Eco-systems of agricultural landscapes
and sustainable land use: Livestock systems

05 - Livestock Environment Interaction - 5

Functional biodiversity in natural and agricultural eco-systems

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Risk management and process quality control in agricultural production relating to:

- Soil conservation
- Ground water protection
- Watershed management
- Dumping of noxious or toxic residues
- Release of “greenhouse gases“
- Conservation of natural biodiversity
- Conservation of agricultural biodiversity

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What is biodiversity?

Biodiversity is defined by the number of eco-systems, communities, species, populations, genotypes, or genes per unit area, landscape, eco-region, eco-zone, or continent

What is biodiversity?

Species diversity

Genetic diversity

Eco-system diversity

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Agriculture and biodiversity

(1) Agriculture destroys biodiversity

(2) Agriculture utilises biodiversity

(3) Agriculture creates biodiversity

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(1) Agriculture destroys biodiversity

Up to 1940	Mostly organic agriculture
from 1940	Chemical pesticides, chemical fertilisers
from 1950	Increasing commercialisation of agriculture
from 1960	HYV in rice, wheat, maize (green revolution)
from 1960	Accelerated increase of irrigation agriculture
1975	Oil crisis, drastic increase of input-costs for „green revolution“
from 1975	Growing commercial control of genetic resources
from 1975	Green revolution including more crops
from 1980	Increasing use of biotechnology in plant breeding
from 1980	Beginning extensification in European agriculture
from 1990	Intensified use of biotechnology in plant and animal breeding
from 2000	Increasing importance of precision agriculture

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(2) Agriculture is using biodiversity

approx. 4 000 mammal species, of which 23 are domestic livestock, 15 more are other domestic animals, and 20 are potential domesticants

approx. 10 000 species of birds, of which 7 are domestic fowl, 1 potential domesticant, 2 other domestic species

approx. 90 000 species of snails, of which 2 are domestic species

approx. 900 000 species of insects, of which 2 are domestic species

(3) Agriculture creates biodiversity

Agro-Biodiversity - (species diversity)
- breeds, cultivars, land races, pedigrees, types, breeding lines, varieties
- genetic diversity
- i.e. ICARDA approx. 22 000 varieties of barley, identifiable by 16 phenotypical parameters
- i.e. more than 820 recognised cattle breeds world wide, in addition many land races, eco-types

Loss of natural biodiversity = loss of species
Loss of agro-biodiversity = genetic erosion

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Bos primigenius

Economic and social importance of livestock genetic resources (I)

- Domestic livestock provide some 30% of all food and agriculture requirements for humans

- They provide direct food products such as meat, milk, eggs, blood and others like dung, fibres, hides and draught power

- 70% of the world's rural poor depend mainly on livestock including
  - 640 million poor farmers in rain fed areas
  - 190 million pastoralists in arid or mountainous areas
  - more than 200 million people in landless households

Economic and social importance of livestock genetic resources (II)

- Livestock have both functions (interactions with the agro-ecosystem) and purposes (functions managed by farmers) within agro-ecosystems
- There exist differences between species, breeds and individual animals allowing to fulfil these functions and purposes
- The immediate and wider environments, and farmers' purposes change over time
- Previous genetic selection for breeds suited to high input/output systems has narrowed the genetic base
- New demands exist on livestock genetic resources to fit into agro-ecological and livelihood oriented production systems

