

Conclusion

Proceeding along its current trajectory, agricultural production will eventually expand onto and degrade most of the habitable areas of the planet. As a consequence, most biodiversity and ecosystem services will be lost. In the worst-case scenario, life as we know it will cease to exist. Many will argue that this will never be allowed to happen, that people always have seen the errors of their ways. The question, then, is what will it take not just to slow the current trajectories but to change them altogether?

This book has suggested a number of ways to make global agriculture more sustainable. Eleven general areas in which policy could stimulate more widespread use of the practices and techniques recommended in this book are summarized below. The list is not exhaustive. Nor will the impacts of global agriculture be corrected or even blunted by pursuing in isolation activities in one or two of the areas that are highlighted here. Fortunately there are synergies among many of the approaches suggested. The goal is not to tell people what to think about how to reduce the impacts of agriculture, but rather to expose them to new ways of thinking that can be adapted to their own realities and spheres of influence. This is the new agriculture.

1. Implement Land-Use Zoning and Regulations to Minimize Damage

The greatest environmental impacts of agriculture by far (50 to 90 percent of impacts, depending on what is measured) occur because of where operations are sited rather than how they are managed. Governments and producers both have an interest in siting operations in areas where they have the best chance of success. Failed investments are not good for anyone. Considerable information is available about the conditions under which crops can be produced sustainably. While using these criteria for zoning and land-use planning will not prevent all failures (e.g. some factors may change in the future—management effectiveness, prices, input costs, etc.), they can prevent mistakes based on the best available information at the time. For example, with no major commodity prices increasing in real terms since 1960, it is possible to predict with increasing accuracy where they can be produced profitably and sustainably.

With proper zoning and land-use planning most biodiversity, biological corridors, and ecosystem functions can be protected. Research still needs to be undertaken to demonstrate the value of such zoning (e.g. reduction of poor or failed investments, or reduction in the ratio of costs to value of production) to current producers and planners alike. Such research could also document existing examples of the income that can be derived from the management and sale of new products such as biodiversity conservation, watershed protection, or carbon sequestration. Finally, there are a number of costs incurred by society when critical habitat that is unsuitable for farming is converted to agricultural uses. These include increased expenditures for road maintenance and dredging, reduced fisheries production, higher costs of fresh water, and loss of tourism revenues, among others.

2. Retire Marginal Lands

Data from research on numerous, very diverse crops suggest that when producers stop farming the 5 to 15 percent of their land that is most marginal for agriculture, they usually end up producing more and being more profitable. Equally important, when farmers stop farming marginal areas (even as little as 5 percent of the total), they can reduce their environmental impacts by as much as 50 percent or more.

So why don't more farmers do this? Most are not familiar with the concept. Many producers, if they have the equipment or ability to farm a greater area, always see it as an advantage to expand production. In some cases, farmers have borrowed money for land or invested in machinery and believe that any return on these investments is worthwhile. Perhaps the most important reason, however, is that most farmers do not keep the kinds of records that would allow them to evaluate accurately where their operations are profitable or not. Few farmers keep production data at all; fewer still have disaggregated data.

For producers (and society as a whole) to take advantage of these possibilities, it is important to generate disaggregated data for different commodities to determine where producers lose money with their current practices. The more the financial and environmental realities can be documented for different producers and crops, the more credible the approach will be with others.

Such data can also be used by government officials to shape policies and programs. Such information, for example, can be used to sharpen land-use planning and zoning programs and can be the basis for identifying and retiring the least productive, most polluting areas.

3. Rehabilitate Degraded Lands

Much of the research on rehabilitation of degraded lands has focused on how much it costs to rehabilitate biodiversity or ecosystem functions. These are important issues. However, this approach assumes that degraded land cannot be rehabilitated for agriculture. There is increasing evidence that this assumption is false. Not only do technology and management practices exist that allow land to be rehabilitated, the market encourages it as well. The increased price of land in most parts of the world encourages the rehabilitation and reclamation of degraded areas.

