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Factors Determining Great Blue Heron Rookery Movement *

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ABSTRACT — The damaging effect of Great Blue Heron (*Ardea herodias*) excrement on nest trees was determined by observation and Hellige-Truog soil analysis methods. In large heronries high chemical concentrations kill nest trees and result in movement of heronry boundaries to a live tree area.

The literature indicates that the effect of excrement on soil composition leads to consequent death of nesting trees in mature colonies of Great Blue Herons (*A. herodias*). Roberts (1932 and 1938) reported a heronry in Minnesota of several hundred nests in elm and basswood trees which had died as a result of their being occupied by the birds. He concludes that this condition is only existent in large heronries. Bent (1963) cites a similar example in a Maine heronry where many of the nests were in dead trees. Young (1936) found that the roosting activities of a large flock of starlings (*Sturnus vulgaris*) resulted in damaged White Pine (*Pinus strobus*); high soil concentrations of NO_3, P, and K resulted from accumulated bird droppings.

Young herons deposit the viscid effluent in the coarse nest where they stand so that the droppings fall through on to the branches below giving a whitewashed appearance to the trees. It is uncertain whether the death of the trees is caused by direct contact of the excrement on the branches or by the action of leached chemical components on the roots; both explanations seem likely. The present authors investigated the effect of excrement on nest trees by analysis of soil composition. These results combined with environmental factors were related to present tree conditions and the corresponding movement of nest sites to the live tree or future location (Fig. 1).

The study area was the Basswood Lake heronry near Ely, in existence since 1920 (correspondence with R. Halliday). The first causes of movement were probably not directly related to the effects of excrement, but to unnatural conditions. Because the nesting trees in the early location were cut down, the herony supposedly moved westward in about 1947. A fire, reported in 1961, burned many of the trees in the same area. In its present location the rookery area nests are located only in the tops of live and dead Red Pine (*Pinus resinosa*). The dead pines are beyond the range of the fire and the live pines extend SW on a high ridge, an area to which the gradual movement of active nesting sites is taking place. Pictures taken by C. Ahlgren, of the Quetico-Superior Wilderness Research Center, over a 10-year time span give evidence of westward movement. Our research involved collecting quantitative data relating to causes of this movement.

Methods

The studies were conducted on an island 4.5 miles NE of the ACM Field Station in Meriam Bay, Basswood Lake, Ontario during June and July, 1965. The proposed 5-year study began in 1964 and included rookery mapping into 50-foot square grids, a young bird population count, and general observations (R. Grooters and D. Werner).

In the present study standardized soil collection procedures were used to sample the old, present, and future rookery areas. Five random locations in each area were permanently marked, then surface litter was cleared away. Separate samples were taken from one, two, and

