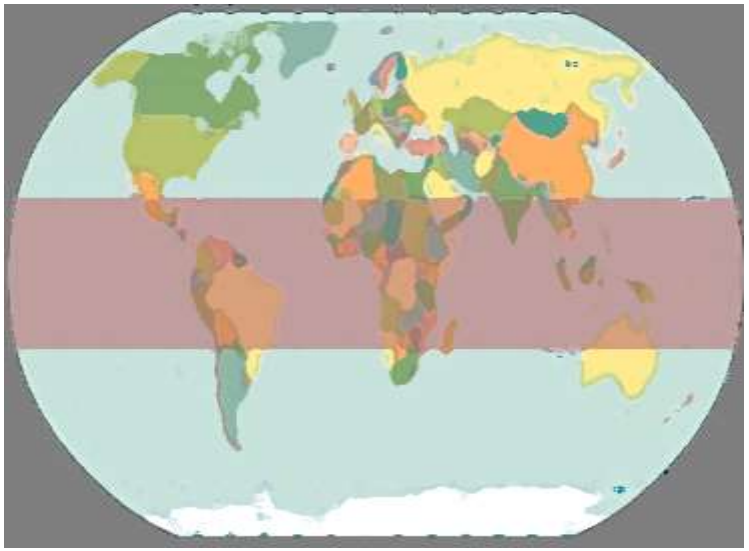
-Best crops for Hawaii/tropics?

-Impact of crops on conversion?

-Impact on environment?

-Impact on communities?

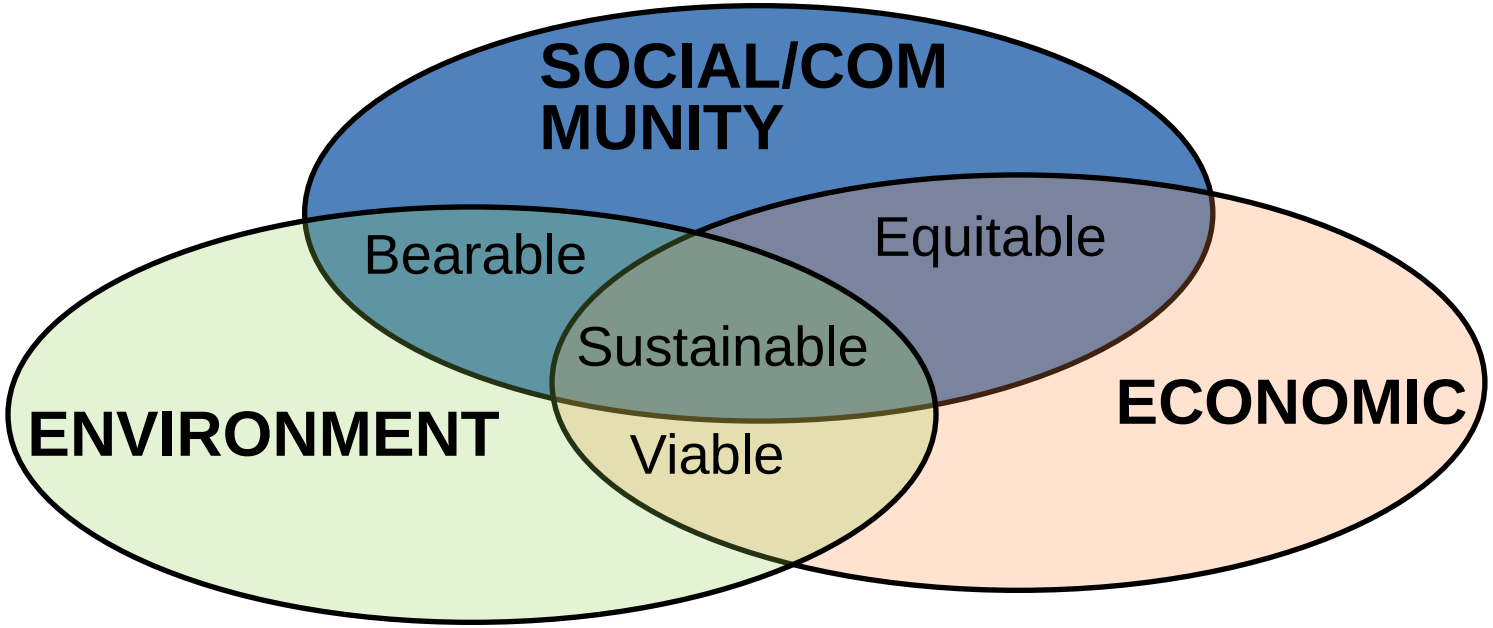
-Impact on public policies?