Rehabilitation of land for agricultural production is an area where producers have tremendous potential to save money and reduce their environmental damage. Bringing degraded lands back into production is cost-effective even when only part of a property can be rehabilitated. Producers have found that it is cheaper to rehabilitate degraded land than to clear natural habitat. In addition to saving the costs of clearing land, they can buy such land cheaply, build its capacity, and then have both the asset with increased value as well as the crops that they can produce on it. The approach reduces the environmental

damage of agricultural expansion in many parts of the world by “retiring” degraded land that, without intervention, would only continue to be degraded and affect downstream ecosystems, or would require producers to move to and clear new areas of natural habitat.

Research that documents the parameters of degradation and demonstrates which land can be rehabilitated is extremely important at this time. What soils can be rehabilitated, with what slope, rainfall, wind, average temperatures, etc.? What specific practices best rehabilitate land for different crops? What is the range of costs for degraded land, as well as the overall cost of rehabilitating degraded land? What are the range of variables that affect those overall costs? And what can farmers do to generate cash flow to cover these costs in the short term? What government incentives can be used to encourage rehabilitation? This information is key in convincing producers to undertake such programs, to make them bankable, and to make government officials take note of how they might encourage such practices through policies and regulations.

4. Farm with Nature

Historically, most farmers tolerated or even encouraged biodiversity. They planted crops side by side (i.e. polyculture), and accepted biodiversity within their fields and on their farms. This was true of producers of annual and perennial crops, as well as mixed systems that incorporated both. In many parts of the world, farming systems evolved and were adapted from extended fallows that were little more than enriched forest plantings. These systems not only produced annual and perennial crops but also attracted animals which were utilized by producers as well.

Most producers around the world still farm with biodiversity in many of these same ways. They plant multiple crops in the same fields and utilize plants and animals that are tolerated and even encouraged within their fields. However, the production and sale of an ever-increasing amount of product from farms has tended to erode the tolerance for biodiversity within farming systems. Farmers who are dedicated commercial producers of commodities for more distant markets tend to fight biodiversity the most within their operations. These producers, often encouraged by subsidies, tend to plant single commodities year after year. These systems are not sustainable.

Farming with biodiversity starts not with planting or accommodating a wide variety of plants and animals, but with the soil itself. The value of maintaining soils and soil fertility is now well understood even by those producers who grow only single crops at a time. To mimic at least some of the positive attributes of farming with biodiversity, many commodity producers plant sequences of crops in the same year and use additional crop rotation strategies over 2-5 year cycles. Similarly, they plant legumes and other crops to maintain or increase soil fertility and to provide ground cover. These practices are common throughout the world. Finally, many integrated pest management programs are based on finding the right balance with nature and biodiversity rather than trying to dominate it. Such practices are increasingly common on farms that are trying to mimic nature yet still remain competitive in the marketplace.

There are several indications that in the future, the trend in agriculture will be to find the right balance between maintaining biodiversity and soil fertility on the one hand and being competitive in global markets on the other. The practices will be driven by a number of factors: consumer desires for fewer pesticides, downstream water users desire for cleaner water; cultural values of increased biodiversity in farm landscapes, and not least, overall efficiency and reduced costs. Currently, most of the trends toward monoculture cropping are driven by subsidies. While there are countless examples of producers who are pursuing a more thoughtful path regarding farming with nature, the question of production and export subsidies will have to be addressed before most producers will be able to adapt or find new ways to farm with nature.

5. Eliminate Subsidies and Market Barriers

Subsidies restricting market access and similar programs are tools that governments can use to encourage producer behavior to provide societal benefits. Unfortunately, many such programs have become entitlements—producers are paid to continue to farm rather than to produce something that is good for society. In fact, many such programs actually harm both people and the environment. There is little doubt, for example, that subsidies and market barriers have maintained or even increased global inequity.

What has received less attention are the environmental consequences of such programs. In developed countries, producers are subsidized to farm areas that would not otherwise be profitable. And in developing countries some producers, who receive few if any subsidies, try to compete by being more efficient, but most cut corners—which causes environmental degradation. Subsidies and restricted market access in developed countries are the most important barriers to the adoption of better management practices.

The elimination of production, export, input, credit, and infrastructure subsidies as well as market barriers is essential if global agriculture is to become more sustainable. Research that documents the impact of such policies on the global environment and the productive base for current and future agricultural producers will be essential for introducing such issues into the current debate on subsidies and market barriers.

