Adirondack Research Consortium

Better Information for Better Decisions

21st Annual Conference on the Adirondacks

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"Moving Forward- Revitalizing Communities and Forging Opportunities"

Presentation Abstracts in Order of Appearance

Kelting, Daniel L.[1], and Corey L. Laxson[1]

Monitoring Road Salt Pollution in Adirondack Streams

New York State is the largest user of road salt in North America, and the amount of road salt used in the Adirondack Park greatly exceeds the inputs of other regionally important pollutants. Road salt has the potential for significant negative ecological effects that may be on par with or greater than those reported for other pollutants. The objectives of this project are to understand the effects of road salt application rates on soil fertility and water quality and to develop practical information to aid agencies and municipalities in selecting management practices that reduce the impacts of road salt on forest and water resources. Stream discharge and chemical export are being monitored intensively on a network of 15 streams in the Adirondack Park representing a broad range of road salt application rates. To provide high-quality and reliable data in a cost-effective manner our approach is to measure specific conductance and stream stage at 30 minute intervals with remote loggers. Water samples are collected periodically for chemical analysis and calibration curves are developed from these data to estimate stream chemistry from conductivity. Export is determined by multiplying estimated ion concentrations by stream discharge, which is derived from stage-discharge calibration curves also developed over time through periodic stream velocity measurements. The data will be used to develop relationships between road salt application rate and water quality response that managers can then use to help choose and justify alternative road salt application rates to meet water quality objectives.

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Ngami, Margueritte1, Peethamparan, Sulapha[1]

Characterization of chemical shrinkage in cement-free concrete

Portland cement concrete is the most commonly used construction material in the world which is made by mixing ordinary portland cement (OPC), water, and fine and coarse aggregates. The cement manufacturing process amounts for 5-7% of global CO2 emissions and touches on a wide range of sustainability issues including climate change, pollution, solid waste land filling and resources depletion. Therefore, sustainable measures to reduce the carbon footprint of cement

production are being researched. One sustainable measure is developing a cement-free concrete commonly known as alkali-activated concrete (AAC). In AAC, the binder is an alkali-activated industrial by-product such as ground-granulated blast furnace slag (GGBFS) or fly ash (FA). Sodium hydroxide or sodium silicate solution is commonly used as the alkali-activator. In this study, chemical shrinkage performance of several AAC binders was evaluated. The influence of concentrations of sodium hydroxide or sodium silicate solutions, the amount of Na2O content, and the curing temperatures (25° and 50°C) on the magnitude and kinetics of chemical shrinkage was evaluated. ASTM C1608 was used for monitoring chemical shrinkage. The results show that chemical shrinkage is much lower in alkali-activated system than in OPC system which implies a higher degree of hydration and product formation in OPC paste than in alkali-activated paste.

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Larkin, Abigail [1,2*] and Colin Beier [1,2]

Adirondack Park Trail Use Database: Construction And Potential Applications

Recreation and its associated benefits represent a common activity among residents, communities, and visitors in the Adirondack Park. Despite the significance of recreation to the Adirondack culture and economy, managers and decision makers have had little or no quantitative information to describe the recreational user base or the distribution of use across the trail network. The New York State Department of Environmental Conservation (NYSDEC) maintains a system of over 250 official trail registers to support search and rescue efforts. Trail registers contain a wealth of raw data describing multiple dimensions of use along the trail network, but doubts regarding register compliance and a lack of resources have challenged efforts to compile this information. With recent work determining 95% register compliance among Adirondack Park trail users, and through collaboration with the NYSDEC, the Adirondack Park Regional Geographic Information Systems (GIS) Consortium collected and digitized extensive trail register data from 2012 and incorporated these data into the Adirondack Park Trail Register Database (ADK-TReD). Over 540,000 user days were recorded in 2012 – a conservative estimate of trail use across the 2,350 mile trail network. In a relational database, trail use data can be evaluated by individual trail, management unit, month or season, and by the origin or destination of trail user. Linked with GIS, data can be analyzed for a wide variety of purposes, including management decision-making, conservation and community planning, economic development, public-private stewardship of recreation infrastructure, and research on the role of recreation in sustaining the Adirondack 'experiment' in conservation.

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Schwartzberg, Ezra G.[1*], David A. Patrick[2]

How Smartphones Are Contributing To Regional Research In The Adirondack Park.

