Mount Allison
Dendrochronology Lab

Mad Lab Report 2006-28

A Dendroarcheological Analysis of St. Anne's Catholic Church: Bear River, Nova Scotia

By

Natasha A. O'Neill, Andre Robichaud and Colin P. Laroque

A Dendroarcheological Analysis of St. Anne's Catholic Church: Bear River, Nova Scotia

Table of Contents

Abstract

Twenty tree-ring samples were taken from beams in St. Anne's Church in Bear River, Nova Scotia. The sampling was conducted in efforts to extend the Mount Allison Dendrochronology (MAD) Lab chronologies for southwestern Nova Scotia using historic structures. Statistical analysis was conducted on the red spruce (*Picea rubens*) samples to deduce the tree-ring growth patterns of the species for the region. Based on analysis, it was determined that the trees used in the construction of the church were felled in 1821, providing parishioners with a construction date of 1822.

Introduction

Churches in Nova Scotia are the pride of many communities and as such have been maintained for many centuries by their parishioners. Southwestern Nova Scotia has a wealth of churches that have been built and cared for by the earliest settlers. Not only are these churches rich in cultural history, the wood used to construct them holds a wealth of information on the environment of the region up to the time of initial settlement.

Dendroarchaeology is the study of tree rings taken from beams in historical structures. The purpose of this project is to understand how several tree species were growing in southwestern Nova Scotia at the time of settlement. Samples were taken from eight historical churches in the region to accomplish this goal. Master chronologies of radial growth from each tree species, at each church, were constructed, with the ultimate goal of adding growth patterns to existing regional chronologies to extend radial growth records for each tree species in the region. This method of collecting tree-rings is used in southwestern Nova Scotia because the majority of the region's old-growth forests have been cut down, and therefore shortening the length of the record accessible from live trees. Beams from historic churches provide records of tree-ring growth of what would be the region's old-growth forests, if they were standing today.

St. Anne's Catholic Church in Bear River, Nova Scotia (MAD Lab #06ALS000) was one of the eight churches the Mount Allison Dendrochronology (MAD) Lab sampled in the summer of 2006 (Figure 1). There are no records of the church's construction date, but historical records suggest it is quite old. Due to its prospective age, there was potential for the tree-rings in the church beams to extend quite far into the past. With the support of the church's parishioners, sampling was conducted.

Figure 1: St. Anne's Catholic Church, Bear River, N.S.

Research Methods

Samples were taken from a total of twenty beams using an increment borer (see Appendix A). The diameter of each sample is 4.3 mm, approximately the size of a pencil (Figures 2 and 3). The sampling process has no negative effects on the structural integrity of the building. All of the beams sampled are located in the church's attic, where they have not been altered since the initial construction of the church. Beams were selected for sampling according to their integrity (the absence of rot) and the presence of bark (indicating the last tree-ring has not been removed in the construction of the church).

Samples were stored in plastic straws and were transported back to the lab to be prepared for analysis. Each core was glued into a slotted mounting board. The cores were sanded using up to 600 grit sandpaper in order to ensure a clear cross-section of the rings. The cores were then measured using a 63x light microscope and the Velmex measuring system. This process produced measurements indicating the annual growth rates of the individual trees to 0.001 mm.

Prior to further analysis, it was important to determine the tree species used in the construction of the church. As all tree species have different growth responses to climatic factors, to compare growth patterns of a set of samples they must be of the same species. Three samples were examined using a scanning electron microscope (SEM) to determine the species

within the sample set. One sample was confirmed to be red spruce and it was inferred that all of the samples were of the same species.

The process of analyzing archeological data requires two steps. The first is to crossdate the samples within the church to like species within the sample set. This ensures that there is a significant correlation between the growth patterns of the trees within the building (representing a stand of trees that was growing together and thus should have similar growth trends). Once this was completed, the church beams were crossdated a red spruce chronology constructed by the MAD Lab from live trees and structural samples obtained from New Brunswick and Nova Scotia.

