

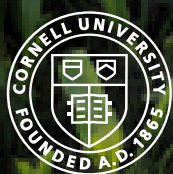


Northeast Climate Adaptation Workbook



Resiliency Planning and Practices for Farmers

Final Working Draft – July 2026



Cornell University

Northeast Climate Adaptation Workbook



Acknowledgements

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Northeast Climate Hub
U.S. DEPARTMENT OF AGRICULTURE



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Introduction to the Workbook

The Climate Adaptation Workbook

This workbook was developed based on farmer and Extension input to serve as a practical guide to help producers in the Northeast understand how extreme weather and climate change are affecting their farms and the adaptation strategies they can adopt. It includes key adaptation strategies, and planning worksheets to help producers assess their goals, evaluate impacts, consider practices, and implement changes to improve their farm's resilience and sustainability.

Climate Challenges for Farmers

The most severe impacts of climate change in the Northeast include extreme precipitation, short-term drought, heat stress, warmer winters, late-spring freezes, increased pest pressure, and higher production costs—impacts that will intensify as temperature and precipitation extremes continue to grow.

Climate Smart Farming and Risk Management

A Climate Smart Farming approach recognizes changing conditions and helps farmers evaluate and experiment with different strategies, practices, and management decisions to protect crops and livestock, improve farm resiliency, reduce greenhouse gas emissions, and ensure sustainable farm incomes and food security. Agricultural adaptation is highly specific and depends on farm location and size, observed climate impacts, commodities produced, and costs. Climate Smart Farm planning helps producers prioritize their farm's long-term sustainability and serve as stewards of their land.



This Workbook: A Starting Point

Most farmers in the Northeast report that increased extreme weather events, greater variability, and greater uncertainty are affecting their operations. While many are implementing and investing in practices that make their farm businesses more resilient to climate extremes, the decision-making process can feel ad hoc and overwhelming.



The workbook serves as a jumping-off point for farm adaptation, guiding a producer - often working with an Extension specialist, consultant, or certified crop advisor - through a structured set of steps to carefully consider on-farm adaptation options and work towards a more climate-resilient future. It offers a set of seven key priority areas for on-farm adaptation, with specific strategies farmers can consider, and then provides step-by-step worksheets to guide farmers in developing an adaptation plan for their farm.

This guide is not meant to diagnose problems or prescribe solutions— instead, it helps farmers identify options and gives them the flexibility to select strategies that fit their operation and goals. Resources at the end of the workbook offer guidance on implementing specific strategies.



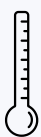
Climate Impacts to Agriculture in the Northeast

To assess your farm's vulnerability to climate change, start by identifying the key climate impacts affecting your operation. Across the Northeast, producers are already experiencing new extremes and increasingly unpredictable weather patterns — and these conditions are only expected to intensify. Impacts vary by operation type and location, since climate trends differ across the region. But these changes affect everything from crop and dairy yields to livestock health, soil quality, planting schedules, labor and energy demands, infrastructure, and water availability — and ultimately, your bottom line.

Northeast Climate Impacts



Rising Temperatures: Across the Northeast, average annual temperatures have increased by 2.5°F since 1895.



Warmer Winters: Temperature changes have been most noticeable during the winter, with nighttime lows rising faster than daytime highs. Temperatures are warming fastest along the coast.



Changes in Growing Season: The length of the growing season has increased by roughly 10-14 days. These changes may bring opportunities (e.g., for double cropping) or challenges for timing.



Increased Rainfall: Increased temperatures mean that the atmosphere can hold more water. Annual precipitation has increased by approximately 5 inches since 1895, and extreme rainfall events (top 1% of daily totals) occur 60% more often.



Sea Level Rise: Since 1990, the global average sea level has risen by 7-8 inches. Sea level has been rising by approximately 0.14–0.17 inches per year (roughly twice the long-term trend).



Drought: Despite an increase in extreme precipitation events, short-term drought conditions persist. Rising temperatures increase evaporative demand, creating highly variable soil moisture even in years with above-average rainfall.



Tools to Identify Climate Impacts

- CSF's Visualizing Climate Change in the Northeast Tool
- CSF's Growing Degree Day Calculator
- NOAA's Seasonal Temperature and Precipitation Outlook Tools
- NOAA's Sea Level Rise Viewer
- US Drought Monitor Maps
- Independent-science-based resources from Climate.us



Climate Impacts & Adaptation Tools and Resources

Visit the LinkTree here: linktr.ee/NEClimateAdaptationWorkbook

Source: USGCRP, 2023: Fifth National Climate Assessment. Chapter 21: Northeast. Crimmins, A.R., et. al., Eds. U.S. Global Change Research Program, Washington, DC, USA. accessed at www.climate.us.

Agricultural Adaptation

What is Climate Adaptation?

Adaptation refers to the process of making adjustments in ecological, social, or economic systems in response to the actual or expected climate change and its impacts. It refers to changes in processes, practices, and structures to reduce potential damages or to benefit from opportunities associated with climate change.

