Analysis of the Agriculture-Environment Nexus

Evolving concepts and approaches

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Overview of presentation

How to understand the agriculture-environment nexus?

UNEP’s contribution towards conceptual understanding:

- PLEC - Agrodiversity
- LUCID - Land-Use Change Analysis
- Millennium Ecosystem Assessment - Ecosystem Services
- Land Degradation Assessment in Drylands (LADA) Framework
Conflict approach
- Agricultural activities lead to environmental degradation
- Environmental conservation prevents agricultural activity

Synergy approach
- Promotion of environmentally friendly agricultural practices.
Global project with UN University as Executing Agency that received GEF funding from 1998-2002

- Main **objective**: to develop sustainable and participatory approaches to biodiversity management and conservation based on farmers’ technologies and knowledge within agricultural systems at the community and landscape levels.
PLEC

- PLEC piloted approaches for conservation of biodiversity in the agricultural production landscape
- Developed a replicable methodology to allow locally adapted solutions to biodiversity and land management emerge and be taken up by scientists and policy makers
- Developed the concept of ‘agrodiversity’ – related to the SRL framework
Elements of Agrodiversity

**Biophysical Diversity**
- Soils, productivity, biota, water, microclimate

**Organisational diversity**
- Household characteristics, resource endowments, gender, age

**Demography**
- Population, migration, age-sex structure

**Management diversity**
- Local knowledge, adaptations and innovation, new technologies

**Macro-economy**
- Government services, subsidies, aid

**Climatic Variability**
- Macro and Mesoclimate cycles and random trends, drought floods

**Agrobiodiversity**
- Use and management of species, production, conservation

**Livelihoods**
- Poverty and food security, sustainability

Natural Environment

Modified Environment

Related developmental issues
Landscape rehabilitation demonstration at Ogotana

Before 2000

After 2002

PLEC - PNG
Land Use Change, Impacts and Dynamics (LUCID)

Regional project in Uganda, Kenya and Tanzania with International Livestock Research Institute (ILRI) as Executing Agency that received GEF funding from 2001-2004.

Main objective: To analyse new and existing data to improve the understanding of the linkages between the processes of change in biodiversity, land degradation and land use.
The tool: spatial and temporal analysis of land-use change over the last 50 years
1) Sequence sometimes applicable to pastoral areas without cultivation:

- Woodlands
- Bushland
- Grassland
- Pasture

2) Sequence applicable to wetter, cultivated areas:

- Forest
- Woodlands
- Bushland
- Grassland

Primary Land Cover or Land Use

Land-use change

Intensive Land Use

Result of less intensive land use

Result of intensive land use

Grazing

Cultivation

Highly grazed

Intensive Monocropping

Intensive Mixed cropping

Fallow

Woodlot

Pasture

Degraded ecosystems (e.g., reduced species numbers and pant cover)

Eroded soils

Depleted soil nutrients

Loss of native species

Poor crop Productivity
The most significant land use changes in East Africa were:
- an expansion of cropping into grazing areas, particularly in the semi-arid and sub-humid areas
- an expansion of rainfed and irrigated agriculture in wetlands or along streams especially in semi-arid areas
- a reduction in size of many woodlands and forests on land that is not protected
- an intensification of land use in areas already under crops in the more humid areas

Many linkages between land use change, biodiversity loss and land degradation that could have direct impact and influence on national and regional policies targeting natural resources management, conservation, poverty reduction and economic development programmes.
Land use and cover also influenced by rainfall variability and trends.

Research on the impact of climate change on land use and land cover has been initiated as a result of the LUCID results: Climate-Land Interaction Project (CLIP) in East Africa.
Global project with UNEP and World Fish Centre as Executing Agencies and World Resource Institute, UNDP and the World Bank were among the partner. The assessment received GEF funding from 2001-2005.

**Main objective:**
To contribute to improved decision-making concerning ecosystem management and human well-being, and to build capacity for scientific assessments of this kind.
More than 1300 authors from almost 100 countries involved.

Focused on ecosystem services, how changes in these services have affected human well-being and consequences for people in the future.