Figure 2: Collecting samples in St. Anne's Catholic Church.

Figure 3: Sample extracted with an increment borer.

Results and Discussion

Based on an analysis using COFECHA, it was determined that the last year of growth of the trees within the church beams was 1837 (Figure 4, Table 1). This suggests that the trees used in the construction of the church were cut down with the last growing year being 1821. Based on construction and logistical schedules of the time, it is reasonable to believe that the trees were felled in the fall/winter of 1821 before construction began. Therefore it is quite reasonable that construction was completed in 1822.

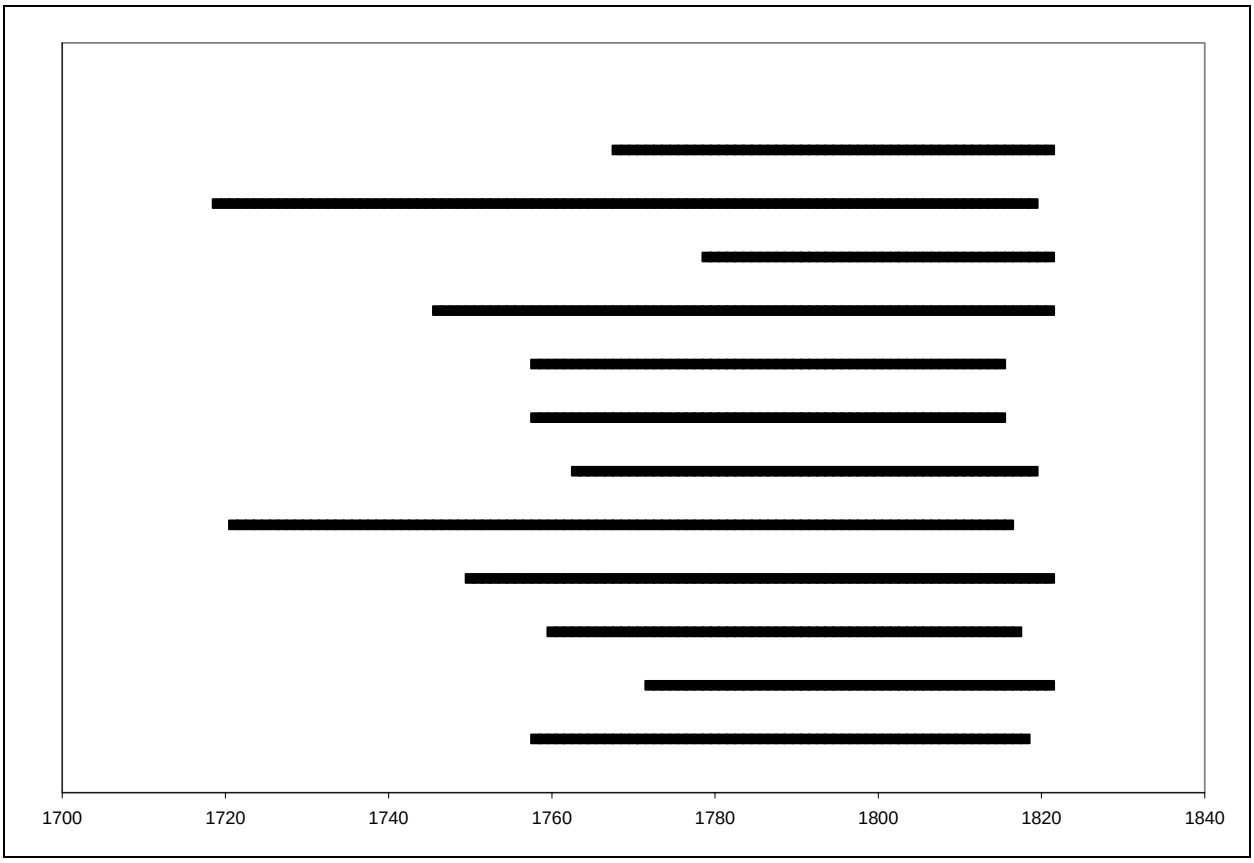


Figure 4: Life-spans of red spruce trees within beams of St. Anne's Catholic Church.

