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**A SYSTEMS THEORY FOR FARMING:
"LAND ETHIC" MAKES INDIVIDUAL FARM
DECISIONS FIT LARGER ENVIRONMENT**

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To remain viable in the face of rising production costs, farmers should adopt a "land ethic" approach which fits their individual decisions into the context of the entire ecological system, suggests a professor at the Georgia Institute of Technology. The approach can be modeled by Hierarchy Theory, a specific application of systems theory drawn from theoretical ecology.

For decades, productivity increases brought about by new technology, better pesticides and improved fertilizers have produced steady growth in farm income. The rising costs of those inputs, however, have in recent years forced farmers to reconsider their drive toward higher productivity. These changes may lead to new areas of agricultural research which would give farmers options that are more environmentally sensitive.

"It has become clear to everyone that there are two ways of increasing farm viability: increasing productivity or reducing the inputs and costs," said Dr. Bryan G. Norton, professor of social sciences at Georgia Tech. "If there is going to be any role for smaller farms, that will have to be found by reducing dependency on pesticides and chemical fertilizers."

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A land ethic approach to farm management would consider the strengths and weaknesses of the farmland -- along with the economic factors -- in making decisions, he explained. Norton traces the land ethic concept to Aldo Leopold, a forester and game manager who advanced the theories in the 1920s, 30s and 40s.

He will present those concepts February 17 at the annual meeting of the American Association for the Advancement of Science in New Orleans.

"A doctor would never treat an organ in the human body without considering the whole patient," Norton argued. "You would not give someone a medication to correct a condition in one organ that would poison the rest of the body."

Similarly, he said, individual farm decisions -- cultivating poor soil, cutting trees or using pesticides -- must not poison the larger agricultural environment.

"Farms should be recognized as part of a larger system, and some of the decisions made with respect to use of the land should be made with an eye to the larger context," he said. "What this really amounts to is application of systems theory to agriculture."

Traditional farm economics use an "atomistic" approach in which the outputs and all elements of the resource stream -- fertilizer, the quality of farmland, pesticides and other factors -- are reduced to dollar values and made interchangeable.

In the traditional system, farming practices which deplete soil fertility, for example, can be countered by heavy doses of fertilizers. Mono-cultural planting of crops plagued by heavy insect infestations can be balanced by increasing pesticide application. A forest can be converted to cropland if the labor to cut the trees costs less than the expected return on the crops that can be grown. Predictions of high prices for wheat or another crop can lead large groups of farmers to abandon other crops.

"Not all fields are created equal," Norton argued. "What you are doing is not paying any attention to the particular characteristics of the fields which might make it suitable only for alfalfa and not for wheat."

The failings of this productivity-oriented system were illustrated by the Dust Bowl in the 1930s, he says.

"Individual farmers decided that the best thing to do with every piece of land was to plant wheat," he noted. "That policy did generate profits over a period of time, but then there was a crash. By failing to pay attention to the fragility of semi-arid lands, they created a major ecological and social disaster."

Environmentalists argue that the costs of interchanging resources are too high, in some cases jeopardizing the future of farming in the United States. Norton suggests a farm policy that provides farmers with incentives for the sensitive use of their land through practices such as crop rotation, integrated pest management, and even organic farming.

Under the Hierarchy Theory, the larger ecological system operates well as long as individual decisions made by farmers do not bring about rapid change in the system. One farmer's decision to allow a field to go fallow, for instance, may balance the environmental impact of another farmer's decision to cut a forest to create a new growing field.

"You are able to maximize your profits up to a point where your activities start to change the overall context and start to introduce accelerated change," he said.

Norton makes three recommendations for agricultural research as part of this land ethic system: (1) Examine the environmental limits of local ecological systems and adopt production levels that will not threaten the limits, (2) Expand agricultural research in technologies that will lower input costs, (3) Assess technologies which will give farmers more individual options without becoming "addictive."

The work was part of a project led by Texas A & M University to examine the role future agricultural research should play.

EDITOR'S NOTE: This presentation will be part of "Beyond the Large Farm: Ethics and Agricultural Research," held February 17 as part of the Agriculture and Food Section of the AAAS meeting. For assistance during the AAAS meeting, John Toon may be contacted at the New Orleans Hilton.