# Aspects of Sustainability

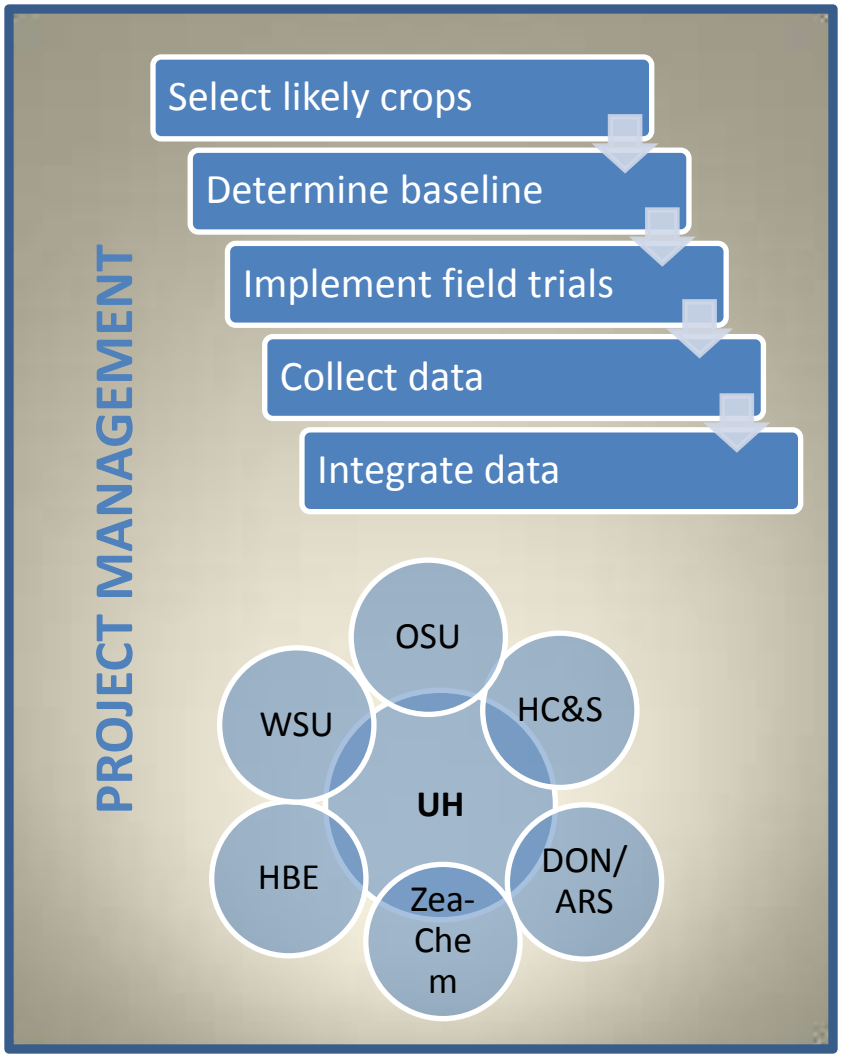
Sustainability is "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (The Brundtland Report. 1987).

