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Jon D. Erickson

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MELISSA J. BURCHARD

*Winter scene along the Raquette River at Stone Valley Cooperative Recreational Area near Colton, New York*

AJES
Adirondack Journal of Environmental Studies

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**Mission Statement**

The *Adirondack Journal of Environmental Studies* (AJES) exists to foster a dialogue about the broad range of issues that concern the Adirondacks and Northern Forest.

AJES serves to bridge the gaps among academic disciplines and among researchers and practitioners devoted to understanding and promoting the development of sustainable communities, both human and wild.

The journal purposefully avoids serving as a vehicle for any single or special point of view. To the contrary, in searching for common ground AJES welcomes variety and a broad spectrum of perspectives from its contributors.

**Contributing to AJES**

We encourage the submission of manuscripts, reviews, photographs, artwork and letters to the editor. For additional information please visit the AJES website at www.ajes.org/ or contact Jon Erickson at jon.erickson@uvm.edu or 802-656-3328.

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*The views expressed in AJES are the authors' and not necessarily those of the editor, publisher, or the Adirondack Research Consortium.*


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# PRESIDENT'S MESSAGE

The first full year of the Adirondack Research Consortium's operation as a nonprofit 501(c)(3) organization has been a time of collaboration and of building partnerships. We identified some 200 academic and research institutions, government agencies, and organizations whose representatives, in recent years, have attended or presented at ARC's annual conference or written articles published in the Adirondack Journal of Environmental Studies. Our aim is to bring them, along with new institutions, into a network of organizational partnerships that collectively will make the ARC a consortium in fact as well as in name.

Our Partnership Advisory Council (ARCPAC), chaired by Dr. Ross Whaley, SUNY College of Environmental Science and Forestry Emeritus President and University Professor and past chair of the Adirondack Park Agency, is bringing together partners from academic, business, government, and NGO sectors to advise the ARC board on programs, initiatives, and priorities. A 'Friendraiser' reception at Heaven Hill Farm in Lake Placid served to launch the council, which will hold its first meeting in February at SUNY Albany.

Our 14th Annual Conference on the Adirondacks in May, on the theme of Sustainability, Climate Change and Protected Areas, drew 175 attendees and some of the nation's leading scientists to the Wild Center in Tupper Lake, resulting in extensive media coverage, including front page lead headlines in Adirondack region newspapers. The 15th Annual Conference on the Adirondacks, continuing the theme of Sustainability, will be held May 21–22 at the Crowne Plaza in Lake Placid.

The ARC is poised to undertake new initiatives, matching the needs of Adirondack users with the capabilities of research producers to address pressing issues for communities, land owners, the tourism, recreation and forest products industries, and local and state governments. None of this would be possible without the exceptional volunteer assistance of ARC board members and other ARC members and the considerable administrative skills of our executive director, Dan Fitts.

If your institution, agency, business, or organization is not yet an ARC Partner, or you are not a member, please join our accelerating agenda for collaborative research-based knowledge to improve the quality and vitality of the Adirondack region, by going to our website, www.adkresearch.org.

Best wishes for 2008 and thank you for playing your part to insure the environmental integrity and economic vitality of the Adirondack region.

Liz Thorndike
President

PREROGATIVE

# Big Shoes, Next Steps

**Jon D. Erickson**

It was with appreciation and humility that I recently agreed to take on the role of executive editor of the *Adirondack Journal of Environmental Studies*. So many people from so many walks of life in the Adirondack region owe a debt of gratitude to Professor Gary Chilson for founding AJES, staying true to its search for common ground, and promoting dialogue around sustainable development through the window of the Adirondack experience. These are big shoes to fill, but ones I humbly accept because so much has been accomplished in the 15 short years since the creation of the Adirondack Research Consortium and its publication AJES, but also because so much more lies ahead.

The first issue of AJES in 1994 was published on the heels of turbulent political times in the Adirondacks. The journal and the research consortium helped to fill a void between entrenched positions along the preservation–development continuum by providing a neutral ground of sorts—shrouded in at least the spirit of academic objectivity—to share ideas and produce a body of research both emerging from and accountable to the region. The hope has been to publish both contemporary debates and peer-reviewed analysis across a broad range of issues and disciplines in a voice approachable by an audience larger than just typical academic circles. I have been fortunate to work with many people in the intervening years involved in planning and participating in annual conferences, writing and reviewing AJES articles, and building bridges between information producers and consumers. We have connected some dots, but much of the borderlands between discipline and perspective remain unexplored.

The opportunity nearly 15 years later is to continue to promote an arena for ground-truthing and fact-checking, aided by open minds and informed dialogue. AJES seeks to explore the nexus of environmental, social, and economic issues, and as such demands a transdisciplinary and participatory approach to inquiry. The world has problems, but the academy has disciplines. More often than not they do not overlap. The study of the Adirondack region, the larger Northern Forest, and similar biomes across the world requires an approach that transcends disciplinary boundaries and pushes for unified descriptions of human-dominated ecosystems from which management recommendations can emerge. And broad participation must not come only from credentialed expertise, but from all layers of society . . . citizen, scientist, and manager alike. As communities worldwide search for examples of genuine development—where economic activity does not erode the very environmental foundation that makes life possible and worthwhile—the time is upon us to further open the lines of communication between the study of our means and the vocalization of our ends.

AJES can be that vehicle. We can hold on to the values and virtues of peer review, while providing a forum for debate, shared understanding, and resolution. We can continue to merge disciplines through the study of place. We can extend the circle of those who speak with authority beyond academics speaking with other academics. And we can aide an ongoing, bottom-up process of visioning management objectives and clarifying decision alternatives.

But AJES cannot reach its full potential in print form, mailed to a fluctuating base of subscribers and publishing commentary and peer-reviewed analysis with a 6 to 12 month lag time. North Country communities are being pulled into the age of the internet (perhaps unwillingly for some), and so can AJES. The world of open-source learning is upon us, enabling faster review and publishing times, extending peer review to a broader group, extending avenues for commentary and feedback through web logged discussion, and creating active readers that can better shape research questions and target research results.

Gary Chilson (and too many colleagues to name) has built a foundation of disciplinary inclusion and broad perspective during the formative years of AJES and the Adirondack Research Consortium. The business of connecting information producers and consumers in real time should be the next big step for AJES. In another 15 years' time, let us look back on the second generation of AJES with pride in having expanded the common ground still further.

As we begin to plan for the next volume of AJES, I would love to hear your thoughts about a move to an internet platform. I can be reached at jon.erickson@uvm.edu, or the old-fashioned way at 802-656-3328.

# Research Notes

Welcome to the second edition of Research Notes, a new feature of AJES that brings you news from the research world in the Adirondacks and related environs. Who is doing what and where? Read on to find out!

**Quantifying the Relationship between Anthropogenic Disturbance and Biotic Integrity in the Adirondack Park** *(Anne Woods, State University of New York, College of Environmental Science and Forestry)*

This study investigates the response of biotic communities to anthropogenic disturbance in the Adirondack Park and examines the relationship between land use and biotic integrity at the landscape scale. I developed an index of biotic integrity (IBI) for the Adirondack Park using data on bird guilds from the 2000–05 New York State Breeding Bird Atlas (BBA). IBI was a better measure of biotic community condition than species richness, which was affected by sampling effort and responded nonlinearly to disturbance. IBI was negatively related to development and open land covers and positively related to forest/wetland cover and elevation. IBI was predicted better by variables measured at the BBA block scale than larger scales. In the Adirondack Park, the biotic integrity of private lands used for natural resource management may be at risk of degradation from expanding development.

**Old-Growth Riparian Forests and Effects on Stream Habitats** *(William Keeton, University of Vermont, Clifford Kraft, Dana Warren, Cornell University)*

Riparian forests regulate linkages between terrestrial and aquatic ecosystems, yet relationships among riparian forest development, stand structure, and stream habitats are poorly understood in many temperate deciduous forest systems. Our research in the Adirondack Park has (1) described structural attributes associated with old-growth riparian forests and (2) assessed linkages between these characteristics and in-stream habitat structure. Indicators included coarse woody debris, debris dams, plunge pools, and variations in canopy structure over stream channels. We sampled 29 sites along first and second order stream reaches in Five Ponds Wilderness, Pigeon Lakes Wilderness, the Ampersand Mountain area of the High Peaks Wilderness, a private preserve in the southwestern Adirondacks, and the SUNY ESF Huntington Wildlife Forest. We are finding that old-growth riparian forest structure is more complex than that found in mature forests and exhibits significantly greater accumulations of aboveground tree biomass, both living and dead. Old-growth riparian forests provide in-stream habitat features that have not been widely recognized in eastern North America, representing a potential benefit from riparian forest management. Our research results suggest that riparian management practices—including buffer delineation and restorative silvicultural approaches—that emphasize development and maintenance of late-successional characteristics may be useful where the associated in-stream effects are desired. For further information see *Ecological Applications* 17(3) (2007): 852–868.

Compiled by Michale Glennon. Submit research notes to mglennon@wcs.org.

**New Measures of Economic Well-Being for Rural Vermont** *(Marta Ceroni, University of Vermont)*

The socioeconomic well-being of Vermont and the Northern Forest depends on the economic vitality of its communities as well as its natural resource wealth, social interactions, health, and knowledge. Yet, classical measures of progress, such as the gross domestic product, are based solely on economic growth, failing to measure what really matters to people. We used the genuine progress indicator (GPI) to investigate the socioeconomic trends of six rural counties of northern Vermont from 1950 to 2000 in a way that genuinely reflects the multiple dimensions of quality of life for the region and its communities. GPI in the most rural counties (Caledonia, Essex, Orleans) was below the U.S. average in 1950 but had risen above the national average by 2000. Rural counties had consistently lower crime rates, generated less solid waste, had less air, water, and noise pollution, and less loss of forest cover and wetlands, but higher costs of underemployment. Such estimates can provide useful interregional comparisons of socioeconomic well-being.

**How Would You Invest Your Dollars in a Sustainable Future for the Northern Forest?** *(William Porter, Anne Woods, State University of New York, College of Environmental Science and Forestry, Jon Erickson, University of Vermont, Graham Cox, Audubon New York)*

In November 2006, at the Adirondack North Country Association's annual meeting in Saranac Lake, researchers from SUNY ESF and UVM presented a summary of their focus group and opinion surveys to assess how people in the Adirondacks/North Country would invest in a sustainable future for their communities. A summary of the results appeared in *AJES* 14(1). We are pleased to report that the ESF and UVM research team has been funded for the coming year by the Northeast States Research Cooperative (NSRC) to expand our survey to all four states in the Northern Forest—Maine, New Hampshire, New York, and Vermont—to ask 1,200 residents to express their opinions about a sustainable future. Saranac Lake consultants Holmes & Associates will work with the research team to conduct the telephone interviews, help analyze the results, and compare them to the initial focus group and e-mail survey results reported in November 2006. In the initial project NSRC funded the research to ask two questions: If additional funds were available to invest in your community for a sustainable future, what would your priorities be? Second, would they get the same answers from local communities as they would get from a regional or statewide planning group? In short, the researchers set out to compare a top-down approach to setting priorities to a bottom-up approach. The intent of this expanded research project is twofold: first, to use the survey results to help guide and influence future federal, state, and private investment decisions at the community, state, and regional levels; and second, to have available a survey questionnaire and procedure that is replicable and repeatable, ready and adaptable for use and comparative purposes in any of the Northern Forest communities, state and regional segments.

**Modeling Adirondack–Tug Hill Connectivity** *(Michelle Brown et al., Adirondack Nature Conservancy and Land Trust, Tug Hill Tomorrow Land Trust, Wildlife Conservation Society)*

Conservation work by the Nature Conservancy (TNC) and others has focused on securing core and buffer areas within the Adirondack Park and Tug Hill. However, the long-term viability of wide-ranging species inhabiting these regions will likely depend on maintaining connectivity across the intervening and relatively unprotected Black River Valley—where land conversion, second home development, and transport infrastructure threaten to further fragment natural habitats. Through spatial connectivity modeling, we seek to identify areas that will maintain or increase landscape permeability for a suite of focal species including American marten, black bear, Canada lynx, cougar, moose, river otter, and scarlet tanager. Results will be used to guide land protection efforts to secure habitat steppingstones by TNC and others and will influence transportation planning and maintenance work to improve permeability of barriers. The spatial model and region-specific parameters will be useful in assessing connectivity potential within other areas surrounding the Adirondack Park (for example, the Saint Lawrence Valley).

**Understanding the Impacts on Wildlife of Exurban Development in the Adirondack Park** *(Michale Glennon, Wildlife Conservation Society, and Heidi Kretser, WCS and Cornell University)*

Building on our past work to disseminate information on the effects of low density rural sprawl in the Adirondacks and elsewhere on wildlife populations (http://www.wcs.org/adirondack research#Development), the Wildlife Conservation Society's Adirondack program is currently engaged in a number of projects to address the overall issue of exurban development and wildlife with on-the-ground field research. With funding from the National Science Foundation, Biodiversity Research Institute, and the Northeastern States Research Cooperative, we are exploring the effects of residential development on a variety of taxa in the Park. Two of these projects investigate the effects of existing development on wildlife populations. We are examining the differences in breeding bird community integrity between subdivisions and adjacent control areas, as well as working to identify what defines a "wildlife disturbance zone" in the Adirondacks—the area around a home in which wildlife habitat should be considered altered by the presence of a residential structure and the associated activities of its inhabitants. A third project explores changes to small mammal, bird, and carnivore communities before and after construction of single-family residences. Collectively, these projects will provide valuable information for local land use planning and provide suggestions for planners to implement projects in ways that will minimize negative impacts on wildlife. If you happen to be building a house and would consider participating in our study, contact us at http://www.wcs.org/adirondacks or 518-891-8872.

**Using Science to Manage Northern Forest Tourism and Recreation** *(Kelly A. Goonan, Carena J. van Riper, Robert Manning, Christopher Monz, University of Vermont)*

Outdoor recreation and tourism is a growing and important use of the Northern Forest— 26 million acres stretching from the Adirondack Mountains in northern New York to eastern Maine. Thousands of visitors are attracted to the region's mountains each year. Ultimately, outdoor recreation must be sustainable to protect natural resources in the area and provide a high-quality experience to visitors. Managing tourism and recreation in the Northern Forest in a sustainable manner will require informed decisions based on a strong scientific foundation. This approach calls for formulating indicators and standards of quality for natural resource conditions and the visitor experience. Indicators of quality are manageable, measurable variables that define the quality of natural resources and visitor experiences, and standards of quality define the minimum acceptable condition of indicator variables. The University of Vermont is conducting research to guide management of the Northern Forest for tourism and recreation. Once indicators and standards of quality are formulated, indicator variables will be monitored and appropriate management action can be taken to ensure that standards are maintained. This study will focus on four summits across the Northern Forest region, and data will be collected during the 2008 summer field season. A pilot study was conducted on Cascade Mountain in New York during the summer of 2007. Data were collected on the summit area to assess resource and social conditions. These data will provide an initial framework from which additional summits will be examined in upcoming field seasons. This research is funded by a grant through the Northeast States Research Cooperative. For more information, please visit http://www.uvm.edu/envnr/parkstudies and http://www.nsrcforest.org.

PROFILE

# Green Community Technologies

## The Innovation Economy and Triple Bottom Line

By ANN RUZOW HOLLAND

Community, economy, and the environment are the "triple bottom line." Today's municipalities resemble socially responsible businesses and are concerned about all three. A group of eight local governments in five states spent the last three years "walking the walk" and seriously changing the impact of their community actions on the local economy and environment. These communities were concerned not only about the escalating price of energy and the toll it takes on budgeting and planning, but also about new ways to organize and manage their capital assets in the public interest. They shared a sense of frustration with aging infrastructure, limited resources, and an overwhelming responsibility to maintain facilities and services that were not meeting town needs today or in the future. Linking local government with the right kind and fit of technical assistance moved the group of eight from dilemma to action, bringing environment, economy, and community together in a dramatic, new way.

The hardest step is getting started and moving away from crisis-to-crisis planning. The Green Community Technologies[SM] (GCT) process is an innovative inventory, analysis, and planning process that helps organize and identify the most pressing problems local governments are facing. Funded by the United States Department of Agriculture's Small Business Innovative Research program, Yellow Wood Associates of St. Albans, Vermont, created the GCT process to help communities access the best state-of-the-art technologies to solve their infrastructure problems. Through GCT, eight local governments instituted a planned progression to more efficient, more environmentally responsible, cost-saving technologies and practices.

