

# **Conference on Environmental Enhancement Through Agriculture**

**November 15 - 17, 1995**

**Boston, Massachusetts**

The goal of the conference is to foster a new kind of strategic thinking about agriculture based on "win-win" approaches that jointly serve both agricultural and environmental intertests.

## **Abstracts**

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## **Establishment of On-Farm Native Plant Vegetation Areas to Enhance Biodiversity Within Intensive Farming Systems of the Sacramento Valley**

**John H. Anderson,<sup>1,2,3</sup> Jennifer L. Anderson,<sup>1</sup> Richard R. Engel,<sup>3,4</sup> and Bruce J. Rominger<sup>3,5</sup>**

Intensive farming occupies the largest percentage of land in the Sacramento Valley of California. Intensive farming techniques, especially "clean farming" that maintains all non-crop areas devoid of vegetation, has created farm ecosystems with depleted or devoid wildlife populations, including beneficial insects. We initiated a planting and outreach program that focused on restoring natural systems to non-cropped areas. Over the past 15 years we have tested species suitability and establishment techniques for over 50 species of native plants from the local bioregion. Potential native plant vegetation areas common to most farmers include roadsides, field borders, drainage ditches and sloughs, tail water ponds, equipment yards, and irrigation canals. Revegetation of these areas includes establishing a ground cover of native perennial grasses, sedges, and rushes and establishing native trees, shrubs, and vines matched to the type of habitat suited to the farm conditions.

Revegetation projects ongoing since 1981 clearly demonstrate increased and diverse wildlife populations on two participating farms. Additional benefits include control of noxious weeds, reduced soil erosion, enhanced water infiltration, and increased aesthetics. Negative impacts on farm production have been negligible.

The outreach programs have included over 12 formal workshops, invited lectures, farm publication articles, and numerous farm tours. Farmer interest and participation is increasing. Grant projects, including the Willow Slough Watershed Integrated Resource Management Plan, the Water Quality and Irrigation Ecosystem Management Program and the Total Resource Management and Outreach Program have recruited nearly twenty more growers to implement wildlife enhancement strategies and use their farms as outreach sites.

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## **An assessment of composted and uncomposted animal waste using the multiple goals of waste recycling, soil restoration, and water quality protection**

Susan S. Andrews<sup>1</sup> and Luanne Lohr<sup>2</sup>

Demonstration of agricultural practices that provide environmental protection is a necessary step in the development of win-win strategies for a sustainable environment. Although definitions vary, sustainable practices often entail methods for chemical input reductions, soil organic matter restoration, and conscious environmental protection. Nutrient recycling is key to sustainable agroecosystem management, making farm reuse of nutrients in the form of animal wastes very attractive. Economic and environmental comparisons of composted and non-composted animal waste management alternative practices can facilitate technology adoption to meet multiple objectives for environmental enhancement through agriculture.

The evaluation of alternative systems at various scales allows decision makers to choose the best management options for their specific situation. As a determination of ecological sustainability, this study compared composted and non-composted broiler litter, and chemical fertilizer amendments on a vegetable crop. The results were used in comparative farm enterprise budgets to assess economic feasibility of several possible management scenarios. Finally, a thumbnail assessment method for watershed level comparison of farm (crop) revenue, animal waste management, and water quality risk was developed.

Using organic matter in place of or coupled with chemical fertilizer can significantly reduce chemical usage and divert nutrients from the farm waste stream. However, the high nitrate-N levels in compost pose a significant threat to ground water quality. Lower weed biomass for potential herbicide savings. Public benefits to compost use appear to be greater than private economic objectives. Analyses of both on-farm and off-farm impacts should be included in the determination of feasibility, at least to the watershed scale, so the public costs and benefits are assessed. It should be the end-users who make the final appraisal of management alternatives allowing for a tailored fit to specific needs. Taking a broader view of systems can assist in the development of win-win approaches to agriculture.

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## **Integrated Resource Management at Work: A Case Study**

**Scott M. Barao**

Integrated Resource Management (IRM) is an important tool for beef cattle producers who wish to operate an efficient, profitable and sustainable enterprise in today's competitive environment. IRM provides a whole farm focus and facilitates the optimum management of farm system resources.

A 4-year participatory on-farm project was initiated to demonstrate and apply the principles of IRM within an existing beef cow-calf enterprise. The overall goal of the project was to design and implement management practices that improve animal and farm system performance and profitability while protecting and enhancing the surrounding environment. General farm goals were set around the assumption that management practices that increase and enhance the grazable land base would also contribute positively to environmental stewardship and farm system sustainability.

The producer-owner demonstration farm that was chosen lies within the Piedmont region of northeast Maryland, is rolling in its terrain, includes a significant percentage of highly erodible, loam-based soil, and is within the Deer Creek Watershed, a tributary of the Susquehanna River leading into the Chesapeake Bay. Several spring-fed streams cross the farm along with one major creek. Annual rainfall totals approximately 45 inches.

Farm goals and a whole farm management plan were established at the onset. Over the duration of the project, existing crop land (tilled) was converted to permanent pasture consisting of mixed stands of grass and legumes; existing pastures were renovated and improved through the no-till addition of up to 30% legume; permanent and temporary fence systems were installed; and a year-round grazing plan was established. In addition, innovative animal watering systems were developed to allow full utilization of grazing land while minimizing animal impact on existing streams.

Significant accomplishments include:

- Improved animal nutrition and increased farm carrying capacity (dry matter yield).
- 80% reduction in nitrogen, phosphorous and herbicide application.
- Elimination of soil erosion and soil loss.
- Reduced and controlled animal access to streams.
- Improved animal waste management.
- 90-100 day increase in grazing season with significantly reduced use of harvested, stored feeds and confinement feeding.
- Improved wildlife habitat with 30% increase in observed deer numbers and 10-15% increase in fox counts.
- 53% increase in cow herd size.
- 40% reduction in yearly cost per cow.

Overall, this project successfully demonstrated the opportunity present within agriculture to attain optimum production levels, reduce costs and achieve farm goals within the context of whole system sustainability. The best management practices that were implemented through this IRM effort resulted in a positive economic and environmental return and made optimum use of an existing renewable resource.

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## **Use of Solid Waste Compost in Landscape Beautification**

**Allen V. Barker, Tara A. O'Brien, Gordon Fletcher-Howell, and Jayaram Daliparthi**

The University of Massachusetts has developed a cropping system by which aesthetically appealing landscapes can be produced with wildflowers in composts. Nitrogen-rich composts made from municipal solid wastes, including biosolids, are applied as mulches in which the wildflowers are seeded. A weed-suppressing barrier mulch of paper, sawdust, geotextiles or other permeable material is placed under the compost mulch. Newspaper is the recommended material. A one- to two-inch thick layer of compost supplies sufficient growing medium and nutrition to support plant growth with much lower fertilization than is required for conventional establishment of plantings without composts. The system can be adapted for small or large plantings in soils with a wide range of fertility. Use of leaf or yard waste compost requires fertilization to support crop growth. This system is recommended for city and park landscapes, roadsides, industrial landscapes, nurseries, home gardens, or any landscape in which a showy display of native flowering species is desired. The system promotes safe recycling of domestic wastes.

## **A Sustainable Alternative to Modern Rural Underdevelopment in a Period of International Integration**

**David Barkin**

The modernization of agriculture via the introduction of Green Revolution technological packages impoverished small-scale farming communities and pushed institutions to discourage the use of intercropping patterns in favor of monocropping. Traditional multiproduct rural production systems have been threatened by the decline in the value of tradable products as international competition strongly influences local market prices. Peasant producers are being forced to abandon their communities or pushed into more fragile ecosystems.

An alternative development model for sustainable regional development is being implemented in a depressed region of central Mexico. A diversified agricultural and agroforestry program is being combined with agroindustrial production along with community provision of on-farm services for recreation, for eco-, nature- and cultural tourism, and environmental protection. The paper will evaluate the conditions that led to the decline of the region and the social and productive processes being developed for its transformation.

## **External Integration of Environmental Objectives Into Agricultural Policy and Law in the Netherlands**

**Victor Bekkers and Jonathan Verschuuren**

In the Netherlands, agriculture and the protection of the environment, especially of nature, have long been closely related. On the policy level, the same Department (Department of Agriculture, Fisheries and Nature) is responsible for both agriculture and protection of nature. This has influenced nature protection policy and legislation. A good example of how farmers are stimulated to preserve nature is the so-called "nature management contract": instead of imposing obligations and prohibitions by law, competent authorities can make contracts with individual farmers in which the farmers agree to run their farming business in a more ecologically balanced way. If they agree, the government compensates the farmers for possible reduction in profits that arise from this way of farming. The European Union strongly supports such measures.

More generally, we have observed a trend towards more external integration. This means that no longer is all environmental policy and law integrated into one Environmental Policy Plan or one Environmental Management Act. Instead, past experiences prove that integration of environmental objectives (quality goals) into each sectoral field of policy (e.g., agriculture) leads to better results. Internalization of environmental interests can only be reached when fully supported by the people in the relevant policy field (governmental authorities, farmers' unions and individual farmers).

We review the consequences of these new forms of steering: external integration of environment into agricultural policy and law, and, as an example, the nature management contract as an instrument to combine agricultural activities with protection of nature.



## **Developing Nature-Based Tourism in Eastern Connecticut**

**Norman Bender<sup>1</sup> and Nini Davis<sup>2</sup>**

Farmers and other owners of agricultural lands, woodlands, and open space tracts in the northeastern United States face strong and persistent economic pressures to consider selling their properties for development purposes. Changes in the structure of agriculture and the spread of suburbanization into formerly rural towns can result in the evaluation of alternative uses of lands by the owners, in order to provide viable incomes while maintaining their properties in current or related uses.

Rural land owners are exploring opportunities that may provide additional income and employment from nature-based tourism and recreation activities. Nature-based tourism, which involves agricultural and ecological enterprises, can contribute to meeting a combination of individual and societal needs. These include promoting economic development that creates employment opportunities through sustainable resources; maintaining a quality of life that includes preserving farmlands, open-space tracts and rural views; and maintaining economically and socially viable rural communities.

The paper describes a regional tourism development project designed to:

1. Develop awareness of opportunities in the Eastern Connecticut region for nature-based tourism activities through a field survey, educational materials and workshops.
2. Promote the region as a family-oriented tourist destination focusing on agricultural and natural resources by developing and distributing guides on farming, biking and hiking attractions.
3. Coordinate selected outdoor recreational activities in the Northeast and Southeast Connecticut tourism districts, including a 50 mile bike tour and a hiking event.
4. Achieve these objectives while developing a network of local farms, businesses, community officials and agricultural and ecological organizations committed to further development of tourism while preserving the region's natural attributes.

