INTRODUCTION:

TITLE: DETERMINATION OF NITROGEN LEVELS IN SOILS BENEATH DOUBLE-CRESTED CORMORANT NEST TREES ON SOUTH MANITOU ISLAND, MI.

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ABSTRACT: Bird colonies affect nitrogen deposition and cycling in terrestrial ecosystems by addition of ammonium, via uric acid. These inputs can lead to considerable enrichment of the soil in nitrogen. Elevated nitrogen levels are known to affect plant growth and survival. This study proposes to collect soil samples from South Manitou Island (SLBE) as part of a larger study to compare soil nitrogen levels at several cormorant colonies in northern Lake Michigan. Results will contribute to understanding of cormorant impacts to vegetation and may provide insights to restoration of sites previously occupied by cormorants. Key Words: (Double-crested Cormorants, soil, nitrogen, South Manitou Island, Great Lakes).

OVERVIEW:

STATEMENT OF ISSUE:

Animals interact and affect their environment through deposition and redistribution of nutrients via fecal material. Bird colonies affect nitrogen deposition and cycling in terrestrial ecosystems by the addition of ammonium, via uric acid. These inputs to terrestrial ecosystems can lead to considerable enrichment of the soil and/or plants in Nitrogen (N). Double-crested Cormorants have increased significantly in the Great Lakes region over the past several decades. In addition to concerns about impacts to fish populations, resource managers have also noted that cormorants kill vegetation within their colony sites. Cormorant guano is extremely rich in N, and soils on bird-inhabited islands have higher concentrations of NO3-, NH4+ and total N than island soils not inhabited by bird colonies. In Japan (Ishida1996), where Common Cormorants nest, studies demonstrate elevated 15N signature in mineral soil from long-term exposure to cormorant excrement. Furthermore in the Great Lakes region, as well as Japan, there have been many qualitative observations that report total or partial loss of forest cover with increased cormorant population growth. With the exception of a study by Cuthbert et al. (2002) on potential impacts of cormorants on Great Blue Herons and their nesting habitat, no previous work has examined Nitrogen levels in cormorant colonies in the Great Lakes. In 2005 we initiated a study at 2 cormorant colonies on islands in northern Lake Michigan to determine the levels of the 15N signal and C:N ratio. By including data from the SMI site we will be able to determine nitrogen levels from: a young cormorant colony (SMI), an old cormorant colony (Green Island), and an abandoned cormorant colony. These data will be matched with samples from control sites not occupied by cormorants. Data from these sites will be used to understand contribution of nitrogen to

the soil in cormorant colonies and changes in nitrogen levels as colonies age and/or become abandoned. Ultimately this information may be of value to managers interested in restoration of sites previously impacted by cormorants. Additionally, recent presence of cormorants at the south end of South Manitou Island has resulted in concerns by Park biologists regarding potential impacts of cormorants on rare vegetation on the island. This study will provide additional understanding of cormorant impacts under different time scales.

HYPOTHESES:

1. There is no difference in nitrogen levels among the following sites:
   a. those recently occupied by cormorants
   b. those occupied by cormorants for > 10 years
   c. those occupied by cormorants but deserted 5 years ago
   d. control sites (never occupied by cormorants).

METHODS:

We propose to visit the land-based (as opposed to the Morazon site) Double-crested Cormorant colony at the south end of South Manitou Island, SLBE, to collect 3 soil samples from approximately the center of the colony site and 3 from a control site 100 m distant from the colony in similar habitat. Samples will be removed from sample plots 25 x 25 x 2 cm by cutting around the edge of the plot with a knife and scooping out the soil with a spatula. Samples will be collected by Anthony Arnold and Charles Smith and placed into labeled zip-lock bags. We anticipate the collection time will take about 1 hour and that the total number of samples will be 6. Samples will be carried out of the study area and off the island in a back pack. If cormorants are still in the colony, care will be taken to enter the site when weather is favorable (no precipitation or strong winds) and we will be careful not to disturb young remaining in the nests. Samples will be returned to the University of Michigan Biological Station where they will be processed (dry and grind) by Anthony Arnold and analyzed using a Costech 1040 Elemental Analyzer (C:N) and a Thermo Finnigan Delta Plus XL mass spectrometer (15N). We request permission to collect samples in mid-August 2006 and plan to complete analysis by 1 September 2006. A final report will be submitted at the NPS annual report time period (March 2007). Expenses for this work will be transportation and per diem while collecting samples and sample analysis. The costs will be covered by research funds to Cuthbert from the University of Minnesota.

PRODUCTS:

We are presently preparing a manuscript/oral presentation to be given at the 07 meeting of the International Association of Great Lakes Research in Pennsylvania in May. The paper will be part of a special symposium on cormorants and currently a special section or issue of the Journal of Great Lakes Research is planned containing papers expanded from the presentations. Soil samples will be held (at the University of Minnesota) for re-analysis, if needed, and eventually discarded.

LITERATURE CITED:

Cuthbert, F.J., L.R. Wires, and J. McKearnon. 2001. Potential impacts of nesting double.crested cormorants on great blue herons and black-crowned night-herons in the U.S. Great Lakes region. J. Great Lakes Res. 28: 145-154.
Ishida, A. 1996a. Effects of the common cormorant on evergreen forests in two nest sites at Lake Biwa, Japan. Ecological Research 11: 193-200.
Ishida, A. 1996b. Changes of soil properties in the colonies of the common cormorant. J. For. Res. 1: 31-35.

SPECIAL CONCERNS:

Access to sites: we will walk to the colony site from one of the approved campsite. We estimate that sampling will take approximately 1 hour.
Animal welfare: No cormorants will be captured. If cormorants are still in the colony, care will be taken to enter the site when weather is favorable (no precipitation or strong winds) and we will be careful not to disturb young remaining in the nests.