Ann Ruzow Holland is a consulting community planning advisor in Willsboro, New York, and a Yellow Wood Associate. She may be reached at aholland@willex.com.

GCT applies a "systems approach" to inventory and analyze public facilities and infrastructure, and identifies areas where alternative approaches have significant potential to save money, protect the environment, and improve service delivery. Based on community priorities, GCT provides customized research into alternative, proven approaches that match community needs, conditions, and constraints. When communities are ready to implement changes, GCT can help identify a roster of qualified contractors. GCT culminates by identifying capital allocation opportunities that provide sustainable solutions to community problems. The results are compelling for public officials and taxpayers alike. By moving from dilemma to action, governments realize substantial cost and energy savings, improved bond ratings, regulatory compliance, and job generation and protect the environment while at the same time improving community quality of life.

### Getting One's House in Order

Capital asset inventories do not appear to rate high on a municipality's list of key management objectives, but the Governmental Accounting Standards Board (GASB) and state Comptrollers believe these inventories are essential and play a critical management function. It is stunning that many municipalities do not possess a comprehensive, up-to-date inventory of the assets they hold in trust for the taxpayers. The GCT inventory process can address this critical gap while meeting GASB requirements. The GCT inventory process promotes communication between decision-makers and asset managers that can lead to better management of government assets. Improved communication leads to increased shared understanding of conditions and a willingness to consider feasible alternatives. Sustainable communities rely upon well-managed public facilities that are cost


*Thetford town hall*

effective, affordable, and environmentally friendly.

Some local governments have already compiled or maintain comprehensive capital asset inventories and have met GASB requirements. GCT enables communities to start with an inventory or not, depending upon their circumstances.

**Comprehensive Asset Assessments in Case Study Communities**

Richmond, Massachusetts, is a moderate-sized community nestled in the Berkshire Mountains. Thetford, Vermont, is a hill town within commuting distance of Dartmouth College in Hanover, New Hampshire. Both Richmond and Thetford are thriving communities that experience moderate residential growth and development. GCT began with a comprehensive assessment of each town's material assets, such as sidewalks and roads, streetlights, buildings and equipment, vehicles, town-owned forests and water resources.

Litchfield, Maine, Barnstable County, Massachusetts, and Hancock, New Hampshire, wanted to focus their initial inventory on a select set of capital assets. Hancock, for example, wanted to combine the GCT inventory and assessment with its highway database to develop a maintenance plan based on road condition and use. The town wanted to understand how well different road segments were meeting community needs today and in the future.

The inventory process itself provided a great benefit to these five communities, detailing holdings and their condition and promoting shared knowledge of assets among town officials. In one case study, conducting an asset inventory revealed that multiple heating systems were in need of replacement. Rather than stagger their replacement, the community could consider bulk purchase, cooperative energy systems, or higher efficiency alternatives, including alternative fuel use. In another community, it became clear that culverts and roads were inadequate in the same locations and that these locations were adjacent to the next town. This situation offered an opportunity to confer with the neighbors and create win-win solutions. Without the capital asset inventory, these options may not have been discovered and evaluated.

Some of the inventories were also designed to meet the new General Accounting Standards Board Statement #34 (GASB 34), which requires communities to report municipal infrastructure as an asset. As a result, roads, bridges, drainage systems, etc., are now subject to depreciation. Estimating cost depreciation requires extensive historical data collection that can be prohibitively expensive and labor-intensive for small local governments. Communities must meet GASB standards if they want to be in a position to finance municipal projects through bonding. In addition to its other benefits, the GCT inventory cost-effectively allowed Richmond to meet this important administrative benchmark.

Towns that have already complied with GASB 34 can incorporate this information into the GCT inventory. Results of the inventory and assessment go beyond GASB compliance and help identify areas in which alternative approaches should be considered to achieve better economic, environmental and/or social outcomes. A systems analysis of community infrastructure leads to specific recommendations for improved management or replacement of infrastructure with more efficient, environmentally friendly technologies. At the conclusion of the inventory and assessment, communities receive an asset management tool in the form of an electronic data base that can be updated as needed for the long term.

**Jumping Ahead on the Fast Track: Hot Button Issues**

Sometimes communities choose to forgo the inventory process in favor of a hot button issue that comes to the forefront and requires immediate attention. The GCT process is flexible and allows alternative applications. Hinesburg and Richmond, Vermont, and Franklin, New York, identified issues of immediate concern for GCT to start researching alternatives. In these three cases, GCT worked with community decision-makers who had already identified assets most in need of repair, improvement, or replacement. In keeping with the "triple bottom line," the GCT process identified potential cost savings and environmental benefits for each community.

Generally, when communities face infrastructure issues, they first turn to engineers or architects, who provide them with a limited set of solutions based on their own expertise. Conventional solutions typically do not open the door to innovative solutions that have been effectively implemented in other places. With GCT, communities define their needs and learn about a wide range of proven solutions in use in the United States and abroad. From its library of technologies and technologists, alternatives are identified that provide for the wisest and most affordable decision for each community.

***Hinesburg, Vermont***

The Vermont Town of Hinesburg (population 5,000) is nestled against the edge of the Green Mountains about 15 miles southeast of Burlington and some 10 miles east of Lake Champlain. In close proximity to metropolitan Burlington, Hinesburg has seen its share of growth over time, but as growth moves out from Burlington, Hinesburg will see even more.

Hinesburg was faced with growing residential demand that would force expansion of its wastewater treatment system. With a multimillion dollar capital project looming, the GCT process helped the town by identifying opportunities to reduce input into the treatment plant by diverting grey water from a single source that does not require expensive secondary treatment. In addition, GCT identified opportunities for water conservation in new construction that will reduce per unit wastewater flows and alternative treatment technologies that will improve efficiency at the plant. As a result, Hinesburg expects to avoid having to invest millions of dollars in expansion in favor of much less expensive pretreatment upgrades and a smaller and more efficient wastewater treatment system.

*Hinesburg town hall*

Solutions such as this one are most likely to emerge when problems are considered in a systems context, rather than as stand-alone issues. The stand-alone solution would have been to expand the treatment plant rather than look at the quality of flows it was treating, as well as opportunities for conservation and redirection. Without GCT, comprehensive solutions would likely not have been considered. The traditional process of hiring expensive architects and engineers to implement conventional, business-as-usual solutions does not leave room for thinking outside the box and addressing the triple bottom line.

***Franklin, New York***

Franklin, New York, population 1,218 (Census 2000) lies in the Adirondack region. The town is at a pivotal point in planning for its facility needs, having identified a variety of issues with respect to existing buildings. The town has also been considering construction of a new building to meet specific town needs. Over the years, the town's building committee collected a variety of information on its buildings. To date, however, the information collected was insufficient to identify a clear path forward. This is a common problem in municipalities and one which GCT was developed to address. Providing external and objective technical assistance often leads to improved decision-making and subsequent action.

Franklin was in need of a new approach that could address the timing and demand of multiple needs. As a result, GCT conducted a multifacility assessment, researched green building alternatives, and identified the regulatory issues and resources associated with the project. GCT maximized the use of existing assets and minimized the amount of new construction required to meet town goals. The more compact spaces are, the easier and less expensive they are to heat and maintain. GCT introduced town decision-makers to principles and practices of green building and gave them conceptual designs to bring to an architect. GCT will locate professionals qualified to implement green building practices for the town to include on its bid lists. The Town of Franklin will consider addressing its building needs in phases in order to address the most critical needs first and move functions around temporarily without running out of space for them. Most importantly, phasing will allow the town to focus its limited resources on one or two projects at a time without becoming overwhelmed. In the words of Dave Decker, member of the Franklin Building Committee, "We need a new community house, and thanks to this we're doing it the right way. I'm really impressed." Franklin is now working on recruiting "green" architects, contractors, and supplies and constructing a capital finance plan for the four facilities.

***Richmond, Vermont***

Richmond, Vermont, is located in the western foothills of the Green Mountains on the eastern edge of the Lake Champlain Valley. Like many communities, parts of Richmond's infrastructure are nearly 100 years old, requiring costly improvements in the near future. While faced with numerous priorities for infrastructure repair and replacement, resources available for these improvements are limited, as is the capacity to consider alternative options.

The town's capital assets had never been completely inventoried so Richmond prepared a GCT capital asset inventory and assessment that satisfied GASB 34 requirements. Local leaders took advantage of this effort to map and digitize all infrastructure locations to create a capital asset overlay in their geographic information system. Richmond's auditors commended the town on completing the fixed asset requirement.

Once the inventory was completed, the Yellow Wood team conducted a participatory review process in collaboration with town administrators and the Richmond Planning Commission. GCT identified six areas in which alternative approaches could make a real difference in outcome and cost. GCT researched the differences in cost, performance, capacity, and impact between conventional and alternative approaches. Six recommendations were made where alternative technologies would provide superior overall economic and environmental performance. Planning was tailored to meet Richmond's triple bottom line and engaged officials and citizens in charting the town's future. This process also equipped them with an analysis of options based on the latest technologies and life-cycle economics.

GCT found a grant to help offset the cost of highly efficient pumps and motors for the new sewage treatment plant. The town is in the process of retrofitting its historic town hall to increase energy efficiency and is taking steps to upgrade underground pipes. Richmond's latest interest is in generating local energy using renewable fuels.

*Richmond town hall*

### Lessons Learned: Moving from Thought to Action

For each of these eight communities, taking the time to analyze alternative approaches was not only in the community's best interests, but also served to conserve taxpayer dollars and improve environmental impacts, thus addressing the triple bottom line. Introduction of a systems approach brought new choices to local government officials, who needed to move from dilemma to concrete action. In the long term, implementation of GCT recommendations depends on a town's financial management capacity, but the GCT process equips administrators with baseline data, asset management tools, information about emerging technologies, and a methodology for decision-making as opportunities arise. Once implemented, GCT is successful at saving tax dollars, improving bond ratings, and helping assure citizens' access to basic services. What is different about the GCT process is that it accomplishes these goals while at the same time reducing environmental impacts, conserving resources, and preserving quality of life.

By linking information on asset conditions with the extent to which they meet and will meet community needs, municipal leaders can take a proactive approach to their infrastructure. Officials can plan replacements well in advance and identify opportunities for cost savings through combined purchases. Understanding the pros and cons of alternative approaches helps public officials explain their decisions and choices to the electorate and improves accountability for municipal infrastructure. Proactive planning combined with intelligent capital allocations will contribute to enhanced fiscal stability and physical security.

Public accountants, auditors, and comptrollers recommend that municipalities take a long-term view of their infrastructure investments. Communities know that it is also in their best interests. The process of analysis can be daunting and complex. GCT uses a life-cycle costing approach to compare the total costs of alternative versus conventional approaches. Life-cycle costing is the process of considering alternatives that satisfy all performance requirements (e.g., code, safety, comfort, reliability) based on all costs spent over the life of the longest lived alternative. These costs include purchase price, operation and maintenance, replacement costs for shorter lived alternatives, and disposal cost. GCT enables communities to take a long-term view of their infrastructure by making the process accessible, affordable, and successful.

GCT is one of many new approaches available to local governments to improve their asset management. For example, the Cities for Climate Protection (CCP) campaign of the International Council for Local Environmental Initiatives (ICLEI) is another successful model for placing local governments on a "low carbon diet." CCP is a formalized and very popular international program for local governments. ICLEI provides technical assistance (fee for service) to over 800 local governments to inventory their existing greenhouse gas emissions and then integrate reduction and monitoring programs into government operations (www.iclei.org). Participation in ICLEI's climate protection campaign continues to gain strength amongst medium and large cities around the globe and its impact and overall carbon emission reductions will contribute to global targets in the respective countries.

Communities attain sustainability by design or fail to by default. The decisions towns make today will profoundly affect their ability to function in a near future in which energy supply and environmental impact become crucial concerns. A new kind of approach is required for municipalities to make use of the emerging technologies and new practices that assure financial solvency, energy efficiency, natural resource conservation, and the capacity to meet citizens' basic needs.

PROFILE

# Upper Saranac Lake Foundation
## An Evolution of Environmental Consciousness

**By CURT STILES**

To those who visited Upper Saranac Lake in the early part of the last century, water quality and miles of undeveloped shoreline must have seemed limitless and inexhaustible by humankind. Upper Saranac Lake was part of the early history of discovery of the Adirondacks as a recreational and vacation destination. There were two hotels on the lake as early as 1854, and a third opened in 1864.

The Great Camp era (1880–1930) began the development of Upper Saranac Lake. A relatively quiet period unfolded throughout the World War II years and shortly after. In the 1950s and 1960s, prior to any real land use regulations, subdivision of major parcels began with the creation of small lots (less than one-third of an acre, without regard to setbacks). Even the Adirondack Park Agency Land Use Regulations of the early 1970s grandfathered existing subdivisions whether built upon or not. As a result, the shoreline was irretrievably changed. In fact, the nature of the ensuing regulations actually encouraged shoreline development. Towns and villages did little or nothing to improve or strengthen land use regulations during this period.

The cost of shoreline property has grown more than hundredfold from the 1950s until today ($25 per foot to well over $2500). Land once deemed a useless lot can now be "improved upon" by creative developers and builders with $100,000 to $200,000 in site work, often without obtaining the necessary permits prior to construction or exhibiting concern for wetlands and shoreline integrity.

The two townships comprising Upper Saranac Lake could not be more different in their approach to local building and zoning codes. One has an almost zero variance policy, while the other would appear more focused on tax revenue. One has a 500 square foot limitation on boathouses, while the other requires them to be no bigger than a percentage of the owned shoreline, creating a preference for larger boathouses on larger properties. One might conclude the administration's motto to be, "If we can tax it, you can probably build it."

**Land once deemed a useless lot can now be "improved upon" . . . with $100,000 to $200,000 in site work, often without obtaining the necessary permits prior to construction or exhibiting concern for wetlands and shoreline integrity.**

The lake is approximately 5000 acres in size and has over 40 miles of shoreline. There are now approximately 525 "camps" or seasonal and year-round homes, two year-round resort hotels, six private or university camps, and over 600 public use campsites on connected Fish Creek and Rollins ponds. A New York State Fish Hatchery discharges through a State Pollutant Discharge Elimination System permit into a stream that feeds Upper Saranac Lake. There are two public and six private boat launching sites, not including access from the public campgrounds and marina on Fish Creek Pond. In reality, the demographics and diversity of use by shore owners, campers, and the public has not changed much in the last 50 years, but the intensity of use and magnitude of development has.

The good news is the State of New York owns roughly 50 percent of the shoreline, which is "Forever Wild" and preserves some ecological balance. As a result of limited land availability and unspoiled shoreline, the value of available land and resale of existing properties continues to escalate unabated. With the additional demands on our natural resources, our regulatory and enforcement processes become overworked, understaffed, and less than effective in managing growth and the corresponding degradation of water quality and integrity of shoreline habitats, wetlands, and scenic aesthetics.

The Upper Saranac Lake Association was founded in 1901 and has been in existence ever since. Early challenges were buoys and charting the safe launch routes around the lake, sailing, and social events. It has progressed to what could effectively be called a homeowners association representing the interests and concerns of the shore owners. The focus over the last 50 years has been on environmental and water quality issues and the premise that the private sector must take more responsibility for its destiny. The association is an active group, publishing quarterly newsletters and holding two membership meetings each summer. Standing committees focus on government relations, communications, cultural and social affairs, environmental issues, and boating safety. Shore owners well appreciate the information exchange, visibility of key issues, coordination, and working relationships with town and state administrations.

Upper Saranac Lake has one of the most robust data sets on water quality within the Adirondack Park. The New

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York State Fish Hatchery had a long history of high phosphorus discharge into a tributary of the lake. Lake Association litigation against the NYSDEC resulted in a 90 percent reduction of the flow of nutrients from the hatchery into the lake and the improvement of many of the management practices associated with raising fish. Water quality monitoring is still an ongoing effort involving four tributary stations and two lake surface and deep water stations for continued monitoring and sampling. All locations are monitored twice monthly from May to October for pH, alkalinity, conductivity, total phosphorus, and nitrite and nitrate nitrogen. Additional sites and testing protocols are added and deleted depending on observation and need.

**In the late 1990s Eurasian water milfoil was discovered on the lake.**

In the mid-1980s, the issues facing Upper Saranac Lake began to expand beyond the normal summer concerns over water quality, water safety, fishing reports, and the increased use of the lake. The issues became more focused and defined by factors that, if not addressed, would have long-term environmental impacts. Water quality, increased development, septic systems, invasive plants and pests, concerns with the New York State Fish Hatchery, and the broken dam at Bartlett Carry, all became of greater consequence to a concerned lake community.

