Biodiversity, Agro-ecosystem Resilience and Wildlife Health

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Food and Agriculture Organization of the United Nations, Rome, ITALY

This came after a recommendation of the Parties to the Convention of Biological Diversity (CBD) at their conference in October 2010, the UN General Assembly declared 2011 – 2020 the UN-Decade of Biodiversity.

The UN Decade aims to make a contribution to achieving the revised and updated global biodiversity targets agreed at the 10th Meeting of the Conference of the Parties (COP10) to the Convention of Biological Diversity.

Related Posts
- Watch out for this new book: Agrodiversity and the Law
- Invitation Countdown 2010 celebrations
- Agriculture Project – Eastern Cape, South Africa
Food and Agriculture Organization of the United Nations
193 Member states + EU
- Department of Agriculture and Consumer Protection
- Natural Resource Management and Environment
- Forestry
- Fisheries and Aquaculture

United Nations Environmental Programme
Universal Membership
Secretariats for Conventions – CBD, CITES, CMS ...

Convention on Migratory Species
114 Parties

Millennium Ecosystem Assessment – over 1000 of the world's leading biological scientists that analyses the state of the Earth’s ecosystems and provides summaries and guidelines for decision-makers

millenniumassessment.org

International Union for Conservation of Nature
The Convention on Biological Diversity
193 Parties (168 Signatures)

Treaty on Plant Genetic Resources for Food and Agriculture
127 (w/EU)

United Nations Framework Convention on Climate Change
193 parties

United Nations Convention to Combat Desertification
193 parties
Socio-economic Trends

Population - Consumption - Urbanization - Migration - Economic growth - Political instability
Food - Feed - Fibre - Energy - Livelihood - Ecosystem Services

Increased demand

Sustainable supply

Adapted from: FAO Profile for Climate Change, 2009

Environmental Challenges

Air - Soil - Land - Water - Biodiversity
Climate Change – Health risks - Loss of Biodiversity - Land degradation - Water scarcity
Undernourishment in 2009, by region (millions)

- Total = 1.02 billion
- Developed countries = 15
- Near East and North Africa = 42
- Latin America and the Caribbean = 53
- Sub-Saharan Africa = 265
- Asia and the Pacific = 642

Source: FAO.
Livelihoods
(Poverty Alleviation and Equity)
Food Security
(and Food Safety)
Millennium Development Goals

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS and other diseases
7. Ensure environmental sustainability
8. Global partnership for development
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8. **Global partnership for development**
Ecosystem Services and their links to Human Well-Being (MEA 2003, p78)
Plastic Debris

The Great Pacific Garbage Patch.
Anthropogenic Impacts

- Long-lasting plastics end up in the stomachs of marine birds and other animals (overtime → starvation).
- ~100,000 marine mammals and 1 million seabirds are killed each year.
- Plastics absorb pollutants from seawater (PCBs, DDT, and PAHs).
- Decomposition of the plastic (toxic effects) mimic estradiol.
- Food chain accumulation of the toxins.
- Facilitate the spread of invasive species.
Anthropogenic Impacts
A major national and international problem because it can lead to:

- an increase in the frequency of: harmful algal blooms, shellfish contamination, anoxic and hypoxic events and massive fish kills;
- a loss of ecosystem integrity, aquaculture production, fish stocks and amenity value; and
- changes in biodiversity.
Estuaries
### Ecosystem Services and The Relative Contributions of Different Coastal System Subtypes.

*Millennium Ecosystem Assessment. 2006*

<table>
<thead>
<tr>
<th>Direct and Indirect Services</th>
<th>Estuaries and Marshes</th>
<th>Mangroves</th>
<th>Lagoons and Salt Ponds</th>
<th>Intertidal</th>
<th>Kelp</th>
<th>Rock and Shell Reefs</th>
<th>Seagrass</th>
<th>Coral Reefs</th>
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</thead>
</table>
Monocultures are not resilient

**resilience**: the capacity of a system to tolerate disturbance without collapsing, to withstand shocks, to rebuild itself when necessary, and to improve itself when possible.
• Climate changes and deforestation threaten forest genetic diversity.
• Trends in encroachment are alarming in certain parts of the world.
• The outcome is weakened resilience of forests and the potential for encountering novel pathogens.
World Agroforestry Centre (ICRAF)

ICRAF is one of a network of 16 Future Harvest centres located throughout the developing world. The mission of ICRAF is to improve human welfare by reducing poverty, improving food and nutritional security, and enhancing environmental resilience in the tropics.