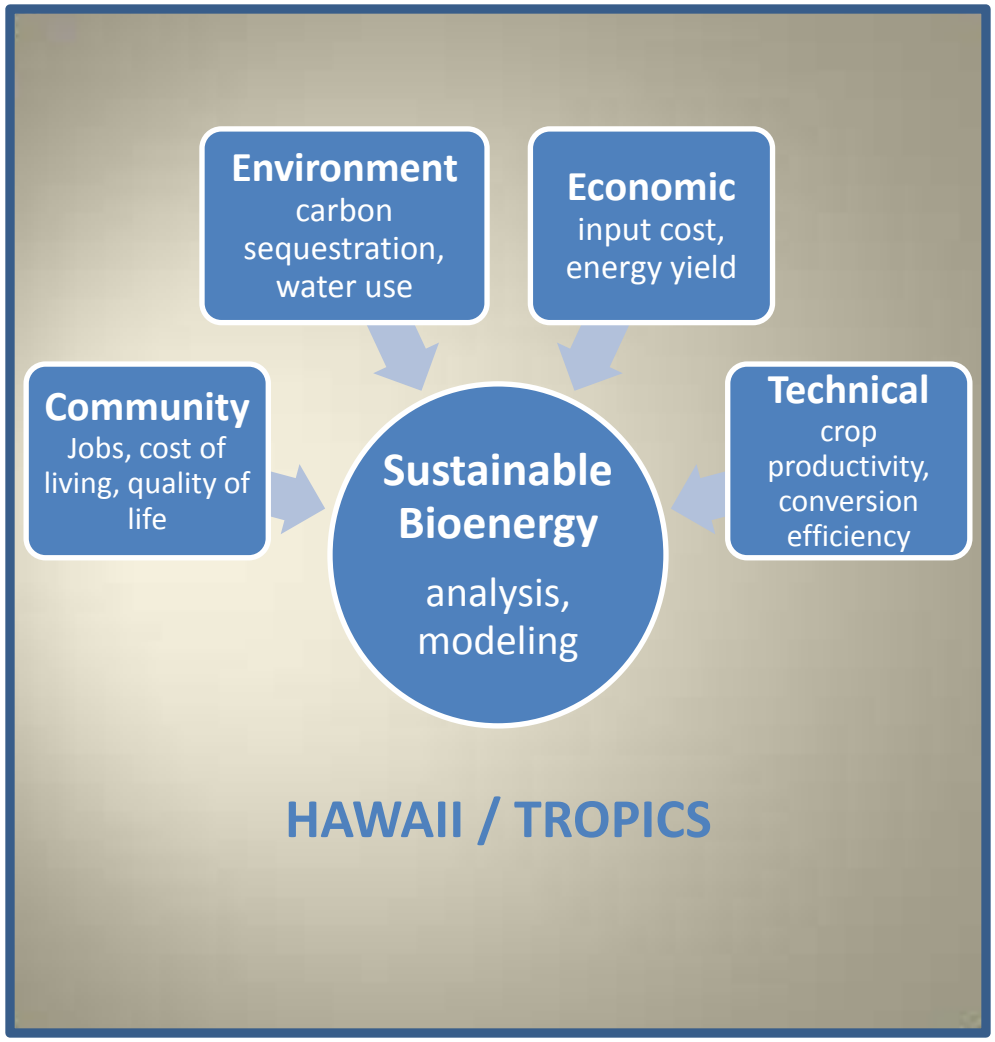
Sustainability is improving the quality of human life while living within the carrying capacity of the supporting ecosystems.- UN Caring for Earth, 2005.