In recent years colleges, research stations, museums, and nature preserves have started implementing long-term monitoring activities to detect and understand the effects of climate change on ecosystems. At the same time, increased use of smartphones and a growing interest among citizen scientists has led to the development of several web-based databases and social networks tailored to naturalists. These web-based smartphone apps, including eBird, iNaturlaist, iMapInvasives, and Nature's Notebook, are enhancing the role of the citizen scientist in regional research. Here, we discuss the web- and network-based approach that the Adirondack All-Taxa Biodiversity Inventory (ATBI) program at Paul Smith's College is utilizing at the biennial Bioblitz scheduled at Huntington Forest June 29th 2014.

[1]Adirondack Research LLC, Saranac Lake, NY
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The Adirondack Center for Working Landscapes

McLeod, Brett; Sweeney, Susan; Glenn, Katharine; McDonnell, Brian

The Adirondack Center for Working Landscapes (ACWL), a collaborative initiative between Paul Smith's College and Cornell Cooperative Extension, will serve as the meeting point for working landscape policy and practice in the Adirondack-North County. This innovative center, housed at the Paul Smith's College VIC, exemplifies experiential learning by engaging faculty, students, and regional stakeholders with the issues and innovations related to forestry, sustainable tourism, agriculture and food production. The promotion of purposefully integrated, multifunctional landscapes is central to crafting durable communities capable of producing both healthy ecosystems and a vibrant economy in the Adirondack-North Country.

Acknowledging that these initiatives begin at the individual and community levels, the partner in the Center, Cornell Cooperative Extension, will offer support, training and access to resources that promote sustainable working landscapes, targeted at farmers, forest owners, entrepreneurs, and natural resource professionals. This presentation will highlight the mission, and outline opportunities associated with the ACWL, including the announcement of numerous workshops and policy forums beginning summer 2014.

School of Natural Resource Management & Ecology, Paul Smith's College

Paul Smith's College VIC, Paul Smiths, New York 12970

Ratner, Shanna[1]

Creating and Retaining Wealth: Connecting Assets with Market Demand for Lasting Livelihoods

Traditionally, wealth – be it natural resources, agricultural output, young people, or other forms of capital – has flowed out of rural communities. WealthWorks is an innovative approach to meeting the complex challenge of building wealth in areas of persistent poverty. WealthWorks is a bridge between community development and conventional economic development that creates and maintains inclusive non-exploitative demand-driven economic opportunities through investment in the assets of rural places to meet the needs of larger markets. The WealthWorks approach, developed in partnership with the Ford Foundation, intends to improve the livelihoods of poor people by creating wealth that is owned, controlled, and reinvested in their places, so that they become valued partners in resilient regions. It offers a systematic approach that identifies enterprising opportunities in a region and engages a wide range of partners in turning those opportunities into results that both build and capture wealth.

This session will provide an overview of the wealth creation approach, which aims to strengthen rural communities and economies by building capacity within shared economic networks, or value chains, to build multiple types of community wealth. Examples of regions where this approach has worked will be shared, as well as exercises that will give attendees some practice in the WealthWorks approach and concepts.

[1] Yellow Wood Associates, St. Albans, Vermont

Matthew Marko, P.E., BCEE, F. ASCE[1]

Infrastructure Optimization: Combined Approaches to Integrate Natural and Built Infrastructure

The role of ecosystems in optimizing the water, food, climate, and energy nexus is of fundamental importance. The services provided by forests, wetlands and floodplains support and complement engineered water, energy and food infrastructure. Without healthy ecosystems in well-functioning watersheds, the built environment will create an unsustainable imbalance. Society needs to invest in strategies that combine natural infrastructure with engineered solutions, which ultimately leads to reduced total costs and highest value outcomes.

This presentation takes a brief look into Integrating natural and built infrastructure solutions, and answers the questions: Will it work? Can it be implemented at the scale needed? We will discuss overcoming institutional and departmental silos, infrastructure optimization, technology, and the partnerships necessary for success.

