



*Promoting the Science of Ecology*

## **Ecological Society of America**

The Ecological Society of America (ESA), founded in 1915, is the nation's leading professional scientific society of 8,000 ecologists. ESA believes that ecological knowledge has a critical role to play in sustaining and enhancing our agricultural systems. The Society appreciates the opportunity to offer its perspective on research needs related to agriculture and environmental quality.

### **Research Priorities**

In order to maintain and even increase agricultural productivity, ecological knowledge about processes such as nutrient cycling and species interactions, and variables such as soil quality needs to be incorporated in the design and management of agro-ecosystems. The threats of invasive species to achieving sustainable agro-ecosystems must be recognized and addressed through research. Future issues that need greater emphasis include the potential impact of aquaculture and GMO's in ecosystem functioning, including the conservation of biological diversity.

#### **I. A Systems Approach**

*The need:* The study of agricultural ecosystems can provide critical fundamental knowledge of ecological processes that are relevant to natural ecosystems. Moreover, agricultural ecosystems are tightly linked to other aquatic and terrestrial ecosystems, through the movement of water, air, and plants and animals. Thus, agricultural ecosystems and their surrounding landscapes must be studied as systems. Agricultural practices are closely linked to the biogeochemistry of air and water, and to the biodiversity and functioning of streams, lakes, and estuaries. For example, many agricultural practices contribute significantly to nutrient pollution of surface waters, rivers, lakes, and coastal waters, often leading to eutrophication and so-called "dead zones." Conversely, agriculture depends upon natural resources such as freshwater, and ecosystem services such as pollination. Increasing productivity of agricultural systems while sustaining other systems essential for human welfare will only become more challenging as human demands for food and fiber grow. These challenges demand an integrated systems approach.

**Studies on agricultural systems should focus on research areas including:**

- regulation of nutrient flows and nutrient losses
- the role of soil biodiversity in plant health and ecosystem processes
- ecological interactions among populations of plants, soil organisms, and other animals, both within and among agricultural systems and unmanaged ecosystems
- the role of spatial heterogeneity and spatial patterning in ecosystem function

#### **II. Integrated Multidisciplinary Research for Sustainable Agriculture**

*The need:* The combination of knowledge and know-how from several disciplines, including agronomy, soil science, ecology, and socio-economics, are essential for developing approaches that make sense for both agriculture and the environment. In addition, in order to identify new management approaches that benefit all these realms, it is critical that research be integrated across geographic scales, combining global and regional as well as local perspectives. Fundamental questions about how systems function need to be addressed, covering the linkages between: food and fiber and environmental health and human well-being.

Merging research in various applicable areas will:

- help sustain natural services that are valuable to the nation's economy and to society at large;

- better anticipate warning signs of impending damage to both agricultural and natural systems;
- facilitate development of alternatives to agricultural practices that may be costly, both economically and environmentally.

### **III. Long-term Research**

The need: The ability to take action on emerging new challenges and to take advantage of innovative opportunities depends upon sustained research, ongoing monitoring, and continual probing of research frontiers. Greater understanding is needed of how biological systems work at the local, watershed and regional scales.

Long-term research should include studies of ecological processes in ecosystems, and the interactions of agricultural systems with the atmosphere, ground and surface water resources, and the diversity and functioning of adjacent aquatic and terrestrial ecosystems.

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*Submitted for CSREES Stakeholder Meeting, November 2002*

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