Sample ID	*Location*	*Bark Condition*	*Species*	*Crossdated Interval*
06ALS004	attic	bark present	Red spruce	1758-1818
06ALS005	attic	no bark present	Red spruce	1772-1821
06ALS006	attic	bark present	Red spruce	1760-1817
06ALS009	attic	bark present	Red spruce	1750-1821
06ALS010	attic	bark present	Red spruce	1721-1816
06ALS011	attic	no bark present	Red spruce	1763-1819
06ALS015	attic	bark present	Red spruce	1762-1819
06ALS016	attic	bark present	Red spruce	1762-1819
06ALS017	attic	bark present	Red spruce	1779-1821
06ALS019	attic	bark present	Red spruce	1719-1819
06ALS020	attic	no bark present	Red spruce	1766-1819
06ALS021	attic	bark present	Red spruce	1746-1821

Table 1: Data on samples collected from beams within St. Anne's Catholic Church.

Once the cut years of the trees were determined, it was possible to create a floating chronology for the "stand" (Figure 5). This shows the average growth patterns for all of the red spruce samples within the beams of the church.

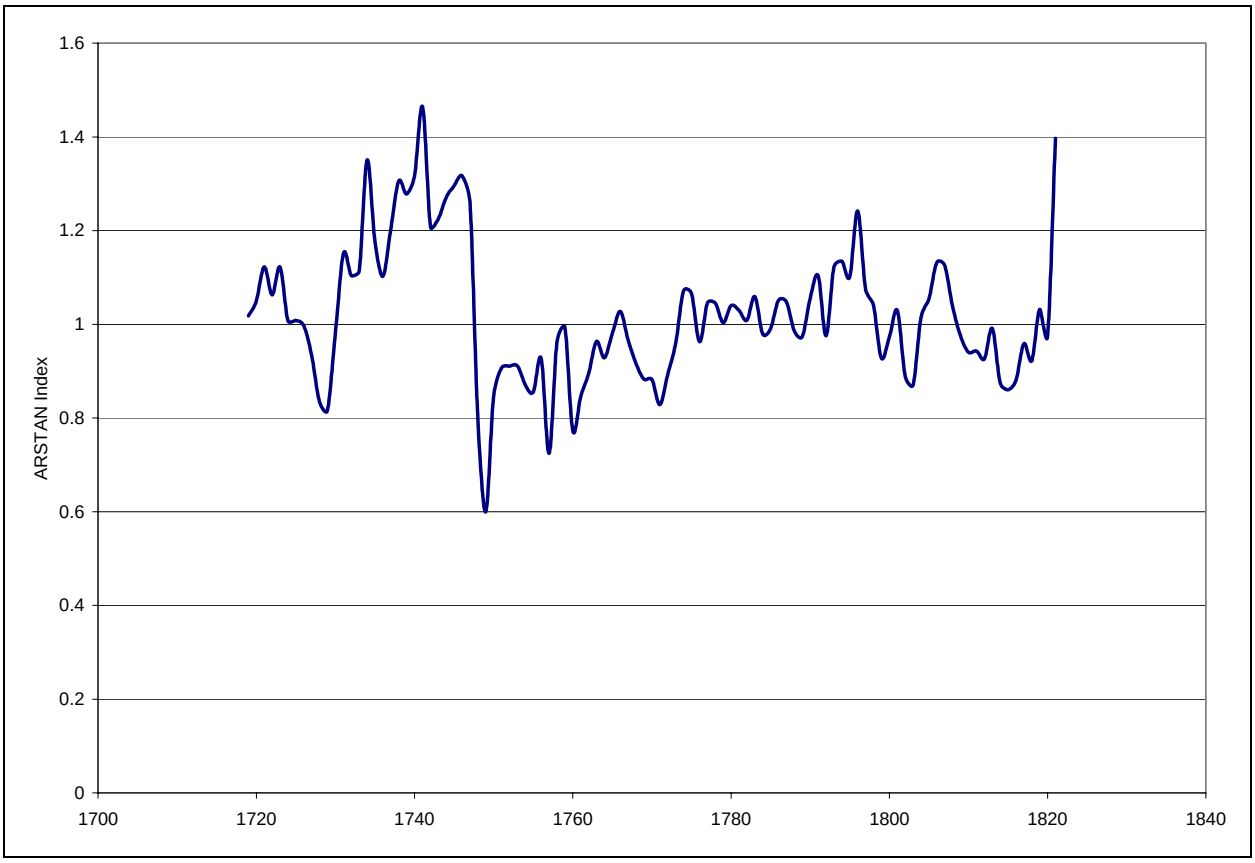


Figure 5: Floating chronology for red spruce in St. Anne's Catholic Church.

The beams from this church effectively contribute to two of the project's objectives which are to increase red spruce sample depth in Nova Scotia and to create a master chronology for red spruce in southwestern Nova Scotia (Figure 6). All red spruce beams crossdate into the master chronology with a significance ranging from 0.002-0.314 (90% confidence of significance at 0. 21). Out of the twelve red spruce samples, two achieve 90% significance or higher, with correlations to the master chronology above 0.21. The reason that the significance levels are not higher than 90% is that the live chronology is likely based predominately on red spruce trees growing in New Brunswick. The distance between the habitats of the live chronology and the stand that made up the church chronology may be the reason for this discrepancy.