Adaptation in Agriculture

Agricultural adaptation is the continuous process of modifying farming practices, systems, and structures to minimize the risks posed by climate change while ensuring food security and sustainable productivity (USDA Climate Hubs). It reduces potential damages, exploits new opportunities, and helps build resilient food systems.

Co-Benefits

Many adaptation strategies, such as improving soil health, also provide positive, overlapping benefits (such as mitigating greenhouse gas emissions). Many of these strategies are beneficial for farms to adopt regardless of climate change and can also provide the cobenefits of reducing greenhouse gas emissions.

No One-Size-Fits All Approach

Adaptation strategies can take many forms, depending on the unique context of a farm business or region. There is no 'one-size-fits-all solution' to adaptation. Instead, strategies will vary based on the climate impacts to your specific type of farm operation and its local context. This means it is incredibly important to identify all climate impacts and the options available to reduce risk and increase resilience. Since adaptation is so farm-specific, developing a careful adaptation plan, often with the help of an advisor, is an important step to take before making investments in new practices or infrastructure.



Agricultural Adaptation Strategies

This workbook helps farmers...

1. Identify the biggest climate risks on their farm.
2. Prioritize issues based on the severity of impacts and farm goals.
3. Select adaptation strategies and consider their costs and benefits.

Adaptation as an Ongoing Process

As climate conditions shift, new scientific data will continue to emerge. It may also take time to see the benefits of changes in farming practices. Viewing adaptation as an iterative, flexible process — rather than a one-time decision — can make it easier to respond as conditions evolve. Farmers' on-farm experience and expertise are invaluable for gauging how well adaptation strategies are working. Guidance on monitoring and evaluating strategies is provided in Step 5.



USDA Climate Hubs
Tools and Resources

Decision Support Tools, AI, and Ag Data

Agricultural decision support tools — such as the Cornell Climate Smart Farming tools, which combine field-level inputs (such as soil type) with agricultural data, weather forecasts, and climate outlooks — can help farmers and advisors make more informed, location-specific management choices. Increasingly, satellite imagery and AI model outputs are being integrated into such tools to improve accuracy, optimize trade-offs, and support better planning and long-term farm resilience.



Use Cornell Climate
Smart Farming
Tools



AI-Land, Economy,
Agriculture, and
Forestry Institute
(AI-LEAF)

7 Key Strategies

1. Improving Soil Health
2. Efficiently Managing Water
3. Utilizing Integrated Pest Management
4. Reducing Heat Stress
5. Diversifying the Farm
6. Sustaining Natural Landscapes
7. Practicing Adaptive Management



1. Improving Soil Health

Soil health is the continued capacity of soil to function as a vital, living ecosystem. Healthy soil anchors vegetation to limit erosion and runoff, while cycling nutrients, filtering pollutants, reducing fertilizer needs, and sequestering carbon. For farmers, these benefits translate to more productive fields, higher yields, and greater profitability. Building and maintaining healthy soil centers on minimizing disturbance, increasing organic matter inputs, keeping ground covered, diversifying crops, maintaining active living root systems, and integrating livestock into the system.

Reduce Soil Disturbance

- Decrease tillage frequency and intensity.
- Reduce soil compaction by decreasing vehicle use.
- Plant windbreaks, hedgerows, or vegetative barriers.
- Use perennial crops with sod or row strip cropping.



Increase Organic Matter Inputs

- Plant cover crops to protect and stabilize soils.
- Leave crop residues on the field - provide ground coverage with residues or mulch to conserve moisture, provide nutrients, and protect from erosion.
- Apply manure and other organic amendments to build organic matter.
- Apply manure to fields with a calibrated spreader or liquid injection to improve soil water-holding capacity while preventing over-application and runoff; avoid manure application in winter or on frozen ground whenever possible.
- Manage manure storage with a gauge and sufficient freeboard in tanks to prevent runoff and contamination from overflow.

Utilize Crop & Grazing Rotations

- Implement a crop rotation strategy to improve soil tilth and nutrition, manage disease and pest pressures, and decrease weed coverage.
- Incorporate a sod-based rotation.
- Adjust the current rotation for a longer, more flexible plan.
- Utilize regenerative grazing rotations to build soil organic matter, reduce runoff, and foster biodiversity.

Increase Nutrient Quality

- Test soils in fall or early spring to best design a nutrient management plan.
- Use accurate soil maps, e.g. <https://soiltwin.org/>
- Establish a rotational intensity that matches the soil water storage.
- Utilize on-site nutrient cycling through composting to reduce unintended losses, use local nutrient sources, or develop local relationships to balance nutrient loads across different types of farms.
- Use cover crops and crop rotations to replenish soil nutrients and prevent disease, weeds, pests, and erosion. Before switching to low- or no-till methods, build up soil nutrients with conventional methods.
- If needed, add fertilizer and other amendments, being mindful of over-application and tillage needs.



