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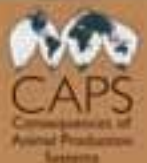
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LIVESTOCK in a CHANGING LANDSCAPE

Livestock production is an important resource ensuring global food supply, meeting the increasing demand for protein and supporting human livelihoods and well-being.

Both extensive and intensive livestock production systems require attention and intervention to promote fewer negative and more positive impacts on social, economic, and environmental aspects, all within a global context.

Ecological and Earth Sciences in UNESCO



Global Food Supply: The Livestock Challenge in the 21st Century

The rapid increase of intensive (confined) livestock production and the land and livelihood needs of extensive production (rangeland grazing) are crucial challenges.

The livestock sector emerges as a very significant contributor to environmental problems at every scale from local to global, including land degradation, climate change and air pollution, water shortage and pollution and loss of biodiversity.

Formulating responses to the wide range of consequences remains a complex task, but there are many promising solutions.

- Livestock products provide **one-third** of humanity's protein intake.
- Livestock production, including production of food, fiber, fertilizers, energy and labor, accounts for **40%** of agricultural gross domestic product (GDP).
- Creates livelihoods for **one billion** of the world's poor.
- Employs **1.3 billion** people.
- Growth and changes in the livestock sector increasingly contribute to a range of **social, environmental and health problems**.
- Various scales of **industrialized production systems** impair air and water quality, de-value real estate and create health and well-being concerns in local communities.
- **Extensive systems** impact biodiversity and ecosystem functioning by rangeland overgrazing practices that cause habitat loss, erosion, polluted watershed, desertification and the transmission of diseases from livestock to wildlife.
- Changes in economies, production rates and systems have led to a substantial **shift of livestock production** from North to South, with large scale production moving from temperate to tropical and sub-tropical regions.
- The emergence and continued growth of intensive systems respond to the rise in demand for animal products and **market pressures**.
- Meanwhile, extensive systems continue to exist alongside, occupying vast territories and providing livelihoods for a large number of **impoverished producers**.

Drivers of change in the livestock sector

Important driving forces in livestock production and agriculture are responsible for major global shifts in consumption, marketing, production and trade:

- Rising incomes.
- Demographic shifts.
- Technology in food chains.
- Liberalization of trade and capital.
- Incentive frameworks, sanitary standards instigated by policy.
- Labor and environmental policies.
- Variable grain prices: decreasing prices over the past four decades, but increasing trends due to changes in land use and crop production shifting from feed to biofuels.
- Fluctuating energy cost and substantial externalities, those by-products of activities that affect the well-being of people or impact the environment and are not reflected in market prices.
- Development of new communication and transport facilities.

Negative consequences of change

Biodiversity loss

Over-grazing has resulted in loss of biodiversity and productive capacity of ecosystems, particularly in arid systems.

While pastoralism and mixed farming provide livelihoods in regions where limited alternatives are available, extensive production has widespread impact.

Pollution and depletion of water

Livestock production can lead to unsustainable water use.

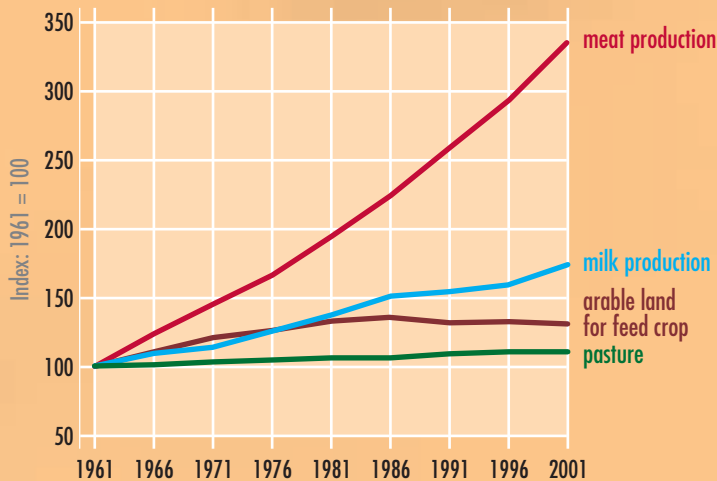
An increased demand for livestock products worldwide will influence water scarcity. Livestock production demands high water usage, often depleting local supplies. Inadequate waste management also causes pollution that impacts water quality.