[1]CH2M HILL Water Business Group, Syracuse, NY

O'Donnell, Jeffrey M.[1*], Patricia Stokowski[1]

Exploring Conservation Discourses In The Adirondacks: From Whitney Park To Finch Pruyn

The primary objective of this research is to illuminate contemporary discourses of conservation in the Adirondacks, where recent collaborative planning efforts are challenging longstanding assumptions of perpetual natural resource conflict. Media content and discourse analysis techniques are employed to investigate the extent to which discourses of conservation in the Adirondacks reflect: (1) discourse characterized by language, metaphors and narratives that embody collaborative themes, such as consensus, cooperation, problem-solving, trust-building, and multiple perspectives; and (2) place discourses, including analysis of the extent to which actors statements embody "place" narratives as opposed to "interest" narratives. Published newspaper articles, commentaries, and letters to the editor published from January, 1995 to December, 2013 in the Adirondack Daily Enterprise, Plattsburgh Press Republican and North Creek News Enterprise concerning six major conservation projects serve as the primary source of data (n = 150). An iterative process of pattern discovery, sorting and categorization guides analysis of the texts, which are sorted by key themes that emerge around collaborative and place-based discourses. Preliminary analysis indicates that the frequency of collaborative talk has increased during the study period. Emerging themes include impacts of conservation projects on local timbering and hunting culture, motorized access to conservation lands, and tensions between place narratives employed by environmental groups and local residents and elected officials. This research will help assess whether recent collaborative efforts have led to measurable change in regional conservation discourses. More broadly, this research also seeks to uncover stakeholders' long-term visions for the Adirondacks, informing managers, planners, and community leaders.

[1]Rubenstein School of Environment and Natural Resources, University of Vermont
University of Vermont, Burlington, VT 05405

Evans, Celia[1] and Yurkova, Natalya[2]

The Role of Formal and Informal Experiences in Developing Ecological Awareness, Sense of Place, and Perception of Nature in Children in rural Communities

Much science education research examines learning that occurs in the classroom, or in settings such as museums. However, in rural cultures where interaction with the environment in the form of outdoor chores, agriculture, hunting, gathering, and outdoor recreation take up large proportions of out-of- school time, children's perceptions , and knowledge about their environment are likely strongly influenced by those activities. We surveyed 3rd and 4th grade classrooms in two rural areas: The Adirondack Park in Northern NY State and the Altai republic of the Russian Federation in Siberia. Our goal was to analyze mechanisms that influence children's ecological awareness, attachment to place, and perceptions of nature. We used descriptive word lists, drawings, short narratives, and a survey, to help us understand the relative importance of school, family, and informal outdoor experiences in children's ecological awareness and understanding. All students came from families that have lived for an average of three generations 'in place'. On average 70% – 90% students in both places have grandparents that live in the same area. In both sets of students, data suggest that learning 'about nature' occurs most when students are involved in a range of outdoor experiences, during school activities, and during exchanges with extended family members. Outcomes are discussed in conjunction with the analysis of images of 'place' drawn by students and their accompanying narratives. Linking information gleaned from this work with formal curriculum development, could provide a familiar jumping off point for a wide variety of formal ecological and biological learning activities.

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Patinelli-Dubay, Marianne[1*]

Philosophy For Science And Forestry Professionals

Philosophy for Science and Forestry Professionals is an ongoing project currently serving New York State Department of Environmental Conservation personnel, as well as forestry professionals through accreditation with the Society of American Foresters.

The purpose of my presentation is to describe the content and usefulness of the Philosophy for Science project, and to encourage broader regional participation from agencies and organizations with an environmental mission. This presentation will provide a brief overview of the primary methods that we employ when faced with ethically-weighted situations and how participants

learn to put those methods to use through organizationally relevant case studies. I will discuss the advantages of gaining greater awareness of the key considerations that we intuitively rely on to navigate situations that are in tension as a result of competing interests, including a heightened ability to reflect more ably on one's decision making process.