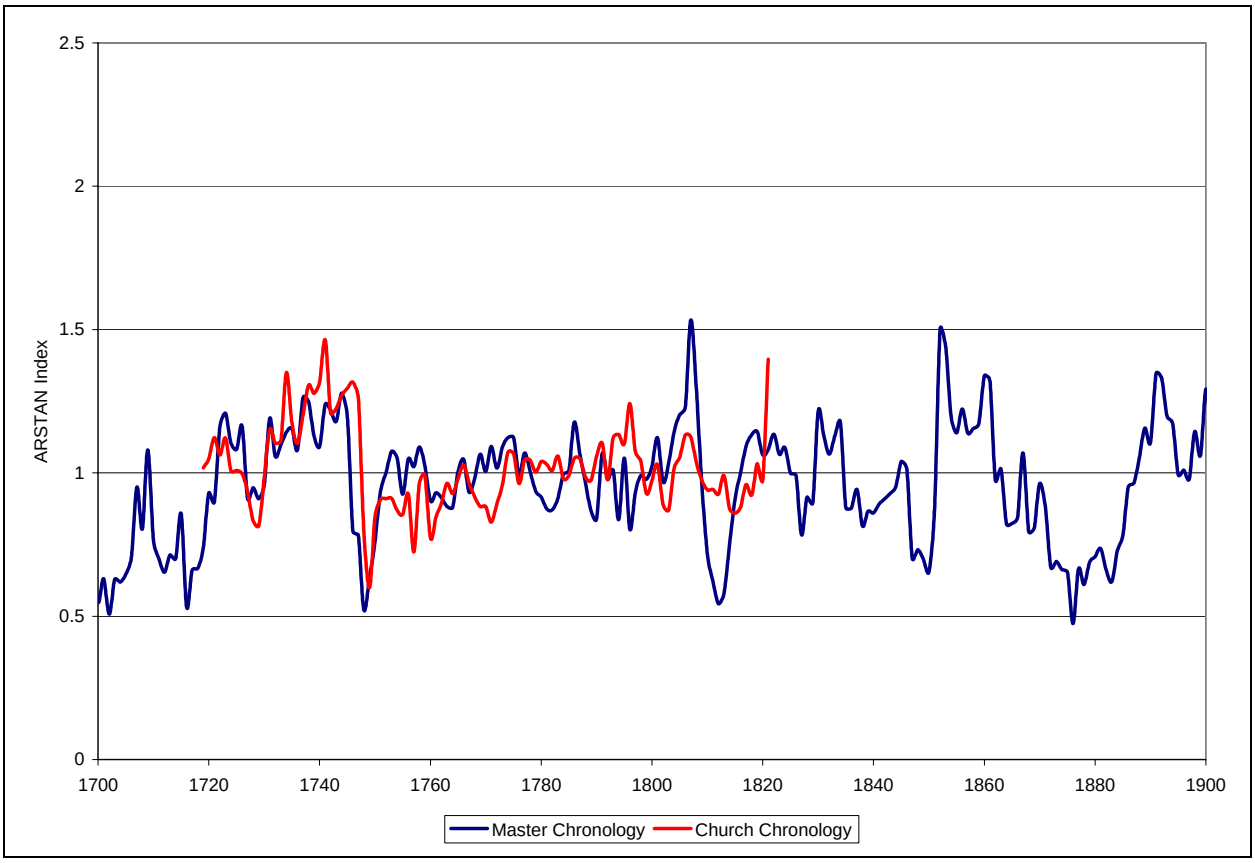


Figure 6: Overlap of the master and church red spruce chronologies shows similar growth patterns.

From the two species, it was possible to develop a master chronology for red spruce trees in New Brunswick and Nova Scotia (Figure 7). The