

Animals in the World Food System

World Livestock Production

Role of Livestock in the Food System

Contribution of Livestock Products to Human Dietary Needs

Should We Feed Grain to Livestock?



World Livestock Production

The world output of animal products has more than doubled in the past 30 years.

In developing countries:

- Highest increases are in poultry and swine – i.e., animals that mainly consume grains – and also production technologies can be readily transferred to developing countries
 - Lowest increases in cattle, sheep and goats – i.e., animals that subsist on rangelands and crop residues
- Livestock production has increased more rapidly than crop production in developing countries during the last decade in contrast to developed countries where the proportion of livestock production to total agricultural output has remained relatively stable.

Ruminants

Cattle, sheep, goats, water buffalo, yaks, camels, deer – these represent one of man's most valuable and renewable resources.

Within species great variation by breed with respect to environmental adaptation and disease resistance.

- Because of their unique digestive tract (with four stomach compartments vs monogastric animal with one), they are able to efficiently use cellulose. Rumen is a microbiological "vat" with both protozoa and bacteria.
- In U.S.A., about 68% of feedstuffs fed cattle are forages, whereas in developing countries a comparable figure is 97%.

Ruminants (continued)

· Milk production:	No concentrates	7,936 lb/year
	25% "	11,905 lb/year
	65% "	30,000 lb/year

i.e., grains raises milk production, and as it increases, the feed cost per unit of milk is reduced.

- Local differences of grain availability, land alternatives, need for draft power or manure can affect above analyses.
- Nevertheless, cattle maintained on forages with or without agricultural residues do have an infinite human edible food conversion efficiency.

Swine

- On a world basis, the most important meat animal.
- Unlike ruminants, monogastric swine are fairly efficient gross converters of plant energy and protein to meat.
- Swine utilize slaughterhouse and fish processing by-products, and also human garbage.
- Swine utilize roughages much less efficiently than do ruminants, but they are more omnivorous and thus offer greater flexibility in different combinations of feed and feed by-products that can be fed.
- Because of size, can be maintained even in urban areas at minimal cost.
- Religious barriers to usage.

Poultry

- Very efficient converters of feedstuffs, especially where high energy/protein by-products are available – e.g., 1 ton of feed will produce 1100 lbs of meat or 500 dozen eggs.
- Can be expanded readily with simple technology and requires minimal land areas (has shown the highest rate of increase in relation to other animals).
- Provide a convenient package for village and family use.
- Improvement of local stock by importation of improved strains and selective breeding among local strains.

Poultry (Continued)

- Other species such as duck, guinea, pigeon, often used in developing countries.
- Excellent disease control programs available.
- Modern poultry industry is divided into specialized sectors dealing with breeding, hatching, feed production, disease control, processing, egg packing, and marketing.
- Technology can readily be transferred from developed to less developed countries providing adequate feed available.

World Livestock Numbers (million head),

	World	Developed Countries	Developing Countries
Cattle	1,263.6	404.8	858.8
Sheep	1,172.8	553.4	619.4
Swine	823.4	338.0	485.4
Goats	520.4	28.5	491.9
Buffalo	136.9	0.7	136.2
Horses, mules, asses	122.3	24.0	98.3
Camels	19.0	0.3	18.7
Chickens	10,215.0	4,515.0	5,700.0
Ducks	519.0	37.0	482.0
Turkeys	233.0	204.0	30.0

World Livestock Production (M Tons)

	World	Developed	Developing
Meat	163.5	101.9 (62%)	61.6 (38%)
Milk	468.4	378.0 (80%)	90.4 (20%)

Trade in Meat and Milk Net transfers (million metric tons)

	Meat		Dried Milk	
	1950	1986	1950	1986
Africa	0	-521	-15	-322
Asia	-20	-1,555	-74	-801
Europe	-890	+1,400	-35	+724

- Role of Livestock**
- Source of human food: meat, milk, blood
 - Source of fiber: textiles, wool, hair, skins
 - Source of power: cultivation, harvesting, transport
 - Source of employment
 - Utilizers of marginal lands and crop by products, inedible by humans
 - As a means of capital accumulation; i.e., insurance
 - Livestock byproducts and their use as manure, energy, or industrial raw materials
 - Source of export earnings
 - Social and cultural significance

Microlivestock (Nontraditional Species) for Food Production

Little-known small animals with a promising economic future.

