

## Northeast State Climate Change Implementation Plans: Agriculture and Forestry

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Agricultural production and climates vary across the Northeast United States, necessitating different strategies to mitigate, and adapt to, climate change. In response to current and projected future changes in the region's climate, most states have begun to develop their own plans to reduce emissions and promote adaptation across sectors. While agriculture is a relatively minor source of greenhouse gas emissions in the Northeast, it can play a major role in both emissions reductions and carbon sequestration. Additionally, forests dominate much of the Northeast landscape, and forestry is both a major economic driver in the region and a source of significant carbon sinks for states in the region.

Below is a brief summary of agriculture and forestry production in Northeast states, as well as a list of mitigation and adaptation practices identified by state climate change plans. These summaries are not comprehensive, but rather offer a snapshot of the major industries in each state, and what states have identified as major actions to reduce emissions and adapt to climate change in their agriculture and forestry sectors.

### Connecticut

Agriculture is a key sector in Connecticut, producing upwards of \$3.5 billion annually, which has made the state the top ranked in New England in terms of market value per farm and per acre. The highest grossing farm commodities in Connecticut are greenhouse and nursery crops, dairy, eggs, aquaculture, and cattle and calves. Forestry is another important industry in Connecticut, with forests covering 60 percent of the state's land area, and contributing nearly \$2.2 billion annually to the state's economy, largely from paper manufacturing. Agriculture accounts for 0.7% of Connecticut's total annual GHG emissions.

According to a 2010 report on climate mitigation in Connecticut by the Northeast States for Coordinated Air Use Management (NESCAUM) coalition, climate mitigation efforts through agriculture should focus on conserving and enhancing carbon sequestration in Connecticut's fields and forests through:

- Conserving agriculture and forest lands;
- Improving management practices such as no-till agriculture;
- Forest "thinning" or "restocking".

*Connecticut Greenhouse Gas Emissions: Mitigation Options Overview and Reduction Estimates (2010):*  
<http://www.ct.gov/deep/lib/deep/climatechange/dec-17-2010-ct-ghg-emissions-mitigation-reportv2.pdf>

### Delaware

Delaware agriculture contributes nearly \$8 billion to the state economy annually. Broilers are the top agriculture commodity in the state (74 percent of all sales), followed by corn, soybeans, wheat, and greenhouse and nursery products. Delaware ranks number one nationally for the value of agricultural products sold per farm and the value of agricultural production produced per acre of land in farms. Agriculture accounts for around 4 percent of Delaware's total annual GHG emissions. Forest products contribute around \$4 million annually to the state economy, and remove about 44,000 metric tons of carbon annually from the atmosphere.

The 2014 Climate Framework for Delaware focused on steps the state could take to adapt its land sector to a changing climate:

- Evaluate response to increased susceptibility to forest wildfires by evaluating policies related to risk management, fire prevention, and fire management;
- Evaluate policies related to nutrient management, pesticide application, risk assessment, and cropping practices that may be affected by potential increases in the number of hot, dry days per year;
- Educate landowners and agricultural operators to address and mitigate loss of land due to sea level rise;
- Educate landowners and agricultural operators on the effects of saltwater intrusion resulting from sea level rise.

*Climate Framework for Delaware (2014):*

<http://www.dnrec.delaware.gov/energy/Documents/The%20Climate%20Framework%20for%20Delaware.pdf>

## **Maine**

Maine's agriculture industry accounts for nearly 25 percent of New England's total agriculture production, and adds over \$600 million to the state's economy annually. Potatoes and other vegetable crops account for over a quarter of all farm sales in the state, followed by dairy and fruit. Commercial fishing and aquaculture are also important sectors in this coastal state. Forestry and the forest products sector account for an even larger share of the state's economy, around \$8 billion every year. Nearly 60 percent of the forest land in Maine has been certified as sustainable by independent auditors, more than any other state in the nation. Only around 3 percent of the state's greenhouse gas emissions originate from the agriculture sector.

