

FINANCIAL IMPACTS OF CLIMATE-RESILIENT AGRICULTURE IN NORTH CAROLINA



N.C. A&T
STATE UNIVERSITY

**COOPERATIVE
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EDF
ENVIRONMENTAL
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THE GROWING NEED FOR CLIMATE-RESILIENT AGRICULTURE

Variable weather associated with a changing climate presents a growing challenge to agriculture in North Carolina. However, the diversity in size, products, farmer backgrounds and soils of North Carolina farms are assets to help build resilience to severe and variable weather. Adopting climate-resilient agricultural practices — including diversified crop rotations, livestock integration in crop operations, cover crops, conservation tillage and efficient water management — can help North Carolina farms respond well and recover quickly and fully to severe weather events.¹

Understanding the financial benefits and costs of adopting climate-resilient agricultural practices on the farm can help farmers and ranchers in decision-making as they adjust their production systems to changing weather. To increase knowledge of the financial implications, Cooperative

Extension at North Carolina Agricultural and Technological State University (N.C. A&T) and Environmental Defense Fund (EDF) conducted financial analyses at three farms implementing these practices in North Carolina.

The goals of the project were to:

- Measure and communicate the financial impacts of climate-resilient practices on North Carolina farms and ranches.
- Represent North Carolina's diversity of small farms by presenting the experience of farmers with different backgrounds, in different regions, and with different crops and livestock.
- Present actionable findings to farmers, farm advisers and farmers' financial partners.

Impacts of climate change on North Carolina agriculture

Climate change is the long-term change in global or regional temperature, precipitation, and severe weather patterns from the mid to late 20th century onwards due to increased heat-trapping greenhouse gasses in the atmosphere. In recent decades, climate change has led to hotter nights, more frequent and severe rainfall, and wetter hurricanes in North Carolina.

Scientists at the North Carolina Institute for Climate Studies, an inter-institutional research institute of the University of North Carolina system administered by NC State University, analyzed how the weather changes associated with climate change will impact agriculture. They found that heavy rains and hurricanes will be more severe, and droughts will become more intense.¹

North Carolina farmers and ranchers will need to adapt to increasingly severe droughts and hotter nights that increase how much water plants lose through evapotranspiration, increasingly severe and frequent flooding events that can affect plant growth and soil conditions, and greater pest pressures on crops due to changes in temperature and moisture conditions.²

¹ Kunkel, K.E., D.R. Easterling, A. Ballinger, S. Bililign, S.M. Champion, D.R. Corbett, K.D. Dello, J. Dissen, G.M. Lackmann, R.A. Luettich, Jr., L.B. Perry, W.A. Robinson, L.E. Stevens, B.C. Stewart, and A.J. Terando, 2020: North Carolina Climate Science Report. North Carolina Institute for Climate Studies, 233 pp. <https://ncics.org/nccsr>

² McNulty, S., S. Wiener, E. Treasure, J. Moore Myers, H. Farahani, L. Fouladbash, D. Marshall, R. Steele, D. Hickman, J. Porter, S. Hestvik, R. Dantzler, W. Hall, M. Cole, J. Bochicchio, D. Meriwether, and K. Klepzig, 2015: Southeast Regional Climate Hub Assessment of Climate Change Vulnerability and Adaptation and Mitigation Strategies, T. Anderson, Ed., United States Department of Agriculture, 61 pp.



CLIMATE-RESILIENT PRACTICES CAN GENERATE FINANCIAL VALUE ON THE FARM

The study identified three key financial impacts of implementing climate-resilient practices among the participating farmers.

1. High tunnels generate a rapid return on investment. The two vegetable farms' investments in high tunnels generated significant and rapid return on investment. Increased crop productivity, new opportunities for higher value crops, more efficient pest management (for weeds, insects and diseases), and extending the growing season all contributed to high tunnels' financial benefits.

2. Cover crops can be managed cost-effectively. The three farms participating in our study implemented cover crops without the practice significantly impacting their net income. Cover crops involve added seed, labor, planting and termination costs that were offset by reduced fertilizer and weed suppression costs. One of the farms

was even able to harvest and sell its cover crop for profit. Although cover crops did not have significant short-term financial impacts, growers were motivated by the longer-term impacts of improved soil health.

3. Reducing tillage reduced operating costs. One of the farms shifted from a conventional tillage system to a reduced tillage system. This resulted in reduced fuel, labor, fertilizer and erosion repair costs. The farm had observable, beneficial impacts from reduced tillage, including darker/richer soils, reduced erosion, and clear pond water downhill from farm fields.



CLEAR GOALS AND STRONG SUPPORT NETWORKS HELP FARMERS ADOPT CLIMATE-RESILIENT PRACTICES SUCCESSFULLY

The farms shared common goals and strategies for adopting climate-resilient practices. They were to:

- **Improve soil health and moisture retention for better crop productivity.**

Despite differences in soil types, topography and climate challenges, all three farms focused on improving soil health to address their climate challenges. Two of the farms focused on soil health to increase soil organic matter and rehabilitate previously depleted soils. All three farms focused on increasing soil health to enhance the soils' ability to drain during severe rainfalls and retain available moisture for drought conditions.

