Excerpts from ***Taking Stock: Animal Farming and the Environment***

Courtesy of the Worldwatch Institute
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During the past 50 years, livestock industries have surged in one country after another as soaring grain yields made feeding animals on corn and barley relatively inexpensive, and intensive, specialized meat, egg, and dairy farms proliferated. In much of the world, meat consumption is rising steadily.

The factory-style livestock industries, now firmly entrenched in industrial countries, have environmental side-effects that stretch along the production line--from growing the vast quantities of feed grain to disposing of the mountains of manure. Worldwide, large livestock populations emit the potent greenhouse gas methane into the atmosphere, contributing to climate change.

Livestock create an array of problems not because cows, pigs, and chickens are hazards in themselves, but because human institutions have driven some forms of animal farming out of alignment with the ecosystems in which they operate. Many governments--including those of China, the European Community, and the United States--subsidize ecologically harmful methods of growing feed crops and raising animals.

Livestock Economy (excerpt):

At a global level, the primary goal of raising livestock is to produce meat, milk, and eggs. Meat has always been popular among those able to afford it, and over the centuries that group has swelled. More than a billion people now consume at least a kilogram (2.2 lbs.) a week. In the case of the world's premier meat-eating country, the United States, per-capita consumption is more than 2 kilograms a week. (USDA FAS 1991; Bailey 1990)

Meat consumption per person around the world ranges from a high of 112 kilograms a year in the United States to a low of 2 kilograms in India. The modern demand for meat can no longer be sustained by traditional livestock production systems, which integrated animals with crops. Outside the world's grasslands, most ruminant (cud-chewing) animals such as cattle and sheep traditionally ate grass and crop wastes on farms. Pigs and fowl, which cannot digest grass, subsisted on crop wastes, kitchen scraps, and whatever else they could find. In either case, domestic animals turned things that people could not eat into things people could.

To raise meat output, livestock producers have adopted new, intensive rearing techniques relying on grains and legumes to feed their animals. For example, farmers have moved nearly all of the pigs and poultry in industrial countries into giant indoor feeding facilities. There, they eat carefully-measured rations of energy-rich grain and protein-rich soybean meal. Cattle everywhere still spend most of their time dining outdoors, although beef producers--particularly in the United States, but also in Russia, South Africa, and Japan--supplement that roughage with grain in the months before slaughter. By contrast, Australian and South American cattle graze their entire lives, while European beef comes mostly from dairy herds, which eat less grain than American beef herds. (Bishop et al. 1989; Hahn et al. 1990)

Large areas of the world's cropland now produce grains for animals. Wealthy meat-consuming regions dedicate the largest shares of their grain to fattening livestock, while the poorest regions use the least grain as feed. **In the United States, for example, animals account for 70 percent of domestic grain use**, while India and sub-Saharan Africa offer just 2 percent of their cereal harvest to livestock. (USDA FAS 1991)

The expansion of the livestock economy has become the most dramatic change in world agriculture in recent decades. Factory-style production facilities have sprung up in much of the world, capitalizing on grain surpluses, advanced production technologies, and a global growing class of consumers rich enough to eat meat regularly. But abundance in the world's butcher shops has its costs--many of which are currently billed to the Earth.

Livestock Ecology (excerpt):

"An alien ecologist observing...earth might conclude that cattle is the dominant animal species in our biosphere," writes University of Georgia biologist David Hamilton Wright. Cattle and other ruminant livestock such as sheep and goats graze one-half of the planet's total land area. Ruminants, along with pigs and poultry, also eat feed and fodder raised on one-fourth of the cropland. Ubiquitous and familiar, livestock exert a huge, and largely unrecognized, impact on the global environment. (Wright 1990; BOSTID, NRC 1990; USDA FAS 1989)

Ecological burdens result from both modern, intensive livestock production methods--such as chicken and pig feeding houses and beef feedlots--and extensive forms--such as ranching and pastoralism. The environmental effects of intensive livestock operations run from

grain fields to manure piles. And unsustainable grazing and ranching patterns of impoverished and affluent regions alike sacrifice forests, drylands, and wild species. Multiple forces have disturbed traditional pastoralists' ecologically sound livestock systems, leaving herders to crowd with their animals in areas where the land is quickly laid to waste.