The nature-based tourism development project initiated by the Northeast Connecticut Visitors District takes a collaborative approach involving: Northeast and Southeast Connecticut visitors/tourism districts, agricultural and ecological businesses, and the University of Connecticut Cooperative Extension System. We provide an overview of the region's geography and economy, and describe the project's objectives, methods, and results (products and outcomes). We discuss the project's implications for developing a sustainable agricultural and ecological tourism industry in the northeastern United States that contributes toward maintaining the region's agricultural and natural resources.

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## **Wildlife Conservation as a Catalyst for Implementation of Sustainable Agricultural Practices in North Carolina**

**Peter T. Bromley,<sup>1</sup> John R. Anderson, Jr.,<sup>2</sup> William E. Palmer,<sup>1</sup> and J. Theodore Morris<sup>3</sup>**

For agricultural producers and for environmentally-concerned citizens, both rural and urban, wildlife conservation represents unique common ground. The bobwhite quail, an environmental barometer and symbol of the high quality of life in the southeastern U.S., has been declining for over 30 years. The demise of quail populations has alarmed sportsmen, landowners, and conservation agencies. Prominent among the hypotheses explaining the downward trend is habitat modification and intensive use of pesticides associated with post-World War II industrialization of southern agriculture. Over the past three years, we have employed radio-telemetry in replicated, whole farm studies as well as on-farm mesocosm experiments to measure the direct and indirect effects of modern, foliar and granular pesticides on quail in realistic field scenarios, to assess the role of conservation tillage in the quail life cycle, and to evaluate the impact of habitat modifications, in the form of ditch bank and field border management, on quail numbers and behavior. Using unique methods like human-imprinted quail to quantify the quality of crop and noncropland habitats, we have demonstrated that management practices that conserve soil and water can be integrated to increase wildlife populations, particularly of quail, on commercial grain farms. The management systems that we have designed simultaneously improve crop production and enhance wildlife resources; they are economically compelling. Our work has generated regional support and unprecedented cooperation among numerous organizations with diverse interests. With farm wildlife as the catalyst, crop producers, global integrators of swine and poultry, agricultural agencies, regulatory agencies and wildlife conservation groups are helping expand our integrated farm and wildlife management ideas to a landscape scale.

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## **A Conjoint Analysis of Farmland Protection Under a Purchase of Development Rights Program**

Maria C. Centenera and John Mackenzie

Farmland can be thought of as a heterogeneous good providing various benefits to residents of an area through combinations of its constituent attributes. Policy makers in the state of Delaware recently funded a statewide farmland purchase of development rights (PDR) program in an effort both to influence land use patterns and to enhance the state's agricultural industry. Residents benefit from not only the economic aspects of agriculture, but also the non-market environmental aspects.

While economic benefits are often reflected in market prices for farmland parcels, environmental benefits are more difficult to calculate. Consequently, PDR program officials lack objective and precise criteria to account for the broader environmental benefits of alternative farms. More generally, PDR programs themselves are not readily evaluated or justified via conventional benefit-cost criteria.

This study explores individual residents' preferences for protected farmland using conjoint analysis. This type of analysis allows for the calculation of willingness to pay for different farmland attributes, including non-market environmental attributes. Farmland attributes (and corresponding levels within each attribute) considered in this study are: farm parcel size (25, 40, 75, 120 and 2000 acres); cost per acre of development rights (\$2,000, \$4,000, \$6,000, \$8,000, and \$10,000); farm type (crop, horse/livestock, and orchard/nursery); percent of parcel in forest (10% or 40%); proximity to already protected farmland (adjacent or not adjacent); percent of parcel's original road frontage that has been subdivided and developed (none, 25%, and 50%); owner's primary occupation (farming, not farming); pace of development (rapid or moderate); annual gross farm receipts (\$12,000 or \$60,000 per year); and expected long-term economic viability of farming in the area (poor or good). A survey of hypothetical combinations of these attributes was conducted using both graphic and word descriptions of the hypothetical bundles of farm attributes. Ratings and rankings for each hypothetical farm were then used to estimate an index reflecting residents' preferences.

There are many advantages of data collection through a survey of this nature. A conjoint survey can be administered to a wide range of audiences, and the results are easily interpreted. In this case, the results can be used by PDR program officials to make objective decisions regarding which candidate farms to protect. Alternatively, the results can be used to evaluate the program as a whole after farms have been protected. The question then becomes "Did the program maximize public benefits through its allocation of PDR funds?"

## **Protecting Important Natural Areas, Wildlife Habitat and Water Quality on Vermont Dairy Farms Through the State's Farmland Protection Program**

Alex Considine,<sup>1</sup> John Roe,<sup>2</sup> and Kate Willard<sup>3</sup>

Vermont has an active farmland conservation program designed to protect the state's best agricultural land and, to the extent possible, important natural areas, recreational sites and historic resources. The Vermont Department of Agriculture and the Department of Fish and Wildlife, Vermont Land Trust and The Nature Conservancy have worked together in the state's most active farming areas to protect high quality farmland associated with critical wildlife habitat along wetlands and river banks in three separate conservation projects. The objectives in these projects were; to conserve good quality farmland to enhance the farm's viability; to protect critical wildlife habitat; to enhance water quality; to protect state threatened/endangered species; and to provide public access for hunting and fishing.

The result has been permanent conservation of four viable, family dairy farms that also provide direct environmental benefits. A variety of methods have been used, including easement and fee purchase, easement donation and regulatory requirements for building setbacks. In all the properties, vegetated buffer strips either were established or were permanently preserved for the purposes stated above. In some cases, cropped grassland buffers were created, designed to reduce runoff to open waters. In other cases, undisturbed buffers, either existing or created, were needed to insure protection of critical habitats or water fowl nesting areas. Providing public access for hunting on some of the buffers was particularly relevant, because the agricultural land provides important staging areas for migrating waterfowl.

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<sup>1</sup>Vermont Land Trust; <sup>2</sup>The Nature Conservancy; <sup>3</sup>Vermont Department of Agriculture.

## **The Watershed Approach to Integrating Agricultural Production and Water Quality Enhancement**

**Maurice G. Cook**

A system of agricultural best management practices (BMPs) was implemented on a 2,100 hectare watershed in Duplin County, North Carolina, for the purpose of improving water quality. The BMPs included: nutrient, pest, and animal waste management; and soil conservation practices. Both surface and ground water were continually analyzed to assess the water quality impacts.

Nutrient management plans have been developed for over 80% of the cropland. Pest management plans have been developed for over 60% of the cropland. Over one-half of all plans have been implemented. Poultry mortality composting and improved swine waste management have decreased the potential adverse effects of animal operations. A constructed wetlands shows promise for pre-treatment of swine waste prior to land application.

Stream monitoring shows decreasing amounts of nitrate - and ammonium-N in the surface waters of the watershed. Ground water monitoring shows relatively high concentrations of nitrate in areas of intensive swine and poultry operations. Ground water monitoring of pesticides reveals low levels of alachlor, atrazine, and metolachlor even though large amounts of these chemicals are used on crops.

The successful implementation of agricultural BMPs appears to be having a positive effect on water quality. Both stream and ground water monitoring will be continued for several years to assess more definitively the changes in water quality.

## **Watershed Protection: A Better Way**

**Richard I. Coombe**

The program of the Watershed Agricultural Council for New York City's watersheds involves a new and better way to protect America's rural surface and groundwater supplies. It is based on maintaining a well-managed agriculture as part of a comprehensive watershed protection program. The high quality of the water yielded by the Catskill and Delaware System watersheds, which is sufficient to meet federal criteria for avoiding filtration, is supported by the current low intensity land uses and land management patterns, including agriculture.

A Whole Farm Plan is the Program's main means for partnership between an individual farmer, whose involvement is voluntary, and the City. Each such plan is tailored to fit the site and the farm business. Specific farming practices to meet strict drinking water quality criteria are based on sound science, and cover animal pathogens, sediment, nutrients, pesticides, and other substances with direct or indirect human health effects.

The Program's governing body and policymaker is the Watershed Agricultural Council, a not-for-profit corporation consisting of farmer and agribusiness leaders, the Commissioner of the New York City Department of Environmental Protection, and advisory members from government and private organizations.

The Program is based on the belief that farming is a preferred land use with significant long-term environmental benefits, as opposed to subdivision on the rural-urban fringe. It hopes to become a national model for watershed protection based on local decisionmaking, scientific evidence, and shared responsibility.

## **Combining Municipal Solid Waste Compost and Poultry Litter to Create a Slow-Release Organic Fertilizer and Reduce Off-farm Nutrient Pollution**

**Leslie R. Cooperband**

Animal wastes are significant contributors to agricultural non-point source pollution in the Chesapeake Bay region, particularly from poultry operations. Nonetheless, animal waste use for on-farm nutrient supply can be an essential aspect of sustainable farming systems. Crop and manure management practices that biologically and chemically immobilize the most soluble nutrient forms could minimize nutrient loss from agricultural fields. The Delmarva's proximity to large urban centers has sparked interest in recycling urban wastes like municipal solid waste (MSW) on agricultural land. However, MSW is composted without adding nitrogen and phosphorus, which are needed to mature the compost prior to crop application. The combination of MSW (essentially carbon) and poultry litter (high in N and P) could convert agricultural and urban wastes into a valuable organic fertilizer with environmentally beneficial nutrient release characteristics.

In an attempt to promote on-farm solutions to manage both rural and urban wastes, I conducted a field trial at the University of Maryland's Wye Research and Education Center on Maryland's Eastern Shore. The objectives of the study were to produce an organic amendment combining poultry litter and MSW compost that supplies adequate nutrients for crop production but minimizes the potential for off-farm contamination. In 1994, I evaluated co-composting of poultry litter and MSW and the N and P release characteristics of varying combinations when applied directly to the farm field. In 1995, I compared nutrient availability and grain crop uptake in fields to which either co-composted or fresh poultry litter had been applied following legume or cereal cover crops.