Examples: Microbreeds (e.g., cattle, goats, sheep, pigs)
 Poultry
 Rabbits
 Rodents (e.g., capybara, guinea pig)
 Deer and antelope
 Lizards
 Bees

- Microlivestock (Continued)**
- Advantages:** Fill economic niches that are not easily filled by large livestock.
- Useful for subsistence farmers, as they are:
- less expensive to buy, less of a financial risk to maintain, give a faster return on investment
 - provide flexibility
 - provide steady source of income
 - easily transported
 - usually efficient converters of energy
 - cheaper to house and manage
 - utilize a wide array of feed sources

Microlivestock (Continued)

Limitations: High energy requirements
 Increased labor requirements
 Disease problems
 Predation
 Lack of research data

General Order of Priorities for Livestock Ownership

USA	Developing Countries
Derive income from Meat, Milk, Eggs, Fiber, sale of surplus or seedstock animals	Reduction of risks from cropping
	Accumulation of capital
	Render services, e.g.: diversification of farm operation traction, fertilization, fuel
Extend use of non-arable lands	Satisfy cultural needs
Prestige	Insure status or prestige
Generate capital	Provide food for home consumption and also surplus for income
Emphasizes production per unit area—e.g., hectare	Emphasizes production per animal

Social and Cultural Issues in the Use of Livestock

Quote:
 “Western Man, Despite His Frequent Temptation To Say His Foodways Are Based On Rational Considerations, Is No More Rational In This Than Other Men, For It Makes No Better Sense To Reject Nutritious Dogflesh, Horseflesh, Grasshoppers And Termites As Food Than To Reject Beef Or Chicken Flesh.” (Frederick Simoons)



Social and Cultural Issues

- Vegetarianism – results from a belief in the sanctity of life and/or that it is a healthful practice.
 - Strict religious beliefs – e.g., Hindus (beef) and Jews (pork)
 - Some prejudices against flesh foods commonly result from recognition of an animal as being of a species that is liked. For other animals, revulsion may be the basis of prejudice.
 - Some food aversions may be a result of dislike of preparation of the meat.
 - Individuals may eat the meat of a species but be averse to eating organs from that species.
- Examples of species eaten by certain cultures:
 horsemeat, dog and cat meat, rodents, primates, reptiles, insects

Women's Role With Livestock

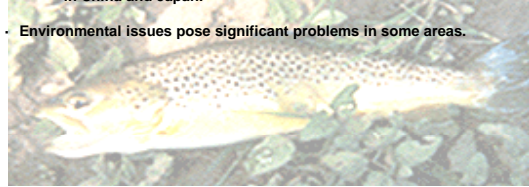
- Although it has long been recognized that women have an important role in livestock care and in the processing and sale of livestock products, the significance of reaching women directly in development projects has not always been understood.
 - There has been an implicit assumption that livestock activities merely take up a slack in women's labor time.
 - In some countries, women do own cattle and other livestock obtained through inheritance or dowry.
 - Need to resolve conflicts in demands on women's time; e.g., calving and crop duties.
 - Goats, sheep, and poultry usually predominantly the concern of women and represent an important security in case of divorce and as a source to pay general family expenses.
- Need to take into account ownership by women in health programs.

Wild Terrestrial Animals As Food

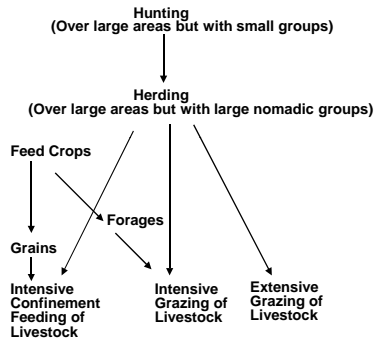
- A wide variety of “non-traditional” animals are used for human foods either by hunter-gatherer groups (e.g., Eskimos) or seasonally in various countries (e.g., venison, wild boar, rabbits, etc.)
- Prospect for increased utilization of wild animals is probably greatest in Africa.
- Game management may be a legitimate form of agricultural land utilization, especially where cattle cannot survive or to supplement cattle.
- These animals may be then perceived as needed by the local population and not merely as tourist attractions.
- Offers improved control of important animal diseases.
- Nevertheless, it would be unrealistic to expect a significant increase in meat production from these sources contributing to the reduction in world animal protein needs.

Aquaculture and Wild-Catch Products

- Currently, fish supply is about 2% of the calories and 10-13% of protein in human diet (approximately 17 lbs/person in USA per year).
- Dramatic increase in annual wild-catch production up to 1970s has since leveled off, and many of the world’s ocean supplies are now in jeopardy.
- Aquaculture has shown significant increases in recent years, particularly in China and Japan.
- Environmental issues pose significant problems in some areas.



Evolution of Food Producing Systems from Livestock



The Contribution of Livestock Products to Human Dietary Needs

As the gross national product increases, child and infant mortality rates and the percentage of low-birth-weight infants decline and life expectancy increases. Since total dietary energy protein, animal protein, and fat availability are highly correlated with wealth, there are also significant correlations with infant and child mortality rates and protein, animal protein and fat consumption. No causal relationship, however, should be implied.

Lysine and threonine levels are considerably higher in animal products than they are in wheat; and thus, relatively small amounts of animal foods can improve the overall protein quality of diets low in these amino acids.

