

# Canadian Maritimes Ecological Connectivity Forum

Dalhousie University, Halifax, Nova Scotia

April 24 – 25, 2019

Sponsored by:

Nova Scotia Department of Lands & Forestry

New Brunswick Department of Energy & Resource Development

Conservation Council of New Brunswick

Dalhousie University

## Summary Report

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## **Preface**

This summary report captures two-days of presentations, discussions and interactive dialogue at the Canadian Maritimes Ecological Connectivity Forum, which took place on April 24<sup>th</sup> and 25<sup>th</sup> 2019, at Dalhousie University, Halifax, Canada.

The objective of the forum was to progress Resolution 40-3 by the New England Governors and Eastern Canadian Premiers which acknowledges the need to work across landscapes and borders to advance efforts in restoring and maintaining ecological connectivity. The event brought together over 110 representatives from all levels and various branches of government, First Nations organizations, academia, industry, and environmental non-government organizations. Together they comprise governing authorities, Rights holders, stakeholders and scientists interested in the implementation of ecological connectivity and landscape conservation across the Canadian Maritimes. This keystone event provided a platform for these individuals and groups to engage with each other, share knowledge, discuss both opportunities and challenges, as well as to collaborate through new partnerships forged with the goal of prioritizing connectivity on all agendas.

The format of the forum included plenary presentations and breakout sessions to engage participants as listeners and problem solvers. Presentations were offered by a wide range of speakers from across Canada and the United States who have championed on-the ground projects, policies and research in landscape conservation, wildlife corridors, climate change resiliency, road ecology, transportation planning, and many other related topics.

The purpose of this report is to summarize the key messages, information, and discussions heard over the two-day forum into a concise document to further share knowledge on the science and implications of implementing ecological connectivity across the Canadian Maritimes and beyond. The appendices include the forum program, abstracts, photos, and slides from all presentations with the consent of all speakers who created and presented the information.

## Day 1 – Plenary

Location: McInnes Room

Time	Item	Presenters
8:30 am – 9:00 am	<i>Registration and Refreshments</i>	
9:00 am – 9:10 am	Welcome and Forum Overview	Karen Beazley and Peter Bush
9:10 am – 9:25 am	Introduction and Opening Remarks	The Honourable Iain Rankin
9:25 am – 10:25 am	A Resilient and Connected Network of Sites to Sustain North America's Natural Diversity	Mark Anderson
10:25 am – 10:45 am	A Brief History of Ecological Connectivity Mapping in the Ecoregion	Karen Beazley
10:45 am – 11:00 pm	<i>*BREAK – coffee, tea, water, muffins*</i>	
11:00 pm – 12:00 pm	Resolution 40-3: A Lever to Ecological Connectivity – Ensuring the Conservation of the Connected Landscape of the Northeast Region	John Austin and Danielle St. Pierre
12:00 pm – 1:00 pm	<i>*LUNCH – provided*</i>	
1:00 pm – 2:40 pm	Implementing Connectivity Science into Action in Transportation Planning: Examples from Ontario and Quebec	Dave Ireland, Jochen Jaeger, Mandy Karch and Kari Gunson
2:40 pm – 3:00 pm	<i>*BREAK – coffee, tea, water, fruit*</i>	
3:00 pm – 4:00 pm	Implementing Connectivity Science into Action in Transportation Planning: Examples from New Brunswick and Vermont (and Quebec)	Greg Quinn, Chris Slesar and Jochen Jaeger
4:00 pm-4:30 pm	Implementing Aquatic Ecosystem Restoration in Massachusetts: Development of State-Wide Approaches to Increase Connectivity through Barrier Removal and Improved Infrastructure	Kristen Ferry
4:30 pm – 5:00 pm	Reflections on Connectivity	Len Wagg
5:00 pm – 6:00 pm	<i>Reception</i>	

## Day 2 – Plenary

Time	Item	Presenters
9:00 am - 9:10 am	Welcome and Forum Day 2 Overview	Karen Beazley and Peter Bush
9:10 am – 10:00 am	Large Scale Conservation in an era of Planetary Thresholds	Gary Tabor
10:00 am - 10:15 am	Pathway to Canada Target 1 – Advancing Connectivity Throughout Canada	Andrea Clouston and Richard Pither
10:15 am – 10:30 am	*BREAK - coffee, tea, muffins *	
10:30 am – 11:30 am	Ten Years of Landscape-Scale Collaboration for a Connected Landscape: The Staying Connected Initiative	Jessica Levine and John Austin
11:30am – 12:30 pm	Discussion Panel: Connectivity Priorities and Opportunities in the Canadian Maritimes	Moderated by Steve Gordon and Dave MacKinnon
12:30 pm – 1:30 pm	*LUNCH - provided*	

## Day 2 – Concurrent Sessions

Session A – McInnes Room		
Time	Topic	Presenters
1:30 pm – 2:30 pm	Tools for Measuring and Monitoring Connectivity	Peter Bush, Jochen Jaeger, Caitlin Cunningham
2:30 pm – 2:45 pm	*BREAK*	
2:45 pm – 4:00 pm	Connectivity in Municipal Park and Land Use Planning	Ben Sivak, Ian Watson, and Amanda Shearin

Session B – Council Chambers		
Time	Topic	Presenters
1:30 pm – 2:30 pm	Protected Areas and Connectivity	Craig Smith, Dave MacKinnon, Karen Beazley
2:30 pm – 2:45 pm	*BREAK*	
2:45 pm – 4:00 pm	Key Linkage Area - Chignecto Isthmus: Achievements and Future Directions	Craig Smith, Paula Noel, Dave Mackinnon, Roberta Clowater, and Amelia Barnes

## Day 2 – Closing Plenary

Location: McInnes Room

Time	Item	Presenter
4:00 pm – 4:30 pm	Forum Conclusion - Key Takeaways and Next Steps	Gary Tabor



## Day 1 – April 24<sup>th</sup>, 2019

### Opening Remarks and Introduction: The Honourable Iain Rankin

The forum began with opening remarks from the Minister of the Nova Scotia Department of Lands & Forestry, the Honourable Iain Rankin. The Minister welcomed everyone to the first forum on ecological connectivity to be held in Nova Scotia and reflected on the current advances their Department has made that supports the purpose and goals of the forum. He provided an overview of the recommendations from the Independent Forestry Review by Dr. William Lahey, also referred to as the Lahey Report, which his department has accepted and is working towards implementing, as well as the new Biodiversity Act that was introduced in March which will place Nova Scotia as the first province to regulate biodiversity. Minister Rankin discussed the introduction of Mi'kmaw Forestry Initiatives to implement two-eyed seeing into the management of forested lands in Nova Scotia and indicated that this partnership will improve the ecological wellbeing of Nova Scotia's ecosystems and biodiversity. The Minister emphasised that these steps are building an important base for improving conservation, connectivity, and biodiversity protection, recognizing that the unique landscapes of the Canadian Maritimes are under increasing pressures from climate change and fragmentation. These opening remarks from Minister Rankin set the stage for the presentations and discussions to come, as he tied together the shift in focus of his department and the need to continue this shift through collaborative efforts.



The Minister of the Department of Lands and Forestry, Honourable Iain Rankin, welcoming the attendees to the first Canadian Maritimes Ecological Connectivity Forum held in Halifax, Nova Scotia.

## **Keynote Presentation: Dr. Mark Anderson – The Nature Conservancy**

The keynote speaker for the first day of the forum was Dr. Mark Anderson of the Nature Conservancy (TNC). His presentation was titled “A Resilient and Connected Network of Sites to Sustain North America’s Natural Diversity”. Dr. Anderson began by highlighting productive US/Canadian partnerships between TNC; Nature Conservancy of Canada; 2 Countries, 1 Forest (2C1Forest); Staying Connected Initiative; and Atlantic Canada Conservation Data Centre. These groups have collaborated in diverse ways to produce terrestrial habitat maps of Northeastern US and the Canadian Maritimes, and more recently stream and river habitat maps, all of which are available online through Data Basin.

Dr. Anderson described the mission of TNC and how it differs from other organizations. They aim to answer the question “what do we need to do to sustain the diversity of North America?”. Their vision is to conserve a network of resilient sites and connecting corridors that will sustain North America’s natural diversity by allowing species to adapt to climate impacts and thrive. Dr. Anderson questions what this statement really means?

To provide context, Dr. Anderson explained how TNC developed portfolios of sites which represented great examples of natural communities and viable populations of rare species 15 years ago. Dr. Anderson led this work in the Northeast and noted that what they didn’t understand at the time was how dynamic nature really was. This led to the development of their eco-regional plan.

Dr. Anderson provided an example by Fei et al. (2017) who used forest inventory and analysis data. They asked the question, for 86 tree species, has the centre of range changed for any of the species in response to climate change? They determined that for every single species of tree, the range has shifted. The average shift was 16 km northward per decade, and 18 km westward per decade. He emphasized that this study shows how dynamic nature is in the US.

He also noted the key concept in conservation biology of “representation”. Dr. Anderson asked the question, how do you think of representation in such a dynamic world? Think of the underlying physical properties that drive diversity, such as topography, soil, elevation change, etc. He discussed how these physical properties predict the diversity of species found in different areas. Biological diversity is highly correlated with ecoregions and land properties, and thus, we can think about how to design conservation networks by thinking about the underlying physical properties of land. We can let the species move and change while we know the underlying physical properties will sustain diversity, which they coined as “conserving nature's stage”.

He then brought up the questions of ‘How do you decide what to conserve?’, and ‘Can we identify places that will be more resilient to climate change?’

Dr. Anderson identified that we can try to do so by looking at:

1. Microclimates (landscape complexity), and,
2. Connectedness.

He provided an example of a study he completed looking at site resiliency through topography and moisture that create species-relevant microclimates. He noted that the way the climate appears on the ground can be very different across a landscape. Landscapes with lots of different microclimates are more resilient as they provide different species with a variety of climates to suit their needs.

To spatially analyze landscapes by microclimates, Dr. Anderson and his team developed maps of microclimates through slope, aspect, topography, landforms, elevation range, wetland density, and moisture accumulation to estimate of microclimates that would be available about 100 acres around any point on the landscape. They use this map to pull out areas of microclimates that are more resilient to climate change.

Another example he provided was from a study in England that looked at the local extinction of 430 species over 40 years and found that the local extinction of species in areas with a lot of microclimates was much lower than in others.

To understand the ability of species to access microclimates, they looked at local connectedness. A site would be more resilient if the high variety of microclimates were connected and more easily accessed by species. To measure the connectedness of microclimates, they estimated the amount of resistance to movement created by factors such as roads, agriculture etc. by creating a resistance layer.

They developed a resilience map that allows you to look at the estimated resilience of properties anywhere on the landscape. The principles of microclimates and connectedness help you think of resilient lands. They have released this map and it has been used by a variety of people – to provide a perspective of microclimates and areas of potential climate refugia in the landscape.



Dr. Anderson posed the question on how to keep the landscape connected. Individual species must move, so we need to think of range shifts and expansions in response to climate change. These range changes require a permeable landscape in order for the dynamics to happen and for species to adjust.

To visualize the changes that have been documented for tree species in the last 40 years, Dr. Anderson superimposed range shifts and expansions in the US over the Canadian Maritimes to better show the scale of the changes.