In 2004, Maine released its Climate Action Plan, which identified a number of voluntary options to reduce GHG emissions from Maine agriculture and forestry sectors:

- Promote locally grown produce;
- Increasing soil carbon reserves;
- Protecting agriculture land from conversion to other uses;
- Increasing the amount of land dedicated to organic farming;
- Better nutrient management;
- Increasing the growth of biomass for biodiesel;
- Planting faster growing trees;
- Protecting forestland;
- Early commercial thinning, timber harvest to capture anticipated mortality;
- Increasing the use of wood as a bioenergy feedstock;
- Expanding use of wood products;
- Increasing planting of softwoods.

*Climate Action Plan for Maine (2004):*

<http://www.eesi.org/files/MaineClimateActionPlan2004Volume%201.pdf>

## **Maryland**

Agriculture is the largest commercial industry in Maryland, with around one-third of the state's land dedicated to agriculture production, and agriculture receipts totaling around \$2.7 billion annually. Poultry is Maryland's leading farm product, followed by dairy, greenhouse and nursery products, as well as corn and soybean production. Poultry and egg production alone account for 49% of Maryland's total agriculture sales and 75% of livestock sales. Maryland also has a forestry industry that produces around \$4 billion annually. Agriculture accounts for around 2 percent of the state's total GHG emission.

A 2011 report from the Maryland Department of the Environment outlines mitigation options through agriculture and forestry, including:

- Managing forests to capture carbon;
- Creating ecosystems markets to reduce emissions;
- Increasing urban trees to capture carbon;
- Creating and protecting wetlands and waterway borders to capture carbon;
- Planting forests;
- Expanded use of forests and feedstocks for energy production;
- Conservation of agriculture land for GHG benefits;
- Buy Local for GHG benefits;
- Nutrient trading (e.g. cap-and-trade for nutrient runoff).

These mitigation options together are projected to reduce total GHG emissions by 9.72 MMtCO<sub>2</sub>e by 2020 (12 percent of the total emissions reductions expected in the state by that year).

*Maryland's Plan to Reduce Greenhouse Gas Emissions (2011):*

(<http://www.mde.state.md.us/programs/Air/ClimateChange/Documents/2011%20Draft%20Plan/2011GGRADRAFTPlan.pdf>)

## **Massachusetts**

Smaller farms producing specialty crops largely dominate agriculture production in Massachusetts. For example, Massachusetts ranks 43<sup>rd</sup> in the nation for agriculture production, but it ranks 4<sup>th</sup> in the nation for net farm income per acre, and six of the state's counties rank in the top two percent in the US for direct sales to consumers. The cranberry industry is the second largest agriculture sector in the state, making Massachusetts the second largest producer of cranberries in the nation. Combined with other fruits, vegetables, and greenhouse and nursery production, these sectors made up nearly 70 percent of all Massachusetts agriculture cash receipts in 2012 (around \$492 million). More than 63 percent of the state is forested, and forestry and related industries contribute nearly \$16 billion annually to the state's economy. In 2011, agriculture accounted for only 0.3 percent of the state's total GHG emissions.

According to the 2011 Massachusetts Climate Change Adaptation Report, much of state's strategy to respond to climate change through its agriculture sector centers around expanding its already strong local food economy. Key to this strategy includes:

- Promoting more "buy local" efforts and supporting community and urban gardening to reduce transportation distance for agriculture products;
- Building and expanding storage facilities to protect produce after harvest;

- Develop more local energy production on agricultural lands (e.g. solar, wind, tidal and wave power);
- Development of alternative irrigation and water storage strategies;
- Continue to protect farmland from conversion.

*Massachusetts Climate Change Adaptation Report (2011):*

<http://www.mass.gov/eea/docs/eea/energy/cca/eea-climate-adaptation-report.pdf>

### **New Hampshire**

New Hampshire's agriculture industry generates around \$930 million annually, representing over 2 percent of the state's GDP. Around 84% of New Hampshire is forested land, with forestry and related industries contributing over \$2.3 billion annually (nearly 4% of the State Gross Product). Key to New Hampshire's forestry industry is maple sugar production (\$3 million annually) and tourism around the fall foliage (\$292 million annually). Agriculture accounts for about 2 percent of the state's GHG emissions, while its forests serve as a large sink of GHG emissions.

