Balancing ecology and technology

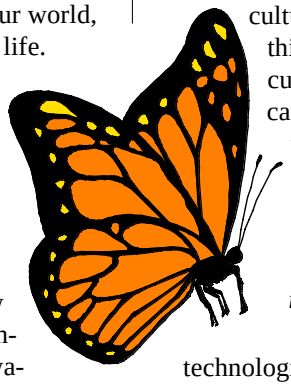
We live in a culture that seems to assume that all of our problems can and must be solved with technology. It is easy to see how we came to this conclusion. Ever since the beginning of the industrial revolution, we have created one technological marvel after another. Technologies have increased our productivity, reshaped our world, and improved our quality of life.

One thing we seem to have forgotten along the way is that there is a cost to every technology. We haven't always done a good job of assessing the costs, particularly those with long-term consequences, and now some of those costs are catching up with us. Our global water systems contain 50 dead zones. The planet's temperatures are on the rise. There is a hole in the earth's ozone layer. Evidence linking the byproducts of our technologies with health-related problems is increasingly disturbing. The loss of biodiversity from our technologies not only threatens the stability of the planet, but—according to separate studies issued by the World Bank and the Council for Agricultural Science and Technology—also imperils further agricultural productivity.

Farmers face another disturbing circumstance. Even though agricultural technologies have enabled producers to dramatically increase their productivity and solve many of their immediate production problems, technology does not appear to have helped them improve their net income. According to a recent study by Mike Duffy, associate director at the Leopold Center, Iowa farmers' gross income and total expenses both increased thirteen-fold from 1950 to 1998—while their net income remained flat! This seems to indicate that all of the improved technologies ultimately didn't help farmers' bottom line.

At the same time, evidence surfacing in many parts of the world suggests that we should consider an alternative approach. An ecological approach would try to achieve production goals by using nature's own ecosystem services instead of relying solely on technology.

Our technologically-oriented culture remains skeptical of this new approach to agriculture. News media have carried articles suggesting that without intensive technological management the world's people would suffer extensive malnutrition and/or we would have to plow up all of our wilderness areas and fragile lands to feed a growing population. It is ironic that such propositions occasionally appear even in respected scientific journals, although dire predictions are based largely on conjecture rather than field-tested data. At the same time, extensive on-farm research now suggests that ecological approaches usually are both more productive and more profitable.



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A newly published study by Jules Pretty and Rachel Hine at the University of Essex (UK) looked at 208 cases from 52 countries to assess the performance of sustainable agriculture. They define sustainable agriculture as an agriculture that "seeks to make the best use of nature's goods and services as functional inputs"—in other words, farms that use an ecological approach. They found that in these projects—which involve 8.98 million farmers who have adopted sustainable agriculture practices on 28.82 million hectares—yield increases for rain-fed crops went up 50 to100 percent, and yields increased 5 to 10 percent on irrigated crops.

A study in the April 19 issue of *Nature* magazine, conducted by John Reganold and his colleagues at Washington State University, compared the economic, energy and environmental performances of organic, integrated and conventional farms from 1994 to 1999. The study demonstrates that organic apple orchards (one type of ecological farming) in Washington state produced "sweeter and less tart apples, higher profitability and greater energy efficiency" than the conventional apple farms. Additionally, their data show that "the organic system ranked first in environmental and economic sustainability, the integrated system ranked second and the conventional system last." Soil quality ratings for the organic and integrated farms also were "significantly higher than those for the conventional system."

The October 1999 issue of the *Ecologist* magazine reported that Japanese farmer Takao Furuno developed a new system on his two-hectare farm with similar results. Rice paddies occupy 1.4 hectares; the rest is devoted to organic vegetable production. A few years ago, Mr. Furuno decided to incorporate ducks into his rice paddies. He discovered that the ducks ate the insects and snails that normally attack the rice. They ate the weed seeds and weed seedlings, so he no longer needs to weed his rice paddies. The activity of the ducks also appears to oxygenate the water "encouraging the roots of the rice plants to grow." Other species (fish, duckweed, etc.) in his paddies provide fertilizer.