He then posed another question: 'How do we keep the landscape permeable to allow for these kinds of changes?' The landscape that the species are dealing with right now are not permeable. There are severe resistances and fragmentation.

Next, Dr. Anderson acknowledged that the fragmentation literature is confusing, as hundreds of studies show conflicting patterns. However, a meta-analysis by Haddad et al (2015) found strong, consistent, accumulating effects of fragmentation. There is a lot of variation between species and how they respond to fragmentation, as well as temporal variation. However, the meta-analysis showed that over time there is a decline in species richness due to fragmentation. Dr. Anderson explained, however, that

declines due to fragmentation are reversible. From a conservation perspective, this is something we can succeed on.

The question was then asked as to where we should really think about connectivity?

Lawler et al. (2015) movement of mammals, birds and amphibians using Circuitscape – the flow of species populations over the landscape. Dr. Anderson and his team wanted to take the Circuitscape model and their resistance grid and apply it to eastern North American grid to represent “climate flow”.

They tested this data through 58 studies of connectivity in eastern US to see how well their results matched the flow patterns. They found that the agreement was very high between the flow models and the species data/species core data from literature.

However, they decided to take a different look at connectivity as it has always been approached by connecting the dots, the step after identifying priority sites. They called their strategy “go with the flow” in which they start with connectivity and flow first, then prioritize resilient sites that naturally fall within the flow pattern.

Their “go with the flow” method is based on the physical properties of land, connectedness, and resilient sites. This determines a network of climate flow and resilient sites that is then layered with areas of confirmed high biodiversity.

They have released this connectivity identification method through an open access [mapping tool](#).

Their resilient and connected network map identified 23% of their study landscape of eastern US and Canada as priority areas for connectivity. They also measured the benefits of this network for people and found that it stores 56% of all above-ground carbon, contains 75% of high value source water supply areas, produces O<sub>2</sub> for 1.8 billion people per year, and mitigates 1.3 million tons of pollution per year

To achieve this network, it was emphasized that agreement and integration of this work and values is necessary. It will have to be a collaborative effort across both US and Canada. With this tool being open access, it provides the opportunity for collaboration, but need to couple it with talking and discussing, we can develop a common mapping tool and integrate our ideas together.

To conclude, Dr. Anderson left the participants with a quote by Aldo Leopold “Health is the capacity of the land for self-renewal, conservation is our effort to understand and preserve that capacity”



## **Plenary Session: Dr. Karen Beazley – Dalhousie University**

Dr. Beazley followed the keynote speaker with a background overview of connectivity work within the region to provide context for the remainder of the forum. The work she presented occurred parallel with the work TNC has done, as well as before and after.

She first mentioned how connectivity science came to fruition. Observations of the increasing fragmentation and isolation of habitat patches sparked discussions of networks, corridors, and linkages to counter fragmentation. These discussions brought about the twin sciences of landscape ecology and conservation biology, both of which have taken off tremendously with the rise of computer-based geographic information systems (GIS) and satellite data that allow for complex spatial analyses over large regions.

Connectivity efforts are occurring at all different scales, such as continental, regional, and local. For continental work, Yellowstone to Yukon (Y2Y) and Algonquin to Adirondacks (A2A) are early and on-going examples in other regions. For an example more relevant to the Canadian Maritimes, Dr. Beazley highlighted a recent initiative called the Eastern Wildway Network, comprised of a collaborative approach among many contributors such as the Wildlands Network, TNC, Nature Conservancy of Canada, Staying Connected initiative, 2C1Forest, and many scientists from across borders.

On a more regional scale, a lot of work has been done in the Appalachian/Acadian ecoregion, starting about 25 years ago. This work was based on ways to protect and restore (i) viable populations of focal species, as well as (ii) represent environmental variation, and (iii) capture special features, such as hotspots of diversity and rarity. Core areas, other key areas of biodiversity, and connecting corridors were identified and contributed to a rich mix of maps and data that form a strong basis for broad system planning for 'networks' of connectivity.

Dr. Beazley then highlighted a few key examples that represent a progression of such mapping research. First, the Wildlands Network and collaborators developed a plan that looked at 12 different scenarios of connectivity and network planning through GIS and satellite data. An umbrella group, 2 Countries, 1 Forest, used this and updated data to identify priority areas and key linkage areas among them for conservation action, as well as the threats to those areas (depicted through current human footprint and modelled scenarios of future human footprint). These priority landscape linkage areas were adapted by the Staying Connected Initiative, including the Three Borders area between Quebec, New Brunswick and Maine, and the Chignecto Isthmus area in New Brunswick and Nova Scotia.

Models of connectivity around this region by Perkl and Baldwin 2013 shows a large gap in ecological connectivity between New Brunswick and Nova Scotia in the Chignecto region. Although the various aspects of the models looked at different connectivity components, such as connecting areas of low human footprint and connecting marine source habitat, similar patterns emerged, specifically the gap in connectivity in the Chignecto isthmus region.

CPAWS conducted research in the Chignecto Isthmus area in 2005, identifying the remaining patches of habitat and best potential for linkages among those patches. This important early work has been built upon by NCC, who modeled connectivity for 12 species of wildlife in the area and identified the highest probability wildlife movement pathways.

Within Nova Scotia, Dr. Beazley's students and others have looked at connectivity more specifically in relation to certain focal species, such as mainland moose. Some of the work integrates patterns of both habitat suitability and road density to identify areas of highest habitat effectiveness. Dr. Beazley's students have extended such modelling across the mainland area of the province to identify intersections between wildlife pathways and highways, to identify key areas for maintaining and restoring wildlife connectivity across highways.

Dr. Beazley highlighted the dynamic nature of our landscapes through climate change and human land use changes, both of which create challenges in modelling connectivity and wildlife movement, and at the same time demonstrate the critical need for it. There are many areas that are threatened by human use and yet offer pathways for wildlife that need to be prioritized on a continental scale.

It was emphasized that this work is significant and there is a lot of data behind it. Dr. Beazley urged that we are past scratching the surface, we need to start using data such as these that are publicly available and start implementing the findings on the ground.

### **Plenary Session: Danielle St-Pierre & John Austin – New England Governors and Eastern Canadian Premiers Working Group**

Danielle St-Pierre and John Austin co-presented on the Resolution 40-3 working group, providing information on their accomplishments, goals, objectives, and future actions. To provide context, Danielle St-Pierre gave a background on the New England Governors and Eastern Canadian Premiers (NEGECP) group, which represents 5 Canadian provinces and 6 states of the United States. The purpose of the NEGECP group is to develop networks, relationships and collaborative action. She discussed several accomplishments that have been achieved through the NEGECP partnership from 1984 to 2017. One of these is Resolution 40-3, adopted in 2016, to leverage ecological connectivity as a strategy for adapting to climate change and biodiversity protection. A working group was established to help progress its goals.

To dive deeper into the resolution, Danielle St-Pierre established the Resolution's definition of ecological connectivity as "the degree to which similar facets of the landscape such as habitats or vegetation patches are interconnected to facilitate movements of plants, animals, and the attendant ecological processes". This definition serves to solidify a common understanding to help the group identify and move forward toward the purpose of their work.

The difficulty and challenges involved with ecological connectivity, maintaining a connected landscape for wildlife and plants to move to meet their needs with changing climate conditions, are recognized by the resolution. As such, it is a call for effective action across the region and jurisdictional borders to advance effort as it further recognizes the importance of ecological connectivity for the adaptability and resiliency of the ecoregions facing climate change. It was stressed that engagement and collaboration efforts in conservation, planning, development, and transportation are key to improve habitat connectivity and facilitate wildlife movement.

Following this, John Austin discussed the working group and his role as Co-Chair. He shared the journey this process has been on over the past 3 years to effectively move forward with the resolution, which is incredibly ambitious, broad in scope and complicated.

John Austin emphasized that the political statement in the resolution, which has unanimous support from Connecticut and Rhode Island to Newfoundland and Nova Scotia, is monumental and should not be taken for granted. The partners and others within the region have raised the profile of connectivity. He noted that this place (the eastern United States and Canada) has a lot of significance in terms of biodiversity and conservation, and emphasized the need to make the most of this opportunity to maintain the integrity of the landscapes within the region.

The association of the governors and premiers in this region provides an organized system to gather together and set important policies around the environment and climate change, which are called resolutions. The resolutions are often sparked by outside interest. Ecological connectivity was strategically put on their radar by the partnerships created over the years. Responsibility for ecological connectivity went to the environment committee of the New Governors and Eastern Canadian Premiers Group. A working group representing various jurisdictions was then formed to advance connectivity work and address the challenges in terms of functionality within the region over 4 years.

John Austin highlighted the work accomplished since 2017, which has focused on assessing current science, sharing information, and creating frameworks for long-term collaboration despite varied political and economic realities across the jurisdictions. He noted that “collaboration” is said repeatedly within the Resolution, which boils down to 5 functional categories:

1. Transportation: What will we do about transportation planning and design as it is a key challenge?
2. Land use planning: How can we enable people engaged at different levels to best reflect the land use planning needs and challenges that speak to connectivity?
3. Land conservation: To focus on the conservation of important pieces of land in this region is the greatest legacy that conservation practitioners will leave for future generations. With climate change, how can we be most strategic and thoughtful in prioritizing land in which we make investments to conserve for the future, mindful of the connective landscape? We need to figure out ways in which all initiatives and organizations working towards this goal will contribute to a unified vision.
4. Land Stewardship: How can we work with both private and public landowners to make sure that the way they manage their lands is mindful and respectful of connectivity?
5. Social and Economic Benefits: Connectivity is central to the interests of health and integral to providing many benefits to society. How do we integrate considerations around working lands and forest product economies within the connected landscape?

These overarching facets of the resolution were brought down to 3 primary issues to tackle in the short term:

1. How will we establish a system that ensures long-term collaboration across the region and borders to continue the work for the resolution?
  - a. Durable system for regional and international collaboration
2. Establishing a common agreement and understanding of the current methods, work, information etc. through a central space for everyone to access this information to work more collaboratively and coordinate efforts.
  - a. Information sharing



3. Sound understanding of the current science – What is a connective landscape? What are we dealing with? Where are the gaps in this understanding? To establish a unified agreement on what the best science is.
  - a. Science based

Mr. Austin emphasized the importance of this work having a firm level of objectivity and science base. There has been work completed on the landscape and regional scales already, but there is a need to make sense of it and to be able to explain this current science now to move forward.

Mr. Austin addressed the need to be able to tell the story of what various states and jurisdictions have completed in land use planning and its inclusion of connectivity strategies. Opportunities are there to build on this where landowners and stewardship initiatives implement their land management strategies into the overarching landscape connectivity. In terms of transportation, he highlighted efforts in Vermont and in New Brunswick that have implemented road structures and crossing for wildlife and undertaken measures to better understand the important travel corridors and to find solutions to improve connectivity.

In terms of land conservation, John Austin referred to it as Conservation with a big “C” because permanent, public ownership of the land is not the only form of conservation. Conservation can take many forms, such as through easements and other mechanisms to guarantee conservation for the future.