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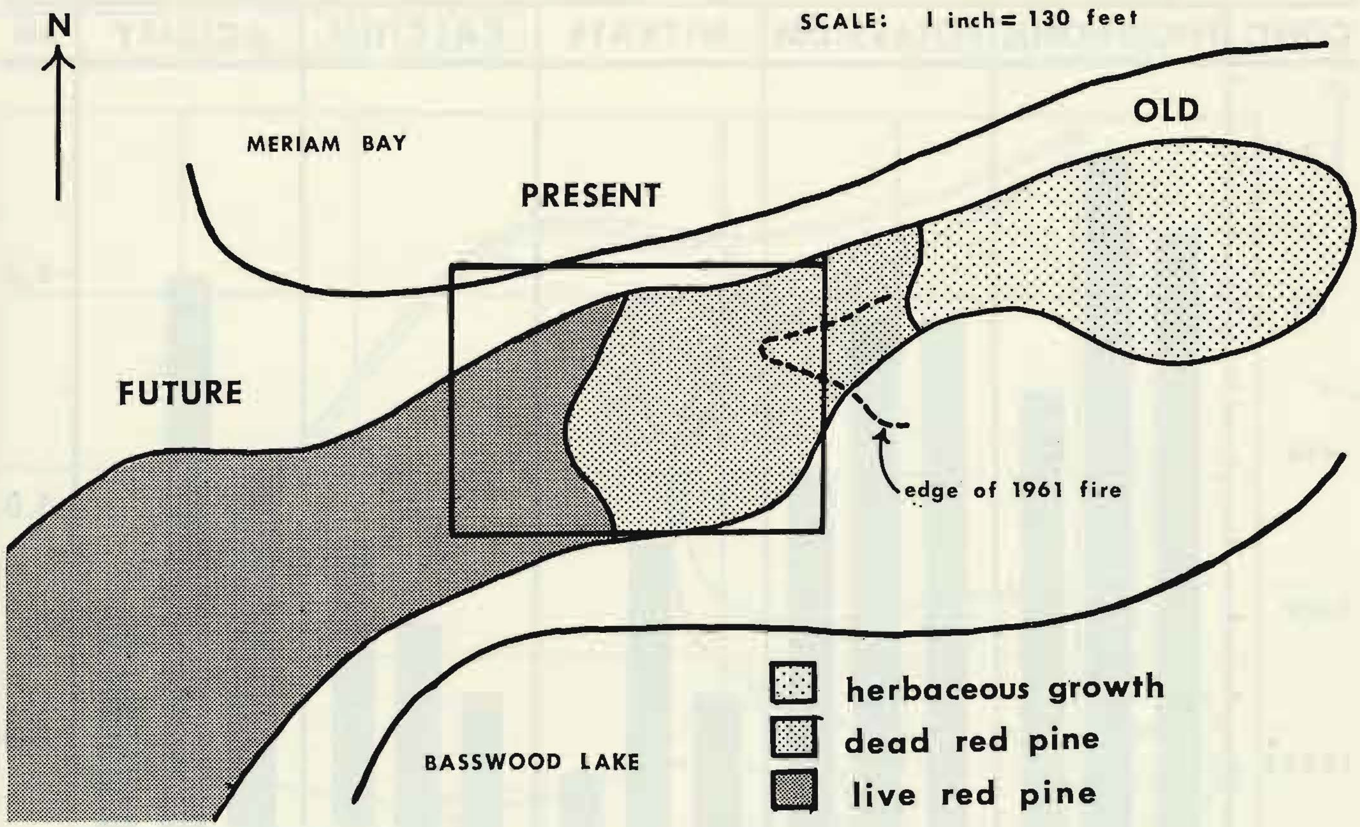

FIGURE 1. Map of heron rookery areas.

eight inch levels (humus, transition, and mineral layers respectively); they were dried and run through a standard sieve series. Chemical analysis was by the Hellige-Truog methods for acidity, P, K, NO_3, Ca, NH_3, and Mg with the available concentration expressed in lbs per acre for each soil level. These quantitative elemental units were converted to relative values for ease in graphic representation.

To evaluate the effect of the differences in soil composition it was necessary to record 1965 nest tree conditions, fallen nests, and new nests since 1964. The boundary of nest trees active in 1964 was compared to that in 1965 to determine the westward movement.

Results

Concentration values of the separate soil levels were reduced to an average value. The concentration of P and K increased from the surface level to the mineral level while NO_3, Ca, and acidity were highest at the surface. The values of Mg and NH_3 showed no variance in the three rookery areas, so they were disregarded.

The present rookery area in its most active locations was more acidic and more concentrated in P, K, and NO_3 than the vacant future rookery area, a comparison standard. The values in the old rookery were intermediate, which probably resulted from the effects of weathering after it had been abandoned. Our data indicate a deficiency of Ca in the old and present rookery areas (Fig. 2).

Observation of nest trees in the live-dead tree border indicated many nest trees reported to be alive in 1964 were dying in 1965. 95% of the nests were in 45 dead and 41 live pines. From fallen nest remains and previous nest data, it was determined that 26 nests had fallen in one year; there was evidence of 18 newly built nests during this period, or a net loss of 8 nests. These combined data of active nest site boundaries suggest a movement rate of about 25 feet per year westward (Fig. 3).

Discussion

Our data support the general hypotheses that heron excrement has a damaging effect on nest trees in large heronries and that when possible directional movement of nest sites results.

Until improved techniques are developed and more quantitative data is accumulated, it is impossible to state with certainty the relative importance of leaching in each soil level and the specific element causing the damage. Interpretation of the results is hypothetical because of complexities in diagnosis. McMurrtrey (1949) suggests that unbalanced nutritional requirements may result from a deficiency or an excess of an element in relation to the others.

