CLIMATE ADAPTATION FOR VEGETABLE AND FLOWER FARMERS





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Climate Change Impacts on U.S. Agriculture

- 1 Increased water requirements of crops due to warmer temperatures and changes in precipitation
- 1 Increased **heat** affecting crops, animals, and humans
- 1 Increased **soil erosion** from heavy rain
- Increased **pest and weed** pressure









Observed U.S. Precipitation Change



Climate Change Projections for the Northeast and Mid-Atlantic:

- Temperature increases average 4-10°F, with more extreme heat waves
- Warmer, wetter springs with increased variability
- 10-15% increase in yearly precipitation, but more variable precipitation amounts leading to drought
- During heavy precipitation events, rainfall amounts +70%
- 12-14 additional frost-free days
- Warming ocean temperatures

Projected Increases in the Number of Days over 90°F



https://nca2014.globalchange.gov/report/regions/ northeast#tab2-images

Climate Change Projections for the Northwest:

- Temperature increases average 3-10°F, largest change in summer
- Summer precipitation to decline by as much as 30%, with less frequent but heavier downpours
- Declining snowpack and reduced streamflow, causing a strain on summer water supply
- Forests becoming warmer and drier, greater frequency of fires and insect outbreaks
- Increased water temperatures and sea level rise

Land surface temperatures (°C) in June 2021 exceeded scientists' predictions of extreme heat in the Northwest



The heat wave in June 2021 is one example of an event that is both outside the range of what we expect and where scientists have quantified the ex tent to which climate change contributed to the event. Image: European Space Agency under CC BY-SA 2.0.

Climate Change Projections for the Southeast:

- Temperature increases average 4-8°F
- More predicted days over 95°F and fewer freezing events
- Inland areas are projected to warm more than coasts
- Increased frequency of heavy downpours
- Periods of extreme drying and reduced freshwater availability
- Substantial increase in the intensity, frequency, duration, and strength of Atlantic hurricane activity
- Sea level rise effecting shorelines, wetlands, coastal areas



https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-southeast_.html

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Projected Change in Number of Days Over 95°F



Climate Adaptation Can Reduce Risks and Increase Resilience

MITIGATION

Manure management Pasture expansion Fertilizer efficiency Regional food Wind & solar energy Perennial production Reduced machinery use

Soil mgt Cover crops Reduce tillage Agroforestry Integrate livestock Soil health Crop selection Irrigation efficiency Water management Shifted planting dates Diversification Risk mitigation Infrastructure

ADAPTATION

Healthy Soil is a Universal Adaptation





Climate Adaptation Planning



Adaptation Practices

- Cover crops and/or mulch to protect soil
- Reduced tillage
- Find carbon sources for soil
- Adjust nutrient application timing
- Manage water to prevent ponding, run off, erosion
- Diversify crops (livestock breeds, perennials, mixtures)
- Adjust crop plan, trial new varieties, etc
- Conservation buffer strips
- Convert marginal cropland to riparian buffer or perennial zone
- Improve or expand pasture



Infrastructure

- Greenhouses/ high tunnels
- Increase irrigation capacity
- Tile drainage
- Water storage
- Post-harvest cooling
- Climate controlled storage
- Shade for employees & animals
- Create pollinator habitat
- Sensors to monitor water needs and applications





Prioritization and Triage



Precautionary Actions



Flexible and Adaptive Mgt



Support Mitigation



"No Regrets" Decisions



Fill Your Toolbox



Climate Adaptation Planning for Farms

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GOALS

EVALUATE

ADAPTATION

PLAN

This worksheet was developed for farmers to develop their own plan for climate adaptation and farm resilience, knowing the unique variables of their land and operation.

Five steps for farmland climate adaptation planning:

- 1. Define your farm goals and priorities
- 2. Identify specific, observed climate impacts
- 3. Conduct a risk & vulnerabilities assessment based on
- your climate impacts and farm goals
- 4. Develop a set of adaptation practices
- 5. Evaluate the effectiveness of those adaptations practices and update your plan accordingly

This approach is adapted from <u>Adaptation Resources for Agriculture: Respond-</u> ing to Climate Variability and Change in the Midwest and Northeast. USDA Midwest, Northeast, and Northern Forests Climate Hubs. 2016.

1. Goals what are the overall or immediate goals of your farm operation? These goals will inform your choices and priorities. Include considerations of resources, timeframe for goals, foundational values, financial requirements, etc.



3. Risks & Vulnerabilities

Based on the observed and projected climate impacts, what are the major vulnerabilities of your farm operation? What areas of land, important crops, animals, or essential infrastructure are a priority to protect? What is at most risk? Do the identified climate impacts directly impact your top farm goals?