Mr. Austin posed the question of how all 11 jurisdictions come to the table on a complicated topic such as this and figure out the diversity of interests, conditions and realities. He stressed that they have made incredible progress that he believes will hopefully partner with and complement the other good work that is already in place with partners, such as the Staying Connected Initiative.

His final message towards implementing Resolution 40-3 is that by highlighting many efforts across the vast region that have advanced connectivity, both terrestrial and aquatic and in line with the resolution, the whole effort comes back to the leaders of the region working together. It can't be done state by state, province by province. Moving forward, over the next year and a half they will create a web portal to share information, and work on understanding the science and establishing a durable network system to continue collaboration. The magnificent aspect of the resolution is that our individual interests are not as important as the broader interest of a connected landscape.

**Plenary Session: Dave Ireland of the Conservation Council of New Brunswick, Dr. Jochen Jaeger of Concordia University, Mandy Karch of the Ontario Road Ecology Group, and Kari Gunson, road ecologist and author of Wildlife on Roads**

Through a tag-team presentation, the story of how road ecology was implemented within policy and planning in Ontario, as well as the formation of the Ontario Road Ecology Group, was told by its facilitators, Dave Ireland of the Conservation Council of New Brunswick and Mandy Karch of the Ontario Road Ecology Group, with the help of Kari Gunson, an Ontario road ecologist and author of Wildlife on Roads, and Dr. Jochen Jaeger of Concordia University in Montreal. The presentation began with a personal story from Dave Ireland who described the pivotal moments which led him to founding the Ontario Road Ecology Group at the Toronto Zoo. Lenore Fahrig and Bob Johnson pushed the science of road ecology in academia through publishing studies and hosting conferences in 2005 to 2009. A pivotal



moment for road ecology in Ontario was a conference in 2009 that aimed to address the impacts of roads on all biodiversity in the province and how to mitigate those impacts. He emphasized that energy, interest and momentum powered the next steps and formation of a sustainable collaborative now known as the Ontario Road Ecology Group (OREG). The group began at the Toronto Zoo which provided stability for OREG yet be self governed by an executive director. The strong partnerships and collaboration OREG has cultivated were achieved through listening to stakeholders' interests by bringing everyone to the table. Road ecology is steeped in partnerships, and achieving safe wildlife movement is a group effort.

In Southern Ontario, safe wildlife crossing is a challenging tasks as it is the most densely concentrated area in Canada, with increasing traffic volume and continually expanding road networks. The approach OREG took in Southern Ontario occurred at a large and small scales. They focused in on small communities to keep them viable and to look at them in terms of wildlife movement, road ecology principles and to include them into community plans.

Policy in Ontario also played a role, such as the Natural Heritage Reference Manual, The Growth Plan for the Greater Golden Horseshoe Area, and the Greenbelt Plan. These policies incorporate connectivity and use connectivity language about balancing human growth and maintaining wildlife corridors. Another key piece of legislation in Ontario is the Endangered Species Act which speaks to protecting reptiles and amphibians with eco-passages and fencing.

A significant outcome of OREG's work to improve safe wildlife crossings in Ontario was the introduction of habitat awareness signs. Through sitting down with the Ministry of Transportation and the Ministry of Natural Resources, they designed new wildlife crossing signs that are meant for wildlife safety rather than the conventional yellow deer crossing signs meant for human safety. These signs were designed to be different; they are square, brown background with a yellow animal (i.e. turtle), which conveys a different message and cultural shift towards prioritizing wildlife safety.

Many other documents and reports are in place in Ontario, such Municipal Conservation Plans and Provincial documents that employ local, community-based natural resource management. It was highlighted that the Region of Waterloo has dedicated \$250,000 to turtle crossings in their transportation budget, which was a milestone in conservation efforts. The lessons learned in Ontario and OREG's progress in government, NGO, and community partnerships through engagement and communication can help guide the progress of connectivity and wildlife corridor conservation in the Maritimes.

Road ecology research in Quebec on the impacts of roads on wildlife and the effectiveness of mitigation measures, such as roadside fencing and wildlife passages, was presented by Dr. Jochen Jaeger to inform the audience of the current state of road ecology science and provide examples of the work he and his lab have accomplished at Concordia University. An important question Dr. Jaeger posed was whether we need even more roads in the future if Canada already has the most roads per capita. Traffic mortality is a significant cause of biodiversity loss and every dead animal represents a failed attempt of making a connection between habitats. There is a need to understand how roads are impacting wildlife populations and connectivity. The main impacts of roads on ecological connectivity identified by Dr. Jaeger were habitat quality loss, road mortality, movement restriction from road avoidance, and the subdivision of wildlife populations into smaller subpopulations by road network patterns. They have worked to find solutions that mitigate these impacts through understanding the hot spots of wildlife

movement across roads and the effectiveness of fencing and crossing structures. Their study found that crossing structures alone do not reduce mortality (published in Rytwinski et al. 2016) and that higher road mortality occurs at the ends of fences (published in Plante et al. 2019 and Jaeger et al. 2019). Crossing structures are more effective when they are combined with fences that are significantly longer than 100 m.

References mentioned:

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## **Plenary Session: Greg Quinn of New Brunswick Department of Transportation, Chris Slesar of Vermont's Transportation Agency and Dr. Jochen Jaeger of Concordia University**

Greg Quinn opened the session by providing an overview from New Brunswick. He indicated that the current landscape of New Brunswick is more than half crown land and 85% is productive forest with 20,000 km of highways. Because of its vast amount of connected forested landscapes, reducing road mortality and maintaining connectivity has not been a priority for their Department of Transportation, although it is on their agenda. Currently, connectivity efforts are a by-product of public safety issues and regulations, such as wildlife fencing for reducing vehicle collisions and replacing aging structures over water courses designed not to hinder connectivity of aquatic habitat. Accomplishments include 350 km of fencing for moose and 80 wildlife passages; however, they have goals to broaden their scope from just moose to include more wildlife.

With connectivity rising on the priority list across the Maritimes, New Brunswick is in an opportunistic place to facilitate efforts in improving connectivity. They have large data sets on wildlife road mortality and from tracking moose movements that are currently not being utilized. More research on the impacts of roads on various wildlife and species at risk such as the wood turtle is needed to facilitate progress on connectivity efforts.

In Vermont, there has been a prominent and notable culture shift within their Transportation Agency that has taken time, patience, and education to achieve. Chris Slesar provided an overview highlighting the effective accomplishments in improving connectivity within the transportation network of Vermont. He stressed the biggest challenge is bringing transportation representatives into the discussion of connectivity. In Vermont, the culture shifts in the transportation agency happened slowly through various outside forces and having a diverse representation of people in the room. One of the prominent

agents of change was the cultivation and working relationship with the Vermont Fish and Wildlife Department. They found solutions to achieve both sets of interests while being cost effective. Through agreeing on what they were doing when rebuilding failing roads and bridges, they accommodated wildlife while improving flood resiliency and human safety issues. They achieved this understanding through stewardship training on highways and habitats. Monitoring allows for continued collaboration, which is crucial to ensuring that connectivity is being achieved through these projects.

Dr. Jaeger noted that progress in Quebec towards reducing road mortality has also been achieved through the use of Siriema v. 2.0 Road Mortality Software, which is used to analyse data collected from road surveys of roadkill to identify crossing hotspots and priority places to fence. This software identifies those hotspots as sections of road with greater amounts of roadkill than expected from a random distribution along the entire road using the roadkill survey data. Mortality reduction graphs show how an increase in the length of the fence contributes to a reduction in road mortality on the road.

These lessons and examples of transportation departments' and agencies' current efforts and future goals to implement connectivity shed light on how other jurisdictions can lessen the barriers to inter-government collaboration and how to use survey data to improve connectivity within transportation plans for reducing wildlife mortality.

### **Plenary Session: Kristin Ferry, Massachusetts' Division of Ecological Restoration**

Ecological restoration efforts in Massachusetts for aquatic connectivity were presented by Ms. Kristen Ferry from the Massachusetts' Division of Ecological Restoration. She provided an overview of the work her diverse team is doing in dam removal and culvert implementation to restore continuation of streams, rivers, wetlands and watersheds. It was noted that the implementation and success of these projects are dependent on community momentum and engagement. Partnerships with government and communities are critical for funding the completion of projects because they raise awareness and capacity for all restoration practices. She highlighted that funding was the biggest challenge in achieving restoration and explained how they have established a grant program for communities and towns to use their grants to match other funding to build further capacity. Lastly, it was emphasized that this work in ecological restoration for communities acts as a mechanism for climate resiliency and adaptation.

### **Closing Presentation: Len Wagg, Professional Nature Photographer**

To conclude the first day of presentations, a local professional photographer, Len Wagg, shared with the audience his stories, photos, and experience of being in Nova Scotia's nature where he has spent most of his time. He provided his thoughts on why it is important to spend time outdoors and that we need to remember that we live amongst nature, so we need to accommodate for it to live amongst us.

Len Wagg is an award winning Canadian photographer and author. His work has been published in newspapers, magazines, and books all over the world. He is the author of seven books including award winning Wild Nova Scotia. A visual storyteller for over thirty years, his work is known for capturing the majestic beauty of his native Nova Scotia. Len provided the audience with his experiences of photographing the wilderness of Nova Scotia from on the ground and in the air to express the importance of the work being done to protect it.

## Day 2 – April 25<sup>th</sup>, 2019

### Keynote Presentation – Gary Tabor, Centre for Large Landscape Conservation

Dr. Gary Tabor, founder and director of the Centre for Large Landscape Conservation, began his presentation with a focus on connectivity at a global scale to remind the audience of why we need to strive for the improvement of connectivity. He noted that more than 50% of the planet is human dominated due to urbanization and city expansion into megacities from which our reach for resources is extending further. Efforts to protect land from urbanization in North America began with the introduction of protected areas in 1872 through the designation of Yellowstone National Park. At the early stages of land protection through national parks and protected areas, they managed nature within isolated boxes creating problems for protecting wildlife movements. Dr. Tabor suggested that we need to protect the processes that sustain life on the planet, which are not contained within protected areas and parks. Processes such as pollination and migration are the circulatory systems of nature which we are striving to protect through improving connectivity. Only recently are we understanding that the more connected, the better. Dr. Tabor stressed that we need to work in the messy middle, in the land between protected areas, known as the 'matrix', because we need to embrace the diversity of the landscape and to think of better ways to conserve it. He introduced a new perspective of connectivity as the underlying architecture for conservation and emphasized the need to understand connectivity to improve biodiversity conservation.

International connectivity initiatives such as Yellowstone to Yukon (Y2Y) have been underway for many years and are examples of the successful cross-border partnerships and effective collaboration that can happen through being ambitious. Y2Y has 300 conservation groups working together to connect Yellowstone National Park to the Yukon. The scale of this initiative reflects the scale of how we approach climate change – wildlife will need to move greater distances due to a changing climate, and so, connectivity conservation will need to occur across greater distances, too. Dr. Tabor noted that the initiative started with a focus on grizzly bears. This allowed for them to have a starting place to then expand to include more focused efforts for other wildlife movement.

