

## Ecosystem Services

A key component of the NE-RESM is the translation of biogeophysical model outputs into actionable information to support decision-making.

Our project will generate a portfolio of information on a range of sustainability issues in the Northeast, including:

- Climate change mitigation and adaptation
- Energy security
- Food security
- Municipal water supply
- Water quality and pollution reduction
- Wildlife conservation and biodiversity
- Preservation of cultural and recreational resources

### Economic Modeling

Using the *World Trade Model*, we will be able to assess the impact of climate change and planning decisions on different sectors of the regional economy.

*“Environmental technology which duplicates the work available from the ecological sector is an economic handicap”*

- Howard Odum

## The planning decisions made over the next few years will reverberate through the 21st Century

FOR MORE INFORMATION AND TO JOIN OUR  
STAKEHOLDER MAILING LIST

Visit the project website: [ne-resm.org](http://ne-resm.org)



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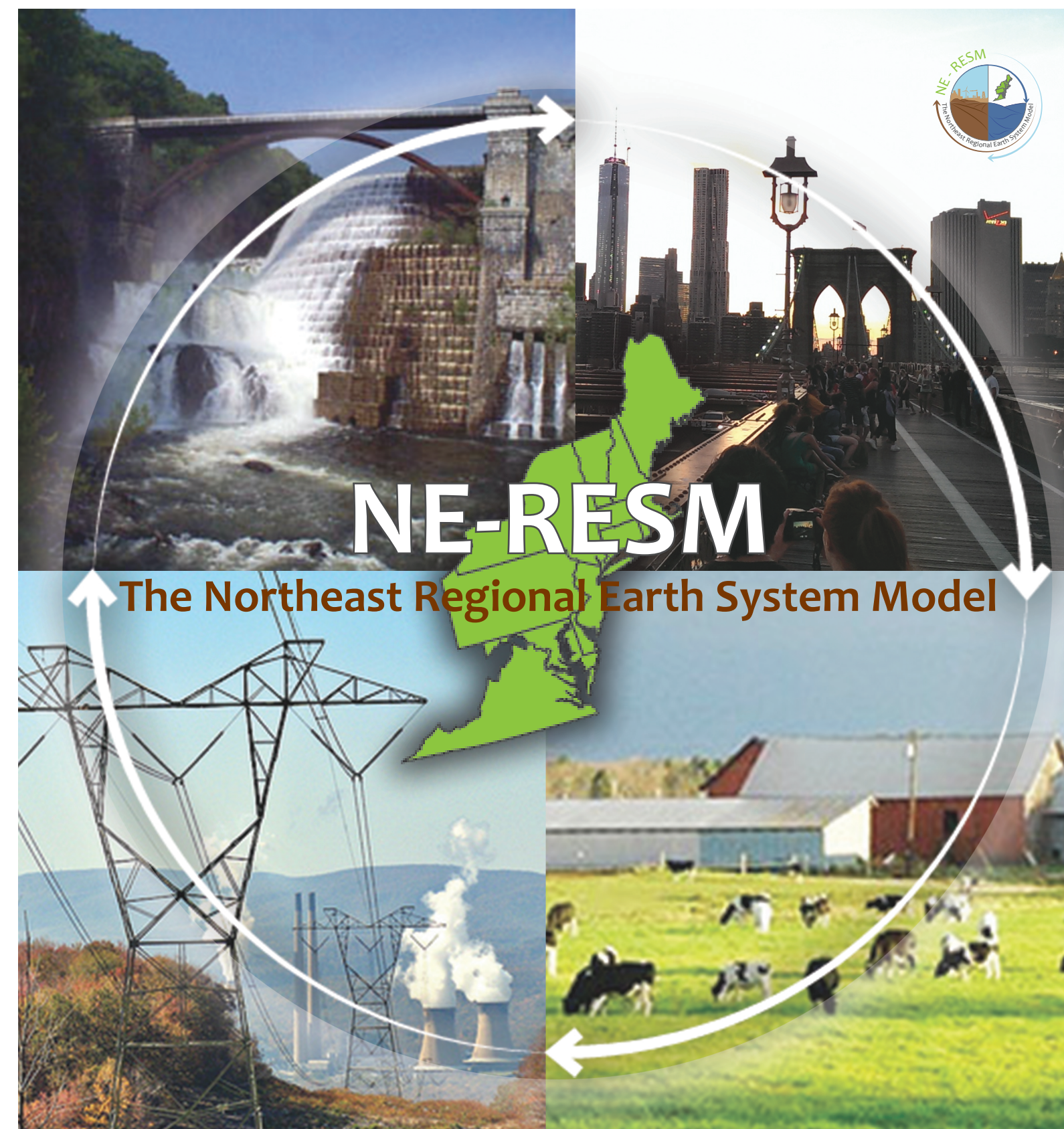
This project was also supported by the US Department of Energy and the US Department of Agriculture. It is a collaboration of researchers from the City University of New York, the University of New Hampshire, Rensselaer Polytechnic Institute, Marine Biological Institute and Brookhaven National Laboratory