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McGovern, Elizabeth B.[1*], Heidi E. Kretser[2]

Puma concolor cougar in the Adirondack Park: Resident and Visitor Perspectives

Mountain lions (Puma concolor cougar) were extirpated from the Adirondack Park in northern New York more than 100 years ago, but the species may be regaining its former range in the eastern United States. We measured the wildlife values orientations (WVOs), risk perception, and factual knowledge of 315 Adirondack residents and visitors at grocery stores, farmer's markets, tourist destinations, and a privately-owned public trailhead in the summer of 2013. Our results revealed a relationship between perceived risk from mountain lions, factual knowledge about mountain lions, and support for their return to the Adirondacks – those with higher knowledge scores perceived less risk to humans (Pearson correlation=-0.188, $p=0.001$) and had greater support for wildlife management agency action ($F=19.84$, $df=2$, $p<0.001$). This survey also showed 69% support among residents and 84% support among Park visitors for natural restoration of mountain lions, as well as a plurality (49%) of overall support for wildlife management agency action to facilitate the return of mountain lions to the area. These results suggest that additional assessments of the region's social and ecological capacity to support a viable population of mountain lions are needed.

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Jensen, Paul G.[1*] and Timothy M. Watson[1]

Carnivore Monitoring in the Northern Forest: A Citizen Science Approach

Many forest carnivores represent high-priority conservation targets, yet are difficult to survey due to their low population densities and cryptic behavior. In addition to these challenges, estimating the distribution and abundance of these species at a landscape-scale represents a formidable task given limited resources available to state agencies charged with their

management. Here, we describe a new effort to monitor several carnivore populations in Adirondack Park using non-invasive survey techniques within a citizen science framework. These surveys will generate detection/non-detection and mark-recapture data for estimating occupancy and abundance, respectively. Our initial efforts will focus on American martens (Martes americana) and fishers (Martes pennanti), however, we plan to collect additional data on other species (e.g., coyotes; Canis latrans) in this dynamic carnivore community. We anticipate that in addition to building our capacity to collect these data, a citizen science approach may foster support for conservation programs using forest carnivores as focal species in the northeast.

[1]New York State Department of Environmental Conservation, Division of Fish, Wildlife and Marine Resources

Celia Evans[1*], Dan Kelting[1], Martin Serwatka[1], Derek Scott[1], Megan OReilly[1]

Title: Investigating growth and growth form in invasive and native watermilfoil species across a range of water temperatures: implications for aquatic plant communities under climate change scenarios

In the Northeastern United States, predicted temperature increases of 2.5 to 4 degrees Fahrenheit in the winter season, and 1.5 to 3.5 degrees Fahrenheit in the summer will be reflected in lakes with earlier ice out, warmer spring water, and higher summer peak temperatures. Few published studies have examined the effect of temperature change on aquatic invasive species growth, in the Northeastern United States. We studied the physiological responses of fragments of two invasive (Myriophyllum spicatum - Eurasian Watermilfoil (EWM) and Myriophyllum heterophyllum - Variable Leaf Milfoil (VLM)) and one native (Myriophyllum spicatum - Northern Watermilfoil (NWM)) species of milfoil over a range of water temperatures that reflect a broad range of current and predicted water temperatures (14C, 21C, 24C, 26C, 31C). We measured total biomass, new biomass growth, length and lateral growth, and rootlet production over a 6 week period. For all growth variables, the native NWM was significantly less than the invasive species regardless of temperature, and was reduced in higher water temperature. Invasive EWM and VLM fragments added about the same amount of new biomass over the experiment, however they had distinctly different response curves to temperature increases. Differences in carbon allocation appears to be important to overall fragment success. VLM fragments are very robust and maintain much of the green biomass of the initial fragment while adding some new tissue. NWM fragments are fairly fragile and maintain a fair amount of green initial biomass, however they have very low growth rates at any temperature and grow particularly poorly at the higher temperatures. EWM essentially puts no carbon into maintenance of initial fragment biomass, but allocates the most carbon to apical and lateral growth in buds that break after fragmentation. Controlled laboratory studies are the first step in developing hypotheses about competition outcomes that might alter community composition in a future of

warming summer water temperatures. These outcomes clearly suggest that the slow growing, native NWM will be negatively affected by warmer spring water temperatures, while the invasives will benefit, at least at the fragment stage.

[1]Paul Smith's College and the Adirondack Watershed Institute, Paul Smiths, NY

Hai, Paul B.[1] Morehouse, Frank E.[1] Pasquino, Kristin L.[1]

Outreach at ESF's Adirondack Interpretive Center: Reaching Beyond Traditional Audiences and Uses

SUNY ESF assumed management of the Interpretive Center in Newcomb 3 years ago, making a commitment to maintaining the facility as a center for informal science education and information in the region, while also supporting the local economy by maintaining an important community resource. Over the intervening 36 months ESF has invested significantly in improvements to the facility, added full-time staffing capacity, reconceived the scope of content provided and audiences served by the center, and inaugurated a primary research initiative.