Results from the composting and nutrient release studies showed we can modify both the magnitude and the pattern of soluble P and N released from organic wastes like poultry litter by combining with a carbon materials like MSW, and that these modifications can be tailored to meet crop demands. The 1995 field trial showed a negative effect on both soluble soil  $\text{NO}_3^-$ -N and corn biomass production from the combination of rye cover and poultry litter-MSW compost. Plots with crimson clover had slightly higher soil  $\text{NO}_3^-$  levels than rye plots over all fertility treatments. Preliminary analysis of results suggests that if cover crops are to be used with MSW-poultry litter compost to supply crop nutrient needs, the cover crop should have a low enough C:N ratio to prevent N immobilization in the soil.

## **Collaborative Problem Solving in Cameron County, Texas: The Coexistence Committee**

Duane Dale,<sup>1</sup> Amy Purvis,<sup>2</sup> Terry Lockamy,<sup>3</sup> and Steve Thompson<sup>4</sup>

In an effort to protect an endangered falcon that was being released in a south Texas wildlife refuge, EPA proposed a one-county ban of all pesticides used in cotton production. This occurred in 1987, shortly after revisions to the jeopardy clause of the Endangered Species Act broadened the agency's power. Agricultural interests resorted to traditional lobbying activities and the draft proposal was withdrawn.

Facing the likelihood of a revised EPA regulation, cotton growers organized the Cameron County Agricultural and Wildlife Coexistence Committee, recruited environmentalists and wildlife managers as participants, and obtained legitimation as an ad hoc function of county government.

The committee developed its own plan for protecting the endangered falcon without totally eliminating cotton pesticides. To do so, they pooled their knowledge of the bird, of cotton production, and of pesticides, a significant step in itself given the mistrust in which environmental and agricultural interests typically hold each other. They also worked together to identify pesticides that were not in use, those used in doses determined to be no risk, and those determined to be safe to the bird if restricted to in-soil application. The U.S. EPA and the Fish and Wildlife Service were slow to respond to the committee's recommendations, but because of the members' persistence, the EPA eventually reversed the ruling that the 17 cotton pesticides jeopardized the falcon.

The most significant innovation in this case was to address pesticide regulation and endangered species protection through a collaborative local dialogue. A number of factors contributed to an outcome that the participants considered positive: diversity of membership, legitimation from external authorities, a shared purpose, a flexible process, a thoughtful reframing of the problem, attention to mutual trust, anticipation of the consequences of their proposals, and development of "learning loops" as the committee monitored the impact of their recommendations. The process has been emulated within Texas and beyond, with varying degrees of success.

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## **Best Nutrient Management Practices on Watersheds to Protect Water Quality in Massachusetts**

Jayaram Daliparthi, Stephen J. Herbert, Thomas J. Akin, and Betsey O'Toole

Environmental protection can be achieved through the adoption of improved nutrient management practices, especially in areas of critical environmental concern such as watersheds and coastal areas. Previous studies at the University of Massachusetts indicated that dairy manure application to perennial forages in addition to manure application to silage corn would greatly increase the land area for spreading, thereby decreasing the amount spread on any one field and thus lessening the potential for nitrate leaching. Such a practice could be vital on farms that have an excess of manure because of a high ratio of dairy cows to annually tilled land. Other studies showed that the application of fertilizers such as nitrogen, phosphorus, and potassium can be avoided by adopting proper nutrient management plans and crop rotations.

A survey of Massachusetts dairy farms has shown 96% of all farms surveyed test their soils but only 20% calibrate their manure spreaders. A high proportion (65%) of farmers surveyed have no manure storage facilities. Planting cover crops can prevent soil erosion and runoff, thereby reducing the potential for eutrophication of lakes, ponds, and other water resources. Fall cover crops planted after silage corn harvest can also act as nitrogen scavengers, thereby preventing nitrate leaching. Conservation tillage practices coupled with the best nutrient management strategies will have a positive impact on water quality. Adoption of best nutrient management practices will also improve soil quality, agricultural sustainability, and farm economy. However, farmers' aversion to economic risk is identified as one of the major obstacles to the adoption of alternative technologies. A more pro-active role from the farming community is required for the adoption of many environmentally sound and economically sustainable strategies.

## **Padilla Bay Proposes a Unique Community Partnership for On-Farm Agriculture and Estuary Research and Education**

**Colette DePhelps**

In April 1993, the Washington State Department of Ecology, state administrator of the Padilla Bay National Estuarine Research Reserve, partnered with Washington State University's College of Agriculture and Home Economics for three purposes: to identify and evaluate the primary environmental issues associated with the interface between farming systems and adjacent estuarine or other public receiving waters; to develop and evaluate problem-solving strategies related to these issues; and to propose educational strategies for use with the public and the agriculture community.

Outcomes of the partnership include the development of a Padilla Bay on-farm research and education program and a strategy for forming collaborative partnerships among diverse community interest groups, such as farmers and environmentalists, to identify, design, implement, and evaluate potential on-farm research and education strategy activities. The participatory research and education strategy that developed is built on the premise that the educational process is multi-directional. Not only do project participants learn from the professionals, but professionals learn from the project participants. The strength of the strategy lies in the development of a working coalition that energizes the creative forces of a wide range of community members to devise research and education activities that address agriculture/estuary issues of local concern and whose results will be locally acceptable and applicable.

## **Perennial Grasses for Energy and Conservation: Evaluating Some Ecological, Agricultural and Economic Issues**

**Mark Downing, Marie Walsh and Sandy McLaughlin**

Perennial prairie grasses offer many advantages to the developing biofuels industry. High yielding varieties of native prairie grasses, such as switchgrass, which combine lower levels of nutrient demand, diverse geographical growing range, high net energy yields and high soil and water conservation potential, could supplement annual row crops such as corn in developing alternative fuels markets. Favorable net energy returns, increased soil erosion prevention, and a geographically diverse land base that can incorporate energy grasses into conventional farm practices will provide accelerated commercialization of conversion technologies. Displacement of row crops by perennial grasses will have major agricultural, economic, social and cross-market implications. Thus, perennial grass production for biofuels offers significant advantages to a national energy strategy that considers environmental economic issues.

## Land Protection as Environmental Enhancement Through Agriculture

Thomas E. Duston

Land protection, defined as the permanent removal of parcels or corridors of land from development consideration, is an important objective for a wide variety of conservation interests. These interests include large, well-established organizations like the Sierra Club, the Conservation Law Foundation, and the Audubon Society; international political movements such as the "Greens"; local organizations interested in pathways, greenways, and parks; and the growing number of economists, environmental biologists, and regional planners pursuing the elusive concept of "sustainable economic growth." Land protection clearly enhances the environment, whether by allowing the development of hiking trails, by creating wildlife corridors, or simply protecting aesthetically pleasing landscapes. The question is: How can this type of environmental enhancement be related to agricultural practices?

The concept that connects land protection through agriculture to environmental improvements is that of *agricultural potential*. Land protection programs represent current environmental enhancement that comes not through current agriculture practices, but through the saving of the future agricultural potential of the land. Although admittedly it might not be the easiest thing politically to convert a town forest into a cornfield at some time in the future, it would be far more difficult to convert a piece of land that had become a shopping mall instead of a town forest. The shopping mall greatly restricts the future options on the land. In addition, we cannot anticipate what new methods of agriculture might be based in protected areas. Among these might be low impact "shade horticulture," hydroponic gardening in wetlands, or even the discovery of additional forest plants with medicinal uses.

In any case, the protection of the agricultural potential of the land as a current benefit of land protection seems to be ignored in cost-benefit calculations of the value of land protection. This paper takes the various methods of land protection -- donation, easement, trust, land swap, purchase, bargain sale, lease, etc. -- and determines how the inclusion of agricultural potential affects the benefits and costs associated with the particular land protection method. Not surprisingly, the type of land protection method, as well as alternative tax structures and the nature of the land itself, are important variables in the analysis of land protection as environmental enhancement through the "banking" of agricultural potential.

## **Are Productivity Enhancing, Resource Conserving Technologies a Viable “Win-win” Approach in the Tropics? The Case of Conservation Tillage in Mexico**

**Olaf Erenstein**

Agricultural development experience in the tropics suggests that addressing just productivity is generally unsustainable, whereas expensive resource conserving practices are not necessarily economically viable in the tropics. Productivity Enhancing, Resource Conserving (PERC) technologies opt for the middle ground, simultaneously addressing agricultural and environmental issues to achieve sustainable agricultural development. As such, these technologies have a “win-win” potential because they serve both agricultural and environmental interests.

Conservation tillage is one example of a PERC technology, as it has the potential of simultaneously reducing soil degradation and increasing productivity. However, an array of agro-ecological and socioeconomic factors determine the potential impacts of the technology, both agricultural and environmental. Most of these factors are specific to the farming systems and environmental conditions in the tropics. The paper specifically reviews some of the advantages and disadvantages of conservation tillage in maize-based farming systems in the Mexican tropics. The paper concludes that PERC technologies such as conservation tillage are only viable in those locations where they actually would achieve their “win-win” potential.

## Birds of Prey and Their Use of Agricultural Fields

Kerry J. Fitzpatrick

This paper examines the potential of agricultural fields as a viable habitat for grasslands birds of prey. A review of the literature reveals several studies suggesting a management strategy to attract raptors to agricultural lands. These studies document the preference of birds of prey to forage over shorter vegetation, particularly grasses. The basis for this trend is thought to be an increased vulnerability of prey. In the North Eastern states, the dominant grassland prey is the meadow vole, *Microtus pennsylvanicus*. A balance is needed between providing enough vegetation to provide food and cover for a healthy vole population and having short enough vegetation to allow raptors to locate and capture prey more easily. Minor adjustments in standard field management practices could create the right conditions to meet both species' needs. Because the group of raptors using fields represents the largest portion of birds of prey, the management of agricultural fields offers the potential for significant habitat improvements. Specific land uses are examined where this strategy can be applied with little or no extra effort over standard practices. The agricultural benefits, benign aspects, and potential conflicts are discussed. The paper concludes with the direction of my study and other areas where more information is needed to utilize this approach.

## **The Environmental Benefits of Cellulosic Energy Crops at a Landscape Scale**

**Robin L. Graham,<sup>1</sup> Wei Liu,<sup>1</sup> and Burton C. English<sup>2</sup>**

This paper presents a broad overview of the potential environmental benefits of bioenergy from energy crops -- crops grown specifically to provide energy, such as corn produced for ethanol production or wood produced for power plants. The environmental benefits of using biomass for energy must be considered in the context of alternative energy options, while the benefits of producing biomass from energy crops must be considered in the context of alternative land uses.