According to the 2009 New Hampshire Climate Action Plan, strategies to reduce emissions from the land sector include:

- Increasing carbon storage through changes in forestry practices;
- Using biomass for energy;
- Promotion of sustainable wood products;
- Protection of agriculture and forested land from conversion;
- Promotion of fire suppression activities in response to increased fire risk;
- Maintaining forest reserves to protect biodiversity in the face of climate change.

*New Hampshire Climate Action Plan (2011):*

<http://www.nhcf.org/document.doc?id=37>

### **New Jersey**

New Jersey farms generate around \$1.14 billion in annual sales, producing over 100 different varieties of fruits and vegetables. Nursery and greenhouse products, and fruits and vegetables are the main crops grown in the state. Top vegetables include bell peppers, asparagus, eggplant, and major fruit crops include cranberries, blueberries, and apples. Horses are the most valuable livestock product in New Jersey, accounting for about 12 percent of the state's total agriculture receipts. Forestry is a relatively small industry in New Jersey, generating only around \$218.1 million in annual sales. Agriculture accounts for 0.4 percent of New Jersey's total GHG emissions (0.48 MMtCO<sub>2</sub>e annually), while forests and other land sectors sequester around 6.5 MMtCO<sub>2</sub>e annually.

A 2009 report from the New Jersey Department of Environmental Protection outlined a number of options available to mitigate climate change through agriculture and the land sector, including:

- Encouraging, where practical, minimum tillage/no tillage/conservation tillage farming;
- For conventional tillage methods, ensuring that farmers plant cover crops during the winter;
- Harmonizing the 2008 Farm Bill and New Jersey statewide GHG limits;
- Providing demonstration and education programs, and encouraging the use of methane abatement processes from livestock waste and techniques for managing nutrients back to the farmlands from livestock waste;

- Investigating the feasibility of encouraging farmers to utilize certain fertilizer application methods which reduce the release of nitrous oxide;
- Managing an overabundant deer population that impacts forest regeneration and consequently forest carbon sequestration.

*Meeting New Jersey's 2020 Greenhouse Gas Limit: New Jersey's Global Warming Response Act Recommendations Report (2009):*

[http://www.nj.gov/dep/sage/docs/njgrwa\\_final\\_report\\_and\\_appendices\\_dec2009.pdf](http://www.nj.gov/dep/sage/docs/njgrwa_final_report_and_appendices_dec2009.pdf)

## **New York**

The agriculture sector in New York State encompasses about one-quarter of the state's land area (more than 7.5 million acres) and contributes \$4.5 billion annually to the state's economy. Dairy is the major agriculture commodity, accounting for over half of all farm cash receipts (\$2.4 billion). Hay, grain silage, corn, and apples are other major agriculture products in the state. Forestry is another major industry for New York, contributing nearly \$4.6 billion annually to the state's economy, largely through wood and pulp production. Agriculture accounts for nearly 2 percent of New York State's total GHG emissions (almost 5.5 MMtCO<sub>2</sub>e per year), nearly 62 percent of which comes from livestock, mainly dairy production. New York's forests sequester an estimated 19.5 MMtCO<sub>2</sub>e annually.

In 2009, the New York Climate Action Council released an interim report outlining actions the state can take to reduce agriculture emissions across the state, including:

- Production and conversion of sustainable feedstock for electricity, heat, steam production, and liquid/gaseous biofuels;
- Maximizing waste reduction, recycling, and composting;
- Integrating climate mitigation into farm management planning;
- Conserve open space, agricultural land and wetlands;
- Increase on-farm energy efficiency and production of renewable energy;
- Forest restoration and reforestation, and promotion of urban forestry

*New York State Climate Action Council Interim Report (2010):*

[http://www.dec.ny.gov/docs/administration\\_pdf/irchap9.pdf](http://www.dec.ny.gov/docs/administration_pdf/irchap9.pdf)

## **Pennsylvania**

Agriculture contributes around \$7.5 billion annually to Pennsylvania's economy, making up nearly one in every seven job in the state. Livestock and related products, namely dairy, account for around 40 percent of Pennsylvania's farm income. Pennsylvania dairy production creates \$2.3 billion in annual sales, and accounts for 6.7 percent of the nation's total national supply. Pennsylvania leads the nation in mushroom production, and is a major grower of winter wheat, apples, cherries, and other specialty crops. Forestry, primarily hardwood production, is a major industry in the state, producing around \$17 billion in annual sales. Agriculture accounts for around 2.7 percent of total statewide emissions (8.63 MMtCo<sub>2</sub>e), while forestry sequesters around 20.44 MMtCo<sub>2</sub>e annually.

