



## FACING OUR FUTURE: Wildlife Adapting to Connecticut's Changing Climate

“It is not the strongest of the species that survive, not the most intelligent, but the most responsive to change.” Charles Darwin (1853)

### Implications for Wildlife

Though small in area (5,544 sq. miles), Connecticut hosts an incredible diversity of wildlife due to the variety of habitats it contains from the coastal plain and Long Island Sound in the south to the northwest hills. According to the Connecticut's *Comprehensive Wildlife Conservation Strategy* (CWCS) dated October 1, 2005, there are 84 species of mammals, 335 species of birds, 49 species of reptiles and amphibians, 168 species of fish, and an estimated 20,000 species of invertebrates living in the state. Some of these species, particularly “generalists” with adaptable habitat requirements are flourishing. Others, with very specific habitat requirements or existing on borders of their geographic range, are listed as endangered, threatened, or of special concern and their future existence in Connecticut is in jeopardy.

The accelerated rate of climate change will have a direct impact on habitats and the wildlife that depend upon them. Rising sea level will impact coastal wetlands and the balance between fresh and salt water in estuarine systems. More frequent and extreme occurrences of droughts and floods will impact the quantity, quality and condition of freshwater habitats. The composition of the forest will change as the northward progression of tree species accelerates. These changes will alter the suitability of habitats for specific species of wildlife over time. Simplistically, Connecticut can anticipate that some species will adapt to shifts in their habitat by shifting their ranges upward in elevation, northward or inland.

However, this is less likely to occur if the changes are sudden or if there are obstacles to such migrations resulting in disconnected habitats. (Additional habitat related implications are discussed in the Biodiversity factsheet).

The CWCS identifies a number of threats to those wildlife species in greatest need of conservation. These include habitat loss and fragmentation, introduction of exotic invasive plants and animals, and habitat degradation. It is important to note that the impacts of climate change should not overshadow these other stressors. In fact, if the Connecticut Department of Environmental Protection (CTDEP) can effectively address some of these other threats, wildlife may be better able to adapt to the changing climate.

**Birds** - Connecticut's avifauna is dynamic. In general, over the past century, southern species such as cardinals and mockingbirds have extended their range northward. As temperatures warm at a greater rate, some bird species will benefit from milder winters and extended breeding seasons. Others, such as northern birds associated with forest habitats, will likely decline in Connecticut. Increased frequency of droughts and extreme storm events may inflict higher mortality during the breeding seasons.

Migratory birds, in particular, are vulnerable to the timing of food availability throughout their entire migration route. (Phenological implications are elaborated on in the Biodiversity fact sheet). In brief, synchronies between time of arrival and food supplies could

be disrupted by phenological changes and the consequences could be sudden and severe. Most insectivorous birds synchronize their nesting to coincide with invertebrate emergence. Changes in spring and fall temperatures may cause a shift in this synchrony, resulting in nest failure. Also, increased droughts in the Midwest prairie pothole region (the continent's "duck factory") and the inundation of coastal wintering marshes in the Southeastern United States could dramatically reduce waterfowl numbers.

To sustain viable populations throughout the progression of climate change, it will be necessary to maintain enough quality habitat over time. This is literally a moving target that will require bridging current habitats to future locations. For example, rising sea level along the Connecticut coast could jeopardize the saltmarsh sharp-tailed sparrow. Connecticut has the largest percentage of the world's population of this species and sea level rise will increase the risk of nest flooding. In order to sustain breeding populations of these sparrows, coastal buffers must be established to facilitate an inland expansion of coastal wetlands where this species occurs. (Coastal habitats are discussed further in the Natural Coastal fact sheet).



Saltmarsh sharp-tailed sparrow

**Mammals** - Connecticut's mammals range in size from the least shrew to the moose and in adaptability from the generalists to the specialists. As a rule, the larger more adaptable species will benefit from climate change while the smaller specialists may decline. Because mammals are not as mobile as birds, it is extremely important that their habitats be linked to allow for genetic diversity. Small populations existing in isolated patches of habitat are less likely to survive climate change than larger populations in large blocks of interconnected habitat. This can vary by species, even within the same genus. For example, the eastern cottontail is an introduced species of rabbit that occurs statewide in a wide variety of habitats. Its relative, the native New England cottontail, appears to have much more rigid habitat requirements and occurs only in localized areas. Should their localized habitats become unsuitable due to climate change, the New England cottontail would require replacement habitat and a way to get there in order to survive. The strategy for maintaining this species includes managing existing habitat, planning for future habitat, and ensuring that the two are connected.