Use Soil Health
Decision
Support Tools



2. Efficiently Managing Water

Water is essential to all farm enterprises, yet both too much and too little water are increasingly common challenges in the Northeast as precipitation patterns become more variable and extreme. Drought reduces crop yields, stresses livestock, and strains water supplies. Conversely, excess precipitation water-logs soils, delays planting, damages crops, and degrades fields and infrastructure. Effective water management helps farms navigate these extremes while minimizing erosion, runoff, and environmental costs. Protecting and restoring natural water systems further supports farm resilience by moderating both flood and drought conditions, benefiting the ecosystem and the overall health of the land.

Collect and Store Water for Dry Spells

- Use ponds, swales, wells, ditches, and collected rainwater.
- Increase storage capacity and improve supply systems by drilling deeper wells, installing cisterns, and building farm ponds.
- Maintain soil moisture and work to improve soil health to build resilience to drought.

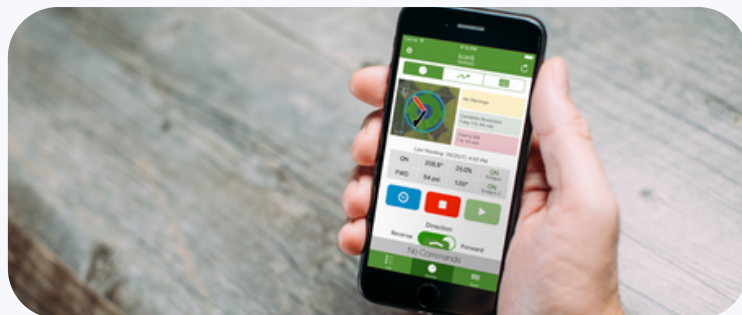


Use Water Efficiently

- Improve irrigation efficiency with micro, drip, or subsurface irrigation systems.
- Incorporate gray or reclaimed water
- Adjust planting density.
- Increase irrigation capacity.
- Adjust irrigation and fertilizer applications based on temperature and precipitation forecasts.
- Monitor and record water use to identify overuse; AI tools can help detect leaks.
- Use the CSF Water Deficit Calculator or other decision-support tools.

Avoid Flood-Prone Areas and Manage Water

- Move production away from flood-prone areas.
- Switch fields at high risk for erosion and pollution runoff to perennial crops, pastures, forest cover, or conservation buffers.
- Reduce mud in high-traffic livestock areas by installing heavy-use area pads and diverting water from heavy traffic or confinement areas.
- Regulate water flow with diversions, terraces, waterways, grade stabilization structures, etc.
- Install surface and subsurface tile drainage.
- Prevent hydrologic variability by protecting or adding wetlands, buffer strips, swales, etc.



Protect Natural Water Systems

- Preserve or restore natural water systems: riparian areas, wetlands, bottomlands, and floodplains.
- Limit livestock's direct access to natural waterways.
- Adjust manure and fertilizer application based on nutrient assessments and weather forecasts (utilize the nutrient runoff tool on the CSF website).
- Consider precision nutrient and pesticide application tools.



3. Utilizing Integrated Pest Management

As temperatures and precipitation shift, pest, pathogen, and weed pressures intensify. Integrated Pest Management (IPM) builds resilience by reducing reliance on chemical pesticides — combining cultural practices like crop rotation, biological controls such as natural predators, and targeted chemical interventions only when needed. Increased scouting, early detection, and diversified varieties help farmers adapt to climate-driven pest shifts, prevent resistance, protect natural resources and human health, and lower economic risk.

IPM Key Points

1. Use accurate detection to minimize environmental, health, and economic risks.
2. Increase scouting for early detection of pests and diseases to prevent problems before they start.
3. Diversify crops and livestock to species with resistance to pests and pathogens.

Increase Scouting for Early Detection

- Increase surveillance as conditions become more favorable.
- Conduct regular scouting.
- Map and track new infestations.
- Identify indicator plants and learn about pest life cycles.
- Utilize tools that monitor weather and phenology models for crops, such as <https://newa.cornell.edu/>



Network for
Environment
& Weather Applications



Implement Integrated Pest Management Strategies

- Utilize prevention, avoidance, monitoring, and suppression.
- Deploy biological controls whenever possible.
- Leverage cultural controls, such as shifting planting dates.
- Practice sanitary farming practices to reduce the spread.
- Prevent the spread of invasive species following a crop disturbance.
- Correctly use appropriate pesticides when necessary.



Diversify Varieties and Species

- Utilize crop varieties bred for natural resistance or tolerance to environmental stressors and disease strains.
- Plant multiple crop types together or in strips to slow the spread of pests.
- Plant diverse cover crops to suppress weeds, break pest cycles, and improve soil health,
- Create field borders with wildflowers or native shrubs to provide food and shelter for beneficial insects and pollinators that assist in natural pest control.



