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ORIGINAL ARTICLE

A multi-century eastern white pine tree-ring chronology developed from salvaged river logs and its utility for dating heritage structures in Canada's National Capital Region

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ABSTRACT

The early settlement history of Canada's National Capital Region, including Ottawa (Ontario) and Gatineau (Québec), was shaped in large part by the towering eastern white pine (*Pinus strobus*) forests that once covered the Ottawa Valley and fuelled a lucrative lumber export industry spanning the 19th and much of the 20th century. Some of the first dwellings and farmsteads of this era are still standing and serve as reminders of this history. A crucial piece of information in the assessment of a structure's heritage value is its date of construction. Unfortunately, this information is not always known and is approximated based on construction styles and other sources of information. In this study, dendroarchaeology methods are applied to constrain the construction dates of six historic structures in the National Capital Region of 19th century vintage. A multi-century (AD 1670–2009) eastern white pine ring-width chronology was developed for dating the study structures using cross sections from sunken logs recovered from the Ottawa River and cores from live trees from the Petawawa Research Forest. The tree-ring inferred construction dates for the six structures ranged from 1830 to 1878. For most structures, historical records about the property or first inhabitants were available to corroborate the results. The ring-width chronologies of the individual structures were well correlated with the regional chronology ($r_{avg} = 0.63$, $p \leq 0.01$), and this regional coherence clearly demonstrates the value of tree-rings for heritage structure assessments and reconstructing the settlement history of this region.

Introduction

The Ottawa-Gatineau region, also known as Canada's National Capital Region, was an important centre in the Canadian timber trade during the 19th and 20th centuries. The Ottawa River was an important waterway to transport lumber used for the construction of buildings, ships and furniture in eastern North America and foreign markets. Towering, old-growth eastern white pine (*Pinus strobus* L.) was abundant in this region and valued in construction for its straight and relatively strong trunks. Given the high demand and quality of the wood, the timber trade of the 19th and 20th centuries removed most of the old-growth white pine forests in eastern Ontario. Today, some of the oldest re-growth white pine stands are found in the Petawawa Research Forest (Fig. 1), and isolated trees upwards of 200–400 years are known to exist in parts of Algonquin Park, Ontario (Guyette and Dey, 1995; Guyette and Cole, 1999).

The combination of tree-ring series from living and dead trees provides an opportunity to develop long tree-ring chronologies for dendrochronology research. Pertinent to this study is the use of tree-rings for dating structures built from local timbers. Dendroarchaeology methods have been applied to numerous buildings and antiquities around the world (Getty, 1935; Becker et al., 1985; Grissino-Mayer et al., 2004; Wang et al., 2008; Pearson et al., 2012) and elsewhere in Canada (Smith, 2000; Smith et al., 2005; Selig

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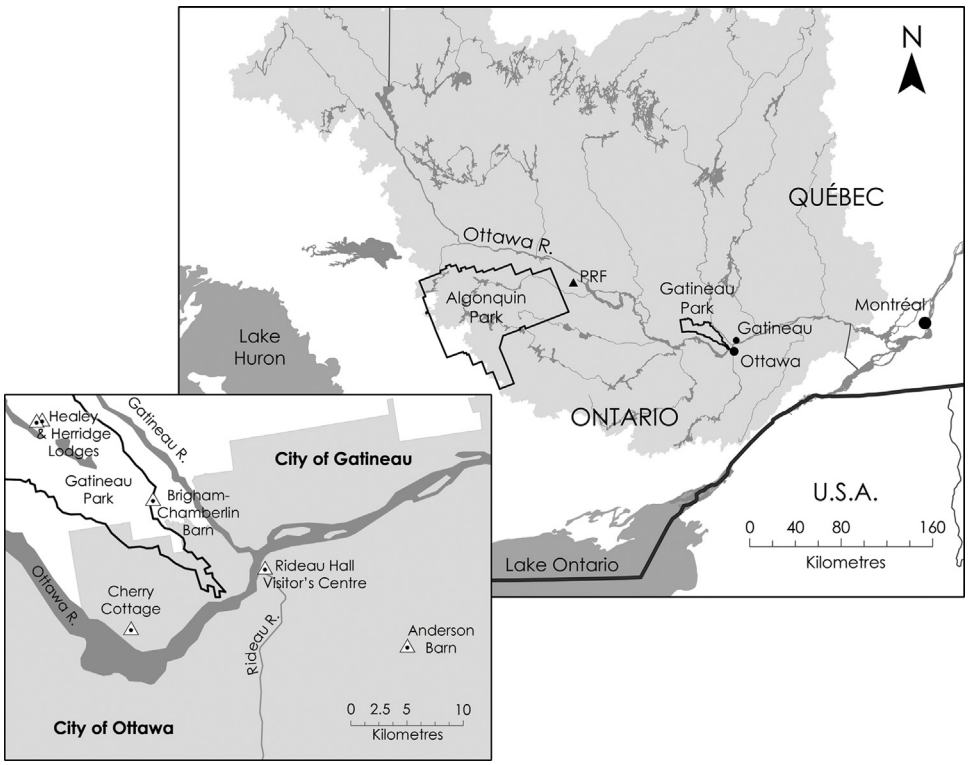