Using bioenergy will reduce both greenhouse gas emissions and air pollution if the bioenergy displaces fossil energy. Environmental benefits are greatest for coal displacement and least for natural gas. Bioenergy also avoids the safety and waste disposal problems of nuclear energy and the land loss and fishery concerns of hydropower. As the production and use of bioenergy emits small net amounts of greenhouse gasses and creates some air pollution, it is less benign in these respects than other renewable energy forms (wind, solar, hydro).

Significant production of bioenergy will require large areas of land dedicated to energy crops (200-400 ha per MW of base power; 150-300 ha per million liters of ethanol). Large-scale energy crop production will produce landscape and regional environmental benefits if perennial, low-input, cellulosic energy crops (e.g., short rotation tree crops or switchgrass) displace annual, high input crops such as corn or soybeans. These benefits include better wildlife habitat, reduced erosion, increased soil carbon, and improved water quality. Quantifying these benefits requires a modeling approach; empirical data at a landscape or regional scale are not available, as the crops are not yet widely grown. Development and applications of such an approach demonstrate the site-specificity of environmental benefits and the importance of including economic factors in predicting them.

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## **Buffalo River Tributaries Watershed Project**

**Dennis D. Hackbart**

The Buffalo River Tributaries Watershed Project demonstrates that application of watershed protection and water quality enhancement practices can simultaneously support agricultural activity. The Buffalo River, designated the first national river in 1972, is a free flowing stream that meanders through the beautiful Ozark Mountains. The 150 mile long river draws about one million visitors annually to participate in canoeing, camping, fishing, picnicking, and related activities. Unfortunately, this nearly pristine stream is threatened by an increase in bacteria stemming from the livestock industry, a classic example of conflict between economic and environmental concerns.

The good news is that a coalition of livestock producers, conservation districts, environmental activists, and State and Federal agencies have developed a "win-win" strategy that will enhance the water quality of the Buffalo River by reducing bacteria counts, while increasing incomes of the livestock producers. The strategy involves the planning and implementation of a project funded under Public Law 83-566, the Small Watershed Act. The project includes about 230,000 acres of forest and grassland. This land supports dairy and beef cattle production and drains into the Buffalo River.

The project's dual approval plan calls for Federal cost-sharing with landowners who install animal waste and grassland management systems and streambank erosion control measures, and with local conservation districts for acquisition of conservation easements to protect riparian grasslands and forest lands. Project participation will be voluntary. Expected results of project implementation include significant reductions in bacteria counts in the Buffalo, an increase in agricultural incomes from improved pasture production, and reduction of livestock losses from waterborne diseases.



# **The Provision of Countryside Amenities: External Benefits of Agricultural Production in Mountainous Regions**

Franz Hackl and Gerald J. Pruckner

This paper covers nonmarket services provided by farmers for recreational and residential purposes in several Central European regions. A regionally specified general equilibrium model is used to derive the efficiency conditions for a competitive equilibrium to guarantee a Pareto optimal outcome, and theoretical conclusions regarding compensation payments are drawn. We also present compensation models already used in Central Europe and assess them from an economic perspective.

The empirical analysis focuses on tourist's willingness to pay (WTP) for the provision of agricultural landscape services in Austria. The mean and median WTP of vacationers is 0.65 ECU and 0.25 ECU per person per day, respectively, with the figures varying according to the tourists' nationality. A comparison of these measures with current voluntary compensation payments made to farmers for the preservation of an agricultural countryside in several Austrian tourism communities suggests that results of hypothetical contingent valuation (CV) are of the right order of magnitude for the value of recreation-related agricultural services.

From an agricultural policy perspective, increased direct subsidies to farmers for the provision of countryside amenities and the application of environmentally sound production measures combined with a decrease of indirect price supports represent win-win options. Environmental improvements can be expected simultaneously with the stabilization of agricultural income levels, diminishing intrasectoral income differences and the development of economically disadvantaged rural regions in Central European countries.

## **Operation Future: Farmers Protecting Darby Creek and the Bottom Line**

**Dennis W. Hall**

Farmers along Big Darby Creek might have reacted negatively to the many outside interests in their agricultural community. In the span of just a few years, Big Darby had been declared a State Scenic River by the Ohio Department of Natural Resources, a Hydrologic Unit Area by the USDA, and one of twelve "Last Great Places" in the Western Hemisphere by The Nature Conservancy.

Admirably, Big Darby Creek farmers chose a different strategy. With the assistance of local Extension agents, farmers came together to form Operation Future, a nonprofit association with the mission of linking economic and environmental soundness to enhance the quality of life in the watershed. A positive sense of cooperation emerged when Operation Future farmers canoed Big Darby Creek with stream protection advocates to learn why the creek was so highly prized. Seeing many of the stream's 86 species of fish and 40 species of mussels was impressive, but the most valuable lesson was recognizing that two potentially adversarial groups, farmers and environmentalists, had more similar interests than first assumed.

Funded by the Kellogg Foundation, Operation Future has conducted a variety of watershed activities. The original canoe trip has been replicated 9 times, with over 300 different people participating. A "Farm of the Future" field day, conducted with Monsanto, drew 400 people. Recent annual meetings featured a prominent speaker and sold over 450 tickets.

As one of forty organizations in the Darby Partners, Operation Future has helped to advance a positive campaign that has become a national model for cooperation in ecosystem protection.

## **On-Farm Composting of Food and Farm Wastes: Economic and Environmental Considerations**

**John M. Halstead<sup>1</sup> and Terri Emmer Cook<sup>2</sup>**

Food waste, which comprises between 8 and 25% of the national waste stream is a legitimate target for alternatives to the traditional waste management strategies of landfilling and conversion to energy. On-farm source separated food waste composting holds promise as an environmentally sound, economically viable alternative for waste management.

We examine whether on-farm composting can be a profitable alternative enterprise for farmers, whether a high quality, valuable compost product can be made from source-separated fruit and vegetable waste and on-farm "waste" products, and assess the level of technology necessary for on-farm composting. Using three case studies of on-farm composting projects in New Hampshire, cost estimates for compost production under various levels of technology are developed and analyses of compost quality resulting from different composting approaches are provided. In addition, we estimate the volume of waste generation necessary within a region to support a single on-farm composting enterprise. This research provides guidelines for deciding whether to purchase new equipment or use existing equipment for composting, for establishing tipping fees for waste generators, and for estimating the time necessary to collect, mix, and turn the compost, based on the volume of waste collected.

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## **The evolution of environmental enhancement programs for agriculture in Ontario**

**Stewart Hilts**

Over the past five years, a coalition of farm groups in Ontario has developed a comprehensive Environmental Farm Planning Program. With extensive government support, it has been subject to a pilot evaluation, and is now being implemented with a target of reaching 14,000 farm families in four years. In this paper the need for the program, its establishment, and its success to date are reviewed. The program is one of the most comprehensive environmental farm planning programs in the world, and one of few that have been organized and implemented by farm organizations themselves. Within it are numerous examples of environmentally positive agricultural practices. This paper examines four of these themes: practices to enhance surface and groundwater quality, wildlife habitat, woodland stewardship, and ecotourism. These provide specific examples, while being placed in the context of a general strategy to enhance positive agriculture/environment interactions. The role of the rural landowner and the contribution of "private stewardship" to the enhancement of ecologically sustainable rural landscapes provides a theoretical context for the paper. The concept of farmer provision of "ecological services" in the context of agricultural production is presented as a policy strategy.

## **Sustainable Farming Practices Benefit Minnesota Landscape**

**Dana Jackson and George Boody**

Minnesota's rural landscapes are dominated by large fields of one crop, mostly corn or soybeans. Conservationists work to preserve remnants of the original landscape and scenic areas but assume that land in agriculture offers few environmental benefits.

The Land Stewardship Project (LSP) is a Minnesota non-profit membership organization that fosters a renewed ethic of farmland stewardship and promotes sustainable agriculture. LSP works with farmers who are developing an ecosystem relationship between agriculture and the natural world. They understand that their land is part of a larger whole, and their practices, unlike those of conventional agriculture, protect the soil and water and encourage the presence of wild species of plants and animals.

Two major influences lead farmers to establish sustainable practices that enhance the environment. Holistic Resource Management™ (HRM), is a decision making process that teaches farm families to work together with neighbors and relatives to set a three part goal that includes a vision of how they want the landscape to look far into the future. Under HRM, they also consider the effects of their farming upon culture and society. Management intensive grazing (MIG) is a method of grazing animals intensively for a short time in one area and then moving them to another area. Farmers strive for a thick, diverse mixture of grass and legumes that nourishes livestock profitably while soaking up rainwater. Minnesota landscapes benefit when row crops to feed animals are replaced by grass-based farming.

LSP's Biological, Social and Financial Monitoring Project and its projects to protect the Minnesota River watershed support both HRM and MIG. These projects are based on collaborations with other organizations and government agencies. The first involves a team of 25 people developing a kit of indicators for farmers to use in monitoring the sustainability of their farms. The second involves two elements: Clean Up Our River Environment, a grassroots effort to educate citizens about pollution of the Minnesota River; and the Chippewa River Stewardship partnership, a collaboration among diverse entities to restore wetlands and decrease pollution of the Chippewa River, a tributary of the Minnesota. Community discussion and collaboration undergird successful efforts to farm sustainably and create opportunities to change agriculture and enhance landscapes.

## **Community Food Security, Agriculture, and the Environment: A Massachusetts Perspective**

**Hugh M. Joseph**

Community Food Security (CFS) is an emerging strategy to address hunger, access to food, and environmental concerns through a comprehensive food systems approach. It is an adaptation of the food security model, and integrates agriculture, food supply, nutrition and other local food system elements with broader socioeconomic objectives at the community level. An important goal of CFS is to link concerns such as environmental protection and preservation of local farming with urban priorities such as reducing hunger and expanding access to affordable food in the inner city.

Examples of established programs that fit the CFS model include farmers' markets, community gardens, and inner city cooperative supermarkets. Some recent initiatives involve more integrative strategies. For example, the Western Massachusetts Food Bank developed a Community Supported Agriculture farm that provides fresh produce for hundreds of paying households while supplying thousands of pounds of free food each season to hungry people. Similarly, the Farmers' Market Nutrition Program promotes better nutrition for WIC recipients while supporting farmers' markets in low-income urban areas. These programs demonstrate to urban residents the benefits of farming in states such as Massachusetts and build farmers' support for problems that affect the city and the poor.