As the issues emerged and became better defined, it became clear that in order to effect meaningful change, it would be necessary to have a vehicle to raise significant funds. In 1989 the Upper Saranac Lake Foundation was created as a 501(c)(3) not-for-profit corporation to build a "war chest" to deal with the aforementioned issues. The foundation is a separate, arm's length organization, which works in concert with the Lake Association. It provides financial support through grant requests for specific programs and activities the association would be unable to fund through membership dues. Since 1989 the foundation has raised over $3 million and directly manages those programs that are associated with large financial or operational risks. More than 95 percent of all funding comes from the private sector.

In the late 1990s Eurasian water milfoil was discovered on the lake. Initial efforts quickly became ineffective as the voracious plant grew faster than the ability to remove it. By 2003 it became clear that Eurasian water milfoil was winning the battle and a dramatically different approach was required.

In 2004, the Upper Saranac Lake Foundation, with the help of the Adirondack Watershed Institute at Paul Smith's College, initiated a three-year, $1.5 million program to control Eurasian water milfoil, and 2007 represents year four in the continuing effort to ensure control of this aggressive invasive species. The Upper Saranac Lake Foundation funds and manages the milfoil project by setting overall program direction and goals, and it operates together with several members of the Upper Saranac Lake Association executive committee to provide experienced volunteer management capability for oversight and support. Day-to-day operations are contracted through the Adirondack Watershed Institute at Paul Smith's College and managed by a crew chief. The college hires and administers payroll and insurance functions for the crew chief, divers, and top-water support people. Complete details of the operational plan and results can be found at the Upper Saranac Lake Foundation website (http://uslf.org/). Under the Fundraising tab, there is a complete project plan, and in the Information Archive section readers find a thorough scientific assessment of the three-year effort by Dr. Dan Kelting. By scrolling through the Upper Saranac Lake Foundation Today section, pictures and descriptions of day-to-day operations can be accessed.

Eurasian water milfoil will be aggressively managed through the end of 2011. While the first two years utilized a crew of 20 divers and 10 support people, 16 divers and 8 top-water people were used in 2006, and the plan for 2007 called for eight divers and four support people. The plan is to gradually decrease the resources deployed to a sustainable maintenance level with supporting scientific measurement. Concentrating on early detection, rapid response, and maintenance of troublesome areas will ensure long-term success. Interaction with shore owners continues to be critically important. The Adirondack Watershed Institute at Paul Smith's College produces all scientific plans, data, and physical measurements. For three years in a row, the milfoil project was completed ahead of schedule and under budget. The entire lake was harvested three times in 2005 and 2006, but even more significantly, 18 tons of wet milfoil was removed in 2004, 4.5 tons in 2005, and less than 500 pounds in 2006.

**The mission of the Waterkeeper Alliance is to "connect and support local Waterkeeper programs to provide a voice for waterways and communities worldwide."**

With increased pressures on development and use, it became increasingly apparent that full-time environmental advocacy and attention to the myriad issues facing Upper Saranac was necessary to protect water quality. Observing the success Lake George has enjoyed with Chris Navitsky as the Waterkeeper, the Upper Saranac Lake Foundation contacted the Waterkeeper Alliance to pursue a similar concept for Upper Saranac Lake. The Waterkeeper Alliance was formed in 1966 by Robert F. Kennedy, Jr., to stop the pollution of Hudson River, making it, today, one of the richest water bodies in the United States. Since then, the alliance has grown to over 150 Waterkeepers on six continents.

The mission of the Waterkeeper Alliance is to "connect and support local Waterkeeper programs to provide a voice for waterways and communities worldwide." An extensive application and licensing process ensures applicants' dedication to maintaining the alliance's rigorous standards and serving both public and private needs for high water quality.

The Upper Saranac Lake Foundation was licensed to create a Saranac Waterkeeper and hired Jill Reymore in December of 2006. The Saranac Waterkeeper will advocate for enforcement and compliance with local ordinances and environmental laws, respond to citizen complaints, and identify problems that affect the lake and its use for the common good. Protecting the water quality of Upper Saranac Lake and the watershed from pollution of all kinds, habitat and wetlands degradation, and invasive species by directly investigating, confronting, and seeking resolution through documentation and follow-up of all identified issues is the primary responsibility of the Saranac Waterkeeper. The Waterkeeper will provide a single point of focus for all issues that negatively impact the lake or watershed. She will act as a spokesperson for the lake, working closely with the environmental committee, executive committee, and zone chairs of the Upper Saranac Lake Association and local code enforcement officers. The Upper Saranac Lake Foundation provides funding and oversight as the licensee. Once success is modeled on Upper Saranac Lake, the expectation is for the Waterkeeper to expand her responsibility to the Saranac chain of lakes. Waterkeepers believe everyone has the right to clean water and no one may diminish water quality at the expense of the public.

**Protecting the water quality of Upper Saranac Lake and the watershed from pollution of all kinds, habitat and wetlands degradation, and invasive species by directly investigating, confronting, and seeking resolution through documentation and follow-up of all identified issues is the primary responsibility of the Saranac Waterkeeper.**

In January of 2007 the Upper Saranac Lake Foundation published "A Commitment to the Environment," which sets forth a seven-point set of goals and specific objectives that will ensure the protection of Upper Saranac Lake for future generations. The introduction to the document, which can be found in "2007 January USLF Update #1" under the Information Archive section of the Upper Saranac Lake Foundation website, states in part:

> Upper Saranac Lake and its neighboring water bodies attract a large and diverse population. The many and varied values of our region attract ever increasing numbers of visitors, as well as more who want to stay. Pressures on nature's resources, and man's aging infrastructures and governance, call for pro-active steps to protect our future.
>
> The Upper Saranac Lake Foundation is committed to protecting the water quality of Upper Saranac Lake, its neighboring water bodies and its watershed. Our challenge must be to minimize man-made pollution and to stabilize or improve our water quality into the next century, by encouraging and ensuring the establishment of effective and enduring protocols and procedures.
>
> To this end the Upper Saranac Lake Foundation will aggressively:
>
> - Advocate and seek cooperation for water quality issues among all stakeholders (municipalities, owners, neighbors, realtors, contractors, architects and agencies—all users, private and public);
> - Build consensus to address land use issues of site planning, vegetation removal, run-off prevention, septic and drainage systems and wetlands disturbance;
> - Challenge abuse, and fully support the intent and scope of all applicable government laws, codes and regulations;
> - Advocate for more up-to-date, and continuing review, of Land Use regulations at all levels; and
> - Provide advice and support concerning development and maintenance issues related to the health of our environment.
>
> Our large and diverse population of users will agree that our water bodies enjoy nearly unique advantages when it comes to natural beauty.
>
> Watershed is forested, largely natural. Vistas are mostly clean and natural. Boating is often vintage and relatively calm. At night, it is quiet and dark. Courtesy on the Lakes is deeply traditional. Shoreline integrity is largely intact.
>
> All ages, all users, experience an uncommon resource. The quality of the water is consistently ranked as the highest in value and common concern.
>
> The Upper Saranac Lake Foundation believes it is essential to maintain and preserve these attributes of the Lake, and its watershed, for future generations.

Environmental awareness and improved stewardship of our natural resources is imperative to protect water quality. One only has to understand the magnitude and severity of current global warming arguments to appreciate the urgency.

The Upper Saranac Lake Association, Upper Saranac Lake Foundation, and the Saranac Waterkeeper believe that, over time, we can forge a partnership of shared values and active stewardship with shore owners, the public, and regulatory agencies, both state and local, to continue to improve and protect the water quality and environmental beauty of Upper Saranac Lake for everyone.

ANALYSIS

# Adirondack River Discharge During the Last Century

**By JEFFREY R. CHIARENZELLI**

## Introduction

While the effects of climate change since the end of the last Ice Age are varied and imperfectly understood, one of the most fundamental changes in terms of the history of civilization is the variation in the amount of water available for human use. Indeed, the collapse of some civilizations appears to be directly related to diminished water resources, drought, and associated environmental change (Diamond 2005). Zhang et al. (2007) provide the first evidence of human-induced changes in global precipitation patterns. While models of global temperature and precipitation trends are becoming more sophisticated, the prediction of local, or even regional, changes from global climate models with coarse gridding[1] is problematic (Smith et al. 2006). While global climate models are important for examination of global trends in climate, they reduce the entire Adirondack region to a single data point or portion thereof.

The amount of water available for use by plants, animals, and humans in any given location depends upon many intra- and extra-basinal factors. These include climatic and meteorological (evaporation, precipitation, temperature, seasonality, sunlight, etc.), geological (elevation, slope, permeability, infiltration rates, storage, material properties, etc.), and biological (land cover, species, transpiration rates, etc.) factors, among others. Many of these factors are notoriously difficult to accurately measure or estimate. For example, evaporative loss in a given area is estimated by measuring evaporation rates from a metal pan and has a high uncertainty (Dingman 2002). In contrast, discharge is easily measured and has been monitored in many waterways in the United States for decades (Slack and Landwehr 1992; Wahl et al. 1995).

In many regions of the United States and the world humans have had a great impact on the hydrologic cycle (Lins 2005). In particular, the withdrawal of surface water and, especially, ground water for irrigation and domestic and industrial use can lower the water table by tens, or even hundreds, of feet, rapidly depleting water stored for hundreds or thousands of years. The Adirondack region has seen relatively little anthropogenic impact on the hydrologic cycle because rainfall and snow melt are plentiful, population is sparse, vast tracks of land are uninhabited, and there is minimal agriculture, industry (except logging), and manufacturing. The continued use of century-old, often hand dug, shallow wells and perennially damp basements confirm shallow water tables over many decades. Nonetheless the influence of flood control, water diversion, and hydroelectric dams on discharge may be locally important.

Previously in this journal Stager and Martin (2002) summarized trends in precipitation and temperature from select weather stations in the Adirondack region over a 75-year period (1926–2000). Their main finding is that the Adirondack region is not in lockstep with global climate trends, emphasizing the utility of empirical data, from specific sites, in order to accurately assess local conditions. They demonstrate that weather conditions in the Adirondacks, specifically at the Wanakena Ranger School, have changed relatively little thus far. Herein the variation in the discharge of Adirondack rivers is investigated. These trends are used to evaluate annual, seasonal, and monthly trends in discharge over half-century to century-long (62–101 years) time spans (Neuroth and Chiarenzelli 2007) and the last 30 years.

## Methodology

The United States Geological Survey is charged with maintaining stream discharge records for the nation. This program began in 1889 and has grown to include more than 7000 stations (Wahl et al. 1995). Stream flow records have many uses including the management and prediction of floods, determination of contaminant and nutrient inputs, delineation of flood plains, reservoir and hydroelectric plant management, highway, culvert, and bridge design, and the allocation of water, among others. The uncertainty in discharge is a function of the variability of stream flow in a given area and the length of record keeping. Because natural cycles of precipitation longer than a decade have been observed, record lengths of greater than 30–50 years are required to detect trends related to human activity or global warming (Wahl et al. 1995; Lins 2005). Approximately 1650 stations in the United States Geological Survey database are suitable for trend analysis to determine the impact of climate change on the hydrologic cycle (Slack and Landwehr 1992).

The discharge gauging stations investigated (Figure 1) were selected based on the completeness of their records and geographic coverage of the Adirondack region (USGS 2008). Note that some rivers (Black, Mohawk, Sacandaga) include areas within their drainage basins

[1] Typical grids cover 1° to 2.5° of latitude and longitude.

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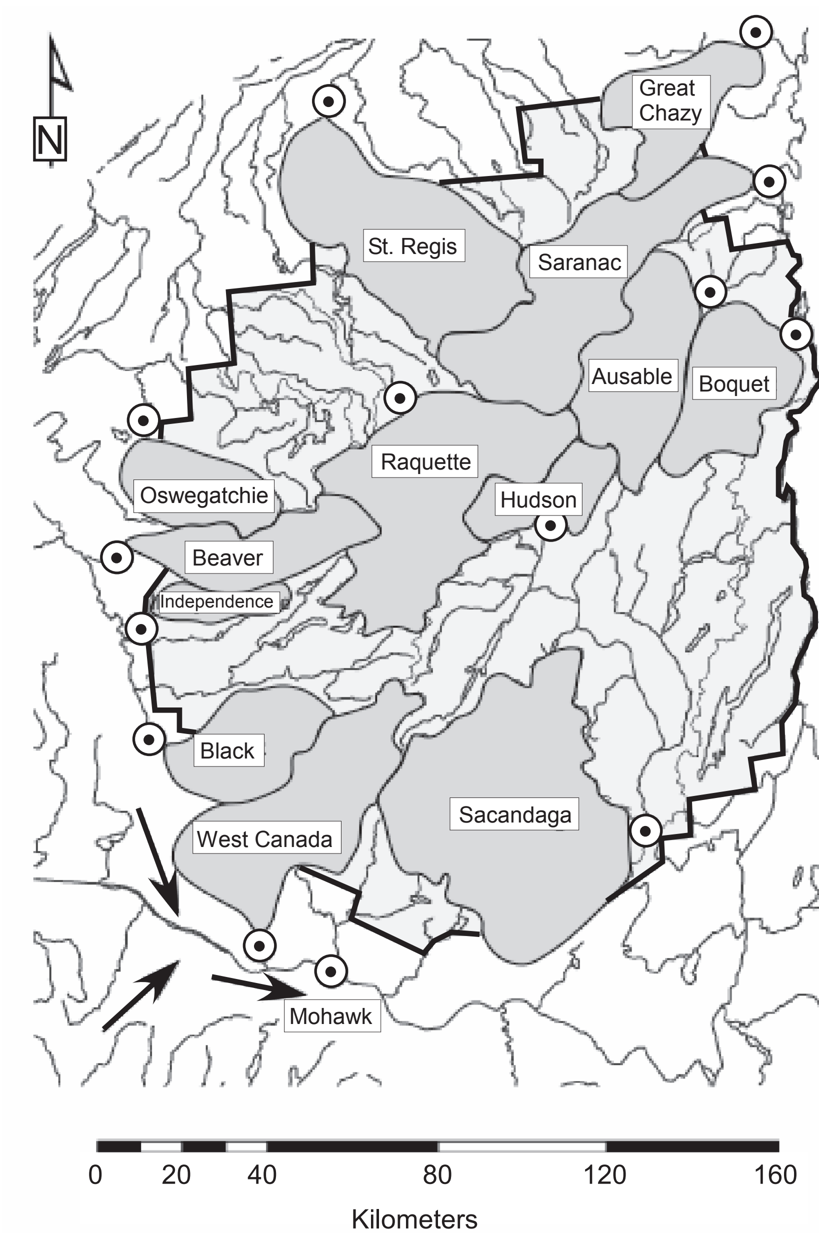


**Figure 1.** *Location of discharge gauging stations and associated drainage basins investigated during this study.*

that fall outside of the Adirondack Blue-line. Figure 1 shows the location and size of each drainage basin analyzed during this study. Table 1 gives the location and elevation of gauging stations, the area of drainage basins, and the duration of record keeping for both long-term (62–101 years) and short-term (30 years) stations, respectively.[2]

Mean and standard deviation were calculated for annual, seasonal, and monthly discharge for long-term time spans and the last 30 years at each Adirondack gauging station using Excel.[3]

The trends have been investigated by the use of correlation coefficients and trend lines on derived charts. Changes have been evaluated using both percent change and raw volume in cubic feet per second.

**Quality Control**

A number of quality control issues must be evaluated here including the overall quality, completeness, and representativeness of the data. Also, the statistical validity of any of the trends observed must be assessed. Given the long experience (Wahl et al. 1995) and internal quality control of the United States Geological Survey, it is assumed that the records used here accurately reflect river conditions.

A critical question is whether or not a sufficient period of record keeping is available for the evaluation of long-term trends. Five Adirondack gauging stations are included in the HydroClimatic Data Network[4] that includes rivers with continuous discharge records sufficiently long to be influenced by climatic fluctuations. Some Adirondack rivers with long discharge records were not selected as part of the HydroClimatic Data Network because of water regulation by hydroelectric dams. Here they are included so that discharge trends for most of the region, over an extended time period, can be evaluated. Despite the possible inaccuracies in some data sets, it is useful to evaluate long-term changes over the entire region.

A related question is whether the discharge measurements made are truly representative of the flow of the rivers in question. In other words, have large amounts of water been removed or

2 Climatic variations depend on long-term records of at least 30–50 years (Wahl et al. 1995; Lins 2005) . The completeness of the annual discharge record is given in Table 1; calendar years were judged complete if data was available for each month. Note that several substantial gaps occur in the recent data at the Ausable, Boquet, Great Chazy, Hudson, and St. Regis stations, limiting their use for short-term trends.