4. Adaptation Practices & Strategies

Review the risks and vulnerabilities section, and choose which should be addressed first. These would be immediate vulnerabilities and/or precautionary actions to prevent risk. Once you've chosen your priorities, consider practices that could address them. Refer to the ideas on p 4. Adaptive practices should involve:

- A reasonable timeline
- Flexible management that can adapt with new information
- "No regrets" decisions that will create broad benefits with little risk
 Considerations of feasibility and
- potential effectiveness
 Resources that are available and
- supported in your network



Content from Adaptation Resources for Agriculture: Responding to Climate Variability and Change in the Midwest and Northeast, USDA Midwest, Northeast, and Northern Forests Climate Hubs. 2016.

Adaptation Practices

Cover crops to protect bare soil,	Diversify crops and livestock	• Water-I
cycle nutrients, fix nitrogen, etc	Transition to perennial crops	tion non-
Adjust nutrient application tim-	 Improve or expand pasture 	• Install t
ing due to excessive rainfall	Build soil health	• Waters
 Manage water to prevent pond- ing, run off, erosion 	Conservation buffer strips	Optimiz
Increase inigation canacity	Reduced tillage	Climate
Sancors to measure water needs	Greenhouses/ high tunnels	• Shade/
and applications	Trial new varieties	Convert
Create shade for animals, crops	 Irrigation expansion 	buffer
		 Create

Water-bank by using less irriga- on non-drought years	
Install tile drainage	
Water storage	
Optimize post-harvest cooling	
Climate controlled storage	
Shade/cooling for employees	
Convert wet cropland to riparian	

Create pollinator habitat





"Cultivating Climate Resilience on Farms and Ranches" Adaptation Resources for Agriculture: Case Studies

Building Soils for Better Crops Managing Cover Crops Profitably

Websites and Organizations The Adaptation Workbook

Regional Resources
The Farming and Climate Change F
Extension Center for Sustaina
Cornell Climate Smart Farming Pro
Quick Guide to "Climate Change a
Vermont"
UVM Farming & Climate Change: I
ers Adapt video series

GROWER EXPERIENCES

NORTHWEST SpringRain Farm and Orchards

SOUTHEAST Colusa Farms

NORTHEAST Simple Gifts Farm



Organic No-Till Farming: A Response to Climate Disruption The first two years of no-till transition at Simple Gifts Farm Jeremy Barker Plotkin (Simple Gifts Farm) & Caro Roszell (American Farmland Trust)





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No-Till & Climate Adaptation

Regional climate change projections for the Northeast include:

An overall gradual increase in:

- Frost-free days
- Days > 90 °F
- Total precipitation volume
- Humidity

Precipitation, however, is expected to be concentrated in more extreme precipitation events with higher frequency in the winter and early spring months, while summers are expected to include longer periods without precipitation.

Janowiak Maria K. et al. 2016. Adaptation Resources for Agriculture: Responding to Climate Variability and Change in the Midwest and Northeast. Technical Bulletin 1944. Washington, DC: U.S. Department of Agriculture. <u>https://www.climatehubs.usda.gov/sites/</u> default/files/AdaptationResourcesForAgriculture.pdf Accessed January 17, 2021.



ADAPTATION RESOURCES FOR AGRICULTURE

Responding to Climate Variability and Change in the Midwest and Northeast



No till farming systems go even further in increasing soil health

- We became interested in pursuing organic no-till after extreme wet season of 2018
- Organic matter in the soil acts as a sponge to absorb more moisture when it's wet and release it when it's dry
- Surface residues also slow soil moisture loss and protect soil surface
- In theory, reduced tillage= fewer weeds over time

Two Soil Health Management Systems:

Organic No-till Systems

Intensive system using compost as a mulch and tarps for weed control

- Mimics "postage stamp" sized farms
- Started in 2020

Extensive system with heavy transferred mulch

- Based on ideas of German agronomist Jan-Hendrik Cropp
- Started in 2021 with help from MDAR ACRE grant





Intensive system

- Compost mulch applied
- Tarps laid to clear the beds
- Seed directly into compost
- Harvest
- Tarp after harvest to kill crop
- Seed salad again after 3 weeks of tarping
- 2020: rotated 3 cycles through field
- 2021: practiced on more blocks









Weed Control Largely Successful

BUT:

Seeding into compost and dead crop residue is sometimes problematic.

an a st

- Second year in this system, perennial grass weeds coming in
- Questions remain about fitting the system into rotation and size of tarp



Extensive System (transferred mulch)



- Use the spiky transplanter to plant into heavy mulch
- Mulch can come from cutting cover crops elsewhere or leaves from the spring
- Need heavy enough mulch to keep weed control going all season
- Timing of mulch harvest critical
- Use weed mat as a backup



2021: Significant Learning Curve for Transferred Mulch System

- Transplanting into mulch a real challenge: lack of soil flow, mulch pushed into hole -> difficult root-to-soil contact
- Possible nitrogen tie-up issues
- Timing of cover crop mowing and quantity of mulch need a lot of work





