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Restoration and Reclamation in Agricultural Landscapes

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The Importance of Restoration in Agricultural Landscapes

Food production is a major component of human disturbance of Earth's ecosystems. Modern, high-intensity agricultural practices generally exclude natural communities and can degrade adjacent areas by altering hydrology, increasing nutrient and chemical inputs, and providing sources of invasive species. Currently, an estimated "10 to 15% of the Earth's land surface is occupied by row-crop agriculture or by urban-industrial areas, and another 6 to 8% has been converted to pastureland" (Vitousek et al. 1997). Because such a large portion of our land is tied up in agriculture, any large-scale, long-term conservation plan must include efforts to increase natural diversity in our agricultural landscapes. Revegetation and restoration of natural systems within agricultural landscapes should be a major component of such a plan (Hobbs et al. 1993). In particular, restoration of marginal lands (e.g. poorly drained areas, highly saline areas, riparian zones, etc.) currently in production would contribute substantially to natural diversity in agricultural landscapes (Lefroy et al. 1993). Both conservation and agriculture stand to gain from such efforts (Hobbs and Saunders, 1993). Integrating natural systems into agricultural landscapes can increase agricultural system stability by improving soil stability, improving water movement, reducing wind, and controlling pest populations. From a conservation perspective, restoring and preserving natural systems in agricultural landscapes can improve water quality, increase habitat availability, and provide corridors for movement through areas otherwise uninhabitable to wildlife. The papers included in this chapter describe seven restoration programs aimed at reclaiming land and restoring natural systems in agricultural landscapes.

Financial Constraints

Because agricultural communities are so often on tenuous financial ground, it would be unrealistic to expect farmers to absorb the costs of restoration and conservation efforts on their land. Farmers attempting to meet state or federal regulations requiring restoration on their land would be likely to lose their farms because the costs of meeting those regulations would make them unable to compete in international markets. Therefore, if we are to receive the benefits of natural systems in our agricultural landscapes, funding for restoration efforts on agricultural lands will need to come from the public. Increasing public awareness of the importance of restoration in agricultural lands and of the need for public support is integral to the development and continuation of these restoration efforts.

The seven programs described in this chapter are all publicly funded. The Conservation Reserve Program (CRP), the U.S. Bureau of Reclamation (USBR), and Minnesota Partners for Wildlife are federally funded, Reinvest in Minnesota (RIM) is state funded, and Ethiopia Food for Work (FFW) was funded internationally by the EEC, FAO, and USAID. The Minnesota Waterfowl Association (MWA) and the Rainforest Alliance are private non-profit organizations funded by donations, fundraising, membership proceeds, and grants. Most of these programs provide the funding for ecological restorations on agricultural land. Only the Rainforest Alliance ECO-O.K. program requires farmers to pay for the restorations implemented on their land. Although meeting the restoration standards of the program is expensive, coffee farmers enroll in the program to increase the sustainability of their farms and to receive certification from the Rainforest Alliance, which presumably allows them to receive a premium on their product.

Approaches to Restoration in Agricultural Landscapes

The restoration programs described in this chapter differ in their approaches to restoration in agricultural settings. Some restoration programs remove land from production and attempt to restore approximations of natural ecosystems on the "retired" land (e.g. RIM, MWA, Minnesota Partners for Wildlife, and USBR). This approach is particularly beneficial in regions where marginal land is relatively abundant and where restoration of natural ecosystems is a primary goal. In contrast, other restoration programs encourage farmers to alter agricultural practices to reduce negative impacts of agriculture on the surrounding landscape (e.g. CRP, Ethiopia Food for Work). Focusing on altering agricultural practices is likely most appropriate in agricultural systems that have substantial negative impacts (e.g. soil erosion and sedimentation) on adjacent ecosystems or in systems in which only minimal agricultural changes are necessary. Thirdly, restoration programs may focus on improving the ecological sustainability of farming systems within agricultural landscapes (e.g. Ethiopia Food for Work, Rainforest Alliance ECO-O.K.). These efforts are distinct from efforts to restore or protect natural systems in agricultural landscapes, and function primarily to maintain agricultural productivity. Occasionally, sustainable agricultural systems are sufficiently diverse to provide ecological functions similar to those of natural systems (e.g. Rainforest Alliance ECO-O.K.). In these cases, increasing agricultural sustainability can be coupled to some degree with natural ecosystem restoration.

The approaches to restoration in agricultural landscapes discussed above are not intended to be exclusive of one another. All three approaches share the goals of increasing diversity and sustainability and reducing the influence of production in agricultural landscapes. Incorporation of natural systems into agricultural landscapes depends both on increasing the space available for natural systems to regenerate and on reducing the negative influences of agricultural production on these natural systems. Conservation and management plans for agricultural landscapes must balance these approaches in ways that are appropriate to the socio-economic and ecological character of the individual region. In choosing among approaches, restoration programs must weigh the yield reductions that result from practicing less intensive agriculture and the consequent requirement for more productive land against improvements in the environmental quality of agricultural land and reductions in negative influences on adjacent natural systems. Several of the restoration programs described in this chapter have attempted to create such

balances. The Ethiopia Food for Work program encouraged farmers to both reforest highly erosible land and to establish erosion control structures in their fields (Anderson). Likewise, the Rainforest Alliance ECO-O.K. program encourages farmers to practice traditional coffee production methods, which are more sustainable and ecologically valuable, but also requires that unproductive land on coffee plantations be restored to rainforest (Heisler).

