CLIMATE-SMART AGRICULTURE

by Tracy Hmielowski
Changing climate conditions will impact urban and rural communities worldwide. Agriculture may be particularly sensitive to rapid changes in climate and extreme weather events. Climate-smart agriculture focuses on ways to maintain or increase production under future climate scenarios while also reducing emissions. Climate-smart planning examples are unique to regions and industries, and here we summarize two approaches: One focused on soil organic carbon management and the other on weather and climate prediction tools.

**Strategies for Managing Soil Organic Carbon**

An example of climate-smart planning from Europe was recently published in *Agricultural and Environmental Letters*. The article, titled, “Exploring Climate-Smart Land Management for Atlantic Europe,” proposes ways to manage soil organic carbon (SOC) in Ireland. The article’s lead author, Rogier Schulte, a researcher in Agriculture and Environmental Policy at Wageningen University and Research, says Ireland provides “a good example of decoupling economic growth and emissions” as dairy farmers have increased milk production without increasing emissions in recent years.

Given that agriculture accounts for approximately one-third of total emissions for Ireland, plans to reduce emissions need to consider the impact of farm management. The current Climate and Energy Framework 2030 proposed by the European Commission allows for soil carbon offsets, something earlier targets did not include. Schulte believes this change is very important since farmers can have a direct impact on land use to reduce SOC emissions or sequester carbon in soil.

Schulte and co-authors sought to identify the management practices that would have the greatest impact on SOC, based on the existing soil properties and land use. Development of the strategies was funded and supported by the Irish Department of Agriculture and Dairy Research Ireland, which administers the national dairy levy. These stakeholders support farmers in maintaining or increasing production but also want to meet the goal of reducing emissions.

In this analysis, the strategies for managing SOC included (1) maintenance of existing SOC, (2) reduction in existing SOC emissions from “hotspots,” (3) prevention of new SOC emissions, (4) long-term carbon sequestration in grasslands, and (5) carbon sequestration through afforestation.

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1 See dx.doi.org/doi:10.2134/ael2016.07.0029

Farmers can have a direct impact on land use to reduce soil organic carbon emissions or sequester carbon in soil. *Source: USDA-NRCS.*
The resulting maps provide a landscape-scale view of SOC management strategies. Schulte says the emissions from drained peatland were greater than expected but occur as isolated areas that could be targeted for remediation. Similarly, intact peatlands could be a high priority for conservation efforts to prevent new carbon emission hotspots. The analysis also revealed Ireland has a large capacity for future soil carbon storage in the currently unsaturated soils. The authors caution that this analysis cannot be used to pinpoint individual properties; however, landowners and land managers can use these guidelines to develop an individualized plan.

As part of a comprehensive strategy, these SOC management strategies can be combined with other emission reduction tools. For example, Schulte describes the Carbon Navigator tool, which “assists farmers in identifying which management actions can help reduce emissions and increase income...given their unique circumstances.” The tool was developed prior to the Energy Framework 2030 and, therefore, does not include soil carbon management. Schulte says there is “a need to integrate these SOC management strategies into the Navigator.” Combining these tools will have a greater impact than individual strategies to achieve the EU emission targets.

Improved Forecasting for Farmers

The Cornell Climate Smart Farming program started as a small group of researchers and cooperative extension staff who were working on climate science in their region. ASA and SSSA member David Wolfe, a climate and soil scientist at Cornell University, shared an overview of the Cornell program at the 2016 Annual Meeting in Phoenix last November.2

“When I first got started in this back in the 1990s, I didn’t expect it would be the fruit growers calling me out to talk about frost and freeze damage.” But Wolfe and his colleagues quickly realized that farmers with orchards and vineyards were already being impacted by changing climate

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conditions, with bud break occurring earlier in the spring, making plants susceptible to frost damage.

Cornell Climate Smart Farming (climatesmartfarming.org) provides online tools, educational materials, and the expertise of extension agents and researchers to farmers in the northeastern U.S. The online tools use improved forecasting methods to assess the short-term risk of drought, flood, and frost. These tools use real-time weather data, estimates of soil water deficit, and historical data on temperature and rainfall. An important next step still in development is including longer range “seasonal” forecasts that take into account the impact of El Niño, winter snowpack, and other factors that affect the probability of deviations in water availability or temperature from the historical average during the growing season.

Long-term climate models are also being used to help farmers plan for future conditions. Farmers can then use this information to decide if they need to invest in irrigation, tile drains, or improved cooling capacity for dairy barns to mitigate drought, flooding, and warmer temperatures. The long-term predictions may also be useful for farmers establishing new orchards or vineyards as the tools can provide “better information on site selection [and variety selection], taking into account future climate,” Wolfe says.

Another way to improve resiliency to extreme weather events is through improved soil health. Wolfe shares the example of a farmer who had put time and money into increasing soil organic matter. In a year where the tomato harvest was hampered by wet conditions, most growers were unable to get into fields, and prices were spiking due to low supply. The farmer he had worked with was able to get into his field because of better drainage and soil health.

“He made out like a bandit that year,” Wolfe notes, adding that he has also observed that the farmers who improve soil health are less impacted by drought.

One of the most successful outreach tools for the Cornell Climate Smart program has been a series of videos that feature local farmers. In the videos, farmers discuss how they have observed changes in the weather and how they cope with changing climate conditions. There are also videos in which farmers explain how and why they have incorporated renewable energy sources, like solar, and the economic returns of this technology.

“Farmers just like any homeowner [are concerned with] improving energy efficiency,” Wolfe says. Having a way to hear the perspective of their peers helps to start the conversation with Cornell Climate Smart Farming researchers and extension agents.

T. Hmielowski, Science Editor for CSA News magazine

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