Northeastern IPM
Center Tools



4. Reducing Heat Stress

Rising temperatures, more frequent extreme heat days, and shifting precipitation patterns are intensifying heat stress in agriculture, the physiological damage caused by temperatures exceeding a plant or animal's optimal threshold. The number of very hot days, along with the frequency and duration of heat waves (three or more consecutive days at or above 90°F), is projected to increase in the coming decades. Warmer air holds more moisture, and increased evaporation raises humidity, compounding effects on livestock productivity and fertility, crop photosynthesis and yields, and the health and safety of farmworkers. Building resilience requires coordinated adaptation strategies that address the distinct vulnerabilities of livestock, crops, and the people who work the land.

Reduce Heat Stress in Crops

- Adjust the timing of planting to avoid heat stress during critical periods of plant development.
- Alter plant population density to reduce crop demands for water or nutrients.
- Select longer-growing-season, heat-tolerant, or drought-resistant crop varieties.
- Increase the efficiency of irrigation systems and water transportation, and expand irrigation, especially for new plantings.
- Increase soil cover to conserve soil moisture and reduce soil temperatures.

Mitigate Heat Stress Risks in Livestock

- Increase access to clean, fresh water, ideally in a cool or shaded area.
- Increase herd surveillance for disease and monitor animal temperatures for early warning of stress.
- Select more heat-tolerant breeds.
- Alter grazing management practices or consider silvopasture; provide more shade in pastures.
- Alter animal diets and feed management.
- Upgrade facilities with better ventilation and cooling mechanisms, including fans and sprinklers



Farmworkers and Safety

- Shift strenuous outdoor tasks to early mornings or late evenings when the sun is weakest.
- Provide cool, potable water at all times and ensure workers hydrate adequately.
- Enforce regular rest periods in shaded or air-conditioned areas and monitor employees using a buddy system to spot early signs of heat exhaustion.
- Develop a comprehensive farm heat management plan.



Cornell Pro Dairy
Resources



5. Diversifying the Farm

Diversifying crops, livestock, and farming systems can reduce a farm's exposure to climate risks and the economic losses associated with lower yields or market swings, though start-up costs, learning curves, and reduced economies of scale make diversification costly in the near term. Climate change may require greater investment and experimentation with new plants, animals, and other commodities on a much larger scale, and farms may need to shift to different products or production systems altogether. Farmers can also take advantage of new opportunities that arise from the changing climate.

Diversify Crops

- Diversify varieties or species based on maturity dates and genetics to match anticipated season length, rainfall and drought patterns, and pest and pathogen pressures.
- Plant multi-species cover crops, especially species suited to warmer or drier climates, to enhance soil health and recovery.
- Plant successive crops to take advantage of the longer growing season (double-cropping) and increase annual production.
- Match planting density to water and nutrient availability.
- Increase forage crop diversity to varieties more resistant to extreme precipitation effects.
- Plant multi-species pasture mixtures, especially species suited to warmer climates.



Diversify Livestock

- Diversify livestock, especially with breeds or species that have higher heat, drought, and parasite tolerance.
- Diversify animal products, such as with value-added products or on-farm processing.
- Integrate livestock into cropping systems to access additional forage, reduce feed costs, eliminate manure concentration areas, or improve overall farm efficiency.
- Incorporate agroforestry or silvopasture on the farm.
- Diversify grazing species for best pasture management.

Diversity Products, Services & Operations

- Diversify and expand farm production to include a greater variety of commodities, such as perennial fruits and nuts, forest products, food products, or livestock.
- Develop on-farm services or experiences for consumers that increase farm revenue streams and also help boost community awareness and economic growth through jobs, retail, and other services.



6. Sustaining Natural Landscapes

Individual farms are part of a larger landscape-level agroecosystem that provides ecosystem services beyond agricultural products. Since climate impacts span landscapes and regions, increasing diversity and connectivity — through features such as field edges, riparian buffers, and wetlands — strengthens adaptive capacity and supports carbon sequestration, biodiversity, and water quality. This approach, known as agroecology or regenerative agriculture, promotes positive interactions among humans, plants, animals, and the environment. Farmers and landowners can integrate natural areas into working lands while improving the productivity and prosperity of agriculture, communities, and ecosystems.

Sustaining Natural Landscapes Key Points

1. Preserve the surrounding landscape with buffer strips and diverse edge vegetation.
2. Utilize agroforestry practices for livestock, crop, and ecosystem benefits.
3. Preserve biodiversity by protecting habitats especially for pollinators.



Preserve the Surrounding Landscape

- Promote species diversity by supporting a range of vegetation types and ecosystems.
- Implement and protect riparian buffers or grass filter strips.
- Enhance landscape connectivity for wildlife movement.

