Ecosystem-based Adaptation: Cultivating Climate Resilience with Agroforestry

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Ron Rossman at a Practical Farmers of Iowa field day. Photo by Practical Farmers of Iowa.

Like agricultural producers worldwide, farmers and ranchers in the United States face more variable and extreme weather that increasingly challenges their ability to manage crop and livestock production. More frequent heavy rainfalls complicate fieldwork and bring catastrophic flooding in the Midwest and Northeast, while producers in the Southwest are challenged by prolonged extreme drought. Crop and livestock pest populations are increasing throughout the country as winters warm and the growing seasons lengthen. Warmer winters, earlier spring warm ups, and more variable spring temperatures have complicated tree fruit production and increased the risk of total crop failure. Producers everywhere are struggling to manage more dry periods, more drought, and longer periods of high temperatures and heat wave, as competition for water intensifies in many regions. Interest in agroforestry is increasing in the U.S. as farmers and ranchers search for effective climate risk management strategies.

Ecosystem-based adaptation strategies restore, conserve, and manage ecosystem services to reduce the potential damages and take advantage of opportunities created by climate change. These cost effective and broadly applicable strategies often fulfill both mitigation and adaptation objectives. For example, shelterbelts moderate extremes of temperature and wind; restored riparian areas and wetlands contribute to a healthy regional hydrologic cycle and reduce inland flooding; and afforestation with native species facilitates the adaptation of woodlands to climate change. All of these practices also sequester carbon. While the benefits of ecosystem-based adaptation are widely recognized by the international development community, they have received less attention in the U.S.

Because sustainable agriculture and food systems are designed to produce multiple benefits along three dimensions - environmental, social and economic – many sustainable agriculture practices promote mitigation and adaptation. Production systems that reduce heat-trapping gas emissions and sequester carbon while enhancing adaptive capacity include conservation and no-till systems that use cover crops, diversified crop rotations, organic farming, rotational grazing, perennial production, agroforestry and farmscaping. Recent case study research offers some practical examples of how agroforestry practices are being used by leading sustainable producers to adapt to changing climate conditions across the U.S.

A field at Full Belly Farm with a hedgerow. Photo by Laura Lengnick.

Case study research shows agroforestry reduces climate risk

In the face of extreme and continuing drought, Full Belly Farm, a 400-acre diversified organic vegetable farm in Guinda, California has remained productive and profitable as many other growers in the Central Valley have idled land, invested in new wells, or exited farming. According to Paul Muller, co-owner and production manager of Full Belly Farm, the success of the production system under a changing climate is supported by the diverse mosaic of annual crops, forages, pastures and perennial orchards, hedgerows, and riparian areas that make up the farm's landscape. This extraordinary biological diversity promotes soil health, produces healthy, high-quality products, reduces the need for purchased

inputs such as fertilizers and pesticides, conserves water, and protects the farm from flooding.

Historic drought in the southern Great Plains in 2011 and 2012 led to massive destocking of beef cattle on ranches in Texas, yet Gary and Sue Price, owners and operators of the 77 Ranch in Blooming Grove, maintained their cowherd without the need for supplemental feed or water. Gary credits the success of the ranch under such extreme conditions to the high-quality natural resource base – soil, water, and biodiversity – cultivated by many years of planned grazing coupled with the exceptional drought tolerance of the restored and grazed oak savanna ecosystem that dominates the ranch landscape.

Bob Quinn owns and manages the 4,000-acre Quinn Farm and Ranch in Big Sandy, Montana, where he produces certified organic food grains in a full tillage, diversified, dryland production system. Winter warming in his region has got Bob thinking about some new fruit-growing possibilities on the farm and he has had some success growing sour cherries and other fruit trees in orchards protected by a shelterbelt.

The Rosmann Family Farm is a 700-acre certified organic crop and livestock farm located in the rolling prairie lands of west central Iowa near Harlan. Increasingly challenged by flooding rains, extreme temperature fluctuations, and higher weed pressures, Ron Rosmann works to enhance ecosystem services on the farm by managing for high quality soils and continually planting more trees, shrubs, and crops for pollinators, windbreaks, and wildlife habitat. Inspired by Mark Shepard's New Forest Farm in Wisconsin, Ron plans to add more perennial nut, fruit and berry crops on his farm, both as food and as forages for livestock.

USDA launches new climate smart program

In May of this year, the USDA launched a new comprehensive program, called the Building Blocks for Climate Smart Agriculture, that helps farmers, ranchers, and forest landowners respond to climate change with actions that reduce heat-trapping gas emissions, increase carbon storage, and generate clean renewable energy. The program is designed to mitigate about 2% percent of current U.S. emissions by 2025 - the equivalent of taking 25 million cars off the road. The USDA will offer incentives and technical assistance to farmers, ranchers and forest land owners to encourage actions that promote soil health, improve nutrient management, and conserve and enhance forest resources on private and public lands.

Additional Resources:

- *Resilient Agriculture: Cultivating Food Systems for a Changing Climate,* Laura Lengnick, 2015, New Society Publishers.
- *Carbon Sequestration Potential on Agricultural Lands: A Review of Current Science and Available Practices*, Daniel Kane, 2015, National Sustainable Agriculture Coalition.

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Some examples of the potential mitigation and adaptation benefits of sustainable agriculture practices and production systems are provided below.

Replacing **synthetic fertilizers** with **nitrogen-fixing cover crops** can reduce carbon dioxide emissions by **50%**

Soils amended with **animal manures, composts**, and **cover crops** have greater **soil carbon sequestration** than soils amended with **synthetic fertilizers.**

Grassfed livestock **may require** up to **50%** less **fossil fuel energy inputs** compared to **conventional feedlot livestock** as well as lower methane and nitrous oxide emissions.

Riparian and hedgerow habitats with **woody vegetation** can store up to **20%** of **total farm carbon** on less than 6% of **total farm area.**

*Actual benefits are dependent on soil type, regional climate, and specific production practices
(Source: California Climate and Agriculture Network 2014)

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VOLUME 24 ISSUE 2

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