Smaller mammals have limited home ranges, making them more vulnerable to the effects of climate change and habitat loss. They are unable to move long distances when local conditions deteriorate. Climate change may cause local conditions to degrade through drought, pollution, and hydrological changes. For example, water shrews feed on aquatic invertebrates found in streams. Hydrological changes could diminish local food availability and consequently reduce this species' distribution. Preservation of high quality corridors could mitigate these impacts.

The white-tailed deer is an example of a mammal that would likely benefit from a warming climate since a decline in winter severity would increase its survival. It is imperative that management systems be in place to maintain populations at levels that are consistent with the ecological carrying capacity. Overabundant deer populations can have devastating impacts on native vegetation, small mammals, and ground and shrub nesting birds. They can inhibit the forest's ability to regenerate and create opportunities for invasive plants to

colonize and overtake an ecosystem. In the case of deer, regulated hunting seasons are the only practical method of balancing populations of this species with ecological tolerances.



Overabundant deer, ©Paul J. Fusco All Rights Reserved

The potential for climate change to affect bats is unknown; however their winter survival could be threatened. Climate changes that affect the abundance and availability of night-flying insects could impact bats by reducing their food supply or impacting their ability to store fat reserves prior to hibernation. Additionally, warmer weather may delay the onset of hibernation disrupting a delicate bioenergetic balance. Suboptimal body conditions coupled with even minor changes in the temperature and humidity of their hibernacula could create excessive stressors at hibernation sites leading to low winter survival.

**Reptiles and Amphibians** - Reptiles and amphibians are often grouped together, but comprise a variety of species that use a diversity of wetland and terrestrial habitats. Amphibians are very closely associated with water resources, whereas reptiles are typically more mobile and some are better able to tolerate drought conditions. Reptiles and amphibians tend to be very sensitive to subtle environmental changes. Potentially, as temperatures warm with climate change, the availability of water and the quality of aquatic habitats will become more variable. Species associated with ephemeral aquatic habitats, like vernal pools, may be particularly vulnerable to altered precipitation patterns. Water resources may dry up before the larvae have metamorphosed into adults, causing lower rates of survival for these species.

Protection of core habitats, such as vernal pools and their upland buffers, is critical to reptiles and amphibians because of their limited capacity to migrate to new locations once their preferred habitat has been degraded. Climate change may result in local extinctions for some species if the hydrologic regime is significantly altered or if wetland buffers are not protected. (Water quality and quantity implications are discussed in the Water Resources fact sheet).



spotted salamander

**Invertebrates** - The invertebrate fauna of Connecticut is incredibly diverse; it is estimated that more than 20,000 species occur here. Taxa include; freshwater mussels, gastropods, dragonflies and damselflies, butterflies and moths, benthic marine mollusks, crustaceans, and numerous others. Many of these are rare and 170 species are state-listed as endangered, threatened or species of special concern in Connecticut.

Invertebrates are inextricably linked to their habitat and because of this, are excellent indicators of habitat health and quality. Native pollinators, like solitary bees, flower flies, and butterflies, feed on the nectar of wildflowers. Flowering, on average, is occurring earlier. As a result, the synchrony between plants and their pollinators may be changing. If the plants and the pollinators respond differently to climate change, the disruption of synchrony could have far-reaching impacts, extending to our own food supply. These synergies of factors, or multiple stressors, are causing tipping points in species' populations and life histories that cannot be recovered from.

As a group, freshwater mussels have declined historically due to physical alterations of their

habitat caused by dam construction and stream channelization. They are also susceptible to diminished water quality. Droughts and irregular precipitation patterns associated with the changing climate may exacerbate these conditions. Mitigating the existing threats by reducing non-point source pollution and restoring functional riparian buffers could help to alleviate the long-term effects of climate change on freshwater mussels.

Introduced insect pests have done incalculable damage to New England's ecosystems over the past century. Some of these, such as the wooly adelgid, are periodically reduced by extremely cold winter temperatures. As winters become warmer, the climatic controls on these exotic invasives may be reduced allowing them to expand their range and their impact.