Utilize Agroforestry Practices

- Plant native trees to enhance ecosystem services, such as storing carbon.
- Incorporate trees in riparian buffers.
- Utilize alley cropping, which integrates field crops and trees within the same field.
- Consider silvopasture practices (the combination of trees and pastureland) for livestock enterprises.
- Incorporate high-value crops in forest farming, such as through mushroom cultivation.

Preserve Biodiversity

- Protect and promote habitats for vulnerable species.
- Plant native species and a diversity of plants.
- Reduce or eliminate pesticides, if possible.
- Create habitats for pollinator species and other beneficial organisms to support integrated pest management.





7. Practicing Adaptive Management

Practicing Adaptive Management: Key Points

1. Explore financial options to maintain profitability and achieve goals.
2. Utilize decision tools to monitor conditions and guide decisions.
3. Plan for infrastructure changes built for likely climate conditions.
4. Implement a plan with measurable outcomes to assess success.

Climate-informed agriculture requires proactive farm planning and flexible management practices to withstand weather extremes. By leveraging advanced decision tools and robust disaster preparedness plans, producers can build long-term economic success and infrastructure resilience. Priority strategies are identified below:

Utilize Agriculture and Climate Decision Support Tools

- Explore the Cornell Climate Smart Farming tools to provide more accurate data for decisions.
- Conduct a farm energy audit or use a farm greenhouse gas calculator to inform decisions.

Explore Financial Options

- Carry crop or production insurance — such as the Dairy Margin Coverage program or multi-peril crop insurance through the USDA Risk Management Agency.
- Explore financing, cost-share, and grant programs to help fund new resilience projects.

Explore Long-Term Infrastructure Options

- Increase the energy efficiency of barns to reduce summer heat stress and improve winter performance.
- Maintain or upgrade infrastructure to withstand more extreme precipitation.
- Integrate on-farm renewable energy to improve energy resilience and efficiency.
- Incorporate controlled-environment agriculture into the operation if feasible to extend the growing season, diversify operations, and reduce weather-related risks.
- If starting a new operation, design barns, crop management, and livestock systems from the outset that are well-suited to future conditions.

Iterative Farm Planning and Disaster Preparedness

- Treat the farm plan as a living document, revisiting it seasonally or annually as conditions and forecasts change.
- Utilize scenario planning for multiple possible futures, rather than a single fixed projection.
- Develop (and practice implementing) a farm disaster management plan to prepare for sudden, extreme weather events, including backup systems and a clear response plan for when disaster strikes.
- Reassess the suitability of crops or livestock areas that are repeatedly impacted and realign management to better match anticipated conditions.
- Network with other producers or Extension specialists to share or learn what is working locally.



Notes



Adaptation Planning: How to Use the Worksheets

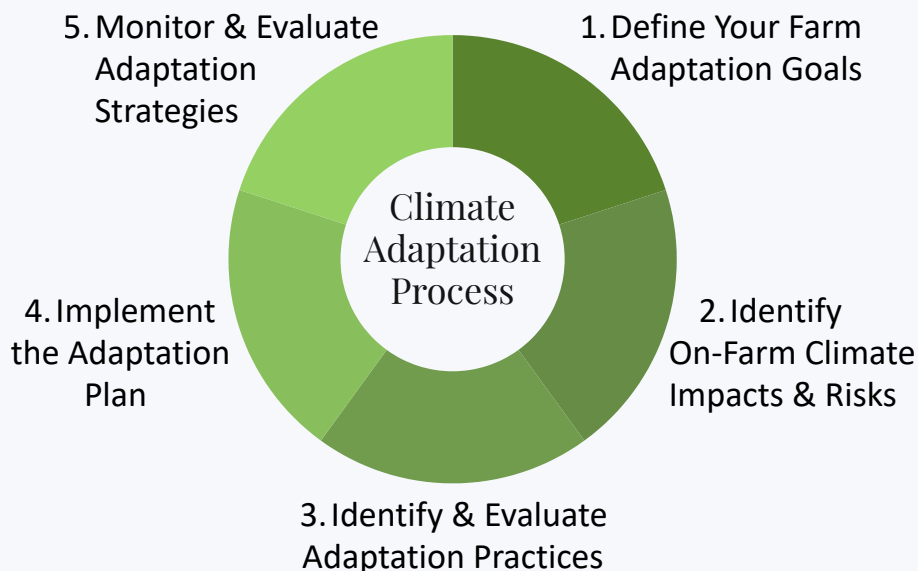
Steps for Making Informed Climate Adaptation Decisions

Farmers can use a five-step process to develop a farm-specific plan to adapt to climate change, based on their farm goals:

Step 1: Define Farm Adaptation Goals: Any good plan starts with a clear goal! In step one, consider your farm goals and objectives for production profitability and stewardship. In this season, what will you prioritize? What is important to you and your land? What does the future look like on your farm?

