Climate Change and Forestry in Rhode Island

Climate change in Rhode Island is expected to result in increased temperatures and precipitation. Since much of the precipitation will come in storms, Rhode Island will also experience increased summer droughts between storm events. Over the coming decades, these factors will have an important impact on the species composition of our forests.

The Climate Change Tree Atlas of the USDA Forest Service documents the current and possible future distribution of 134 tree species in the Eastern United States under current and future climates. The predictions are based on 7 climate variables, 5 elevation classes, 9 soil classes, 13 soil properties and 4 land use variables. Future climate variables are predicted by three models under two carbon emission scenarios (high and low).

The Tree Atlas predicts the location of suitable habitat in the year 2100, but cannot predict the many biological and disturbance factors that will affect species distribution (insect outbreaks, fire, etc). However, the Tree Atlas provides a separate scoring system based on the available literature to assess these factors. The scoring system gauges the effect of 9 biological and 12 disturbance components on the adaptability of the species to climate change.

Table 1 on the next page presents the predictions for 23 of the most common tree species in Rhode Island. Of these species, a large decrease in suitable habitat is predicted for Eastern hemlock, Red maple, and Eastern white pine, and a smaller decrease is predicted for American beech, Northern red oak, Yellow birch and Sweet birch. Red Maple has a high rating for adaptability to climate change (8.49), which may help it cope with the decrease in suitable habitat, while Eastern hemlock has a low adaptability rating (2.69) which may make it more vulnerable. Table 1 also lists some of the positive and negative traits that affect the adaptability to climate change of each species.

For more information on forestry and climate change, visit: http://www.fs.fed.us/nrs/atlas/

Forest Adaptation

Adaptation, in the context of forest management, is action intended to enhance the ability of ecosystems to adapt to climate change and its effects. Adaptation includes a wide variety of actions that complement the sustainable management, conservation, and restoration of forests and helps to maintain ecosystem integrity and environmental benefits.

There are three broad options for responding to climate change:

- **Resistance** actions improve the defenses of the forest against anticipated changes or directly defend the forest against disturbance in order to maintain relatively unchanged conditions.
- **Resilience** actions accommodate some degree of change, but encourages a return to prior conditions after a disturbance, either naturally or through management.
- **Transition**, or response, actions intentionally accommodate change and enable ecosystems to adaptively respond to changing and new conditions. The intention is to adapt ecosystems to future conditions, rather than be caught off-guard by rapid and catastrophic changes.

Learn more about options for forestry adaptation at: http://climatehubs.oce.usda.gov/northernforests
For other types of adaption to climate change, see: http://climatehubs.oce.usda.gov/northeast

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Table 1. Predicted changes in future habitat and adaptability to climate change of 23 common tree species in Rhode Island

Predicted change in suitable habitat by 2100*	Common Name	Modifying biological and disturbance factors that will affect adaptability to climate change		
		Positive Traits	Negative Traits	Adaptability index
Large decrease	Eastern hemlock	Competition for light	Insect pests, Drought	2.69
	Red maple	Seedling establishment, Habitat specificity, Soil specificity, Competition for light, Dispersal		8.49
	Eastern white pine	Dispersal	Drought, Fire, Insect pests	3.30
Small decrease	American beech	Competition for light	Insect pests, Fire	3.56
	Northern red oak		Insect pests	5.39
	Yellow birch	Dispersal	Fire, Insect pests, Disease	3.38
	Sweet birch	Dispersal	Fire, Competition for light, Insect pests, Disease	3.18
No change	American chestnut	Competition for light	Disease, Fire	4.55
	Black cherry	Drought, Habitat specificity	Insect pests, Fire, Competition for light,	3.04
	Sugar maple	Competition for light, Habitat specificity		5.81
	White ash		Insect pests, Fire, Competition for light	2.65
	Pitch pine		Competition for light, Insect pests	3.76
Small increase	American hornbeam	Competition for light, Seedling establishment	Fire Drought	5.08
	Black oak	Drought, Habitat specificity	Insect pests, Disease	4.90
	Chestnut oak	Seedling establishment, Veg reproduction, Habitat specificity, Fire	Insect pests, Disease	6.14
	Scarlet oak	Veg reproduction, Habitat specificity, Soil specificity	Insect pests, Disease, Fire	4.56
Large increase	Blackgum	Competition for light, Fire		5.88
	Flowering dogwood	Competition for light		5.00
	Sassafras		Competition for light, Fire	4.20
	American basswood	Competition for light	Fire	4.58
	Eastern cottonwood	Seedling establishment	Insect pests, Competition for light, Disease, Fire	3.93
	Pignut hickory	Habitat specificity	Insect pests, Drought,	4.68
	White oak	Habitat specificity, Soil specificity, Seedling establishment, Fire	Insect pests, Disease	6.14

Notes: * Based on the Geophysical Fluid Dynamics Laboratory Coupled Model (GFDL) assuming the high emissions scenario of "fossil intensive" (A1FI).

Data Source: http://www.fs.fed.us/nrs/atlas/

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