Governments have legitimate interests in protecting the productive resource bases of their countries and in making sure that their citizens are not held hostage to the uncertainty of food production in other parts of the world. However, both of these issues can be addressed by using the money that is currently paid for subsidies and market barriers to pay farmers to provide environmental services that are beneficial to all members of society, both for this generation as well as for future ones.

6. Develop Payments for Environmental Services

Some producers already realize that farming marginal areas is not a viable production strategy. Most, however, either have not yet come to this realization or are faced with the

reality that most if not all of the land that they farm already is marginal. The creation of payments for environmental services such as maintaining water quality and quantity, protecting biodiversity, maintaining watersheds, and sequestering carbon (in either soil or plant biomass) could stimulate producers to rethink their current production strategies.

Documenting the range of existing environmental service payment systems could help producers, and those interested in public policies, better understand the role of such payments in maintaining farmer income while reducing environmental impacts. Research could also evaluate the scope and effectiveness of public expenditures to correct environmental impacts resulting from destructive farming practices or farming marginal areas.

Given the political clout of producers and the legitimate need of society to ensure food and fiber supplies, subsidies and market barriers are not likely to be eliminated in the short term. Many of the payments for current agricultural support programs such as subsidies and market protection can be usefully shifted to environmental service payments. Delinking such payments from the production of specific commodities and the prices for those commodities would tend to reduce the overall effect of subsidies globally while still supporting producers. Such shifts in payments would be welcomed in most parts of the world provided they do not distort trade. In the short term, any shift of payments would probably reduce the current distortions caused by subsidies and market barriers. Over time, however, producers and governments will want the market-distorting impacts of such programs to be reduced further still.

7. Promote Better Management Practices (BMPs)

As competition in the global economy increases, the producers that survive are going to be those that are the most efficient. They will be defined by their ability to invent, identify, or adapt practices that reduce input use as well as waste and pollution. Such producers will be more profitable, or at the very least will remain competitive, in the face of globally declining prices.

Efficiency will not be limited to the largest or the smallest producers, or to the wealthiest or the poorest. The producers that remain competitive will be those who learn from other, often more innovative, producers. Those who remain competitive will also not merely focus on how to produce a single commodity better. They will focus on their overall production system, and they will evaluate periodically what crops they can produce to best utilize their physical, financial, and market advantages. These crops, like the practices used to produce them, will change.

Because of their importance to the overall sustainability of agriculture, the adoption of better management practices cannot be left to the market alone. Most producers in the world will not make the transition without support. Government subsidies can, in the short term, provide incentives for the adoption of BMPs. Government regulatory and permitting systems can also encourage the identification and adoption of these practices.

Most producers learned to farm from their parents, who in turn were taught by their parents and so on. Such lessons are important, but in a world of global markets, limited resources, and increased demand, those producers who survive will take the best of the traditional approaches and graft on new lessons, approaches, and technology from others.

8. Promote Social- and Equity-Based BMPs

Those who fear globalization have legitimate concerns about the impact of “free” trade on the rural poor. However, the proposed solutions to address rural poverty—to improve the viability of small farmers, or simply protect them—miss the mark and, furthermore, cease when funding ends. In many rural areas, the truly poor are not landowners. Few have the skills, capital, or market access to take advantage of well-intentioned programs.

A new approach is needed to reduce rural poverty. Fortunately, research suggests that social- and equity-based better agricultural practices are not only important for reducing the impacts of producers around the world but for increasing profits as well. Such programs, while increasingly common, vary incredibly and include such approaches as worker incentive programs, bonuses, equity positions, employee stock option plans (ESOPs), and benefits. Such programs result in increased productivity and reduced costs as well as increased product quality, reduced input use, and maintenance of the resource base.

Some of the greatest gains in agricultural production are likely to come not from technology, but rather from rewarding people who think. In addition to more traditional worker incentive and bonus programs, line workers are increasingly empowered to make management suggestions about how to improve production and production efficiency. Management rewards valuable ideas from line workers, not just increased productivity. This can increase overall profits and has great potential for reducing environmental damage from day-to-day production decisions.