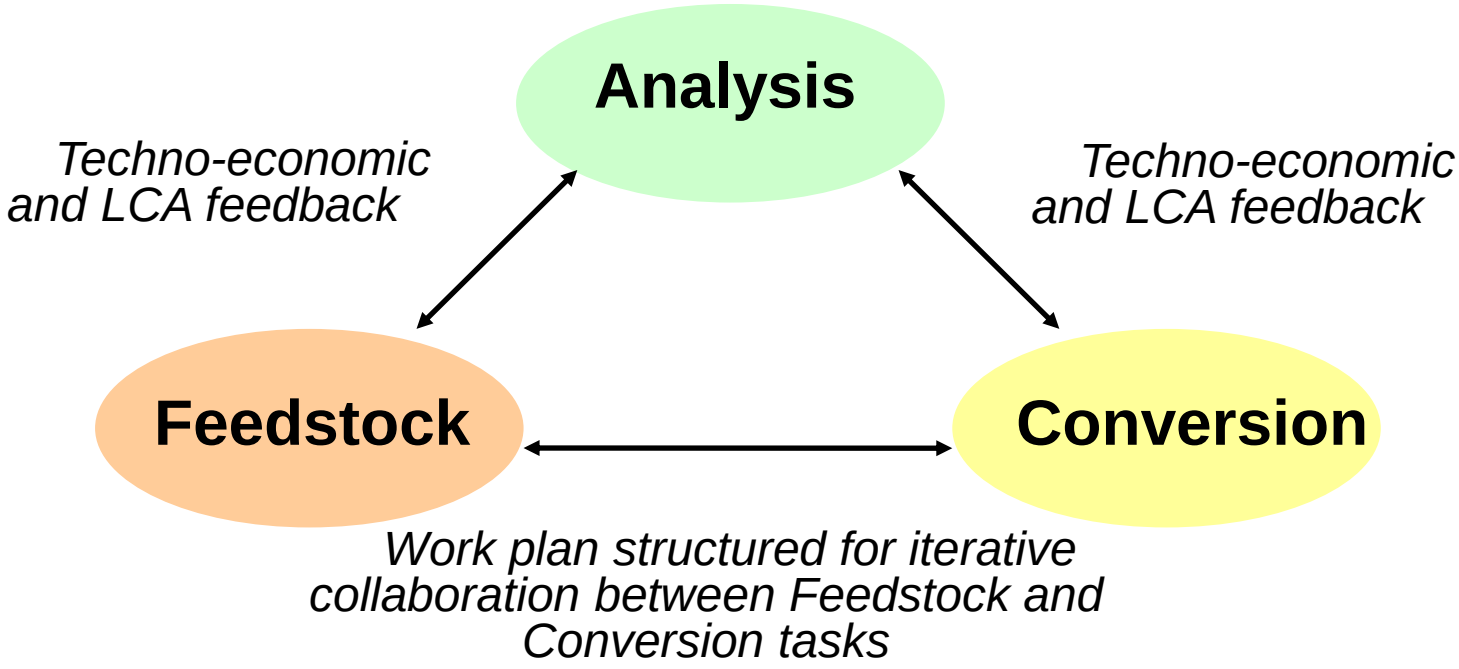

Adams, A. W. 2006

# Project Approach



# Integration of Tasks



# Hawaiian Commercial & Sugar Company

Integrated grower/processor of sugarcane.

Cultivate 35,000 acres on the island of Maui.

Last remaining sugar grower in Hawaii.

Products:

- 200,000 tons raw sugar.
- 65,000 tons molasses.
- 200,000 MWH electricity.

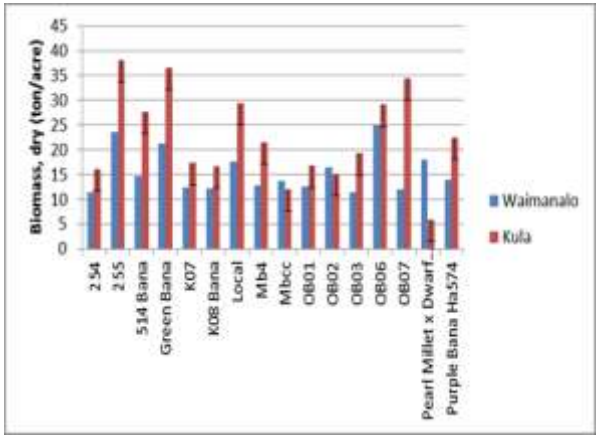
# Hawaiian Commercial & Sugar Company

- Energy crops (Energycane, Napiergrass, Energy Sorghum, Sugarcane)
  - 3 cultivars per crop
  - 3 elevations (100', 1000', and 3000')
  - 3 water regimes (50%, 75%, and 100% commercial rates)
- Measure input requirements, costs and impacts
  - Land
  - Water
  - Nutrients
  - Machinery
  - Air and water quality
  - Carbon sequestration