Land degradation

An estimated 20% of the total land used for livestock production is being degraded by grazing activities; 70% of land degradation occurs in arid regions.

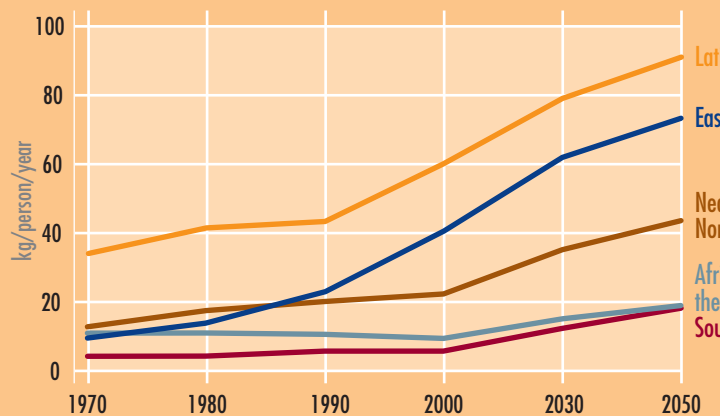
Many livestock systems provide environmental services for terrestrial systems, improving vegetation cover, biodiversity, and carbon sequestration. However, land modification and degradation lead to alteration of ecosystem dynamics and functioning. This includes impacts on biogeochemical and hydrological cycles, erosion and desertification.

Nearly 30% of the Earth's terrestrial ice-free surface is devoted to livestock production, while 8% is devoted to production of crops that are directly consumed by people. As livestock production shifts to more intensive systems, it will place more pressure on arable land for the production of feed.



Global trends in land-use area for livestock production and total production of meat and milk. Source: Steinfeld et al, 2006.

The demand is increasing. Global meat production **tripled from 47 million to 139 million tons** per year between 1980 and 2002. Although the pace of growth is slowing down, current meat production is expected to double by 2050 to meet rising demand.



Past and projected regional differences in meat consumption. Source: Steinfeld et al, 2006.

Dairy cows waiting at the milking station, Grignon, France.
Photo: © Anne-Hélène Cain/INRA.

Changes in global biogeochemistry

- **Increase in nitrogen, ammonia and methane.**

The global nitrogen cycle is being deeply impacted by fertilizer production and intensive grazing systems.

Livestock are responsible for over 60% of global anthropogenic ammonia emissions, which contribute significantly to acid rain and acidification of ecosystems. Most nitrogen added to fields or fed to an animal is released to the environment. This nitrogen causes a cascading series of negative effects on ecosystems and humans, including photochemical smog, acid deposition, and coastal eutrophication.

- **Increase in greenhouse gas emissions.**

Higher carbon emissions are associated more with grazing systems than with industrial livestock production systems.

Livestock production is responsible for 18% of greenhouse gas emissions. It accounts for 9% of anthropogenic carbon dioxide emissions, mainly due to expansion of pastures and arable land for feed crops. It generates emissions of other gases with greater potential to warm the atmosphere: as much as 37% of anthropogenic methane, and 65% of anthropogenic nitrous oxide.



Finishing hogs on a farm in central Arkansas, USA.
Photo by Tim McCabe, USDA Natural Resources Conservation Service.

Increased social and health risks

Livestock can transmit diseases to humans and countermeasures may be a source of social inequities.