CFS holds the promise of bringing together usually disparate interests to address food system concerns in a more integrated manner. CFS will thereby demonstrate the environmental benefits of local agriculture to urban constituencies while broadening support for these issues among diverse interests, including community development, anti-hunger, environmental, and public health/nutrition groups. It similarly will reduce the relative isolation of agricultural issues among groups involved with other environmental or food system concerns or programs.

With declining farming and rural populations and the resulting decline in their political representation, agriculture relies increasingly on urban policy makers and consumers for support. In Massachusetts, the urban vote has been crucial for programs that preserve farmland, help farmers address environmental problems, and provide marketing and other economic opportunities that sustain local agriculture. Strategies that maintain consumer as well as local, state, and federal support for regional agriculture are critical elements for this sector's long-term sustainability. CFS advocates and associated anti-hunger, environmental, and community development groups can articulate the importance of community-based food and farm projects that expand awareness and support among the public and politicians for Massachusetts agriculture and related environmental benefits.

## **Cultural Resources and Conservation Policy**

**Michael J. Kaczor**

Several laws and regulations mandate that federal agencies consider cultural resources in their program activities in order to protect and preserve the Nation's heritage. The centerpiece of these requirements is Section 106 of the National Historic Preservation Act (NHPA), which outlines a compliance process to account for the effects of federal actions or assistance on significant cultural resources. Recent changes to NHPA have strengthened the requirements to protect these nonrenewable resources.

Changes to policy by the Natural Resources Conservation Service (NRCS) [formerly the Soil Conservation Service] have attempted to extend natural resource stewardship principles and Ecosystem Based Assistance (EBA) planning to the preservation of cultural resources on private lands. Studies by NRCS show that a significant portion of the Nation's unique cultural resources exist on private lands, and that trends in the condition of these resources have been negative because of the lack of consideration in previous farm policy. By adopting new strategies and integrating the protection of cultural resources into existing farm programs, agricultural production systems can be managed to maximize the environmental benefits. For example, the inclusion of significant cultural resources in easement eligibility can simultaneously provide critical wildlife habitat, water quality buffers, landscape aesthetics, and potential sites for low-impact tourism and rural economic development.

This paper briefly addresses why cultural resources are protected, and discusses recent and proposed regulatory changes and their impact on NRCS policies and land users. The discussion focuses on solutions and recommendations for achieving common ground between historic preservation, environmental, and conservation policies and programs.

## **Can Sustainable Agriculture Landscapes Accommodate Corporate Agriculture?**

**Dennis R. Keeney**

Livestock-based farming systems in the United States have rapidly moved toward the industrial model. A current example is the rapid growth in the past five years in large-scale swine confinement operations. These are characterized by dominance of outside capital and management and by odor and pollution problems caused by concentration of swine in small areas. This development is causing concern because of the negative effects it may have on rural communities and landscapes. Promoters of large swine systems point out that the income and job potential, competitive pressures of a world economy, and economies of scale make this switch essential to retain the competitive power of local, state, regional and national economies.

The resulting debate has split the agricultural community at a time when it can ill afford to lose energy and influence by such divisive arguments. Instead, dialogue needs to be established and a fresh look should be taken of the issue. Can these type of systems fit into the landscape? Watershed planning could be the answer. Large confinement systems could readily be designed that fit the unique aspects of a watershed. Examples include siting them to protect streams and trout water, staying clear of communities that might be offended by the odors, and designing systems that can assimilate the wastes and control odors, such as by putting a system in a wetland area surrounded by trees.

However, the development patterns in the affected rural landscapes are already set because of property ownership, access to utilities, etc. Thus more immediate measures must be taken so that development does not overwhelm the landscape. Measures are proposed that include grain and manure sharing and putting emphasis on developing competitive technologies so that operations of a wide range of sizes can exist together.



## **Empirical Evidence of Public Preferences for Farmland Preservation**

**Jeffrey Kline and Dennis Wichelns**

Environmental amenities such as wildlife habitat, scenic vistas, and cultural values have become scarcer relative to food and fiber in developed countries. As a result, public concern has shifted from increasing agricultural production as a policy goal toward protecting and enhancing the quality of the rural environment. Conflicts arise between private and public socially optimal amounts of environmental amenities. Public policies can reduce these conflicts by encouraging landowners to manage farmland in a socially desired manner.

Choosing appropriate policies requires accurate information describing public preferences for the environmental amenities provided by farmland. We use qualitative information provided by focus groups and survey data from a sample of Rhode Island residents to identify and compare socially valued environmental amenities associated with farmland and other open space lands. The results provide empirical evidence that the public perceives significant environmental amenities associated with farmland, such as wildlife habitat and groundwater protection.

Rhode Island residents believe that protecting the environmental amenities associated with farmland is more important than protecting local agricultural production or maintaining farming as a way of life. In Rhode Island, public preferences for preserving farmland compare favorably with preferences for preserving other types of open space. The characteristics of these preferences with respect to specific amenities are useful in designing public policies that protect and enhance the environmental benefits provided by farmland and open space.

## **Enhancement of Communities with Pasture-based Dairy Production Systems**

René J. Knook,<sup>1</sup> Steven P. Washburn,<sup>1</sup> James T. Green, Jr.,<sup>2</sup> Gregory D. Jennings,<sup>3</sup> Geoffrey A. Benson,<sup>4</sup> James C. Barker,<sup>3</sup> and Matthew H. Poore<sup>1</sup>

A collective vision of seasonal, pasture-based dairy farms is being developed for North Carolina. Such dairies should ensure continued local supplies of fresh milk for a growing population while providing economic, aesthetic, and social benefits for communities. Pasture-based dairies have lower feed costs, provide an acceptable nutrient balance of nitrogen and phosphorus, and reduce concerns about odor, pollution, flies, noise, and use of fossil fuel. Seasonal, pasture-based dairies could lower stress and provide more variety and free time for farm workers. Provisions for economical land would allow such dairies to function compatibly in rural and suburban environments. Near larger urban areas, pasture-based dairies could seek long-term land leases within local park systems or special agricultural zones, thereby providing effective public green space. The aesthetic appearance of such farms would make farm vacation enterprises and tours for school children or civic clubs popular.

Profitable local family farms and the sense of community resulting from such cooperation should have lasting social and economic benefits. Differing soil types, climates, and economic conditions dictate needs for functional, local prototypes to demonstrate feasibility of grazing-based dairies to farmers, lenders, and community leaders.

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## **Agriculture Environmental Management and Community Relations**

Nathan Leonard<sup>1</sup> and Duncan Hilchey<sup>2</sup>

Agriculture environmental management is receiving high priority from both farm and nonfarm interests. Complaints frequently arise around larger farm operations even when they maintain excellent environmental management. Cornell Cooperative Extension is publishing material encouraging greater understanding, communication, and conflict resolution between farmers and neighbors to support sustainability of agriculture in communities.

Agriculture is often a preferred land use because it has considerably less environmental impact than most alternative uses. However, as nonfarm residents come in contact with agriculture, conflicts occasionally arise. Even commonly accepted farm practices may disturb communities. Frequently, environmental concerns are the triggering issues.

Farm and neighbor relations are often strained as farms increase in size. A landmark lawsuit in New York (C.A.R.E. vs. Southview Farm) offers an extreme example of what can happen if a community group takes issue with environmental management on a farm. Although manure odor was the triggering concern, the issues brought to court involved accidental manure spills, manure runoff from fields, and elevated nitrate levels in neighboring wells. The cost of this case would exceed the ability of most farms to pay.

A new trend is for farms to open communications with neighbors. Visiting neighbors, writing letters, hosting meetings, inviting people to the farm are among the strategies being used to communicate. Farmers also are asking people to request manure spreading adjustments to avoid interfering with special events.

Farmers also have concerns. These range from property line disputes to vandalism. Communications and proactive conflict resolution skills are enabling farmers and neighbors to solve their concerns. Greater understanding often dissolves issues. Sometimes farmers have no awareness of a problem and are willing to change practices even at great expense.

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## **Fostering biodiversity in agricultural systems: Integrating landscape ecology, cultural ecology and community participation**

Luis Malaret<sup>1</sup> and Dianne E. Rocheleau<sup>2</sup>

Landscape pattern, a major determinant of biotic diversity and distribution, constitutes a critical nexus of human influence on biodiversity in agricultural mosaics. Complex agrarian landscapes include the interaction of humans with flora and fauna, at multiple scales of time and space, that defies analysis by traditional experimental approaches.

We focus on issues of design and methods in a landscape-level research project on biodiversity in program in a rural community in Kenya. This project examines the interaction between biodiversity and changing land use in present day and historical contexts, promotes maintenance and possible increases in biodiversity, and assists human residents in the sustainable use of the resources. The study uses concepts and methods from population, landscape and cultural ecology, ecosystem analysis, and geographic information systems.

The project team consists of biologists and social scientists from the United States and Kenya in partnership with a rural community. The team did a preliminary survey in 1993 of the biota and conducted intensive interviews about environmental history at the extremes of an environmental gradient defined by the study site. The survey revealed distinct assemblages in the two areas, and a total of 41 species of trees, 16 species of reptiles, 7 species of amphibians, and 17 species of termites, a surprisingly high diversity of study organisms, considering the intensive human use and widespread land degradation.

The conclusion outlines strategies for building upon the preliminary data to structure participatory research and land use planning.

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## **Delta Farmland and Wildlife Trust**

**David Melnychuk**

The Delta Farmland & Wildlife Trust (DF&WT) was established in 1993 as a nonprofit organization dedicated to the preservation of farmland and the conservation of wildlife in the Fraser River Delta ecosystem of British Columbia.

The Fraser River Delta contains some of the most productive farmland in Canada as well as internationally significant wildlife values. Both of these important resources are under threat from urban expansion of the city of Vancouver and surrounding municipalities. In response to this threat, the community of farmers, conservationists, and concerned citizens have banded together in a constructive and cooperative manner and created a new and exciting organization. Its prime mandate is to promote and encourage sustainable and stewardship practices that not only conserve but also enhance wildlife habitat.

The board of directors of this community-based organization includes representation from the farming sector and from local conservation groups. In its brief history, the DF&WT has already had a positive impact on the farming/wildlife issue through several practical, on-the-ground initiatives. These initiatives can be categorized into two main groups: the first centers on demonstration of stewardship practices that sustain the agricultural resource and wildlife habitat, while the second concentrates on increasing public awareness and appreciation of the importance of farming and wildlife and the need for the conservation of both of the resources for the benefit of future generations.

