Lecture 13
Themes in Tropical Agriculture





Plantation Agriculture vs. Small Holders

- Plantations have better technology and are more efficient than small holders despite problems with cycles of boom and bust economy, and crop agreements and allocations.
- There are colonial overtones with foreign ownership now a problem since most of the tropical world has shaken off colonialism to form independent governments (which are often corrupt and dictatorial).
- In many areas foreign experts are being lured back but as consultants or as employees of national corporations.

- Small holders have advantages if farm is owned outright and small holder becomes his own master.
- With pressure on labor, the advantage goes to small holder who may be better off on his own farm.
- Typically small holders are more diversified and the family can be employed.
- The problem has been that technology may be low and credit is often difficult to obtain.
- The compromise solution may be to encourage a combination of plantation and small holders though a cooperative structure.

Disease (Crop, Animal, and Plant)

- Disease is worse in the tropics than temperate climates because there is no break in the season.
- Pest control requires high technology and with illiterate population in many tropical countries, disease control is often a problem.
- Plant breeding for disease resistance is necessary but with long-lived perennial plants, cultivar change is slow and breeding efforts must be long term.
- Disease resistance breeding is now being met by international research organizations who concentrate on major crops such as rice.

- Many tropical human diseases such as malaria, leprosy, sleeping sickness have had a negative impact on economic development.
- Malaria continues to be an important problem that has recently been exacerbated with drug-resistant strains of the pathogen (*Plasmodium*).
- Leprosy can now be controlled with antibiotics.
- Important nutrient deficiency diseases in many tropical areas such as beriberi and eye problems due to Vitamin A deficiency can be easily controlled by improving diets.

Glossary of Some Human Nutritional Diseases

Beriberi:

- From the Singhalese, meaning “I cannot,” since persons with severe beriberi cannot move easily.
- A condition caused by thiamin (Vitamin B) deficiency.
- It is characterized by numbness or tingling of toes and feet, stiffness of ankles, cramping pain in legs, difficulty in walking, and, finally paralysis of legs with atrophy of leg muscles.

Dental Caries:

- A local disease of the teeth (caries is derived from the Greek word for "rottenness") that involves the action of specific bacteria in the mouth and the presence of certain substrates (such as sugar) required for bacterial action.
- Fluorine appears to prevent decay by rendering the structure of tooth enamel more resistant to acid-producing bacteria.

Goiter:

- A chronic enlargement of the thyroid gland as a result of iodine deficiency.

Iron-deficiency Anemia:

- A condition resulting from low stores of iron, caused by inadequate dietary intake, blood loss, or malabsorption of iron.
- It is characterized by a reduction of the oxygen-carrying capacity of the blood.
- Symptoms include paleness of skin, weakness, shortness of breath, lack of appetite, and a general slowing of vital body functions.

Kwashiorkor:

- A severe clinical condition, occurring most frequently in children 1 to 3 years of age, resulting from a deficiency of protein (and other nutrients) combined with a relative excess of calories.
- It is characterized by growth failure, edema, and muscle wasting.
- There is often a preceding or associated infection, such as diarrhea, respiratory infection, or measles.
- Other frequently associated changes are reduced pigmentation, hair loss, liver enlargement, dermatosis, and apathy.

Marasmus:

A condition occurring mostly in infants (3–18 months) as a result of a chronic gross deficiency of calories and an accompanying lack of protein and other nutrients.

It is characterized by low body weight, loss of subcutaneous fat, and wasting of muscle tissue.

The condition is frequently accompanied by diarrhea.

Obesity:

Excessive fatness; or, more strictly defined, body weight in excess of 20% of the ideal weight for a particular body type.

It is caused by overeating and inactivity, usually in combination. Exacerbated by starchy diets.

Pellagra:

A clinical condition caused by niacin deficiency and characterized by tissue damage, chiefly of the skin, gastro-intestinal tract, and nerves.

The most striking symptom is a reddish skin rash, especially on the face, hands, and feet when exposed to sunlight.

Other associated disorders include inflamed membranes in the digestive tract with bloody diarrhea and distressing nervous and mental disturbances (hence “the 3 Ds” of pellagra: dermatitis, diarrhea, and depression or dementia).

Pernicious Anemia:

- A condition caused by insufficient absorption of vitamin B_{12} from the intestine, regardless of food intake, due to a lack of vitamin B_{12} binding protein in the gut.
- It is characterized by anemia, degeneration of the spinal cord, and, if untreated, sore tongue, weakness, weight loss, back pain, tingling of extremities, apathy, and mental and nervous abnormalities.
- A daily intramuscular injection of B_{12} will restore normal blood count and cause symptoms to disappear.

Rickets:

- A condition, seen most strikingly in young children, caused by Vitamin D deficiency.
- It is characterized by poor growth and lack of normal development of bones (typically, bow legs) as a result of disturbed calcium and phosphorus metabolism.

Xerophthalmia:

- Extreme dryness of the eyes caused by a deficiency of Vitamin A.

Livestock

- Many problems involving nutrition, diseases, stress susceptibility, low productivity (fertility as well as rate of gain for both meat and milk).
- One of the main problems is pasture management.
- Many tropical grasses are poor in nutrition with low digestibility.
- There are few pasture legumes.
- Tropical grasses tend to be coarse and high in lignin in the dry season and thus unpalatable.
- There is a need for new introductions.
- Unimproved tropical grasslands support few animals.

- Mineral deficiency in the soil also leads to mineral deficiency in the grass and diets need to be supplemented with minor elements.
- Stress resistance is important due to heat, insects and ticks.
- Native breeds are more resistant but are low yielding, especially for milk.
- Most breeds in the tropics are crosses with humped Indian cattle (Zebu).
- Milk production typically carried out with European cattle such as Holstein but management must be very high.