Increasing soil organic matter can improve many soil characteristics, including holding more water

during dry spells and draining excess moisture during wet parts of the year.² Increased organic matter in soil also contributes to soil health and biology, which can enhance nutrient availability to plants.³ Cover cropping, reducing tillage, composting, and properly including livestock in cropping systems all contribute to an increase in soil health.

- **Shift seasonal production to capture premium marketing opportunities.**

Small-scale growers need to differentiate themselves from the rest of the market to get premium prices. For vegetable growers, this is often done by varying the time of harvest. Those with dif-

² Franzluebbbers, A.J. 2002. Water infiltration and soil structure related to organic matter and its stratification with depth. *Soil and Tillage Research*. Pg 197-205.

³ Zibilske, L.M. and J.M. Bradford. 2007. Soil Aggregation, Aggregate Carbon and Nitrogen, and Moisture Retention Induced by Conservation Tillage. *Soil Science Society of America Journal* 71(3):793-802. doi: 10.2136/sssaj2006.0217.

ferent produce or who come early or who stay later in the market don't have to take the lower prices of goods sold during the typical season. For livestock growers, this could mean calving when quality pasture is available.

The growers in this study all took different approaches to marketing, but all had a component of changing their management calendar to reflect natural biology, to match plant or animal performance with growing conditions, or to enhance resilience for dealing with too much, too little or poorly timed rainfall.

- **Take advantage of technical advisory services and financial support.**

Successfully adopting climate-resilient practices requires technical advisory services and financial support. The farms participating in our study received support from Cooperative Extension at the local and state level. Their extension agents helped educate them about climate-resilient practices, different options that could work on their farms and benefits they could expect.

The farmers also applied for and received financial support from the U.S. Department of Agriculture's Natural Resources Conservation

Service cost-share programs for high tunnel construction, erosion control and other on-farm improvements.

The growers relied on a network of support, including neighboring farms, farmworkers and agricultural associations to inform their decisions to implement climate-resilient practices. The advisory, financial and network support farmers received allowed them to try climate-resilient practices and ultimately implement them into their farming systems profitably.

- **Strong financial recordkeeping supports good decision-making.**

The three farms participating in this study balanced their agronomic goals with financial insights. Each farmer observed and measured the costs and benefits of their climate-resilient practices as they implemented them over time. This allowed the farmers to adjust their practices to ensure they were financially beneficial. One of the farmers maintained her farm's expenses, input rates and dates, yields and more in the accounting software QuickBooks®. This allowed her to assess the financial performance of her climate-resilience practices with precision.

Learn how climate-resilient practices can benefit your farm

To learn how climate-resilient practices can benefit your farm, reach out to your county cooperative extension agent at ces.ncsu.edu/directory. You can also learn more about cost-share opportunities by calling or visiting your local USDA NRCS service center, which can be found at nrcs.usda.gov/wps/portal/nrcs/main/nc/contact.

If you're interested in loan financing for climate-resilient practices, equipment or infrastructure, visit a local agricultural lender or Farm Service Agency. Make sure to bring your lender a plan for how the investment will be paid for over time and the financial numbers that support your plan.

Find a full list of resources about climate-resilient practices, extension and education support, and cost-share programs at ncat.edu/caes/cooperative-extension.

About the farmers



Holly Whitesides and Andy Bryant *Against the Grain Farm*

County/region: Watauga/mountains.

Crops: Tomatoes, lettuce, greens, ginger, peppers and more.

Farm size: 35 acres.

Climate-resilient practices: High tunnels, cover crops and compost building.

Financial outcomes:

- High tunnels increased farm income by \$13,000 per year.
- Cover crops planted on a quarter-acre field increased net income by \$7 per year.



Millard and Connie Locklear, *New Ground Farm*

County/region: Robeson/coastal plain.

Crops: Peas, sweet corn, kale, collards, tomatoes, squash, peppers, eggplants and more.

Farm size: 26 acres.

Climate-resilient practices: High tunnels, cover crops and reduced tillage.

Financial outcomes:

- High tunnels increased farm income by \$9,365 per year.
- Cover crops planted on a half-acre field increased net income by \$27 per year.



Beverly Bowen *Blackwell's Farm*

County/region: Rockingham/Piedmont.