Many agricultural employers have even found that it is cost-effective to extend their benefit packages to nearby communities. Education programs, for example, not only help companies reduce the often costly mistakes that arise from illiteracy, but also create more qualified worker pools. Such programs also help communities and future generations develop skills that they would not otherwise have. Similarly, community health programs not only reduce worker sick days or the time they spend with sick family members but also increase their productivity as well as that of their family.

9. Base Regulatory Structures and Permitting Systems on BMPs

Agriculture is the most polluting activity in most countries. Governments realize this. Because it is often very difficult to identify the particular source of pollution (e.g. nonpoint-source air or water pollution), many governments require producers to adopt

good or best management practices with a goal of achieving minimally acceptable performance levels.

The types of better practices that have been identified in this volume could serve as the basis of government BMP-based regulations, permitting, or licensing programs. Better practices should give government insights about what they can achieve through regulations in the future. After all, today's better practices will be tomorrow's norm. The role of government should be to identify the main environmental costs of agriculture. Policies can then be either prescriptive (e.g. prescribe practices to be adopted that are known to reduce those impacts) or results-based, in which performance levels are measured and producers achieve those performance levels in whatever way they see fit. In general, more innovative solutions will come from the latter than from the former.

Unfortunately, when governments set levels of performance that are required from producers, the results sought are rarely close to those that could be achieved through the adoption of better management practices that are already known and understood at the time. In general, such standards are designed to achieve the minimal performance levels required to meet such laws or regulations. As such, they do not encourage continued improvement, rather just minimal performance levels that comply with the law. Furthermore, such approaches are inevitably out of date with current realities.

10. Base Investment, Insurance, and Purchase Screens on BMPs

Increasingly, there is interest on the part of investors, insurers, and major purchasers to look to BMP-based screens to reduce their risks from exposure to the environmental and social impacts of commercial agricultural and aquacultural production. Because overall management quality is the key factor in producing consistent profits, investors already evaluate management as a condition of investment in commercial operations. The adoption of BMP-based screens is, in fact, little more than a more precise way of evaluating the specific management practices of a business as they relate to critical impacts. The intent is not to reduce impacts per se, but rather to reduce liability, costs, and wastes as well as to increase profits and returns on investment. In the end, however, the two are often one and the same.

For insurers, the identification and adoption of BMP-based screens can reduce risks by determining whether producers have adopted practices that reduce overall liability. The liability could be related to impacts that contribute to crop failure, personal liability, or injury for workers; that reduce the life or productivity of soil, permanent crops, or machinery; that relate to downstream/downwind liability resulting from erosion, agrochemical runoff, or smoke from burning; or that arise from chemical residues that affect consumer safety.

With increasing concerns about food quality and safety, a number of food manufacturers and retailers are developing BMP-based screens to guide their purchases and reduce their liability resulting, for example, from pesticide residues on food products. Another

important factor for manufacturers and retailers is to be able to trace problems back to their source. This also reduces liability. These concerns have resulted in the development of producer contracts that require producers, as a cost of doing business, to adopt certain practices that limit or restrict agrochemical use. Previously, producer contracts required the prophylactic use of chemicals. Today's contracts are just the opposite—some chemicals are banned altogether, and the use of other chemicals is reduced and often limited to the treatment of specific issues as they arise.

Such self-developed programs, however well-intentioned and comprehensive, have limited credibility with consumers. Thus, the first move of such companies should be to unite with similar companies to increase the market share of products using better management practices. This at least will enhance their programs' credibility in the eyes of producers, if not consumers. Over time, however, credibility with consumers will be based on third-party certification and independent, measurable standards.

While each set of actors has different reasons for pursuing BMP-based screens, their actions can be mutually reinforcing. Such synergies allow market-based approaches to be adopted very rapidly. Successful efforts to develop complementary BMP-based screens for investors, insurers, and purchasers will send signals to producers from every part of the market chain. To the extent that BMPs pay for themselves, result in market premiums, or improve market share, they will shape producer practices.