3 Data available from the United States Geological Survey at http://waterdata.usgs.gov/usa/nwis/sw.

4 The United States Geological Survey has established the HydroClimatic Data Network consisting of over 1600 stream gages where discharge is primarily influenced by climatic variations (Slack and Landwehr 1992). Only 15 of these gages, however, have records that extend 90 years or more, thus limiting most estimates for stream flow to the last two-thirds of the previous century (Lins 2005).

**Table 1.** *Location, elevation, drainage basin area, and period of record keeping of discharge stations utilized in this study.*

| River | Station Location | USGS Station # | Coordinates latitude | longitude | Elevation feet | Drainage Basin mi2 | Initiation year* | Duration years | Completeness % |
|---|---|---|---|---|---|---|---|---|---|
| Ausable | Ausable Forks | **4275500** | 44°27′05″ | 73°38′35″ | 506 | 446 | 1916 | 89 | 74 |
| Beaver | Croghan | 4258000 | 44°53′50″ | 75°24′16″ | 806 | 291 | 1931 | 74 | 100 |
| Black | Boonville | 4252500 | 43°30′42″ | 75°18′25″ | 936 | 304 | 1912 | 93 | 100 |
| Boquet | Willsboro | **4276500** | 44°21′30″ | 73°23′50″ | 151 | 270 | 1924 | 81 | 72 |
| Great Chazy | Perry Mills | 4271500 | 45°00′00″ | 73°30′05″ | 165 | 243 | 1929 | 76 | 70 |
| Hudson | Newcomb | 1312000 | 43°57′58″ | 74°07′52″ | 1550 | 192 | 1926 | 79 | 77 |
| Independence | Donnattsburg | **4255000** | 43°44′50″ | 75°20′05″ | 973 | 89 | 1943 | 62 | 100 |
| Mohawk | Little Falls | 1347000 | 43°00′53″ | 74°46′47″ | 309 | 1342 | 1928 | 77 | 100 |
| Oswegatchie | Harrisville | **4262500** | 44°11′08″ | 75°19′52″ | 739 | 258 | 1917 | 88 | 100 |
| Raquette | Piercefield | 4266500 | 44°14′05″ | 74°34′20″ | 1502 | 721 | 1909 | 96 | 100 |
| Sacandaga | Stewart's Bridge | 1325000 | 43°18′41″ | 73°52′04″ | 582 | 1055 | 1931 | 74 | 100 |
| Saranac | Plattsburgh | 4273500 | 44°40′54″ | 73°28′18″ | 156 | 608 | 1904 | 101 | 86 |
| St. Regis | Brasher Center | **4269000** | 44°51′49″ | 74°46′45″ | 217 | 612 | 1911 | 94 | 96 |
| West Canada | Kast Bridge | 1346000 | 43°04′08″ | 74°59′19″ | 439 | 560 | 1921 | 84 | 100 |
| **Average** | | | | | | | | **83** | **91** |

* Year shown is first year for which annual discharge can be determined.
USGS stations in bold are part of the Hydroclimatic Data Network.

added to the rivers? The Adirondack region is sparsely populated[5] and does not provide substantial water for irrigation, industry, or agriculture. Nonetheless, temporary storage of water in reservoirs and small dams for hydropower, minor diversions for municipal and prison systems, and historic spring logging runs do occur and may impart trends in the discharge data not entirely reflective of natural "run of the river" conditions. Most important among these are diurnal variations due to fluctuation of power demands on hydrostations and storage or release of water to maintain reservoir water levels. While this imparts uncertainty to shorter-term records (particularly daily and diurnal records), longer records are less likely to be affected.

Perhaps the most serious quality control considerations are gaps in record keeping. Eight of the 14 stations investigated here have essentially complete coverage (100%) since their initiation (Table 1). Other stations generally have 70% or more completeness and thus provide a nearly continuous record of discharge in the Adirondack region. As a group, the entire data set analyzed has a completeness of 91%.

Another important question is the statistical validity of any trends identified in the discharge data. The approach taken is simplistic in terms of evaluating time-series trends; the discharge (y-axis) was plotted against calendar year (x-axis) for each river and the trend-line and correlation coefficient determined. Because the trends were relatively weak and corresponding squares of the correlation coefficient are low, confidence in the observed relations in any given river system is also low. The high correlation of discharge trends[6] observed among rivers in the same area suggests, however, that the long-term trends observed are meaningful.

Perhaps the ultimate test of the influence of local factors such as hydroelectric dams and reservoirs or diversion of water is whether or not rivers in the region show similar trends over extended time periods. This analysis assumes of course that the region in question has many similarities in terms of climate, geology, and biology. This similarity is broadly true for the Adirondack region that lies within the Blueline and shares a common climate, geology dominated by crystalline rocks and thin, glacially derived soils, and similar ecosystems. Figure 2 plots the discharge of all fourteen rivers during their period of measurement. Note that period of enhanced and low flows can easily be correlated over the 100-year measurement period. As can be seen, the resemblance between the patterns is striking. This suggests that across the greater Adirondack region, natural trends, rather than local factors such as reservoirs, dams, and water withdrawals, play the overwhelming role in determining discharge and the long-term trends observed are real.

[5] The full-time population of the 6 million acre park is less than 200,000 people (Jenkins and Keal 2004).

[6] The correlation coefficient of the annual discharge of Ausable River compared with nearby rivers also draining into Lake Champlain ranged from 0.96 (Boquet) to 0.93 (Saranac) over the period of data collection.

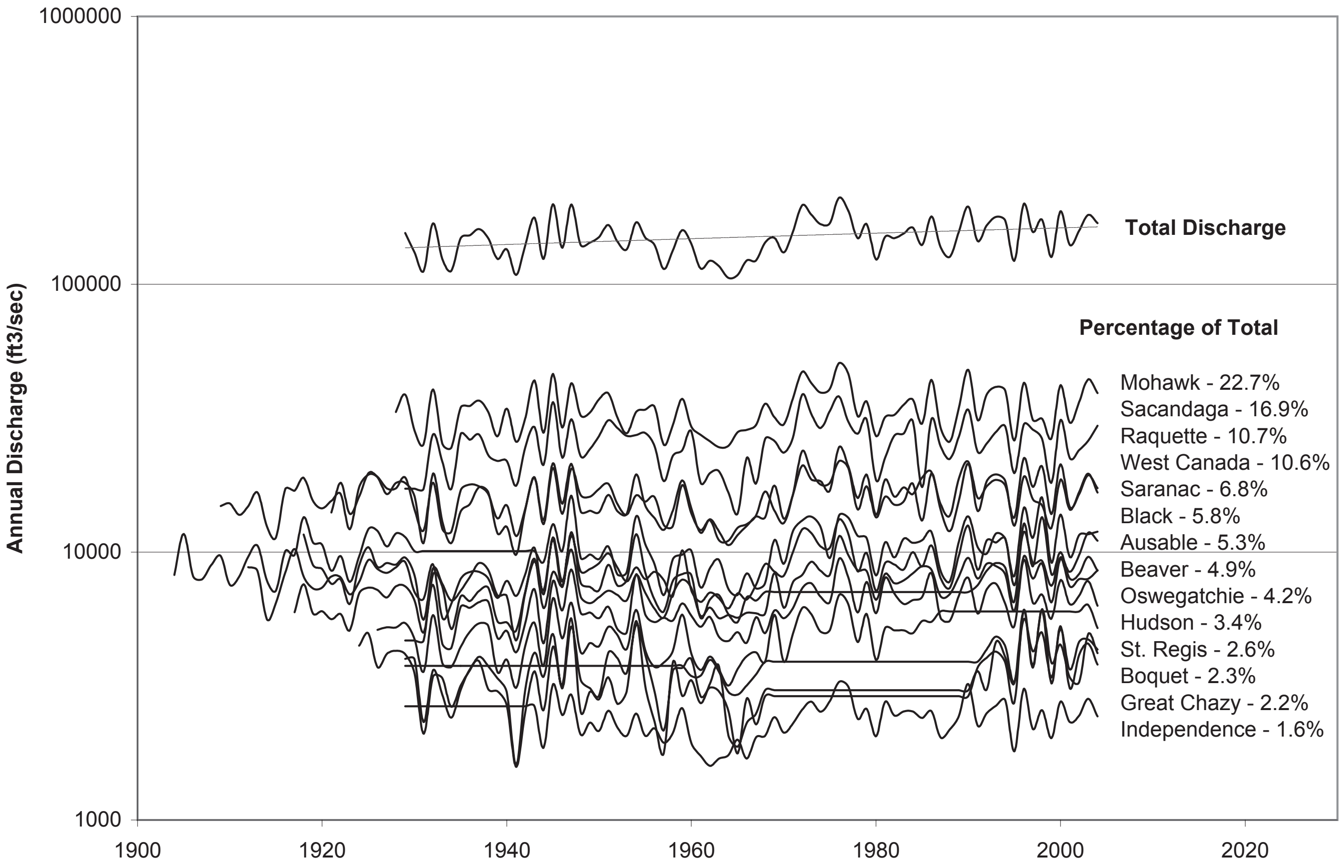


**Figure 2.** *Annual discharge trends for all 14 Adirondack rivers over their respective periods of measurements. Straight-line segments represent gaps in record keeping.*

## Results and Discussion

*Annual Trends in Discharge.* Of the fourteen rivers investigated all show an increase (avg. 19.2 ± 10.5%; Table 2) in discharge over their period of observation (62–101 years). The Beaver, Black, and Great Chazy have greater increases (32.8–42.7%), while the increases shown by the Ausable, St. Regis, and West Canada are substantially less (4.9–7.9%) than average. Some of this variability is likely related to the different periods of observation at each station; nonetheless, the relatively low standard of deviation suggests the observed increase is real and significant over the long term. No significant correlation was found between drainage basin area, elevation, or location and annual discharge.

Conversely, over the last 30 years only three of 10 rivers have positive increases in discharge (0.4–8.8%), while the remainder have negative discharges (–14.8% to –5.1%). On the average, the decrease in discharge has been –4.6 ± 6.6% (Table 2). Note that the Sacandaga River in the southern Adirondacks showed the greatest loss (–14.8%) while the Saranac River in the northeast Adirondacks showed the greatest gain (8.8%). This hints at possible local differences in discharge over the last 30 years within the Adirondack region.

Despite an average decrease in discharge of approximately –4.6% during the last 30-year period (1975–2004), the Adirondack rivers examined in this study display, on the average, a 19.2 ± 10.5% increase in discharge over their period of measurement, and all rivers show an increase. Given that annual long-term discharge measurements have been estimated to have an error of 3–10% (Shiklomanov et al. 2004) and ±5% (Winter 1981), this trend is believed to represent a real and significant increase in annual discharge. Since runoff or discharge is a function of precipitation minus evapotranspiration, this increase must be tied to an increase in precipitation, a decrease

**Table 2.** *Annual discharge variation over period of record keeping and last thirty years (1974–2004).*

| River | Duration % | 30 years % |
|---|---|---|
| Ausable | 8 | nd |
| Beaver | 33 | –9.6 |
| Black | 33 | 1 |
| Boquet | 17 | nd |
| Great Chazy | 43 | nd |
| Hudson | 19 | nd |
| Independence | 15 | –8.8 |
| Mohawk | 16 | –5.5 |
| Oswegatchie | 19 | –6.8 |
| Raquette | 21 | –5.1 |
| Sacandaga | 14 | –14.8 |
| Saranac | 21 | 9 |
| St. Regis | 5 | 0 |
| West Canada | 5 | –5.6 |
| **Average** | **19** | **–4.6** |
| **Std. Dev.** | **11** | **7** |

"nd" means not determined.

in evapotranspiration, or both over the period of measurement. Given the relatively minor temperature variation (–0.20–0.14°F/decade) noted for the Adirondack region (Stager and Martin 2002), it is unlikely that decreases in evaporation have occurred. This suggests increases in discharge are a function of increased precipitation.

Review of hydrographs of individual rivers clearly shows abrupt increases in discharge in the early 1940s and 1970s. These trends are enhanced when a moving average is used to help smooth out some of the year-to-year variability (Figure 3). These abrupt changes are also seen in most monthly hydrographs that span the period of record keeping. This observation is not surprising, as annual increases in precipitation must be reflected in monthly discharge values. An abrupt increase in discharge around 1970 in the United States has been noted previously by McCabe and Wolock (2002) and Lins (2005) and is thought to indicate a shift in conditions likely to persist through a complete cycle. The rapid increase also seen in the 1940s in the Adirondack region may indicate 30-year cyclicity in discharge trends. If the trend continues, a new cycle (2000s) may have begun. Data from the Mohawk River, which drains parts of the Adirondacks, Tug Hill Plateau, and Central New York, are in good agreement with long-term and short-term discharge trends for the Adirondack region, suggesting such trends may also occur over wider areas.

*Seasonal and Monthly Trends in Discharge.* If annual precipitation has indeed increased throughout the Adirondack region, it would be instructive to know when during the year the increases have occurred. For example, increases in winter precipitation could result in a thicker snow pack and enhanced spring discharge. Pooling of the discharge data into three-month[7] seasonal periods (Figure 4) suggests long-term annual gains in discharge are apparent in the fall (32.4 ± 12.4%), winter (23.0 ± 9.1%), and summer (19.6 ± 15.8%), while little or no gain is apparent in the spring (3.3 ± 11.3%). Longer-term trends indicate more rainfall in the summer and fall; winter trends, however, are more difficult to interpret. Increased discharge could be a function of more precipitation falling as rain or enhanced intermittent melting of the snow pack or both. Either of these

[7] Seasonal trends were evaluated by pooling December, January, and February (winter), March, April, and May (spring), June, July, and August (summer), and September, October, and November (fall) for each river.