This session will feature three presentations exploring the new investment, programs, and research unfolding at the AIC. 1. Investing in the Center, Investing in the Community - This section will discuss the suite of improvements at the AIC in the context of improving guest experience and the role of the center as a community resource. 2. More than Meets the Eye: Rethinking the Traditional Role of a Nature Center – Natural history programing and low-impact recreation is has been the core mission of nature centers, however the breadth of nature-based experience enjoyed by visitors to the Adirondacks provides a wide opening to deliver exciting new content to diverse new audiences. 3. A Return on Investment: Using Outreach to Generate Primary Research – As a public resource providing informal science education and information to thousands of visitors a year, the AIC represent a unique asset for research institution granting undergraduate and graduate degrees in multiple disciplines investigating ecology, natural resource management, informal science education, and associated social sciences.

[1] Northern Forest institute, SUNY-ESF, Newcomb, NY 12852

Christine L. Abplanalp[1], Jessica Beach[1], Colin Dowd1, Melissa Martinez[1], Alessandra Pratt[1], Ryan Recchia[1], Samantha Karpa[1], Zoe Spindelman[1], Emma Vandelinde[1], and Ian Vitek[1]

Energizing local communities through biomass heating solutions- pros, cons & policy considerations

As one of the coldest winters in recent memory comes to a close many people found that they were spending too much money heating their homes and businesses with inefficient systems. This winter has demonstrated that there is a need to change to a cheaper and more sustainable heating solution. With increasing trends in fossil fuel prices, people have growing concerns about how they can afford to heat their homes. But, there is hope! The extensive natural resources of the Adirondack region have the potential to be harnessed for renewable biomass heating implementation; this would provide local economic prosperity and energy security while simultaneously encouraging environmental sustainability. The purpose of this research is to determine the efficiency of various heating systems and the feasibility of incorporating widespread biomass heating implementation with sustainable forestry practices already established in the Park. In comparison to other fuel options, the implementation of sustainable forestry in combination with efficient biomass heating systems would result in local economic benefits, a reduced carbon footprint, and lower emissions. Research was conducted to gain a comprehensive understanding of the economic, environmental, political, and social aspects of biomass heating implementation for local residents and businesses. Regarding political aspects of biomass heating, organizations provide incentives to help spread the use of biomass heating systems; the regulations are ultimately up to residents and the local and state governments to decide. There are many stove and boiler options for homeowners and businesses to choose from to fit their specific needs. In this case, an organization like NYSERDA will be more interested in helping to pay for the initial boiler cost. While upfront costs may scare people away from these biomass systems, the savings in the long run will outweigh the initial expense. Contrary to popular belief, high efficiency pellet boilers and stoves yield low volumes of ash as a byproduct when compared to cord wood. This ash is non-toxic and nutrient rich; as such it is often spread on homeowner's lawns. Pelletized wood contains lower water content than cord wood which results in higher energy content per volume. The emissions and particulate matter that are released from pellet stoves and boilers are minimal when compared to conventional woodstoves. A majority of carbon that is released into the atmosphere from the combustion of biomass can be sequestered by replanting trees through sustainable forestry. The formation of a local supply chain, from the logging sites to the customers, is essential for keeping money in a region, while stimulating the economy. Residential markets allow for communal expenses to stay local, while consumption upholds endless demand. Additionally, we toured a wood pellet manufacturing facility, a local pellet boiler project, a logging site, and attended many presentations from industry professionals. While there's a growing interest in biomass burning in New York State, we are not at the level of European countries or even New England, where use is more prevalent. Our mission is to inform you of available options of biomass heating systems that are affordable, minimize pollution, and are sustainable solutions to heating your home or business.

