Biodiversity/landuse Indicators Workshop Narrative

Introduction

Changes in landscape due to such activities as agriculture, silviculture, fishing, urban sprawl and transportation infrastructure have been recognized for some time as one of the major causes of the loss of biodiversity planet-wide.

There have been several efforts at all levels from the local to the global to develop indicators for land use that would capture the effects of changing land use patterns on biodiversity (Oregon Biodiversity Project; Heinz Center Project; WWF project; TNC and Natural Heritage efforts). However, there is no consensus framework for measuring or tracking these impacts. In addition, there has been little work that attempts to link indicators of land use that are valid at the local level (i.e. the level of the individual land owner) and the regional and national level indicators that are important to the public policy debate.

The lack of a consistent measurement tool or tools (i.e., indicators) makes it difficult to assess relative impacts and direct programs towards better conservation practices. It makes it difficult for the individual decision maker to tell what steps should be taken on a particular piece of land to promote biodiversity.

Recognizing this need, the Defenders of Wildlife and the Institute for Environmental Research and Education (IERE) organized a workshop at the Defenders of Wildlife's national offices in Washington D.C. held on 13 July 2000. The workshop was attended by representatives of environmental NGO's, the U.S. Government, university researchers and business. Interests ranged widely, but most of the participants had direct experience in developing or using indicators or standards for environmental performance. A list of attendees can be seen in the text box to the right. This workshop was envisioned as a first of several, beginning the dialog towards some consensus. Future workshops should include international input. The ultimate goal is to have indicators that can be used anywhere in the world, and that could aggregate impacts in multiple locations.

Attendees

Chapman Stewart (Defenders)
Sara Vickerman (Defenders)
Frank Casey (Defenders)
Dorothy Bowers (Merck)
Bill Hohman (University of Iowa)
Laura Watchman (Defenders)
Roger Claassen (USDA-Economic Res.)
Bruce Stein (TNC)
Noah Matson (Defenders)
Jeff Zinn (Congressional Research)
Mike Anderson (USDA-NRCS)
Terry Riley (USDA)
Shara Howie (TNC)
Mary Ann Current (EPA)
Rita Schenck (IERE)
Robin O'Malley (Heintz)

One of the drivers for this workshop was the need of IERE to have indicators for land use that can be used for a life cycle impact assessment of agricultural products. IERE is

developing an ecolabel based on life cycle assessment that will provide agricultural porducers with an incentive for improved environmental performance, including protecting biodiversity values (see appendix Rita's Presentation).

The following sections summarize the discussion carried out throughout the day. Many topics were presented and revisited during the day, so the summary is organized by topic, rather than chronologically.

Workshop Discussion

Indicators

The attendees of the workshop came from very different backgrounds, and some time was spent discussing and clarifying concepts. Conceptually, indicators can be seen to fall along a continuum form pressure to state indicators. Pressure indicators are those relating to actions taken by human beings, for example, building roads or plowing fields. State indicators are measures of the condition of the environment, for example, diversity of animals and plants, or the fragmentation of ecosystems.

After some discussion, there was a clear desire to prefer measurement of the environmental state over environmental pressure indicators. However, there was some recognition that pressure indicators are generally easier to obtain, and represent leading rather than trailing indicators. As a practical matter they may be the best option until better data becomes available.

Although there is an immediate need for land use indicators that can be applied to agricultural areas, such indicators should be applicable to other landscapes, such as forestland, urban, and industrial environments. Further, the focus of this effort was on direct land use impacts, not on issues such as pesticide use or nutrient management. That is to say, that physical rather than chemical alterations were the topic of interest.

Aggregation

One important aspect of environmental indicators is how well they can be aggregated. It is important that the information that is gathered can be rolled up to higher levels to meet different needs. For example, although land use decisions are made on a field by field basis on farms, policy makers need to look at the aggregated land use over many farms. In addition, one may wish to look at aggregation of land use decisions over time as well as space. Time trend analysis is one way to think about this, but also, the data sampled at different times should be comparable: randomized methodologies will sample different points at different times.

In addition, we may wish to aggregate different measures of land use to achieve a single indicator of impacts. For example, one might want to aggregate landuse decisions on farms with use decision for forests. One participant likened this to adding up apples and

oranges to get fruit. Very often, policy makers need to know the size of the total fruit basket, not the individual apples and oranges.

Several participants raised questions about temporal trends issues. The U.S. Government has several reserve programs, including the Conservation Reserve Program, and the Wetlands Reserve Program. Many of these programs have a time limit on their reserve status. For example after a ten-to-fifteen year contract period, land in the conservation reserve program (CRP) may come out of reserve status, depending on the decision of the producer. At the moment, no one is tracking what happens to those lands once they leave the program. This raises the issue of the value of temporary reserves. However, further discussion of this important issue was tabled for later meetings.