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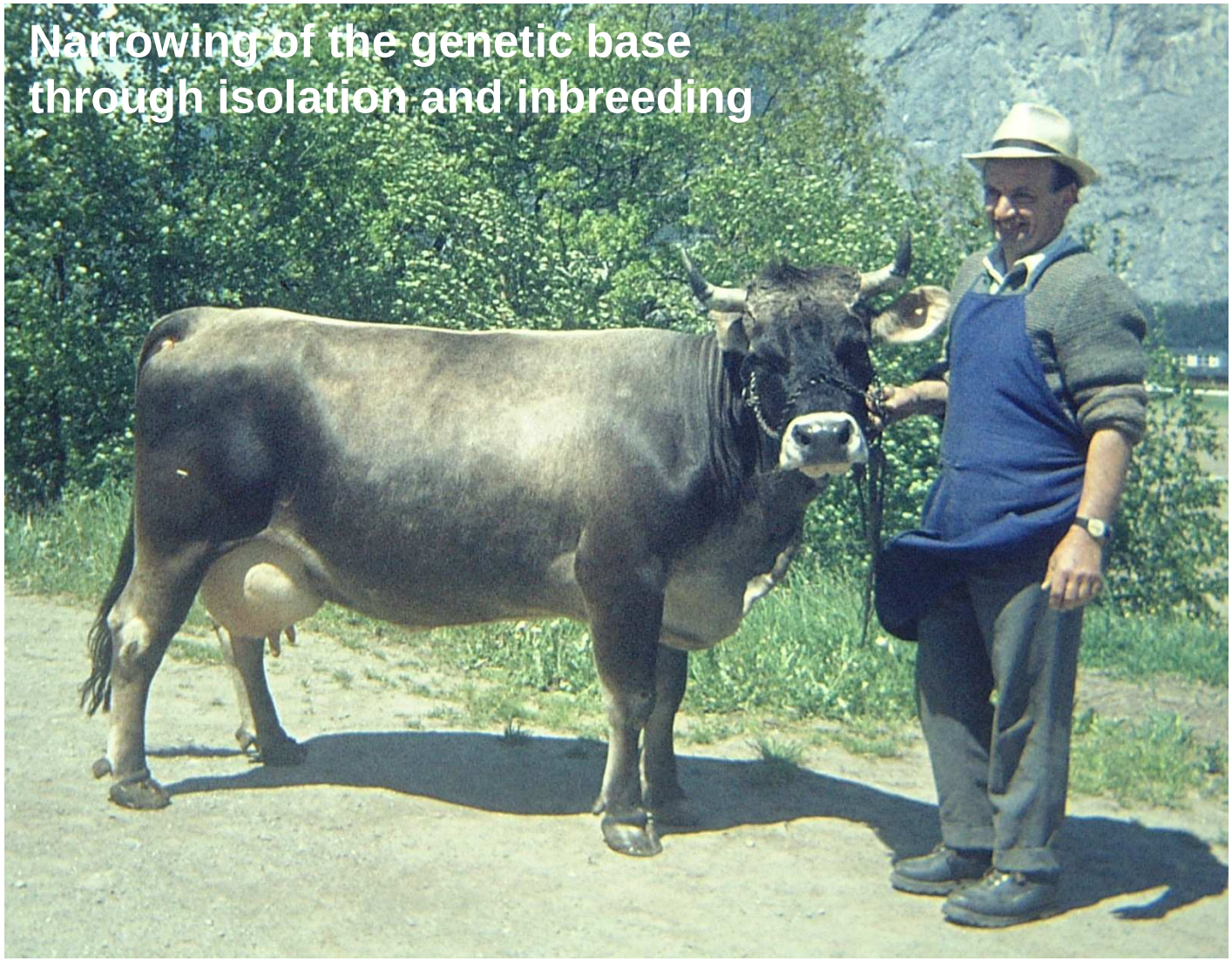
Three types of genetic erosion in livestock

1. Narrowing of the genetic base through isolation and inbreeding
2. Breed substitution and upgrading by cross-breeding
3. Sudden threats to small populations

Source: A.G. Drucker et al., Ecological Economics 36 (2001)

Narrowing of the genetic base through isolation and inbreeding



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Breed substitution and upgrading by cross-breeding

Sudden threats to small populations

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A summary of livestock breeds at risk in different regions

Region	Breeds recorded	Breeds at risk	% of recorded
Africa	396	27	6.8
Asia/Pacific	996	105	10.5
Europe	1688	638	37.8
Near East	220	29	13.2
Latin America	378	15	4.0
North America	204	59	28.9
World	3882	873	22.5

Source: A.G. Drucker et al., Ecological Economics 36 (2001)