

have had any significant impact on changes in productivity or farm incomes. As an economist, Gardner wants to say they are very wasteful.

But the counterpoint claims such programs have shown American democracy at its messy but functional best. Thus, Gardner ends his book:

The results often make the seeker after rationality in economic policy cringe. But if one believes that the overall record of U.S. agriculture has been a success story, and if the government's role has been generally supportive, one's criticisms should be tempered accordingly. Indeed we may reasonably see the outcome as one of democracy's positive achievements.

Within the narrow confines of American politics, this is an appealing view. But it begs two larger issues. If pushed very far, the view implies that no policy is bad so long as it is passed by Congress and signed by the President. Gardner, a good policy analyst, certainly does not intend that message. And the impact of U.S. farm policy on poor countries and on the skewing of global trade (and global income distribution) needs to be considered in the reckoning. Such an analysis would result in a very different book than the one Gardner has written. Its message would not be nearly so optimistic.

BOOKS: AGRICULTURE

Reconnecting Farms and Ecosystems—If It Pays

Andrew Bent

Vast tracts of land in many countries are devoted to commercial agriculture. That land provides us with sustenance, but is it a nice place to be? Do our agricultural systems do enough to minimize pollution, promote stable jobs and communities, or sustain wildlife habitats and attractive landscapes? Depending on one's criteria, modern farming can be characterized as a booming success or a crisis—or both. But given that so much land is devoted to growing our crops, it is relevant for all of us to wonder how we might use this land better. *The Farm as Natural Habitat* provides excellent food for thought on the subject.

The central thesis of this edited set of es-

says is that our society's move toward industrialized agriculture is creating "ecological sacrifice zones." We make food on farms, and when we want nature we drive somewhere else to find it. Native plants and animals that require bits of habitat adjacent to agricultural lands are being pushed out, and pollutants are spreading well beyond farm borders. The thesis is overtly environmentalist, but the book avoids ready pigeonholing because it is consistently loyal to the personal and economic realities of farmers. The authors, each from their own perspective, explore one unifying question: how can we change farming practices to improve environmental values in a way that works for farmers and their families?

What are the finer issues at hand? Nitrogen and other "non-point source pollutants" are one place to start. Excess corn fertilizer is damaging large segments of the Mississippi River watershed, and manure from confinement-based livestock operations (cows, pigs, poultry) is a serious toxic waste liability. The book suggests that this problem would be greatly diminished by a return to family farms that raise animals in integrated rotational grazing systems, with less reliance on corn and soybeans. The manure produced would be reused on-site, and field drainage could be modified to increase retention and slow release of runoff water. More balanced farm and regional ecosystems would result.

The rotational grazing recipe, however, runs counter to overwhelming production trends that are driven in part by fierce economic pressures. Feeding millions of people is an industrial enterprise, and the system of corn and soybean production to feed confined livestock optimizes productivity in many settings. But at what present and future costs? In the United States, we have the luxury of asking if cheap food production is the only part of the equation that needs to be maximized. The authors argue for broader ecological and social valuations; others will reply that maximally intensive agriculture feeds the world and also frees other land for purposes such as nature preservation. These are not easy issues to resolve, but the book successfully makes the point that alternative options should receive more attention. The contributors are similarly provocative when they address issues of soil erosion, small-farm viability, and, most prominently, the preservation or creation of "wild" lands on farms.

A principal claim of the book is that industrial-style agriculture does not have to be inevitable. In the closing chapter, George Boody drives home the point that agriculture is a public "good" in the economic and sociological sense. The United States and other countries have a long history of public subsidies that foster desirable farm practices through legislated economic incentives, and the book makes a good case for stronger action in this regard. Programs such as the new U.S. Conservation Security Program, which will reward growers who furnish ecologically desirable outcomes, such as lower nitrogen runoff or better wildlife habitats, represent steps in the right direction.

One of the most appealing aspects of *The Farm as Natural Habitat* is its variety; the authors discuss farming methods, nature philosophy, farm policy, sociology, conservation biology, agribusiness economics and other diverse subjects. Their level of focus shifts fluidly among national, regional, community, single farm, and personal. Specialists of many stripes will be stimulated by inputs from other disciplines, and the writing style and chapter lengths are friendly to all readers. The editors, Dana and Laura Jackson, have

The Farm as Natural Habitat Reconnecting Food Systems with Ecosystems
by Dana L. Jackson and Laura L. Jackson, Eds.

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Retaining room for the wild.

created a coherent whole through their selection of topics and coordination of authors. They also provide excellent prefatory and summarizing pages at multiple junctures.

Minor segments of the book can be criticized as too anecdotal or for taking knee-jerk anti-technology stances, and almost all of the book is idealistic. But most chapters are very instructive in drawing models for success that are based on first-hand experience. Rhonda Janke, for example, describes how "whole-farm planning" can help farmers to self-evaluate their operations and identify specific areas for improvement. She emphasizes the incentives needed to get farmers to actually do this. Beth Water-

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SCIENCE'S COMPASS

house provides an eloquent chapter on the things that make some people care about environmental values in their personal and, more germane, their professional lives. It is usually because a parent, grandparent, or teacher, at some point in the person's young life, showed them an appreciation for the land. Many authors discuss projects where local farmers and conservationists worked together to integrate environmental goals and viable farming operations, with different degrees of success. These are voices of experience, and many dos and don'ts are suggested for future efforts.