[1]Clarkson University, Potsdam, NY/Adirondack Experience Program, Saranac Lake, NY

Poster Abstracts

Paul Casson[1], Richard Brandt[1], and James Schwab [2]

ASRC Whiteface Mountain Field Station

The Atmospheric Sciences Research Center and Whiteface Mountain Field Station was established on February 16, 1961 by the State University of New York as a University-wide center for the purpose of promoting and encouraging programs in basic and applied sciences related to the atmosphere. The mission of the research at ASRC's Whiteface Observatory is to enhance our fundamental understanding of the chemical and physical nature of the atmosphere, and to apply that knowledge to study the interaction of chemical, physical, geological and biological processes impacting our environment. Atmospheric trace gases, particulates, and meteorological measurements are made at two different monitoring sites. The lodge site is located at an elevation of 604 meters and the summit site is located at an elevation of 1483 meters. Monitored gases include carbon monoxide, sulfur dioxide, ozone, and nitrous oxides. Condensed phase pollutants measured include sulfates and nitrates that result in acid rain, as well as black carbon.

The ASRC Whiteface Mountain field station is ideally suited to conduct environmental monitoring programs and support a range of ecological research studies. One of the primary reasons for tracking atmospheric trace gases and particulates at Whiteface is to gauge the effectiveness of pollution controls. The opportunity to educate and inform the public about the atmospheric monitoring and research activities being conducted at the ASRC Whiteface Mountain Field Station is critical in promoting scientifically sound public policy.

Atmospheric Sciences Research Center, University at Albany, State University of New York
[1]Whiteface Mountain Station, Wilmington, NY
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Research supported by NYSERDA contracts 22873 and 30567.

Brandt, Richard. E. [1*], James J. Schwab[1], Kenneth L. Demerjian[1], Henry D. Felton[2] and Oliver V. Rattigan[2].

25 Years of Atmospheric Monitoring at Whiteface Mountain Observatory.

Long term records of trace gas (O_3, NO, NO_2, NO_Y, SO_2, CO) atmospheric constituents and standard meteorological parameters have been collected at the Whiteface Mountain Observatory in the Adirondack Mountains of northern New York. Built in 1971 by the Atmospheric Sciences Research Center (ASRC) of the University of Albany, the observatory sits atop Whiteface

Mountain (44.366□N 73.903□W) at 1483 m above sea level. At this altitude, near the 850 mb pressure level, the bulk of the trace gases arrive from long range transport from regional sources. Analysis of the record has shown that local pollution rarely contaminates the summit sampling site.

Tropospheric ozone has been continuously monitored since 1973, with CO and oxides of nitrogen added to the monitoring program in 1988 followed by SO_2 in 1992. Beginning in 1989, trace gas and meteorological data were collected electronically at one minute intervals, then processed and stored as hourly averages. This data set will span a 25 year period at the end of 2013, and will be openly available to the research community for the period 1989 – 2011, with the most recent data added after processing and quality control. The remarkable decrease of SO_2 from an annual average of more than 1.2 ppbv to under 0.2 ppbv demonstrates the effectiveness of implemented regulatory emission control actions. It also demonstrates the challenges faced by modern instrumentation as it attempts to detect ever decreasing trace levels of atmospheric pollutants at this location.

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James E. Dukett[1], Nathan Houck[1], Phil Snyder[1], and Sue Capone[1]

An Examination of Fish Presence using the Relationship between Base Cations (BC) and Strong Organic Anions ($RCOO_s^-$) in Waters Collected by the Adirondack Lakes Survey Corporation

Research shows recent decreases in toxic aluminum concentrations are a result of a combination of acid deposition decreases and dissolved organic carbon increases. This is a positive recovery signal, which is a result of policy efforts to reduce acidity from emissions of sulfur dioxide and nitrogen oxides. As Adirondack lakes recover from years of acidification, and toxic aluminum continues to decrease, fishery managers will require additional information to evaluate chemical nutrient status to allow for efficient resource allocation (i.e. fish stocking). An examination of the relationship between base cations (BC) and strong organic anions ($RCOO_s^-$) provides an additional metric to evaluate the chemical recovery status of Adirondack lakes. In this poster, we will show the unique relationship between BC and $RCOO_s^-$ and how it, along with other chemical metrics (i.e. base cation surplus, ANC, toxic Al, and pH), are related to fish presence.