There is also connectivity between social groups that goes hand in hand with ecological connectivity. Building networks of social and institutional groups is key for achieving large landscape conservation, or as Dr. Tabor called them, 'globescapes'. The practice of building large-scale collaborative efforts is what his organization champions. They are the backbone organization that links together the partnerships and collaborative efforts of many groups. This linking of groups cultivates a learning community network to progress and integrate efforts of connectivity conservation across the US. He noted that no one organization can build this capacity on their own. He stressed that we need all hands, resources and investments to achieve long-term success. He also emphasized the need for banks and civil infrastructure to strengthen social network capacity and to embrace green infrastructure that is critical for mitigating the impacts of increasing urbanization.

Dr. Tabor challenged the audience and the representatives of the Resolution 40-3 working group to engage in and strengthen this 'social connectivity' now, to maintain its institutional memory past 2020 and through the changes within governments. He pressed that establishing a connectivity learning community now in eastern US and the Canadian Maritimes is essential for the long-term success of

connectivity conservation and to counteract climate change. There is momentum happening here and around the world with large-scale conservation through collaborative efforts built from the bottom by a backbone organization.

## **Plenary Presentation: Andrea Clouston & Richard Pither – Canada’s Connectivity Working Group**

Target 1 of the 2020 *Biodiversity Goals and Targets for Canada* states that by 2020, at least 17% of terrestrial areas and inland water, and 10% of marine and coastal areas of Canada will be conserved through networks of protected areas and other effective area-based measures. In April 2016, Federal, provincial, and territorial (FPT) Deputy Ministers responsible for protected areas started the Pathway to Target 1 initiative to help coordinate and encourage efforts to achieve Target 1. Months of consultation and collaboration led to the 2019 release of *One With Nature*, in which Pathway departments agreed to four priorities and several actions, including to work together to design and implement coordinated, connected, representative and effective networks of protected and conserved areas throughout Canada.

A Pathway Connectivity Working Group (CWG) was established to advance the actions in *One With Nature* that relate to connectivity. CWG representatives, Andrea Clouston and Richard Pither, presented an overview of the work they are undertaking to achieve these goals. Currently, Canada is only at 10.5% terrestrial land protected. However, they explained that it is not just “how much” land and water is protected that is important, it is also “where” as there are critically important areas for biodiversity and connectivity that need to be focused on. They noted that the main approach to land protection in Canada is top down as the majority of land is administered by provincial and territorial governments. More so, partnerships have been vital for this work, specifically with indigenous organizations through their involvement on the steering committee. The Pathway established a National Advisory Panel and an Indigenous Circle of Experts (ICE), both of which recommended establishing Indigenous Protected and Conserved Areas (IPCAs), which could significantly increase the amount and quality of protection across Canada while contributing to reconciliation.

They also highlighted the historic investment the Government of Canada has made towards advancing conservation by establishing the Canada Nature Fund with 500 million dollars for conservation projects and new protected and conserved areas.

More specifically, the CWG has started to develop connectivity indicators for measuring terrestrial and freshwater connectivity among protected and conserved areas at the national scale. The indicators will be able to measure progress towards achieving connectivity for each protected area. In addition, the CWG will be producing and collecting material (e.g., best practices, guidance) related to connectivity for a conservation toolbox and is overseeing a study that will identify and propose solutions to address barriers to achieving connectivity in Canada.

They emphasized that their work is ongoing and that progress is expected to accelerate as they develop partnerships with indigenous organizations and non-governmental connectivity experts.

## **Plenary Presentation: Jessica Levine – Staying Connected Initiative**

The Staying Connected Initiative (SCI) is a key player in cultivating and connecting organizations' efforts to sustain landscape scale connectivity in the Northern Appalachian and Acadian ecoregion, which includes New Brunswick, Nova Scotia, Quebec and the northeastern US. SCI partners base their efforts on the pillars of multiple strategies, multiple scales, and multiple partners. Ms. Levine, the coordinator of SCI, presented an overview of SCI strategies and achievements in connectivity. SCI includes 60 partners (conservation organizations, government agencies, and universities) from across the region, and partners focus their efforts in 9 linkage areas important for ecoregional connectivity. Working at multiple scales, from local to regional, through provinces and states, provides many opportunities to achieve connectivity. As well, using multiple strategies to overcome the multiple barriers of working across borders and on different scales has shown to be effective in achieving connectivity across the diverse region. The first strategy includes using conservation science to guide efforts in identifying priority places and areas, as well as field science to further focus resources. Other strategies involve land protection, building relationships with landowners, land use planning, local engagement, mitigation of road barriers, and a focus on policy. Ms. Levine stressed that SCI's success has not come without challenges, and partners have learned a great deal through their collaboration over the past decade. A key lesson of the partnership is that a vision guided by science focuses work, allows for collaboration and brings expertise in partnership. It has taken time to build a culture of trust and mutual respect among diverse partners to deploy multiple tactics on the ground and work at multiple scales. She finished with noting that they are continuously seeking to grow the partnership as they continue to share best practices and knowledge across the region.

## **Plenary Presentation: John Austin – Vermont's Fish and Wildlife Agency**

As a partner of the Staying Connectivity Initiative, John Austin of Vermont's Fish and Wildlife Agency provided his experience of collaboration and conservation achievements to shed light on the benefits of working together to overcome barriers. He explained that this partnership demonstrates how successful conservation happens through getting to know each other and understanding their differences over time. He noted that the '2 Countries, 1 Forest' initiative was the first of its kind in the region and sparked inspiration for more cross-border efforts. Mr. Austin reiterated the multi-pronged approach of these partnerships through scale, strategies and science. He emphasized the importance of working on many scales because it helps partners see how they can effectively fit into the big idea and explain where the interest is at the local scale compared to the regional scale. He noted that when opportunities were identified on these multiple scales, organizations began to hop on board. For Vermont, he noted that their power is through sending a consistent message through a consistent approach; as many diverse efforts are going on it can become overwhelming and hard to get a handle on. Consistency allowed for them to create one message around which all organizations can establish strong partnerships. More specifically, it was stressed that private landowners have a key role and are instrumental to success but are not direct partners – another significant reason for consistent messaging when connecting with them to protect and conserve private land. Through the Staying Connected partnership, opportunities flourished to intersect with private landowners in Vermont through experts crafting those consistent messages to help them understand their role in the conservation of the integrity of the landscape. Another important method of engaging private landowners was on personal levels through celebrating

their land and the special places they have in Vermont on personal levels to build awareness and conservation thinking.

Community engagement and involvement in land use planning is a powerful way to bring local values to the table and to implement conservation interest at a local scale. Mr. Austin noted that towns are required to develop town plans which are strategic opportunities to incorporate conservation language and progress. These are small but important steps because conservation happens across all scales and relationships. He emphasized that the more people working together with a common vision means the better work they can do.

## **Policy Discussion Panel**

**Chris Norfolk of New Brunswick Department of Transportation,  
Connie Rooney of Nova Scotia Department of Transportation,  
John Austin of Vermont's Fish and Wildlife Agency,  
and Amanda Shearin of Maine's Fish and Wildlife Agency**

To engage more discussion and collaboration, a discussion panel was held where four government and state representatives shared their perspectives on connectivity from working inside government and provided advice on how to progress the implementation of connectivity conservation into government decision making. Panelists were Mr. Chris Norfolk from the New Brunswick Department of Transportation, Ms. Connie Rooney from the Nova Scotia Department of Transportation and Infrastructure Renewal, Ms. Amanda Shearin from Maine Fish and Wildlife Agency, and Mr. John Austin from Vermont Fish and Wildlife Agency.

Chris Norfolk began by providing his thoughts and perspectives towards connectivity in his department's work in New Brunswick. He described his experience over the years with landscape-level connectedness, indicating that the concepts around connected landscapes isn't new but hasn't been the highest priority for biodiversity challenges in New Brunswick.

He pointed out that although New Brunswick has a relatively low human footprint, it is important to think about and plan for future change as the global population is rising exponentially and New Brunswick will feel those impacts, whether directly or indirectly. He mentioned that New Brunswick will need and want to play a role in adapting to increased populations, cultural expansions, and intensification of resource development in parts of its landscape. He recognized that New Brunswick need careful design and thoughtful management of the "messy middle" known as the landscape matrix through sustainable forest management and land use planning.

He noted opportunities arising from the confluence of 3 important features at this moment. The state of knowledge has increased significantly around ecological connectivity through the translation of science into spatially explicit tools for landscape managers, helping to make sense of the data. He also noted that it is encouraging to see multiple initiatives and multiple scientific approaches achieving agreement between their models within the region around where the priority areas are.

He advised that we need to put these principles into action through building capacity to do so. He suggested that the design of the Nature Fund is smart as it allows projects to move forward with the crown land component and private land component. He emphasized that it allows cash poor provinces to leverage an opportunity to input strong partnerships and for NGOs to hold government decision

makers to it. He assured the audience that their department knows they cannot achieve effective conservation alone and needs to look at new partnerships across the agricultural, natural resource and transportation sectors, NGOs, indigenous organizations, and landowners. He added that big parts of government share the responsibility to protect biodiversity and there needs to be a big group working to preserve what they have now. He finished with his appreciation of the opportunities that this Forum is creating and that it shows the recognition of connectivity becoming a priority on government agendas.

John Austin followed with his advice from a state government standpoint for leveraging opportunities in the Canadian Maritimes through building capacity. He noted that success has already been achieved through having such a diverse representation in the audience, which means people care about connectivity and it's on many agendas. He noted that the foundation has been laid and now it is time to build through listening and engaging. For provincial governments, his advice is to achieve support from the public through considering their interests and being transparent.

Connie Rooney then provided insight into how Nova Scotia's Department of Transportation and Infrastructure Renewal implements connectivity into their work. First, she noted that connectivity is addressed indirectly through addressing safety concerns by reducing wildlife collisions. Their department seeks out partnerships to leverage infrastructure projects and for proactive approaches that go beyond compliance to implementing projects. She provided an example of their department partnering with Acadia University in improving wood turtle recovery, habitat and movement through implementing culverts. Their highway engineering team and their wildlife working group are developing wildlife management plans to use as starting points for general approaches to implement connectivity. She noted that they are also working with Nova Scotia's Department of Lands and Forestry by using police collision data for developing safety plans that reduce wildlife collisions which will recommend underpass and fence installation locations in Nova Scotia.

Amanda Shearin provided her insights in how the state of Maine has managed wildlife movement and connectivity through State Wildlife Action Plans. These plans are required for each state to qualify for funding through State Wildlife Grants, which are the primary source of funding for the management of at-risk species and habitat conservation. She described how these plans evaluate the status of species in the state that are on a watch list, so as to set a foundation for their efforts. In 2015, these plans were re-evaluated so as to take climate change into consideration, and they engaged with tribal partners to look more holistically at the landscape. They took 2 years to complete this review, partnering with over 100 organizations. They came up with more than 700 actions, organized into themes of invasive species, outreach, and connectivity for climate change. The state now also considers Resolution 40-3 in their plans and actions, to echo its language. Current goals are to progress grant funding for land conservation through the focus of purchasing and easements and to better consider linkages rather than specific habitat patches.





Following the discussion panel were two concurrent sessions (A and B) where the audience could choose which session to attend. The sessions are summarized below.

