

Agriculture, Resources, and the Environment

V. Harnessing Ecosystem Services to Increase Agricultural Sustainability

Summary

This initiative assesses the ecological, agronomic, and economic viability of methods to conserve and increase on-farm biodiversity and accompanying ecosystem services. By analyzing landscape-wide characteristics that affect ecological functioning on farms, research under this initiative will help farmers, ranchers, and government agencies such as NRCS to better understand how to ensure the continued provision of services essential to agriculture, such as crop pollination, water filtration, pollutant degradation, pathogen elimination, pest control, and nutrient cycling. It will also clarify the role that agricultural landscapes play in providing ecosystem services needed by sectors outside of agriculture, for example, wildlife habitat and groundwater storage. Finally, this initiative offers the potential for applied research and engagement with stakeholders to identify the social and economic drivers responsible for increasing the value assigned to non-marketed ecosystem services by the agricultural community as well as the general public.

Problem statement/ Baseline

While ecosystem services are becoming more widely recognized as essential to agriculture and to other natural and human systems, scientific understanding of the complex and often interrelated landscape-scale factors that affect these services is still weak. Meanwhile, examples of failures of ecosystem services continue to appear, such as recent food safety problems, soil salinization, and colony collapse disorder in honeybees.

Structural issues/ Broad drivers shaping change

- Economic value is traditionally assigned to cropland based on the value of its harvested products, and not based on the value of other, non-marketed services provided to the farm as well as to the larger surrounding community. As a result, farmers and ranchers have little financial incentive to protect or enhance ecosystem services from their land.
- The current regulatory environment is so complex that it inhibits landowners from pursuing activities such as hedgerow planting and stream bank restoration.
- In some commodities such as dairy, declining profit margins and low crop prices motivate farm managers to maximize productivity from "fence row to fence row", leaving little room for biodiversity on field margins.
- Numerous products are on the market that purportedly promote biodiversity but lack the scientific foundation to support their claims, and they are being sold to a public with minimal exposure to basic concepts of biodiversity.

Strategic opportunity

The widespread incidence and media coverage of colony collapse disorder in honeybees has signaled the need for more attention on the non-marketed ecological services required by and also provided by healthy agroecosystems. Climate change legislation is also providing impetus for farm and ranch managers to consider methods for increased carbon sequestration on their land, methods which often correspond with increased biodiversity.

Desired outcomes

- Increased scientific understanding about how to manage agricultural landscapes for specific ecosystem services, such as pollination and efficient nutrient cycling.
- Policy makers, NGO's, and farm service agencies such as NRCS, have information about priority socioeconomic factors that influence producer and public interest in enhancing ecosystem services.
- Government agencies understand what types of streamlining efforts are needed to make biodiversity-enhancing practices on private lands easier to implement.

Key Partners

- Producers (farmers, ranchers, dairies) - special emphasis on organic producers who are pioneering biodiversity-related management practices
- Beekeepers
- Agricultural and environmental NGOs, such as Sustainable Conservation, Audubon, CAFF, Wild Farm Alliance, etc.
- County and regional planning agencies; irrigation districts
- CA Dept of Fish and Game
- UCCE
- Horticulture industry that provides planting materials for ecosystem restoration (such as Hedgerow Farms)
- Industries promoting microbial inoculants and other products promoting microbial activity

Activities

- Research projects on crop pollination services:
 - Effect of farm management on the stability/ reliability of crop pollination by wild and managed bees.
 - Modeling how landscape composition and configuration impacts pollinator diversity and the delivery of pollination crops.
 - Identification of native plants to enhance pollinator diversity and honeybee health within intensive agricultural landscapes.
- Research projects on soil biodiversity:
 - Metagenomic analysis of plots at Russell Ranch
 - Functional genes microarray analysis of microbial diversity in Russell Ranch soils
 - Investigations of below-ground insect biodiversity at agricultural-wildland interfaces

- Research projects on policy and institutional needs for increasing adoption of practices that enhance ecosystems services
- Field days at Russell Ranch to provide producers and researchers with focused opportunities to share information and insights
- Hiring of a Program Representative to work as "Biodiversity Ombudsman" with UCCE to assess needs in local areas and to help producers connect with regulatory agencies, plant retailers, and science-based information resources
- Communications and outreach via website and information pamphlets geared toward producers and extension staff

Resources needed for 5 years

Total need: \$730K

- Research grants (intra- or extramural funds) = \$500K
- Field days at Russell Ranch (for 2-3 field days) = \$50K
- Program Representative: \$65K/year for 2 years = \$130K
- Communications and outreach: \$50K for student support to create informational products

- *Additional SAREP/ASI staffing (using extramural funds) dedicated to ARE @ \$60K for 5 years = \$300K [part of all initiatives]*

Current extramural grants: <\$50K*

Additional need: approx \$700K

** Additional grants for pollination research by N. William pending.*