Small-scale Livestock Production in Agroforestry Landscapes

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Creative Agroforestry for Food Production in Landscapes, June 27, 2015
Kunia Research Station, HARC, Waipahu, HI

Mahalo to ....
- Craig Elevitch, agroforestry.net
- Hawaiian Homegrown Food Network
- USDA - WSARE
- Hawaii Agriculture Research Center
- Farmers in the Pacific-basin island Nations and Territories.

- Livestock Programs
- Focus on beef cattle production research and outreach
- Livestock nutrient management and water quality impacts
- Agroforestry experiences from work in the Pacific basin island nations and US flagged territories

Source: Glen K. Fukumoto, University of Hawaii at Manoa
Overview

- Livestock Industry in Hawaii
- Why livestock agriculture
- Which livestock
- Concepts in Livestock Management
- Integration: Small-scale systems

Livestock Industries in Hawaii

- Dairy ($9.5 M)
- Pork ($2.0M)
- Poultry ($3.0 M)
- Beef ($4.4 M)

$67.3 Million *
Farm-Gate Value
Generating
$202 Million
in Hawaii’s Economy

* Hawaii Agricultural Statistics Service, 2011

Our challenges are many …

- State Constitution (call for food self-sufficiency)
- Land (HRS 205) and Water
- Oil (transportation, fuel, utilities, etc.)
- Weather (sea to the landscape/environment)
- Labor
- Regulations
- Urbanization
- Human Industry (knowledge base)
- Lack of understanding of agriculture in the state
- Highest per capita tax burden

Why Livestock ?

- Convert inedible or poor quality plants and food wastes into high quality protein
- Ecosystem services
- Traction, land preparation
- Living food “storage”
- Supplemental organic soil nutrient
- Cultural significance (Pigs in the Pacific)
- Economic generator

Source: Glen K. Fukumoto, University of Hawaii at Manoa
Solar Dollar Concept:

SUN ➔ PLANT ➔ ANIMAL ➔ SOLAR DOLLAR

Which Livestock?

- The species of livestock that can best take advantage of the “Solar Dollar”
- Ability of the owner to care for the health, welfare and management of the livestock
- The adaptability of the livestock species and breeds to the environment
- Space (land) availability, and
- Market for the products.


<table>
<thead>
<tr>
<th></th>
<th>1999</th>
<th>2008</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broiler</td>
<td>5</td>
<td>0</td>
<td>-100</td>
</tr>
<tr>
<td>Dairy</td>
<td>10</td>
<td>2</td>
<td>-80</td>
</tr>
<tr>
<td>Hog</td>
<td>30</td>
<td>21</td>
<td>-30</td>
</tr>
<tr>
<td>Beef</td>
<td>800</td>
<td>1100</td>
<td>+38</td>
</tr>
<tr>
<td>Goat</td>
<td>189</td>
<td>342</td>
<td>+82</td>
</tr>
<tr>
<td>Sheep</td>
<td>103</td>
<td>394</td>
<td>+283</td>
</tr>
</tbody>
</table>

Table 2. Suitability of animals to local resource systems (after Tokarik et al. 2013)

Source: Glen K. Fukumoto, University of Hawaii at Manoa
**Nutrients**

- **Most Important ... Water**
  - Essential for many body processes and functions
  - Should be available 24/7
  - Source should be clean, free of pathogens, no ocean water!

- **Energy**
  - For growth and maintenance
  - Carbohydrates, Oils and Fats

- **Proteins**
  - For growth and maintenance, especially for young livestock
  - Legumes, meat & fishmeal
  - Most limiting nutrient in tropical ecosystems

- **Vitamins and Minerals**
  - For many important body processes, required in small amounts
  - Complex functions and interactions
  - Commercial supplements readily available

- **Total intake and minimum % crude protein required in the diet for broiler (top) and pork production.**

- **Packing on the protein**

Source: Glen K. Fukumoto, University of Hawaii at Manoa
Health

- Parasites (external, internal)
- Diseases (virus)
- Treatment of injury, infections (bacteria)
- Biological cycle & herd management
- Facilities, Shelter, Comfort

Genetic Improvement

- Start with quality stock for optimum growth, production and reproduction.
- Acquire breeding stock a trusted source
- Select replacements that is adapted to your environment (parasite, disease, growth)
- Avoid inbreeding

Feedstuffs

- See Table 3 in Livestock chapter
- Tropical feedstuffs: high moisture, high energy, low protein, fibrous.
- Narrow availability for omnivore/monogastric
- Broader availability for herbivore/ruminant

Marketing (Live, Processed)

- Meat products regulated: USDA Food Safety & Inspection Service

Source: Glen K. Fukumoto, University of Hawaii at Manoa
Integration into an Agroforestry Ecosystem

- Rotational Grazing Systems
- Dry Litter Technology
- Composting opportunities

Rotational Grazing Concept: Pastured Poultry Grazing Cage

- Grazing on perennial peanut (Arachis pintoi) provides supplemental protein to the diet.
- 16-18% crude protein
- Nutrient recycling
- Low cost
- Small footprint
- Incorporates rotational grazing concepts

Source: Glen K. Fukumoto, University of Hawaii at Manoa
Rotational Grazing Concept: Portable Pig Pen System

- Low cost
- Low level of management
- No waste water discharge
- Carbon bed mixes with nutrients
- Composting of residual material

Source: Glen K. Fukumoto, University of Hawaii at Manoa
Dry Litter Technology

- Developed in Kona
- Uses no water for pen washing, no discharge
- Low tech & practical, New design by Brian Rippy
- Carbon bedding mix with manure by pigs
- Reduced odor and vector generation
- Produced compost product

- 6-Pen Model
- Relatively small footprint
- Adopted in American Samoa, Palau, Pohnpei, Guam, CNMI
- More than 200 DLT installed in the Pacific-Basin.

- Creatively modified DLT units in Pohnpei.
- Creative use of local materials

- Compost provide additional income
- Savings on soil amendment
- Heat of composting destroys pathogens.

Source: Glen K. Fukumoto, University of Hawaii at Manoa