# Opportunities and Obstacles in Adoption of Biodiversity-Enhancing Features on California Farms

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Key words: biodiversity, ecosystem services, adoption, multifunctionality

## Abstract

*The USDA National Organic Program requires the conservation of biodiversity and the maintenance or improvement of natural resources on organic farms. On-farm biodiversity-enhancing features such as border plantings can provide many of these ecosystem services. However, which practices farmers currently use to manage non-cropped edges, why and how they use these practices, and how subsidies and technical assistance affect farmers' ability and willingness to manage farm edges for biodiversity are little studied topics. Our study set out to identify the range of practices currently used to manage non-cropped field edges, roadsides, pond edges, and banks of permanent watercourses (sloughs, canals, ditches) in a case study area in California. Secondary objectives were to gauge local farmers' awareness of planted hedgerows and vegetated waterways and to gather preliminary information about the range of incentives and constraints to installing such features.*

## Introduction

Border plantings enhance the multifunctionality of farms in that they provide numerous ecosystem services. They can provide habitat and dispersal corridors for wildlife (Ouin and Burel 2002), and alternative food sources and habitat for predator and pollinator insect populations (Kremen et al. 2002). They can lower pest populations, displace noxious weeds (Long and Pease 2005), and function as buffers to slow soil erosion and runoff and intercept airborne dust (Marshall and Moonen 2002). A diversity of perennial vegetation along watercourses may increase net accumulation of soil carbon and soil organic matter, improve retention of nutrients, and reduce greenhouse gas emissions due to greater plant uptake (Rowe et al. 2005). The USDA National Organic Program requires the conservation of biodiversity and the maintenance or improvement of natural resources on farms marketing products as organic. Therefore, adoption of practices that enhance biodiversity, such as border plantings, is of particular significance to organic farmers.

Several voluntary USDA conservation programs, including the Conservation Reserve Program and the Environmental Quality Incentives Program, give farmers technical and financial assistance in installing border features such as hedgerows, buffer strips,

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and grassed waterways, among others. However, little is known about why farmers do or do not adopt these multifunctional edge management practices, and inferences must be drawn from literature about related conservation practices. Stonehouse (1996) reviewed the literature on adoption of various in-field and field edge soil conservation practices in the U.S. and Canada and found that more and better technical information is needed about most conservation practices, but that often the available information about costs and benefits of such practices is inadequate. A 2001 USDA study (Lambert et al. 2006) found that percentage of off-farm income was negatively associated with participation in federal programs involving conservation structures, indicating the importance of an orientation to farming as a way of life. This study also found that the production of high-value crops was negatively associated with installation of conservation structures.

The above cited literature focuses on farmers as individual decision makers who manage individual farms, instead of a community of decision makers who manage contiguous pieces of a larger landscape. However, many of the ecosystem services potentially attributable to biodiverse farm edges occur at a larger landscape scale, suggesting that a landscape, with its collective of land managers, may be a more appropriate unit of analysis than an individual farm with individual decision makers. The general literature on adoption and diffusion of innovations demonstrates that the observability of innovations as well farmers' physical and social proximity to each other are important factors in the spread of practices across a community.

## Materials and methods

We chose the geographic area for this study to include farm and rangeland in western Yolo County, California, encompassing 7,114 ha, or roughly 72 square km. It includes both lowland, irrigated and intensively farmed cropland, as well as hilly, more extensively farmed, unirrigated rangeland. This area has a prevalence of public and private sector programs focused on increasing on-farm biodiversity and conservation. Yolo County has a very active Resource Conservation District (RCD) that works closely with the local office of the Natural Resources Conservation Service to connect local farmers with federal conservation cost-share programs. In the private sector, Audubon California's Landowner Stewardship Program has conducted farmer and landowner conservation projects in and near the study area.

We sought to interview all individuals who make day-to-day farm management decisions over the land in our study area in telephone interviews that were conducted in August-November, 2006. We succeeded in interviewing 22 out of 28 total farm managers, a response rate of 81%. The land managed by the interviewed farmers represents 71% of the total study area and produces over 20 different crops during different seasons, including field crops (tomatoes, alfalfa, vegetable seeds), orchard crops (almonds, walnuts, plums) and cattle. About 61% of the land area are owned by the farm operators, with the remaining 39% being rented. Twelve of the 22 respondents (55%) pursue farming as their sole occupation, while 10 farmers (45%) have off-farm employment. Four of the farms are either fully or partially in certified organic land, two in field crops and two in orchard crops.