Issues of Scale and System Integrity

If we wish to have indicators of land use, they must provide useful guidance to decision-makers on actions that should be taken. In this context, the group discussed the issues of ecosystem integrity and scale. Ecologists have known for decades that the fragmentation of environments leads to the loss of species diversity. So the question arises: how large a piece of land must be preserved in order to preserve biodiversity values?

One attendee suggested that units of 25,000 acres were appropriate units to evaluate, especially in a grasslands/prairie ecosystem. This size of planning unit permits management of mammals and birds. If at least 30% the land is being managed for biodiversity values, then bird populations seem quite healthy. Another attendee notes that quite small units, on the order of one acre can be important for the preservation of amphibians and reptiles. There was general consensus that the appropriate planning size depends on the species one is interested in preserving and that progress can be made on all scales.

Possibly the most important issue of preserving systems integrity is access to open waters. The interface between water and land is important to all animals, and protecting this area may well be the best first step towards preserving wildlife.

There was also general recognition that the focus on animals was less useful than the focus on plants. Animals are entirely dependent on the primary production and the physical environment provided by plants, and being mobile, they have the opportunity to leave undesirable habitats. Animals are also often flexible with respect to the actual plants they associate with. For example, cornfields have replaced native grasses as a source of protective habitat and to a lesser extent, food for some birds. In a similar fashion, flooded rice fields provide habitat for migrating water birds. As a practical matter, the rooted nature of plants makes them much better subjects for sampling by remote sensing.

Another approach for indicators of biodiversity and land use is to focus on the issue of the functions of the ecosystem, rather than its specific components. In looking at system function, we might look at ground cover, soil fertility, the interaction of land and water

and so forth. Focusing on these issues, especially as they pertain to plant species coverage might give good indicators of the environmental state of the system.

Brainstorming Indicators

The group undertook a brainstorming effort to identify potentially useful indicators. After consolidation of similar ideas, the following list was developed.

Biodiversity Indicators
Protection of priority habitats/species
Soil characteristics: soil health
Proximity to & protection of high priority vegetative communities
Interface between water and terrestrial habitats/buffer zones
Assimilative capacity of water and land (TMDL process); hydrological function;
Percent coverage of invasive species (within protected areas)
Road density
Percent native-dominated vegetation
Restoration of native vegetation
Adoption of BMP's linked to biodiversity objectives
Distribution (patchiness; evenness, etc.)
Connectivity of native habitat

Data Sources

Throughout the day, many potential sources of data for evaluating the environmental state of various locations were mentioned. These were augmented by discussions after the workshop. A brief list is shown below.

- USGS/NASA on-meter resolution land cover maps
- TNC database of vegetative cover
- Natural Heritage databases for T&E species

Summary Conclusions and Further Work

The workshop brought together individuals with the background and interest necessary to begin the process of developing useful indicators for land use/biodiversity that can be used at all scales. These preliminary discussions identified several areas of concurrence that should be evaluated to measure the impacts of land use. Considering the diverse backgrounds of the individuals at this workshop, the convergence of thought towards a few indicators was very encouraging.

We anticipate that developing good indicators will take several years, and it will be important to bring in our colleagues from other countries, in order to develop a global perspective. Over the next several months, we will be contacting our colleagues overseas to inform them of our efforts and to invite them to participate in our efforts.

IERE will be testing these indicators in the field over the next year. IERE is working with farmers in the Midwest to improve their overall environmental performance, as measured by a life cycle assessment. In addition to land use indicators, IERE will be measuring a comprehensive group of environmental indicators including:

- Aquatic and airborne toxicity (including those based on pesticides),
- Climate change (including soil carbon sequestration)
- Eutrophication (which evaluates the nutrient effects of fertilizer and manure management)
- Stratospheric ozone depletion (due to refrigerant use, primarily)
- Acidification (primarily a fuel use issue)
- Water depletion
- Fossil fuel depletion
- Mineral depletion (primarily due to fertilizer use)
- Hormone and antibiotic use

To evaluate land use decisions, IERE will be measuring the parameters described in the table below, and will report back to this group the results of that effort.

IERE's efforts need to be complemented by the efforts of others in different environments. While the primarily agricultural/prairie one that they are studying is an important one from the point of view of the landuse impacts of agricultural practice, other landscapes, such as urban and forest landscapes are equally important.