ICRAF focuses on four primary themes:

- Agroforestry systems that help restore soil fertility and regenerate degraded lands;
- Market-driven tree cultivation systems that uplift rural poor out of poverty and improve their health and nutrition;
- Agroforestry systems that enhance environmental services, such as watershed protection, biodiversity conservation, and carbon sequestration; and Capacity building for agroforestry research and development.

ICRAF shares its expertise and aims for improved coordination with CPF members within the UNFF themes of: Forest-related scientific knowledge; and Rehabilitation and restoration of degraded lands, and the promotion of natural and planted forests.

http://www.worldagroforestrycentre.org
Opportunities in food security and commerce

Conservation efforts in provision of shelter and top soil erosion

Health Risks in sharing habitats – floor and canopies - with reservoirs such as that of Nipah or Lyme’s Disease
The forests

• Wildlife provide high quality source of proteins that for millennia have fed the local human populations.
• These are important sources of food security and must be preserved.
• Wild meat – Africa / Medicinal aspect – Asia
• Commercialization and Management
• Threats - habitat loss, due to conversion of forest to other land uses; and habitat fragmentation, due to road construction and other infrastructural developments.

www.fao.org/biodiversity
www.fao.org/forestry/Forestry.asp
Bush Meat

• **Bushmeat**
  – Unsustainable and often illegal hunting and commercial trade in wildlife and wildlife products in developing countries poses a major threat to wildlife, including emerging diseases which are a risk to humans and the survival of wild animal populations and species alike.

• **Human-wildlife conflict**
  – Increased migration of people and animals exacerbate contacts and conflicts at the human-wildlife-livestock interface and thus facilitate disease transmission.
Smuggled bushmeat poses disease risk to Britain, says report

Melissa Kite
Deputy Political Editor
The Sunday Telegraph
5th September 2004, p.11

At least 11,600 tons of illegal bush meat, including monkey, rat, bat, gorilla, camel and elephant, were smuggled into Britain last year, exposing cattle to a range of infectious diseases, including foot and mouth.

The extent of the illegal trade in meat from Africa, Asia and the Middle East is revealed in an

Bush meat → a way of life

Bush meat -- a risk to life

Diseases that can be transmitted → Ebola, Marburg, simian foamy virus, ... Origin of HIVs,

Some of it is infected and could cause epidemics, according to the report from the Department of the Environment, Food and Rural Affairs (Defra).
Hunting, Trade and Management of Wildlife in Tropical Forests

when: Wednesday, 6/10/2010
where: Green Room, Building A, 1st floor

Interpretation in French and Spanish

Speakers:
- Edgar Kaeslin, FAO: Sustainable Management of the Wildlife and Bushmeat Sector in Central Africa - The GEF Bushmeat Project
- Scott Newman, FAO: Wildlife Farming and Bushmeat Consumption - One Health Implications for Resource Management, Livestock and Public Health

Moderator: Kai Wolscheid, CIC
The term "wildlife" refers to all non-domesticated animals. It thus singles out one component of biodiversity.

In historical terms it is understandable that wildlife is singled out in this way. The earliest humans were hunter gatherers. In the sense that wildlife is currently almost certainly the single most threatened component of forest biodiversity.

Forest wildlife faces a number of dire threats. Perhaps the most ominous of
Loss of diversity is reflected by more disease morbidities and increases in mortality.
• Asia, Europe, Middle East, East Africa → Egypt, Sub-Saharan Africa
• Millions upon millions of cattle, buffalo, yaks and wild ungulates perished
• Wildlife surveillance as indicator of rinderpest virus disappearance

• **2011** → Global Declaration of Freedom from Rinderpest by FAO and OIE
Biodiversity and Efficacy

• What is the optimal level of agricultural biodiversity?
• What is the best mix (spatial, temporal, distribution/equity)?
• How to maintain use and option value?
• How to address trade-offs between agricultural biodiversity and other global public goods?