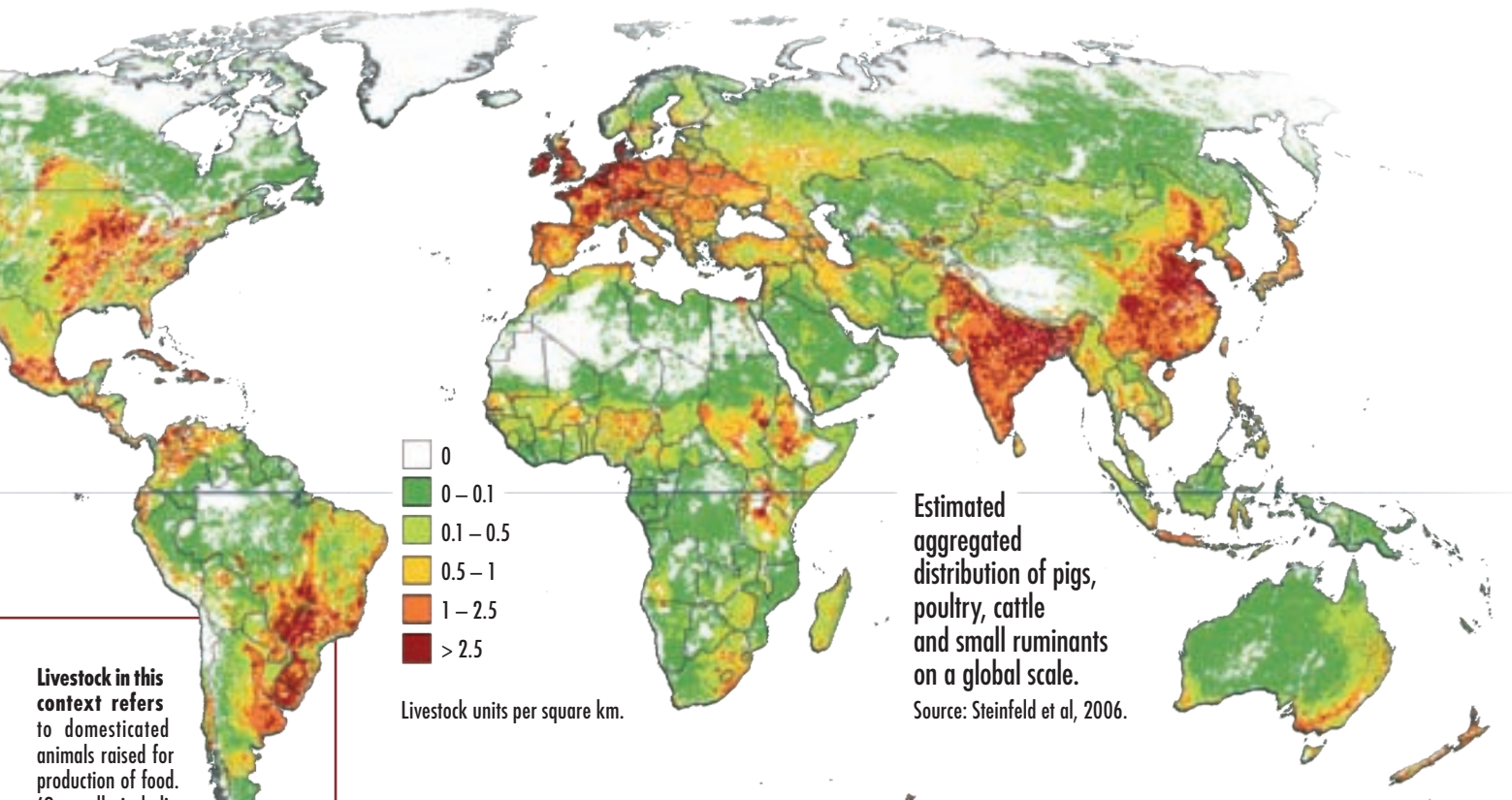
International standards for food safety and animal health often restrict trade in live animals and livestock products. A key concern is the ability of exporters to meet standards and to implement procedures to protect human and animal populations. Advanced technologies are not equally available to all producers. Smallholders who cannot access these technologies cannot compete on an equal basis with businesses and livelihoods are lost.



Cattle with herders in Abidi, Senegal. Photo: © UNESCO/D. Roger.

Sheep rearing, one of the principal export activities of New Zealand. Photo: © UNESCO/I. Forbes.





Livestock units per square km.

Estimated aggregated distribution of pigs, poultry, cattle and small ruminants on a global scale.
Source: Steinfeld et al, 2006.

Livestock in this context refers to domesticated animals raised for production of food. (Generally including cattle, sheep, goats, swine, and poultry).