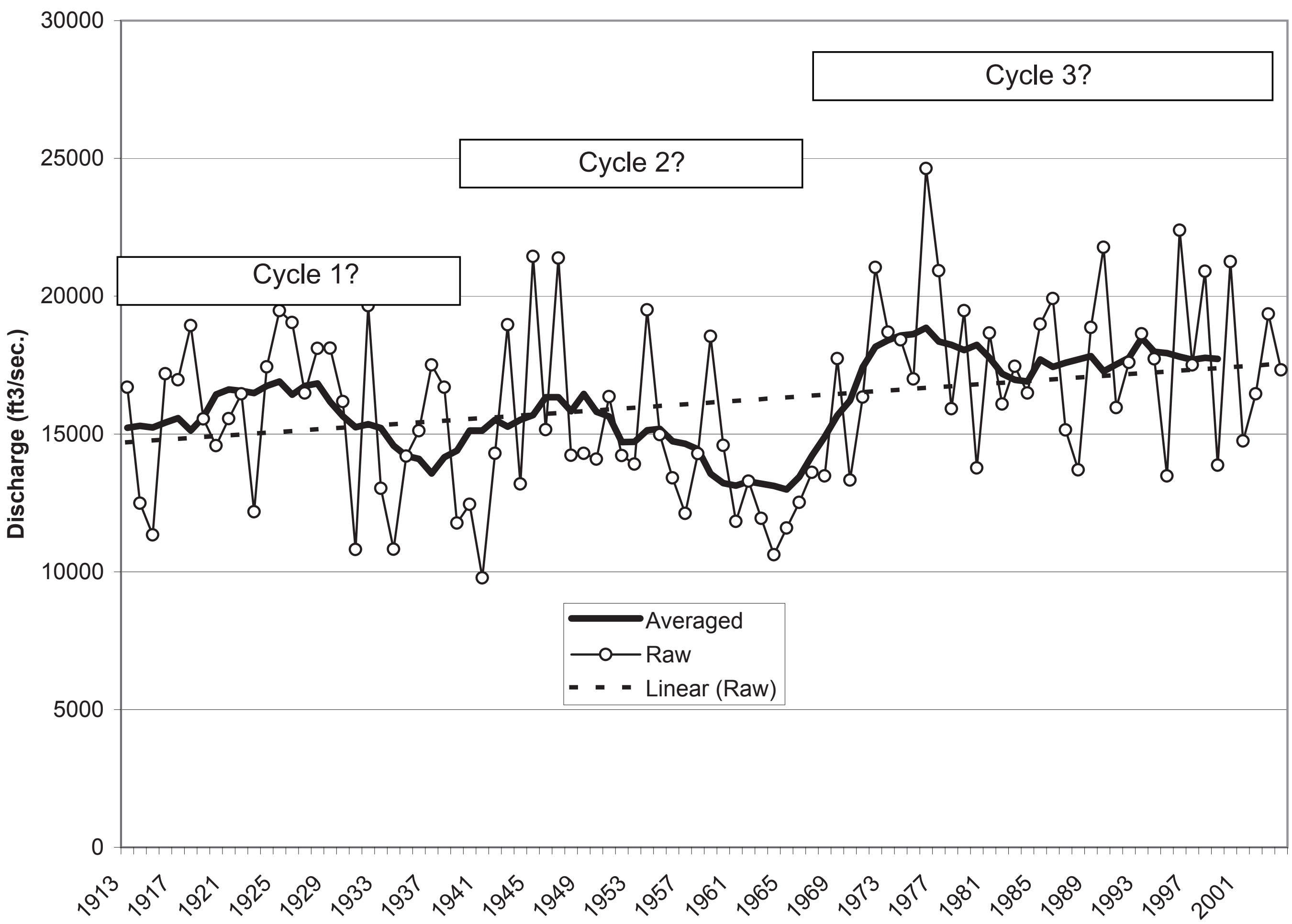


**Figure 3.** *Annual time series hydrograph for the Raquette River showing raw and time-averaged (10-year) data.*

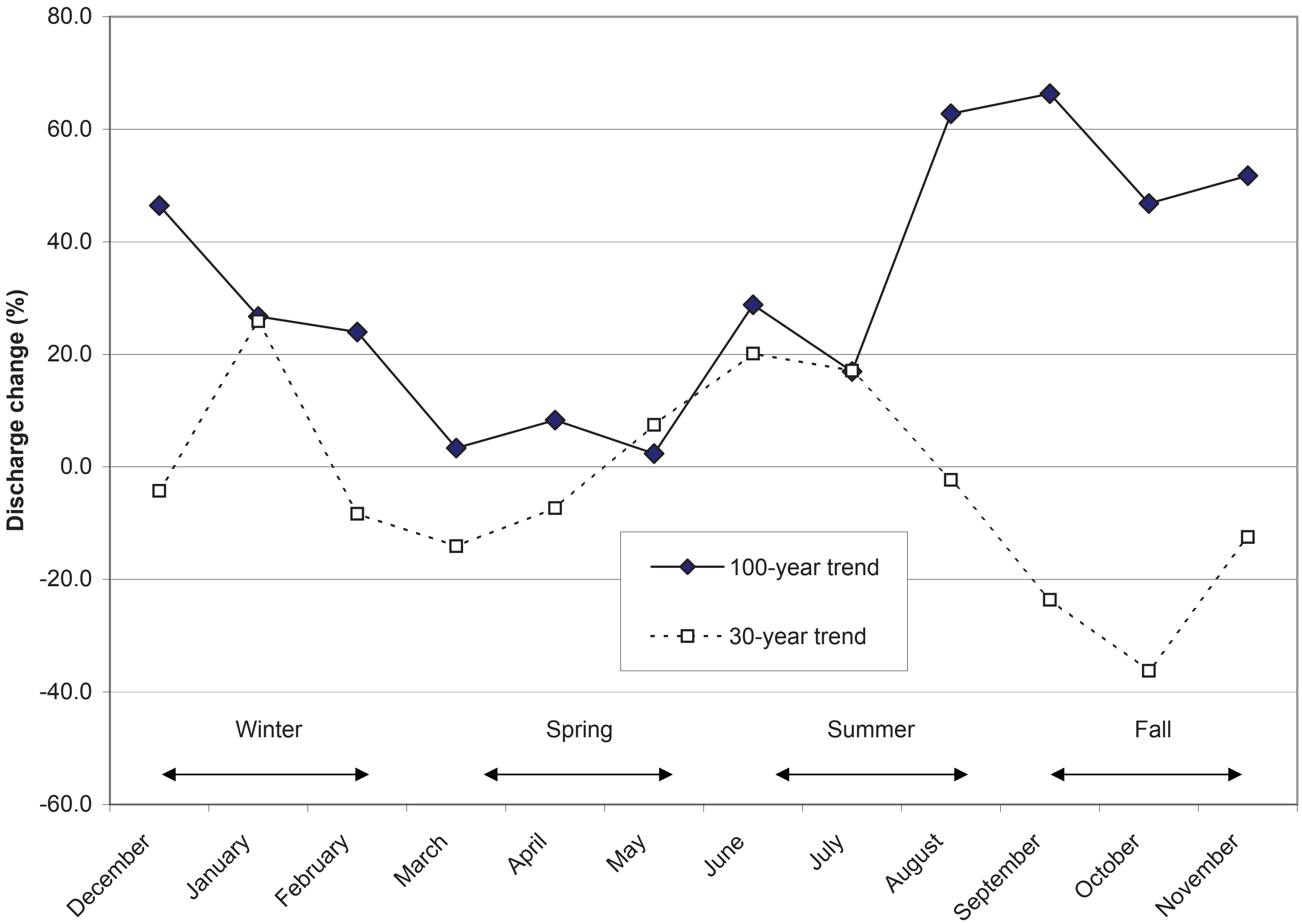


**Figure 4.** *Seasonal and monthly variations in Adirondack river discharge showing average long-term and short-term trends.*

options seems difficult to reconcile with the slight decline in temperature noted by Stager and Martin (2002).

Long-term monthly data suggest large gains in discharge for the fall months but smaller increases in winter and summer months (Figure 4). Spring month discharge has remained constant or has slightly increased. Although the variability among rivers is large, the average increase in discharge during the period of record keeping is greater than 40% for August–December and smaller than 7% for March–May. In general, gains in discharge are shown for 12 (out of 14) or more rivers during the fall and winter months but as few as six for the spring months (Neuroth and Chiarenzelli 2007).

Enhanced winter discharge without significant changes in mean winter temperatures could be caused by more extreme temperature variations. Available temperature data indicating little or no change in maximum and minimum temperatures (Stager and Martin 2002) do not support this possibility. Alternatively, water temporarily stored in aquifers, bank storage along rivers, and surface water bodies from enhanced precipitation in the fall could raise winter discharge volumes. The return of this water to rivers would be slowed and prolonged by freeze events and travel via groundwater pathways. This scenario would result in enhanced river base flow conditions during the winter months as precipitation stored during the fall is gradually released over time.

Given the relatively large increases in discharge apparent over the long term in the summer, fall, and winter, the relatively steady discharge of Adirondack rivers during the spring season is intriguing. Note that substantial gains in discharge (46–66%) have been measured for the months August–December over the period of recording keeping (Figure 4). Both January and February show increases of approximately 25%. While it is unlikely that these increases in discharge during the winter months are related to enhanced rainfall or snow pack melting, they may represent the hydrologic system's response to enhanced late summer and fall precipitation. Long-term trends indicate that discharge in March and April has remained nearly constant, despite enhanced winter discharge. Since peak discharge occurs in the spring, gains in long-term annual discharge have resulted in increases during times of low and moderate flow, primarily summer and fall.

*Comparison of Local and Regional Trends.* Numerous workers have noted changes in the hydrologic cycle over broad parts of the contiguous United States (Karl and Knight 1998; NERA 2001; Groisman et al. 2004; Lins 2005). As summarized by Lins (2005), in general, stream flow in the United States has been increasing since at least 1940 and in most instances it occurs in streams of low to moderate discharge. In most cases, stream minimum and median flows have increased, whereas maximum flows have not. Most increases have occurred in the Upper Mississippi, Ohio Valley, Texas Gulf, and Mid-Atlantic regions, while other regions experienced stream flow decreases. In the Upper Mississippi and Ohio Valley regions increases occur mostly during the late summer and September–December (Lins 2005). These trends appear to have begun as an abrupt change around 1970.

Adirondack regional data is in excellent agreement with trends reported for the Ohio Valley region and large parts of the contiguous United States. It also appears likely that the increases began earlier than 1940. In the Adirondack region both 1940 and 1970 appear to be times of change resulting in discrete "steps" in discharge as reported by McGabe and Wolock (2002). Likewise, increases in discharge are most evident in the late summer and fall, as spring discharges have been relatively constant. The most likely explanation for these changes are enhanced precipitation in the Adirondack region during the late summer and fall, resulting in enhanced winter base flow in streams and rivers draining the Adirondacks. This change, in turn, is apparently related to climatic factors that affect large portions of the United States (Lins 2005) and perhaps the world (Zhang et al. 2007).

*Forecasting Water Management Issues.* The temptation to forecast climatic changes is hard to resist (McKibben 2002; Stager and Martin 2002). Here it is instructive to point out several possible changes in the Adirondacks related to water and its availability. If current trends continue, particularly the 30-year cycle of precipitation and discharge stepwise increases, Adirondack rivers will experience record historic stream flows, particularly in the fall and winter, providing more water for all uses. We already are benefiting from annual flows about 20% greater than 100 years ago, with monthly averages up to 50–60% greater. While some may welcome the abundance of water for recreation and hydropower purposes, the questions remain, When will enhanced precipitation and discharge result in negative consequences? And what will they be?

One legitimate question is whether enhanced discharge will lead to more frequent or more intense flood events. A direct link to increased flooding seems unlikely, however, because Adirondack monthly discharge histograms indicate that historically the greatest discharge volumes occur in spring, which has seen little or no increase in discharge over the duration of record keeping or the last 30 years. Even with the annual increases observed, spring flow still dominates the annual cycle and remains the time most prone to significant flooding events.

Indirectly, however, more rain and discharge at any period of time leads to saturation of the soil and a reduced capacity for infiltration and greater tendency for runoff and severe erosion events, including landslides. If discharge continues to increase, water tables will rise and valuable shorelines will retreat. Engineering charts, culverts, bridges, etc., for the region may need to be updated to handle greater flows. Wetlands and marshy areas may become inundated. With greater fall and winter discharges, less and less stable ice cover on lakes and rivers is likely. Eventually changes in vegetation and fauna may occur as the ecosystem adjusts to the new conditions.

Although little evidence exists for warming temperatures in the Adirondack region at the present time, warming would have a significant impact on the hydrologic cycle. For example, changes in the snow pack because of milder winter temperatures may lead to further increases in winter discharge and perhaps even shifting of stream discharge histograms. In particular, times of maximum flow may shift earlier in the spring season. Such shifts, combined with a spring and summer with low precipitation, and enhanced evaporation, could set the stage for lower summer discharge during dry years.

**Summary**

Adirondack rivers show an average increase of about 20% in their annual discharge over the last 100 years. These increases have occurred largely during the summer, fall, and winter months, while discharge during the spring months has remained steady. It is concluded that enhanced winter discharge (approximately 20%) is caused by the gradual release of water temporarily stored during the fall, which shows an average increase in discharge of approximately 32% over the same time period. These changes in discharge are driven by real changes in the amount of precipitation in the Adirondack region and beyond. The trends identified here are in agreement with regional discharge trends reported by the HydroClimatic Data Network for small rivers in the Upper Midwest and Northeast. In particular, 30-year cycles of precipitation, punctuated by abrupt increases in discharge, have been identified. In the Adirondack region these cycles appear to have operated since at least the 1940s.

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Melissa J. Burchard

*Raquette River at Jamestown Falls, some 15 miles downriver of the Piercefield USGS gaging station*

ANALYSIS

# Using GIS and Spatial Statistics to Examine Patterns of Crowding on Lake George

**By NANCY A. CONNELLY, TOMMY L. BROWN and TIMOTHY P. HOLMES**

**Abstract**

*The Lake George Park Commission recently undertook a large planning study to assist them in fulfilling their legislative mission of "providing reasonable public access to Lake George without congestion, overcrowding, or safety hazards." The results reported here, directed at assessing Lake George users' perceptions of crowding on the Lake, are but a small part of the larger study. We studied five types of recreational users on Lake George (lakeshore property owners, annual motorboat permit holders, temporary motorboat permit holders, beach users, and commercial dock owners). We used geographic information systems (GIS) and spatial statistics to identify zones of varying levels of crowding based on users' perceptions. On a questionnaire mailed in summer and fall of 2005, respondents indicated on a map the areas they used and the areas they perceived as crowded. We found some disparity between use and perceptions of crowding in various portions of the lake, but these variables were moderately correlated. Using the spatial statistic of Local Moran's I, three areas were identified for all types of users as being significantly correlated with either high or low levels of crowding. Displaying maps produced using GIS allows for much easier interpretation of spatial data, and the use of spatial statistics can confirm (or deny) perceived spatial patterns. We believe these results will be useful for future planning and management of Lake George, and we think this technique can be successfully applied to a variety of recreational situations in the Adirondacks and elsewhere.*

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## Introduction

Lake George, a beautiful lake located within the Adirondack Park in upstate New York, is 32 miles long and up to three miles wide. It is easily accessible from the interstate highway connecting New York City and Montreal, Canada. The Lake George region provides a variety of water-related recreational opportunities. Motorboaters, sailboaters, canoeists, swimmers, and fishermen all enjoy the lake, which is noted for its clarity. In recent years, however, moderately heavy recreational use of the lake has been accompanied by concern for the preservation of the lake's beauty and water quality (Martin and Borgos 2002). Development pressure, especially for seasonal-use housing, has increased almost twofold in the past 30 years (Rath 2005). Development has occurred primarily along the shore of the southern half of the lake, but access is possible from many points around the lake.

Lake George Park Commission (LGPC) is the state agency charged with management of the lake. Its legislative mission is to "provide reasonable public access to Lake George without congestion, overcrowding, or safety hazards." The LGPC recently undertook a large planning study to assist the commission in fulfilling its legislative mission. The results reported here, directed at assessing Lake George users' perceptions of crowding on the lake, are but a small part of the larger study (Holmes et al. 2006). The goal of the work reported on here was to identify zones of varying levels of crowding based on users' perceptions. This type of analysis could be particularly valuable to the LGPC in deciding whether sufficient need exists to manage different zones of the lake for varying levels of use or to identify "hot spots" of crowding where safety is an issue and policy changes may be needed.

Past research on the issue of crowding has been extensive (see for example review articles by Shelby et al. 1989; Kuentzel and Heberlein 1992; or more recently Manning 1999), but there has been little focus on mapping the spatial aspects of perceptions of crowding. Peters and Dawson (2004), for example, used line thicknesses on a map to show concentrations of use, but did not equate that with user perceptions of crowding. Therefore the specific objectives for the research reported herein are to

- compare recreationist-identified areas of use with their perceptions of crowded areas,
- use spatial statistics to establish zones of high or low crowding based on recreationists' perceptions,
- examine sociodemographic and use characteristics that are related to perceptions of crowding, and
- examine whether a spatial dimension exists to different types of users' perceptions of crowding.

## Methods

A mail survey was developed and sent to five types of Lake George users in the summer and fall of 2005. The questionnaire asked about use of the lake for recreation, perceptions of potential water-based recreation issues or problems, and identification of specific areas of crowding.

### *Survey Audiences and Sample Selection*

Five types of users were identified as potential survey audiences. Below is a description of each group and how a sample of that group was obtained.

*Residential dock owners.* Any residential landowner with a dock on Lake George must obtain a permit from the LGPC. Since almost all shoreline owners have docks, this group essentially represents residential lakeshore property owners. We drew a systematic sample of 600 names from the 2005 list of 2,380 permittees.

*Annual boat permit holders.* Members of this group purchased a permit from the LGPC allowing them to use motorboats (10 hp. or more) or larger sailboats (18 ft. or more) on Lake George during the 2005 season. In drawing our sample from this group, we excluded residential dock owners. Thus, annual boat permit holders represent annual users who do not own land along the lake. We drew a systematic sample of 600 names from the 2005 list of 10,713 permittees.

*Temporary boat permit holders.* Members of this group purchased a permit from the LGPC allowing them to use motorboats (10 hp. or more) or larger sailboats (18 ft. or more) on Lake George for a day or a week during the 2005 season. We drew a systematic sample of 599 names from the 2005 list of 5,732 temporary permit holders.

*Beach users.* This group represents non–motorboat users of 13 beaches along the Lake George shoreline during the 2005 season. They could be using nonmotorized boats such as canoes or kayaks, but most were observed engaged in beach-related activities. A sample of 446 users was obtained over the course of the season by field interviewers stationed at each of the beaches.

*Commercial dock owners.* This group consists mostly of marina and hotel owners. Surveys were sent to all 166 commercial dock owners on the LGPC list as of August 2005.