Cooperation and respect between farmers and conservationists is essential for the survival of wildlife in the Fraser River Delta. The future success of the DF&WT is largely dependent on how well it can maintain and foster this relationship.

## **Environmental, Economic, and Social Benefits of Feeding Livestock on Well Managed Pasture**

William Murphy,<sup>1</sup> Joshua Silman,<sup>1</sup> Lisa McCrory,<sup>1</sup> Sarah Flack,<sup>1</sup> Jon Winsten,<sup>1</sup> David Hoke,<sup>1</sup> Abdon Schmitt<sup>1</sup>, and Brian Pillsbury<sup>2</sup>

A sustainable rural culture and its agriculture depends not only on fixing what is wrong with conventional agriculture in terms of soil erosion, pollution, and farm profitability, but also on improving the farm family's quality of life and revitalizing rural communities. One solution to the problems of farmers and rural communities lies in better use of permanent pasture. Feeding livestock on well managed pasture can cost only one-sixth as much as feeding them in confinement. Also, it requires less labor, thereby improving farm profitability and family quality of life. As pasture-based farm profitability increases, farmers diversify their spending in ways that can result in more prosperous rural communities.

Using permanent pasture instead of tilled crops to feed livestock stops soil erosion, adds soil organic matter, and decreases atmospheric carbon dioxide. About 48,000 kg of carbon dioxide can be removed from the atmosphere and the carbon sequestered in the soil in each hectare of land converted from tilled crops to permanent pasture. Is this a way of reducing the danger of global warming from atmospheric carbon dioxide?

Surface and ground water quality has been degraded especially by soil sediments and nitrogen, phosphorus, and pesticide runoff and leaching from tilled cropland. Farmers feeding livestock on intensively managed permanent pasture grow less corn and other tilled crops, and require less fertilizer, pesticides, and phosphorus-containing feed supplements. These input reductions could benefit surface and ground water quality because less pollutants would enter and leave pasture-based farms.

The Pasture Management Outreach Program of the University of Vermont's Environmental Programs in Communities Project strives to help farmers learn how to use the pasture resource to its full potential to achieve these benefits. This program has helped increase the net income of more than 120 farms by as much as 350% and has saved farms from bankruptcy. It also has resulted in farm children returning to dairy farming after they had rejected it as a career when it was being done in confinement.

The special beauty of all this is that no government incentive is needed to attract farmers to use this beneficial farming practice. Dramatically improved farm profitability and decreased labor demands that result from using well managed pasture are the large, very attractive carrot.

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## **Regional Farmers' Market Development as an Employment and Economic Development Strategy**

**John S. Nettleton**

Cornell University Cooperative Extension/New York City Programs has joined with Extension programs in surrounding counties and with not-for-profit groups based in New York City to form the "New Farmers/New Markets" Program. This is an effort to: 1) expand participation in existing and newly established farmers' markets (25 presently in NYC); 2) train neighborhood residents, primarily youth, to grow crops for market as part of a team-building and skills development effort based in camps and retreats surrounding the City, and; 3) train new immigrants and interested adults in farm market production, with primary emphasis on organic and sustainable production methods.

The efficacy of this strategy on a regional scale is examined as a demonstration that builds on the organizational advantages of each participant group. The Extension education network is statewide and longstanding; the not-for-profit summer facilities can benefit from added programs during the summer, reduced operating costs from fresh fruits and vegetables grown on site, and the potential for year-round program expansion with neighborhood residents in the city. For participating youth, the program provides an opportunity to gain an understanding of the food system, increase science and mathematics literacy skills in a hands-on and experiential process, and learn social and marketing skills through face-to-face marketing of the produce they have grown.

Long-term planning will engage civic grouping representing new immigrants, where recent traditions of agriculture offer the potential for participation and a variety of niche marketing options keyed to farmers' markets in multicultural settings. Fallow and productive farmland throughout the metropolitan area offers near-term potential for groups of cooperating producers, while the labor-intensive aspect of organic production avoids some of the start-up capital requirements of traditional production agriculture. The program aims to link local and regional groups involved in farm market production with land preservation groups and trusts active throughout the region.

Urban to rural linkages already established and underway are discussed, showing concrete examples of interagency and group collaboration.

## **Recycling Municipal Organic Wastes Through Compost Application to Agricultural Land**

**Thomas A. Obreza**

Disposal of municipal solid waste (MSW) has become complex because of difficulties in siting new landfills. Florida's MSW production is steadily increasing with its population, so other environmentally acceptable disposal means need to be explored. Composting MSW and returning it to the land recycles organics back to the site where they originated.

The importance of organic matter to soil productivity, especially in Florida's sandy soils, has long been recognized. Adding a high rate of MSW compost improves soil physical, chemical, and biological properties. Compost can increase long-term soil quality because of its stability.

Composts made from household garbage feedstock were evaluated for effects on soil properties and vegetable crop yields. When added to sand at 112 t/ha, compost increased water-holding capacity about 6% by volume. When stable, mature composts were added to field soils at 27 to 112 t/ha, tomato, bell pepper, crookneck squash, and watermelon grew as well or better than crops in unamended soil. Yield increases were associated with increased water use efficiency and soil fertility. When immature composts were applied, plant growth was reduced by phytotoxicity. Unstable composts matured in the soil after about 90 days. Heavy metal uptake by watermelon was negligible from compost-amended soil.

Long-term positive compost effects on soil fertility included increases in soil pH, organic matter concentration, and soil-extractable P, K, Ca and Mg. Chemical analysis of composts showed high Ca and Fe concentrations, which may have increased retention of P fertilizer.

The main barriers for large-scale compost use by agriculture are production and transportation costs. There will be no incentive to produce compost if growers cannot afford to use it. If the urban community will subsidize the cost of compost distribution, then its use will become more attractive.



## Value of Shade Coffee Plantations for Tropical Birds: Landscape and Vegetation Effects

Jeffrey David Parrish<sup>1</sup> and Lisa J. Petit<sup>2</sup>

With the imminent full conversion of the natural tropical landscape to an agricultural mosaic, tropical conservation requires a redirected effort toward alternatives offered by the agricultural ecosystems remaining after forests have disappeared. Coffee is one such alternative: it is a dominant feature in the economy and landscape of developing tropical countries that can even enhance tropical biodiversity. Grown under a shade canopy, coffee can provide critical habitat for tropical forest organisms where no natural forest vegetation remains. However, since the early 1980s, coffee has undergone a conversion from shade-managed production to cultivation under full sun conditions with removal of most or all of the shade canopy. The loss of canopy trees in a "technified" plantation represents a concomitant loss in biodiversity of forest organisms. While traditional shade coffee plantations generally support biodiversity they vary tremendously in habitat characteristics, placement in the tropical agricultural landscape, and the resulting abilities to harbor viable populations of many forest species. In this study we evaluated the individual and combined effects of several habitat characters and landscape-level factors on the species richness and abundance of tropical resident and migratory birds in shade coffee plantations of western Panama.

We measured bird abundances, community composition, and vegetation and landscape variables within 10 plantations located at varying distances from contiguous forest. As canopy cover increased in a plantation, there was a concomitant increase in the abundance of forest-wintering migrants and in the number of migrant species within a plantation. This suggests that shadier sites more closely resemble a forest in vegetation structure or in available resources, and as a result can harbor a greater diversity and abundance of migratory birds. Migrant species tended to be more abundant in coffee plantations with higher densities of flowering canopy trees. As a plantation was located further from the contiguous forest, the number of forest species shared with both the local forest interior and the forest border decreased significantly, suggesting that shade coffee has maximum conservation value when used as a multi-use buffer zone habitat along the border of protected forest areas. As distance from riparian dispersal corridors increased, the number of forest species in a plantation also declined. Multiple regression models showed that landscape and habitat factors were both important in explaining bird abundance and species richness. When managed with these habitat and landscape level factors in consort, shade coffee plantations can provide a viable conservation tool in highly managed agricultural landscapes while meeting the needs of human economy.

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## **Valley Care: Bringing Conservation and Agriculture Together in California's Central Valley**

Jack M. Payne,<sup>1</sup> Michael A. Bias,<sup>1</sup> and Richard G. Kempka<sup>2</sup>

Valley Care is Ducks Unlimited's five-year comprehensive plan to expand its historic work on public wetlands in the Central Valley of California to private lands. Valley Care implements a major portion of the Central Valley Habitat Joint Venture's plan for waterfowl while directly benefitting neotropical migratory birds, threatened and endangered species, and other wildlife. Valley Care is finding ways to restore private wetlands, as well as provide wildlife enhancement to private agricultural lands while continuing to add to the public wetlands base. This program is providing education about wildlife to a broad range of the public and is establishing new partnerships among the agricultural community, businesses, public agencies, and environmental/conservation organizations.

Valley Care provides large acreage of seasonally flooded wetlands (wildlife enhanced agricultural lands), improved management of existing habitats, permanently restored natural wetlands, riparian corridors and other habitats, and improved public understanding of the needs of wildlife in the Central Valley. The project directly benefits continental populations of neotropical migratory birds, migratory waterfowl and sandhill cranes, federal- and state-listed threatened and endangered species, and a host of resident wildlife and fish.

The primary goal of Valley Care is to change the way land is managed in the Central Valley. Valley Care Demonstrates ecosystem management on a landscape scale. It serves as a prototype in that it is one of the first ecosystem-level efforts to be planned and carried out on this comprehensive scale. Ducks Unlimited is using this as a model to develop other landscape-scale projects throughout North America. At the end of the five-year program for Valley Care, Ducks Unlimited expects to have dramatically altered the cultural practices associated with rice farming and other agriculture in the Central Valley. We anticipate growers to winter-flood 200,000 acres of rice fields annually, with major benefits to wildlife, and expect 30,000 acres of farmland in the Sacramento-San Joaquin Delta to be flooded each winter for wildlife habitat. These 230,000 acres of seasonal habitat will be provided at no continuing cost to the public. Through a variety of programs, an additional 100,000 acres of habitat will directly benefit from improved management. We will have restored 12,500 acres of wetlands and riparian habitats, and a comprehensive wetlands education and communications program also will be in place.