## **Concurrent Session A: Tools for Measuring and Monitoring Connectivity**

### **Caitlin Cunningham – Measuring Forest Connectivity in Nova Scotia – comparing a variety of methods to gain perspective**

Currently, research is underway in Nova Scotia to progress Resolution 40-3 that is evaluating forest connectivity to identify places where connectivity is restricted. This research will also compare different metrics for connectivity to have a more holistic understanding of the landscape and matrix. These methods are effective mesh size ( $m_{eff}$ ), Circuitscape, and FRAGSTATS. When using these methods, important questions that arise are “what is forest?” and “what is connectivity” in relation to the objectives of the specific project. It is important to identify these terms as it can have implications for the results. For example, forests in Nova Scotia are classified under 49 different classes, making the forest data more intricate to use. This research is focusing on three different interpretations of ‘forest’, each of which will entail different subsets of forest classes: (i) any treed ecosystem, (ii) mature forests that are older than 40 years, and (iii) natural landscapes with no anthropogenic influence. To determine forest connectivity restrictions, the influence of roads as a major source of habitat fragmentation and its impact on wildlife movement will be quantified. The road effect zone (measured by distance in meters), which varies by the road type and traffic volume, will also be defined by a variety of factors, including roadkill, dust, road salt, and wildlife avoidance. In this study, the Road Effect Zone distances are set between 200 m and 810 m. While road surfaces and verges are much narrower, it is understood that the effects of infrastructure extend over much larger distances, up to about 1 km for birds and 5 km for mammals (Benitez-Lopez et al. 2010). This research is in its preliminary stages and is in partnership with the Nova Scotia Department of Lands & Forestry (NSL&F) and Dalhousie University through funding from NSL&F and NSERC.

Linked to cited paper: <https://www.sciencedirect.com/science/article/pii/S0006320710000480>

### **Jochen Jaeger – Measuring and Monitoring Connectivity**

Landscape fragmentation is a global problem that threatens the sustainability of human land use, biodiversity, and many ecosystem services. Monitoring connectivity is a priority in order to understand how these impacts of fragmentation are unfolding and changing the landscape. Monitoring ecological connectivity also aids in the planning of new roads and railways, as well as mitigating their impacts. Connectivity also is an indicator for the state of ecosystems. However, some methods published in the literature are not reliable. Three examples of important points to pay attention to include (1) the difference between landscape and habitat connectivity, (2) the role of within-patch and between-patch connectivity, and (3) the influence of changes in habitat amount. Landscape connectivity is the probability of movement between all points in a landscape, whereas habitat connectivity is the probability of movement between all points located in resource patches in a landscape. When measuring connectivity, within-patch connectivity must be included rather than just measuring between-patch connectivity (Spanowicz and Jaeger, *subm.*). A useful method for measuring landscape connectivity is based on the Effective Mesh Size method (Jaeger, 2000) as it includes intra-patch connectivity. This measurement method has been used in Europe on various scales (EEA & FOEN 2011), as well as in Ontario on a more local scale and used in Montreal as an indicator in the City Biodiversity Index (CBI) (Deslauriers et al. 2018).

It was emphasized that calculating and considering the amount of habitat is also a sensitive task as it is easy to obtain misleading results when habitat amount changes, stressing the reminder to not trust

methods just because they are published. When measuring connectivity, it was suggested to use more up-to-date methods and to conduct a sensitivity analysis to ensure the accuracy of the results.

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Jaeger, J.A.G. (2000): Landscape division, splitting index, and effective mesh size: New measures of landscape fragmentation. *Landscape Ecology* 15(2): 115–130.

European Environment Agency and the Swiss Federal Office for the Environment (2011): *Landscape fragmentation in Europe. Joint EEA-FOEN report*. EEA Report No 2/2011. ISSN 1725-9177, ISBN 978-92-9213-215-6, doi:10.2800/78322. Luxembourg, Publications Office of the European Union. 87 pp.

Available as PDF online: <http://www.eea.europa.eu/publications/landscape-fragmentation-in-europe/>

Deslauriers, M.R., Asgary, A., Nazarnia, N., Jaeger, J.A.G. (2018): Implementing the connectivity of natural areas in cities as an indicator in the City Biodiversity Index (CBI). *Ecological Indicators* 94: 99-113 doi: 10.1016/j.ecolind.2017.02.028

Spanowicz, A.G., Jaeger, J.A.G. (subm.): Measuring landscape connectivity: On the importance of within-patch connectivity. Submitted to *Landscape Ecology*.

## **Concurrent Session A: Connectivity in Municipal Park and Land Use Planning**

### **Ben Sivak – Halifax Green Network Plan**

The Halifax Green Network Plan is a priorities plan developed by the Halifax Regional Municipality that was completed over 3 years of information gathering and engagement. The plan, which aims to identify green areas to connect into a network within the municipality, is made of 5 key themes that include ecology, working landscapes, community shaping, outdoor recreation, and cultural landscapes. Without legislation in place to implement this plan, coordination and information sharing is vital for ensuring that these areas are considered with connectivity in mind. With the lack of resources, implementation of the Green Network Plan's 79 action items will need to occur through the establishment of partnerships with federal and provincial departments, universities and non-profit groups. To further the implementation of the Plan, tools can be utilized through land use planning, park network management, current and future project work and partnerships across short, medium and long timeframes. To achieve progress, immediate and ongoing guidance to activities and decisions is necessary.

### **Ian Watson – Upland Consulting**

A local example of connectivity implementation through municipal land use planning was presented and explored the benefits and challenges of doing so in Cumberland County, Nova Scotia. Through hiring a consultant agency, the municipality added to their ability to strategize and plan for connectivity within their jurisdiction. Under the Municipal Government Act, there are two guiding policies that are of importance: the Municipal Planning Strategy and the Land Use By-law. There remains a challenge, however, in that a large percentage of land within Cumberland is privately owned, making it difficult to restrict use and development on those lands.

### **Amanda Shearin – Maine's Habitat Outreach Program**

Across the state of Maine, 94% of the land is privately owned, similar to the land ownership distribution of the Maritimes. More specifically, where biodiversity is highest in Maine is also where development expansion is expected to increase. Maine is also a “home rule” state where 492 organized towns have volunteer boards and enforcement where local development does not often trigger resource agency involvement. The challenge here for the state is to achieve conservation amidst the independent growth and diverse development visions of the towns. Over the last two decades, partnerships and collaborations have aided in the balance of conservation and development needs. Partnerships between municipalities, state agencies, land trusts and conservation commissions, and most importantly, landowners were cultivated over time through engagement and greater consideration of local priorities. New methods of viewing and sharing local data, as well as online accessibility, was critical in continuing and progressing local partnerships. Regional partnerships have been cultivated with the Staying Connected Initiative, New England Governors and Eastern Canadian Premiers Resolution 0-3 working group, and the Northeast Wildlife Action Plan Coordinators. Beyond these partnerships, the lessons learned was that connectivity has many meanings, the ability to connect people to nature is one of them.

## **Concurrent Session B: Chignecto Isthmus and Protected Areas**

### **Dave MacKinnon – Protected Areas and Connectivity – Current Policy and Landscape Context**

Connectivity work is rooted in political agreements. Government efforts were highlighted across Canada such as Pathway to Canada’s Target 1 and the diversity of representatives on its steering committee. This collaboration is a major step in connectivity work as the current state of Canada’s protected areas network is less than 4% connected. More specifically, in the Canadian Maritimes there is increased coverage through some protected areas being connected to their near neighbours. However, connectivity is lacking between the largest, furthest away networks of protected areas. It was emphasized that connectivity can and needs to happen across the landscape through identifying connections rather than focusing solely on areas for protection. The barriers to connectivity from agricultural land, suburban and urban areas, highways and roads, and forestry dominated areas have not been mitigated in Nova Scotia as there is limited success, with one example being the implementation of a culvert under a highway for wood turtles in Antigonish. Connectivity planning is not happening at the same level as protected areas planning in the Maritimes and that needs to change.

### **Roberta Clowater – Protecting and Connecting Nature in the Maritimes – Seizing the Moment**

In New Brunswick, connectivity is being addressed beyond the connection of protected areas. There is work being done to identify other areas of significance/importance, such as drinking water watersheds and old forest habitat, to add to the network. Connectivity of the landscape is more than connectivity between areas with legal protection; the matrix is configured of a variety of lands that all play a role. However, the dynamic nature of politics and policies also plays a challenging role within protected areas and connectivity establishment.

The overarching role in the success of connectivity is trust. As emphasized throughout the previous presentations, trust is needed between the policy makers, land users, landowners, public, conservation groups, government departments and so forth. All stakeholders who have an impact on the

implementation of connectivity need to first develop trust between each other in order to progress towards achieving their shared interests.

The connectivity priorities and gaps were identified. Increasing protected areas simultaneously increases connectivity as more land coverage is being conserved thereby helping to fill holes in the network. Prioritizing ecosystem resilience improves connectivity planning as it considers both the structure and function of corridors. Lastly, prioritizing the role of transportation such as implementing road crossings, underpasses and overpasses, and monitoring wildlife movement will help fill gaps that exist in habitat connectivity due to road fragmentation. The next task in protected areas connectivity is to start designing them so they are all well connected rather than just isolated pockets. To achieve this task, there is a need to identify immediate openings where stakeholders could work together more effectively, such as place, themes or policy levels. How can this be achieved over the next few months rather than years? There is also a need to create buy-in of communities and partnerships to deliver the same message from different partners and frame connectivity action as a solution for decision makers.

### **Amelia Barnes – Road-wildlife interactions in the Chignecto Isthmus region of NS and NB**

Masters of Environmental Studies candidate, Amelia Barnes, presented an overview of her research and preliminary results. The following is an abstract of her presentation.

Roadkill is a frequent symptom of loss of wildlife habitat connectivity due to transportation infrastructure. Master's research using roadkill surveys is attempting to quantify this problem in the Chignecto Isthmus region to help increase ecological flow between New Brunswick and Nova Scotia.

### **Craig Smith of the Nature Conservancy of Canada, Dave MacKinnon of the Nova Scotia Environment, Key Linkage Area – Chignecto Isthmus: Achievements and Future Directions**

Through the structure of Staying Connected Initiative, presenters first summarized and contextualized the Chignecto Isthmus, the only thing keeping Nova Scotia from being set adrift into a sea of ecological uncertainty. Then, the presenters turned the collective brain power of session attendees towards scoping and defining "Isthmus 2.0" or, the next phase of conservation objectives and activities to be pursued in the region.



## **Plenary Session: Closing Remarks by Gary Tabor – Centre for Large Landscape Conservation**

To close the forum, Dr. Gary Tabor highlighted the key messages across both days of presentations and discussions. He highlighted the Nova Scotia Department of Lands and Forestry efforts in introducing Mi'kmaw Forestry Initiatives to manage forests more ecologically, as well as the introduction of the Biodiversity Act in the province.

He urged the audience to make this meeting an inspiration, to make it affirm our work, to make it cement social connectivity to advance ecological connectivity. He claimed that we are in the midst of a historic moment, an all-hands-on-deck moment, as the earth and oceans are changing under our feet.