Fig. 1. Regional-scale map of the Ottawa River watershed ('PRF' is the Petawawa Research Forest), and local-scale map (lower-left) of the six study sites in the Ottawa-Gatineau area.

et al., 2007; Robichaud and Laroque, 2008; Pickard et al., 2011), but remain underutilised in eastern Ontario despite the occurrence of archaeological artefacts such as dugout canoes (Johnston, 1962; Rogers, 1965; Mitchell et al., 1968) and numerous heritage buildings (Aldred, 1989) that lack precise information about dates of construction.

In the National Capital Region, part of the mandate of the National Capital Commission (NCC) is to preserve the 'built heritage' of the region, and there are numerous log barns and dwellings of interest in the NCC's jurisdiction with construction dates that are only loosely known from historical records (e.g., land registry documents), mostly of early to late 19th century vintage. Here, dendroarchaeology methods are applied to provide independent age constraints on five of these structures and one privately owned dwelling in the National Capital Region (Fig. 1). All of the log structures were built using eastern white pine timbers that predate existing forests of the region and, therefore, developing a useful reference chronology was a challenge. Multi-century eastern white pine chronologies have been compiled in Algonquin Park using logs buried in the littoral zone of lakes (Guyette and Cole, 1999). We apply a similar strategy to develop our reference chronology (AD 1670–2009) using white pine logs salvaged from the bed of the Ottawa River. Most of these logs were floated down river by lumberjacks, but some of these sunk before reaching the lumber mills in Ottawa. The most recent portion of our reference chronology is developed using living trees from the Petawawa Research Forest. The reference chronology provides unambiguous cross-dating results when compared with tree-ring growth patterns from the heritage structures of interest, and these results are well supported by the historical records. This study demonstrates the viability of dendroarchaeological methods to improve knowledge of the early settlement history of the National Capital Region.

Methods

Development of the regional pine chronology

The Petawawa Research Forest is a 10,000 ha mixed mature forest in the upper Ottawa Valley, located ~200 km northwest from Ottawa (Fig. 1). The modern forest is a mixture of eastern white pine, red pine (*Pinus resinosa* Ait.), jack pine (*Pinus banksiana* Lamb.), trembling aspen (*Populus tremuloides* Michx.), white birch (*Betula papyrifera* Marsh.) and red oak (*Quercus rubra* L.). This area was at the centre of the timber trade in the 19th and 20th centuries, and selective logging during the late 19th century removed most of the largest and oldest white pine (Canadian Forest Service, 1998). This area has been protected from logging for most of the 20th century and provides access to some of the oldest re-growth white pines in the province, needed to anchor the Ottawa River tree-ring chronology. Tree cores were collected from 14 eastern white pine trees at the Petawawa Research Forest in 2010 using Hagloff increment borers. Sample cores were stored in straws, air dried, mounted, and sanded with progressively finer grits of sand paper (Speer, 2010). The living white pine samples were visually cross dated and measured (±0.001 mm) using a Velmex tree-ring measuring system. The computer program COFECHA was used to verify the cross-dating results (Holmes, 1983). A mean chronology was developed from these samples and used to anchor the Ottawa River log samples in time.

In some areas, the Ottawa River is an ideal environment to preserve sunken logs because the bottom waters lack oxygen and light which would otherwise cause the logs to degrade. Cross sections of 35 white pine logs recovered from the bed of the Ottawa River were provided by a local wood products company (Logs End) in Quyon, Quebec. The preservation of the logs was exceptional, and in many cases the original stamp of the lumber companies that