It is not yet widely recognized that the livestock industry has become a major threat to the world's economy, the environment, consumer health, and the food security of nations and generations to come. Farm animals do have a place in ecologically sound agriculture, but, as will be shown, they have not been properly integrated either in the United States or in other developed and less-developed nations of the world.

Basic Issues and Solutions

The world's 4 billion livestock (and some 10 billion poultry and rabbits) are raised under either pastoral, rangeland conditions, or more intensive husbandry conditions in less arid regions (see Figure 1). There is a clear correlation between pastoral and nomadic livestock production and the spread of deserts worldwide (see Figure 2). Areas of desertification in various countries are caused in part by ecologically unsound livestock husbandry practices. Improper livestock practices and destruction of vegetation combine to cause environmental degradation. Overstocking results in overgrazing, soil erosion, and poor herd nutrition and productivity. These problems are often compounded by diseases and inadequate veterinary preventive medicine. According to the United Nations Environment Programme, the role of the veterinary profession in contributing to environmental degradation through expansion of nonsustainable livestock practices is very significant (see Figure 3). Deserts continue to spread as a consequence. Overgrazing has now degraded 73 percent of the world's rangeland.

Table I: Numbers (Millions) of Livestock in the World in 1985

<table>
<thead>
<tr>
<th>Livestock</th>
<th>Number</th>
<th>Livestock</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>1,269</td>
<td>Asses</td>
<td>41</td>
</tr>
<tr>
<td>Sheep</td>
<td>1,122</td>
<td>Camels</td>
<td>17</td>
</tr>
<tr>
<td>Pigs</td>
<td>791</td>
<td>Mules</td>
<td>15</td>
</tr>
<tr>
<td>Goats</td>
<td>460</td>
<td>Chickens</td>
<td>8,287</td>
</tr>
<tr>
<td>Buffaloes</td>
<td>129</td>
<td>Turkeys</td>
<td>216</td>
</tr>
<tr>
<td>Horses</td>
<td>65</td>
<td>Ducks</td>
<td>169</td>
</tr>
</tbody>
</table>

Source: FAO (1986).

The FAO estimates 1 million tons of rabbit meat were produced in the 1980's. Which would require an estimated 1 billion animals per annum.
Figure 1: World's Distribution of Extensively & Intensively Raised Livestock

Source: From Till and Brixholm (1986)

Figure 2: United Nations Environment Programme

Areas Threatened by Desertification

- Existing Desert
- High Risk
- Moderate Risk

Source: 1987 UNEP Environment Brief No. 2

Figure 3: Factors (Including Veterinary Services) Leading to Desertification

Desertification: The Causes are Complex

- More People
- More Trees and Forests
- More Soil Erosion
- More Water Balance
- More Tree and Forest Fires
- More Livestock
- More Livestock Diseases
- Less Livestock Markets
- More Boreholes
- Need for Cash
- More Livestock

Source: 1987 UNEP Environment Brief No. 2
Nonsustainable agricultural practices have led to the demise of past civilizations. The U.S. Department of Agriculture, Soil Conservation Service report "Conquest of the Land Through 7,000 Years" has documented how deforestation and poor livestock husbandry practices have led to the demise of civilizations and empires, especially in the Middle East, over the past 7,000 years. Cattle once thrived some 3,000 years B.C. in the Algerian Central Sahara, which is now a desert. Rock paintings from Tassili-N-Ajjer, Algerian Central Sahara, 2,900 B.C., show how abundant cattle once were in this region.

Nonsustainable agricultural practices and poor range management continue to create deserts today. Poverty and famine in many regions of the world are linked with destructive livestock and other agricultural practices. The increasing human population, now at 5.4 billion, necessitates a radical shift toward a more sustainable use of natural resources, as well as rigorous constraints on population growth. Increasing human population growth has resulted in deforestation in many parts of the world for fuel and to clear more land for crop as well as livestock production (see Figure 4). Deforestation is a major contributing factor to the greenhouse effect of global warming, since trees absorb carbon dioxide, one of the greenhouse gases that traps heat in the lower atmosphere. This problem is compounded by the widespread practice of burning rangeland to stimulate new growth for livestock and to control brush. Regular burning may actually lead to a loss of soil nitrogen. Deforestation, especially in the Amazon, is a significant contributing factor to global warming, as hundreds of thousands of acres of tropical forests are burned or felled to clear land primarily for livestock production by government-subsidized cattle ranchers.