Pollination
Nutrition

Nutrition and biodiversity converge to a common path leading to food security and sustainable development. They feature directly in the Millennium Development Goals to halve the proportion of people who suffer from hunger (Goal 1) and to ensure environmental sustainability (Goal 7).

The alarming pace of food biodiversity loss and ecosystem degradation makes a compelling case for re-examining food systems and diets. Globalization, industrial agriculture, population increases and urbanization have changed patterns of food production and consumption in ways that profoundly affect ecosystems and human diets.

Presently, one billion people suffer from hunger and another two billion suffer from micronutrient deficiencies. Simplification of diets, low in variety but high in energy, contributes to the escalating problems of obesity and chronic disease, which are increasingly found alongside micronutrient deficiencies and undernourishment, particularly in poor areas of the developing world.

Biodiversity plays a key role in ensuring dietary adequacy, because nutrient contents between foods and among varieties/cultivars/breeds of the same food can differ dramatically.

FAO, together with the Bioversity International, is leading the "Cross-cutting Initiative on Biodiversity for Food and..."
A SAFETY NET FOR THE FUTURE

Livestock biodiversity is essential to food and livelihood security, particularly in the developing world. Livestock provide meat, milk, eggs, fibres, skins, manure for fertilizer and fuel, draught power for cultivation and transport, and a range of other products and services. Many of the world’s rural poor – an estimated 70 percent – keep livestock and rely on them as important components of their livelihoods. Domesticated animals also contribute to the ecosystems in which they exist, providing services such as seed dispersal and nutrient cycling.

Genetic diversity underpins the many roles that livestock fulfill and allows people to keep livestock under a wide variety of environmental conditions. As a result, domesticated animals survive in some of the most inhospitable areas on Earth – from Arctic tundras and high mountains to hot dry deserts – where crop production is difficult or impossible.

Livestock exposed to extreme climatic conditions develop adaptive characteristics that help them survive and produce where other animals would succumb. They adapt to local feed resources and develop resistance to diseases and parasites. Natural selection plays a role, but today’s breeds with their unique combinations of genes would not have emerged without continuous active management and selection by farmers and pastoralists over the 12,000 years since the first livestock species were domesticated.

Maintaining the livestock gene pool

A challenging task

The cost of establishing and maintaining animal gene banks is high compared to those for crops. Preserving animal genetic material entails costly materials, equipment, trained staff and a constant power supply.

In reality, however, gene banks should primarily serve as a backup to maintaining the breeds in the production systems in which they were developed. The overall goal would be to foster the long-term sustainable use and development of livestock breeds – meeting the economic and social needs of livestock keepers and minimizing pressures on the environment and natural resources while retaining genetic options for the future. However, many constraints must be dealt with:

Genetic erosion: counting the loss

Despite their enormous potential contribution to sustainable development and to reducing hunger and poverty, animal genetic resources for food and agriculture are underutilized and underconserved. Of the 7,600 breeds reported to FAO by its Member Countries, more than 1,500 are at risk of extinction or are already extinct. During the first six years of this century, more than 60 breeds – almost one a month – disappeared forever, taking with them their unique genetic make-up. Losing these breeds is like losing a global insurance policy against future threats to food security. It undermines capacity to adapt livestock populations to environmental changes, emerging

Web: www.fao.org/nr/cgrfa
State of knowledge: domestic breeds

Caution of “improved” breeds entering a new pathoshere for which they are not prepared (Performance depends of the environment and feed not only the genes).
Integrated approach and iterative steps

Characterization  Update  Inventory

New tools and technologies

Sustainable use and conservation diversity between populations AND within population
Main direct drivers of change in biodiversity and ecosystems

http://www.millenniumassessment.org/en/GraphicResources.aspx
Eleven of the last twelve years rank among the twelve warmest years in the instrumental record of global surface temperature.

