IPM in Ecoagriculture Landscapes:
The Challenges and Opportunities of Coordinated Pest Management for Products & Ecosystem Services

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Challenges for agricultural production in the 21st century

- Reduce rural food insecurity
- Reduce rural poverty
- Secure urban food supply
- Meet global demand for food rising by 50-100% by 2030
- Provide biofuel energy
- Adapt to climate change
- Restore degraded resources
- Reverse its ecological ‘footprint’
Farming communities depend on biodiversity & ecosystem services

Direct

- Nutrition: direct consumption of wild plants and game; micro-nutrients, “safety net”
- Medicines
- Fuel and construction materials
- Farm inputs (fodder, fertilizer, packaging)
- Income from sale of wild species
- Quality water supply for domestic use
- Reliable irrigation water supply
- Pollinate crops, key wild species
- Cultural, spiritual, aesthetic value

Indirect

- Maintain soil fertility
- Maintain healthy human habitat
- Maintain microclimate for crops
- Pest & disease control
- Nutrient cycling, detoxification
- Wild crop/livestock relatives
Our “natural infrastructure” depends on agriculture to produce ecosystem services

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<thead>
<tr>
<th>Air quality</th>
<th>Pest &amp; disease control</th>
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<td>Watershed protection and regulation</td>
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<th>Wild species &amp; habitat protection</th>
<th>Plant pollination</th>
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<td>Carbon sequestration and storage</td>
<td>Soil formation and fertility</td>
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| Decomposition of wastes | Landscape beauty |
Half the world’s land resources are affected by crop production

Map 1
PAGE Agricultural Extent
Most other land areas are affected by grazing.
Major watersheds are under agricultural land use

Map 17
Agricultural Share of Watershed Area

Source: UNH - CRUQ Runoff Database (UNH - CRUQ 1998).
Projection: Interrupted Goode's Homolosine
Note: The share of each watershed that is agricultural was calculated by applying a weighted percentage to each layer agriculture land cover class (80 percent for areas with at least 80 percent agriculture; 10 percent for areas with 40-80 percent agriculture; 25 percent for areas with 20-40 percent agriculture; and 5 percent for areas with 0-20 percent agriculture) to determine the total agricultural area within a watershed. Only watersheds with 10 percent or greater agricultural area are mapped. The agricultural shares do not include additional irrigated areas based on Beall and Siibert 1980.
Half of public Protected Areas are in agricultural landscapes
Agricultural land use to mitigate climate change (and benefit farmers)

- Soil carbon
- Grow perennials
- Protect natural vegetation
- Restore degraded land
- Livestock mgmt

Degraded soils are revegetated, producing bio-char; fertile soils remain productive using organic methods and reducing tillage.

Perennials, tree-crops, and other agroforestry methods retain greater biomass in the cropping rotation.

Retaining forests and grasslands maintains carbon sinks while protecting watersheds.

Rotational grazing minimizes livestock impacts; biogas digesters turn waste into energy and organic fertilizer.
Agricultural landscapes managed to enhance rural livelihoods and sustainable agricultural production (of crops, livestock, fish and forest), while conserving or restoring ecosystem services and biodiversity.
### Ecoagriculture strategies

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<th>In conservation areas</th>
<th>In production areas</th>
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<tr>
<td>• Create conservation reserves that benefit local farming communities</td>
<td>• Minimize agricultural pollution</td>
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<td>• Develop habitat networks in non-farmed areas</td>
<td>• Use ecologically-compatible management of soil, water, and vegetation</td>
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<td>• Reduce or reverse land conversion by increasing farm productivity</td>
<td>• Modify farming systems to mimic natural ecosystems</td>
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<td>• Maintain diversity of crop species &amp; varieties</td>
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Policies and market trends favoring ecoagriculture strategies

- Climate change action
- Consumer & policy demand for sustainable biofuels, meat, fish
- Supply chains for reduced energy cost, eco-certification, env-friendly procurement, biosafety
- Payments for Ecosystem Services (PES) in agricultural landscapes
- Farmer-env NGO partnerships
- Ecosystem risks (e.g. pollinators; epizootics; drought; bioterrorism) are engaging non-farm sectors
Challenges for IPM
Science & Action
Shifting the focus of IPM to integrated ecosystem management

Figure 10.2. Some levels considered in the four dimensions of expanded Integrated Pest Management (IPM) systems, based on work by Conway (1984), Kogan et al. (1999) and Baumgartner et al. (2002, 2003a, 2007) (Excerpted from Koul and Cuperus (2007), reproduced with permission).
Impacts of climate change on pest and disease populations & management
Impacts of diversification & increased perennials on pest populations & mgmt

Kabale, Uganda

Willamette Valley, USA

Eastern Region, Burkina Faso

Tea Zone, Kenya
Managing pests/diseases in mosaics of natural habitats & production areas
Pest and disease management for newly domesticated crops

- Perennial grains
- Trees, shrubs, palms
- Polycultures
- Cover crops
- Understory crops
Beyond farmer field schools: Multi-stakeholder landscape plans/action
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Thank you!