Jeremy's Recommended Resources



Organic Practices for Climate Mitigation, Adaptation and Carbon Sequestration. Organic Farming Research Foundation

https://ofrf.org/soil-health-and-organicfarming-reports/



Rotational No-till and Mulching Systems for Organic Vegetable Farms Webinar, Jan-Hendrik Cropp

https://eorganic.org/node/12857



Tools for Transitioning to No-Till Vegetable Production: Event Highlights Video from Soil Health Field Day at Simple Gifts Farm (& lots of other organic no-till videos)

NOFA/Mass YouTube Channel

https://www.youtube.com/c/nofamass/videos



Adaptation Resources for Agriculture: Responding to Climate Variability and Change in the Midwest and Northeast https://www.climatehubs.usda.gov/sites/default/files/adaptation_resources_workbook_ne_mw.pdf

Cultivating Climate Resilience on Farms and Ranches

https://www.sare.org/wp-content/uploads/Cultivating-Climate-Resilience-on-Farms-and-Ranches.pdf?inlinedownload=1

The Adaptation Workbook https://adaptationworkbook.org/

Adaptation Resources for Agriculture: Case Studies

https://www.climatehubs.usda.gov/hubs/topic/adaptation-resources-agriculture-case-studies-using-adaptation-workbook

American Farmland Trust Climate Programs https://farmland.org/project/climate/

Soil Health and Organic Farming: Organic Practices for Climate Mitigation, Adaptation and Carbon Sequestration https://ofrf.org/soil-health-and-organic-farming-reports/



Resources Shared in the Webinar Chat Portal

Simple Gifts Farm Field Day Video: <u>https://www.youtube.com/watch?v=V0-rXH8YkA4</u>

Xerces Society Invertebrate Conservation: https://www.xerces.org/

SARE – Pollinator Habitat: https://www.sare.org/sare-category/crop-production/pollination/pollinator-habitat/

Savanna Institute – Agroforestry in the Midwest: https://www.savannainstitute.org/

USDA Climate Hubs: <u>https://www.climatehubs.usda.gov/</u>

The Fourth National Climate Assessment <u>https://nca2018.globalchange.gov/</u>

"Tarping in the Northeast: A Guide for Small Farms," <u>https://extension.unh.edu/blog/2022/03/new-tarping-guide-available</u>

Johnny's Beat the Heat Webinar: https://www.johnnyseeds.com/growers-library/webinar/webinar-series-lettuce-and-greens-for-southern-growers.html

Climatelinks – Global Knowledge Portal: <u>https://www.climatelinks.org/sector/adaptation</u> USAID – Climate-Resilient Development: <u>https://pdf.usaid.gov/pdf_docs/PBAAA245.pdf</u>

Dry Farming Institute: https://dryfarming.org/

USDA – Dry Farming in the Pacific Northwest: https://www.climatehubs.usda.gov/hubs/northwest/topic/dry-farming-techniques-maritime-pacific-northwest

OSU Dry Farming Info: <u>https://smallfarms.oregonstate.edu/smallfarms/dry-farming</u>

https://smallfarms.oregonstate.edu/dry-farming-demonstration

WSDA – Dry Farming in the Pacific Northwest: <u>https://wastatedeptag.blogspot.com/2017/10/beyond-wheat-dry-farming-in-pacific.html</u>

Resources from the AFT Worksheet

Primary References

Adaptation Resources for Agriculture "Cultivating Climate Resilience on Farms and Ranches" Adaptation Resources for Agriculture: Case Studies Building Soils for Better Crops Managing Cover Crops Profitably

Websites and Organizations

The Adaptation Workbook USDA Climate Hubs U.S. Climate Resilience Toolkit American Farmland Trust: Climate Link to find local NRCS office Climate Adaptation Knowledge Exchange Fourth National Climate Assessment Sustainable Agriculture Research and Education (SARE) Outreach Videos

Technical Resources

NRCS Climate Smart Conservation Practices SARE Ensuring Sustainable Field Crop Agriculture in the Face of a Changing Climate Tile Drainage Fact Sheet SARE Outreach videos Tarping in the Northeast

Regional Resources

The Farming and Climate Change Program at the UVM **Extension Center for Sustainable Agriculture Cornell Climate Smart Farming Program** Quick Guide to "Climate Change and Agriculture in Vermont" UVM Farming & Climate Change: New England Farmers Adapt video series **New England Adaptation Survey** Northeast Cover Crops Decision Tool Midwest Cover Crop Selection Tool (Row and Vegetable Crop Tools) **Colorado Small Acreage Irrigation Guide Climate Adaptation Resources for Northern New England** Farmers California Climate and Agriculture Network (CalCAN) Cal-Adapt (California Climate Tool) Agriculture Climate Network: Climate and Agriculture Research for the Northwest