Regions where livestock are raised intensively, especially in Europe, have been linked with the destruction of forests through acid rain derived from ammonium sulfate and other gases from animal wastes. Livestock wastes also result in significant quantities of methane production, which is now recognized as a major greenhouse gas, the accumulation of which contributes to global warming.

Overstocking and overgrazing by livestock not only contribute to environmental degradation but also result in the so-called albedo effect. This phenomenon entails the reflection of sunlight from the land back into the atmosphere, which inhibits cloud formation and thus contributes to increased arid conditions.

Since its beginnings some 8,000 years ago, livestock farming has waged war against predators, which has led to the further degradation of natural ecosystems and the loss of biodiversity. Modern indiscriminate methods of predator control, including traps and poison baits, have resulted in serious ecological imbalances and the eruption of pest problems, especially of small rodents, which compete with livestock for forage in the absence of predators that normally keep their numbers in check. As a consequence of the livestock industries' war against predators, costing billions of dollars over the years in the United States at taxpayers' expense, many predator species are now endangered, like the wolf in North America, Europe, and Asia. In 1988, the
Animal Damage Control program (ADC), run by the U.S. Department of Agriculture, intentionally killed 4.6 million birds, 9,000 beavers, 76,000 coyotes, 5,000 raccoons, 300 black bears and 200 mountain lions. (The various poisons that the ADC uses are a major reason why the California condor is close to extinction.)

With skilled rangeland management, however, natural biodiversity can be preserved, if not enhanced. But in many regions of the world, poor rangeland management, price supports, and ill-conceived aid and development programs have resulted in a drastic loss of biodiversity reflected in the decline of wild herbivorous animals that compete with livestock and sometimes harbor and transmit disease to livestock. Once vast herds of buffalo, or bison, roamed the open ranges and prairie plains of the United States. Uncontrolled hunting and poor rangeland management have resulted in the virtual extermination of not only the buffalo but also of bighorn sheep, elk, and pronghorn. Such loss of biodiversity is a cardinal sign of environmental degradation and means an overall loss of rangeland productivity.

More intensive livestock husbandry practices entail the use of confinement buildings that were considered pathogenic and not conducive to livestock health, and feedlot operations. These intensive systems of cattle production are responsible for many health and welfare problems. According to the U.S. National Research Council report "Alternative Agriculture," the total death and disease losses in U.S. livestock are estimated at $4.6 billion annually; losses in cows from mastitis are around $2 billion annually; losses from pneumonia in hogs and cattle are some $800 million; and losses from crippling lamenesses in confinement-reared hogs were estimated at more than $24 million for 1988–1989. According to the 1992 USDA National Swine Survey, 15% of live-born pigs die before weaning.

Intensive livestock production is not adequately integrated with other agricultural practices. The nutrient loop (of recycling animal manure) that once connected crops and livestock has been broken (see Figure 5), resulting in high fertilizer bills, high waste-disposal costs, and widespread pollution of surface and ground waters. Farm animal wastes contain potentially harmful quantities of nitrogen, phosphorus, bacteria, and feed additive residues, including a variety of drugs and chemicals, like arsenic, selenium, copper, and zinc.

Another related problem associated with livestock production is the need for water, cattle (cows in particular) having a very high water requirement averaging more than 9,000 liters per year per animal. Some 300–400 gallons of water are used in the United States to produce one pound of beef (see Table II).
A reduction in the production and consumption of meat is clearly necessary, not only for economic and environmental reasons, but also for reasons of public health. There is increasing medical evidence of the contribution of high animal protein and fat consumption to a variety of human diseases, such as various forms of cancer, osteoporosis, arteriosclerosis, heart attack, kidney disease, gallbladder disease, obesity and diabetes. Human illness costs are estimated at more than $4 billion annually when millions of people develop bacterial food poisoning from contaminated meat and other animal produce. The widespread practice of feeding animal wastes and renderings back to farm animals is a major source of such bacterial contamination and can cause serious animal health problems also.

Demographic studies reveal a very clear correlation between the per capita meat consumption and the incidence of bowel cancer and heart disease. In the more developed nations where per capita meat consumption is higher than in poorer countries, there is a greater incidence of colon cancer and death from heart attacks and arteriosclerosis. Likewise, a correlation has been found demographically between daily per capita intake of animal fat and death from breast cancer. It is a tragic irony that many human health problems that arise as a result of excessive animal fat and protein consumption and that could be prevented by a change in dietary habits are modeled in animal experiments aimed at curing these diseases of conspicuous consumption among the affluent.