In an exemplary chapter about regional land-use planning, Cheryl Miller describes a money-saving and outcome-optimizing approach to conflict resolution among farmers, environmentalists, and other interested parties. Following the severe 1997 floods in the Red River Valley of the north-central United States, the Minnesota government funded a professionally mediated planning process. Representatives of relevant government agencies (including water management boards, the Army Corps of Engineers, the Fish and Wildlife Service, and the state Department of Natural Resources) and advocacy groups (such as the National Audubon Society and the Rivers Council of Minnesota) as well as farmers, urban residents, and academics met regularly as a group, with input from technical experts as needed. Decisions on a land-use plan that balanced commercial, flood control, and environmental protection needs were made by consensus. The approach should help private and public players to move forward with expensive business activities while avoiding costly cycles of future litigation and project redesign.

It is noteworthy that the problems the authors describe tend to be the greatest and least tractable where farming is most successful. Diverse, attractive farmscapes can be found in New England and other regions where farming is interspersed with hills, forests, and, significantly, land from failed farms. Judith Soule's case studies reveal that growers are most likely to participate in conservation efforts in marginal farming areas rather than the top-producing regions, largely because land-use choices usually favor the most rewarding financial opportunities.

One idea that the book might have explored further is long-term conservation easements or outright government purchase of strips or corridors on farm properties. Networks of trails, bicycle paths, wildlife refuges, or hunting and fishing areas that wind their way through farms and adjacent natural areas could prove highly popular and would certainly help to reconnect people with the land where their food comes from.

The Farm as Natural Habitat is a fairly direct descendent of the approach advocated by

biologist Aldo Leopold, whose widely read essays (especially those gathered in *Sand County Almanac*) helped to enunciate the land-use ethic in the mid-20th century. Enjoyable, thought-provoking quotations and aphorisms (from Leopold and others) are scattered at regular intervals throughout the book. For example, Soule comments: "The less conservation advocates talk and sell their ideas with logic and facts, and the more they demonstrate and explore them with their farm neighbors, making it a truly two-way exchange, the more likely that the neighbors will adopt conservation goals and new practices."

Such kernels of wisdom, coupled with the realistic discussion of farming economics and the examples of farms that successfully attend to environmental values, provide a fountain of ideas that beg further investigation. For some, the dogmatic tone that appears now and again in *The Farm as Natural Habitat* will reduce the book's palatability. But we can all hope that its messages penetrate beyond interested lay readers to alter, even if only subtly, the approach to agriculture taken by legislators, conservationists, agricultural researchers, and farmers. One or more interest groups will undoubtedly lobby against any particular change. But who among us, the local residents most of all, would not like to make farm country a nicer place?

BOOKS: PLANT GENETICS

Some GM Facts

Mark Tester

If only the first genetically modified (GM) plant had been developed to prevent wrinkling or to slow aging. Western Europeans happily ate tomato paste made from GM plants for years—after all, it was of a higher quality than non-GM paste. However, as soon as genetic engineering of plants was used to reduce farmers' inputs (and thus perceived to have the express purpose of increasing profits of Western farmers and their suppliers), self-righteous opposition could take hold. Here was a technology with little apparent benefit to well-off consumers in the West and that carried unknown risks; so, almost as a matter of course, opposition followed.

Pro-GM scientists then advanced counter-claims to defend "Frankenfoods," and the logic used by some of them was

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Before the controversy and after. (Right) In the early 1990s, tomato paste sold in UK supermarkets proudly proclaimed the use of GM tomatoes. In the late 1990s, herbicide-resistant GM crops in the United Kingdom were damaged (above) by protestors (who were later acquitted because, the court ruled, they acted in the belief that they were saving the world from greater damage).

patently as weak as that of some of their opponents. For example, it was frequently claimed that new GM technology is no different from modifying genes through traditional breeding. This might be true when changing the expression of plant genes in plants, but before GM who ever moved genes between kingdoms? The public could sense that not all was right. Where were the facts? Suspicions were fueled by resistance to labeling by the industry and the blurring of tangential issues concerning organic agriculture, the industrialization of agriculture, and the increasing control of international economics by large multinational corporations. The arguments moved even further away from the facts.

While those who can afford to oppose this new technology continue to do so, the other 80% of the world's population (who earn only 11% of the wealth) are being denied the opportunity of even trying GM foods as another tool for agricultural improvement. Moving the debate up to a more informed level will not only benefit Western agriculture and plant scientists; such a step is essential and urgently needed for all countries (the majority) where agricultural self-sufficiency is a social and economic imperative.

Shifting the debate in this manner is precisely Paul Lurquin's aim in *High Tech Harvest*. Lurquin, a plant geneticist at Washington State University, has contributed to the development of GM technologies for some three decades. His earlier book, *The Green Phoenix* (Columbia University Press, New York, 2001), was a history of GM plants written for academic readers.

High Tech Harvest Understanding Genetically Modified Food Plants

by Paul F. Lurquin

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