## Results

Most farmers reported using a combination of two or more practices from a set of six active management practices (disc, apply herbicide, mow, hand hoe, burn, graze). Almost half use discing and herbicide applications in combination either with or without additional practices. In the sample as a whole, edges along natural

watercourses tend to be less intensively-managed than other farm edges. Five farmers reported using no active management practices on watercourse edges while all farmers mentioned using at least one active practice on field and road edges. Half of the farmers reported leaving naturally occurring vegetation, including large trees, along waterways compared to only 18% for field and road edges. Thirteen farmers in the sample have planted hedgerows, windbreaks, individual trees, and/or native grasses and sedges, and one-third of these farmers (4) farm organically. Of the remaining farmers, all but one indicated that they had heard of these practices before. Nine of the farmers have installed tail water or rangeland ponds.

**Table 1: Numbers of farmers using designated practices on farm edges**

| Practice | # of farmers in total sample using practice on waterway edges (N=22) | # of farmers in total sample using practice on field/road edges (N=22) | # of organic farmers using this practice on any edge (N=4) |
|---|---|---|---|
| Disc/scrape | 6 | 11 | 1 |
| Herbicide | 9 | 14 | 2* |
| Hand hoe | 2 | 3 | 1 |
| Burn | 2 | 3 | 1 |
| Mow | 6 | 12 | 4 |
| Do nothing/ natural veg. | 14 | 8 | 3 |
| Grasses/ sedges | 1 | 0 | 3 |
| Hedgerows | 4 | 4 | 4 |
| Graze | 2 | 0 | 0 |
| Install pond | NA | 9 | 3 |

* These farmers have both certified organic and conventional fields.

## Discussion

One of the most frequently mentioned objectives in edge management is to keep undesirable elements out of crop fields, in almost all cases weeds but in some cases also rodents and other pests. While RCD materials suggest that filling edge areas with non-invasive native and introduced plants can suppress the growth of invasive weeds, only a minority of farmers in the study appear to consider this potential of hedgerows in their edge management decisions. Six individuals expressed a desire to attract beneficials and possibly even decrease pesticide use as a strong motivating factor, in keeping with the relatively larger number of research studies that have suggested important roles for hedgerows in pest management. Several of these farmers also indicated, however, that the direct impact of such plantings on pest populations is currently difficult for them to discern on their farms and is a topic that could benefit from further research. This observation is consistent with research on conservation practices that technical and performance information about practices is inadequate. The benefits that were more visible to farmers who had edge plantings included increasing wildlife habitat, especially for birds such as quail and pheasants. Two farmers observed dust control as a benefit of hedgerows.

Three fourths of the farmers explicitly mentioned awareness of cost-share and technical assistance programs for hedgerow and pond installation. All sampled farmers who have hedgerows and ponds have taken advantage of one of these programs. Despite the presence of and high familiarity with cost-share programs, however, the high cost of hedgerows and other planted features is still one of the most frequently noted constraints to installing such features. Absentee landlords whose main concerns are getting a rent check were also mentioned as potential blocks to conservation projects, consistent with previous research in other parts of the U.S. associating tenure with adoption of all types of conservation practices. Finally, most of the farmers with hedgerows are full-time farmers with no off-farm income and farm relatively larger acreages. These findings are also consistent with other research on adoption of on-farm conservation practices. Two organic farmers and one conventional farmer were mentioned by a majority of respondents for providing examples of border plantings for other farmers to see. All three farmers have played leadership roles in on-farm research and demonstration projects, and were regarded by others as influencing the unusually high adoption rate of border plantings in this area.

## Conclusions

This study demonstrates that organic farmers can provide a leadership role in installing multifunctional farm edge features across a landscape. It also, however, reveals critical gaps in information and understanding about the implementation as well as the benefits of such biodiversity features. Demand for relevant information will likely increase along with the continuing increase in organic farmland and the growing awareness of farmers, landowners, scientists, and government of the potential capacity for farm edge features to provide multifunctional ecosystem services.

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