[1]Adirondack Lakes Survey Corporation, Ray Brook, NY

Kaitlin Hayes[1]*, Tyler Smith[1], Kelsey Jencso[2], Brian McGlynn[3], Lucy Marshall[4], Anna Bergstrom[2]

Exploring the Scalability of Hydrologic Model Parameters: A Closer Look at the Catchment Connectivity Model

While many hydrologic models have been developed, few possess the ability to produce results consistent with both internal and external hydrologic variables. This well-recognized fact led to the development of the Catchment Connectivity Model (CCM). Developed following a dominant process conceptualization based on hillslope hydrologic connectivity at the Tenderfoot Creek Experimental Forest (TCEF; Montana, USA), the three-parameter CCM is a spatially explicit model structure with input requirements of a digital elevation model (DEM), evapotranspiration, and precipitation. The CCM has been validated against extensive field observations of hillslope hydrologic connectivity (an internal process simulated by the model) to demonstrate its internal consistency, in addition to a traditional assessment to the external streamflow dynamics. With only three parameters the CCM retains the simplicity of a conceptual model, while incorporating a physical basis in the description of the internal water balances of the hillslopes.

In this study, we sought to explore the spatial scalability of the CCM model parameters. Specifically, we explored whether a catchment-scale parameterization of the CCM structure was transferrable to nested, sub-catchments. The study was conducted in the Tenderfoot Creek Experimental Forest, which is defined by the Lower Tenderfoot Creek Watershed (LTEN). TCEF is 22.8 km^2 in area and encompasses eight nested sub-catchments. Of the nested sub-catchments, the six best instrumented were used in this study (Bubbling, Sun, Upper Tenderfoot, Spring Park, Middle Stringer, and Lower Stringer creeks). These watersheds vary in a number of physical characteristics, including: area, slope, elevation, aspect, geology, and vegetation. Notably, of these characteristics, the model only explicitly considers elevation. Other factors are implicitly represented by the model forcing data: evapotranspiration (e.g., vegetation) and precipitation (as rain and snowmelt; e.g., elevation, aspect). Catchment-specific precipitation was used to force the model (based on an elevation weighting of records available from two SNOTEL meteorological stations located within TCEF), while evapotranspiration was assumed uniform across TCEF (based on data availability).

In order to assess the spatial scalability of the model parameters, the CCM was calibrated to the outlet at Lower Tenderfoot Creek. The model parameters were transferred to each of the five sub-catchments located within LTEN. Model assessment of external watershed dynamics (discharge) was informed by, and tested against, gauged streamflow records for each sub-catchment, including flow duration curves (FDC). Assessment of internal watershed dynamics was based upon the comparison of modeled catchment hydrologic connectivity to empirical results via hydrologic connectivity duration curves (CDC). Overall performance (model fit)

across all catchments was benchmarked using the Nash-Sutcliffe Efficiency (NSE) – an SSE-like objective function.

This investigation allowed us to develop a more in-depth understanding of the model structure, its flexibility, its transferability, and its scalability. The south-facing sub-catchments (Lower Stringer, Middle Stringer, and Spring Park) were well simulated using the model parameters fitted to Lower Tenderfoot Creek. At the same time, the north-facing sub-catchments (Bubbling, Sun, and Upper Tenderfoot) all experienced diminished fits. While watershed aspect seems like a potentially powerful descriptor, other unique characteristics are also present in these sub-catchments: Sun Creek has undergone silvicultural treatments, Bubbling and Sun creeks experience major geologic transitions, and Upper Tenderfoot Creek is considerably flatter than the other watersheds. Ultimately, these results suggest that while hydrologic catchment connectivity may be a first-order control, it cannot fully describe runoff response in all TCEF catchments.

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Rockefeller, Daniel M.[1*], Colin M. Beier[1], Abigail M. Larkin[1]

Invasive Species Risk and Vulnerability Assessments for Adirondack Park Recreational Infrastructure.

Humans are important vectors for invasive species dispersal. Wild-land recreationists can be effective contributors to the dispersal of terrestrial invasive plant species into natural areas; carrying propagules on clothing, equipment, and pets. We assume that recreationists originating from areas with an abundance of invasive plant species are more likely to act as vectors for transporting propagules from one or more of these species to their chosen trail. Combining never before available Adirondack trail registry data; statewide invasive species data; and habitat data we will provide invasive species dispersal risk and vulnerability assessments for Adirondack Park recreational infrastructure, specifically hiking trails. Assessments and demonstrated methodology can be used by state agencies and conservation organizations as a mechanism to prioritize future invasive species monitoring and management investments.
[1]Department of Forestry and Natural Resources, State University of New York College of Environmental Science and Forestry

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The NEW Adirondack Long Term Monitoring program: where are we going and why?

