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Restoration and Recovery of an Industrial Region

Progress in Restoring the Smelter-Damaged Landscape Near Sudbury, Canada

With 221 illustrations, 18 in full color

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Cover photos: A site at the Copper Cliff tailings area were taken in 1973 (by Tom Peters) and in 1994 (by Ellen Peale).

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In August, 1888, a roast pile was built and started burning in the middle of a dense growth of spruce and birch trees. Again mind triumphed over matter and the woods fell before the stench. The roast yard was quite a success.

D.H. Browne (circa 1889),
an official with Canadian Copper Company

Last came the prospector and the mining company: but when they came they made the region theirs, and what they found, made all other industries seem of no account. Even the sulphur that blasted all things living, only made nature's grimness grimmer still, substitutued, as it were, deadly purpose for beautiful desolation.

Stephen Leacock (1937),
from *My Discovery of the West*

It was really very encouraging to see the results of all your labours particularly in the quest of trying to reduce the sulphur emissions . . . and the fact that you are setting an example in this area will I'm sure make a great difference to other plants in other parts of the world.

Prince Charles (1991),
during his visit to Sudbury

One of the happiest and most proud moments of the entire Earth Summit, for me as a Canadian, came when the Sudbury community was given the 1992 United Nations Local Government Honours Award for its work to reverse the process of environmental degradation.

Maurice Strong (1994),
UN Secretary General of Earth Summit

Preface

> The acid test of our understanding is not whether we can take ecosystems to bits on pieces of paper, however scientifically, but whether we can put them together in practice and make them work.
>
> *A.D. Bradshaw, 1983*

Home of one of the world's largest metal smelting complexes, Sudbury, Ontario, Canada is well known as a polluted region. Many superlatives and startling statistics describe this area: one of the largest point sources of sulfur dioxide emissions; 17,000 ha of industrial barrens; 7000 acid-damaged lakes; but the picture of "Superstack," the world's tallest smokestack, dispersing pollutants high into the atmosphere, is the powerful image that has brought this area so much unwanted attention. Throughout the much publicized acid rain debates of the 1980s, this 381-m structure became symbolic of the global nature of environmental destruction and the need for international agreements to control these problems.

Sudbury is now beginning to assume a new international reputation, this time a more favourable one. During the debates that preceded the 1990 revisions of the Clean Air Act by the U.S. Congress, the evidence of progressive recovery of acid lakes in the Sudbury area after emission reductions from local smelters was a forceful argument in support of expenditures on control of pollution at the source. Similarly, the recognition of Sudbury's "re-greening program" by the United Nations at the Earth Summit in Brazil has again thrust the region into the international spotlight. With the world now facing the prospect of cleaning up horrendous "Sudburys" in China, India, eastern Europe, and elsewhere, a positive example of improved industrial technology and land and water reclamation techniques is badly needed. In the early acid rain research literature, the word *Sudbury* was occasionally used as a unit or measure of pollution. In the future, it is our hope that *Sudbury* may someday deserve to be used as a measure of restoration.

This book grew out of a series of technical workshops, called the Sudbury Rehabilitation Workshops, that were held at Laurentian University in 1990,

1991, and 1992. These workshops were designed as informal sessions to encourage greater technical exchange and collaboration between researchers from universities, government environmental agencies, and local mining companies. Although most of the participants had conducted research in the Sudbury area for many years, many of them were not familiar with each other's work. However, all shared a common interest in reversing the serious environmental problems of the area, and as a result, several collaborative projects have developed from these meetings. This book is a result of that collaborative spirit. It represents a collective effort to bring an important case history of environmental restoration to as wide an audience as possible.

Another important stimulus for this book was the publication of the proceedings of a very similar workshop dealing with the effects of smelter emissions on the Kola Peninsula in the border area between Russia and Finland (Kozlov, M.V. et al. [eds.]. 1993. Aerial Pollution in Kola Peninsula, Proceedings of the International Workshop, April 14–16, 1992, St. Petersburg, Russia). The descriptions of the ecological damage around the Russian smelters are hauntingly similar to those of Sudbury. Interestingly, the scientific studies in that area have not overlapped significantly with research efforts in the Sudbury area, but rather the studies complement each other. In the Kola area most of the research dealt with terrestrial effects, particularly effects on forest growth. In Sudbury, much of the vegetation damage occurred well before scientific studies began. Here most of the research emphasis was placed on aquatic effects and on remedial studies (aquatic, terrestrial, industrial). I should not overstate the case, but in thinking about the Russian smelter problems, it is also noteworthy that the political changes that allowed Russian and Finnish scientists to meet and exchange information parallel some of the recent changes seen at our workshops. True cooperation between scientists from environmental protection agencies and representatives of the polluting companies to solve problems rather than assign blame is also a relatively recent phenomenon.

In almost every book dealing with the new field of restoration ecology there is a struggle with the term *restoration.* (Should the word be *rehabilitation* or *reclamation* if the chances of returning a system to its original condition are nil?) If I can be so bold as to speak on behalf of the many authors of this volume, we did not worry about this term. For us, *restoration* speaks to the goal that this industrial region is working toward, the re-establishment of attractive self-sustaining "healthy" ecosystems, free of toxic or other deleterious substances. Many will say that this a hopelessly naive dream in such a polluted environment. However, the steady progress that has been made suggests otherwise.

This book was designed to serve a wide international audience, including undergraduate students, environmental resource managers, and the general public. Technical terms and details have been kept to a minimum to allow us to cover a wide range of disciplines. Care has been taken to provide suitable literature sources for people desiring more specific information.

I thank the many distinguished authors and reviewers that contributed to this book. I was fortunate to have Dr. James Kramer (McMaster University), Nels Conroy (Ontario Ministry of Environment and Energy), Dr. Harold Harvey (University of Toronto), Dr. Anthony Bradshaw (University of Liverpool), Dr. John Cairns, Jr. (Virginia Polytechnic Institute), and Maurice Strong (Ontario Hydro) review the section chapters and/or prepare introductory articles. Additional external reviews were provided by Dr. Robert Hedin (U.S. Bureau of

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John M. Gunn
Sudbury, 23 January 1995

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