Intensive livestock production systems are associated with a concentration of animals into large units, generally focusing on a single species and rely on commercial inputs and trade.

Extensive production refers to a system of raising animals under conditions that use predominantly non-commercial inputs to the system, in which more than 90% of dry matter fed to animals comes from rangelands, pastures, annual forages and purchased feeds.

Conceptual model of livestock impacts on biodiversity at different spatial and temporal scales.

Source: Reid et al, Forthcoming 2009.

OVERALL TRENDS

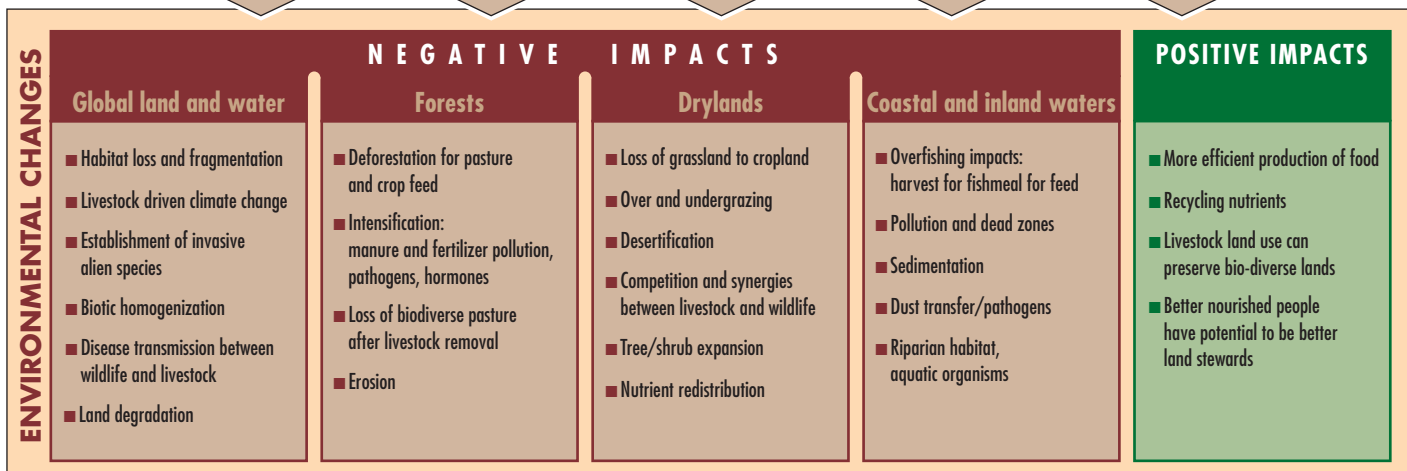
- Rising incomes and population lead to more meat, milk and egg consumption

- Urbanization
- Longer food chains
- Global trade

- Transition from ruminant to monogastric livestock production in many areas

Livestock-specific causes of biodiversity change

- Greenhouse gas production, acid rain, nutrient pollution
- Expansion and/or intensification of livestock and forage crops
- Declining pastoralism, increased settlement and less communal management
- Introduction of pathogens and invasive alien species



Overall impacts on biodiversity

- Higher morbidity and mortality of individuals, species and degradation of ecosystems
- Loss of genes, populations
- Truncated migratory routes
- Range shifts
- Invasives replacing natives
- Less diverse ecosystems

Slower loss of biodiversity

Recommended courses of action to address the environmental, economic and social consequences of intensification of livestock production:

- 1. Environmental services, such as carbon sequestration,** water provision and biodiversity need to be considered in management of grassland-based production systems, particularly in vulnerable areas.
- 2. Carbon loss caused by deforestation for pasturelands** can be reduced if intensive systems are used under appropriate environmental conditions. These measures include locating high-production feed crop systems on fertile soils in regions of moderate rainfall in the tropics, rather than on highly-weathered, low-nutrient soils or in high rainfall areas.
- 3. Environmentally sustainable intensification of livestock production** can be achieved through various measures that include:
 - Applying appropriate technology in feeding and waste management.
 - Providing efficiency gains in resource use for livestock production through price corrections.
 - Replacement of current sub-optimal production with advanced production methods.
 - Reducing nitrogen loads.
- 4 Livestock production can contribute to poverty reduction and economic growth in those poor countries that are not fully exposed to globalized food markets.** In rapidly growing and developed economies, market barriers

and economies of scale will continue to push smallholders out of production, thus alternative livelihoods need to be sought in other sectors.