The Future of Restored Sites in Agricultural Landscapes

The degree to which restored sites are protected from future agricultural production depends on how much control restoration programs acquire over restored sites and on the importance of restored sites to the landowners. Restoration programs vary in the amount of control they acquire over restored sites and in the degree to which they provide incentives for farmers or landowners to maintain restored sites. The Ethiopia Food for Work Program, the Rainforest Alliance Program, and the MWA have no control over landowner behavior following the restoration, but rely on economic or ecological incentives for continued cooperation from landowners. Reliance on economic incentives resulted in failure for the Ethiopia Food for Work Program. However, the more appropriate economic incentives provided by the Rainforest Alliance may be successful. The MWA relies on landowner interest in wildlife habitat availability to ensure site maintenance. The CRP and Minnesota Partners for Wildlife require landowners to keep the land under its restored condition for between 10 and 15 years. While most CRP land is expected to be put back into production after 10 to 15 years, the future of Minnesota Partners for Wildlife restorations is uncertain. Like the MWA, Minnesota Partners for Wildlife relies on long-term landowner interest in wildlife habitat availability to ensure continued site maintenance. In contrast, RIM and the USBR acquire complete and continual control over the land before performing the restoration. These sites are the most certain to be protected indefinitely.

Evaluation of Restoration Success

Evaluation of restoration success is essential to the development of appropriate and effective restoration strategies (Hobbs and Norton, 1991), yet not one of the seven programs described in this chapter has implemented a monitoring program adequate to assess the effectiveness of their efforts at meeting their goals. Monitoring conducted by the Rainforest Alliance ECO-O.K. program and the CRP are limited to inspections for compliance with program regulations (i.e. to ensure that the initial restoration effort occurred). While the stated goals of these programs are to "protect tropical biodiversity" and to "reduce soil erosion", no measurements are taken to ensure that these goals are met at individual restoration sites. Similarly, monitoring conducted by the USBR has been limited to inspection of stream hydrology and habitat characteristics. Although many USBR stream restorations are performed to increase fish populations, changes in fish populations are apparently not studied. The CRP has conducted a few large-scale studies comparing erosion on CRP and non-CRP land that suggest that their program is successful at reducing erosion. However, because these studies have not involved comparisons of CRP land before and after implementation or compared the effectiveness of their different restoration

strategies, it is impossible to assess whether and, if so, how, the CRP has actually resulted in reduced soil erosion from these studies. Wetlands restored by the MWA in cooperation with state and federal agencies receive minimal monitoring. MWA restorations on private lands, Minnesota Partners for Wildlife restorations, and RIM restorations are not monitored. Likewise, the Ethiopia Food for Work program was not monitored.

Restoration programs that do not monitor the success of their efforts rely on the assumption that their methods are effective in all cases and under all circumstances. Generally, this assumption is based on minimal evidence. Because few restoration programs evaluate restoration successes and failures, little information is available to inform choices of restoration strategies. Some restoration methods used currently (e.g. the "just add water" approach to prairie pothole restoration) were developed decades ago and may no longer be appropriate, considering the many recent major changes in the landscape (e.g. nutrient loading, invasive species, increased landscape fragmentation). Even if some currently used restoration strategies are generally effective, climatic variation or unusual site characteristics are likely to cause some failures in any restoration strategy. If restored sites are monitored, these failures can be identified and addressed.

Four of the programs described in this chapter (Minnesota Partners for Wildlife, MWA, RIM, and USBR) are focused primarily or secondarily on restoring prairie pothole wetlands. Although all four programs perform prairie pothole restorations to increase habitat availability and improve water quality, none of the programs collect information to determine whether their restorations provide these functions. The absence of monitoring in these programs is particularly troubling because the emerging scientific literature suggests that the restoration methods implemented by these programs do not produce wetland communities that resemble natural communities (Delphey and Dinsmore, 1993; Galatowitsch and van der Valk, 1996). Considering the cost of restoring prairie pothole wetlands and the impressive number of restorations performed by these four programs, the lack of program evaluation in this field seems tremendously risky. By 1996, Minnesota Partners for Wildlife had attempted to restore 34,676 acres of wetland at an average cost of $450 per acre (Lerhke). Although the program has spent over $15 million on wetland restoration in the last decade, there is no information available to assess whether their efforts have been successful. Certainly, there is a financial trade-off between maximizing the number of ecosystems restored and ensuring that these restored ecosystems are of adequate quality to provide the desired and necessary functions. The programs described in this chapter would undoubtedly improve with increased attention to the quality rather than the quantity of their restorations.

Conclusion and Summary

Because such a large portion of our land is agricultural, restoration of natural systems in agricultural landscapes is an essential component of long-term, large-scale conservation efforts. Restoration efforts in agricultural landscapes must involve a balance of three approaches: 1) removing land from production and restoring natural ecosystems, 2) altering current agricultural practices to reduce the negative impacts of agriculture on the surrounding landscape, and 3)

improving the sustainability of agricultural systems to maintain agricultural productivity. The restoration strategies implemented by restoration programs must be appropriate to both the ecology and the socio-economic character of a region. Many restoration programs in agricultural landscapes assume that the restoration strategies they use are appropriate and do not monitor the success or failure of their efforts. The Ethiopia Food for Work program demonstrated clearly that such untested assumptions can result in the total failure of restoration efforts (Anderson). Thorough monitoring of restoration sites allows restoration programs to assess the effectiveness or ineffectiveness of the restoration strategies they choose. Monitoring should be a major component of every restoration program.

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