IPCC Fourth Assessment Report on Climate Change, 2007
Climate Change Nets Record Highs and Lows in 2010

*Sea ice declines coincide with rising temperatures, record breaking precipitation*

01-13-2011 // Aislinn Maestas

“The National Oceanic and Atmospheric Administration has announced that 2010 tied 2005 for the hottest year on record and broke the record for wettest year. This news comes on the heels of last week’s announcement by the National Snow and Ice Data Center that Arctic ice coverage for December 2010 was the lowest for any December since satellite records began in 1979."
livestock’s long shadow
environmental issues and options

THE STATE OF FOOD AND AGRICULTURE

Livestock in the balance
• “Animal health systems have been neglected in many parts of the world, leading to institutional weaknesses and information gaps as well as inadequate investments in animal-health-related public goods.”
## Climate change impacts on agriculture, forestry, ecosystems and water resources

<table>
<thead>
<tr>
<th>Trend in extreme weather/ climate events</th>
<th>Possible impacts on agriculture, forestry, and ecosystems</th>
<th>Possible impacts on water resources</th>
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<tbody>
<tr>
<td>Warmer &amp; fewer cold days/nights, warmer &amp; more frequent hot days/nights</td>
<td>( \uparrow ) yields in cold, ( \downarrow ) yields in warmer environments ( \uparrow ) insect outbreaks</td>
<td>Effects on snow melt related water resources, water supply</td>
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<tr>
<td>↑ Frequency <strong>warm spells/heat waves</strong></td>
<td>( \downarrow ) yields in warm regions (heat stress) ( \uparrow ) danger of wildfire</td>
<td>↑ water demands, ↓ water quality</td>
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<tr>
<td>↑ Area affected by <strong>drought</strong></td>
<td>Land degradation ( \downarrow ) yields/crop damage; ( \uparrow ) livestock deaths; ( \downarrow ) risk of wildfire</td>
<td>Water stress more widespread</td>
</tr>
<tr>
<td>↑ Frequency <strong>heavy precipitation events</strong></td>
<td>Damage to crops; Soil erosion; Waterlogging ( \rightarrow ) less cultivate land</td>
<td>↓ water quality, contamination of water supply, water stress</td>
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<tr>
<td>↑ <strong>Intense tropical cyclone</strong> activity</td>
<td>Damage to crops; windthrow of trees; Damage to coral reefs</td>
<td>Power outages ( \rightarrow ) disruption of public water supply</td>
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<td>↑ incidence of extreme <strong>high sea level</strong> (excludes tsunamis)</td>
<td>Salinisation of irrigation water, estuaries and freshwater systems</td>
<td>↓ freshwater availability due to salt-water intrusion</td>
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<td>↑ Intense tropical cyclone activity</td>
<td>↑ areas affected by drought, possible losses to crops, trees, coral reefs</td>
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Adapted from IPCC Fourth Assessment Report on Climate Change, 2007
CC impact assessment on agricultural systems: an example

From the “Workshop on Climate Change and Biodiversity for Food and Agriculture. February 2008; Options for Policy Makers”.

Recommendation – to downscale climate change data to allow informed decisions on biodiversity planning by farmers and rural communities
CC impact assessment on agricultural systems: an example

<table>
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<tr>
<th>Region</th>
<th>DEF ORIENTALE</th>
<th>DEF SUD</th>
<th>FAVORABLE</th>
<th>INTERMEDIAIRE</th>
<th>MONTAGNE</th>
<th>SAHARIEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barley</td>
<td>-4</td>
<td>-6</td>
<td>-8</td>
<td>-10</td>
<td>0</td>
<td>-4</td>
</tr>
<tr>
<td>Durum wheat</td>
<td>-6</td>
<td>-8</td>
<td>-10</td>
<td>-12</td>
<td>-6</td>
<td>-8</td>
</tr>
<tr>
<td>Soft wheat</td>
<td>-8</td>
<td>-10</td>
<td>-12</td>
<td>-14</td>
<td>-8</td>
<td>-10</td>
</tr>
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</table>

Percent change in average yield (2030, A2 scenario)

Impacts of biodiversity on the emergence and transmission of infectious diseases
Felicia Keesing, Lisa K. Belden, Peter Daszak et al.  2010.
Nature Volume: 468, Pages: 647–652
J Lubroth did this in February 2011, wonderful that you are using it!

This is a case of anthropogenic biodiversity too.
Thank you very much

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