Testimony before the Maine Department of Environmental Protection

By
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Serving as an Expert Witness for
The Nature Conservancy in Maine

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RE: Central Maine Power's New England Clean Energy Connect Transmission Proposal

Contents

1. **Background and Credentials**

My name is Malcom L. Hunter, Jr., and I am the Libra Professor of Conservation Biology at the University of Maine, where I have taught for the last 40 years. I was born and raised in Damariscotta, Maine, and I received my Bachelor of Science degree in Wildlife Science from the University of Maine. I received my PhD. in Zoology from Oxford University, where I was a Rhodes Scholar. I am the past president of the Society for Conservation Biology, a global professional organization, and have served on the Editorial Board of the Ecological Society of America.

I have been the lead author or co-author in over 200 professional publications on wildlife and conservation biology, including 47 peer-reviewed journal papers and three books that specifically address the issue of fragmentation. My research has covered a variety of ecosystems and organisms – birds, amphibians, mammals, reptiles, insects, vascular plants, rivers, lakes, wetlands, grasslands, and more – but my major focus is on forest ecosystems and the maintenance of their biological diversity. I am a member of a research team that has studied one forest and the evolving interactions among its vascular plants, amphibians, birds, and small mammals through nearly 40 years. Perhaps most relevant to this project, I also work with ecosystems at large spatial and temporal scales, studying the effects of landscape structure and climate change on global ecosystems. My interests are geographically broad, and I have worked in 30 countries and on every continent except Antarctica. As a researcher and advisor, I interact with a broad spectrum of organizations including the Society for Conservation Biology, The Nature Conservancy, the U.S. Fish and Wildlife Service and U.S. Forest Service, and I have had three gubernatorial appointments to various natural resource advisory groups.

2. **Role in this Project**

I have followed the progression of this project over the past year. As a former Trustee of The Nature Conservancy of Maine, I have been in discussion with Conservancy staff over the past few months about their concerns regarding potential impacts to wildlife habitat. As an intervenor in the DEP proceedings, The Nature Conservancy has taken a neither 'for' nor 'against' position on this project. However, the Conservancy strongly asserts that the project will have significant cumulative and long-term impacts on the region's wildlife, and that the compensation and mitigation currently proposed are inadequate and not commensurate with those impacts. I understand that DEP provides significant latitude for the Department to consider cumulative, landscape-level impacts that extend beyond isolated impacts to specific resources, and I am providing testimony in support of The Nature Conservancy's concerns about these issues.

My testimony represents my own research and perspective and does not reflect the University of Maine. I have received no compensation for this testimony.

3. Habitat Fragmentation and NECEC

Stated simply, ecosystem fragmentation is the gradual breaking apart of a natural landscape into smaller blocks of native vegetation.[1] The impacts of fragmentation have been widely evaluated in the scientific literature, and there are at least hundreds, probably thousands, of peer reviewed publications on this topic. In short, it is widely recognized that fragmentation is one of the leading causes of biodiversity decline across the globe, but its role is context-dependent.

Thus, it's important to carefully consider the landscape in which NECEC is planned. Unlike some characterizations of the region, it is not pristine "wilderness." On the other hand, it is not an intensively managed industrial forest landscape with monoculture crops grown on short rotations, such as characterizes much of New Brunswick's forest. It is an extensively managed, working forest, traversed by logging roads and marked by a patchwork of forests in various age classes and harvest conditions. In multiple parts of its application, CMP argues that in a working landscape such as this, the additional impacts from a powerline corridor are inconsequential. However, it is important to recognize that with the exception of major haul roads, clearing from forest management is ***temporary***, and even industrial forest management requires forests to grow back to maturity before they are harvested again. The results of forest management across the western Maine landscape create a patchwork of age classes that shift over time. Although these shifts are more frequent, and the patches larger, than would occur in a totally natural forest setting (i.e., under a regime of natural disturbance such as windstorm and insect damage), because of the largely intact and connected landscape, over time Maine's wildlife are able to move among these patches. In contrast to these temporary and shifting impacts of forest management, ***the proposed NECEC corridor would be a permanent fragmenting feature, much like the few major forest roads in the region.***

It is also important to note that the *type, orientation,* and *spatial scale* of a fragmenting feature are instrumental in determining the level of impact. A 150-foot wide powerline will create a wider barrier to movement than a typical woods logging road (which may be one-fifth the width of the powerline), and both linear features will create far more edge and have a different impact than a similar area of widely spaced clear cuts.