Voluntary BMP-based certification programs can support the enforcement of regulations and permits. Most, for example, require producers to obey the law. In such instances, by insisting on certified products consumers would ultimately ensure that the costs of compliance with all regulations and permits would be covered by players in the market chain rather than local governments, which may or may not be able to enforce them.

11. Improve Certification and Eco-Labels

There has been a tremendous growth in the number of certification and eco-label programs developed over the past twenty to thirty years. This has come about partly from producers and intermediates in the market chain, as they look for ways to differentiate products in the marketplace based on how they are produced. Consumers are also concerned about the quality of the products they are consuming, and to a lesser extent, the overall production processes or the social and environmental impacts of producing them.

The question, then, is whether eco-labeled or certified products actually deliver on their promises. Most certification programs cannot back up their claims. They certify production processes, not products. Most of the standards by which results of the programs are measured are subjective. At this time, no certification program has entirely measurable standards. While most address environmental issues, few address social ones. Many programs are guaranteed by third-party certifiers, but the programs themselves were developed by a small number of interested parties through processes that were

decidedly not transparent. No program yet focuses on the cumulative impacts of production at the larger landscape or ecosystem level. To date, at least, all are focused on the individual farm or fields. Finally, very few programs are financially self-sufficient. They are, in fact, highly subsidized. For these reasons and more, most certification programs will disappear.

The side-by-side comparison of certification programs will allow interested parties to evaluate the relative comprehensiveness of the programs. Such comparisons have already been made or are in the works for bananas, coffee, wood pulp, and shrimp. Given the wide number of programs that have been developed, it is only a question of time before other comparisons are made. Such comparisons make very transparent which claims are actually based on measurements.

So, what will the surviving certification programs look like, and will they have a positive impact on agriculture? Certification programs that are credible to consumers will be objective and will have crop-specific standards that are based on measurable standards. They will be developed through a wide consultative process, with considerable transparency and room for public comment and discussion. The next generation of certification programs will focus on the known major impacts from the production of specific crops and will require that those impacts be reduced as a condition of certification. As such they will not be exhaustive, but rather will address the eight to twelve key social and environmental impacts that account for the vast bulk of subsequent impacts. They will also have to assess carrying-capacity issues at the landscape level and not just focus on the fields or farms of individual producers. Certification will be driven by major actors in the market chain and, thus, will not be aimed at niche markets. Furthermore, consumers buy products, not production processes. Consequently, successful certification systems will have to stand behind their programs and the products delivered through them.

Governments, retailers, and manufacturers are all being asked by consumers to become more involved in certification. At the very least they are being asked to explain the differences between certification programs, expose fraud, and identify those that are credible. In addition, governments, buyers, retailers, and insurers in many parts of the world are developing BMP-based screens on their own to reduce liability or to achieve societal goals. In effect, if certification programs do not exist they will have to be created. Most such programs at the present are second-party certified. Credible, third-party certification programs offer a tremendous advantage for such players. In the near future, each of these groups will be actively involved in enforcing, adapting, creating, and/or implementing agricultural certification programs. There is a tremendous opportunity for producers, nongovernmental organizations (NGOs), and community groups to work with producers and retailers to create credible programs that have the potential to capture significant market share.

The Way Forward

The agriculture of the future will not be the same as the agriculture of today. However, it will not be entirely different either. Success in making agriculture more sustainable will be based on taking the best of the past and melding it with the best of the present and the future. This requires producers who have been exposed to new ideas and approaches and who have the confidence, and the incentives, to be innovative. However, it also will require government officials, investors, buyers, researchers, and others who can also recognize and encourage innovation.

So what can be done to encourage and promote such innovation? It is important to increase the number of people who think in the ways that are highlighted in this book. Producers must have access to information about innovations that might be relevant to their own management decisions. Finally, students must learn to be both entrepreneurial and respectful of tried-and-true production methods at the same time. These students may become producers in their own right or may work for other producers. They may study producers, disseminate lessons to them, invest in them, buy from them, or regulate them. In the end, sustainable agricultural production is about thinking and doing. It is not just about new seed varieties and inputs. Societies are spending all their money on the latter, when it is the human skills more broadly that will ultimately make agriculture deliver societies' needs—food, fiber, and livable environments.