Step 2: Identify On-Farm Climate Impacts and Specific Risks to Key Assets:

Protecting your farm starts with understanding the climate risks it faces. In the first part of step two, you will consider what climate impacts you are most experiencing or at risk for. Often, climate impacts are interconnected or cascading, so it is normal to list multiple risks. Because every farm has different priorities and assets, climate change affects each operation in unique ways. In the second part of step two, you will map climate impacts and valued farm assets onto the matrix to better understand where and what adaptation strategies are most needed.



Step 3: Identify and Evaluate Adaptation Practices: There is no one-size-fits-all for adaptation strategies: what works for large grain farms in the Midwest is likely not applicable to dairy farms in the northeast. Now that you've identified risks and priorities through outlining goals and impacts, you can find the adaptation strategies that suit your on-farm needs. Additionally, in this step, you will evaluate the practicality and feasibility of solutions.

Step 4: Implement the Adaptation Plan: This is where the rubber meets the road... or the tractor hits the field. In this step, you will break down the process for implementing your selected adaptation strategy on your farm. What do you have to do tomorrow, next week, and next month to successfully manage risks?

Step 5: Monitor & Evaluate Adaptation Strategies: The process does not end after implementation though! How do you measure success? In the final step you may consider how to monitor your implemented strategy, and be flexible enough to redefine, reassess, and evaluate goals.



Step 1: Define Your Farm Adaptation Goals



Purpose: Use this worksheet to identify the main climate impacts on your farm and why you want to implement these adaptive strategies by defining your adaptation goals.
Directions: Describe your operation and identify challenges and what you would like to achieve through the adaptation process.

Farm or Project Area: Describe your operation, including all of your different fields or farm areas.

Location: Where is your farm located?

Baseline: What overall challenges are you facing on your farm, in each location?

Example: Flooding, erosion, cattle heat stress

Adaptation Goal(s): What do you want to achieve?

Example: Improved soil health, increased profits



Step 2a: Identify On-Farm Climate Impacts



Purpose: Consider how climate change is affecting your operation, now and in the future.
Directions: Identify how different areas and resources on your farm are currently being impacted by climate change. Consider using the data from the climatesmartfarming.org tools. Then you can identify the problems and opportunities arising from these climate impacts.

Area/Resource Impacted	Key Climate Impact	Climate Projection How will climate change increase/decrease the incidence of this impact?	What problems or opportunities does this create?
<i>Lower field</i>	<i>Repeated flooding</i>	<i>More extreme in the next 10 years</i>	<i>Erosion, loss of crops each spring</i>



Step 2b: Map Farm Climate Risks



Purpose: The purpose of this activity is to practice identifying and mapping out your farm assets/resources, impacts (hazards), and how these climate impacts will affect the availability and quality of your assets. After completing this activity, you'll be able to add this resource to your climate adaptation plan. Both an example matrix and blank worksheet are provided below.

Directions:

- In the left column: Identify assets and resources on your farm. Assets can be any valuable items, public services, natural resources, infrastructure, livestock, etc., which are valuable and you would like to protect.
- In the top row, list all key climate impacts or hazards (man-made or natural) that could affect your farm, one per column in the matrix.
- For each asset-hazard pair on the grid, fill in "low", "medium", or "high" to indicate the asset's risk for each climate impact. Try to be as specific as possible - you can add additional rows or assets as needed.
- For example, in the Example Matrix below, the impact of extreme heat on livestock (grazing cattle) is likely high - while the impact of flooding would be lower than the impact of flooding on the main farm road (see below).
- Use the Blank Matrix on page 18 to map out your own Farm Climate Risks.

Example Matrix:

Climate Impacts → Assets Impacted ↓	<i>Extreme Heat</i>	<i>Flooding</i>	<i>High winds</i>
<i>Livestock: grazing cattle</i>	<i>High risk</i>	<i>Low risk</i>	<i>Low risk</i>
<i>Main Farm Road</i>	<i>Low risk</i>	<i>High risk</i>	<i>Low risk</i>
<i>Hay field</i>	<i>Low risk</i>	<i>High risk</i>	<i>Low risk</i>
<i>Dairy barn</i>	<i>High risk</i>	<i>High risk</i>	<i>High risk</i>



Climate Impacts→ Assets Impacted↓					



Step 3: Identify and Evaluate Adaptation Practices



Purpose: Identify strategies to protect your farm assets and resources.
Directions: From the farm risk matrix in Step 2, list your high-risk assets in column one. Then identify an adaptation strategy that could reduce risk (refer to key adaptation strategies on pages 6-11 of this workbook). Highlight the benefits of that strategy, and consider its feasibility in terms of the cost, labor, and knowledge required to implement the practice.

Farm Asset at Risk	Adaptation Strategy	Benefits	Feasibility



Step 4: Implement the Adaptation Plan



Purpose: Turn your farm adaptation goals into action.

Directions: Develop a practical implementation plan for the adaptation strategies you selected in Step 3.

Adaptation strategy or practice(s):

Site: At what sites will you implement the strategy or practice(s)?

Baseline: What is the starting measurement before implementing the action?

