

## FACT SHEET 2: ECOSYSTEM MEASUREMENTS AND MODEL OUTPUT

### New Hampshire's Changing Climate, Land Cover, and Ecosystems

Measurement and modeling efforts of ecosystems represent central research activities of the NH EPSCoR Ecosystem & Society Project:

1. Measurement of terrestrial and aquatic ecosystem function and atmospheric variables via a statewide sensor network that includes:
  - Data collection at high intensity aquatic and terrestrial networks
  - Instream data collection by the Lotic Volunteer network for sensing Temperature, Electrical Conductivity, and Stage (LoVoTECS)
  - Eddy flux tower network
  - Climate and snow data collected as part of citizen scientist observations from the Community Collaborative Rain, Albedo, Hail, Snow (CoCoRAHS Albedo)

We have also collected and organized monthly data for US Historical Climatology Network stations in New Hampshire.

2. Modeling of forest and aquatic ecosystems was accomplished by coupling of existing forest (PnET-CN) and aquatic (FrAMES) models to provide estimates of environmental condition under different scenarios. PnET-CN (Photosynthetic EvapoTranspiration with Carbon and Nitrogen), simulates forest water, carbon, and nitrogen dynamics. FrAMES (Framework for Aquatic Modeling in the Earth System) is a gridded model that represents land cover and land use to simulate runoff, and nitrogen dynamics through watersheds. PnET-CN and FrAMES were driven by statistically downscaled CMIP3 Global Climate Model Simulations and four different land cover scenarios.

The ecosystem measurements are summarized in **Table 1** and the model outputs in **Table 2**.

**TABLE 1: NH EPSCOR - ECOSYSTEM MEASUREMENTS**

#### HIGH INTENSITY AQUATIC NETWORK

**Number of Sites (Locations):** 10

(Merrimack River, Saco River, and Great Bay Watersheds)

**Date Range:** Sept. 2012 to present

**Temporal Resolution:** 15 minutes

**Variables:**

Estimated discharge (L/s)  
NO<sub>3</sub> (mg/L)  
Specific Conductivity (uS/cm)  
pH  
Turbidity (FNU)  
Water Temperature (deg C)  
Stage Height (m)  
Dissolved Oxygen (% and mg/L)

#### HIGH INTENSITY TERRESTRIAL NETWORK

**Number of Sites (Locations):** 6

(White Mountains, Mid-Transitional Forests, Seacoast)

**Date Range:** Aug. 2012 to present

**Temporal Resolution:** 10 to 60 minutes

**Variables:**

Air Temperature (deg C)  
Soil Temperature (deg C) -  
at 0cm, 15cm, 30cm  
Volumetric Water Content (m<sup>3</sup>/m<sup>3</sup>) -  
at 0cm, 15cm, 30 cm  
Electric Conductivity (uS/cm) -  
at 15cm, 30cm

#### LoVoTECS

**(Lotic Volunteer Temperature, Electric Conductance and Stage) Network**

**Number of Sites (Locations):** 126 (statewide)

**Date Range:** Feb. 2012 to present

**Temporal Resolution:** 1 to 15 minutes

**Variables:**

Specific Electrical Conductance (uS/cm)  
Water Temperature (deg C)  
Water Stage (cm)

#### EDDY FLUX NETWORK

**Number of Sites (Locations):** 4 (Seacoast)

**Date Range:** Jan. 2014 to present

**Temporal Resolution:** 30 minutes

**Variables:**

Air Temperature (deg K)  
Soil Water Content (m<sup>3</sup>/m<sup>3</sup>)  
Rain Precipitation (m)  
Relative Humidity of Air (%)  
Longwave Outgoing Radiation (W/m<sup>2</sup>)  
Longwave Incoming Radiation (W/m<sup>2</sup>)  
Net Radiation (W/m<sup>2</sup>)  
Shortwave Outgoing Radiation (W/m<sup>2</sup>)  
Shortwave Incoming Radiation (W/m<sup>2</sup>)  
Photosynthetic Photon Flux Density (umol/(m<sup>2</sup>s)),  
Wind Speed and Air Direction,  
CO<sub>2</sub> and Water Content in the Air

#### CoCoRAHS - ALBEDO

**Collection Location Count:** 33

**Number of Sites (Locations):** 33 (statewide)

**Date Range:** Dec. 2012 - Mar. 2016

**Temporal Resolution:** Daily (Dec. to Mar.)

**Variables:**

Albedo (noontime)  
Snow Depth (in),  
Snow Density (kg/m<sup>3</sup>)

#### NH CLIMATE

(Data from US Historical Climatology Network v2.5)

**Number of Sites (Locations):** 5

(Bethlehem, Durham, First Connecticut Lake, Hanover, Keene)

**Date Range:** 1895 - 2012

**Temporal Resolution:** Annual

**Variables:**

Annual Total Precipitation (in)  
Spring Total Precipitation (in)  
Summer Total Precipitation (in)  
Fall Total Precipitation (in)  
Winter Total Precipitation (in)  
Max Annual Average Temperature (deg F)  
Max Spring Average Temperature (deg F)  
Max Summer Average Temperature (deg F)  
Max Fall Average Temperature (deg F)  
Max Winter Average Temperature (deg F)  
Min Annual Average Temperature (deg F)  
Min Spring Average Temperature (deg F)  
Min Summer Average Temperature (deg F)  
Min Fall Average Temperature (deg F)  
Min Winter Average (deg F)

## TABLE 2: NH EPSCOR - MODEL OUTPUTS

### COUPLED TERRESTRIAL AND AQUATIC MODELS (PnET-CN/FrAMES)

**PnET-CN** (Photosynthetic EvapoTranspiration Model with Carbon and Nitrogen)

**FrAMES** (Framework for Aquatic Modeling in the Earth System)

**Locations:** Merrimack River and Great Bay Watersheds

**Date Range:** 1980 to 2099

**Spatial Resolution:** 1.5 km<sup>2</sup>

**Temporal Resolution:** Daily

**Variables:**

- Water Temperature (°C)
- Discharge (m<sup>3</sup>/sec)
- Chloride concentration (microS/cm)
- Watershed Chloride Flux (kg Cl / km<sup>2</sup> \* yr)
- Dissolved Inorganic Nitrogen (DIN) Concentration (mg DIN/L)
- Snow Cover (mm)
- Riverine DIN removal (kg / kg)
- Runoff (mm / watershed area \* yr)
- Storm runoff (mm / watershed area \* yr)
- Mean Forest C Sequestration (mean kg C / km<sup>2</sup> of forest \* yr)
- Wood Biomass (mean kg C / km<sup>2</sup> of watershed area)
- Total C storage (mean kg C / km<sup>2</sup> of watershed area)

### DOWNSCALED GLOBAL CLIMATE MODEL OUTPUT

**Locations:**

1. New England grid
2. Specific meteorological stations statewide

**Date Range:** 1960 to 2099

**Spatial Resolution of Gridded Output:** 1/8th of a degree (~ 9 miles<sup>2</sup>)

**Temporal Resolution:** Daily

**Global Climate Models:** CCSM3, PCM, GFDL CM2.1, HAD CM3

**Emission Scenarios:** CMIP3; A1Fi, B1

**Variables:**

- Minimum Temperature (°C)
- Maximum Temperature (°C)
- Precipitation (in)

**ACCESS TO DATA:** [ddc.unh.edu](http://ddc.unh.edu)

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