In addition, we often ask, is a road, pasture, or utility line fragmenting to *what species*? A highly mobile, generalist species such as a black bear will react to a utility corridor very differently than a smaller species that strongly prefers a shaded forest floor, like a spotted salamander or wood frog.

There are no known examples of comparable development projects in Maine that traverse lands mapped as "Resilient and Connected" by The Nature Conservancy. ("Resilient and Connected" lands are those that have been identified, based on land form and land cover, as being most capable of supporting biodiversity as the climate changes.) As a result, because of the scale and location of this project, there are no studies I'm aware of that have assessed impacts in a landscape such as this. Thus, it can be challenging to apply academic studies to specific cases of

[1] Hunter, M.L., Jr., and J. Gibbs. 2007. *Fundamentals of conservation biology* (3rd ed.). Blackwell Publishing. 482 pp.

fragmentation, but I have attempted to draw primarily from those factors and studies that are likely to have implications for the NECEC corridor project.

3.1 Types of Impacts

Fragmentation results in at least three related impacts: immediate loss of forest vegetation, increase in "edge" (i.e., the border between a forest and an opening), and a decrease in the overall amount of "interior" forest. These impacts can have both short-term and long-term impacts.

3.1.1. Habitat Loss and Alteration:

Loss and alteration of ecosystems are the leading causes of biodiversity declines in Maine and worldwide, and climate change is exacerbating these impacts. While the proposed NECEC corridor will retain shrub and herbaceous vegetation cover, Segment 1 is nonetheless a direct loss of nearly 1,000 acres of habitat for forest-dwelling species. According to the 2015 Maine State Wildlife Action plan, Maine is home to more than 800 species of vertebrate wildlife, including more than 200 that are listed as Species of Greatest Conservation Need.[2] For species that have small home ranges, such as the red-backed salamander whose populations can reach one per square yard in northern New England forests[3], the loss of 1,000 acres of forested habitat could impact millions of individuals. Even for larger species, the altered habitat in a utility corridor may serve as a barrier to movement. Biasotto and Kindel[4] report that, "Many studies suggested that the distribution and density of ungulates are affected by powerline RoW, especially when combined with roads. This response may be caused by a higher risk of predation, poor foraging conditions, hindered movement and decreased habitat quality."

3.1.2 Increased Edge and Reduced Interior:

Forest loss associated with a transmission line and associated construction roads is amplified by the edge effects that extend the corridor's impact far into the adjacent forest. At the global scale, forest edges influence more than half of the world's forests and contribute to worldwide declines in biodiversity and ecosystem functions.[5] These changes occur as a result of differences in light and wind exposure at forest edges, associated changes in plant community composition and structure (e.g., forest vs. shrub), introductions of invasive species, and changes in predator/prey relationships. ***Segment 1 of the NECEC will create more than 100 linear miles of permanent new edge habitat in Segment 1 alone.***

Forest edge microclimates are typically windier, warmer, and drier than forest interiors.[6] Because of simple rules of geometry (i.e., a circle has the lowest perimeter to area ratio) the

[2] https://www.maine.gov/ifw/fish-wildlife/wildlife/wildlife-action-plan.html#greatestneed

[3] Burton, T.M., and G.E. Likens. 1975. Salamander populations and biomass in the Hubbard Brook Experimental Forest, New Hampshire Copeia. 1975:541-546.

[4] Biasotto, L., and A. Kindel, 2018. Power lines and impacts on biodiversity: A systematic review. Environmental Impact Review Assessment 71:110-119.

[5] Pfiefer, M., V. Lefebvre, C.A. Peres, et al. 2017. Creation of forest edges has a global impact on forest vertebrates. *Nature 551*: 187–191.

[6] Hunter, M., and F. Schmiegelow. 2011. Wildlife, Forests, and Forestry: Principles of Managing Forests for Biological Diversity. Prentice Hall, Upper Saddle River, New Jersey, USA. 259 pp

amount of edge is also far greater for long narrow clearings, such as roads and utility corridors, than for more compact clearings of the same size, such as harvested areas. Forest edges are often more favorable to "generalist" species that can adapt to a wide variety of conditions, including raccoons, brown-headed cowbirds, blue jays, and others. As a result, some studies have found greater species richness and abundance in habitat fragments and edges compared to forest interiors.[7] These studies have been used to suggest that the impacts of habitat fragmentation on biodiversity may not be as significant as once considered.