The concentrated feeding facilities of the industrial and newly industrializing countries use vast quantities of grain and soy, along with the energy, water, and agricultural chemicals that farmers use to grow these crops. Pork production absorbs more grain worldwide than any other meat industry, followed by poultry production. Together they account for at least two-thirds of feed grain consumption. Dairy and beef cattle consume much of the remaining third. (Fitzhugh et al. 1978; FAO 1985, 1988, 1989)

The efficiency with which livestock industries turn feed into meat, milk, and eggs varies among the different types of animals and different countries. **The United States, one of the more efficient livestock producers, uses 6.9 kilograms of corn and soy to put one kilogram of pork on the table.** Because they graze until the last 100 days of their lives, U.S. beef cattle consume less grain and soy than pigs, gaining about three-fourths of their weight from grass, hay, and other fodder. Grain use declines from beef to cheese to chicken to eggs. Farmers in other countries, notably Russia, are less efficient, and use more grain for each unit of meat, milk, or eggs--twice as much in the case of chicken. (Cattle-Fax, Inc. 1989; Bishop et al. 1989)

Other resources add to the livestock and feed industry's environmental tab, such as the fossil fuels used to supply feed grain. Including fuel for powering farm machinery and for manufacturing fertilizers and pesticides, feed grain turns out to be an energy-intensive product. **US corn fields--producing mostly feed--alone consume about 40 percent of the country's nitrogen fertilizer, along with more total herbicides and insecticides than any other crop.** (Hallberg 1989; Conservation Foundation 1986)

Cornell University's David Pimentel, a specialist in agricultural energy, estimates that 30,000 kilocalories of fossil fuel energy are used to produce a kilogram of pork in the United States--equivalent to the energy in almost 4 liters of gasoline. Energy use, like grain consumption, declines from pork to eggs. **All told, almost half of the energy used in American agriculture goes into the livestock sector,** and producing the red meat and poultry eaten each year by a typical American uses the equivalent of 190 liters of gasoline. (Pimentel 1991; Pimentel et al. 1980; Pimentel & Pimentel 1979; Fluck & Baird 1980; Duewer 1991)

Feed-grain farming guzzles water, too. In California, now the United States' leading dairy state, livestock agriculture consumes nearly one-third of all irrigation water. Similar figures apply across the western United States, including areas using water from dwindling aquifers. The beef feedlot center of the nation--Colorado, Kansas, Nebraska, and the Texas panhandle--relies on crops raised with water pumped out of an underground water source called the Ogallala aquifer, portions of which have been severely depleted. With half of the grain and hay fed to American beef cattle growing on irrigated land, water inputs for beef production mount. **More than 3,000 liters of water are used to produce a kilogram of American beef.** (Reisner & Bates 1990; Sweeten 1990; Weeks et al. 1988; Oltjen 1991; Ward, Dept. Animal Sciences)

The millions of tons of animal waste that accumulate at modern production facilities can pollute rivers and groundwater if precautions are not taken. If they get into rivers or open bodies of water, nitrogen and phosphorus in manure over-fertilize algae, which grow rapidly, deplete oxygen supplies, and suffocate aquatic ecosystems. From the hundreds of algae-choked Italian lakes to the murky Chesapeake Bay, and from the oxygen-starved Baltic Sea to the polluted Adriatic Sea, animal wastes add to the nutrient loads from fertilizer runoff, human sewage, and urban and industrial pollution. (Flavin 1989; Baker & Horton 1990; Hagerman 1990; Lenssen 1989)

Manure nitrogen, mixed with nitrogen from artificial fertilizers, also percolates through the soil into underground water tables as nitrates. These substances can cause nervous system impairments, cancer, and methemoglobinemia, or "blue baby" syndrome, a rare but deadly malady afflicting infants. Nitrate contamination is pervasive in Western Europe, from Spain to Denmark, and is apparently widespread in Eastern Europe as well. An official Czechoslovakian report speaks of a "nitrate cloud" contaminating groundwater under agricultural land. In the United States, roughly one-fifth of the wells in livestock states such as Iowa, Kansas, and Nebraska have nitrate levels that exceed health standards. (WHO guidelines 1984; Jorgensen 1989; others)

Extensive livestock production, like modern intensive production, has environmental side effects. Many of the world's rangelands, covering one-third of the Earth's land surface, bear the scars of improper livestock management: proliferating weeds, depleted soils, and eroded landscapes. In Africa, swelling human populations, shrinking rangeland, the collapse of traditional systems of range management, and misdirected development policies have conspired to concentrate cattle around water sources and towns, degrading the land. Elsewhere, many arid rangelands suffer from overstocking and mismanagement, while ranching in the tropical regions of Latin America--fostered by subsidies and land speculation--depletes forests and soils.

Cattle play a prominent role in global desertification--the reduction of dryland's ecological productivity. The process, however, is far more complex and varied than the word "desertification," conjuring images of sand dunes swallowing the range, implies. Initially, cattle overgraze perennial grasses, allowing annual weeds and tougher shrubs to spread. This shift in species composition is the most prevalent form of range degradation. The new weeds anchor the topsoil poorly, and can leave it vulnerable to trampling hooves and the erosive power of wind and rain. Without the cover of perennial grasses, fires that naturally control bushes lose their tinder, so shrubs expand unchecked. As the variety of plant species dwindles, wildlife species also vanish. (Darnhofer 1991; BOSTID, NRC 1990; Coppock 1991)