It is now becoming more widely recognized that planet Earth is endangered, and evidence is mounting that, without a change in agricultural practices, energy sources and uses, control of human population, and reduction of the livestock population, the quality of life on this planet will continue to decline. The world’s meat industry needs to be drastically reformed to embrace the principles of humane stewardship, which includes the land ethic of an ecologically sound, sustainable, and socially just agriculture.

We must look closely at the real costs of livestock production. Producing beef under feedlot husbandry is the most inefficient way of producing animal protein. Rangeland lamb and beef production are much more efficient, provided the rangeland is not irreparably degraded. Another way of looking at this is at the number of pounds of protein derived per acre. Soybeans produce 360 pounds of protein per acre, while beef produces less than 40 pounds per acre of good land. In other words, one hectare of land will supply one person with beef for only 190 days, increasing to 5,495 days if soybeans are raised on that same land.

The estimated inputs of grain, energy, and water to produce one pound of meat, eggs, and milk reveal a clear trend of decreasing efficiency with confinement-hog and beef-feedlot operations in the United States showing the greatest inefficiencies, principally because of the high costs of grain and soybean production (see Table III). Yet in the United States, public taxes underwrite some 50 percent of these costs via subsidies to the animal feed industry, a cost not fairly reflected in the price of meat in the grocery store. Ironically, contract-meat producers tend to overproduce, which lowers their revenues while the grocery store prices remain the same.

Table III: Inputs Used to Produce One Kilogram of Meat, Eggs or Cheese, United States, 1991

<table>
<thead>
<tr>
<th>Product</th>
<th>Grain¹ (kilograms)</th>
<th>Energy (thousand kilocalories)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pork</td>
<td>6.9</td>
<td>30</td>
</tr>
<tr>
<td>Beef</td>
<td>4.8</td>
<td>17</td>
</tr>
<tr>
<td>Chicken</td>
<td>2.8</td>
<td>13</td>
</tr>
<tr>
<td>Cheese</td>
<td>3.0</td>
<td>10</td>
</tr>
<tr>
<td>Eggs</td>
<td>2.6</td>
<td>10</td>
</tr>
</tbody>
</table>

¹Includes soybean meal.

It should not be forgotten that, in order to maintain meat as a staple in the diet, richer nations rely upon imports of animal feeds from other countries, which too often results in the loss of productive land to feed the people of these countries. This affirms Mahatma Gandhi’s contention that “the cattle of the rich steal the bread of the poor.”

In the United States, 70 percent of the annual grain crop is fed to livestock and poultry (see Table IV). Worldwide, farm animals
consume an estimated 38 percent of the total grain harvest according to World Watch Institute analysts. The production of soya meal in the United States and Brazil for export as livestock and poultry feed is illustrative of how fertile land is being wasted to raise feed for animals rather than food for people (see Table V). In 1990, the governments of industrialized countries spent $120 billion to subsidize farm animal production, including the feed that livestock consume.

### Table IV: Grain Consumed by Livestock, 1990

<table>
<thead>
<tr>
<th>Country/Region</th>
<th>Share of Grain Consumed (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>70</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>64</td>
</tr>
<tr>
<td>EC</td>
<td>57</td>
</tr>
<tr>
<td>Soviet Union</td>
<td>56</td>
</tr>
<tr>
<td>Brazil</td>
<td>55</td>
</tr>
<tr>
<td>Japan</td>
<td>48</td>
</tr>
<tr>
<td>Middle East</td>
<td>33</td>
</tr>
<tr>
<td>China</td>
<td>20</td>
</tr>
<tr>
<td>Southeast Asia</td>
<td>12</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>2</td>
</tr>
<tr>
<td>India</td>
<td>2</td>
</tr>
</tbody>
</table>