The symptoms produced may be due to the high concentration of P, K, or NO_3 interfering with the solubility, absorption, or utilization of another element. It is suggested that the high acidity has a toxic effect and that direct contact of the excrement on the branches reduces

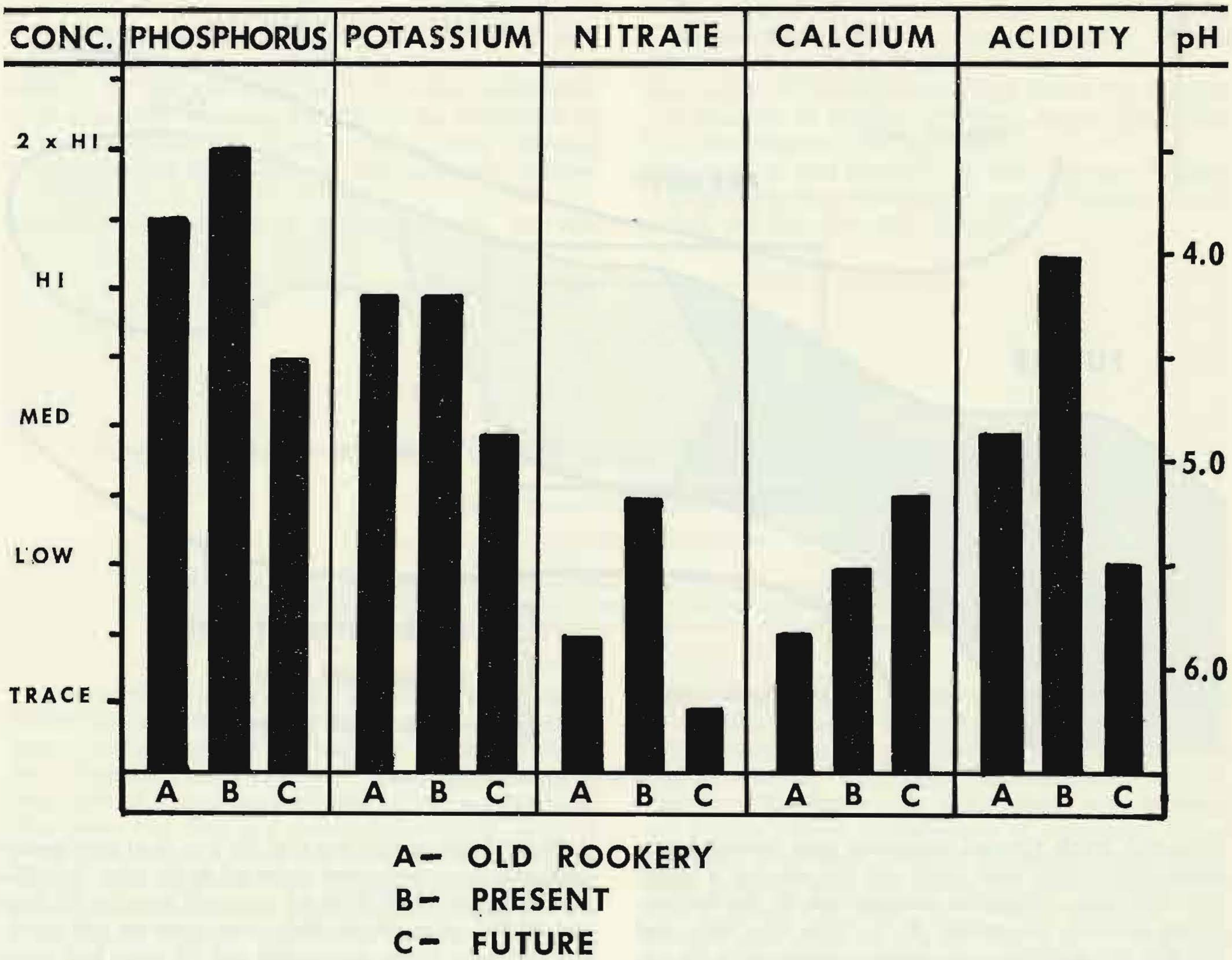

FIGURE 2. Soil analysis of rookery.

the photosynthetic area of the trees. Partial defoliation was caused mechanically by the adult herons landing at the nest.