# Feedstock

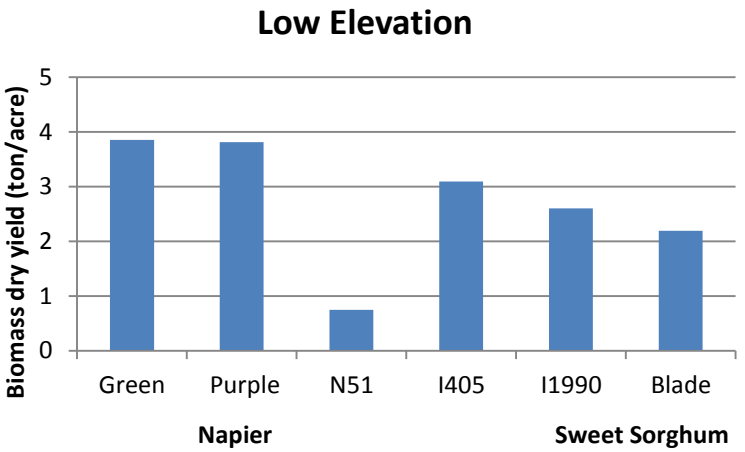
Genotype by environment interaction resulted in biomass yields of up to 38 dry tons/acre (**57 dry tons/acre-year**) were obtained with napiergrass planted at a high (3000 feet) elevation and nearly 24 dry tons/acre at a low (100 feet) elevation.

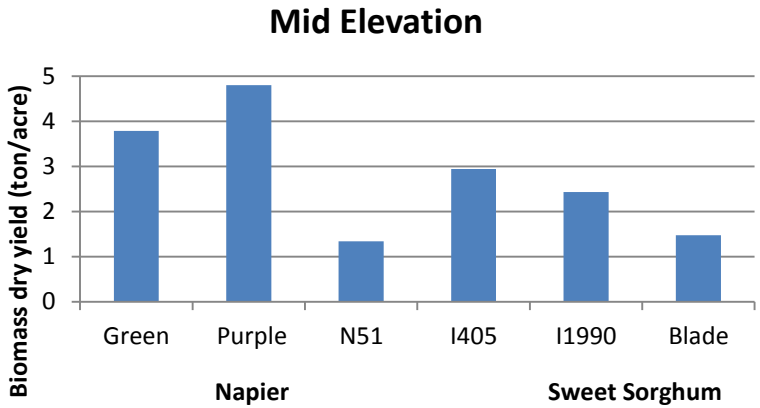
Biomass yields of these grasses are much higher than reported yields of many tropical tree and temperate grass species. With few exceptions, the biomass yields of the 16 napiergrass species selected were greater at the higher elevation.



# Feedstock

Biomass yield at low- and mid-elevation sites (100 and 1000 feet ) show at 6 months after planting that two of three Napiergrass varieties have greater yield than three sweet sorghum varieties. Furthermore, the Napiergrass has been harvest only once while sweet sorghum was harvested twice in the same time period.



# Conversion

Banagrass juice extracted during preprocessing can be used for co-product generation. The extracted juice was used as a substrate for fungal-protein production that proved successful in yielding fungal biomass as a livestock feed source.

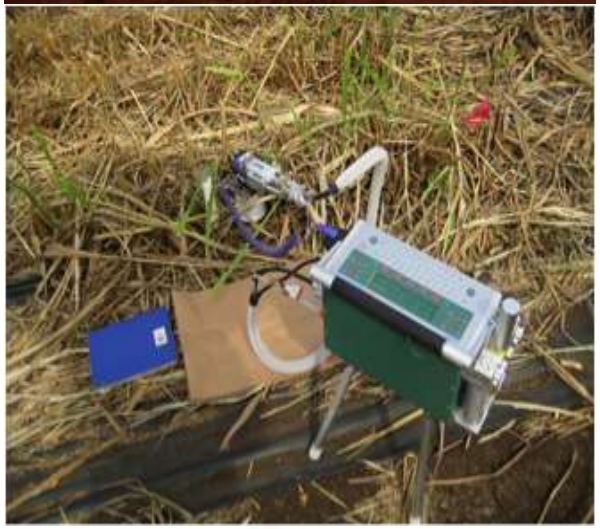

Syngas was produced by thermochemical gasification of C4 grasses. The processed fuels are being tested in a laboratory scale biomass gasifier to determine syngas composition and quality.

# Environment

Minirhizotron tubes were installed in sugar cane and napiergrass plots in the deficit irrigation trial field to monitor root growth and turnover.