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## **The Potential of Dairy Grazing to Protect Agricultural Land Uses and Environmental Quality in Rural and Urban Settings**

**Bryan T. Petrucci**

Of all the new production systems that have emerged and are currently being tested, grass-based livestock systems may have the most potential to address the integrated environmental and social goals promoted by advocates of sustainable agriculture. However, the main benefit of grazing, and the primary reason that so many producers have already converted to grass-based production systems, is the potential for profits.

With this combined package of environmental and economic benefits, grass-based livestock enterprises could be the answer to some of the most pressing economic and resource concerns facing rural America today, particularly in the dairy sector. Dairy grazing may be the way for small to medium size dairy producers to remain competitive and profitable in the 21st century, especially on farms at the urban edge where conflicts with nonfarm residents over environmental concerns are likely to occur. Win-win situations for both farmers and rural nonfarm residents could be created in communities willing to work cooperatively with dairy graziers.

## **Point Remove Wetlands Reclamation and Irrigation Project, Conway and Pope Counties, Arkansas**

Robert G. Price

The Point Remove Wetlands Reclamation and Irrigation Project consists of 43,100 acres in Pope and Conway Counties, Arkansas, located 50 miles northwest of Little Rock. The Arkansas Game and Fish Commission's (AG&FC) Ed Gordon/Point Remove Wildlife Management Area (WMA) occupies 8,500 acres of the project area.

The Point Remove Wetlands Reclamation and Irrigation District, AG&FC, and the Pope and Conway County Conservation Districts have joined to address the project area's resource problems. The major problem is the lack of a dependable water supply to provide for winter waterfowl management on the WMA and to fully irrigate potentially irrigable cropland.

The project would divert water from the Arkansas River into a system of canals, streams, and pipelines to deliver irrigation water in the summer and wildlife water in the fall. Individual cooperators would provide their own farm diversion systems for removing water from the project delivery network. Irrigated land would increase from approximately 4,600 acres to 12,600 acres.

A water level control structure on the WMA would create approximately 6,000 acres of wetland habitat for migratory and resident waterfowl, furbearers, wading birds, and other game and nongame species of wildlife. Taintor gates will provide the capability for moist soil management, greentree reservoirs, and resting and feeding areas for waterfowl.

## **A call for enhanced cooperative wetlands development**

**Richard L. Reed**

Man has been eliminating wetland areas for centuries. Our recent recognition of wetlands as valid and unique environments has led to efforts to preservation, but these efforts have given the Environmental Protection Agency yet another role as policeman. Their efforts are bearing fruit, but land values and marketability are being adversely affected. Some areas being preserved are only the remnants of prior wetland environments, and therefore may only be able to support limited numbers of plant and animal species. Conversely, efforts at protection that fall into a "don't touch it and don't use it for anything" type of control may prove to work too well. Some areas handled this way may turn back into swampland, complete with poisonous snakes, quicksand, and millions of mosquitoes, which would be dangerous to surrounding human populations.

The challenge then becomes how to improve wetland areas in a controllable manner. Nature provides us with an example whereby on common type of residual wetland area could be enhanced, and then maintained using techniques of low-input animal agriculture. However, flexibility and sharing of expertise would be required.

This type of preservation could give the Environmental Protection Agency an opportunity to take on the more positive roles of providing education, consultation, and coordination between various governmental agencies, resulting in increased interest and voluntary compliance in the private sector. Enhanced wetland environments could provide nearby residents with a local point of focus on the environment and, as an education model, could lead to increased understanding and sensitivity to environmental issues.

## **Marin Coastal Watershed Enhancement Project: A Cooperative Approach to Adapting Nonpoint Source Pollution Guidelines to Local Conditions**

Ellen Rilla<sup>1</sup> and Stephanie Larson<sup>2</sup>

Coastal nonpoint source pollution (NPS) concerns led to the design and implementation of the Marin Coastal Watershed Enhancement Project to improve water quality, fish habitat, and natural resources in three western Marin County coastal watersheds in California through voluntary adoption of appropriate rangeland management practices developed cooperatively. Specific objectives of the project include helping landowners identify water quality problems, demonstrating existing examples of good management, providing information on management practices that maintain or enhance water quality, assisting with monitoring programs, and providing technical assistance requested by landowners.

An important aspect of this project, which is ongoing, is the cooperative effort of local government support agencies working together in a "team" approach to assist landowners, and the organization of an advisory oversight committee made up of local community members, agriculturists, regulatory and support agencies and environmental organizations. All meetings are facilitated and recorded, with group agreement reached at each step.

Project products include the development of easy to read fact sheets, a creek care guide for rural landowners, a "how-to" ranch planning workbook and video on developing a ranch conservation plan, and an accompanying report assessing watershed condition and recommending future watershed enhancement projects. Pre-project interviews of the 30 members of the advisory committee indicated that success hinged on acceptance and buy-in from landowners. Followup interviews 18 months later indicated that both agency staff members and landowners have become more aware of NPS and what needs to be done. Both groups also mentioned that just coming together and building consensus was an important accomplishment of the project.

Benefits derived from a coordinated watershed approach include support agencies working together rather than at odds, landowners taking control of how they will respond to NPS regulations in a coordinated fashion rather than alone, and ultimately an enhanced watershed area.

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## **Beyond Nature: Towards a Conceptual Framework that Allows for Environmental Enhancement through Agriculture**

Isidor F. Ruderfer

Before we can consider "environmental enhancement through agriculture," we must rethink what we mean by "environment" and "agriculture." Agriculture is treated antagonistically in most environmental discourse. I distinguish between two extremes in the popular discourse: preservationism and deep ecology. The former sees agriculture as a necessary evil whose impact can be lessened through intensifying technologies. The latter would rather see agriculture abandoned altogether.

At the root of this antagonism is something these two poles of environmentalism share: a concept of "nature" as a well-functioning and self-governing entity-unto-itself. Individual organisms temporarily occupy previously established nodes in this web of energy, nutrient, and information flows. According to preservationism, being human is completely incompatible with being a passive node in the system; to be human is to be self-determining, self-creating, and, therefore, inherently separate from and destructive of nature. According to deep ecology, however, we do have a given role within the system, but rather than accept that passive role (as have hunter-gatherers, holders of this perspective sometimes claim), we have opted for the comforts and conveniences of modernity and, thereby, have fundamentally upset the equilibrium of the system.

In their assessments of human activity, these poles of environmentalism are forced to come to terms with "indigenous" agriculture. Deep ecology tends to see humans who are inherently different from us living "in harmony with nature." Preservationism tends to see humans who are as destructive as any others, once low population densities are taken into account. Oddly enough, evidence appears to support both interpretations: evidence indicating that these peoples who, on one hand, appear to be in passive "harmony with nature" also are actively manipulating their environments.

If we can make coherent sense of this apparent paradox, we are on our way toward an environmentalism that has room for humanity and human action. My suggestion for resolving this apparent paradox is to get rid of the concept of "nature" as a self-contained thing-unto-itself. Rather than viewing organisms as temporary occupants of predefined roles in an already well-defined web, perhaps we should view living beings as active entities that continuously and creatively develop their own roles. Thus, responsible environmental citizenship does not have to preclude active manipulation of the environment. As a result, agriculture would no longer need to be considered an environmental crime, but rather a particular mutualistic arrangement of organisms. The problem posed to us then by the necessarily interspecies ethics of such a post-"nature" would be: "How can we involve a greater variety of organisms in these and other mutualistic arrangements?"

## **Delta-Clearwater River Watershed Project**

James Schmidt

The Delta-Clearwater River Watershed covers 232 thousand acres, of which 113 thousand are forests and woodlands, 59 thousand are in agriculture, and 48 thousand in shrubland and tundra. The State of Alaska owns more than half the land, with about one-fourth in private ownership. About 40 thousand acres is wetlands. The watershed is habitat for the American peregrine falcon, and endangered species, and has thirteen identified cultural sites.

The Delta-Clearwater River Watershed Project is sponsored by the Salcha-Big Delta Soil and Water Conservation District and the Alaska Departments of Fish and Game, Environmental Conservation, and Natural Resources. The recommended plan for this project is to reduce flooding and sediment damage in the river, with prime importance given to protecting its unique fisheries habitat. The plan includes structural and nonstructural measures to reduce flooding and the subsequent stream erosion that takes place in Delta-Clearwater River's two main subwatersheds. Waterspreading diversions and vegetated waterways will be built, and floodplain and wetland areas will be purchased to enlarge the existing greenbelt. Some of these lands will be revegetated with herbaceous and woody vegetation. Some areas will require grade stabilization structures to repair active gully erosion. Sediment delivery to the Delta-Clearwater River will be reduced by about 3,900 tons per year, or 84 %. The rate at which fishery habitat is being lost is expected to decline by 88 %.

The main supports for the area's economic activity are agriculture, military spending (Fort Greely), sport fishing, hunting, and tourism associated with travel along the Alaska Highway. Flooding and erosion jeopardize these activities, and indirectly harm other businesses, such as service stations and motels. Perhaps the most important economic and social value of the Delta-Clearwater River fishery is that it supports a subsistence lifestyle in approximately 60 native villages downstream on the lower Yukon and Tanana Rivers, and is an important part of their cultural heritage.



## **Resource Systems Analysis: Linking Upland Agriculture and Environment for Mutual Benefit in Central Java, Indonesia**

Valerie Sexton

The island of Java is very fertile because of deposits from volcanic activity. In the lowlands, agriculture is quite stable, ecologically and economically. However, upland agriculture, as inherited from colonial times, is less economically beneficial and quite ecologically damaging through accelerated soil erosion.

This need not be the case. One approach that permits a "win-win" situation for both upland agriculture and the environment has been attempted in Indonesia. The Faculty of Forestry at the University of Gadjah Mada, Yogyakarta, Indonesia, is implementing a system of sustainable agriculture in the uplands of the Mangunan/Girirejo area of Central Java.

Resource Systems Analysis is a useful way to visualize how agriculture and related processes impact the environment and are in turn impacted by it. The Resource Systems Framework indicates relationships among the physical environment and its functions, the main resource being processed, the final product, inputs required, by-products, distribution of the product, and consumption patterns as influenced by social organization, demographics, and political economy.

My research in the above-mentioned area of Indonesia in 1992 specified the linkages that existed as the attempt was made to switch to more "environmentally friendly" types of agriculture. This occurred in response to the danger of loss of livelihoods from upland farming because of agricultural methods that were depleting the environment that ultimately had to sustain them.

Specifically, the extent of the intertemporal constraint faced by upland farmers in switching to tree and multi-cropping forms of agriculture was examined in terms of credit provision: the capital needed, the capital available, and the best manner in which to raise and administer this capital according to existing social, political and economic institutions.