Pennsylvania's Climate Action Plan from 2013 outlined initiatives that can be taken in the agriculture and forestry sectors to reduce GHG emissions in the state, including:

- Promoting sustainable forest management;
- Protecting Pennsylvania's forested and agriculture land;
- Increasing urban and suburban tree planting;
- Promoting energy efficiency;

- No-till agriculture.

*Pennsylvania Climate Change Action Plan Update (2013):*

[http://files.dep.state.pa.us/Energy/Office%20of%20Energy%20and%20Technology/OETDPortalFiles/Climate%20Change%20Advisory%20Committee/2013\\_12/DRAFT\\_Climate\\_Change\\_Action\\_Plan.pdf](http://files.dep.state.pa.us/Energy/Office%20of%20Energy%20and%20Technology/OETDPortalFiles/Climate%20Change%20Advisory%20Committee/2013_12/DRAFT_Climate_Change_Action_Plan.pdf)

## **Rhode Island**

Agriculture is a relatively minor industry in Rhode Island, accounting for \$100 million in annual sales (a conservative estimate), but still covers around 10% of the total land in the state. The major commodities grown in the state are greenhouse and nursery products, dairy, sweet corn, aquaculture, and apples. Only one percent of the food consumed in Rhode Island is produced in state, but a growing market for locally produced food has helped make Rhode Island one of the few states in the nation where the number of farms is increasing rather than decreasing. Forestry and related industries produces around \$1.1 billion in annual sales. Agriculture is responsible for around 0.4% of Rhode Island's total GHG emissions load, while forests in the state sequester nearly 12.5 MMTCO<sub>2e</sub> annually.

In July 2014, Rhode Island's governor established the Executive Climate Change Coordinating Council which was charged with developing a comprehensive approach (including both mitigation and adaptation) to address the potential threats from climate change to the State's environment, economy and its people. While plans are still under development, an action plan update from November 2014 lists the following actions under consideration to address climate change through agriculture:

- Reduce agriculture emissions through increased use of composting and methane digestion facilities;
- Promote smart land use, biomass retention, and other carbon-fixing measures.

*Rhode Island Executive Climate Change Council: Action Plan Update (2014)*

[http://www.planning.ri.gov/documents/climate/11\\_14/EC4%20Full%20Action%20Plan%20Updates%20Nov%202014.pdf](http://www.planning.ri.gov/documents/climate/11_14/EC4%20Full%20Action%20Plan%20Updates%20Nov%202014.pdf)

## **Vermont**

Agriculture in Vermont is dominated by dairy and livestock production, which together accounted for nearly 82 percent of the state's agriculture receipts in 2012. Vermont is the 3<sup>rd</sup> most forested state in the contiguous United States, and is the nation's largest producer of maple syrup and a large producer of Christmas trees. Agriculture in Vermont contributes around \$688 million to the state economy annually. Forest products in Vermont generate \$1.4 billion annually. Only 1 percent of Vermont's GHG emissions originate from the agriculture sector, while the state's forests serve as a major carbon sink, removing approximately 8.23 MMTCO<sub>2e</sub> of carbon from the atmosphere per year.

The Vermont Climate Assessment recommends that a number of mitigation practices be implemented in the land sector, including:

- Improve carbon sequestration in biomass and soils;
- Decrease the use of fuels and synthetic fertilizers;
- Reduce methane emissions from livestock production;
- Increase on-farm energy efficiency;
- Adaptive management of Vermont's forests to ensure they continue to remove carbon dioxide from the atmosphere in the face of increased environmental stressors due to climate change.