### *Questionnaire Development and Implementation*

The mail questionnaire topics relevant to this analysis included recreational use of the lake, perceptions of crowding and related issues such as noise, and sociodemographic characteristics of users. The center page of the questionnaire contained a map of Lake George, on which respondents were asked to write a letter "A" where they accessed the lake, to circle the area(s) where they spent the majority of their time recreating, and to lightly shade the areas they thought were "routinely so congested that it interfered with their enjoyment of the Lake." (This wording then becomes our definition of crowding.) Commercial dock owners were not asked about their own experiences, but rather what they thought their clientele did or perceived. Thus, data from this group may be less accurate because it is a mental compilation of the aggregate experiences of their clientele, rather than the direct observations and perceptions obtained from the other groups.

The temporary boat permit holders' and beach users' surveys were mailed out over the course of the summer of 2005 as names became available. This strategy allowed for better recall of the trip experience than would have been obtained if we waited until the end of the season. We anticipated that the other groups would use Lake George over the entire summer season, so mailings went out to them right after Labor Day. Up to three reminder letters were sent to nonrespondents over the course of the month following the first mailing to try to encourage their participation in the study, as advocated by Dillman (2000).

### *Data Entry and Analysis*

Data from the questionnaires except for the map were entered on the computer using standard procedures and analyzed using SPSS, a computer software package designed to analyze social science data. Chi-square tests were used to test for significant differences in the percentages of respondents in different user groups thinking some part of Lake George was crowded. Correlation analysis was used to test for significant differences in perceived crowding by zone between user groups.

The map on each questionnaire was overlaid with a Mylar sheet dividing the lake into the 43 management zones used by the LGPC. Coding was done (presence, absence) to indicate which zones were accessed and used by respondents and which zones respondents thought were crowded. Almost all respondents indicated a location where they accessed the lake or spent the majority of their time (96% and 95%, respectively), therefore we assumed that if they did not mark any areas as being crowded, they were indicating they did not feel any areas were crowded. Data were converted to a geographic information systems (GIS) file showing the percent of respondents in each zone who used the zone and/or thought it was crowded. Data are presented as a map of Lake George using ArcGIS Version 9.1. GeoDA Version 0.9.5-i5 was used to calculate the spatial statistics of Moran's I and Local Moran's I (LISA) using first order neighbors with Queen Contiguity (Spatial Analysis Lab, no date). These statistics test for similarities in user perceptions of crowding between neighboring management zones on the map of Lake George.

Each user group returned a sufficient number of questionnaires to permit analysis by group. In order to also present an overall picture of the views of Lake George users, we weighted the individual responses such that each group was represented in proportion to its contribution to the population of Lake George users. Weighting was not needed to make comparisons between user groups.

## Results

### *Response Rates*

Of the 2,411 questionnaires mailed, 65 were undeliverable and 1,199 were returned usable, for an adjusted response rate of 51%. Response was lowest among commercial dock owners (40%) and highest among residential dock owners (60%). No checks for nonresponse bias were done because it was impossible to ask questions using the maps on the telephone (the usual method chosen for assessing nonresponse bias). Based on past research (Connelly et al. 2003), nonrespondents are typically less interested in the topic being studied. In this case, nonrespondents *may* have used the lake less and *may* be less concerned about lake management issues.

### *Recreational Use*

Respondents made use of all parts of Lake George in 2005, but the middle sections around Shelving Rock and Diamond Point and the northern area around Hague received heaviest use (Fig. 1). Access frequency, as depicted by the boat size shown in each zone in Figure 1, indicates a wide distribution along the southern and eastern shores, but in the north and west access was limited primarily to a few locations where boat launch ramps exist.

### *General Perceptions of Crowding-Related Issues*

Over 90% of respondents were satisfied with their 2005 Lake George recreational experience. Primary sources of dissatisfaction were crowding-related issues (e.g., too many boaters, making too much noise, not following the rules, creating boat wakes and speeding). Over half (53%) of all respondents thought noise from personal watercraft was a problem in 2005; 46% thought noise from other boats was a problem. Over half (52%) thought unsafe operation of boats, and one-third (34%) thought crowding at boat anchorages was a problem.

About one-third (31%) of respondents reported at least one zone as being so congested that it interfered with their enjoyment of the lake. Most respondents reported between one and four zones as being crowded (Fig. 2). A clear visual distinction between the northern and southern ends can be seen from Figure 2, the southern end being perceived as more crowded. Moran's I, used to test for spatial autocorrelation across the whole lake, showed a significant spatial autocorrelation of 0.74 ($p = 0.001$), indicating that neighboring zones were positively correlated with each other—i.e., if one zone was perceived as crowded, it was likely that its neighbors would be perceived the same way. Local Moran's I, a more precise test used to indicate specific areas with statistical significance, indicated three areas where neighboring zones were significantly related to each other (Fig. 3). The northern zone, shown with darker shading, indicates a cluster of zones where the percent perceiving the area as crowded was low. Two areas in the south were a lighter shade, indicating the percent perceiving an area to be crowded was high, with a white area in between showing no significant relationships. One might call this area a transition zone of moderate or variable crowding.

Comparison of Figure 2 with Figure 1 shows some differences between the areas people used and those they thought were crowded. Most

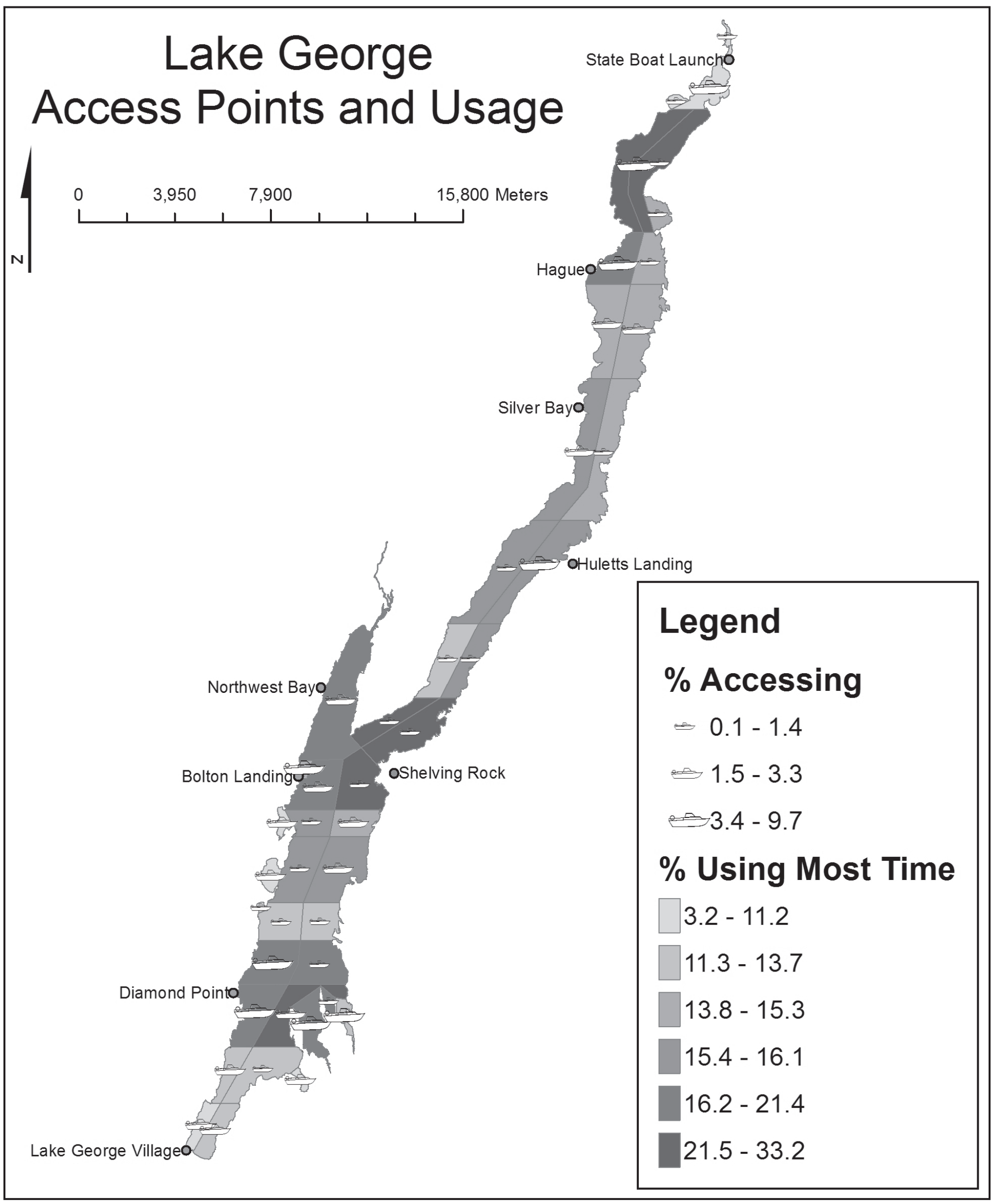


**Figure 1.** *Percent of respondents accessing Lake George in 2005 from each zone and the percent indicating they spent the majority of their time in each zone.*

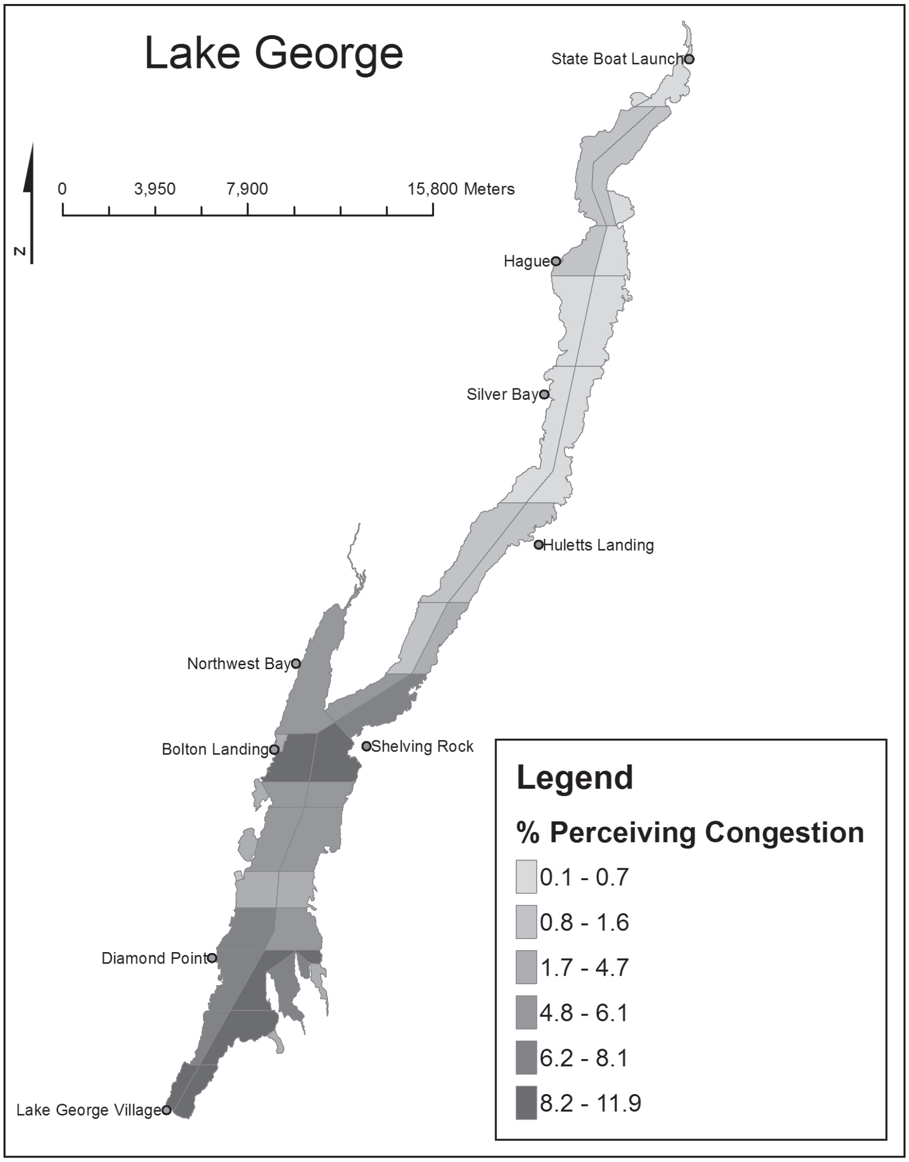


**Figure 2.** *Percent of respondents perceiving each zone as routinely so congested that it interfered with their enjoyment of Lake George in 2005.*

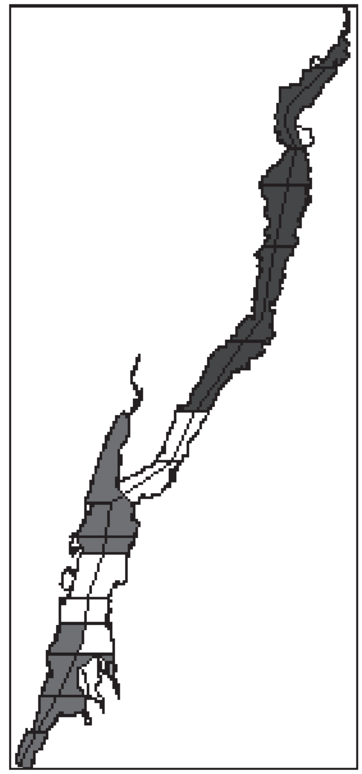

**Figure 3.** *Significantly correlated zones of congestion on Lake George as calculated using Local Moran's I for all survey respondents. (Note: Lighter shading indicates neighboring zones with significantly correlated high levels of congestion; darker shading indicates significantly low levels of congestion. In white zones there are no significant relationships with neighboring zones.)*

notable is the southern end of the lake, where people perceived crowding but their usage alone would not predict crowding. However, the overall correlation between respondent-identified areas of use and crowding was significant ($r$ = 0.460, $p$ = 0.002).

### *User Characteristics and Crowding*

Perceptions of crowding differed based on sociodemographic and use characteristics (Table 1). Respondents who spent more time around Lake George, either by virtue of being seasonal residents, owning shoreline property, having an annual boating permit, or indicating more years of experience, were more likely to indicate at least one zone that they perceived to be crowded. Temporary boat permit holders and day-use visitors had negative correlations with crowding, indicating their general lack of perception of a problem. Current residence area, as measured by community size, was not related to the likelihood that a respondent perceived an area of Lake George as being crowded.

Examination of the spatial distribution of the five user groups' perceptions of crowding using correlation analysis and visual inspection of Local Moran's I significance maps indicates that groups identify the same areas as being crowded (Table 2). The correlation between groups and which zones they perceived to be crowded was always above 0.75. Fewer members of some groups thought the lake was crowded, but those who perceived crowding identified the same areas. For example, more annual than temporary boat permit holders thought the lake was crowded (44% vs. 18%, Table 1), but the zones they identified as most or least crowded were the same, as illustrated by the high correlation between the two groups in Table 2 and visual inspection of Local Moran's I significance maps.

**Table 1.** *Percent of respondents indicating some portion of Lake George was crowded, by sociodemographic and use characteristics*

| Sociodemographic or Use Characteristic | Percent Indicating at Least One Zone Was Crowded |
|---|---|
| ***User group**** | |
| Residential dock owners | 36.6 |
| Annual boat permit holders | 44.1 |
| Temporary boat permit holders | 17.5 |
| Beach users | 17.2 |
| Commercial dock owners | 39.4 |
| ***Local resident status**** | |
| Year-round resident | 37.6 |
| Seasonal resident | 35.2 |
| Visitor or day-user | 20.9 |
| ***Years visited or lived in area**** | |
| Less than 1 year to 29 years | 24.1 |
| 30 or more years | 37.6 |
| ***Residence area*** | |
| Rural | 31.5 |
| Community fewer than 5,000 people | 34.2 |
| Community 5,000 to 24,999 people | 30.8 |
| City 25,000 to 100,000 people | 28.5 |
| City more than 100,000 people | 30.9 |
| ***Age*** | |
| 18–53 years old | 28.9 |
| 54 or more years old | 33.3 |
| ***Gender**** | |
| Male | 32.8 |
| Female | 26.5 |
| ***Own powerboat**** | 35.3 |
| ***Own nonmotorized boat**** | 41.1 |
| ***Own personal watercraft**** | 27.1 |

* Statistically significant difference within sociodemographic or use characteristic in the percent indicating at least one zone was crowded using chi-square test at $p = 0.05$.

