Food Energy Extraction Systems: I

Hunting & Gathering
• extracting what the environment produces
• through hunting, gathering, and fishing

Horticulture (gardening, swidden or slash and burn)
• no fertilization or irrigation
• no major soil modification
• extensive use of land (short to permanent fallow)
• simple technology (ax, machete, and digging stick)

Pastoralism
• dependence on herd animal for food (milk, milk products, blood, & meat)
• marginal agricultural land
• strong trading relations
• warlike
Recently burned swidden
Slash and Burn Cultivation: Michigan ca 1840
Food Energy Extraction Systems: II

Agriculture
- hoeing and plowing, fertilizing and mulching
- irrigation and water control
- traction animals

Industrial Agriculture
- petrochemical dependent (fertilizers, insecticides & fuel)
- machinery
- monocropping
- severe landscape modification
Rice cultivation in Indonesia: terraced paddy
Monocrop of wheat in eastern Nebraska
General Trends in the Evolution of Food Energy Extraction Systems

- Increased landscape modification
- Lowered biodiversity (lack of conservation)
- Increased energy output per unit area
- Increased energy input per unit area
- Specialization and monocropping
- Decreased use of wild resources
- Greater energy input per unit output
# Technoenvironmental Efficiency

## Energetic Efficiency in Basic Economic Formations

<table>
<thead>
<tr>
<th>Economic Formation</th>
<th>Ea/Ee*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foragers (!Kung, Kalahari Desert, Botswana, Africa)</td>
<td>9.600</td>
</tr>
<tr>
<td>Dryland horticulturalists (Genieri, Gambia, West Africa)</td>
<td>11.200</td>
</tr>
<tr>
<td>Tropical horticulturalists (Tsembaga, Highland New Guinea)</td>
<td>18.000</td>
</tr>
<tr>
<td>Agriculturalists (Yunnan Province, China (irrigated rice)</td>
<td>53.500</td>
</tr>
<tr>
<td>Modern grain cultivation (human labor input only)</td>
<td>6,000.000</td>
</tr>
<tr>
<td>Modern grain cultivation if all caloric inputs (e.g., petrochemicals) are included.</td>
<td>0.125</td>
</tr>
</tbody>
</table>

*Energy acquired divided by energy expended

From M. Harris *People, Culture, and Nature*
Energy Consumption in Basic Economic Formations

- Modern industrial societies: 200
- Early industrial society (1875): 77
- Agrarian societies: 26
- Horticulturalists: 12
- Hunter-gatherers: 5

Daily per capita consumption (1000 kilocalories)
Female Contributions to Primary Food Production

Labor time allocation in various economic formations

From: R. Hames
## Variation in Food-Getting and Associated Features

<table>
<thead>
<tr>
<th></th>
<th><strong>FOOD COLLECTORS</strong></th>
<th><strong>FOOD PRODUCERS</strong></th>
<th><strong>Intensive Agriculturalists</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>Foragers</em></td>
<td><em>Horticulturalists</em></td>
<td><em>Pastoralists</em></td>
</tr>
<tr>
<td>Population density</td>
<td>Lowest</td>
<td>Low—moderate</td>
<td>Low</td>
</tr>
<tr>
<td>Maximum community size</td>
<td>Small</td>
<td>Small—moderate</td>
<td>Small—moderate</td>
</tr>
<tr>
<td>Nomadism/perm. of sections</td>
<td>Generally nomadic or seminomadic</td>
<td>More sedentary: communities may move after several years</td>
<td>Generally nomadic or seminomadic</td>
</tr>
<tr>
<td>Food shortages</td>
<td>Infrequent</td>
<td>Infrequent</td>
<td>Frequent</td>
</tr>
<tr>
<td>Trade</td>
<td>Minimal</td>
<td>Minimal</td>
<td>Very important</td>
</tr>
<tr>
<td>Full-time craft specialists</td>
<td>None</td>
<td>None or few</td>
<td>Some</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Many (high degree of craft specialization)</td>
</tr>
<tr>
<td>Individual differences in wealth</td>
<td>Generally none</td>
<td>Generally minimal</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Considerable</td>
</tr>
<tr>
<td>Political leadership</td>
<td>Informal</td>
<td>Some part-time political officials</td>
<td>Part- and full-time political officials</td>
</tr>
</tbody>
</table>

Table 16.1 in E, E, & P