

FINAL REPORT
OF THE
2003 VEGETATION ANALYSIS
OF THE
HORATIO COLONY PRESERVE
Keene & Swanzey, New Hampshire



**Submitted to the Colony Memorial Trust
Keene, N.H.**

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February 20, 2004

**Executive Summary:
Vegetation Analysis of the 168-ha (415-ac) Horatio Colony Preserve
Keene, N.H.**

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A vegetation analysis of the Horatio Colony Preserve was completed during the growing season of 2003 by Dr. Rick Van de Poll of Sandwich, NH. This was the fourth repetition of the study over the course of 18 years. In 1986-7, 51 vegetation plots were established by Dr. Van de Poll and Dr. Ty Minton of Antioch New England Graduate School. Several student interns assisted in the project, and some of the 1986-7 findings included the following:

- * Plant species diversity was relatively high, and favored a fairly small, repeatable plot size of 5 x 15 m. Thirteen species of canopy trees were recorded in mature to submature condition, with the greatest health and vigor in the deep loam soils of the level ridge top. The poorest health and vigor was recorded among the gypsy moth-affected ledge sites near the old 'Tip-Top House' and the adjacent to the old stone post above Walter's Ledge.
- * Vascular plants exceeded 300 species overall, bryophyte diversity equaled 18 species, lichen diversity exceeded 50 species, and mushrooms and other fungi numbered between 200 and 225 species.
- * Soil pH ranged between 4.3 and 6.2, with a median value of 5.4.
- * Tree height averaged 18 - 22 m (59 - 72 ft.), and canopy closure averaged 70 - 75%
- * Herbaceous plant cover averaged between 30 - 35% and bare ground (leaf litter) averaged between 60 and 65%.

All 51 plots were resurveyed in 1991 for vascular and non-vascular plants, lichens, and fungi by Dr. Van de Poll and a team of Antioch graduate students. Since the student team was still learning the skills of vegetation analysis, Dr. Van de Poll resurveyed all of the plots in 1992 and made corrections to the information presented by the students. This did not involve the recalculation of tree dimensions or plant cover, but focused on the accurate identification of all species. It was at this time that metal pipes were installed at each of the plot centra (beginning points). During the 1991 survey, minimum tree dimensions were also changed from 6 inches diameter at breast height to 5 inches. Appropriate adjustments were made to the 1986-7 data set to account for this change.

The third round of the vegetation analysis took place in 1997, with an Upward Bound student assisting Dr. Van de Poll. All plots were completed by the principal investigator, thus ensuring measurement accuracy and consistency. The remaining 3 plot corners were marked by ½-inch diameter pvc pipe, and all plot centrum pipes remarked with flagging and metal tags. The findings demonstrated a consistent growth rate among all canopy trees, a slight loss in herbaceous cover diversity, and a slight drop in soil pH levels. A report on this study is on file with Antioch and with the Museum staff.

This past growing season of 2003, the fourth repetition of the vegetation analysis was completed. Again, Dr. Van de Poll was the lead investigator, and was assisted by Al Stoops of Keene, and on

a few days, by Sue Mansfield also of Keene and a current Antioch graduate student. The following summarizes the findings of this fourth survey of the Horatio Colony Preserve:

- * The sample size of 51, 5 x 15 m plots (.3825 hectares or .94526 acres) was sufficient to capture 88% of the trees on the Horatio Colony Preserve, 78% of the sapling species, 85% of the sub-shrub species, and roughly 30% of the herbaceous species.
- * Tree growth rates were consistent with those of the previous years, with an average estimated volumetric increase of 2.5 - 2.75% per annum. Greatest growth rates were recorded for red oak, whose dominance ratio exceeded 50% of the 15 species of trees recorded.
- * Vascular plant diversity has declined, especially among herbaceous species, owing to the increased shading and aging of the canopy trees.
- * Soil pH dropped considerably with values ranging between 3.67 and 5.93, with a median value of 4.36 for the O or O/A horizon, 4.46 for the A horizon, and 4.81 for the B horizon. The lowering of soil pH can be hypothetically tied to environmental influences, which include natural causes such as higher than average soil moisture levels for the 2003 growing season, increased shade from denser canopy cover with a resultant cooler forest floor temperature, increasing dominance of understory hemlock, and greater acidification from higher bryophyte coverage. Artificial or human causes that may have attributed to the lowering of soil pH include acid precipitation, and instrument error. In the case of the latter, it should be noted that previous soil pH levels were measured using a simple colorimeter (LaMotte) with stated precision levels of .2 - .4 pH points. This year's study was completed using a LaMotte pH Plus digital probe with a stated user precision level of .05 pH units.
- * Tree height increased to an average range of 20 - 25 m (66 - 82 feet), and canopy closure increased to an average range of 85-90%.
- * Herbaceous cover declined 18% since 1987 to less than 20% on the average plot, and bare ground (leaf litter) increased to 69% overall (up from 60% in 1986-7).
- * Bryophyte diversity and abundance more than tripled since the beginning, owing to the greater amount of time searching for new species as well as the measured increase in canopy shading.
- * Lichen diversity and abundance also tripled since 1986 for similar reasons, and no obvious residual effects from air pollution were noted.
- * Mushroom diversity was at an all time high, largely owing to the tremendous amount of rainfall in 2003. Over 300 species were recorded, including 49 species previously unrecorded for the Preserve. Fungal species diversity on a preserve-wide basis has now topped 700 species.

Ancillary information from the study included the observation of insects, amphibians, reptiles, mammals, and birds. The most rigorous tally was of vocalizing birds, with findings that compared favorably with previous breeding bird surveys of the property. GPS readings of all plot corners were recorded for the first time. Digital photos were also taken of plot corners, and these will be archived with the data CD at Antioch and the Museum office.

This study has shown the essential value in monitoring a piece of land over time. No other long-term study of vegetation, lichens or fungi has been completed in the Keene area, let alone in the Monadnock Region.

The most noteworthy conclusions that can be drawn, while still tentative, include the fact that the forest at the Horatio Colony Preserve continues to show expected levels of growth and successional development, with an increase in late successional species, large downed wood, and the consequent micro-habitat structure that supports a higher diversity of non-vascular

plants, lichens and fungi. Although soil pH levels have dropped considerably, no conclusive evidence was found to indicate excessive stress to forest health. Tree volume growth has been maintained, mortality rates are within expected levels, and seedling recruitment appears to be intact. Herbaceous plant diversity loss can be attributed to a general increase in the age and stature of the forest, and mushroom diversity increases can be attributed to both higher rainfall and increasing complexity of the forest floor. In that regard, the amount of coarse woody debris both in the fine (< 10 cm average diameter) and large (>+ 10 cm average diameter) was measured for the first time. The coverage of fines was estimated at 2.5%, and the downed large woody debris was measured at 21.9 m³ per hectare, a figure that is roughly 3/4ths of the way to levels expected in old growth forests (Van de Poll 1997).

The principal investigator wishes to thank his project assistants, Al Stoops and Sue Mansfield, the Horatio Colony Museum Director Anita Carroll-Weldon, and the Colony Memorial Trust Board for all of the assistance they have provided in this valuable study. A full report of the findings is included below.

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February 20, 2004



Unknown grapefern (upper left) new to property; *Galiella rufa* hairy rubber cup (upper right), also new to property; and Al Stoops performing some difficult plant estimation in Tupelo Swamp (left).

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Appendix

A. Charts

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