

**The Turkey Lakes watershed study: milestones and prospects**

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NWRI Contribution # 00-83

## Étude du bassin versant des lacs Turkey – Jalons et perspectives

### Résumé

L'étude du bassin versant des lacs Turkey, un peu au nord de Sault-Sainte-Marie, dans le district d'Algoma du centre de l'Ontario, prend la forme à la fois d'une recherche portant sur un écosystème complet et d'une activité de surveillance. Le présent rapport dresse un tableau des principaux objectifs de l'étude et fournit une brève description du site où se déroule l'étude. Il sert d'introduction à sept articles présentant des données scientifiques récentes et donne des indications sur la direction que pourraient prendre les travaux.

### Sommaire à l'intention de la direction

L'étude du bassin versant des lacs Turkey, un projet à long terme portant sur les effets des dépôts acides sur les milieux aquatiques et terrestres d'un écosystème complet, a débuté en 1980. La mesure et la compréhension de l'incidence des pluies acides continue d'être une priorité importante pour la Table d'*Un environnement sain* d'Environnement Canada. La portée de l'étude a toutefois été étendue : elle porte désormais également sur l'incidence d'autres facteurs relatifs aux changements atmosphériques et d'autres agents stressants anthropiques. Au nombre des partenaires de cette étude figurent Environnement Canada, Ressources naturelles Canada, Pêches et Océans Canada, le ministère des Richesses naturelles de l'Ontario ainsi que plusieurs universités. Sept articles présentés en 1999 à l'occasion d'un atelier portant sur cette étude ont été acceptés pour publication dans un numéro spécial du journal *Ecosystems*. Ce bref article fera office d'introduction à ce numéro spécial.

Mots clés : bassin versant, écosystème, recherche et surveillance.

## **Abstract**

The Turkey Lakes Watershed Study is a whole-ecosystem research and monitoring activity located just north of Sault Ste Marie in the Algoma District of central Ontario. This report outlines the central objectives of the Study, provides a brief description of the field site, introduces seven papers that present recent scientific results, and notes the likely direction of future work.

## **Management Perspective**

The Turkey Lakes Watershed Study (TLWS) was initiated in 1980 as a long-term, whole-system investigation of the aquatic and terrestrial effects of acidic deposition. Quantifying and understanding acid rain effects continues to be a high priority of the Clean Environment Table of Environment Canada. In addition, the Study has now expanded to address both the effects of other elements of atmospheric change as well as other anthropogenic stressors. Partners in the Study include Environment Canada, Natural Resources Canada, Fisheries and Oceans Canada, Ontario Ministry of Natural Resources, and several universities. Seven papers presented at a TLWS Workshop in 1999 have been accepted for publication as a dedicated issue of the scientific journal *Ecosystems*. This brief paper will introduce the issue.

**Key Words:** watershed, ecosystem, research and monitoring

TURKEY LAKES WATERSHED

# The Turkey Lakes Watershed Study: Milestones and Prospects

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The Turkey Lakes Watershed Study (TLWS) was initiated in 1980 to assess the effects of anthropogenic perturbation on Shield ecosystems. The goal of the study was to obtain a whole-ecosystem analysis of the biogeochemical processes that control pollutant–ecosystem interactions and thence to promote the development and validation of system models. It is a cooperative effort that includes investigators from Environment Canada (National Water Research Institute, Meteorological Service of Canada, and Canadian Wildlife Service), Natural Resources Canada (Great Lakes Forestry Centre), and Fisheries and Oceans Canada (Great Lakes Laboratory for Fisheries and Aquatic Science), as well as several universities. The initial impetus for research in the TLW arose from the desire to assess and understand the aquatic and terrestrial effects of acidic deposition.

The TLW (Figure 1) is located 50 km north of Sault Ste. Marie, Ontario, on the Canadian Shield near the northern margin of the Great Lakes–St. Lawrence forest region. The basin, which is 10.5 km<sup>2</sup> in area, is situated predominantly on metamorphic silicate bedrock (greenstone) overlain by thin to absent glacial tills. These geological conditions make the basin moderately sensitive to acidic deposition. The terrestrial and aquatic resources within the basin are representative of the surrounding Algoma district, although for an Ontario site, the TLW has relatively high relief (290 m) and precipitation (mean, more than 1200 mm y<sup>-1</sup>). The forest is an uneven-aged, mature-to-overmature, old-growth hardwood system domi-

nated by sugar maple (*Acer saccharum* Marsh.) and yellow birch (*Betula alleghaniensis* Britton). The drainage system is composed of many intermittent and perennial first-order streams draining into and through a chain of four dimictic lakes that range in size from 5.8 to 52.0 ha and in mean depth from 2.2 to 12.2 m. There is a chemical gradient in the aquatic system such that higher-elevation waters are more dilute (that is, they have lower Ca<sup>2+</sup> and alkalinity concentrations) than lower-elevation waters. The TLW ultimately drains into the Batchawana River and thence to Lake Superior. For greater detail on basin characteristics, see Jeffries and others (1988).

From time to time, study participants have conducted workshops to present, discuss, and integrate the findings from the scientific investigation now being done in the TLW (for example, see the *Canadian Journal of Fisheries and Aquatic Sciences*, 1988, vol. 45, Suppl. 1, pages 1–178.). This issue of *Ecosystems* presents six papers from a 1999 workshop that summarize the results from either long-term monitoring of conditions in the TLW or specific research projects. According to Sirois and others (2001), mean annual wet SO<sub>4</sub><sup>-2</sup> deposition declined from 31 mmol · m<sup>-2</sup> during 1981–1984 to 18 mmol · m<sup>-2</sup> during 1994–97. Two of the following papers address trends or responses in precipitation or surface-water chemistry that were contemporaneous with this change in acid input. Three other papers consider some of the physical and chemical processes that regulate watershed biogeochemistry, and another describes the development and application of a predictive soil acidification model that was designed to assess whether the reduced acid

Received 19 September 2000; accepted 19 September 2000.

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input is sufficient to protect the long-term health of this forested ecosystem.

The ongoing monitoring and research conducted at the TLW has produced an information base that is useful for assessing many environmental issues beyond the original focus on sulfur-based acid rain. Currently, such work includes (a) an evaluation of terrestrial and aquatic responses to climatic change and variability, (b) a large-scale project assessing the ecological effect of different forest harvesting practices, (c) a littoral-zone fish habitat manipulation study, (d) an assessment of basin retention of atmospherically deposited contaminants such as pesticides and mercury, and (e) new acidification studies that address specific gaps in our knowledge in such areas as nitrogen-based acidification, cation depletion, and wetland storage and release of sulfur. Many new publications evaluating ecosystem stress responses in the TLW can be expected in the future.

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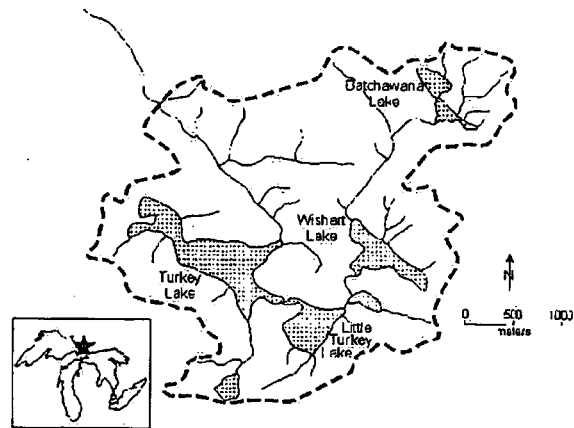


Figure 1. Map of showing the location of the Turkey Lakes Watershed.

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