There is evidence that some mosquito species are expanding their range in response to climate fluctuations. In the last decade, two exotic species of mosquito have been identified in Connecticut: the Asian tiger mosquito (*Aedes albopictus*) and *Ochlerotatus japonicus*. Both are Euro-Asian species that are found in natural and artificial containers that hold rain water. The Asian tiger mosquito has not yet become permanently established in Connecticut, but has become a major pest in New Jersey. The potential expansion of these introduced mammal-biting mosquitoes into Connecticut poses public health impacts since both species are known vectors for diseases including Eastern Equine Encephalitis and West Nile Virus. If temperatures continue to rise and rainfall patterns change in frequency and intensity, the result could be an increased mosquito season that would increase the exposure and risk to humans of mosquito and other vector-borne diseases.

### **What the Department is Doing**

The CTDEP's goal is to maintain healthy, diverse, sustainable wildlife populations by conducting species management, research, inventories, and habitat management. Many of the programs currently in place to address the threats identified in the CWCS will increase the resilience of Connecticut's wildlife and habitats to climate change. It is important to realize that climate change will disrupt ecosystem function,

increasing the probability that certain species, such as deer or an invasive species, could benefit disproportionately and tip the ecosystem further out of balance. Science-based active management will be required to moderate the impacts of climate change. Regulated hunting and trapping seasons are important management tools and will be administered to regulate wildlife populations at levels consistent with human and ecological tolerances.

A great deal is being learned about the distribution, life history and habitat requirements of some of Connecticut's rarest species through projects initiated under the federal/state State Wildlife Grants (SWG) program. The SWG program was developed with the goal of "keeping common species common" while also protecting those of greatest conservation need. The results of SWG projects have led to better understanding of the status of many species that were not well studied in the past. The information derived from these projects can serve as baselines for monitoring the impacts of climate change and for developing adaptation strategies.

The Natural Diversity Data Base (NDDB) maintains geospatial information on state-listed (rare) species and this information is provided to land use decision makers to guide responsible growth. As part of Governor Rell's Responsible Growth Initiative, the Wildlife Division, in conjunction with the University of Connecticut, is mapping key habitats for wildlife species with the greatest conservation need. This information will be incorporated into the NDDB. For many taxa, the NDDB is incomplete and the CTDEP is attempting to fill in the data gaps with new surveys. The data in the NDDB must be as comprehensive as possible in order to effectively guide wise development and monitor species trends due to climate change and other factors.

After managing wildlife for decades in a relatively stable environment, the state and federal agencies will have to adapt to and forecast in an environment that is increasingly affected by climate change. The CTDEP is working with other state agencies, federal agencies and conservation organizations to assess and adapt to the impacts of climate change on a regional level. Climate change is a real phenomenon that will impact the

distribution of plants and animals in the Northeast. This landscape level approach will allow Connecticut to identify vulnerable habitats and wildlife species and project where these habitats and species may be sustained into the future, regardless of political boundaries. Certain states will assume responsibility for vulnerable species if they possess current and future habitat for them. For example, the New England cottontail may be viewed as a “responsibility species” for Connecticut since our state appears to have the best remaining populations of this species.



Research on New England cottontails

Using the New England cottontail as an example, the CTDEP is documenting the distribution of the species and is conducting research to identify attributes that make certain habitats important to them. Several projects are underway to enhance existing New England cottontail habitat. The CTDEP is using a variety of cooperative agreements with conservation partners to protect core habitats that are large enough to ensure genetic viability and continued survival in the face of climate change and other threats.

Because the impacts of climate change on wildlife are based upon projections, the region will be using a technique called “adaptive management” in which actions are implemented, scientifically monitored, and then refined based upon the observed results. Adaptive management allows New England to move forward using the best science at hand and then learn by doing and develop new actions. State and federal agencies are gearing up to improve networking, data sharing and monitoring to improve communication and reduce duplication of efforts in response to the changing climate. The Northeast Association of Fish and Wildlife Agencies will be a key coordinator of these regional efforts. (Implications for fish species are reviewed in the Fisheries fact sheet).