Photo Credits: Cover (Clockwise):

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## Science to Support Regional Decision-Making

The Northeastern US has a rich history of strategic environmental transformations: from deforestation and land clearing to industrialization and urbanization to post-industrial, mega-city growth. The closely woven human-environment system of the region may be even more difficult to manage over the next century due to the impacts of global climate change.

Since atmospheric, aquatic and land ecosystems are closely linked through water, energy and biogeochemical cycles, changes to any one of these systems may lead to unintended feedbacks and consequences. Yet, scientific tools to assist decision-makers in understanding human-environment systems over the regional domain and decadal timescales are currently limited.

We are developing the Northeast Regional Earth System Model (NE-RESM) to better understand the interaction between our infrastructure, land, atmosphere and freshwater systems and to provide insight on the implications of regional environmental management decisions.



## NE-RESM Component Models

The NE-RESM is a framework that integrates 4 main components: **1. The Regional Biogeophysical System, 2. Impacts Assessment, 3. Policy/Stakeholder Engagement, 4. Exogenous Drivers.** Each component is supported by subsidiary modules, which include models of energy systems, atmospheric terrestrial and aquatic dynamics, ecosystem services and the economy. This modeling framework will be used to run scenarios that combine socioeconomic storylines with scenarios of climate change developed for the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report.

With each 'loop' through the NE-RESM framework of models, planners will be able to test alternative, realistic scenarios of future policies and assess their potential impacts.

## NE-RESM Component Models

**Atmospheric Dynamics:** Downscaled, Bias Corrected data from CMIP5 General Circulation Models, City University of New York

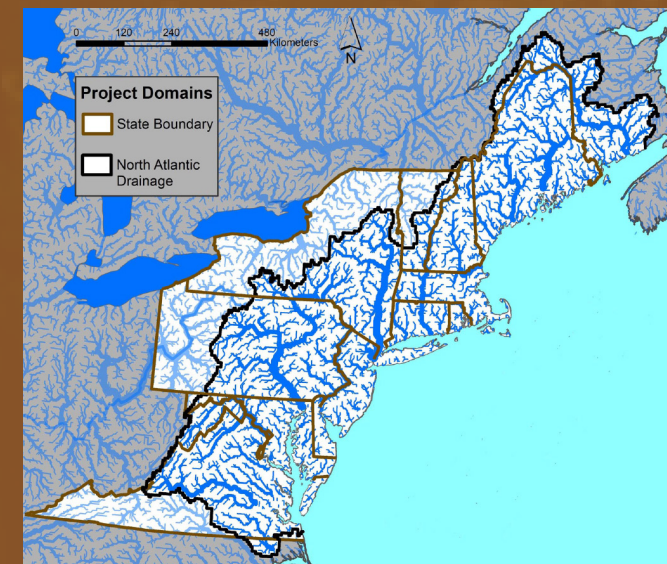
**Terrestrial Ecosystems:** The Terrestrial Ecosystem Model, Marine Biological Laboratory

