NEW ENGLAND
WILD
FLOWER
SOCIETY

New England Wild Flower Society
Policy on Climate Change

Adopted by the Board of Trustees; March 21, 2007

Executive Summary

There is an overwhelming scientific consensus that the buildup of carbon dioxide and other greenhouse gasses, caused by human activity, is changing the earth's climate. The burning of fossil fuels is the principle cause of the buildup but other activities contribute to the accumulation. The increase in surface temperature over the 20th century for the Northern Hemisphere is likely to have been greater than for any other century in the last thousand years, and it is projected that on a global basis in the 21st century, earth will experience higher maximum temperatures, higher minimum temperatures, more intense precipitation events, increased summer drying, and increased storm events, among other changes. These changes pose a threat to all forms of life and ecosystems and pose a direct challenge to the conservation of the flora of New England.

The Society will lead and join in activities that are designed to both adapt to climate change and mitigate further changes. We will collaborate with other groups in plant conservation to adapt our conservation efforts to the realities of the changes coming to the New England landscape, based on scientific principles. The Society will also work to reduce its greenhouse gas emissions. Because information on climate change is rapidly evolving, this policy will be evaluated and modified annually.

A. Background:

1. Global Climate Changes

Based on the science cited by the Intergovernmental Panel on Climate Change (IPCC), there is little doubt that the earth's climate system has changed on both global and regional scales since the pre-industrial era, with some of these changes, e.g. increased concentrations of greenhouse gases and aerosols, attributable to human activities. The increase in surface temperature over the 20th century for the Northern Hemisphere is likely to have been greater than for any other century in the last thousand years, and it is projected that on a global basis in the 21st century, earth will experience higher maximum temperatures, higher minimum temperatures, more intense precipitation events, increased summer drying, and increased storm events, among other changes (IPCC, 2001. Climate Change 2001: Synthesis report, Summary for Policymakers). A 2007 report from IPCC finds additional reinforcement for these predictions, and additional evidence for the link between these changes and anthropogenic activities. (IPCC, 2007. Climate Change 2007: The Physical Science Basis, Summary for Policymakers.)

2. Regional Climate Changes

In October 2006, the Northeast Climate Impacts Assessment (NECIA) collaboration between the Union of Concerned Scientists and a team of independent experts released a new assessment of climate change and associated impacts on key climate-sensitive sectors in the northeastern United States (Union of Concerned Scientists, 2006.). The collaboration formulated two climate change scenarios for the 21st century, one where emissions continue to grow rapidly (higher emissions scenario), and a second where emissions grow at a slower rate (lower emissions scenario). Under either scenario the Northeast of the future will be a different place (see Appendix A for diagram of climate migration scenarios):

- Temperatures across the region are likely to rise by 2.5 to 4°F. in winter and 1 to 3°F. in summer, but under the higher emission scenario, winters could warm 8-12°F. and summers could be 6-14°F warmer.
- A more than 10 percent increase in the number of annual extreme rainfall events and a 20% increase in the maximum amount of rain that falls in a five-day period each year.
- Increases in winter precipitation of 20 to 30%, as rain rather than snow. By the end of the century the length of winter snow season would be cut in half under the higher emissions scenario.
- Under the lower emissions scenario, Boston could experience an average of 30 days over 90°F. (currently [2006] 10-15 days per year) and only a few days per year over 100°F. (1 or 2 days currently). The higher emission scenario predicts 30-60 days of temperatures over 90°F. and 8-14 days over 100°F.
- The character of the seasons will change significantly: spring could arrive anywhere from two weeks (lower scenario) to three weeks earlier (higher scenario); summer would arrive one week (lower scenario) to three weeks earlier (higher scenario), and extend a week and a half further (lower) to three weeks further (higher scenario) into fall.
- The likelihood of summer drought would increase only slightly under the lower scenario, but would increase significantly under the upper scenario with short term droughts (lasting one to three months) becoming as frequent as once per year by the end of the century.
- Regardless of the scenario, a combination of higher temperatures, increased evaporation, expanded growing season, and other factors will cause summer and fall to become drier, with extended periods of low stream flow. This will reduce the availability of water from northeastern rivers to natural ecosystems, agriculture and other needs.
- By the end of the century, sea level will rise anywhere from a few inches to less than a foot under the lower scenario, but could rise eight inches to three feet under the higher scenario. Under the higher scenario, the potential melting of the Greenland and West Antarctica ice sheets could cause a sea-level rise of more than 20 ft. over the next few centuries.