The Chignecto Isthmus was a key discussion topic across the two days as it is a vital link in the Acadian Region; however, is highly fragmented with roads, divided highways and development, all acting as the Berlin Wall to biodiversity. Attention to connectivity is urgently needed in this area.

As we learned, roads in general kill 100 million vertebrates globally each year. The only good news is that this problem of fragmentation and connectivity are becoming mainstream.

From the Staying Connected Initiative, we learned that 5 organizations are incorporating connectivity on multiple scales and through multiple strategies. We also learned that there has been a culture change in the Vermont Transportation Agency where they consider wildlife crossings when designing plans.

The NEG ECP Resolution 40-3 opportunity is huge. He advised to use this opportunity and momentum to sustain the outcomes. He posed the question of 'Why put in all this energy if the results aren't lasting?' His advice is to invest in that lasting process now, set in motion strategies that sustain the work.

Dr. Tabor also noted that there is great hope in Canada's Pathway to Target 1 as their efforts in the connectivity working group feed seamlessly into the efforts across the region. He also highlighted the Canada Nature Fund as a opportunity to look at regional connectivity, but it needs to be done well.

One outcome of this forum is that what was presented and discussed should serve to inform both Environment and Climate Change Canada and the New England Governors and Eastern Canadian Premiers Resolution 40-3 working group over the next three years to develop a regional connectivity process to lead to more opportunity.

He shared his final thoughts and 'outsider' perspectives on the current status of connectivity in the Canadian Maritimes by encouraging the audience not to rest on their laurels, but to continue to go with the flow. The outcomes ahead are to protect habitat and land the size of Alberta, to achieve Target 1 (17% land protection) in the next year. But he urged not to stop

there. In going forward, there is a need to advance and employ good science, strong policy, and better partnerships, all with great enthusiasm to achieve extraordinary results.

By doing this we will ultimately be supporting our regional economies and providing for the sustainable health of people and nature.

He finished with sharing his belief the Canadian Maritime region has something very special. He reminded the audience that the trust built through this Forum should not be diminished, the honesty of conversation should not be devalued, and by investing in this social capital, we will yield amazing, connected ecological rewards.

Further Information on the Canadian Maritimes Ecological Connectivity Forum can be found on the Nova Scotia Department of Lands & Forestry website:

<https://novascotia.ca/natr/forestry/programs/LandscapePlanning/EcologicalConnectivity.asp>

# Abstracts

## **A Resilient and Connected Network of Sites to Sustain North America's Natural Diversity**

By Mark Anderson

The climate is changing, ecosystems are rearranging, and plant and animals are shifting their ranges. How do we design a network of sites that would sustain the full spectrum of biological diversity and ecological functions while allowing nature to change in response to changes in the ambient conditions? This talk will explore the key components of such a network designed to sustain plant and animals, store substantial amounts of carbon, create cleaner air and water, and facilitate nature's adaptation in the US and southern Canada.

## **A Brief History of Ecological Connectivity Mapping in the Ecoregion** By Karen Beazley

Spatial analyses related to connectivity in the Acadian-Northern Appalachian ecoregion over the past 20 years show some common patterns. Key linkage areas and other areas of high conservation priority emerge. A selection of these maps indicate areas of connectivity required to maintain species populations and ecological communities and processes over short and long term at large-regional scale

### **Resolution 40-3:**

## **A Lever to Ecological Connectivity – Ensuring the Conservation of the Connected Landscape of the Northeast Region**

By John Austin & Danielle St-Pierre

This presentation summarizes the purpose and intent of Resolution 40-3 adopted at the Annual Conference of New England Governors and Eastern Canadian Premiers. The presentation also examines the leverage effect of the resolution and highlights the extent to which the various jurisdictions are already implementing it. Lastly, the presentation will consider a long-term vision and plan for continuing to advance the interests of the resolution throughout the region.



# Abstracts

## **The Genesis of a Road Ecology Movement in Ontario and Quebec**

By Dave Ireland

In the early 2000s while studying the movement patterns of amphibians and reptiles in southern Ontario Dave saw first-hand the devastating impacts of road mortality and landscape fragmentation. But he also saw an opportunity and a niche for an applied, collaborative road ecology network that could serve to coalesce conservation voices and inform transportation planners. Dave will tell this story and lead off the session and the two decades of work that followed.

## **How can we mitigate the negative effects of roads on ecological connectivity? Investigating the options.**

By Dr. Jochen Jaegar

Every year, road traffic kills hundreds of millions of animals moving through the landscape from one habitat patch to another, and effectively reduces ecological connectivity. Many types of road mitigation measures are available to reduce wildlife mortality on roads and enhance ecological connectivity, such as fences and wildlife passages. This presentation provides an overview of the research done in our lab about this topic, and makes recommendations concerning ways to improve the mitigation measures, monitoring, and research.

## **Road Ecology: The Process to Progress**

By Mandy Karch

Road ecology in Ontario has developed over time and has become an integral component of road management protocols and practices. The province has developed and implements wildlife/road mitigation guidelines that municipalities across the province may adopt to help reduce the threats of roads to biodiversity. We will review the materials and resources that facilitate integrating road ecology principles into routine road operations.

## **Using geographic information system tools to prioritize road-kill hotspots in areas of high connectivity**

By Kari Gunson

Ten years ago, the Ontario Road Ecology Group, retained Kari to develop a landscape-level model of road-kill hotspots across roads in southern Ontario, this resulted in over 19,000 km of road hotspots for our freshwater turtles and wetland-forest amphibians. Today, with grants from the provincial Ministry of Natural Resources Stewardship fund we continue to build on base-line modelling using Natural Heritage System models and Circuitscape theory to integrate connectivity into the road mitigation planning process.



# Abstracts

## **Opportunities for Ecological Science to Inform Infrastructure Planning in NB**

By Greg Quinn

In New Brunswick, the ecological aspects of highway infrastructure planning and design do not typically extend beyond meeting the requirement of applicable regulations and meeting the requirements of Environmental Impact Assessments for major projects. While NBDTI does mitigate some of the negative effects of highways on wildlife through the use of fencing and wildlife crossing structures, these efforts are largely a byproduct of public safety initiatives related to reducing dangerous collisions with wildlife. Because ecological considerations beyond regulatory compliance are outside NBDTI's mandate, I will propose some avenues where science could be used to improve practices and planning within this context.

## **Culture Change at the Vermont Agency of Transportation; Incorporating Wildlife and Habitat Connectivity Into our Everyday Work**

By Chris Slesar

This presentation will address how the Vermont Agency of Transportation (VTrans) has been collaborating with the Vermont Department of Fish and Wildlife to incorporate wildlife species' needs and habitat connectivity accommodations into our everyday work – from routine maintenance activities to project development. This presentation will give an overview of the range of wildlife improvements that have been incorporated into Vermont transportation infrastructure projects from the simple and inexpensive to the very complex. It will focus on some of the key institutional factors, transportation projects, and wildlife-focused initiatives that have contributed to an institutional culture that values habitat connectivity.

## **Prioritizing road sections for wildlife fencing using an Adaptive Fence Implementation Plan**

By Dr. Jochen Jaegar

Roads have many negative effects on wildlife populations, the most visible of which is wildlife mortality due to vehicle collisions. Fences and wildlife passages have been applied to reduce roadkill. However, wildlife passages without fencing, in general, have been shown to not reduce roadkill. Therefore, fencing is the most important component for mitigating roadkill. Understanding where and why wildlife-vehicle collisions occur can inform planners about where mitigation measures would be most effectively placed. However, it has not been discussed how the choice of scales and confidence levels influence the results and how the locations of the warm- and cold spots should be included in the decision-making.

# Abstracts

## **Implementing aquatic ecosystem restoration in Massachusetts: development of state-wide approaches to increase connectivity through barrier removal and improved infrastructure**

By Kristen Ferry

The Division of Ecological Restoration (DER) is a non-regulatory state agency in Massachusetts, whose mission is to restore and protect rivers, wetlands, and watersheds for the benefit of people and the environment. DER's Habitat Restoration Program implements on-the-ground projects that restore ecosystem processes and connectivity and improve climate resiliency.

Project types include barrier removal or replacement of undersized and degraded infrastructure. While DER has used a successful partnership-based approach to complete dam removals and tidal and freshwater wetland restoration projects, a new municipal capacity-building approach has been developed to address road-stream crossings.

## **Large Scale Conservation in an era of Planetary Thresholds**

By Dr. Gary Tabor

The global ecology of the planet may be undergoing a threshold state shift. Rapid changes in climate and diminishing abundance of biodiversity are challenging the planet's resilience capacity to respond to large-scale human and natural disturbances within historical ranges. Protected area conservation strategies remain the cornerstone of saving nature; yet many protected areas exist as ecological fragments in a matrix of incompatible land and marine uses. Connectivity conservation is an emergent conservation practice that complements and expands the ecological functionality of protected areas. Connectivity conservation is also a restoration tool that optimizes limited resources and time in re-establishing landscape and seascape integrity and serves as the green architecture for large-scale restoration. The science for connectivity conservation has been advancing over six decades, but the practice of connectivity conservation is still relatively nascent. We will look at the evolution of connectivity conservation practice around the globe.

# Abstracts

## **Pathway to Canada Target 1 – Advancing Connectivity Throughout Canada**

**By Richard Pither & Andrea Clouston**

In 2016, Federal, provincial, territorial and local governments, in partnership with First Nations and Métis, launched the Pathway to Canada Target 1 initiative to promote and coordinate efforts to expand and establish connected and effective networks of protected and conserved areas throughout the country. This presentation will provide some background information on the Pathway initiative and outline the work planned for advancing connectivity research and implementation in Canada.

## **Ten Years of Landscape-Scale Collaboration for a Connected Landscape: The Staying Connected Initiative**

**By Jessie Levine & John Austin**

The Staying Connected Initiative (SCI) is an innovative connectivity conservation partnership focused on sustaining and restoring a connected forested landscape in the Northern Appalachian-Acadian ecoregion of the southeastern Canada and the northeastern United States. SCI partners – including public agencies from three provinces and five states, conservation organizations, and universities – collaborate in deploying multiple approaches to achieve landscape-scale connectivity; these include strategic land protection, transportation mitigation, land use planning, local outreach and engagement, and policy solutions. This work is guided by conservation science at regional and local scales. Jessie Levine, SCI coordinator, and John Austin from Vermont's Fish and Wildlife Department, will provide an overview of the partnership at the ecoregional scale, our multi-faceted approach, and examples of recent successes.

# Abstracts

## Session A

**Some important points to be aware of when measuring and monitoring connectivity: Landscape versus habitat connectivity, within-patch and between-patch connectivity, and the influence of changes in habitat amount**

By Dr. Jochen Jaeger

Various methods have been proposed in the literature to measure ecological connectivity.

They have particular strengths and weaknesses, and they often relate to different definitions of connectivity. Some users of these methods are not aware of these differences, which can result in misleading conclusions. I will provide some examples of these points that users should be aware about and explain how the effective mesh size is used to measure the connectivity and fragmentation of landscapes and habitats while addressing these potential issues.

**Measuring Forest Connectivity in Nova Scotia: Comparing a variety of methods to gain perspective**

By Caitlin Cunningham

An approach being used to examine forest connectivity from a variety of perspectives in Nova Scotia using multiple methods including mesh size, circuitscape and patch analytics will be overviewed. Preliminary findings will also be presented.