**Aquatic Ecosystems:** FRAMES, WBM, TP2M, City College of New York, University of New Hampshire

**Energy Systems:** MarkAL, Brookhaven National Laboratory

**Mesoeconomic Modeling:** World Trade Model, Rensselaer Polytechnic Institute

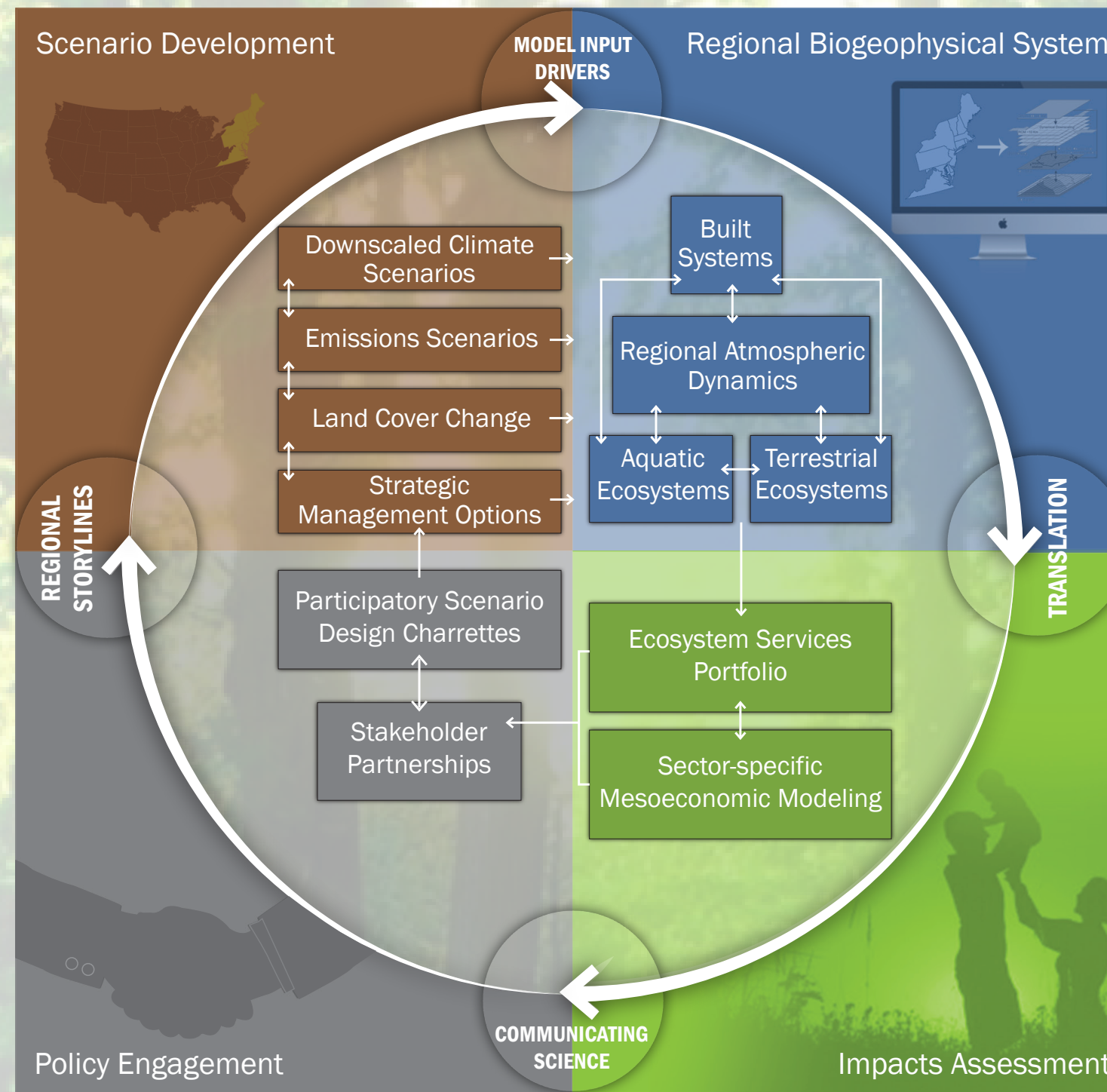
## The NE-RESM Modeling Domain



The NE-RESM encompasses the 12-state region from New England to Virginia. We focus on 4 strategic issues:

1. Energy Security and Climate Change
2. Food Security and Agriculture
3. Water Quality Protection
4. Conservation of Open Space

Scenarios to investigate these issues will be developed collaboratively with regional stakeholders and policymakers.