Significant increases in total soil C stock and higher potential for carbon sequestration observed for varieties of napiergrass, but none for guinea grass over a 12 month period.

Preliminary economic analysis indicate Napiergrass and energycane have the highest net returns over guinea grass, and other potential biofuel crops

# Hamakua Springs Water LLC

Produces fruits and vegetables for major supermarkets in Hawaii.

600 acres, adequate water supply.

Works with five cooperating farmers to diversify products.

High energy costs constrains amount of cooling facilities he can use.

# Hamakua Springs Water LLC

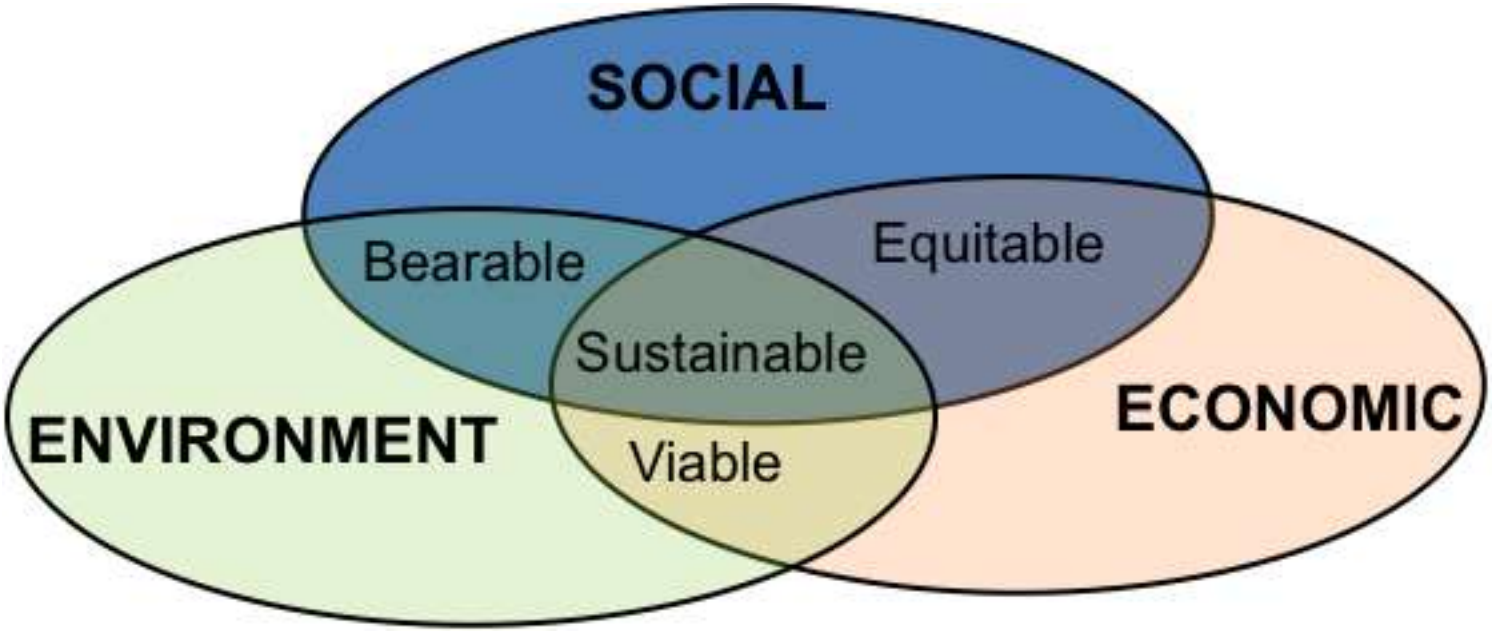
Install hydroelectric plant

Measure financial and economic returns, employment (HSW and 4 cooperation farmers) annually

Measure project impact on quality of life on families and communities

Measure carbon footprint changes

# Farming and Energy: Sustainability in America




Andrew.Hashimoto@hawaii.edu
808-956-7531

University of Hawai'i Mānoa
WESTERN INSULAR PACIFIC SUN GRANT SUBCENTER
SunGrant Initiative