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 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
Westview (Perseus), Boulder, CO, 2002. 236 pp., illus. $25, C$37.95. ISBN 0-8133-3946-4.

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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).

CREDIT: STEVE MORGAN/GREENPEACE; M. TESTER (INSET)

BROWSINGS

Agriculture: The Potential Consequences of Climate Variability and Change. *John M. Reilly, et al.* Cambridge University Press, Cambridge, 2002. 148 pp. Paper, $30, £21.95. ISBN 0-521-01628-2.

The next 100 years are expected to bring a 1° to 5°C rise in global temperature, shifting patterns of precipitation, and increased climate variability. The authors of this report use scenarios from state-of-the-art climate models to quantitatively assess the effects such changes are likely to have on U.S. agriculture. They predict that production will improve in most regions, although it may decline in southern parts of the country. They also identify less desirable impacts such as increased pesticide use, greater runoff of nutrients, and disputes over groundwater resources.

The Encyclopedia of Historic and Endangered Livestock and Poultry Breeds. *Janet Vorwald Dohner.* Yale University Press, New Haven, CT, 2001. 528 pp. $75, £55. ISBN 0-300-08880-9. Yale Agrarian Studies.

The Narragansett turkey, important in the markets of southern New England throughout the 19th century, is now extremely rare (less than 100 remain). Changes in agricultural practices have brought similar declines to the Dominique chicken, the Cotswold sheep, and many once-important farm animals; others have become extinct. Dohner presents concise accounts of the histories, traits, and qualities of nearly 200 North American and British breeds. Her engaging book testifies to the importance of saving the biodiversity of domestic animals.

Now he hopes to reach a broader audience. His laudable goal is simply "to inform" without passing opinion, in an attempt to enable those supporting or opposing GM to base their arguments on facts. Lurquin believes "the public has a right to know and understand how its food is manipulated at its most basic level, that of the DNA itself." He goes further, saying that "the absence of scientific information [is] the main problem blurring the perception of plant biotechnology." In a brave effort to solve that problem, the author presents an interesting and remarkably even-handed history of the development of GM technology.

If only those who should read the book would. Alas, I fear this will not be the case. Lurquin takes an historical approach that, although accurate and useful for students, is probably not the most efficient means of penetrating the minds of either the general public or the busy policy-makers—for whom the more in-depth approach of this book would nevertheless be useful. Worse, the appearance is dull, with a few black-and-white photographs of boffins and petri dishes. These are hardly the gripping images necessary to capture the public's imagination. There is no reason why attention to presentation would have compromised the quality of content.

Because the layout is not inviting, general readers are, unfortunately, unlikely to open the book. Political advisers will probably be too busy to work their way through the historical approach. And many activists on both sides of the controversy will not want to read Lurquin's account, for his reasoned and critical approach challenges most belief structures. Nonetheless, there is one important constituency for whom I would strongly recommend the book: biology undergraduates. Students should be informed about the debate on GM plants, and they should be able to present logical, reasoned arguments, for and against, to their nonbiologist peers and anyone else who will listen.

Going beyond the brief he set for *High Tech Harvest*, Lurquin includes one chapter in which he analyzes the controversy over GM plants. This he does well, with both scientifically accurate and politically acute commentary. He should expand this element into another book, using a publisher willing to invest in quality reproduction and the provision of clear and eye-catching graphics. Such a book might find the audience it deserves.

PERSPECTIVES: EPIDEMIOLOGY

Controlling Smallpox

Jim Koopman

To face the threat of a smallpox outbreak presented by bioterrorism, we need to answer the question: Should we parry the thrusts of intentional spread with targeted vaccination or raise the shield of mass vaccination? During targeted vaccination, health care workers locate and vaccinate people who have been exposed to the disease. In a mass vaccination campaign, anyone who goes to a vaccination center gets vaccinated regardless of their exposure status. The question of which approach is more effective at eradicating a smallpox outbreak is a crucial one. The demands of mass vaccination in the face of ongoing smallpox transmission are considerable and could prevent targeted vaccination of those who need it most. This raises the question of who should be vaccinated before a smallpox outbreak: the individuals most likely to spread infection or anyone who wants to be vaccinated? On page 1428 of this issue, Halloran *et al.* (*1*) present a model that simulates smallpox transmission in a structured community of 2000 people. They use their model to compare the efficiency of mass vaccination versus targeted vaccination for eradicating a smallpox outbreak. These investigators show that in all scenarios, targeted vaccination would prevent more smallpox cases per dose of vaccine than would mass vaccination. Given that we now have sufficient smallpox vaccine available to vaccinate everyone, the more relevant question is which vaccination strategy would be most efficient at preventing a smallpox epidemic. Halloran and colleagues show that the answer depends on the level of immunity in the population before the outbreak. They demonstrate that both pre-outbreak vaccination and residual immunity from previous vaccinations would increase the effectiveness of targeted vaccination after an outbreak of smallpox.

The finding that pre-event vaccination boosts the efficacy of postevent targeted vaccination raises several issues. If we do not vaccinate enough individuals before an event, then during an outbreak even the best efforts of our public health personnel might be insufficient to prevent an epidemic that extends way beyond the first intentionally infected cases. However, no level of pre-event mass vaccination will eliminate the need for intensive epidemic control efforts after an outbreak. Even given pre-event mass vaccination, some people will remain unvaccinated because they

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