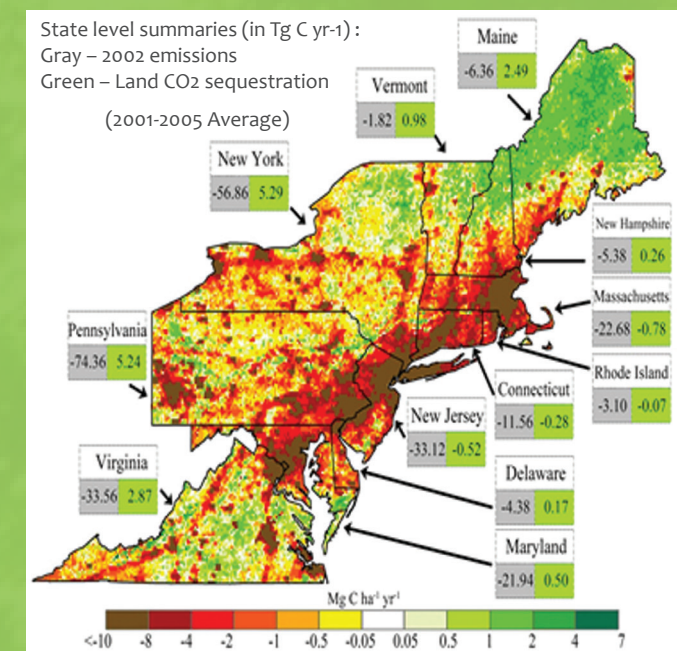
The NE-RESM Modeling Experiment 'Loop'

## Terrestrial Ecosystems

Modeling by the Terrestrial Ecosystem Model (TEM) of net sources and sinks of atmospheric carbon dioxide (CO<sub>2</sub>).

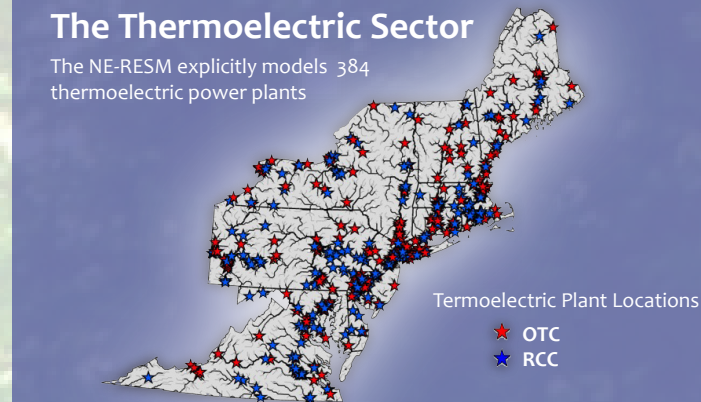
- Positive values represent carbon sequestered - *mitigating climate change*
- Negative values are carbon lost - *exacerbating climate change*

Ongoing modeling experiments will provide information on how strategic land management decisions will impact 21st Century climate change mitigation in the Northeast.



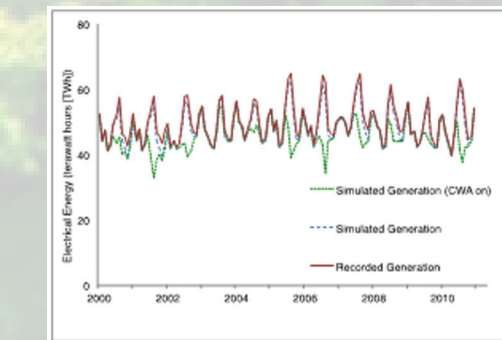
## The Thermoelectric Sector

The NE-RESM explicitly models 384 thermoelectric power plants



Changes to river flow and water temperatures from activities of the thermoelectric sector can impact aquatic ecosystems, pollutant processing and the operations of power plants downstream.

Initial experiments were conducted for the Contemporary Northeast (2000-2010) to demonstrate the technical capabilities of the NE-RESM.



Modeled Power Generation for 2000-2010 Pennsylvania with and without the Clean Water Act (CWA)

Our current work focuses on modeling experiments through 2100. Biogeophysical outputs from the NE-RESM components will be translated into needed information on ecosystem services and the economy.