3. Changes in Ecosystems in New England

As a result of this climate shift, changes in New England vegetation patterns have been projected, most dramatically in forest types. Current ecosystem models have great difficulty in predicting these kinds of biological and ecological response, thus leading to large uncertainties in projections. Nonetheless, general predictions include (complete citations and references in Appendix A):

- Plant species are expected to shift with their climate zones. The new plant communities that result from these shifts are likely to be different from current plant communities because individual species will very likely migrate at different rates and have different degrees of success in establishing themselves in new places.

- The geographical range of many species in North America, especially forest species, is projected to shift northward. By the end of the 21st century for example, the optimal range for some northeastern tree species could have moved 100 to 300 miles (or more) northward.

- Changes include the likely extirpation of the spruce-fir forest types from New England; the reduction, but possible retention of aspen-birch; a large reduction in Maple-beech-birch; and an increase in oak-hickory and oak-pine types. Maple/ Beech/Birch, is very likely to be completely displaced by more southern forest types by the end of the 21st century.

- The projected increase in evapotranspiration and evaporation could eliminate most bog ecosystems, and increases in water temperature may increase bioaccumulation, and possibly biomagnification, of organic and inorganic contaminants. Not all change may be adverse.

- An increase in diseases, parasites, and invasive species can be expected. Temperature changes can weaken the immune systems of many species while encouraging the growth of many pests and parasites to flourish.

B. New England Wild Flower Society Policy on Climate Change

Climate change has important implications for the Society. While we support broad national and global efforts to reverse the direction of global climate changes, our actions must focus on changes in natural ecosystems and plant health in New England. To date, plant conservation in New England has been accomplished by a combination of land preservation followed by habitat management as needed to preserve target elements. Because of changes in the composition of ecosystems, and the species that make up these ecosystems, plant conservation will need to adopt a different paradigm. The concept of "native to New England" (or a state within New England) will change as native plants from the south move northward into our region. Plant community concepts will likely need revision as assemblages of plants become rearranged. Amidst these changes,

difficult questions include, "What is a natural community?" "How do we accommodate shifting species and processes?" and "How do we decide which plants deserve protection as rare native plants?" The Wild Flower Society and its collaborators in plant conservation must be ready to adapt their conservation efforts to the realities of the changes coming to the New England landscape. These collaborations will need to develop the best scientific rationales for conservation action.
In light of the climate disruptions cited above, the Society will adopt two approaches: Adaptation and Mitigation. Adaptation, which can be autonomous or policy-driven, are adjustments in practices, processes, or structures to take account of changing climate conditions (IPCC, 2001, Working Group II: Impacts, Adaptation and Vulnerability.) Mitigation are those actions that are taken to constrain climate change directly (i.e. a reduction in greenhouse gases) (IPCC, 2001, Working Group III: Mitigation.)

Accordingly, the New England Wild Flower Society will:

1. Partner with conservation groups, to develop rational conservation strategies in light of changes to the New England landscape.

2. Advocate changes in environmental laws and programs that help to mitigate and adapt to climate changes with other conservation and environmental partners.

- Work with advocacy groups to set realistic priorities and effective actions.
- Support land protection: Large, unfragmented and linked tracts of land are most likely to enable plants to rearrange themselves successfully on the landscape. We encourage and support agencies and organizations pursuing protection of large tracts of land.

3. Reduce our impact.
As an organization we will reduce our contribution to global climate change. Although some changes are now unavoidable, as demonstrated by the differing predictions in the two emissions scenarios of the Northeast Climate Impacts Assessment (NECIA), "the extent of change and the impact of these changes on the Northeast depend to a large degree on the emissions choices we in the Northeast and the world make today. "

- Use low carbon energy sources when available.
- Build sustainable structures with low energy requirements.
- Compost, recycle, and re-use as many materials as possible.