Potential responses at local, national and global levels identified.
Ecosystem Services Approach

Bridge between Environment and Human Well-being:

- **Provisioning Services** - food, freshwater, fuel, ...
- **Regulating Services** - climate and water regulation, ...
- **Cultural Services** - spiritual and religious benefits, ...
- **Supporting Services** - soil formation, nutrient cycling, ...
Human well-being and poverty reduction
- Basic material for a good life
- Health
- Good social relations
- Security
- Freedom of choice and action

Indirect drivers of change
- Demographic
- Economic (e.g., globalization, trade, market, and policy framework)
- Sociopolitical (e.g., governance, institutional and legal framework)
- Science and technology
- Cultural and religious (e.g., beliefs, consumption choices)

Ecosystem services
- Provisioning (e.g., food, water, fiber, and fuel)
- Regulating (e.g., climate regulation, water, and disease)
- Cultural (e.g., spiritual, aesthetic, recreation, and education)
- Supporting (e.g., primary production, and soil formation)

Direct drivers of change
- Changes in local land use and cover
- Species introduction or removal
- Technology adaptation and use
- External inputs (e.g., fertilizer use, pest control, and irrigation)
- Harvest and resource consumption
- Climate change
- Natural, physical, and biological drivers (e.g., evolution, volcanoes)

LIFE ON EARTH - BIODIVERSITY

Source: Millennium Ecosystem Assessment
Tool for decision-makers

- Identify options that can better achieve core human development and sustainability goals
- Better understand the trade-offs involved in decisions concerning the environment
Land Degradation Assessment in Drylands (LADA)

Global project with UNEP as GEF Implementing Agency and FAO as Executing Agency. GEF funding from 2006-2010

Main objective:

to assess causes, status and impact of land degradation in drylands in order to improve decision making for sustainable development in drylands at:

• local
• national,
• sub-regional and
• global levels.
LADA initiatives in Drylands

Legend
- Hyperarid (<0.05)
- Arid (0.05 - 0.20)
- Semi-arid (0.21 - 0.50)
- Dry sub-humid (0.51 - 0.65)
- Humid (>0.65)
- Cold (Boreal and Polar Temperature)
- Water bodies
- LADA pilot countries
- CACILM LADA associated countries
- Individually LADA associated countries

Geographic Projection (lat/long)
Source: GAEZ (FAO-IIASA, 2003)
DPSIR Framework with LADA

**INDICATORS**

**DRIVING FORCES**
- Incidence of poverty
- Over-intensification LU
- Farm size and land tenure status
- Population density
- Road Market access
- Occurrence of conflicts
- Protected areas
- Climate change

**DIRECT PRESSURES**
- Natural Disasters/Calamities
- Cultivated Sloping land
- Land cover/land use change
- Soil nutrient balance
- Soil Sealing
- Livestock pressure/Stocking rates
- Emission of contaminating substances
- Water consumption

**STATE**
- Aridity index evolution
- Groundwater level
- Rainfall variability
- Soil Contamination
- Soil Fertility
- Soil Health
- Soil Loss
- Soil Moisture
- Soil Salinity
- Vegetation activity/biodiversity
- Water availability
- Water salinity

**RESPONSES**
- Macro economic policies
- Land policies
- Conservation and rehabilitation
- Monitoring and early warning systems
- Commitment to international conventions
- Investments in land water resources

**IMPACTS**
- Incidence of Poverty
- Land productivity decline
- Habitat destruction and loss of biodiversity
- Population size and migration
- Off-site impacts
When analyzing the agriculture-environment nexus, different scales as well as different users require different models and approaches

- **Local level**: Development of “win-win” land management technologies and approaches that improve rural livelihoods while conserving the environment, e.g. the agrodiversity approach, SRL, etc.

- **National and Regional level**: Influencing decision-makers by linking human well-being with environmental change, e.g. land-use change analysis, MA, DPSIR

- **Global level**: Integration of information at different scales and across sectors, e.g. MA, DPSIR

Climate change considerations need to be better integrated into existing models and frameworks for analysis of the agriculture-environment nexus
Thank you for your attention