The New York State Department of Environmental Conservation (NYSDEC) has been monitoring surface water acidification in the Adirondacks for over 30 years. The legacy monitoring effort evolved in concert with the Adirondack Lakes Survey Corporation (ALSC) Survey (1984-87) and Charley Driscoll's Adirondack Long Term Monitoring (ALTM) program (1982) continues today under the auspices of the NYSDEC Division of Air Resources, NYSERDA, USGS and USEPA. The recent significant chemical improvements in several ALTM program ***lakes*** has continued to advise air policy and prompted reviews of the efficiencies of the existing schedules. Furthermore, new knowledge about the sensitivity of ***streams***, the behavior of mercury, and climate-related influences provide additional reasons to re-examine the ALTM. As a follow-up to the NYSERDA sponsored study by State University of New York College of Environmental Science and Forestry, NYSDEC conducted additional assessments of ALTM lakes with a particular focus on preserving sampling integrity over a range of key chemical parameters, watershed characteristics, fisheries management considerations, and intensive long term research study sites, such as Arbutus Lake and Brook Trout Lake. We present the results of our assessments and the rationale for the refinements made to the ALTM lake/watershed sampling locations and frequencies which began earlier this year. We also discuss an USEPA-sponsored pilot project to investigate the use of specific ultraviolet absorbance ($SUVA_{254}$) as an indicator for mercury in ALTM lakes.

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It's All About the Experience: Opportunities for Integrating Professional Ecological Research and Undergraduate Mentoring and Education in the Adirondacks

Involving undergraduate students in professional ecological research offers a valuable opportunity to enrich curricula and prepare students for continuing careers in science. However, the structure of undergraduate programs often limits the opportunities available to students. Furthermore, the standard metrics by which research scientists at academic institutions are evaluated ("grants in and publications out") may preclude faculty from undertaking projects that are well-suited for undergraduate education and mentoring. The focus of Paul Smith's College

on undergraduate education has offered faculty the opportunity to develop innovative models for using professional research to benefit scientific knowledge and undergraduate students. These models consider the needs and limitations of undergraduate students from the outset, and are designed to expose students to the entire process of professional research from conception of a study question to production of a final deliverable. The "wilderness" setting of the college also allows student to undertake fieldwork without the need to travel to distant research sites. To date, this model has yielded considerable success, providing many students with the first line of professional experience on their resumes and with numerous students co-authoring professional publications. However, this model also presents challenges to both faculty and students including the time and care needed to effectively mentor undergraduate students in a field environment and the level of academic preparedness found in students in the formative years of their undergraduate experience. Nevertheless, the approaches we have developed may offer a model for other residential academic institutions seeking to enrich the learning environment for undergraduate students in ecology-related programs.

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A Regional Landscape Level Estimate of Lands and Waters Impacted by Road Runoff in the Adirondack Park of New York State

Delineating overland flow down-slope of roads can provide fundamental spatial information to resource management in forested landscapes, yet little has been developed to efficiently extract downslope sampling units from topographic data. We developed methods to quantify the downslope area of roads over large geographic areas. We applied our methodology to the 2.4 million hectare Adirondack Park. We constructed a park-wide hydrologic terrain model, derived from 10m USGS DEMs, that (a) quantifies the total area of terrestrial land impacted by runoff, (b) identifies the lakes and ponds intersected by runoff and calculates their total surface area, and (c) quantifies the total length of rivers and streams impacted by runoff. This study delineates hydrologic flow originating from three categories of roads: state and federal (SF), county (C), and local (L) roads using TauDEM 5.1.1 Hydrologic Terrain Analysis and ArcMap 10.2 software. Our results show as much as 10% of total land area, 80% of total surface water area, and 50% of rivers and stream length may be impacted by road runoff in the Adirondack Park and much of these impacts may be occurring in state protected forest preserves. The spatial information produced by this study offers a landscape scale perspective on road runoff stressors and is useful for focusing monitoring, research, and management efforts aimed at understanding and reducing the impacts of road runoff on terrestrial and aquatic environments at the regional scale.

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