These problems may be overcome by:

1. Selection for better grasses.
   Many tropical grasslands have been Africanized by importing some African species such as Kikuyu grass and pangola grass.
2. Planting of legumes and search for inoculants with improved nitrogen-fixing bacterial strains.
3. Better pasture management.

4. Breeding of stock using zebu × high yielding temperate breeds.
5. Disease prevention though insect control and minor element supplementation.

   At the present time there is a large expansion in tropical America and New Guinea for livestock production.

6. Alternate meat production systems.
   - Native ungulates in Africa are well adapted to the tropical savanna but have never been seriously considered for meat production.
   - Are there alternatives meat production systems such as farming of native ungulates (antelope, zebras, or even many tropical rodents)?
   - Yield per square mile of wild animals is higher than introduced domestic cattle.
   - Also wild cattle do not degrade pastures as do domestic cattle.
   - However no ready market for wild game animals; beef is still considered choice food.

- There is still only minor interest in the US for buffalo (American bison) or even buffalo × cattle crosses (beefalo).
- In New Zealand (a temperate country) deer are being farmed successful with venison going to Germany and young antlers (velvet) going to the Far East where they are assumed to have aphrodisiac properties.
- In Ecuador, guinea pig, a rodent is an important food and other rodents such as coati are popular in Africa (Ivory Coast).

- Unlikely that alternate meats will become popular but ostrich, emu, and kangaroo have been considered.
- Rabbit is popular in Europe and turkey has become popular world wide.
- The problem is that our food habits are very conservative and difficult to change, especially for the animals we choose to eat.

Forestry

- Few natural tropical forests are productive with exceptions such as teak in Burma and Aracaria in New Guinea.
- Need for sustained yield. Tropical forestry at the present time is largely dominated by a "collection mentality."
- High management is required for successful forestry.
- The future changes include:
  - Biomass harvesting for cellulose extraction.
  - Alcohol production for fuel. However, technology not yet available and will have to compete with grasses such as sugar cane.
  - Agroforestry.

Industry

- Nothing unique about the tropics in respect to industrialization but some special problems.
- These include lack of capital, lack of skilled personnel, lack of markets because of sparse population in *Af* climate.
- It is very difficult to complete with developed markets.
- Traditionally underdeveloped because colonial powers wished to protect their markets from local competition.
- Also there is not much coal in many parts of the tropics.
- Coal was an important factor in establishing industrialization in temperate areas.

- Parts of the tropics are rich in petroleum and other resources (SE Asia, Venezuela, Mexico, Indonesia).
- Brazil, however, has little coal or petroleum.
- At the present time large capital investments are needed.
- It has been difficult to reach the "take-off" phase of growth.
- At the present time industries are moving to areas of low labor costs and this could have a large impact in the future.

Why are the tropics poor and undeveloped?

- Geographic Determinism, a theory proposed by Elsworth Huntington, assumes that geography determines human activity and development.
- Temperate climates with cold winters require struggle, initiative and planning to survive.
- Arctic climates are too difficult for humans to proper
- Tropical climates make survival easier but high temperatures and disease make economic activity difficult.

- While it is true that the pace is slower in the tropics and diseases and parasites may put pressure on human health and activity, it is unlikely that this is still a viable explanation.
- Anyone who watches furious soccer matches with not believe in local indolence and inactivity.
- In the future, air conditioning will have a strong impact as it has in the US south.

Explanations for Poverty of the Tropics

1. Climate is a factor but is not the complete explanation.
   - The old theory was that life was too easy and did not encourage industry.
   - Unlikely a real explanation because life is not easy.
   - The other explanation was the opposite, that is, life was too difficult but many hot humid places (Hong Kong, Singapore) have been shown to be very capable of a very high level of activity and development.

2. Soil in the tropics are poor but they are not uniformly poor.
   - Cannot fully explain agricultural underdevelopment.
3. Disease at the present time is more a problem of cultural environment rather than natural environment.
   - Many disease-ridden places (Panama and Rio as well as Rome and New York) are now very healthy places.

4. Diet.
   - Could low protein diets deteriorate mental capacity resulting in low energy and initiative.
   - Requirements of protein are only 30 g/day, more for pregnant women.
   - Difficult to prove.
   - Extreme food deficiency of Europe in WWII had little permanent effect.
   - Current opinion is that that low calorie, low fat diets are healthier than high calorie, high fat diets.
   - Josue de Castro in a book *Geography of Hunger* suggests that low protein increases fertility.
   - Thus poor nutrition results in overpopulation.
   - Intriguing but unverified and most probably false.

5. Historical Development.
   - The industrial revolution developed in Northern Europe fueled by abundant coal.
   - Is this a historical accident?
6. Capital Shortages.
   - Great influx of capital in tropical places such as Hawaii and Puerto Rico are examples of the effect of abundant capital on development.
   - The “tigers” of Asia (Taiwan, Singapore, Malaysia) are tropical countries that have done well recently by industrializing.
   - Puerto Rico for many years exported excess population to New York City and still requires great influx of US aid.

- US Foreign Aid to the tropical world is actually at very low levels when divided by population.
- The Alliance for Progress (US Aid to South American) started during the Kennedy Administration but was initiated for political reasons associated with the Cold War.
- However, falling prices for goods exported by poor countries vs. rising prices for imported goods has resulted in a net outflow of capital.
- US military aid was always greater than alliance funds.
- A case can be made that our limited foreign aid has had a negligible influence on economic development in most of the tropics.