Resources: What do you need to get started (labor, equipment, education, advising, etc)?

Tools: What do you need to manage or monitor the strategy or practice?

Schedule: When will you implement the strategy or practice(s)?

Data Results (test or lab analysis):

Target: What is the threshold that you would consider this a success?



Step 5: Monitor and Evaluate Adaptation Strategies



Purpose: Monitoring and evaluation will help you track the success of your adaptation strategies and determine your next steps.

Directions: Using the same adaptation strategy or practice(s) from Step 4, develop a plan for evaluating the success of the changes you've implemented on the farm. Update your goals after evaluating the program's success.

Adaptation strategy or practice(s):

Progress/Status: In what ways are your actions helping you achieve your management goals? What measured data has changed (or not changed)?

Target Achieved: Did the practice achieve its intended outcome?

Updating Goals: How have the outcomes of this adaptation action changed your farm management goals and objectives?

Maintenance of Practice: How often does the practice need to be implemented in the future to meet your goal?

Improving Effectiveness: Are there any changes needed to increase the success of the practices?

Next Steps: How can you further advance your adaptation plan?



Notes



Notes



Key Takeaways



The Northeast Climate Adaptation Workbook helps producers identify farm-specific options to build resilience and adapt to climate change, which often have co-benefits such as lower risks, lower greenhouse gas emissions, protection of ecosystem services, increased productivity and yields, and lower operating costs. Because producers know their land and animals best, these strategies are offered as options rather than prescriptions. For the best results, farmers can set reasonable, achievable goals and revisit them each year based on their progress. Acting on what's possible now, while planning for long-term solutions, is key to building resilience — helping producers face future climate challenges and protect their farm and land for the future.

Reach out, Share your Story, and Get Involved!

- This guide will be continuously updated based on stakeholder feedback. If you have any suggestions on improving the planning workbook for farmers, we want to hear from you! Contact us at: climatesmartsolutions@gmail.com.
- For additional resources or contacts of Extension specialists or consultants who can work with you, or assistance in using the *Northeast Climate Adaptation Workbook* or adopting any CSF strategies on your farm, visit climatesmartfarming.org, climatehubs.usda.gov/hubs/northeast.
- Share your Story! Join our Network of Climate-Smart farms and consultants at climatesmartfarming.org.



Definitions



Adaptation: Anticipating the adverse effects of climate change and taking appropriate action to prevent or minimize anticipated damage, or taking advantage of opportunities that may arise.

Adaptive management: a systematic, "learning-by-doing" approach. It involves making informed decisions using real-time data, continuously monitoring farm conditions, and adjusting practices in response to environmental changes rather than rigidly adhering to a predetermined plan.

Agroecology: A holistic approach to farming and food systems that applies ecological and social principles to create sustainable, resilient production.

Agroforestry: A land-use management system that intentionally integrates trees and shrubs with agricultural crops and/or livestock.

Alley Cropping: An agroforestry practice in which rows of trees or shrubs are planted with wide alleys between them, allowing farmers to grow crops or forage simultaneously.

Artificial intelligence (AI) in agriculture: the use of machine learning algorithms, computer vision, and predictive analytics to analyze farm data and automate decision-making, to transform agriculture into a data-driven, predictive practice that maximizes crop yields and reduces resource waste.

Carbon Sequestration: The process of capturing and storing atmospheric carbon dioxide (CO₂).

Carbon Sink: Any reservoir (natural or artificial) that absorbs more carbon than it produces.

Climate: The average weather of a given area over a period of time, including variables such as temperature and precipitation.

Climate Change: Any significant, long-lasting change in climate variables (such as temperature, precipitation, or wind patterns) that occurs over decades or longer. Human influence contributes to increased warming of the atmosphere, ocean, and land largely through activities that increase greenhouse gas emissions.

Climate-Smart Farming: An approach to transforming agricultural systems that aims to sustainably increase productivity and farmer incomes, build resilience and adaptation to climate change, and reduce or remove greenhouse gas emissions, where possible.

Co-Benefits: The positive spillover effects that a practice or strategy aimed at one objective - such as improving soil health for climate adaptation — also have on other objectives, such as climate mitigation, water quality, or farm profitability.

Conservation agriculture: A sustainable farming system that prevents land degradation and regenerates soil health. It is built on three core practices: minimizing physical soil disturbance (such as no-till farming), maintaining a permanent organic soil cover with crop residues, and implementing diverse crop rotations.

Decision Support Tools (DSTs): Software-based systems that analyze farm data, integrating weather forecasts, soil sensors, or satellite imagery to provide actionable recommendations that improve productivity and sustainability.



Definitions



Ecosystem Services: Aspects of an ecosystem that provide value to individuals or society, categorized as supporting services (biodiversity, productivity, etc.), provisioning services (food, fiber, fish, etc.), regulating services (carbon sequestration, climate, etc.), and cultural services (ecotourism, aesthetics, etc.).