However, generalist species are typically more common, and thus of lower conservation concern, than many species that are restricted to the specific habitat of interior forest. Depending on the species in question the edge impact may extend hundreds of feet into the forest.[8,9] At the global scale, species that live in interior forest and are more likely to be listed as threatened by the International Union for Conservation of Nature (IUCN), reached peak abundances only at sites farther than 200–400 m from forest edges. [10] In particular, smaller-bodied amphibians, larger reptiles, and some medium-sized mammals experience greater reduction from edge effects than other forest-core species.[11] Moreover, "distance from power lines has also been demonstrated as the most important factor determining the choice of nest and rest sites, influencing the movement of migratory birds and acting as a barrier to populations."[12]

In the Northeast U.S., the decline of many ground-nesting forest interior birds has been attributed to increased predation or competition from generalist species.[13] In Maine there are more than two dozen bird speciese.g., black-throated blue warbler, Canada warbler, black-throated green warbler, and wood thrush-- that are associated with forest interiors and are listed as Species of Greatest Conservation Need.[14] Typically these species tend to avoid forest edges and require hundreds of acres of continuous, relatively interior forest to reproduce, as do some mammals with large home ranges, such as American marten.[15] Northeastern forests have been shown to support important breeding grounds for many of these species, and these area-sensitive habitat specialists will decline if the size of habitat blocks falls.[16,17,18]

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[7] Fahrig, L., Arroyo-Rodríguez, V., Bennett, J., et al. 2019. Is habitat fragmentation bad for biodiversity? Biological Conservation 230.

[8] Laurance, W.F., T.E. Lovejoy, H.L. Vasconcelow, et al. 2002. Ecosystem decay of Amazonian forest fragments: A 22 year investigation. *Conservation Biology 16*: 605–618.

[9] Laurance, W.F., J.L.C. Camargo, P.M. Fearnside,et al. 2017. An Amazonian rainforest and its fragments as a laboratory of
global change. *Biological Reviews, 93*(1). 25 pp.

[10] Pfeifer et al 2017.

[11] Pfeifer et al 2017.

[12] Biasotto and Kindel 2018.

[13] Ortega, Y.K., and D.E. Capen. 1999. Effects of forest roads on habitat quality for ovenbirds in a forested landscape. *The Auk, 116*(4): 937–94.

[14] https://www.maine.gov/ifw/fish-wildlife/wildlife/wildlife-action-plan.html#greatestneed

[15] Chapin, T.G., D.J. Harrison, and D.D. Katnik, 1998. Influence of landscape pattern on habitat use by American marten in an industrial forest. *Conservation Biology, 12*: 1327–1337.

[16] Askins, R.A. 2002. Restoring North America's birds: lessons from landscape ecology. Yale University Press, New Haven, Connecticut.

[17] Blake, J.G., and J.R. Karr. 1984. Species composition of bird communities and the conservation benefit of large versus small forests. *Biological Conservation, 30*: 173–187.

As previously noted, most of the land surrounding Segment 1 is privately-owned working forest, traversed by logging roads and marked by a patchwork of forests in various age classes and harvest conditions. Nonetheless, approximately 48% of the forest in the Western Mountains is more than 3,300 feet from a public road or major logging road, which is beyond the distance of most edge effects (McMahon 2018). By contrast, only 5% of forestland in southern Maine is beyond this threshold[19], and globally this figure is about 30%[20]. ***Assuming an edge effect of just 330 feet, the acreage affected by Segment 1 of NECEC jumps roughly five-fold to 5,000 acres, and assuming an edge effect of 1,000 feet, the acreage affected increases nearly fifteen-fold.***

3.1.3 Introduction of Invasive Species

Utility corridors may serve as conduits for the movement and spread of invasive exotic species.[21] Most invasive plant species in Maine thrive on disturbed and early successional sites, such as old fields, roadsides, and utility corridors. Invasive plants such as Japanese honeysuckle, glossy buckthorn, Japanese barberry, and Japanese knotweed have the potential to profoundly alter forest ecosystems by colonizing forest edges, and they may penetrate far into the forest interior, degrading or eliminating habitat for native plants.[22] There are a number of locations in southern Maine such as the Rachel Carson National Wildlife Refuge where this alteration is already occurring.