**Halifax Green Network Plan**

By Ben Sivak

In 2018, Halifax Regional Council approved the Halifax Green Network Plan, a strategic planning documents that will guide municipal decisions and investments related to the regions green spaces over the next decade. This presentation will provide a overview of the Plan's development and outline how it will help shape the growth and development of the Halifax Region.

# Abstracts

## **Integrating Wildlife Connectivity with Municipal Land Use Planning in Cumberland, NS**

By Ian Watson

In 2016, the Municipality of the County of Cumberland began to develop a new municipal land use plan and the associated regulations that enforce that plan. The Municipality encompasses much of the Isthmus of Chignecto, a crucial wildlife corridor. The new land use plan presented a unique opportunity to integrate new research on probable wildlife routes into municipal decision making processes. This presentation will review the process and outcomes for the new Cumberland plan and connectivity, as well as the challenges along the way.

## **Maine's Beginning with Habitat Partnership: Providing Technical Assistance at Multiple Scales**

By Amanda Shearin

Maine's conservation decisions often are made locally by municipalities and landowners. This presentation will explore Maine's Beginning with Habitat program, an agency-NGO partnership that provides natural resource information and technical assistance to conservation decision-makers and planners across the state.

## **Session B**

### **Protected Areas and Connectivity: Building Networks**

By Dave MacKinnon, Craig Smith & Karen Beazley

Protected areas are known to be effective for reducing habitat loss and fragmentation within their boundaries, however land use activities continue outside their boundaries, leading to isolation and subsequent declines in species and processes they are intended to protect. Ecological science, international guidance and national commitments call for conservation of connectivity areas between protected areas. We summarize challenges and opportunities to building interconnected networks of protected areas and linkages, with examples from Nova Scotia and New Brunswick.

# Abstracts

## **Key Linkage Area - Chignecto Isthmus: Achievements and Future Directions**

By Craig Smith, Dave MacKinnon, Paula Noel, Roberta Clowater

Through the structure of Staying Connected Initiative, presenters will first summarize and contextualize the Chignecto Isthmus, the only thing keeping Nova Scotia from being set adrift into a sea of ecological uncertainty before turning the collective brain power of session attendees towards scoping and defining “Isthmus 2.0” or, the next phase of conservation objectives and activities to be pursued in the region.

## **Chignecto Isthmus Linkage Area: Progress to Date** By Dave MacKinnon

The Chignecto Isthmus connects Nova Scotia to the rest of North America and is the only current overland route for species movement into and out of Nova Scotia. Recognition of its importance has grown in recent decades, leading to rising conservation focus and a growing conservation footprint on the land.

## **Road-wildlife interactions in the Chignecto Isthmus region of NS and NB** By Amelia Barnes

Roadkill is a frequent symptom of loss of wildlife habitat connectivity due to transportation infrastructure. Master’s research using roadkill surveys is attempting to quantify this problem in the Chignecto Isthmus region to help increase ecological flow between New Brunswick and Nova Scotia.



# CANADIAN MARITIMES ECOLOGICAL CONNECTIVITY FORUM

**APRIL 24-25, 2019 | HALIFAX, NS  
STUDENT UNION BUILDING  
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Conservation Council of  
New Brunswick





# Welcome to the Canadian Maritimes Ecological Connectivity Forum

## **Forum Purpose**

To support the goals of Resolution 40-3 made by the New England Governors and Eastern Canadian Premiers that acknowledges the need to work across landscapes and borders to advance efforts to restore and maintain ecological connectivity.



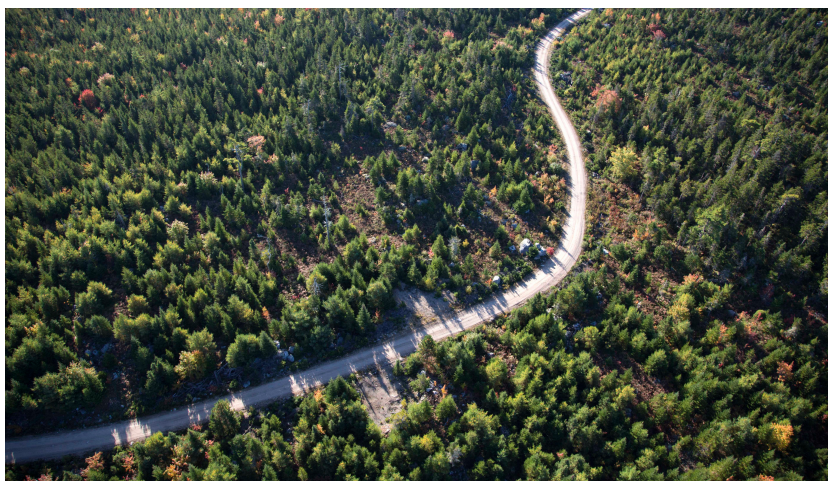
## **Resolution 40-3**

A resolution adopted on August 29, 2016 at the Conference of New England Governors and Eastern Canadian Premiers to address the importance of ecological connectivity for the adaptability and resilience of our region's ecosystems, biodiversity, and human communities in the face of climate change.



## **Forum Objective**

To provide a platform for sharing knowledge and experience between jurisdictions and across borders on planning efforts and land protection for restoring ecological connectivity.



*Photos by Len Wagg*



*With keynote speakers...*



## DR. MARK ANDERSON

*Director of Conservation Science, Eastern US*  
The Nature Conservancy

Mark provides science leadership, ecological analysis, and landscape assessments for conservation efforts across twenty-two states in the Eastern United States. He holds a Ph.D. in Ecology from University of New Hampshire and has worked in conservation for over 26 years. He manages a team of six scientists specializing in landscape ecology, aquatic biology, marine spatial planning, and regional data management.



## DR. GARY TABOR

*Founder, Center for Large Landscape*  
Conservation

Gary is an ecologist and wildlife veterinarian based in Bozeman, Montana. In 2007, Gary founded the Center for Large Landscape Conservation to help people and institutions make better land use decisions at the scale nature functions. He has worked on behalf of large landscape conservation internationally for over 35 years with 10 years of experience in Africa, South America and Australia and 12 years as a leader within the U.S. philanthropic community, including the Yellowstone to Yukon Program Director for the Wilburforce Foundation.

# Lead Organizers



## **Morgan Rice, Master of Resource and Environmental Management, Dalhousie University**

Morgan is a recent graduate of the Master of Resource and Environmental Management Program at Dalhousie University. After receiving her Hon. B.Sc. in Environmental Science from the University of Guelph, Morgan worked at Credit Valley Conservation Authority in Ontario where she contributed to the implementation of both stream and habitat restoration projects, and educated local residents and students on conservation stewardship. Through this, her passions for conservation and protecting the environment became stronger, leading her to pursue her Masters degree at Dalhousie University. Morgan has recently completed a position as Project Manager for a government funded research project on forested wetlands in Atlantic Canada. Now, Morgan is planning to continue devoting her time to help with ecological connectivity efforts and improving landscape conservation across Atlantic Canada.



## **Karen Beazley, Professor, School for Resource and Environmental Studies, Dalhousie University**

Karen is a professor in the School for Resource and Environmental Studies at Dalhousie University. For more than 30 years, her teaching and research has covered a range of topics related to ecological connectivity, from various socio-ecological perspectives, including systematic conservation planning. She has been engaged with several non-governmental partnerships, such as the Canadian Council on Ecological Areas; Wildlands Network; Two Countries, One Forest; Staying Connected Initiative; and, The Nature Conservancy of Canada, among others. She Chairs the Nova Scotia Crown Share Land Legacy Trust, and is a proud Nova Scotian and Maritimer, from birth.



## **Peter Bush, Provincial Landscape Ecologist, Nova Scotia Dept. of Lands and Forestry**

Peter Bush is the Provincial Landscape Ecologist for Forest Research and Planning Group in the Forestry Division for the Nova Scotia Department of Lands and Forestry. Peter holds a Doctorate in Geography from the University of Western Ontario, a Masters in Forestry from Lakehead University and Environmental Geography degree from Laurentian University. Peter is an adjunct professor at Dalhousie and Saint Mary's Universities and an Honorary Research Associate at University of New Brunswick.



# Speakers



## **John Austin, Co-chair of the working group for Resolution 40-3, New England Governors and Eastern Canadian Premiers**

Mr. John Austin is the Director of Land and Habitat Conservation for the Vermont Fish and Wildlife Department. Mr. Austin has served as a wildlife scientist and administrator for the State of Vermont for the past 25 years. In this capacity, Mr. Austin oversees all aspects of the Department's land and habitat conservation interests. He was involved in the development of Resolution 40-3 and has a long history of working closely with a wide range of conservation partners on matters related to region-wide landscape conservation, including working with the Staying Connected Initiative.



## **Danielle St-Pierre, Co-chair of the working group for Resolution 40-3, New England Governors and Eastern Canadian Premiers**

Mrs. Danielle St-Pierre holds a Bachelor's degree in Biology from the Université du Québec à Chicoutimi and a Masters degree in management and organizational development from Université Laval. She has 28 years experience in public services in environment and wildlife fields. She has worked in nine different administrative regions in Quebec. As a Wildlife Manager since 2005, she is director of the Direction de l'expertise sur la faune terrestre, l'herpétofaune et l'avifaune (Terrestrial Wildlife) of the ministère des Forêts, de la Faune et des Parcs (Forest, Wildlife and Parks). She is a member of the Canadian Wildlife Directors Committee, the Eastern Habitat Joint Venture Council, and co-chair, with Mr. John Austin of Vermont, the working group for the implementation of the Resolution 40-3 on Ecological Connectivity, Adaptation to Climate Change and Biodiversity Conservation.



## **Jessie Levine, Senior Conservation Advisor and Coordinator of the Staying Connected Initiative, Nature United**

Jessie works on developing and implementing tools to sustain connected forest and freshwater habitats and addressing challenges posed by climate change. Jessie is the Eastern North America lead for the IUCN Connectivity Conservation Specialist Group and a member of the Executive Committee of the Network for Landscape Conservation. Her prior work includes managing local and international environmental partnerships in the US, Canada, and across North America, coordinating biodiversity research, overseeing youth environmental education programs, and directing volunteer programs in Latin America. Jessie has a BA in Human Biology from Stanford University, an MS in Energy and Resources, and an MCP in City and Regional Planning, both from UC Berkeley.

# Speakers



## **Dave Ireland, Senior Project Manager, Conservation Council of New Brunswick**

Dave works at the intersection of science, policy and public engagement, and has over 20 years experience in conservation biology and environmental action. Previously Dave was the Managing Director of Natural History at the Royal Ontario Museum and is the co-founder of the Ontario Road Ecology Group.



## **Dr. Jochen Jaeger, Associate Professor, Concordia University Montreal, Department of Geography, Planning and Environment**

Jochen Jaeger joined Concordia University in Montreal in 2007. He is working in the fields of landscape ecology, road ecology, urban sprawl, ecological modelling, environmental indicators, environmental impact assessment, and trans-disciplinary research concepts. His lab recently investigated the effectiveness of fences and wildlife passages along a major highway in Quebec (HW 175), the ecological connectivity of natural areas in cities, and the role of uncertainties in environmental impact assessment in Canada. His research team received the IENE Project Award 2011 for their project "Landscape Fragmentation in Europe" from the Infra Eco Network Europe (IENE) in 2011.