	Biodiversity Indicators	**Proposed Measures**
1	Protection of priority habitats/species	Acreage of habitat that is physically protected (i.e.; through fencing or other methods); habitat to be identified as including • 100 feet each side of rivers; • maps with location of T&E species
2	Soil characteristics: soil health	Concentration of organic carbon in the soil
3	Proximity to & protection of high priority vegetative communities	Acreage of habitat set aside (not farmed) that is identified as "high priority" in TNC vegetative maps
4	Interface between water and terrestrial habitats/buffer zones	Total linear space of aquatic habitat (i.e. river, lakeshore, etc) protected via physical means vs. total area managed
5	Assimilative capacity of water and land (TMDL process); hydrological function;	Depletion of water resources (annual use versus recharge rate)
6	Percent coverage of invasive species (within protected areas)	For physically protected areas, density of non-native vegetation (area percent)
7	Road density	Miles of road per square mile
8	Percent native-dominated vegetation	Acreage in native species dominated areas/total area managed
9	Restoration of native vegetation	Acreage newly returned (in last 12 months) to native habitat
10	Adoption of BMP's linked to biodiversity objectives	Number of BMP's adopted
11	Distribution (patchiness; evenness, etc.)	Size of native-managed acres vs. total acres managed Size of native-managed acres vs. average field size
12	Connectivity of native habitat	On managed acres, percent of native-managed land units that has at least one adjacency to other native-managed land

Appendix A

Biodiversity and Land Use Indicators Workshop

July 13, 2000
Defenders of Wildlife Offices, Washington DC

Rita Schenck, IERE
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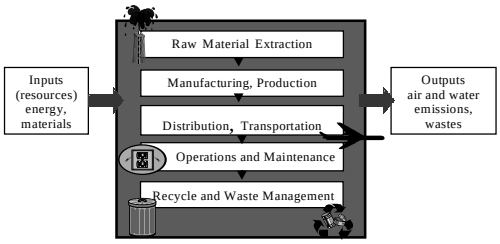
Who is IERE

- A non-profit 501c3 with offices in Seattle and Davenport, IA
- Dedicated to fact-based environmental decision making
- Have staff of scientists and economists
- Funded by private foundations, U.S. Government, and industry

Background on LCA

- **Technique evaluates the environmental impacts of products and services on a cradle-to-grave basis**
- **A comprehensive set of indicators are evaluated for all major environmental issues: e.g. global climate change, acidification, eutrophication, ecotoxic effects.**
- **Indicators don't measure impacts directly, but calculate indicators that are believed to correlate to those impacts.**
- **LCA practitioners typically borrow their models from other disciplines, e.g. using radiative forcing factors developed by IPCC for global climate change**

Life Cycle Assessment



Industrial System

Example Impact Categories

Resources

- Freshwater Use
- Biological Resources
- Fossil Fuel Depletion
- Land Use
- Mineral Resources

Emissions

- Global Climate Change
- Acidification
- Photochemical Smog
- Eutrophication
- Ecotoxicity

Landuse Rarely Taken Into Account

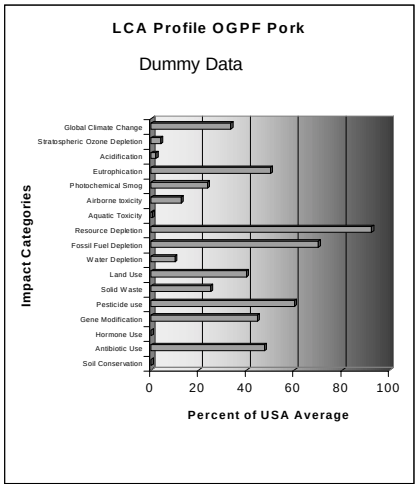
LCA has many applications

- Used for marketing claims (controlled by ISO standards)
- Policy guidance at local and national levels
- Used to drive environmental communication inside and outside of organizations
- US government to use it for environmentally preferable purchasing (as required by the FAR)

Land Use Dilemma

- We know that physical changes to the landscape are probably at least as important as biogeochemical impacts such as as global climate change.
- But,we have found no consistent models for indicators of these impacts.

We are not ecologists, and need help from that com munity to address this issue.



IERE's interest

- Long term concern that biodiversity is poorly characterized in LCA's
  - started discussions in 1999 with Chalmers Institute of Technology (Sweden)
- EPA's Environmentally Preferable Products Program, which mandates the federal government prefer bio-based products
- Current project on sustainable agriculture, developing ecolabels based on LCA

IERE's Ecolabel

- Community based EMS; Farm EMS
- Based on single farm performance
- Results available on the website
- Comprehensive, site-specific assessment
- Full ecoprofile

Characteristics of Good LCA Indicators

- Should be global in coverage and acceptance
- Should be correlated to actual environmental impacts, but not at the level of organisms affected
- Models may be complex, but their application should be simple

Objectives for Today

- Become better acquainted with each other
- Develop a better understanding of the current state of land use indicators
- Begin the process of identifying potential cross cutting land use indicators that have global applicability
- Develop plans for further steps