### Table V: Major Exporters of Basic Agricultural Commodities Traded Worldwide

<table>
<thead>
<tr>
<th>Wheat</th>
<th>Feed grains</th>
<th>Soybeans and soybean products</th>
<th>Beef</th>
<th>Pork</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>United States</td>
<td>United States</td>
<td>European Community</td>
<td>European Community</td>
</tr>
<tr>
<td>Canada</td>
<td>Argentina</td>
<td>Brazil</td>
<td>Community</td>
<td>Community</td>
</tr>
<tr>
<td>Australia</td>
<td>Canada</td>
<td>Argentina</td>
<td>Australia</td>
<td>Eastern</td>
</tr>
<tr>
<td>France</td>
<td>South Africa</td>
<td>European Community</td>
<td>Argentina</td>
<td>Europe</td>
</tr>
<tr>
<td>Argentina</td>
<td>Thailand</td>
<td>New Zealand</td>
<td>Brazil</td>
<td>Canada</td>
</tr>
<tr>
<td></td>
<td>Australia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>France</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Intensive monocultures of wheat, corn, and soybean raised to feed farm animals require costly and harmful inputs of synthetic fertilizers, herbicides, and pesticides, which have increased dramatically in recent years. Tilling the soil and adding these chemicals to raise these same crops year after year not only sterilizes the soil and reduces its organic nutrient content, but it also releases more nitrous oxide, a greenhouse gas, into the atmosphere. Bacteria in the soil that help take methane out of the atmosphere also are destroyed. Uncultivated grassland acts as a methane sink or "sponge," thus playing a vital role in reducing global warming and in taking up methane from forage-consuming livestock. The ecologically and economically unsound use of arable land to raise feed for farm animals and not food for people first must become a thing of the past if we are to develop a sustainable and socially just food production system. Governments should consider imposing an energy tax on agricultural petrochemical fertilizers and pesticides. This would raise the cost of feed grain and encourage farmers to use more forages for their livestock (see Figure 6). It would also help reduce the overuse of such potentially harmful chemicals.

Government subsidies for farmers adopting alternative, low-input, and certified organic practices of crop, livestock, and poultry production would also do much to help rectify the chronic problems of overproduction and help keep more farmers on the land. In addition, marginal and environmentally fragile land should be taken out of production, natural ecosystems (especially swamplands and natural deserts) protected from further agricultural encroachment, and their restoration encouraged.

With mounting evidence that most contemporary agricultural practices are nonsustainable in the long-term, the urgency to develop alternative, ecologically sound agriculture is considerable. One definition of humane sustainable agriculture is as follows:

**Humane sustainable agriculture (HSA) produces adequate amounts of safe, wholesome food in a manner that is ecologically sound, economically viable, equitable, and humane. HSA meets farm animals' basic physical and behavioral requirements for health and well-being through a food and agricultural system that respects all of nature — humans, soil, water, plants, and animals, wild as well as domestic (see Addendum I describing the seven principles of HSA).**
While social justice is one cardinal aspect of a humane sustainable agriculture, there are additional important considerations. A sustainable agriculture minimizes the agricultural pollution of the environment. It reduces soil erosion and compaction. It conserves energy. It avoids dependence on expensive, uncertain, and costly sources of petrochemically based and potentially harmful fertilizers and pesticides. It helps preserve the family farm and other more sustainable, agricultural, and pastoral farming practices. It increases net farm income by lowering production costs. And it helps ensure both food quality and safety and the health and well-being of the soil, crops, and farm animals.

There are several other characteristics of sustainable agriculture. It is biodynamic. Soil quality is regenerated and not depleted. It is ecologically sound with rotations of locally adapted crops and following to control pests. There is no net loss of biodiversity. It is also humane, with small farm animal populations in seminatural husbandry conditions or under natural rangeland conditions with good stockmanship.

Intensive livestock farming practices are energy intensive rather than labor intensive. This results in local unemployment and decline of rural communities. These practices also are capital intensive and rely upon economies of scale and size. This results in the elimination of small farms and alternative agricultural systems. With large herds and flocks, there is increased incidence of animal disease and problems associated with pollution and manure disposal. Overcrowding and other husbandry practices result in animal deprivation, distress, stress, disease, and suffering. The increased dependence on drugs results in consumer and animal health hazards.

A humane sustainable animal agriculture recognizes that refinement, reduction, and replacement are important animal husbandry principles. Refinement of husbandry practices is needed to reduce stress and disease.

A reduction in the numbers of farm animals being raised for human consumption is essential for humane, economic, and environmental reasons. Their replacement with high-quality cereals, legumes and other vegetables, fruits, and nuts is a wise economic and public health decision. The U.S. Department of Agriculture's "Food Guide Pyramid" clearly recognizes the im-
The Place of Farm Animals in Humane Sustainable Agriculture

Importance of reduced animal fat and protein consumption for most American consumers (see Figure 7).

Humane sustainable animal agriculture recognizes ensuring the basic rights of animals as a human responsibility. These include right breeding to increase disease resistance, right rearing and socialization, right nutrition, and right environment to optimize overall animal health, well-being, and productivity. Animal health and well-being are too often sacrificed in order to maximize productivity.

Figure 7: Food Guide Pyramid — A Guide to Daily Food Choices

- Fats, Oils, & Sweets
  - USE SPARINGLY
  - Fats, oils, and added sugars in foods.