The case study indicates not only how to attain enhanced agricultural productivity and prevent pollution by pesticide runoff, but also how sound agricultural practices help to maintain watersheds, enhance water supplies, reintroduce native species and maintain biodiversity, all of which in turn sustain agriculture.

## **Wetland/Cropland Rotational Management for Improved Wetland and Sustained Agricultural Production in the Tulelake Basin**

Carol Shennan

Tulelake is a high mountain valley on the California-Oregon border where 44,000 acres of irrigated agriculture exist adjacent to the 13,000 acre Tulelake National Wildlife Refuge. The refuge is a critical part of the Pacific Flyway and, with Lower Klamath Refuge, supports one million migrating waterfowl, waterfowl production of 40,000 per year, and habitat for 411 wildlife species. Concerns facing the basin include degeneration of wetland habitat, declining fish and bird populations, hypereutrophication, pesticide use adjacent to the refuge, and declining crop productivity from build-up of soilborne pests.

Wetland/cropland rotation cycles are being proposed as a management strategy to improve wetland habitat and reduce pest levels on agricultural land, and thus reduce pesticide use. A collaborative project was developed to test the feasibility of such schemes. The project's goals are: to establish effective mechanisms for participation of federal agencies, local farmers and concerned public groups in the research process; to test whether cover crops or short-term flooding can reduce soil pathogens, weeds and nematodes while providing desirable wildlife habitat; to establish farmer/refuge managed pilot study sites to test short and long-cycle wetland/cropland rotation schemes; to compare the ability of managed wetlands and croplands to remove nutrients and pollutants from agricultural drainage water; and to collectively quantify economic, ecological and social barriers and opportunities for implementing alternative management options.

Outcomes from the initial stages of the project will be used to illustrate the effectiveness of approaches to establish farmer involvement and agency collaboration in the research program, and to illustrate issues that arise from working in a volatile political context.

## **Environmental and economic benefits of organic dairy farming in Ontario**

O. Sholubi, D.P. Stonehouse, and E.A. Clark

Societal concerns about the long-term viability of commercial livestock agriculture reflect growing dissatisfaction with prevailing methods of livestock production. Yet ruminant livestock are the foundation on which profitable and environmentally sustainable food production systems are based. Although the environmental benefits of perennial forages are widely acknowledged, profitable economic returns require that the forages be processed through livestock. Systems that depend less on conserved feeds and confinement and more on pasture and grazing management will reveal the environmental and aesthetic advantages of ruminant-based agriculture.

A survey of eight organic dairy farms in western Ontario illustrates both the crop and livestock husbandry practices and the potential profitability of dairies that emphasize environmentally beneficial methods of milk production. For example, soil erosion and degradation were minimized through year-round soil cover with winter cereals, catch crops and perennial forages. Choosing small grains instead of corn as a feedstuff enhanced weed control while eliminating the hazards of using biocides.

Rations emphasizing perennial forages and small grains, all grown without synthetic fertilizers or biocides, supported production levels equal to the provincial average. With comparable herd sizes, organic dairies posted net returns per cow, per hectare, and per unit of labor that exceeded those from conventional dairies. The findings of this preliminary study suggest that environmentally sound agriculture can be at least as profitable as the agriculture practiced under the prevailing paradigm.

## **Riparian Wetlands Then and Now: An Enhanced Environment Created by Agriculture**

**Quentin D. Skinner and Joseph G. Hiller**

A historical account of hydrological conditions of the Rocky Mountain Region is used to describe streamside vegetation as observed by Lewis and Clark and other early explorers. We compare these presettlement conditions to riparian conditions that now exist to demonstrate what agriculture has accomplished to enhance the fishery, wildlife, and recreation resources of the Western U.S. We demonstrate that ranches alone have enhanced riparian wetland systems and developed off-stream water in such a way that they are now a major element in the proper control of nonpoint pollution from western rangeland. Because of land ownership patterns and permitted rights to water resources, maintaining the integrity of ranching operations is essential to insure continued existence of present fishery and wildlife resources of the West.

## **Environmental Enhancement Using Short-Rotation Woody Crops and Perennial Grasses as Alternatives to Traditional Agricultural Crops**

Virginia R. Tolbert<sup>1</sup> and Andrew Schiller<sup>2</sup>

Short-rotation woody crops and perennial grasses are grown as biomass feedstocks for energy and fiber. When they replace traditional row crops on similar lands, these alternative crops can provide multiple environmental benefits in addition to enhancing the economy of rural areas. The Department of Energy is supporting environmental research to address how these biomass crops can reduce soil erosion and the effects of chemical runoff on water quality, increase soil organic matter and soil stability, and enhance habitat for native wildlife species.

Studies in the north central and southeastern regions of the U.S are addressing the effects of replacing traditional row crops on marginal, erosive lands with biomass crops, and of establishing biomass plantings as filter strips to control erosion and chemical runoff. The habitat value of grass crops and tree crops compared with agricultural crops, grasslands, and natural forests is being studied for selected wildlife species. To date, studies have shown that biomass plantings of trees support increased biodiversity of birds compared with row crops; however, the habitat value of tree plantings was less than that of natural forests. Switchgrass plantings in Iowa showed habitat enhancement for grasslands birds. Combining findings on wildlife use of individual plantings with the results of ongoing studies of the cumulative effects of multiple plantings on wildlife populations can help in designing, establishing, and managing biomass crop plantings to enhance biodiversity while providing biomass feedstocks. Site-specific environmental studies of deployment of biomass crops within the existing landscape can provide direction for establishment of large-scale plantings for both environmental and economic benefits to regional and local agricultural communities.

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## **"The Living Countryside": Maintaining Sweden's Agrarian Landscape**

David Vail

Sweden, like its northern European neighbors, has a long history of measures to maintain an open and varied agrarian landscape. The intention has been to counteract three tendencies: loss of arable land to development, reversion of open land to forest, and landscape "rationalization," a part of agricultural industrialization. The latter tendency has been reinforced by policies encouraging increased farm scale, specialization and mechanization.

In the late 1980s, two farmland protection measures were introduced: a multiyear contract system that pays rents for maintenance of biologically rich, scenically beautiful, and culturally valued meadows and pastures; and conversion grants to restore wetlands, hedgerows, and other landscape elements previously lost through rationalization. Taking account of the land's "public goods" value, these initiatives were cost-effective.

The political economy behind these initiatives centered on the state's search for low cost ways to reduce food surpluses, but it also was influenced by farm interest groups' "rent protecting" behavior, the Department of Environmental Protection's critique of agriculture's environmental impacts, and environmental organizations' mobilization of public opinion behind farmland protection.

Other agricultural policies of the late 1980s, all intended to reduce farm output, also affected the rural landscape. Three measures -- financial subsidies for conversion to organic farming, animal rights legislation mandating increased grazing, and a cover crop requirement in the voluntary acreage setaside -- had positive landscape effects. However, subsidized afforestation of arable land, particularly in already heavily forested regions, contradicted the goal of an open and varied landscape.

Two major policy changes in the 1990s -- a market-oriented food policy (1990) and European Union membership (1995) -- have had complex and contradictory effects on both the extent and the qualities of Sweden's agrarian landscape.

## **Biomass Energy Crops: Production Costs and Supply**

Marie E. Walsh

Biomass energy crops are potential renewable sources of liquid fuels, power, and chemicals. The economic feasibility of these crops hinges on their prices being sufficiently low to be competitive with alternative energy feedstocks, yet high enough to provide a profit to farmers comparable to what they could earn in alternative uses for their land.

This paper presents estimates of the full economic cost (i.e., variable cash, fixed cash, and opportunity cost of owned resources) of producing switchgrass and hybrid poplars in six regions in the United States. Average production costs vary by region and yield, ranging from \$25 to \$62/dry ton for switchgrass bales, and \$30 to \$86/dry ton for poplar chips. Biomass prices are generally lower for switchgrass than for hybrid poplar, and are higher in the Lake States and Corn Belt than for other regions of the U.S.

Using a distribution of cropland rental rates as a proxy for the profitability of conventional agricultural crops, regional biomass supply curves are estimated. Assuming average U.S. yields of 5 dry ton/acre/year, approximately 300 million dry tons of switchgrass could be supplied nationally at farmgate prices of less than \$30/dry ton. Approximately 250 million dry tons of woody crops potentially can be supplied nationally at farmgate prices of less than \$40/dry ton. This is enough biomass to produce 24 to 33 billion gallons of ethanol at a feedstock price of \$0.36 to \$0.63/gal (depending on conversion efficiency), or 600 billion kWh at a price of \$0.04 to \$0.05/kWh.

## **Zuni River Watershed Act: An Ecosystem Plan**

Gary Wooten and Ellen R. Dietrich

The Zuni River Watershed Act (ZRWA) was passed by Congress in August, 1992, with the purpose of authorizing formulation of "a plan for the management of natural and cultural resources...within the Zuni River watershed and upstream from the Zuni Indian Reservation." Potential watershed problems identified in the Act include severe erosion, reduced productivity of renewable resources, and reduced quality and quantity of surface water.

The Work Group, the decision-making group established for carrying out the intent of the Zuni River Watershed Act, is composed of the eight entities specified in the Act. This includes Tribes, Federal and state agencies, and private landowners. The Work Group is assisted by a broadly representative Advisory Committee, and by ten technical teams, composed of experts in soils, range, forestry, wildlife, agriculture and cropland, hydrology and erosion, geographic information systems, archaeology, social and economic values, and cultural values. The link between the technical teams and the Work Group is a coordinator.

The final plan, due to Congress by September 30, 1997, must include a watershed survey describing current natural and cultural resource conditions, recommendations for watershed protection and rehabilitation on both public and private lands, management guidelines for maintaining and improving the natural and cultural resource conditions, and proposals for voluntary cooperative programs for plan implementation.

The Technical Teams have developed data collection methods that will be used by an interdisciplinary inventory team at sampling locations selected in each of the five subwatersheds. The sampling locations were selected using a stratified random sampling approach based on the distribution of land cover, slope, aspect, and soils within each subwatershed. The inventory will provide these teams with information on the current condition of the natural resources and will enable them to determine the types of problems that exist in different parts of the project area.

The Cultural Values and the Social and Economic Technical Teams will meet with the people in the watershed to identify the concerns and values that might affect how the project recommendations are accepted.