Evapotranspiration: The process of water moving from the Earth's surface into the atmosphere from the combination of evaporation (water turning into vapor from soil, lakes, and surfaces) and transpiration (water absorbed by plants and released as vapor through their leaves).

Extreme Weather: Increased strength and/or frequency of weather events such as heat waves, droughts, heavy downpours, flooding, hurricanes, tornadoes, hail, and winter storms, which can negatively impact community resources.

Greenhouse Gas (GHG) Emissions: Atmospheric gases, such as carbon dioxide and methane, that absorb and trap heat, acting like a blanket wrapped around the Earth.

High Tunnel: An enclosed plastic- or fabric-covered structure used to protect crops from sun, wind, excessive rainfall, and cold.

Integrated Pest Management (IPM): A sustainable approach to controlling pests using a combination of biological, cultural, physical, and chemical practices.

Invasive Species: An alien (non-native) species whose introduction causes economic harm, environmental harm, or harm to human, animal, or plant health.

Low-Till: Any tillage method that reduces soil disturbance compared to conventional methods while leaving at least 30% of the soil surface covered by crop residue.

Mitigation: Actions that reduce or prevent greenhouse gas emissions — or enhance carbon sinks — to limit the magnitude of future warming.

Regenerative Agriculture: A conservation management approach that addresses natural resource concerns through soil health, water management, and biodiversity to improve the productivity and prosperity of agriculture, communities, and ecosystems.

Resilience: A system's ability to accommodate change and resulting hazards to maintain function and output.

Riparian Buffer: A strip of native trees, shrubs, and grasses planted alongside waterways such as streams, rivers, and lakes that serves as a natural, protective transition zone between the water and adjacent land uses.

Silvopasture: An agricultural system that deliberately integrates trees, forage, and livestock grazing into a single, mutually beneficial unit.

Soil Health: The continued capacity of soil to function as a vital, living ecosystem that sustains plants, animals, and humans, based on its three key properties—biological, chemical, and physical.

Weather: The state of the atmosphere at a given time and place, including conditions such as temperature, precipitation, humidity, and wind.



Next Steps and Resources



Completing this workbook helps farmers start identifying options to improve their farm's resilience. But there are many other aspects of farm resilience - including business planning, worker health and safety, market and infrastructure considerations, or specific adaptations for various cropping or livestock systems - that can be considered. Please check out the additional resources below available through our Linktree.

Climate Impacts to Agriculture

- Visualizing Climate Change in the Northeast Tool | CSF Tools
- NOAA Season Temperature Outlook Tool | CSF Tools
- Growing Degree Day Calculator | CSF Tools
- NOAA Seasonal Precipitation Outlook Tool | CSF Tools
- Sea Level Rise Viewer | NOAA
- Current Map | U.S. Drought Monitor
- Climate.us: A Successor to Climate.gov

Climate Adaptation Planning

- Cornell Climate Smart Farming
- USDA Northeast Climate Hub | USDA Climate Hubs
- Adaptation Resources for Agriculture | USDA Climate Hubs

Tools for IPM Decision Making

- Northeastern IPM Center
- Network for Environment and Weather Applications | NEWA

Dairy Resources

- PRO-DAIRY | Cornell CALS
- Dairies and Environmental Stewardship | US EPA
- Dairy Margin Coverage Program (DMC) | Farm Service Agency
- Guide to Good Dairy Farming Practice | FAO
- How to Reduce Heat Stress in Dairy and Cattle | MU Extension
- CDQAP Ruminations: Managing Mud on Dairies | California Dairy Quality Assurance Program

Agroforestry Practices Resources

- Agroforestry Practices | USDA National Agroforestry Center
- Silvopasture | USDA

Soils Management

- Building Soils for Better Crops | SARE
- Soil Compaction | UMN Extension
- Mud Control is Grazing Management | Farm and Dairy

Funding and Cost-Benefit Analysis

- Agricultural Funding Resources by Topic | National Agricultural Library

Additional Resources

- Contact USDA's Farm Production and Conservation Agencies | Farmers.gov
- What is Agroecology? | Agroecology Knowledge Hub | Food and Agriculture Organization of the UN
- Sustainable Agriculture Research and Education | SARE
- Crop Rotation on Organic Farms | SARE
- List of Alternative Crops and Enterprises for Small Farm Diversification | National Agriculture Library
- Crop Rotation on Organic Farms - A Planning Manual | SARE
- Glossary of Climate Change | US EPA



Utilize Climate
Adaptation Tools
and Resources

[linktr.ee/NEClimateAdaptation
Workbook](https://linktr.ee/NEClimateAdaptationWorkbook)





Thanks for working through the Northeast Climate Adaptation Workbook to build a plan for your farm. For more resources, visit climatesmartfarming.org, climatehubs.usda.gov/hubs/northeast, or reach out to us with any questions at climatesmartsolutions@gmail.com.



Northeast Climate Hub
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