When weakened, the trees no longer seem able to support the bulk of the nests which are soon blown down by strong winds. This explains the net loss of nests since 1964 and the accompanying movement. It is unlikely that these factors affect the total heron population, but Wallace (1963) suggests that the proximity of colony neighbors stimulates breeding and peripheral nesters are often unsuccessful. More information is needed to relate these reports.

Correlating the previous history of the Basswood heronry with evidence from this study seems to show an overall movement of 20-30 feet per year, but no single factor can explain the reason since many environmental interrelationships seem to be involved.

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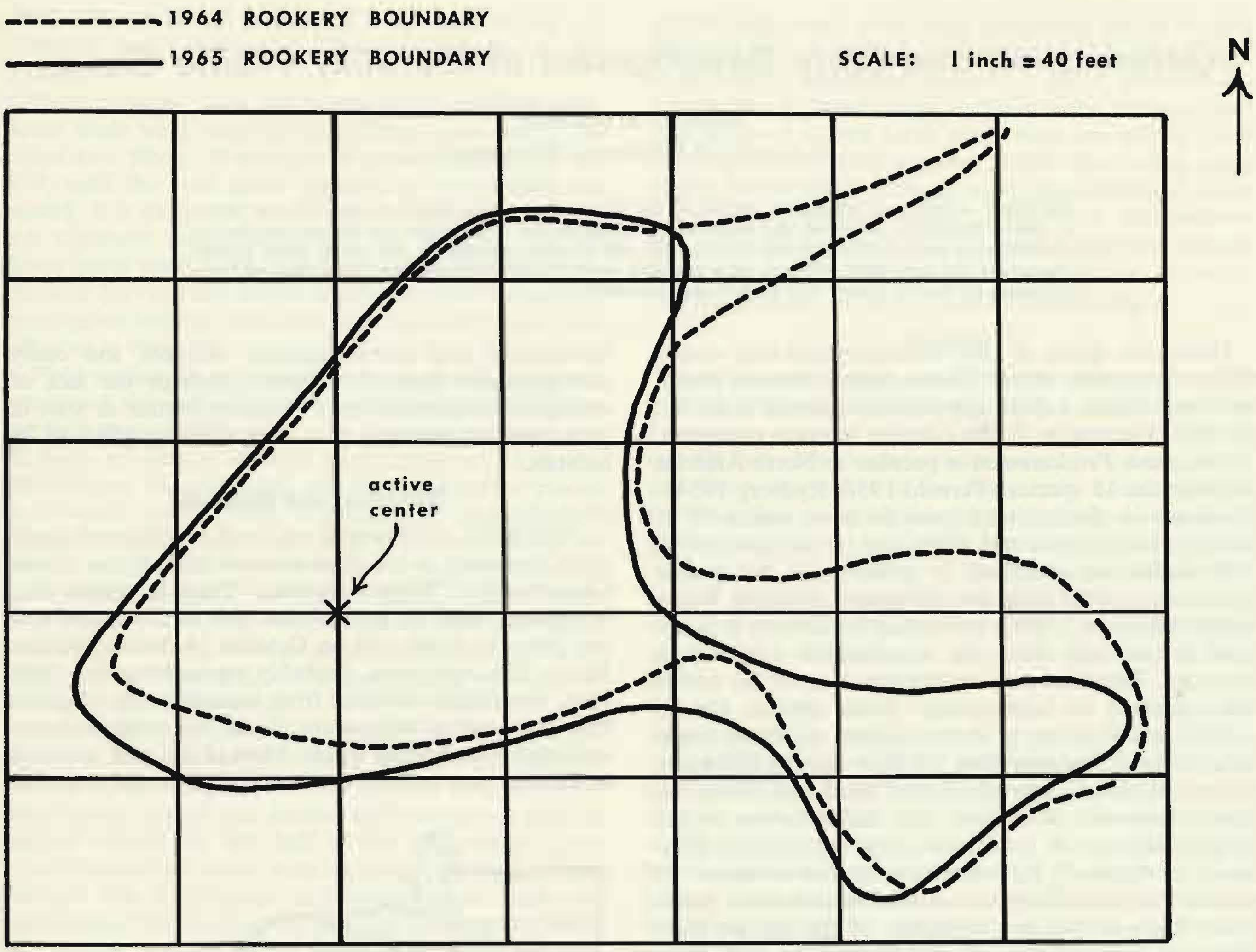

FIGURE 3. Grid map of rookery boundary movement.