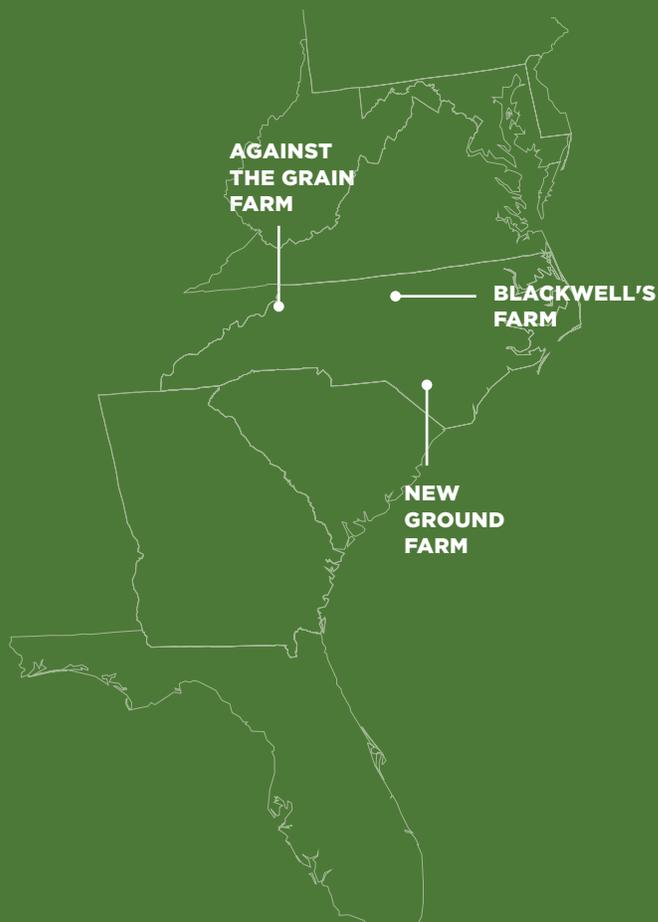
Livestock and crops: Beef cattle, wheat, rye and specialty greens.

Farm size: 60 acres.

Climate-resilient practices: No-till and cover crops.

Financial outcomes:

- Reduced tillage increased farm income by \$437 per year.
- Cover crops increased net income on the farm by \$238 per year.



 **ABOUT THE STUDY**

The study utilized best practices for analyzing the financial impacts of climate-resilient practices outlined in [*A practitioner's guide to conducting budget analyses for conservation agriculture*](#), developed by EDF and partners.⁴ EDF and N.C. A&T Cooperative Extension selected the three participating farms based on the following criteria:

- Implementing practices that build resilience, including cover crops, high tunnels, conservation tillage, and efficient water management.
- Strong financial recordkeeping practices.
- Willingness to share their stories and data to demonstrate the financial impacts of resilient practices on their farms.
- Historically underserved farmers who identify as women, Black, Indigenous or people of color.
- Small- to medium-size farms in different North Carolina regions.

The farmers were compensated for participating in the study and contributing their time, knowledge and information.

The financial analysis used a partial budget analysis approach. The project team modified the Retrospective Soil Health Economic Calculator, developed by American Farmland Trust, to implement the analysis.⁵ A partial budget analysis helps isolate the economic effects associated with a change in management practices, which in this study is the adoption of climate-resilient practices. Financial information is gathered on practice-related costs and revenues, and the net impact on income is calculated from these changes. This approach was used instead of a complete budget analysis due to the complexity of the farm operations and the available time and capacity of the project partners. N.C. A&T Cooperative Extension and EDF adjusted the Retrospective Soil Health Economic Calculator questionnaires and spreadsheets provided in American Farmland Trust's toolkit to meet the needs of the project.

Farmers completed a pre-interview questionnaire to communicate details about their operation, including acreage, crops and practices. The project team then conducted two separate farm visits to gather the production and financial data. EDF gathered information about the cost and revenue impacts that the climate-resilient practices had on the farmers' budgets. The team reviewed the data gathered during the first visit and asked the farmers follow-up questions to fill in gaps. EDF analyzed the partial budget revenue, cost and net return impacts after the second visit. Finally, farmers and project advisers reviewed the partial budget information and the written case studies before publication.

⁴ This report and others can be downloaded at business.edf.org/farm-finance.

⁵ Access the calculator at farmland.org/cig-retrospective-soil-health-economic-calculator.

OUR PROJECT TEAM



N.C. A&T Cooperative Extension

Cooperative Extension at N.C. A&T provides research-based educational information, programming and technical assistance to limited-resource audiences across a diverse range of issues in four programmatic areas: Agriculture and Natural Resources, Family and Consumer Sciences, Community and Rural Development, and 4-H Youth Development. Together with its partners — NC State University Extension, USDA, state and county governments, and other key stakeholders, — a dynamic and resourceful system is formed.

Project team members:

- Dr. Mark Blevins.
- Dr. Fletcher Barber.
- Nelson Brownlee.
- Richard Boylan.



Environmental Defense Fund

EDF is a leading international nonprofit organization on a mission to create transformational solutions to the most serious environmental challenges. EDF links science, economics, law and innovative private-sector partnerships in order to maximize the impact of our efforts. EDF's agricultural finance work includes farm budget analyses, financial solutions and agricultural finance policy.

Project team members:

- Vincent Gauthier.
- Maggie Monast.
- Summer Lauder, N.C. A&T Intern.

Project advisers and reviewers:

- Chad Puryear, Carolina Farm Credit.
- Michelle Perez, American Farmland Trust.
- Ben Wiercinski, American Farmland Trust.
- Michelle Lovejoy, EDF.



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