**Table 2.** *Correlation of user groups' perceptions of crowding by zone on Lake George*

| User Groups | Residential Dock Owners Correlation ($p$-value) | Annual Boat Permit Holders | Temporary Boat Permit Holders | Beach Users |
|---|---|---|---|---|
| Annual boat permit holders | 0.934 (<0.001) | | | |
| Temporary boat permit holders | 0.862 (<0.001) | 0.888 (<0.001) | | |
| Beach users | 0.758 (<0.001) | 0.807 (<0.001) | 0.788 (<0.001) | |
| Commercial dock owners | 0.853 (<0.001) | 0.902 (<0.001) | 0.775 (<0.001) | 0.823 (<0.001) |

## Discussion

The use of spatial statistics was helpful in identifying areas of the lake with both high and low perceived crowding and in defining transition areas. Local Moran's I showed neighboring zones where crowding was high in two sections of Lake George. The LGPC and others can examine these areas in more detail and consider whether management actions are needed to reduce crowding. Although not all user groups were equally likely to perceive crowding, they identified the same areas as being crowded. This degree of concurrence should ease the task of the LGPC in targeting specific areas of the lake for special consideration in future planning efforts.

We found some disparity between areas of use and perceptions of crowding across the lake, but there was a good correlation. We believe, as do others (Cole et al. 2005), that use estimates alone are insufficient for addressing issues of crowding. Therefore, our measure of perceptions of crowding contributes additional valuable information for planners.

This study, like others, found relationships between sociodemographic and use characteristics and perceptions of crowding (e.g., Kuentzel and Heberlein 2003). Those with more experience on the lake were more likely to perceive the lake as crowded.

GIS, and more recently spatial statistics, have become important tools for recreation planners (McNulty 2004). Displaying maps produced using GIS allows for much easier interpretation of spatial data, and the use of spatial statistics can confirm (or deny) perceived spatial patterns. The current application is the first to our knowledge in which perceptions of users have been mapped and analyzed to identify potential areas of crowding. We believe this technique can be successfully applied to a variety of recreational situations.

## Acknowledgment

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MELISSA J. BURCHARD

*One of the many waterfalls on the Raquette River visible along the 7.5-mile Stone Valley Loop Trail*

ANALYSIS

# Seasonal Homes in the Adirondack Park and Their Impact on Property Taxes

By CHAD COLARUSSO and LESTER HADSELL

**Abstract**

*Seasonal homes are becoming more common all across the United States, including the Adirondack Park. Their presence affects communities in many ways, environmental, social, and economic. This study examines a subset of the latter—the impact of seasonal homes on local municipal property taxes. Our analysis indicates that, for towns and villages in the Adirondack Park between 1990 and 2000, an inverse relationship existed between seasonal homes and property tax rates. That is, the greater the share of seasonal homes in a municipality the lower the property tax rate. The effect was particularly clear in small and rural towns and villages. An alternative measure of tax burden, property taxes as a percentage of median household income, also appears to be negatively related to the presence of seasonal homes.*

## Introduction

The Adirondack Park is unique among parks in the United States. Within its 6 million acres we find a mixture of public and private properties, more than 100 municipalities, and commercial interests interspersed with pristine lands. Among the several hot button issues currently occupying the attention of park residents and officials is the impact of an increasing number of seasonal (i.e., second or vacation) homes. A survey by Graham Cox and colleagues (2007) reveals that two-fifths of North Country residents think that second home development is incompatible with the character of their community. Particularly relevant to our study, they also find that more than 40% think that second home development is largely responsible for the rising property taxes in their community (Cox et al. 2007, Table 2).

Of course, the impact of seasonal homes, as part of "exurban development," reaches beyond economic dimensions, to include environmental and social concerns. The environmental issues surround the encroachment of exurban development into previously wild areas. Preserving wildlife habitat and species diversity is becoming increasingly difficult as is conservation of natural areas for human recreation such as hiking. Michale Glennon and Heidi Kretser (2005) provide a comprehensive look at the ecological impact of exurban development, with specific attention to the Adirondack Park. They note,

> The presence of humans, their structures, and the shelter and food sources they create for wildlife can lead to altered population dynamics and increased human–wildlife conflicts around local communities. . . . Increased recreation by humans in areas surrounding exurban developments has many potentially negative impacts to wildlife species, especially in heavily used areas with trails.

Social conflict also takes many forms and often overlaps with economic concerns. It can occur when newcomers have much greater financial resources than long-time residents, come from backgrounds that are widely different (e.g., come to the park after living many years in an urban environment), and have different voting preferences. These social conflicts then spill over to economic concerns. Unequal financial resources lead to increasing housing values in certain areas of the park (and upstate New York generally), perhaps driving out some long-time residents. Local residents sometimes bitterly complain of the increasing tax burden that accompanies rising homes values (and, of course, rising government spending by the municipality to accommodate the newcomers). The popular press has reported stories of long-time residents of Adirondack Park having been forced to sell their homes because of their rising tax bill (i.e., *Albany Times Union* 1999, 2006).

On the other side, some seasonal homeowners have voiced concern over their lack of voting rights in their seasonal home district. New York, like most states, limits citizens to one person one vote, the location of one's vote being determined by one's primary residence. The perception of these seasonal owners is that property taxes in the seasonal home district are an unfair burden, given their part-time residency status. Economic theory of "tax exporting" lends support to their argument (Wildasin 1986, 124–128; Anderson 2004b). Under tax exporting, local residents vote for a greater level of public spending because part of the spending is paid by out-of-towners (i.e., is exported)—somewhat similar to the hotel tax, which is typically much higher than other local tax rates because nonresidents are paying most of it.

The economic impacts extend beyond local municipal spending and property taxes and include changes to consumer spending and employment. But the primary fiscal impacts of seasonal homes are tied to the demand for government services such as water, sewer, fire and police protection, road maintenance, and recreational amenities, funded mostly by local taxes. These fiscal issues present themselves most often in the form of changing property taxes.

This study focuses on the fiscal dimension, presenting an analysis of the

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impact of seasonal homes on property taxes in 101 municipalities entirely or partially within Adirondack Park. We present regression results that identify the statistical relationship between the share of seasonal homeownership in a municipality and the property tax rate within that municipality. The findings indicate a negative relationship between the share of seasonal homes in a municipality and the property tax rate. That is, the greater the share of seasonal homes the lower the property tax rate. We also examine real estate taxes paid per dollar of income and find a similar relationship. This second measure assesses the impact of seasonal homes on the ability of local residents to pay their property tax from the income they earn. This factor seems particularly important given the rising home values and stagnant incomes of many communities in the park.

## Background

Nationally, according to the census, the number of seasonal homes increased faster than the overall housing stock in the 1990s, more than doubling in number since 1980 to reach nearly 4 million by 2000. Due to inaccuracies in data collection census data may be considered as a lower bound on the estimate of seasonal homes. Di et al. (2001) note, for example, one drawback with using census data: the census appears to underestimate the number of seasonal homes because some seasonal homeowners, despite specific instructions advising otherwise, completed census forms received at their seasonal homes, leading those homes to be counted as primary residences. Even so, Di et al. assert that "the census remains a useful data source on second homes with some distinct advantages," primarily that it provides a geographic link to other data to answer questions such as the main focus of our paper.[1]

The northeastern United States contains the highest share of seasonal homes as a percentage of all housing units and New York State contains the largest number of seasonal homes in the Northeast, with over 230,000 units in 2000. Excluding New York City, the proportion of seasonal homes in New York is about five percent of all homes and has been increasing, following the national trend. Seasonal homes as a percentage of all housing units varies considerably by location. In New York, for example, while less than one percent of all housing units are classified as seasonal in most urban counties, in many rural counties the share of seasonal homes exceeds 20 percent of all units (Table 1).

While the share of housing units in Adirondack Park municipalities classified by the census as seasonal declined slightly from 1990 to 2000, the percentage is still quite high. For the Adirondack Park region as a whole, seasonal homes constituted more than one-quarter of all homes. Many of the municipalities with the highest share of seasonal homes are in Hamilton County: Arietta has 82 percent of its units classified as seasonal; Morehouse, Inlet, and Lake Pleasant all are above 70 percent. Santa Clara in Franklin County is the only other municipality with more than 80 percent seasonal homes, but altogether 26 municipalities have more than 50 percent seasonal homes. Many of the municipalities with a low share of seasonal homes are villages (8 of the 14 lowest municipalities). Figure 1 shows

**Table 1.** *Seasonal homes in New York State (excluding New York City), 2000*

| Type | Total housing units | Seasonal units | Seasonal share (%) |
|---|---|---|---|
| Towns | 3,458,510 | 202,527 | 5.86 |
| Rural* | 558,059 | 116,799 | 20.93 |
| Villages | 744,654 | 15,934 | 2.14 |
| Rural* | 87,473 | 4,628 | 5.29 |
| Adirondack Park Towns and Villages | 157,327 | 40,464 | 25.72 |
| Cities | 1,016,303 | 4,308 | 0.42 |

* 100% rural as defined by the Census.
Source: U.S. Census 2000

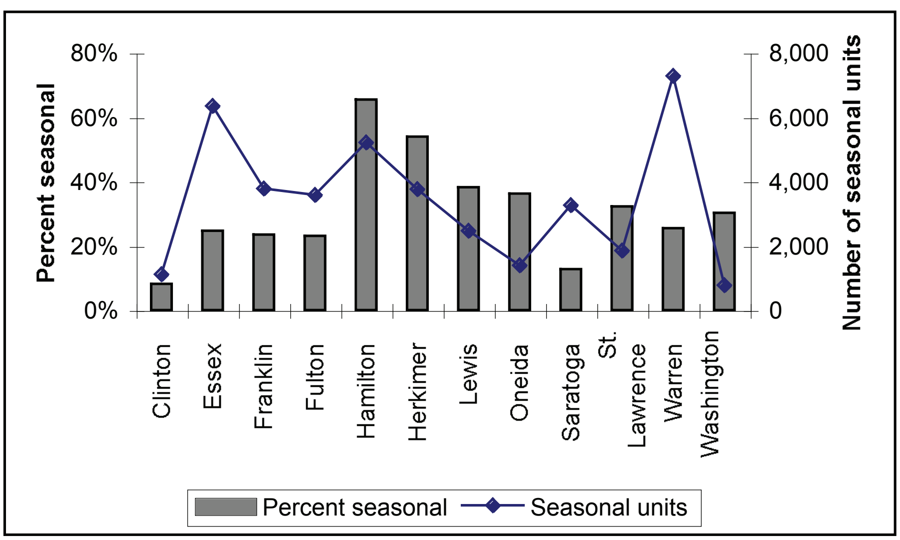


**Figure 1.** *Seasonal homes in Adirondack counties*

the number and share of seasonal homes for each county.

With the increasing importance of seasonal homes, interest in the impact of these homes on local economies and government finances is once again gaining attention of economic researchers after a two-decade lull. Recent work by Weagraff (2004), Cho et al. (2003), Di et al. (2001), and Stynes et al. (1997) has complemented earlier work by Burby et al. (1972), Ragatz (1970), and Tombaugh (1970). The earlier work focused on two issues: development, designed to provide "planners and policy makers with a useful tool to evaluate the effects of policy alternatives on recreation area development patterns" (Burby et al.; also Ragatz), and the determinants of seasonal home location (Tombaugh).

A summary of the recent findings, which focuses on measuring the economic impacts of seasonal homes, is shown in Table 2. Cho et al. (2003) find that the presence of seasonal homes in a neighborhood has a significant influence on housing prices in the area, the effects being strongest in rural areas. Weagraff (2004) finds evidence that seasonal homes are associated with greater growth in employment, per capita income, and population in a large sample of coastal counties in the Northeast. Stynes et al. (1997), in a study of Michigan, survey seasonal homeowners to estimate their seasonal home use and spending patterns. They note that on a given day the population of some counties in Michigan may be six or seven times the official resident population, probably a familiar occurrence for many Adirondackers. Not only does this population influx affect consumer spending and employment (as well as the environment), and therefore have important implications for economic development, it also affects the demand for local public services, potentially putting a strain on police, highway, fire, water, and sewer services.

A two-decades old study of 240 Vermont towns by Fritz (1982) found that an increase in town property allocated to vacation homes was significantly associated with an increased tax burden on residential property. The impact seemed to be more important the smaller the town. Anderson (2004a, b) provides an update with two new studies. In his first paper, Anderson examines the theoretical opportunity for local residents to export part of the local property tax. In his second paper, he presents empirical results indicating that a greater share of seasonal homes in a municipality's tax base (in Minnesota) is associated with a slight increase in per capita municipal spending. Our paper adds to these research findings by studying the relationship between seasonal homes and two measures of the property tax burden in Adirondack Park.

Adirondack communities are special. Because they are within a protected area, the actions of citizens are constrained (e.g., in terms of building) as are the options for communities (e.g., in terms of economic development). These constraints lead to outcomes that distinguish park municipalities from others in New York State. Compared with non–Adirondack Park municipalities in New York State, Adirondack Park municipalities in 2000

- have lower median household income,
- have fewer residents,
- have more water and land area,
- are less densely populated,
- are much more rural (as defined by the census),
- have a much higher rate of seasonal homes,
- have a property tax rate that is about the same,
- receive 50 percent more non–property tax revenue per capita,
- receive 125 percent more intergovernmental revenue per capita, and
- did not see an increase from 1990 to 2000 in the share of housing units that are seasonal homes (Table 3).

One hundred four municipalities lie all or partly within Adirondack Park. We had to remove Altamont (Tupper Lake), Benson, and Morehouse from our study because we lacked property tax data for 2000. Remaining were 88 towns and 13 villages.

**Table 2.** *Key findings in previous research of economic impact of seasonal homes*

Seasonal homes:

- have a significant influence on area housing prices, especially in rural areas (Cho et al. 2003);
- are associated with greater growth in employment, per capita income, and population in a large sample of coastal counties in the northeastern United States (Weagraff 2004);
- create incentives for local governments to increase public spending (tax exporting) (Anderson 2004a);
- foster increase in per capita municipal spending (Anderson 2004b); and
- may increase the tax burden on residential property (Fritz 1982).

**Table 3.** *Characteristics of Adirondack Park towns and villages, 2000 (averages except when noted)*

| | |
|---|---|
| Rural | 0.88% |
| Median real estate taxes | $1,327 |
| Median household income | $35,819 |
| Population | 2,795 |
| Water area | 5.1 sq. mi. |
| Land area | 93.3 sq. mi. |
| People per square mile | 239.8 |
| Houses per square mile | 110.2 |
| Total housing units | 1,558 |
| Number of second home units | 401 |
| Municipality-wide assessed value | $155,646,171 |
| Municipality-wide full value | $182,536,689 |
| Property tax revenue | $755,212 |
| Property tax rate | 0.0055% |
| Sales tax revenue, total | $322,037 |
| Non–property tax revenue per capita | $103 |
| Intergovernmental revenue per capita | $262 |

## Analysis

### *Data and Model*

We focus on property tax as a measure of fiscal impact because it generally is the largest source of revenue for local governments. It represents 79 percent of all local taxes and 43 percent of all revenue in New York State outside New York City (Office of the State Comptroller 2006). Property taxes in New York currently are roughly five percent of personal income, significantly above the national average of about 3 percent, and grew at twice the rate of inflation in the 10 years ending 2005. Because the property tax is set locally, it varies considerably across the state.

To determine the required property tax revenue, local governments first determine their projected overall expenditures and then subtract projected revenues from other, nonproperty sources. The resulting estimated tax bill must be raised from the property tax levy, and the nominal property tax rate is set by dividing the property tax levy by the assessed property tax base (the effective rate uses the full market value of properties). Seasonal homes, to the extent that they require provision of additional local municipal spending, raise the required property tax levy. At the same time, new or improved seasonal homes may add to the property tax base and possibly to household incomes or other tax revenues (e.g., sales). To gauge the net impact, we use two measures of the burden of the property tax. The first is the effective property tax rate, which for homeowners and local officials is probably the most commonly discussed measure of tax burden.

The second measure is property tax revenue as a share of median household income, a measure commonly considered when evaluating state tax policy (e.g., Reed and Rogers 2006). We use this second measure because residents may be more concerned with their tax bill (payment) as it relates to their income, since it is from their income that they are able to pay their property tax levy. In many areas, upstate New York included, residents voice concern over tax bills that are rising faster than incomes (e.g., Albany Times Union 1999, 2006). Even when tax rates fall, tax bills may rise if property values rise more than proportionately. This second measure of tax burden is more comprehensive than the first because it includes county and school property taxes in additional to the town and village taxes. For all these reasons, this second measure provides a fuller picture of what is happening to the tax burden on residents.