Farmers who have adopted similar methods in various parts of the

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Check out research in new Center Progress Report

By Mary Adams, Editor

The Leopold Center is now distributing copies of its 2001 *Center Progress Report*. The 80-page volume features summaries of research efforts supported by the Center's competitive research and education grants programs. The tenth in an annual series of reports, it describes 24 projects that ended in 2000.

Highlights of this year's completed efforts involved research and education on forages, legumes, oats and alfalfa. Other researchers explored biological controls for apples, strawberries, and corn borers; botanicals to feed pigs in lieu of growth promotants; and swine manure management decisions. Two special projects sought to help farmers stressed by economic uncertainty in rural communities. Restoration of farmland woods was one of three ecology projects completed.

For those with questions about the projects, the principal investigator's name, phone number, e-mail, and regular addresses appear at the end of each summary. The Center also can provide copies of the entire final project report.

In the course of preparing the project summaries, director Fred Kirschenmann asked researchers to summarize their work. Here are a few of their responses.

What was the central question in your project? What did you find out?

Botanicals as part of an integrated value-added pork production system
Some consumers are interested in purchasing livestock products from animals not fed antibiotics. These studies evaluated four botanicals with various claims to enhance human health or immunity as potential replacements for antibiotics. Based on these trials, Echinacea (purple coneflower) at various levels may offer an alternative to the feed additive, Mecadox. – *Palmer Holden, ISU Animal Science.*

Manipulation of predatory insects for enhanced biological control of pests
The central questions were to identify the chemicals used by predatory lacewings and lady beetles to locate insect prey and to use these compounds to attract these predators to specific locations. The attractants identified in this project are the basis for a new commercially available lure for these predatory insects. Growers now have a method to attract predators to their gardens or fields. – *John Obrycki and Tom Baker, ISU Entomology*

Community regeneration through strengthening the local food economy
The central goal was to work with institutional food buyers to explore and implement ways that would help them purchase a greater portion of their food supply from local/regional farmers and processors. What we found is that it is possible and practical to expand local markets for local agricultural products through institutional markets. More than $110,000 per year was invested in local farms and processors by the three institutions we worked with. And that is only in one metro area, with many other institutional buyers. The farmers who participated in this project reported small to significant increases in their gross income. – *Kamyar Enshyan, University of Northern Iowa*

Biologically intensive pest management and Iowa apple growers
Is biologically intensive management of apple scab, codling moth, and sooty blotch/flyspeck complex a viable option for Iowa apple growers? Several scab-resistant apple varieties showed good yields and scored well in consumer preference tests. Two new management tactics–a weather-based disease-warning system and post-harvest dips in chlorine solutions–can significantly reduce reliance on fungicides for control of sooty blotch and flyspeck. Due to low populations of codling moth during our tests, the jury is still out on the suitability of biologically intensive methods to manage this pest in Iowa. – *Mark Gleason, ISU Plant Pathology*

A simple method to increase alfalfa yield in the establishment year
Our question was: Can we increase the yield of alfalfa in the year of planting and not adversely affect subsequent production by adding some proportion of non-dormant (non-winter hardy) alfalfa to the seeding mix? We do not recommend this practice. Although non-dormant alfalfa slightly boosted first-year yields by allowing a late fall harvest, even 10 percent of non-dormant seed depressed yield in the second year. – *Charlie Brummer, ISU Agronomy*

Sustainable approach puts nature's services to work

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world report a 20 to 50 percent increase in rice yields the first year. Furuno's small farm now annually produces "seven tonnes of rice, 300 ducks, 4,000 ducklings and enough vegetables to supply 100 people." From the perspective of the bottom line, it is worth noting that Furuno not only has dramatically increased his yield, but once he is finished with the inputs (namely the ducks) they, too, become a source of income. Isn't this a model we should consider for "feeding the world?"

These studies and others that tell similar stories suggest that we should be putting at least 25 to 30 percent of our research dollars into exploring such ecological approaches to solving production problems. Investing virtually all of our dollars in technological solutions means that farmers not only will continue to see their potential profits eaten up by input costs, but also will be forced onto a treadmill that eventually puts them out of business.

Nature always finds a way to adapt to the technologies we create, quickly developing resistance to all our efforts to eradicate pests. And on top of that, we continue to degrade our environment with technologies that we always initially assumed were "safe."