4. Develop Responsive Management Strategies.
We will aid in helping species move northward, if necessary, while protecting those that remain.

- Seed Banking. Since we do not yet know the precise effect of climate disruption on New England, we will collect seeds of rare and common species in order to preserve as wide a range of genotypes as possible for future restoration projects.
- Invasive Species Control. We will control invasive species (however they ultimately may be defined) in the New England landscape, both to reduce competition with and increase the chances for survival of native species.
- Responsive Management. Examples might include assisting plants in their movement (because plants cannot move quickly enough to adapt to shifting

temperatures) or replanting invaded habitats with ecologically successful genotypes of native plants

5. Community Awareness/Participation.
The Society will continue to educate and involve the citizens of New England in mitigation and adaptive strategies.

Because the effects of climate change are not certain, this policy will be evaluated and modified annually.

Appendix A.

1. Projected climate “migrations (Union of Concerned Scientists, 2006.)

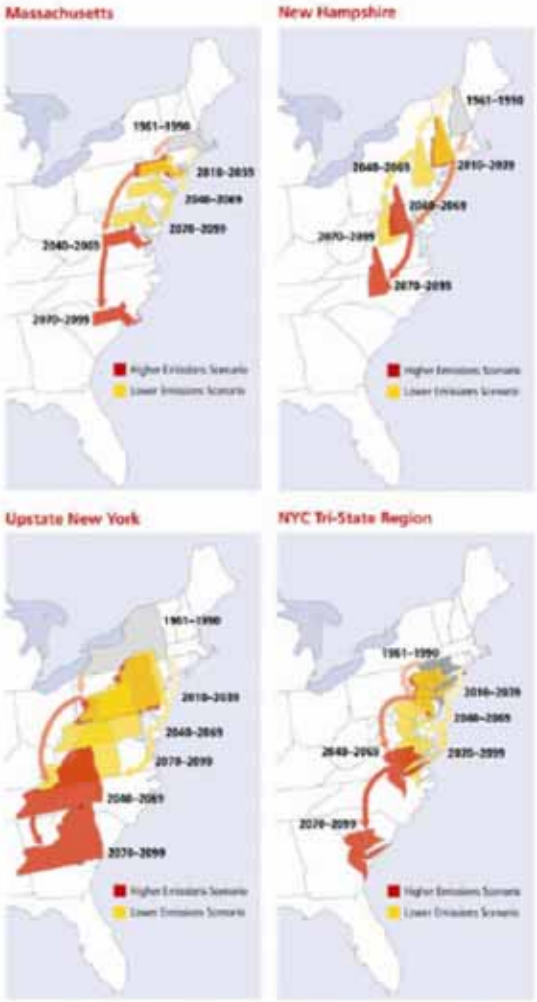

Figure 4: Projected climate "migrations" for several states and regions in the Northeast, based on average summer heat index, under the lower- and higher-emissions scenarios. Based on the average of the GFDL, HadCM3 and PCM model projections.

BOX 5: HEAT INDEX

Heat index is defined as the temperature perceived by the human body based on both air temperature and the amount of moisture or humidity present in the air.

The impact of changes in summer heat and humidity can best be illustrated by comparing the types of future conditions expected in northeastern states with states along the southeastern U.S. coast (Figure 4). For example, based on present-day average heat index values, the state of Massachusetts is projected to resemble New Jersey under the lower-emissions scenario by mid-century, and Maryland under the higher-emissions scenario.

With higher emissions, a typical summer day may feel 12 to 16°F warmer late in this century.

Even greater changes are expected by the end of the century. Under higher emissions, the typical northeastern summer day is projected to feel 12 to 16°F warmer than it did on average between 1961 and 1990 (the historical reference period used in this study). Thus, an average summer in the NYC Tri-State region could resemble those of South Carolina today under the higher-emissions scenario, and Virginia under the lower-emissions scenario. Summers in New Hampshire and upstate New York are projected to feel more like current summers in North Carolina and Georgia, respectively, under the higher-emissions scenario, and like Virginia under the lower-emissions scenario.