## **Mandy Karch, Executive Director, Ontario Road Ecology Group**

Mandy has studied turtle populations that rely on safe movement corridors whether it be across roads or ocean habitat. Mandy has been dedicated to the Ontario Road Ecology Group for a decade and has initiated research projects, launched citizen science programs, facilitated government and non-government collaborations, and championed mitigation and policies that enhance landscape connectivity to improve the way wildlife/road interactions are managed.



## **Kari Gunson, Road Ecologist, Wildlife on the Roads**

Kari Gunson is a practicing road ecologist in Ontario and elsewhere in North America. In the past ten years her work has focused on monitoring the use of crossing structures for both large and small animals on both large highways and small municipal roads. In addition, Kari is an experienced Geographic Information Systems analyst and has worked with municipalities and the provincial government in Ontario to integrate new and emerging planning tools into landscape-level analyses to better understand where animals are killed on roads, and to prioritize mitigation. More recently Kari has started a new program called 'Wildlife on Roads' that includes a handbook, citizen science data collection platform, and forum for education and awareness about collecting good and complete wildlife on roads data to be used in mitigation planning



# Speakers



## **Chris Slesar, Environmental Resource Coordinator, Vermont Agency of Transportation**

Chris oversees the work of a top-notch staff of natural and cultural resources experts. Chris has been engaged in road ecology and habitat connectivity issues since 2002, when he developed the Highways & Habitats Training for VTrans staff. As the Chair of his town's (Monkton, VT) conservation commission, Chris was the volunteer project manager for the Monkton Amphibian crossing project that retrofitted a town road with two dry culverts that provide safe passage for migrating amphibians at one of the region's most robust and threatened amphibian crossing sites. The Amphibian Crossing project received a 2017 Federal Highway Administration (FHWA) Environmental Excellence Award. Chris is a member of the Steering Committee for the International Conference on Ecology and Transportation (ICOET) and is the ICOET 2019 Program Chair.



## **Greg Quinn, Ecologist, New Brunswick Dept. of Transportation and Infrastructure**

Greg works on a variety of wildlife, wetland, and environmental regulatory issues. Recent projects include wetland compensation, vehicle/wildlife collision monitoring, track and camera surveys, Canada goose management and various environmental assessments for road and bridge infrastructure. Prior to working at NBDTI, he spent over a decade working in consulting, and served as a technical lead in wetlands and vegetation. He also has extensive work and educational experience in forestry, bat ecology, birds, and other wildlife. Greg is currently on the steering committee for the Staying Connected Initiative.



## **Kristen Ferry, Habitat Restoration Program Manager, Division of Ecological Restoration, Massachusetts Dept. of Fish & Game**

For the past 18 years, Kristen has worked in the fields of ecological restoration and marine fisheries biology at the state and federal agency levels in the Northeastern, United States. As Habitat Restoration Program Manager, she provides oversight for DER's river, stream, and wetland restoration activities. The Habitat Restoration Program includes five practice areas: dam removal, tidal wetland restoration, stream continuity (i.e., culvert replacement), retired cranberry bog restoration, and ecological restoration engineering. DER's habitat restoration projects also increase climate change resiliency for aquatic systems and communities through the removal or replacement of outdated and degraded aquatic infrastructure.

# Speakers



**David MacKinnon, Systems Planning Coordinator, Protected Areas Branch, Nova Scotia Environment**

David co-founded the Nova Scotia Nature Trust and is a former chair and current vice-chair of the Canadian Council on Ecological Areas, as well as former chair and current treasurer of the Atlantic Canada Conservation Data Centre. He is currently a member of the Staying Connected Initiative steering committee.



**Craig Smith, Nova Scotia Program Director, Nature Conservancy of Canada**

Craig has been working and volunteering on conservation issues in Nova Scotia for over a decade, including directing the Nature Conservancy of Canada's conservation efforts across the province. Craig enjoys working at the intersection of science, planning and management and teaching his young kids how to enjoy being outside.



**Roberta Clowater, Executive Director, Canadian Parks and Wilderness Society - NB Chapter**

Roberta has worked for the past 26 years in leadership roles for non-government conservation organizations in New Brunswick. Roberta has a B.Sc. in Biology from the University of New Brunswick, and a MA in regional and park planning from the University of Waterloo. She is a part-time instructor in Forestry and Environmental Management at the University of New Brunswick. Roberta is a Board member and current chair for the international Two Countries, One Forest network.



**Amelia Barnes, Master of Environmental Studies Candidate, Dalhousie University**

Amelia holds a Bachelors of Science in Biology and a Bachelors of Education from Cape Breton University. She is currently a Masters of Environmental Studies Candidate at Dalhousie University with research interests in road ecology, landscape connectivity and biodiversity conservation.



**Caitlin Cunningham, PhD Candidate, Interdisciplinary PhD Program, Dalhousie University**

Caitlin is an Interdisciplinary PhD student at Dalhousie University. Her work is broadly focused on landscape ecology and large scale connectivity analyses. She will discuss some of her work through an approach being used to examine forest connectivity from a variety of perspectives in Nova Scotia using multiple methods including mesh size, circuitscape and patch analytics.



# Speakers



## **Andrea Clouston & Richard Pither, Scientists, Landscape Ecology Research Section, Environment & Climate Change Canada**

Andrea and Richard both have academic and applied backgrounds in landscape ecology and have worked for the Federal Government for more than 10 and 15 years respectively.



## **Paula Noel, New Brunswick Program Director, Nature Conservancy of Canada**

Paula is the New Brunswick Program Director with the Nature Conservancy of Canada, and board member of the NB Wildlife Council, Nature NB and the Canadian Council on Invasive Species. With NCC, Paula has been working to protect and understand terrestrial connectivity on the Chignecto Isthmus since 2009, leading programs in land conservation, road ecology, collaborative planning and communications.



## **Dr. Amanda Shearin, Habitat Outreach Coordinator, Maine Dept. of Inland Fisheries and Wildlife**

Amanda is the Habitat Outreach Coordinator with Maine Department of Inland Fisheries and Wildlife. Prior to joining MDIFW in 2014, Amanda worked on multiple natural resource issues across Maine, New England and internationally, including wildlife and transportation conflicts, vernal pools and wetland ecology, fishless lakes, sustainable agriculture, and cetacean ecology. She holds a Ph.D. in Ecology and Environmental Sciences from the University of Maine.



## **Ben Sivak, Principal Planner, Halifax Regional Municipality**

Ben Sivak is a Principal Planner for the Halifax Regional Municipality with 14 years of municipal planning experience in both urban and rural contexts. He received an Hon. B.Sc. from the University of Toronto and a Masters of Urban and Rural Planning from Dalhousie University.



## **Ian Watson, Senior Planner, UPLAND Planning + Design,**

Ian is a Senior Planner with UPLAND Planning + Design. Ian leads and manages all of UPLAND's comprehensive planning projects, including drafting policies and regulations, leading background analyses, and leading public engagement strategies. Prior to becoming a planner, Ian completed an Honours Degree in Biology at Queens University.



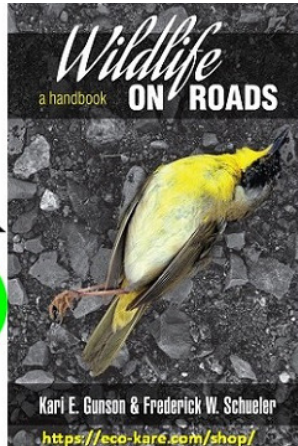
## **Len Wagg, Photographer**

Len Wagg is an award winning Canadian photographer and author. His work has been published in newspapers, magazines, and books all over the world. He is the author of seven books including award winning Wild Nova Scotia. A visual storyteller for over thirty years, his work is known for capturing the majestic beauty of his native Nova Scotia.



# Wildlife on Roads: A Handbook

## By Kari Gunson & Frederick Schueler



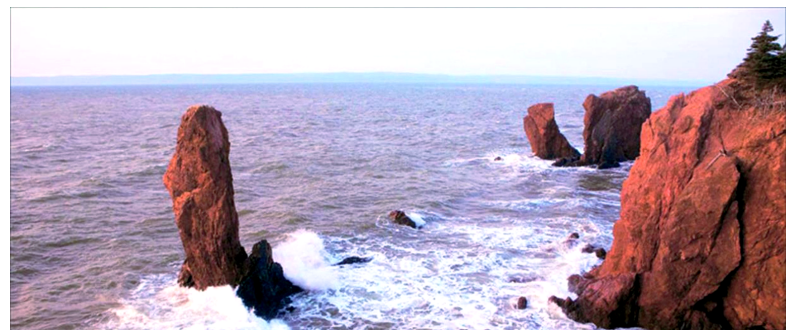
Wildlife on Roads is a handbook for those that wish to or are currently collecting data about wildlife on roads. It focuses on two key aspects of data collection: identifying wildlife on-roads to the lowest taxa level possible and accurately measuring its location. The book is organized by the following vertebrate orders: Turtles, Snakes and Lizards and by the following vertebrate classes: Amphibia, Mammalia, and Aves. Each section begins by describing why these animals are found on roads, and what information is important to collect. Each section is then detailed further by family and eventually to species. Descriptive species accounts were carefully selected based on whether road mortality was thought to be a concern. The book emphasizes how these data would help to evaluate road-kill impacts but also to provide solutions. The book features photos, sketches and case studies by artists, naturalists, ecologists, and citizen scientists, and is a precursor for a larger citizen science project that entails a repository to submit data, and upcoming workshops.

<https://eco-kare.com/>

# Wild Nova Scotia

## Photography by Len Wagg

Nova Scotia has designated thirty-three Crown-owned areas as Wilderness Areas, consisting of about five percent of the provincial land-mass. The wilderness area designation means no mining or logging is allowed, but people are free to hunt, fish, hike, and camp as they have for generations. These Wilderness Areas - from the massive Tobeatic Wilderness Area that covers five counties to tiny McGill Lake- showcase the best of natural Nova Scotia, and Len Wagg has photographed them all for Wild Nova Scotia. Over the last year and a half, Wagg spent close to a hundred days in the province's wilderness, logging over fifteen thousand kilometres and taking beautiful, telling portraits of the province's most secret and lovely places. Photos of important areas not designated Wilderness Areas are included as well- like the shores of the Northumberland Strait, where herds of seals find places along the shores to have their young; the Bay of Fundy, where world-class tides erode massive cliffs; Kejia National Park, where the sounds campers hear are all natural; and Nova Scotia's "barren" Sable Island, home to birds, plants, seals and a herd of wild horses. Each area has distinctive characteristics that make it unique. Wild Nova Scotia showcases the special places, protected or not, allowing people to bring home some of the amazing natural beauty of this province



Wild Nova Scotia

Photography by Len Wagg

Text by Bob Bancroft

PROTECTED WILDERNESS AREAS AND CANADIAN HERITAGE RIVERS, AND OTHER NATURE SITES

<http://lenwagg.com/>