PREFACE

TREE-RING STUDIES IN NEW YORK STATE: PAST AND PRESENT [A *TREE-RING RESEARCH* SPECIAL ISSUE]

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ABSTRACT

New York State (NYS) has a long and significant history of tree-ring research. Some of the earliest dendroarchaeological and dendroclimatic work in eastern North America was done in NYS, and 1970s studies in Hudson Valley in the east of the state were important for demonstrating that drought records could be reconstructed from trees growing in humid environments. Some recent work in NYS is described in this issue of *Tree-Ring Research*, including tree-ring dating and provenancing of a boat in New York City, dendroarchaeological studies in a town in northeastern NYS, dendrogeomorphological work in central NYS, and a dendroclimatic investigation of two range-margin *Juniperus* species growing on alvars. The last of the five NYS papers in this issue provides a personal historical perspective on the beginnings of drought reconstructions in the Hudson Valley. There is considerable potential for future work in New York with extension of existing studies and work in new areas and with new tree species.

Keywords: New York, tree rings, dendroarchaeology, dendroclimatology, dendrogeomorphology, dendrochronology.

INTRODUCTION

This issue of *Tree-Ring Research* contains five papers that describe past and present tree-ring research in New York State (NYS). This thematic set of papers continues in the vein of two previous issues of *Tree-Ring Bulletin*/*Tree-Ring Research*, *The Laboratory of Tree-Ring Research at Sixty* (vol. 55, 1997) and *An Issue Devoted to Southeastern Dendrochronology* (vol. 65(1), 2009), that presented collections of papers on a common topic or region. The papers in this NYS collection span topics such as dendroarchaeology, dendrogeomorphology, and dendroclimatology, and include original research contributions, a synthesis of previously published work, and a personal reflection on the beginnings of quantitative

dendroclimatology in the Hudson Valley of eastern NYS. Our intent here is to showcase both recent and ongoing research, and to stimulate further tree-ring work in the region.

This project began in 2012 with a solicitation for manuscripts relating to any kind of tree-ring research in New York or adjacent regions. At least two reviewers commented on each submitted manuscript. If reviewers viewed the manuscripts positively, authors were given the chance to revise the manuscripts for possible acceptance, and the guest editors (in consultation with the chief Editor) applied the same standards for acceptance for publication as in any other issue of *Tree-Ring Research*. We are deeply grateful to all the authors who submitted manuscripts for consideration in this project. We also thank the reviewers who responded to requests for peer-review, and who provided detailed and constructive comments.

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Figure 1. Shaded relief map of New York State. Numbers refer to study sites in this issue. 1: Martin-Benito *et al.*, 2: Barclay and Rayburn, 3: Kappel, 4: Riddle *et al.*, 5: Cook.

BACKGROUND AND OVERVIEW

New York is located in the northeastern United States and includes a variety of landscapes and environments. Elevations range from sea level where the fjord of the lower Hudson River meets the Atlantic Ocean, to 1629 m a.s.l. at the treeless summit of Mount Marcy in the Adirondack Mountains (Figure 1). Linear ridges and valleys of the Appalachian Mountains extend through southeastern NYS, whereas the center and west of the state are dominated by uplands of the Allegheny Plateau and lowlands adjacent to Lake Erie and Lake Ontario. Climate is generally humid continental with minimum January temperatures of -16°C to -3°C , maximum July temperatures of 22°C to 30°C , and annual precipitation of 965 to 1650 mm (1981–2000 NCDC normals). Maritime influences are strongest in the southeast, “lake effects” significantly modify air temperatures and precipitation in areas fringing and downwind (east) of Lake Erie and Lake Ontario, and coldest temperatures occur most often in the center of the Adirondack region.

The topographic diversity and climatological range influence the biological diversity of the state. New York includes nine different ecoregions (Bryce *et al.* 2010) and has about 130 native species of tree (Little 1971). Approximately 61% of the NYS land surface ($75,552\text{ km}^2$) is currently

forested (Smith *et al.* 2009), with eastern broadleaf forest in the Hudson Valley and lowlands near Lake Erie and Lake Ontario, Laurentian mixed forest on the Allegheny Plateau and in the Saint Lawrence and Champlain valleys, and boreal species more common in the mixed forests at higher elevations of the Adirondacks and Catskills (Bray 1915; Little 1971; Thompson *et al.* 2013). It is estimated that forest covered 90% ($111,087\text{ km}^2$) of the NYS land surface in A.D. 1630, immediately prior to arrival of European settlers (Kellogg 1909; Smith *et al.* 2009). Forest clearing for farming, commercial logging, and fuelwood from the late 18th through mid-19th Centuries (Fox 1902; Defebaugh 1907; Whitney 1994) caused changes in species abundances, with pre-settlement forests generally having had more beech and less maple when compared with modern regrown forests (Thompson *et al.* 2013). A survey of old-growth forests in the eastern United States, a prime habitat for tree-ring research (Sheppard and Cook 1988), indicated that NYS might have the most “undocumented old growth east of the Mississippi” River (Davis 2003, p. 36). Given the mix of tree species and the range of environments, New York is almost a region unto itself, not quite fitting into either the adjacent Mid-Atlantic or New England regions.