B. References

- Changes in the composition and distribution of the plants and animals of the region are to be expected in connection with the impacts of climate changes on forests. The changes are likely to take place over several time scales. Trees and forests change slowly -- e.g., two to three centuries -- unless that change is accelerated by unexpected or secondary factors like fire, disease, and insects. But short-lived grasses and perennial plants can change quickly. Changes in the animal populations depend on whether the species require fast- or slow-changing vegetation types for habitat, or whether the physical environment puts limitations on their current populations (U.S. Global Change Research Program, 2006. Section: Forests)

- In response to projected climate changes, the general geographical range of many tree species is projected to shift northward. By the end of the 21st century for example, the optimal range for some northeastern tree species could have moved 100 to 300 miles (or more) northward. However, historical records show that trees are generally only able to successfully develop at rates of about 8 to 31 miles per century depending on methods of seed distribution. Because of acorn distribution by blue jays, the presence of oaks may be able to move northward at a relatively rapid rate while maples will be slow moving because their seeds are dispersed by wind. (Ibid.)

- Specific states in New England currently have extensive forest cover; for example: Maine is 89% forested; New Hampshire, 88%; Vermont, 78%. Over the next 100 years, climate change could have a noticeable effect on these forests. One climate model study carried out by the World Wildlife Fund suggests that a warming of 4.5˚F over the next century would cause 44% of the current habitats of Maine and 35% of New Hampshire's to change. (Ibid.)

- Seeds dispersed by birds are often able to grow many miles from the parent tree, while wind-dispersed seeds travel only a few feet from the parent tree. The difference in their historical migration rates and the potential changes in their ranges raise concerns that some tree species will not be able to keep up with the climate alterations in their ranges without assistance. (Ibid.)

- Looking at sugar maples over the last century, some studies found no evidence of widespread decline of this species in New England and New York while others found that large-scale die-offs have occurred when temperatures were warmer than normal. If the studies that suggest die-off associated with winter warmth are accurate, this would indicate that sugar maples are susceptible to summer droughts and mid-winter thaws that result in the loss of snow cover. Forests also could have to endure increased exposure to other stresses that can be directly or indirectly associated with climate change, such as fire, floods, windstorms, and the outbreak and increased ranges of pests and pathogens. (Ibid.)

- Changes include the likely extirpation of the spruce-fir forest types from New England, the reduction, but possible retention of aspen-birch, a large reduction in

Maple-beech-birch, and an increase in oak-hickory and oak-pine types. Maple/ Beech/Birch, is very likely to be completely displaced by more southern forest types by the end of the 21st century. Maples are projected to die-out in the NE region, except for isolated high elevation sites. Maple sugar production will decline as will fall color. (Ibid)

- The projected increase in evapotranspiration and evaporation could eliminate most bog ecosystems, and increases in water temperature may increase bioaccumulation, and possibly biomagnification, of organic and inorganic contaminants. Not all change may be adverse. For example, a decrease in runoff may reduce the intensity of ongoing estuarine eutrophication, and acidification of aquatic habitats during the spring snowmelt period may be ameliorated (Moore et al., 1998)

- Plant species are expected to shift with their climate zones. The new plant communities that result from these shifts are likely to be different from current plant communities because individual species will very likely migrate at different rates and have different degrees of success in establishing themselves in new places. (Pitelka, 1997).

- Systems may be more vulnerable to invasion by exotic species. The conditions of global climate change greatly favor the survival and spread of the hardy, aggressive, quick-moving invasive species, and decrease the chance of survival for more delicate native species that have evolved in the unique conditions of a given place. (Dukes and Mooney, 1999)

- Moderate warming can result in the migration of plant species. Alpine species in high mountains can be pushed upwards in elevation and be eliminated if already at mountain summits. Most at risk in New England would be the smaller alpine areas, all those in the Adirondack and Green Mountains and, excluding Mount Washington and Katahdin, all others in NH and ME. (Kimball, 1997.)

- Sea level is predicted to rise substantially along the coastal northeast, causing a lost of coastal wetlands, and increasing saltwater migration upstream unless freshwater runoff is increased. Erosion rates are difficult to predict because they depend on topography and geography, but generally each foot of sea level rise could erode 50-100 ft. of shoreline in New Jersey and Maryland. (U.S. Global Change Research Program, 2006. Section: Rise in Sea Level)

C. Literature Cited

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