overall correlation of the red spruce chronology is 0.498. This correlation is much higher than the 0.3281 required for 99% confidence of significance.

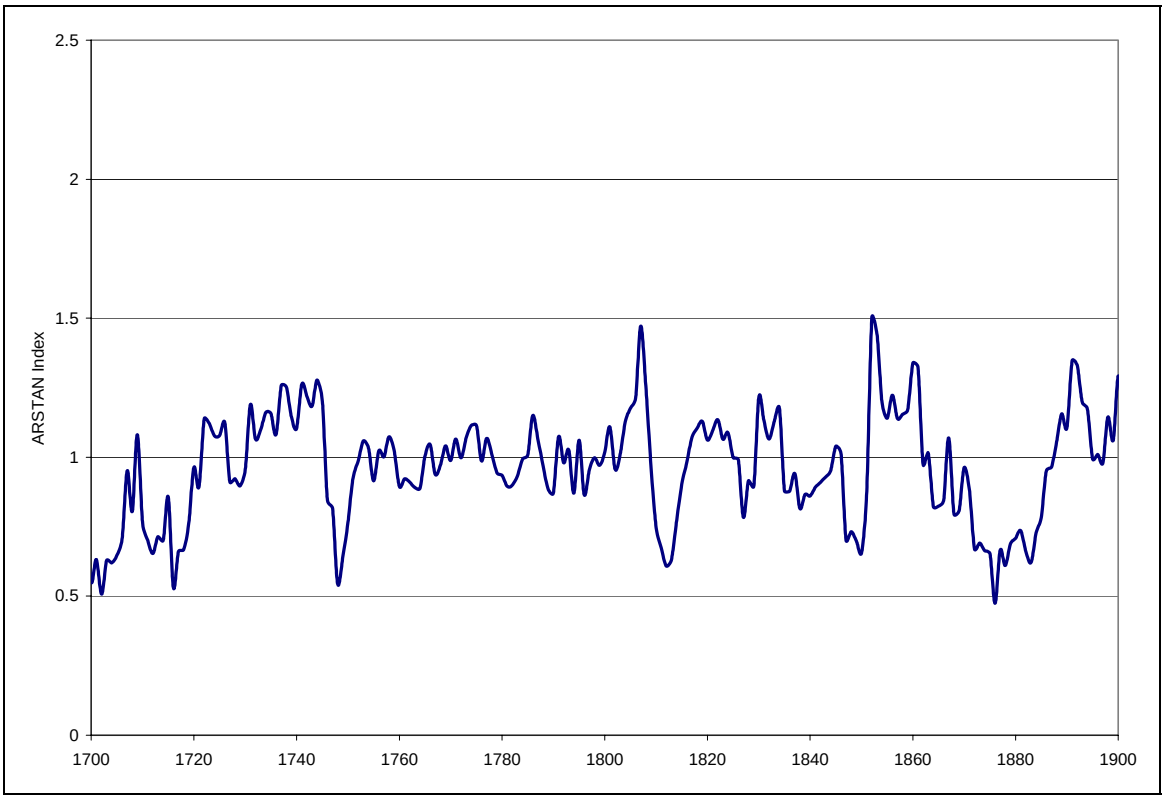


Figure 7: Combined master chronology for red spruce in New Brunswick and Nova Scotia.