Role of Livestock in Food Production

- -Livestock production has a multi-purpose role in agriculture particularly in developing countries. Also, in these countries, animals have much more diverse uses than similar animals in the U.S.
- -Some of the most striking gains in livestock production have been achieved where technologies have been imported from developed countries.
- -Nevertheless, failure to recognize that the pastoralist is still a herdsman or shepherd in many developing countries rather than a rancher or a farmer has hindered efforts to bring about changes.
- -Misconceptions that most animal production depends heavily on cereal grains.
- -Dynamic changes in world supply and demands for meat, milk, and other livestock products are taking place.
- -With the growth of urban populations, large agribusinesses, and international trade, it has become costly and politically difficult for many industrialized countries to protect small livestock producers.
- -Energy and environmental issues are closely related to non-food attributes of livestock – e.g., traction, fiber and manure for fuel/fertilizer.

Comparison of Characteristics of Crops and Livestock

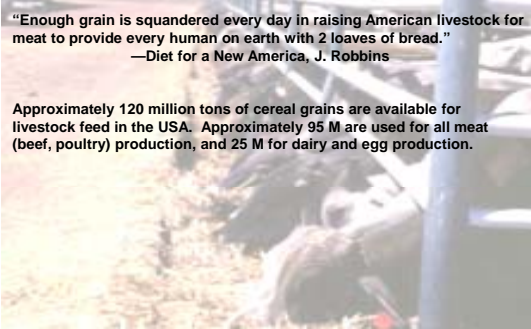
Factor	Crops	Livestock
Mobility	Stationary	Mobile; restraint required
Life cycle	Generally less than 4 months	Generally over 1 year
Life cycle	All units synchronized	Seldom synchronized
Labor	Inputs reflect stage of growth	Frequently require daily attention
Outputs	Only grain/tuber and residue; few nonmarket inputs/outputs	Multiple outputs; many nonmarket inputs/outputs
Producer	Impersonal attitudes	Personal attachments; cultural taboos
Management variability	Low	High
Market orientation	Produced for food or \$	Often kept for occasional food and emergency cash
Processing, storage	Usually shelf-stable	Less stable—require refrigeration

Human Global Protein Intakes 1978/80 Data FAO gms/head/day (Adults)*			
	Animal Origin (Includes Fish)	Vegetable Origin	Total Protein
World	24 (35)	46	69
Developed Countries	56 (57)	43	99
Eastern Europe and USSR	51 (50)	50	101
Developing Countries (Africa)	11 (20)	43	54
Far East	7 (14)	43	50
Near East	16 (22)	58	74
Latin America	28 (42)	39	67

* FAO estimates of protein requirements/day for adults are:
 46 g – developed countries (high income)
 53 g – developing (medium income)
 62 g – developing (low income)

Should We Feed Grain to Livestock?

“Enough grain is squandered every day in raising American livestock for meat to provide every human on earth with 2 loaves of bread.”
 —Diet for a New America, J. Robbins



Approximately 120 million tons of cereal grains are available for livestock feed in the USA. Approximately 95 M are used for all meat (beef, poultry) production, and 25 M for dairy and egg production.

Do Livestock Compete for Scarce Food Production Resources, or Do They Add to Our Ability to Increase Total Food Supplies?

In sub-Saharan Africa, areas of India, and other Asian countries where significant production increases in wheat and rice have occurred, one also finds large increases in milk production.

Reasons:

- An upward production spiral can be started by increasing the sale of livestock products to provide cash to produce crops (spent on fertilizer, better seed, irrigation).
- Role of livestock in providing draught power.
- Market demands – as countries grow in wealth, need increases for more and better food; i.e., meat and milk.

- ### Major Feed Sources for Animals in Developing Countries
- In developing countries, livestock production is usually geared to a low-input system which maximizes the use of land and crop by-products otherwise unsuitable for human use.
- | | | |
|------------------|---|--|
| Non-Arable Lands | – | grazing and browsing |
| Arable Lands | – | fallow grazing |
| | – | forages – grazing |
| | – | grains or tubers, either directly or use residuals |
| | – | plant residues – grazing |
| By-Products | – | aquatic plants in waterways |
| | – | straw |
| | – | vegetable and fruit processing wastes |
| | – | ground and fermented rice husks |
| | – | chopped banana stalks |
| | – | weeds |

Protein Efficiency of Milk Production (1,400-lb Cow Producing 14,000 lb Milk/Year)

Grain Fed	4,000 lb
Roughage Fed	8,000 lb
Total Dry Matter Fed	12,000 lb
Total Crude Protein Fed	1,560 lb
Milk Produced	14,000 lb
Milk Protein Produced	468 lb
Gross Efficiency (468 ÷ 1,560)	30%
Total Protein in Grain (13%)	520 lb
Efficiency of Grain Protein (468 ÷ 520)	90%
Biological Value of Grain Protein (60%)	312 lb
Biological Value of Milk Protein (100%)	468 lb
Milk Protein Produced From Grain Protein Usable By Humans (468 ÷ 312)	150%

Food Security

World/US Food-Public Health Concerns

- Diseases
- Transgenics
- Terrorism