**The results quite clearly indicate that seasonal homes in Adirondack communities are associated with slightly lower municipal-level (town or village) property tax rates and tax burdens as measured by real estate taxes (which include county and school taxes) per dollar of income. This association appears to be stronger for small and rural towns. These findings are likely at odds with the perception of many residents of the Adirondacks.**

We use regression analysis to identify the effects of seasonal homes on the local tax burden. Regression analysis is a statistical technique that can account for natural differences across towns and villages in terms of taxing and spending needs, allowing us to control for factors that also may affect the tax levy through their effect on demand for local expenditures. Thus, the effect of seasonal homes can be isolated. Regression analysis relates a dependent variable to "explanatory" or "control" variables. In this case, these control variables are geographic, population, and intergovernmental characteristics of the municipality. In particular, we account for differences across towns and villages in terms of land area (in square miles), population (year-round residents), total number of housing units, per capita non–property tax revenue, per capita intergovernmental aid received by the municipality, and whether the town or village is a county seat. The control (i.e., explanatory) variable of primary interest is percentage of homes in the municipality that are seasonal homes. (Additional background on regression analysis can be found in introductory statistics or econometrics textbooks such as Mirer, 1988). Details of the data sources and statistical approach are available from the author upon request.[2]

We use data at the town and village level from the 1990 and 2000 U.S. censuses and from the New York State Office of Real Property Services.[3] For our first set of regressions we use as the dependent variable (i.e., what is being explained) the effective property tax rate, obtained by dividing total municipal-wide property tax revenue by the full market value of all taxable property within the municipality. We have these data and the data for the explanatory variables for both 1990 and 2000 and so are able to account for changes over time. Our second set of regressions uses total real estate taxes paid (including town or villages, county, and school) by full-time residents divided by median household income of those residents. As we were able to obtain this real estate tax information only for the 2000 census we are limited to a single year analysis for this second set of regressions.

### *Estimation Results*

A summary of results from our regression analyses is shown in Table 4. The

**Table 4.** *Regression results*

| Sample | Dependent variable: Property tax rate | | Dependent variable: Real estate taxes per dollar of income | |
|---|---|---|---|---|
| | Effect of seasonal homes | Confidence | Effect of seasonal homes | Confidence |
| All towns and villages | –0.0047 | 0.999 | –0.0223 | 0.999 |
| Towns only | –0.0033 | 0.995 | –0.0143 | 0.949 |
| Villages only | –0.0119 | 0.558 | 0.0910 | 0.699 |
| Medium-size and large towns and villages | –0.0019 | 0.567 | –0.0241 | 0.767 |
| Small towns and villages | –0.0054 | 0.999 | –0.0225 | 0.978 |
| Rural towns and villages | –0.0071 | 0.999 | –0.0121 | 0.883 |

first two sets of results include all towns and villages, with property tax rate as the dependent variable. We find that the higher the share of seasonal homes in a municipality the lower the property tax rate, all else being equal. The relationship is statistically strong (that is, we have a high degree of confidence in the results), although the dollar amount itself is less so significant. The value of effect of seasonals on tax burden indicates that the tax rate is 0.47 percentage point lower if all housing is seasonal versus if none were. Thus, if seasonal homes are 20 percent of all housing units, then the tax burden is about 0.1 percentage point lower.[4] Based on a typical town effective tax rate of 0.5 percent, the tax bill for a home with a full market value of $100,000 would be about $500, so the change in the tax bill attributable to the presence of seasonal homes is about –$100 per home.

Looking at the real estate taxes paid by year-round residents per dollar of income of those residents, we also find that the higher the share of seasonal homes in a municipality the lower the level of tax burden. The results indicate that if, for example, seasonals are 20 percent of all homes, the change in the tax bill is estimated at –$156.10. (Remember that this measure of property taxes includes county and school taxes for full-time residents only.)

Because towns and villages typically have differing spending needs and taxing authority we separate the towns and villages for our next set of results. As one may expect (with 88 of 101 municipalities being towns) the findings for towns are similar to the findings for all municipalities. For villages, however, we can be much less sure that seasonal homes have an effect on property taxes. We note that with only 13 villages the number of observations is smaller than is normally used in statistical inference, so the lack of confidence may be partly reflective of sample size.

**The northeastern United States contains the highest share of seasonal homes as a percentage of all housing units and New York State contains the largest number of seasonal homes in the Northeast.**

Because larger towns and villages may have spending and taxing requirements that differ from those of smaller ones, we separate our sample somewhat arbitrarily into 31 medium-size and larger municipalities with populations greater than 2,000 and 70 small ones. We see that the effect of seasonal homes is essentially zero for the medium and large towns and villages, while it is negative in the smaller municipalities. In fact, the effect of seasonals in these smaller towns and villages is very similar to the effects described earlier for all 101 municipalities.

Our last grouping looks at 78 rural-dominant municipalities (defined by the census as 100 percent rural). In these areas seasonals also appear to be associated with a lower property tax burden, although the relationship is stronger for property tax rate than it is for real estates taxes per dollar of income. In fact, the effect of seasonals on the property tax rate is about 50 percent larger in rural areas than for the overall sample. Thus, if seasonal homes were 20 percent of all housing units, then for an average home with a full market value of $100,000 the change in the tax bill attributable to the presence of seasonal homes is about –$140.[5]

## Concluding Remarks

The results quite clearly indicate that seasonal homes in Adirondack communities are associated with slightly lower municipal-level (town or village) property tax rates and tax burdens as measured by real estate taxes (which include county and school taxes) per dollar of income. This association appears to be stronger for small and rural towns.

These findings are likely at odds with the perception of many residents of the Adirondacks. We can only note that property taxes have been rising all over New York State (at twice the rate of inflation). Our results do not necessarily indicate that property taxes are falling in municipalities with a greater share of seasonal homes, only that they are not rising as fast as in other, similar municipalities. The question remains why seasonals have the effect we report. The short answer is that increased municipal spending due to seasonal homes is not rising as fast as property values or incomes in the municipality.

Of course, these are statistical relationships for a given time period and so should be viewed with a healthy skepticism afforded all such analyses. Nonetheless, the information provided by the results of this analysis represents new, unbiased information that should be of value in the debate over the impact of seasonal homes in Adirondack Park.

**Acknowledgments**

We thank Bill O'Dea, Mary Ellen Mallia, Jim LaValley, and participants of the Adirondack Research Consortium Annual Conference in Tupper Lake, May 2007, for comments on earlier drafts of this paper. We also thank the reviewer of this manuscript for many helpful suggestions.

**Notes**

1 The U.S. decennial census records the occupancy status of housing units, including data on second (seasonal) homeownership by municipality. The census defines second homes as vacant units used or intended for use only in certain seasons, for weekends, or other occasional use throughout the year. This definition includes housing units used for summer or winter sports or recreation, such as beach cottages and hunting cabins and quarters for workers such as herders and loggers. Time-sharing condominiums also are included in this category.

While local property assessors in New York State have a code (260) for seasonal homes, state and local officials have indicated to the authors that this measure is an unreliable indicator of seasonal homeownership, given its practical definition and variable implementation among local assessors. According to one assessor with whom we spoke, "All towns use 'property class codes.' Most of these second homes are technically four season or remodeled and labeled 'One Family Year-Round Residence' (code 210). Code 260 basically includes only 'shacks with no indoor plumbing or electricity.'"

2 In summary, we estimate

$$t = \alpha + \beta_1 LAND + \beta_2 POP + \beta_3 HOUSE + \beta_4 NPTR + \beta_5 IGOV + \beta_6 COUNTY + \beta_7 SEAS$$

where

t = the tax burden: either the effective property tax rate or real estate taxes paid divided by median household income;
LAND = land area, in square miles;
POP = population (year-round residents);
HOUSE = total number of housing units;
NPTR = per capita non–property tax revenue;
IGOV = per capita intergovernmental aid received by the municipality;
COUNTY = county seat (government) dummy: 1 if municipality is a county seat, 0 otherwise;
SEAS = percentage of homes in the municipality that are seasonal homes.

3 Data for 2000 were obtained from http://www.orps.state.ny.us/. The Office of Real Property Services supplied data for 1990 upon written request. We gratefully acknowledge the quick response. Detailed information on data sources is available from the authors upon request.

4 If, for instance, seasonal homes are 20% of all housing units (SEAS = 0.20), then $\beta_7 \times SEAS = -0.0047 \times 0.20 = -0.00094$. That is, the tax rate is about 0.1 percentage point lower. Based on an average home with a full market value of \$100,000 the change in the tax bill attributable to the presence of seasonal homes is –\$94 per home.

5 For a typical town effective tax rate of 0.5%, the tax bill for a home with a full market value of \$100,000 would be about \$500 if no seasonal homes were present, and \$358 if 20% of homes were seasonals (\$100,000 × (0.005 – 0.0071 × 0.20)).

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# Call for Papers

The Adirondack Research Consortium will hold its 15th Annual Conference on the Adirondacks on May 21–22, 2008, at the Crowne Plaza Resort in Lake Placid. The conference theme, "Working Together for the Future of a Sustainable Adirondack Park," centers on research related to long-term resource trends and collaborative partnerships focused on promoting sustainability and innovation in three concept areas:

- Energy and Technology
- Environmental and Ecological Issues
- Community and Economic Issues

The ARC invites researchers of national, regional, and local expertise to present the latest scientific information on these topics. In addition to a broad spectrum of invited speakers, panel participants will discuss their latest work in these subject areas. There will also be opportunity for researchers to display poster presentations of their work during the conference.

The conference is a forum for researchers to present current information on natural, social, economic, and recreational resources, as well as an opportunity to bring people with diverse backgrounds together in collaborative efforts. The ARC invites oral presentations and posters.

*Oral Presentations.* Talks are limited to 20 minutes for both presentation and question-and-answer period. Your audience may include laypersons who, although they may have a keen interest in your research and results, may not be fully conversant with the jargon of your science. We encourage you to use plain language. Slide, overhead, and digital projectors will be available in all meeting rooms. Laptops equipped with DVD/CD-RW drives, loaded with Microsoft Windows and PowerPoint, and connected to projectors will be available for presentations. (Note: These computers do NOT have Zip disk capability.)

*Poster Presentations.* The ARC will accept posters on May 20, 2008, from 4:00 PM to 6:00 PM, and in the morning of May 21, 2008, beginning at 7:00 AM. Special arrangements will be accommodated by the ARC. Posters must be mounted on a rigid backing. Conference staff will aid in affixing and removing posters in the display area. An opportunity for conference attendees to meet the poster presenters will be formally scheduled during the conference.

If you are interested in presenting your research at the 2008 Conference on the Adirondacks, please obtain an Abstract Submission Form from the ARC website at http://www.adkresearch.org, by e-mailing info@adkresearch.org, or by calling 518-523-1814. To be considered for inclusion in the conference, abstracts are due by April 1, 2008, at Adirondack Research Consortium, c/o Dan Fitts, 45 Cherry Lane, Lake Placid, NY 12946, or by e-mail at info@adkresearch.org. The ARC will make its final decisions by April 15, 2008, and notify all applicants shortly thereafter. Please be sure to submit early and include your e-mail contact information. Note: Students must submit name of faculty sponsor for presentations.

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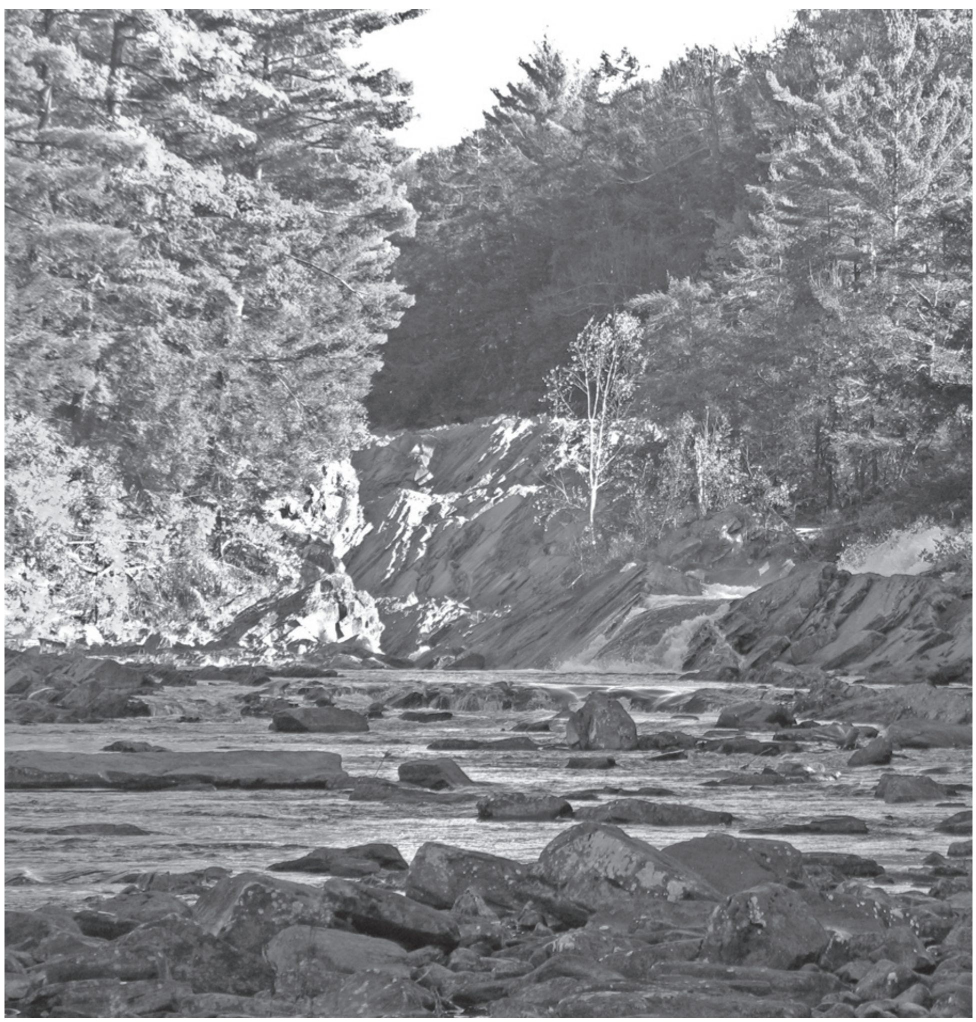

Melissa J. Burchard

*The Narrows on the Raquette River, where steeply dipping and deformed Precambrian rocks form the boundary between the Adirondack Lowlands and Highlands*

ANNOUNCEMENTS

# Notes for Contributors

The *Adirondack Journal of Environmental Studies* (*AJES*) encourages the submission of work promoting and documenting the development of sustainable communities in the Adirondacks and Northern Forest. Authors are typically academics and students, as well as nonacademic practitioners working through agencies, businesses, and voluntary organizations. More specifically, *AJES* seeks articles that cover the theory and practice of sustainable development promoting ecological integrity, renewable energy, sustainable economies, the reduction of inequities, and the empowerment of local communities.

*AJES* being a transdisciplinary journal, authors should avoid technical or discipline-specific terms or thoroughly explain them in the text. Articles must not have appeared elsewhere in the same form (i.e., discipline-specific articles published elsewhere but rewritten for a general audience are acceptable) and must not be submitted for publication elsewhere while under consideration by *AJES*. Electronic submissions are strongly encouraged. Text should be double-spaced, references should be typed as endnotes, and all tables, figures, and photos should appear individually on separate pages at the end of the document. The author's phone number, mailing and e-mail addresses, title, and academic or professional affiliation must accompany the manuscript.

All submissions except book reviews must include an abstract of less than 150 words.

**Peer-Reviewed Commentary and Analysis**

The approximate length of more scholarly articles submitted is 5,000 to 7,000 words. All articles in this category will undergo a peer review process, overseen by the *AJES* editorial board.

**Features**

The approximate length of articles submitted in this category, describing a significant issue in the region or discussing a special topic of general interest, is 5,000 to 7,000 words. These articles are often invited by the *AJES* editorial board or the journal's overseeing board of the Adirondack Research Consortium.

**Organizational Profiles**

Articles in this category are 2,000 to 3,000 words long and seek to disseminate useful approaches, promote networking opportunities among practitioners and academics, and document an organization's contributions to promoting sustainable communities.

**Essays**

Not all knowledge is a matter of fact, and in our efforts to visualize and promote sustainable communities, it is frequently necessary to understand views from a wide range of vantage points. Articles submitted to the opinion forum are approximately 1,500 to 2,500 words long. They do not undergo a full peer-review process, but are reviewed for factual errors.

**Interviews**

Interviews or profiles of influential individuals active in the region are approximately 1,000 to 2,000 words long.

**Book Reviews and Research News**

Articles in these categories are approximately 500 to 1,000 words long.

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*The Narrows on the Raquette River in the winter*