Dendroarchaeology

One of the earliest attempts at using trees to date archaeological sites was in central New York, when Clinton (1812, p. 53–58) asserted that “concentric circles” (*i.e.* growth rings) in living oaks growing on earthen breastworks indicated that some abandoned pre-Columbian forts were of considerable antiquity. More rigorous and recent tree-ring studies have focused on dendrochronological dating of colonial-era buildings in the Hudson Valley, with numerous building reports produced from the 1990s onwards by the Tree-Ring Laboratory of Lamont-Doherty Earth Observatory of Columbia University (reports online at <http://hvva.net/dendro.html>). More recently, the Cornell University Tree-Ring Laboratory has been continuing the tree-ring crossdating of structures in the Hudson Valley and extending

these studies into central New York (reports online at <http://dendro.cornell.edu/projects/usa.php>; summarized in Harvey 2012).

The paper by Martin-Benito *et al.* (this issue) details a new tree-ring study of a boat hull in New York City. This boat was discovered during excavations at the World Trade Center site in Manhattan and, by crossdating oak timbers from the boat to a network of oak chronologies for the northeastern United States, the authors were able to constrain both the construction date and likely area of origin of the boat. There are few tree-ring studies of historical boats in the literature, and this study showcases both the value of tree-ring analyses to archaeological science and the usefulness of a dense network of living tree chronologies for dendroprovenancing of mobile wooden artifacts.

Barclay and Rayburn (this issue) present a study of late 18th and 19th Century buildings in Willsboro in northeastern New York. The challenge in this project was the diversity of tree species found in the historical structures and the lack of suitable master chronologies for crossdating. The authors describe how this challenge was met, how the tree-ring crossdates for buildings based on the new Willsboro chronologies compare with documentary records for the same sites, and consider some implications of the town-wide tree-ring results with respect to wood use in this northern area.

Dendrogeomorphology

Tully Valley in central New York is geomorphologically unusual for several reasons. This north-draining valley contains thick deposits of glaciolacustrine clay that were deposited in proglacial lakes during the late Pleistocene but, unlike similar valleys to the west, does not currently contain a deep lake. As a result, Tully Valley has ongoing problems of mud boils and landslide activity that impact inhabitants and infrastructure on the subaerial valley floor. In addition, the valley overlies substantial rock salt deposits that were solution-mined from the 1880s to 1980s, leading to further land surface instability and brine migration into surface streams. The US Geological Survey has intensively studied Tully Valley over the past two decades to better

understand the geologic and hydrologic controls on these geomorphic phenomena and the hazards they pose to local people.

Kappel (this issue) summarizes three US Geological Survey studies that used tree rings to hindcast hydrologic and geomorphic events in Tully Valley. The first study used tree rings in wetland trees to infer intervals of brine discharge from solution mining activity, the second study used pith flecks in exposed tree roots to document the opening of a surface fissure in response to land surface subsidence, and the third study used tree rings to better understand movement of a landslide. Collectively these studies show the use of tree rings for extending a short observational record and placing geomorphic processes in a longer-term context.

Dendroclimatology

Davis (1912) and Stewart (1913) were perhaps the first studies in New York and the eastern United States to show connections between rainfall and ring widths. Following a subsequent long lapse in research activity in NYS, the 1970s marked an increase of interest in dendroclimatology in the state, which continues unabated today. Cook and Jacoby (1977, 1979) developed drought reconstructions for the Hudson Valley and firmly established that tree rings can be used for the reconstruction of past climate in regions with relatively high and constant rainfall. Additional pioneering work in NYS is that of White *et al.* (1985, 1994), who demonstrated the utility of isotopic data from tree rings. More recently, research using multiple drought-sensitive species, using chronologies extended back in time with samples from historical structures, and integration of New York chronologies with data from across North America have continued to advance understanding of hydroclimate in eastern North America (*e.g.* Cook *et al.* 2007; Stahle *et al.* 2007; Pederson *et al.* 2013).

Riddle *et al.* (this issue) present new research on the climate sensitivity of two *Juniperus* species growing in alvar environments at the eastern end of Lake Ontario. The two species are respectively at their northern and southern range margins, and

show contrasting responses to climate in recent decades. This work shows some of the complexities that might occur as woody plants respond to future climate change.

Lastly, Cook (this issue) offers a personal narrative on the 1970s development of quantitative dendroclimatology in the Hudson Valley. Serendipity, intellectual curiosity, and the naturalist Daniel Smiley at Mohonk Lake in the Shawangunk Mountains all played prominent roles in the discovery of ancient trees in the Hudson Valley and the development of centuries-long drought records from their tree rings.

THE FUTURE

The future is bright for further tree-ring research in New York. The work described in this issue of *Tree-Ring Research* shows dendrochronology in NYS expanding into new locations, utilizing new species, and addressing new questions. Furthermore, there is much more that can be done. For example, there is considerable potential for dendroecologic and dendroclimatic studies of forests in central and western areas of the state, for more tree-ring based studies of hydrologic and geomorphic hazards such as landsliding and flooding, and for further chronology development and tree-ring dating of historic structures and artifacts. Promising work in these areas is already underway, and we look forward to seeing these and other NYS projects being published in coming years.

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