Overall the region surrounding the proposed NECEC corridor has few invasive species documented, probably because large forest blocks resist woody plant invasions better than land that has a history of agricultural or residential use.[23] The current rarity of invasive plants in the region increases the importance of keeping them out, because after new populations establish in remote locations, they may go undetected or controlled for many years, and control becomes virtually impossible once populations have gained a strong foothold.

3.1.4. Other Impacts

In addition to impacts associated with forest loss and creation of edge, other impacts from utility corridors may include bird and bat collisions with transmission lines, and electromagnetic radiation on wildlife. This is not my area of expertise but I would note that Fernie and Reynolds[24] have reported that exposure of birds to electromagnetic radiation "altered the behavior, physiology, endocrine system, and the immune function of birds, which generally

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[18] Whitcomb, R.F., C.S. Robbins, J.F. Lynch, et al. 1981. Effects of forest fragmentation on avifauna of the eastern deciduous forest. Page 125-205 in R.L. Burgess and D.M. Sharpe (eds.), Springer-Verlag, New York.

[19] McMahon, J. 2018. The Environmental Consequences of Forest Fragmentation in the Western Maine Mountains. Occasional Paper #2 for the Maine Mountain Collaborative.

[20] Haddad, N.M., L.A. Brudvig, J. Clobert, et al. 2015. Habitat fragmentation and its lasting impacts on Earth's ecosystems. American Association for the Advancement of Science. *Science Advances, 1*, 9 pp

[21] Forman, R.T.T., and L.E. Alexander. 1998. Roads and their major ecological effects. *Annual Review of Ecological Systematics 29*: 207–231.

[22] Charry, B. 1996. *Conserving wildlife in Maine's developing landscape.* Maine Audubon Society, Falmouth, Maine.

[23] Mosher, E.S., J.A. Silander, Jr., and A.M. Latimer. 2009. The role of land-use history in major invasions by woody plant species in the northeastern North American landscape. *Biological Invasions 11*: 2317.

[24] Fernie, K.J., and J. Reynolds. 2005. The effects of electromagnetic fields from power lines on avian reproductive biology and physiology: A review. *Journal of Toxicology and Environmental Health, Part B, 8*: 127–140.

resulted in negative repercussions on their reproduction or development. Such effects were observed in multiple species, including passerines, birds of prey, and chickens in laboratory and field situations, and in North America and Europe."

3.2 Cumulative, Long Term Consequences

Many forest fragmentation impacts are not immediate and may in fact take years, or even decades, to fully play out on the landscape. Tere and Parasharya[25] note that, "the cumulative effects of power lines and other sources of mortality might be noticed only after a few decades, making it difficult to reverse population declines." If, for example, is the edge effect of a powerline causes just a 10% decline in reproduction rate of a population deterred from crossing a powerline each year, over many years the cumulative impact of this may have a significant lag time, whereby impacts created today set in motion a population decline that is not fully manifested for years to come. The regulatory framework often falls short in acknowledging cumulative impacts. Bisotto and Kindel[26] note that most impact assessments neglect the long-term effects of transmission lines on biodiversity.

Immediate impacts from fragmentation may be deceiving. In one relevant study in Maine's working forestlands, Hagan et al.[27] found that densities of some forest-dwelling bird species actually increased within a forest patch soon after the onset of fragmentation, reflecting displaced individuals packing into remaining habitat. However, because many forest songbirds are highly territorial during the breeding season, nesting productivity was actually lower in these densely populated habitats.

As noted previously, pine marten in Maine prefer mature forests, and much prior work has focused on quantifying their habitat requirements. Studying marten populations in northern Maine, Legaard et al[28] and Simons-Legaard et al[29] suggest that forest harvest practices on much of Maine's commercial forestland are creating young habitat that no longer serves the needs of marten. As a result, the forest management practices of today are likely to have a detrimental impact on pine marten in the future.[30,31] Indeed, given that marten is an "umbrella species" (i.e., a species whose habitat overlaps the habitat of many other species), we should be concerned that the cumulative impact of logging roads, harvest practices, and powerlines may be creating a challenging future for many other species that use similar habitat.