**Habitat Management** - The CTDEP manages wildlife habitat on state land, primarily Wildlife Management Areas and State Forests, using a variety of tools. Because early-successional habitats and the wildlife that depend upon them are declining, many of the habitat management activities are directed towards reversing natural succession to create and maintain grasslands, shrublands and old fields. Timber harvesting, brush mowing, and burning are used to maintain early successional habitats on state land. (Additional forest management techniques are detailed in the Forestry fact sheet).

With over 90% of Connecticut under private ownership, the need for private lands habitat management for rare and declining species is overwhelming. Through the federally funded Landowner Incentive Program (LIP), the Wildlife Division provides technical assistance and cost assistance to landowners for habitat management that results in the protection, restoration, reclamation, enhancement and maintenance of habitats that support species at risk. In addition, the Natural Resource Conservation Service administers a Wildlife Habitat Incentive Program (WHIP) that encourages landowners to maintain or establish wildlife habitat. Privately held land will be a critical component in linking current habitats to future ones in response to climate change.

The CTDEP Wetland Restoration Program works statewide, but primarily in coastal areas to restore the natural hydrology in degraded marshes and to restore native vegetation by eliminating monocultures of the invasive plant, *Phragmites*. The Wildlife Division’s Wetland Habitat and Mosquito Management Program staff works with the CTDEP Wetland Restoration Unit to design and implement Open Marsh Water Management and other wetland enhancement techniques to improve wildlife habitat and control mosquitoes. As a result of the CTDEP restoration efforts, Connecticut’s coastal wetlands have been enhanced to the benefit of the plants and animals that require these habitats. However, the projected rise in sea level could impact these marshes and many sites are hemmed in by development preventing inland migration of the marsh. The CTDEP is identifying locations where such habitat migration opportunities do exist and attempting

to protect these areas through acquisition or other means.

The CTDEP has implemented a Grassland Habitat Initiative to secure and expand the amount of habitat in the state that will support grassland-obligate species. The initiative promotes a public/private partnership to create and maintain grasslands and this model could be used to protect other imperiled habitats as well.

**Land Protection and Conservation** - The CTDEP has acquired many ecologically important properties over the past decade. In anticipation of the shifts in ranges that will occur in future decades due to the changing climate, more attention needs to be directed towards connecting large blocks of habitat so that species have room to migrate inland, upward in elevation, and northward. The CTDEP will not be able to purchase enough lands to make all of these connections, but should evaluate other ways to piece together corridors, critical habitats and potential habitats. The CTDEP is in the process of mapping all protected open space in the state, regardless of ownership, and the results of this project will assist the CTDEP in targeting gaps where additional land protection should be prioritized.

**In Conclusion** - It is important to recognize that humans will not be able to sustain all species and all habitats in the face of climate change. Connecticut will lose species and will gain species over time. These changes will have to be evaluated and planned for at the landscape, rather than the state level. In other words, the question becomes, how will society sustain biodiversity in the Northeast, rather than in Connecticut alone.

While the ranges of plants and animals will shift, they will do so at different rates. Whole ecosystems will not shift at the same time. New assemblages of plants and animals will develop and will have to be monitored and studied over time.

This is one of eight documents in the series *Facing our Future* concerning Connecticut's changing climate, [www.ct.gov/dep/climatechange](http://www.ct.gov/dep/climatechange)

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# IMPROVEMENTS AND CHALLENGES FOR TODAY

## Individual, Corporate, Municipal and State Stewardship

- Conduct vulnerability assessments for wildlife species at risk and their habitats.
- Determine “responsibility species” in concert with regional conservation partners.
- Identify species and habitats that Connecticut is likely to lose and evaluate the consequences on a landscape level.
- Identify core habitats for species at risk; enhance and enlarge them if possible.
- Build connectivity into habitat protection strategies; include all conservation partners to coordinate management of privately and publicly protected land.
- Continue and enhance the management of potentially overabundant species, such as deer, to prevent ecological damage.
- Maintain trapper and hunter numbers to conduct viable management programs.
- Promote responsible growth and discourage actions that increase habitat fragmentation.
- Educate the public about the threats to native wildlife and the critical importance of private lands stewardship. Promote incentives for private land habitat management.
- Improve communication, monitoring and data exchange between state and federal agencies and conservation partners working on climate change adaptation.
- Protect important wetlands, streams and vernal pools by establishing adequate buffers.
- Manage and enhance habitats on state land and monitor wildlife response.
- Conduct research to better understand wildlife/habitat relationships for species at risk.