Estimates by the United Nations Environment Program indicate that 73 percent of the world's 3.3 billion hectares of dry rangeland is at least moderately desertified, having lost more than 25 percent of its carrying capacity. But quantifying and evaluating

degradation is complicated, and such estimates have been challenged. Some argue that calculations of the number of livestock a region can support are a poor indicator of degradation on Africa's arid rangelands because the environment is so drought-prone. They conclude that drought destroys the vegetation with or without cattle. Others point out that measuring degradation in drier areas by the presence of annual, rather than perennial, plants is misleading because annuals are native there. (Darnhofer, private communication; Ellis & Swift 1988; Mace 1990; Bartels 1991)

Although the environmental status of drier rangeland may defy simple quantification, there is little debate that degradation is occurring in environments where rainfall is more plentiful and regular. The perennial plants that flourish in these intermediate zones are easily disrupted by cattle; clay soils are easily compacted and rendered impervious to water; and rains often arrive in strong, sudden downpours, sluicing away soils destabilized by cattle. In addition, these areas can support crops, so farmers have crowded pastoralists and their herds onto smaller areas, accelerating degradation. (Coppock 1990)

Ranchers commonly overstock their land with cattle, leading to weed invasion and erosion. In the savannas of northern and central Mexico, livestock are stocked at nearly four times the land's carrying capacity. And wealthy nations are not immune from the effects of overgrazing on rangeland. Spain and Portugal still bear the scars of pro-sheep land policies that began hundreds of years ago. The western United States is likewise left with a sad legacy: The great cattle boom of the last century annihilated native mixed-grass ecosystems. And unsustainable practices--including overstocking and grazing cattle for too long in the same place--continue on much of the 110-million-hectare area of public land the federal government leases to ranchers. (Vera et al. 1984; World Resources Institute 1990-91; Pearson et al. 1991; Chaney et al. 1990; Wald & Alberswerth 1989)

The US Bureau of Land Management (BLM), which, along with the US Forest Service, is responsible for overseeing public grazing land, reported in 1990 that only 23 million hectares--33 percent of its holdings in the west--were in good or excellent condition. Other studies indicate that half of US rangeland is severely degraded, with its carrying capacity reduced by at least 50 percent, and that the narrow streambank habitats crucial to arid-land ecology are in the worst condition in history. (US Dept. Interior 1990; Chaney et al. 1990)

Damage to rangeland is only one measure of the destructiveness of current grazing patterns. Forests also suffer from livestock production, as branches are cut for fodder or entire stands are leveled to make way for pastures. The roster of impacts from forest clearing includes the loss of watershed protection, loss of plant and animal species, and on a larger scale, substantial contributions of the greenhouse gas carbon dioxide to the atmosphere. **Latin America has suffered the most dramatic forest loss due to inappropriate livestock production. Since 1970, farmers and ranchers have converted more than 20 million hectares of the region's moist tropical forests to cattle pasture.** (Pearson et al. 1991)

Eradicating tree cover sets the wheels of land degradation in motion. Shallow, acidic, and nutrient-poor, tropical soils rapidly lose critical phosphorus and other nutrients when the forest is converted to pasture. To compensate for the fertility decline, ranchers often stock newly cleared land at four times the standard rate of of one cow per hectare, which accelerates erosion and the vegetative shift to annual weeds and shrubs. Stocking rates fall precipitously thereafter, and most pasture is abandoned for land newly carved from the forest. (Hecht 1990)

Where forests recede before advancing ranches, so too does the diversity of life. The tropical forests, covering under 7 percent of the earth's land area, contain perhaps half of the earth's species. A typical hectare in the Brazilian Amazon, for example, hosts 300 to 500 different species, plus mammals, birds, reptiles, and thousands of distinct types of insects and microorganisms, many of them unknown to science. (Wolf 1987; Hecht 1990; Uhl & Parker 1986)

Forest destruction for ranching also contributes to climate change. When living plants are cut down and burned, or when they decompose, they release carbon into the atmosphere as the greenhouse gas carbon dioxide. In the atmosphere, carbon dioxide traps the heat of the sun, warming the earth. In addition, livestock are a source of the second-most important greenhouse gas, methane. Ruminant animals release perhaps 80 million tons of the gas each year in belches and flatulence, while animal wastes at feedlots and factory-style farms emit another 35 million tons. In such operations, waste is commonly stored in the oxygen-short environments of sewage lagoons and manure piles, where methane forms during decomposition. Manure that falls in the fields, by contrast, decomposes without releasing methane because oxygen is present. Livestock account for 15 percent to 20 percent of global methane emissions--about 3 percent of global warming from all gases. (Pearson et al. 1991; Houghton et al. 1987; BP Statistical Review 1990; Marland et al. 1989)

From the most immediate impacts--nitrogen contamination and retreating grasses--to the most far-reaching--loss of species and climate change--current methods of rearing animals around the world take a large toll on nature. Overgrown and resource-intensive, animal agriculture is out of alignment with the Earth's ecosystems.

Detailed references available in Worldwatch Paper 103, "Taking Stock: Animal Farming and the Environment."