- Milk, Yogurt, & Cheese
  - 2-3 SERVINGS

- Vegetable Group
  - 3-5 SERVINGS

- Meat, Poultry, Fish, Dry Beans, Eggs, & Nuts Group
  - 2-3 SERVINGS

- Fruit Group
  - 2-4 SERVINGS

- Bread, Cereal, Rice, & Pasta Group
  - 6-11 SERVINGS

Source: USDA

Figure 8: Effects of Chronic Concentrate Overfeeding in Dairy Cows and Fattening Beef Animals

- Fatty liver syndrome impairs the defense system of the mammary gland
- Higher incidence of infectious diseases

Source: Boehncke (1985)

The widespread myth that productivity and farmers’ profits correlate with farm animal health must be dispelled. We must accept the reality that disease incidence increases once animals’ productivity is pushed too far. Effects of concentrate overfeeding of dairy cows and beef cattle contribute significantly to a variety of health problems, including fatty liver disease, mastitis, crippling foot diseases, and overall weakening of the immune system, with a resulting higher incidence of infectious diseases (see Figure 8). Hogs and poultry also suffer from a variety of other so-called production-related diseases, in part due to concentrate overfeeding — a gross waste of food indeed.

Advances in genetic engineering biotechnology to make livestock more productive and disease resistant should be based upon the principles of humane sustainable agriculture; otherwise, today’s problems of nonsustainable livestock husbandry practices will simply be intensified.
The Place of Farm Animals in Humane Sustainable Agriculture

The use of good arable land to feed farm animals and not people first must become a thing of the past. The gentle cow has harmed no one; but by exploiting her to the degree that we do today, we harm her kind and all of creation, including ourselves.

Farm animals can have a significant role to play in sustainable agriculture. Grazing different species together, like cattle and sheep, are traditional, natural farming practices that help preserve the countryside. Because of high levels of nutrient cycling, pasture and forage-grazing systems are among the most efficient of farming practices in maintaining soil fertility.

The greatest challenge today facing agriculturists, the veterinary profession, policymakers, and others involved in the livestock industry is to articulate and practice the principles of humane planetary stewardship. Such humane planetary stewardship is not only a moral or ethical choice, it has become a survival imperative essential to the future and integrity of Earth's creation.

We do not inherit the land, we borrow it from our children, and it is ours only in sacred trust. We are being called upon to develop an Earth- or Creation-centered world view that no longer makes life a commodity, commoditizes life and parasitizes the planet, but seeks to live in harmony with and reverence for all life. This new world view impels us to develop appropriate technologies and agricultural industries that are life-sustaining and enhancing, like organic and biodynamic farming practices. While increasing numbers of people regard meat consumption as unethical, a reduction in meat production and consumption, especially by more affluent nations, is an essential step toward restoration of the planet and the adoption of humane sustainable agricultural practices. Already, for reasons of health and economy, people are shifting toward a more vegetarian diet and endorse the new environmental dictum “Eat With Conscience.” With 5.4 billion people on the planet and 4 billion livestock, such changes in dietary habits and agricultural practices are crucial for the future well-being of all our relations.

International Dimensions of Humane, Sustainable Agriculture

Native, peasant farmers of the third world should not be encouraged to emulate the industrial nations’ addiction to meat, and their low-input sustainable agricultural practices should be respected and not obliterated by colonial agribusiness “aid and development” enterprises.

Through careful study of their often highly efficient, traditional agricultural practices and the various environments or bioregions they inhabit, peasant farmers can be assisted to help restore the land where needed, such as by reforestation, and feed themselves and their livestock more sustainably. Small-scale livestock-improvement programs, like those of Heifer Project International in Tanzania, East Africa, have combined soil conservation and regeneration with other sustainable agricultural practices, where the production of crops and forages is closely integrated, ecologically and economically, with humane, small-scale dairy cow milk production. Such programs have benefited countless families and village communities, where women, in a polygamous society, are the main work force.

A handful of small, nonprofit organizations are making a difference by linking other appropriate aid and development projects, like bio-gas production and improved garden-field soil-enrichment by nutrient animal-waste irrigation. Other examples are improved animal breeding and husbandry practices, and developments like a crop-integrated small-scale dairy goat enterprises, and improved cart and plough design and utilization.

But these organizations face the ideological and economic opposition of such larger organizations as the World Bank, IMF, AID, and FAO, who, for example, have helped underwrite a variety of nonsustainable colonial-style agricultural projects, especially monocrop plantations and livestock development projects that benefit the rich and further disenfranchise the poor.

These organizations have done little to improve standards of humane slaughter, basic hygiene and safety in third world slaughterhouses, the care and handling of livestock in transit to slaughter in their programs designed to increase meat consumption.