- 5. Livestock products are scarce in the diets of poor and under-nourished people** but they figure prominently in the eating habits of the wealthy. Both conditions lead to health problems, and steps need to be taken to move people towards healthy levels of animal product consumption.
- 6. Livestock can transmit diseases to humans.** Vigorous bio-security measures and food safety control are required with consumer awareness to address the mounting threat of traditional and emerging diseases.

This brief draws on the **Livestock in a Changing Landscape project**, a collaborative work within SCOPE's Consequences of Animal Production Systems (CAPS) initiative, carried out in partnership with the Livestock Environment and Development Initiative (LEAD-FAO), the Swiss College of Agriculture (SHL), the International Livestock Research Institute (ILRI) and the Centre de coopération internationale en recherche agronomique pour le développement (CIRAD).

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Sources

- CAST. 1999. *Animal Agriculture and Global Food Supply*. Council for Agricultural Science and Technology (CAST), July 1999.
- Millennium Assessment (MA). 2005. *Ecosystems and Human Well-being. Desertification Synthesis*. In: Millennium Ecosystem Assessment. Island Press, Washington DC.
- Mosier, A.R., J.K. Syers, and J.R. Freney. 2004. *Agriculture and the Nitrogen Cycle: Assessing the Impacts of Fertilizer Use on Food Production and the Environment*. SCOPE 65. Island Press, Washington DC.
- Rosegrant, M.W., M.S. Paisner, S. Meijer, and J. Witcover. 2001. *Global Food Projections to 2020: Emerging Trends and Alternative Futures*. International Food Policy Research Institute, Washington DC.
- Steinfeld, H., P. Gerber, T. Wassenaar, V. Castel, M. Rosales, and C. de Haan. 2006. *Livestock's Long Shadow: Environmental Issues and Options*. Food and Agricultural Organization, United Nations. Rome.

Forthcoming (2009)

- Gerber, P., H.A. Mooney, J. Dijkman, C. de Haan, S. Tarawali, C. Opio, (ed). *Livestock in a Changing Landscape: Regional Perspectives*.
- Reid, R.S., C. Bedelian, M.Y. Said, R.L. Kruska, R. M. Mauricio, V. Castel, J. Olson, and P.K. Thornton. *Global livestock impacts on biodiversity*. In: Steinfeld, H., H.A. Mooney, F. Schneider, and L.E. Neville (ed). *Livestock in a Changing Landscape: Drivers, Consequences, and Responses*.
- Steinfeld, H., H. A. Mooney, F. Schneider, L.E. Neville (ed). *Livestock in a Changing Landscape: Drivers, Consequences and Responses*.

Useful links

- UNESCO: www.unesco.org
 SCOPE: www.icsu-scope.org
 UNEP: www.unep.org
- Centre de coopération internationale en recherche agronomique pour le développement (CIRAD): <http://www.cirad.fr>
 FAO/LEAD (Food and Agriculture Organization/Livestock, Environment and Development): www.fao.org/AG/AGAInfo/projects/en/lead.html and www.fao.org/lead/
 Global Environmental Change and Food Systems: <http://www.gecafs.org>
 International Assessment of Agricultural Science and Technology (IAASTD): <http://www.agassessment.org>
 International Livestock Research Institute: <http://www.ilri.org>
 International Nitrogen Initiative: www.initrogen.org
 Swiss College of Agriculture (SHL): <http://www.shl.bfh.ch>
- UNESCO-SCOPE Policy Brief - N° 4 April 2007. Human alteration of the nitrogen cycle: threats, benefits and opportunities: [http://www.icsu-scope.org/unesco/070424%20\(w\)%20USPB04%20En.pdf](http://www.icsu-scope.org/unesco/070424%20(w)%20USPB04%20En.pdf)