[25] Tere, A., & Parasharya, B. M., 2011. Flamingo mortality due to collision with high tension electric wires in Gujarat, India. Journal of Threatened Taxa 3: 2192–2201

[26] Biasotto and Kindel 2018.

[27] Hagan, J.M., W.M. Vander Haegen, and P.S. McKinley. 1996. The early development of forest fragmentation effects on birds. *Conservation Biology, 10*: 188–202.

[28] Legaard, K.R., S.A. Sader, and E.M. Simons-Legaard. 2015. Evaluating the impact of abrupt changes in forest policy and management practices on landscape dynamics: Analysis of a Landsat image time series in the Atlantic Northern Forest. *PLoS ONE, 10*(6): e0130428.

[29] Simons-Legaard, E.M., D.J. Harrison, and K.R. Legaard. 2018. Ineffectiveness of local zoning to reduce regional loss and fragmentation of deer wintering habitat for white-tailed deer. *Forest Ecology and Management, 427*: 78–85.

[30] Simons-Legaard, E.M., D.J. Harrison, W.B. Krohn, and J.H. Vashon. 2013. Canada Lynx occurrence and forest management in the Acadian Forest. *The Journal of Wildlife Management, 77*: 567–578.

[31] Simons-Legaard 2018.

In addition to the cumulative impacts cited above, forest fragmentation likely increases the vulnerability of Maine's native flora and fauna to climate change.[32,33] This is true because movements of individuals and ultimately entire populations is the main ways that species respond to climate change. According to McMahon, "The resiliency of the Western Maine Mountains in the face of climate change is largely due to the extent and connectivity of the region's forests."[34] In short, when we consider the long-term, cumulative nature of fragmentation impacts, the forest of western Maine may already be stressed by forestry roads and the addition of the NECEC could, while not the "straw that breaks the camel's back", still be a log that significantly weakens the camel.

4. Shortcomings of the Proposed Mitigation Plan

The NECEC corridor would be one of the largest fragmenting features in the region, and as previously noted, there really is no comparable precedent for assessing the impacts to wildlife connectivity. CMP has made adjustments to its original compensation plan to accommodate for corridor impacts to white-tailed deer (particularly wintering habitat) and a few selected rare species (roaring brook mayfly and northern spring salamander). While deer have been identified in this process because of their regulatory standing, there are approximately 800 species of vertebrate wildlife in Maine and thousands of species of invertebrates, and many hundreds of species are present in the region affected by this corridor. Although habitat fragmentation affects different species in different ways, it is clear that many other species would be affected in addition to deer. These include birds such as scarlet tanager and black-throated blue warbler, mammals including pine marten and Canada lynx, amphibians such as spotted salamander and wood frog, and reptiles such as the wood turtle. ***The proposed mitigation and compensation plan does not adequately address the cumulative impacts to the full array of Maine's wildlife.***

5. Conclusion

Because of the global ecological importance of this region and the substantial length of new corridor, it is challenging to find comparable examples of regulatory review and commensurate mitigation and compensation. It is my contention that, based on the evidence presented above, CMP has not made adequate provisions for the protection of wildlife and fisheries. If in fact the project is permitted, I believe that the DEP should recommend that either: A) the proposed mitigation package needs to be substantially increased (by significantly expanding some of the existing strategies proposed for Segment 1), and/or B) the compensation package needs to be considerably increased to conserve land commensurate with the impacts, as outlined by TNC.

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[32] Fernandez, I.J., C.V. Schmitt, S.D. Birkel, et al. 2015. *Maine's climate future: 2015 update*. University of Maine, Orono, Maine. 24 pp.

[33] Rustad, L., J. Campbell, J.S. Dukes, et al. 2012. *Changing climate, changing forests: The impacts of climate change on forests of the northeastern United States and eastern Canada. Gen. Tech. Rep. NRS-99. USDA Forest Service, Northern Research Station. Newtown Square, Pennsylvania. 48 pp.*

[34] McMahon 2018

By: ______________
Malcolm L. Hunter, Jr., PhD.

Date: 25 Feb 2019

The above-named Malcolm L. Hunter Jr. did personally appear before me and made oath as to the truth of the foregoing pre-filed testimony.

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Notary Public/Attorney at Law

Date: 02/25/2019.

Althea Tibbetts
Notary Public, State of Maine
My Commission Expires: My Commission Expires August 12, 2025