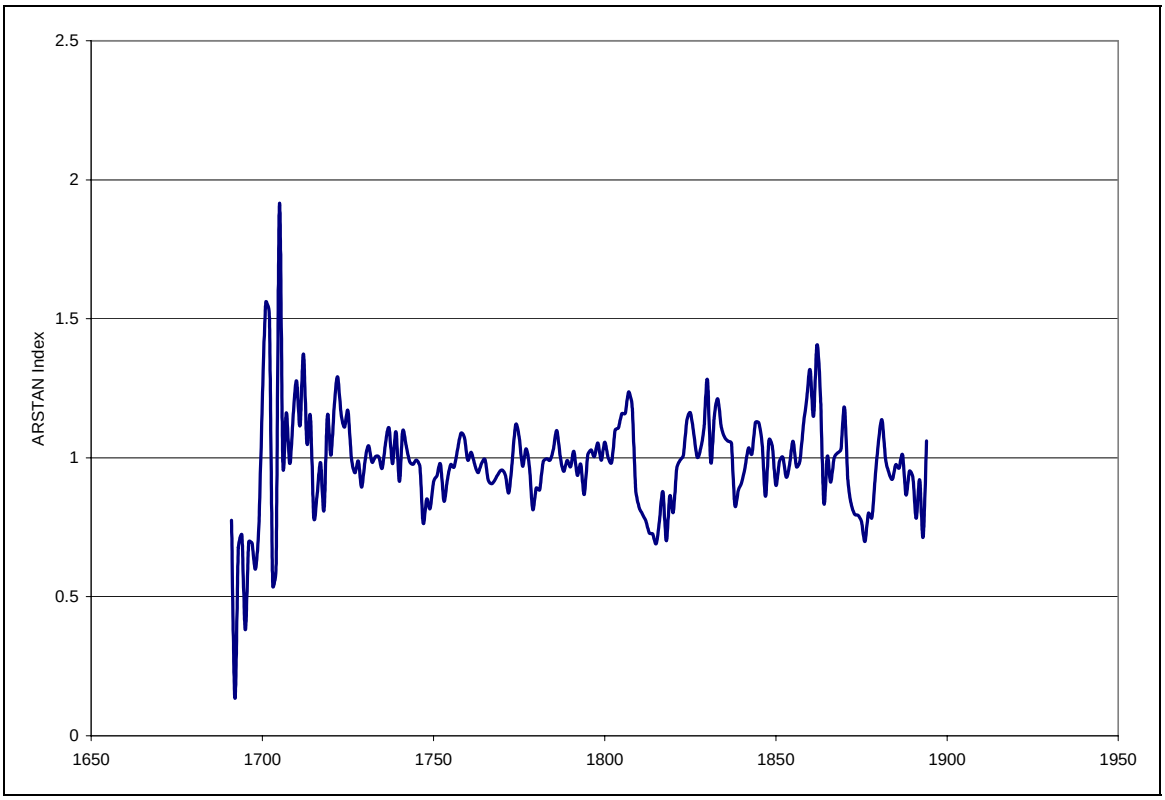


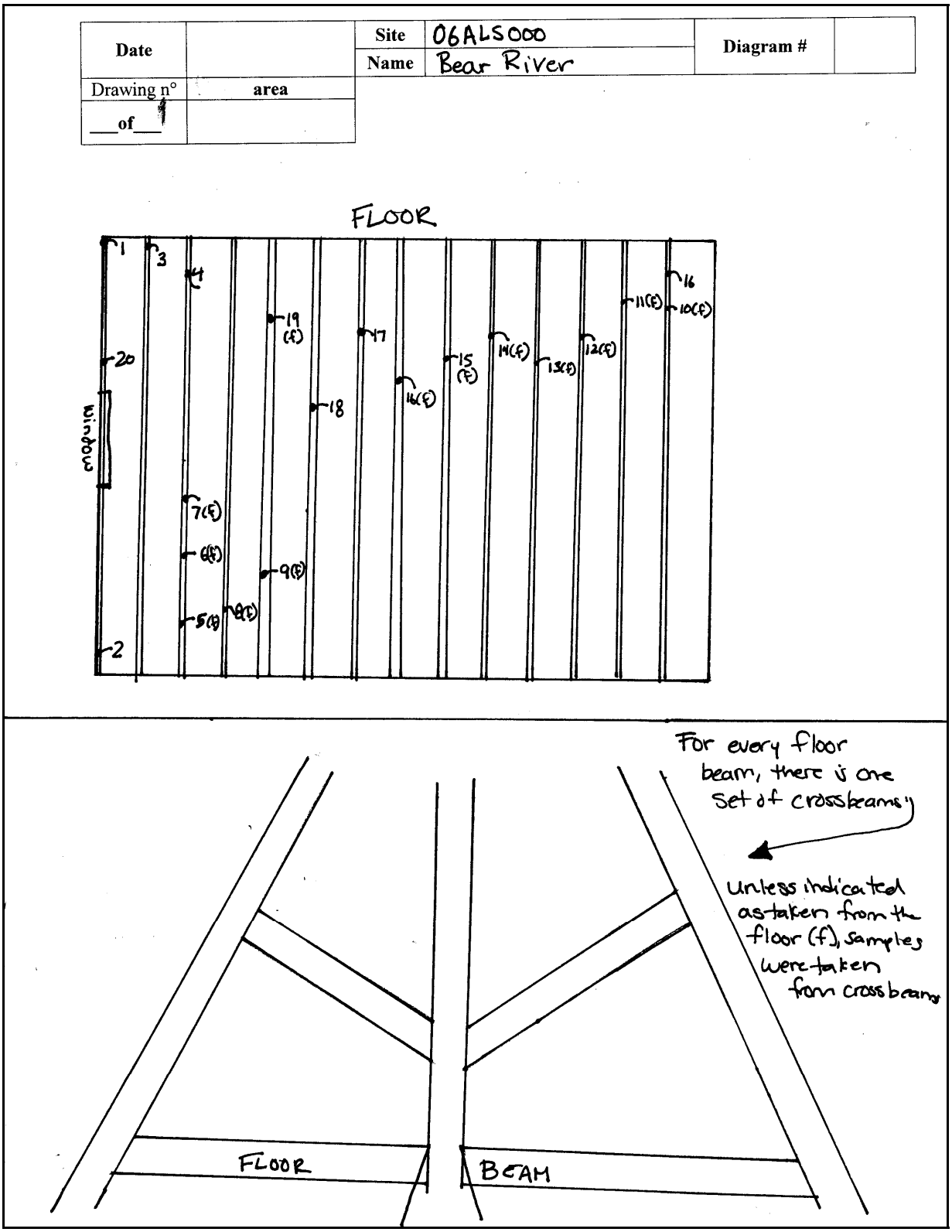
Figure 8: Master chronology for red spruce in southwestern Nova Scotia.

Conclusion

The master chronology for red spruce in southwestern Nova Scotia will have a number of uses. If samples of red spruce from other structures in the region are found, it will be possible to place them into their respective timeframe and thus determine the construction date of the unknown structure. As well, this chronology can be used to learn about climatic trends in the past, enabling us both to have a better understanding about past climates and to compare these trends to the current Atlantic climate.

We found that the wood in this church dated to the end of the growing season of 1821 and this means that the construction date of the church is 1822.

Appendix



Appendix A: Diagram of St. Anne's Church attic.