*Vermont Climate Assessment (2014):*

[http://dev.vtclimate.org/wp-content/uploads/2014/04/VCA2014\\_FullReport.pdf](http://dev.vtclimate.org/wp-content/uploads/2014/04/VCA2014_FullReport.pdf)

### **West Virginia**

West Virginia agriculture generates around \$560 million in annual sales, largely through broiler production (around half of all agriculture sales), calves and cattle, and crops such as apples and peaches. West Virginia is the third most forested state in the nation, with the wood products industry, mainly from hardwoods, generating over \$4 billion in annual sales. Agriculture accounts for around 1.5 percent of West Virginia's total GHG emissions.

West Virginia does not have formal climate mitigation or adaptation plans, and has not released any plans for reducing emissions from its agriculture or forestry sector.

### **Regional Greenhouse Gas Initiative**

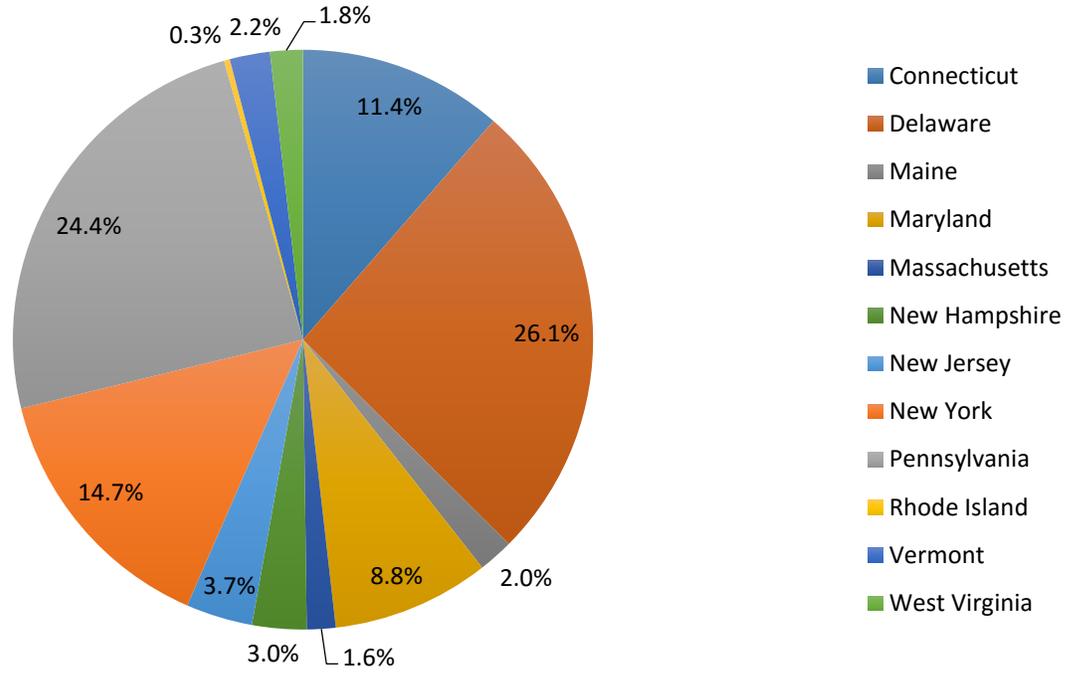
The Regional Greenhouse Gas Initiative (RGGI) is a cooperative effort among the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont to cap and reduce CO<sub>2</sub> emissions from the power sector. RGGI is the first market-based regulatory program (i.e. cap-and-trade) in the United States to reduce greenhouse gas emissions from power plants.

While RGGI is focused on reducing emissions from power plants, offset credits can be sold to power plants for management practices that reduce emissions. Two such practices related to the land sector include avoided methane emissions from agriculture manure management and forest projects that sequester carbon such as reforestation, improved forest management, and avoided conversion of forest land. Currently, regulated power plants may use CO<sub>2</sub> offset allowances to satisfy 3.3 percent of their CO<sub>2</sub> compliance obligation.

*The Regional Greenhouse Gas Initiative:*

<https://www.rggi.org>

## Percent of Agriculture Economy in Northeast US



## Percent of Forestry Economy in Northeast US

