Livestock Basics for Agroforestry Systems

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Overview

• Livestock in Hawaii
• Why livestock in agroforestry systems?
• Which livestock are for you?
• Nutrition & Breeding Basics
• Animal Health & Welfare
• Nutrient Management
• Applications

All photos by G. Fukumoto unless noted

Hawaii’s Livestock Industries

$54 Million* 
Farm Gate Value

Dairy ($8.8 M)  
Hogs ($3.7 M)

Generating 
$162 Million
in Hawai‘i’s Economy

Poultry ($8.8 M)  
Beef ($33.0 M)

*NAAS, 2012. Slide by G. Fukumoto

Hawaii’s Livestock Industries

Top 20 commodities, 
State of Hawai‘i, 2010-2011

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Rank</th>
<th>2010</th>
<th>2011</th>
<th>Value of production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed crops</td>
<td>1</td>
<td>30.892</td>
<td>242.870</td>
<td></td>
</tr>
<tr>
<td>Sugarcane (unprocessed)</td>
<td>2</td>
<td>66,000</td>
<td>78,100</td>
<td></td>
</tr>
<tr>
<td>Cattle</td>
<td>4</td>
<td>12,755</td>
<td>20,000</td>
<td></td>
</tr>
<tr>
<td>Macadamia nuts</td>
<td>5</td>
<td>10,680</td>
<td>20,230</td>
<td></td>
</tr>
<tr>
<td>Coffee</td>
<td>6</td>
<td>3,144</td>
<td>3,540</td>
<td></td>
</tr>
<tr>
<td>Algae</td>
<td>7</td>
<td>16,725</td>
<td>25,230</td>
<td></td>
</tr>
<tr>
<td>Bananas</td>
<td>8</td>
<td>16,725</td>
<td>25,230</td>
<td></td>
</tr>
<tr>
<td>Papayas</td>
<td>9</td>
<td>11,123</td>
<td>9,722</td>
<td></td>
</tr>
</tbody>
</table>

NAAS 2012

Number of Livestock Operations 1999 to 2008

<table>
<thead>
<tr>
<th>Year</th>
<th>Broiler</th>
<th>Dairy</th>
<th>Layer</th>
<th>Swine</th>
<th>Processors</th>
<th>Cattle</th>
<th>Goats</th>
<th>Sheep</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>5</td>
<td>10</td>
<td>11</td>
<td>30</td>
<td>11</td>
<td>800</td>
<td>189</td>
<td>103</td>
</tr>
<tr>
<td>2008</td>
<td>0</td>
<td>2</td>
<td>9</td>
<td>21</td>
<td>9</td>
<td>1,100</td>
<td>343</td>
<td>394</td>
</tr>
</tbody>
</table>

Why Livestock?

“The inability of humans to directly derive caloric value from the 19 billion metric tons of vegetation produced annually in tropical and temperate grasslands and savannas…provides the ultimate justification for evaluating grazing as an ecological process.”

- Briske and Heitschmidt
  Grazing Management: An Ecological Perspective (1991)

Why Livestock?

- Convert inedible or poor quality plants into high quality protein
- Traction and land preparation
- Ecosystem services
- Food “storage” and mobility
- Supplemental soil nutrients
- Cultural significance
- General principles apply to aquaculture
Choosing Livestock

Match species to your:

- Environment
- Feed resources
- Market
- Space & labor availability
- Overall farm goals

Nutrition Basics

Water

- Essential for multiple processes
- Clean – low salinity, pathogen free
- Always available

Energy

- Required for maintenance and growth
- Starch, sugar, oil, fat
- Grains, breadfruit, yams, sweet potato, coconut, cull fruits
- Ruminants: forage grasses & legumes, banana stumps

Table 2. Suitability of animals to local resource systems (after Tokamp et al. 2010)

<table>
<thead>
<tr>
<th>Species and time to harvest</th>
<th>Gross energy efficiency</th>
<th>Food Conversion Rate**</th>
<th>Local feed (dry matter)</th>
<th>Management ease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pig, 6-month</td>
<td>96%</td>
<td>3.33</td>
<td>Dried date, food waste, Vernicia fruit, bananas, guava, coconut</td>
<td>Must be contained or fenced area</td>
</tr>
<tr>
<td>Chickens, Layer, 6 months</td>
<td>57%</td>
<td>3.77</td>
<td>Dried date, grasses, legumes, insects, fruits, coconut</td>
<td>Free range or portable grating cage</td>
</tr>
<tr>
<td>Ducks, 6 months</td>
<td>69%</td>
<td>3.97</td>
<td>Dried date, grasses, legumes, insects, fruits, coconut</td>
<td>Free range or portable grating cage</td>
</tr>
<tr>
<td>Cattle, 6 months</td>
<td>69%</td>
<td>0.43</td>
<td>Dried date, grasses, legumes, insects</td>
<td>Required large liquid area, water, periodic control</td>
</tr>
<tr>
<td>Geese, 6 months</td>
<td>73%</td>
<td>0.45</td>
<td>Fresh grass &amp; legumes, grasses</td>
<td>Required liquid area, water, periodic control</td>
</tr>
</tbody>
</table>

*Feed volume behind

**Weight of food required per unit of live weight gain.
Nutrition Basics

Protein
- Required for maintenance, growth, lactation, eggs
- High quality ≥ 20% of dry matter
- Legumes, fish and bonemeal byproducts
- Often limiting factor in Pacific systems

Vitamins & Minerals
- Required for many functions to maintain normal health and productivity
- Complex interactions: deficiencies, excesses, combinations
- Animal requirements change over time
- Diverse diet can help prevent issues
- Commercial supplements available

Breeding & Genetics
- Choose good sires: Contribute most to herd/flock level gene pool
- Avoid inbreeding – production losses & health issues
- Avoid open breeding
- Prioritize your selections: local adaptability, production goals, “easy keepers”

Health & Welfare
- Ounce of prevention...
- Clean housing with adequate space
- Good shelter includes:
  - Rain & sun protection
  - Ventilation
  - Good drainage (no standing water)
  - Clean feeding areas
  - Easy waste collection
  - Predator protection
Nutrient Management

- Manage as farm resource and/or to protect water bodies
- Composting manure recovers some feed inputs
- Can be used on farm or sold
- Reduces risks to human and animal health

Livestock in Agroforestry Systems

Photo: M. Stevenson

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The Take Home

- Provide efficient and effective shelter
- Use local genetics when possible
- Feed high quality during young phase
- Use mix of local/seasonal feeds, food wastes, byproducts for growing/finishing
- Recover and compost nutrients
- Learn from workshops, other farmers, Extension Service
- Be creative and have fun!