It was during the construction of the Canadian Pacific Railway that the rich mineral deposits of the Sudbury Basin were uncovered leading to the development of a mine and a smelter in the area of Copper Cliff in 1888. Originally owned by Canadian Copper Company, which later came to be part of the International Nickel Company (INCO), mining rapidly expanded and Sudbury soon became the dominant supplier of nickel to the world.

The nature of the ores from the Sudbury Basin required that they first be treated before they could be smelted. Early methods for separating materials and reducing sulphur content of the ore involved the construction of large roast yards built with wood cut from surrounding forests that were covered with ore and would be left to burn for months. This process put enormous pressure on the surrounding environment due to the deforestation and the emission of high concentrations of ground level sulphur dioxide.

The open bed roast yards were used from around 1900 up until 1929 when a new smelter with mechanical roasters was built at Copper Cliff. Although the smelters were a huge improvement over the roast yards they continued to emit large quantities of sulphur dioxide, as well as copper and nickel particulate, which peaked in 1960s. The combined effect of these pollutants led to the acidification of the soil rendering massive areas of barren landscape around Sudbury and effectively killing lakes from acid rain.

By 1970s, the absence of vegetation and the exposed rock blackened by the roast yards gave Sudbury a striking resemblance to a moonscape which had a significant impact on the city’s image and did little for its ability to recruit new businesses or attract newcomers.

After almost a century of mineral extraction and processing the landscape surrounding Sudbury was devoid of vegetation and the soil and water contaminated with toxic chemicals. The City of Sudbury, in partnership with the local university, the mining industry and with support from other levels of government, embarked on one of the largest environmental remediation efforts of a mining site ever undertaken in the world.

CASE STUDY:
The Re-Greening of Sudbury, Ontario

The Sudbury Case

Environmental remediation efforts
The impact was being felt directly by residents that had to live with intense atmospheric pollution, the loss of a valuable tourism industry and growing concerns by citizens about public health and safety. Although the construction of Sudbury’s 1,250 foot (380 meters) “super stack” in 1972 contributed to improving the local air quality, the blackened landscape around Sudbury was a shocking reminder of the environmental legacy that mining had in the region.

» CHALLENGE

To revegetate vast area of land around the City of Greater Sudbury that had suffered from years of industrial pollution from the extraction and processing of ores with unusually high levels of sulphur content.

» APPROACH

The sheer size and scope of the environmental impact of mining in Sudbury was astounding: 20,000 hectares of barren lands; 80,000 hectares of semi-barren land; 7,000 lakes within 17,000 square kilometers were acidified, hundreds were completely dead. The impact that years of environmental neglect was having on the city was being felt in terms of its tarnished image as an industrial wasteland, the drop in revenues from tourism, concerns over the impact on the health of it residents and the growing environmental awareness of citizens forced Sudbury to take action in the 1970s.

The revegetation process was a labour intensive effort, although it was initially helped by the fact that there were significant layoffs at the mines happening around the same time as Sudbury launched its re-greening program. With provincial and federal financial support it became part of a short-term job creation strategy for affected workers. Below are some of the main steps Sudbury has taken and continues to take in the re-greening process:

1. Organizational Development

In 1973 the newly formed Regional Municipality of Sudbury established the Technical Tree Planting Committee which changed its name to the Vegetation Enhancement Technical Advisory Committee (VETAC) in 1978. With a mandate to restore and protect the city’s air, land and water, VETAC includes volunteer technical experts from government, academia, industry and the community, that are responsible for overseeing the implementation of the re-greening program.

2. Community Engagement

An important part of the process is the engagement of individual citizens and community groups to participate in planting trees and revegetation activities. This has included a program of outreach to schools, volunteer groups and service clubs including the Scouts, Rotary and environmental organizations.

3. Building Knowledge

Initial efforts by the mining companies to revegetate areas were unsuccessful leading to a collaborative effort between the provincial Ministry of Natural Resources and Sudbury’s Laurentian University to better understand the science behind a successful reclamation initiative. What they discovered was that the high levels of acidity and toxicity in the soil was a major barrier to restoring ground cover. However, with the application of the right combination of crushed limestone, fertilizer and seed, it was possible to remediate previously barren land with selected native grasses and trees.

4. The Liming Phase

Barren or semi-barren landscapes requires site treatment to counteract soil acidity and metal toxicity. An agricultural grade of limestone is applied to the soil surface at an average rate of ten tonnes per hectare.

5. Fertilizer Application

Fertilizer is spread at a rate of approximately 400 kilograms per hectare. The fertilizer is high in phosphorus to encourage the growth of legumes (trefoils and clovers), which enrich the soil with nitrogen by fixing it from the atmosphere.

1. Sudbury: The Journey from Moonscape to Sustainably Green, Krista McCracken, June 2013 http://activehistory.ca/2013/06/11360/

2. https://www.greatersudbury.ca/living/environmental-initiatives/re-greening-program/program-operation/
Furthermore, phosphorus can decrease the amount of toxic metals available to roots. The fertilizer application usually occurs in the summer to coincide with the seeding operation.

6. The Seeding Phase

In the early fall, usually in mid-August continuing through September, a seed mixture of 5 agricultural grasses and 2 nitrogen fixing legumes are broadcast by cyclone seeders at a rate of 25 to 45 kilograms per hectare.

7. Natural Colonization

In the first year following seeding, a bright green cover of grasses and legumes develops. In the spaces between the plants, seeds of birches, poplars and willows, blown in from neighbouring woodlands, germinate and take root, forming a "pioneer" forest community.

8. Additional Plantings

Additional tree species are introduced one to three years after initial treatment. Later on, native forest floor plants are reintroduced through transplanting from nearby areas.

9. Soil Sampling

A comprehensive soil sampling and analysis program was undertaken in 2001 by the MOE and the mining companies. While confirming the scope and extent of the impact of mining on the surrounding landscape, the study led to the development of the Ecological Risk Management Framework Report which recommended the development of a Biodiversity Action Plan for Sudbury.

> RESULTS

Below are some of the main results from the reclamation work:

- **Remediation**

  It is estimated that between 1978 and 2011 almost 3,400 hectares have been remediated and more than 15 million trees have been planted by the city, the industry and citizens. The City of Sudbury provides seedlings, planting equipment and technical advice while large numbers of community based volunteer groups such as the Scouts and local schools have done as much as 25% of the planting.

- **Corporate Citizenship**

  Apart from growing seedlings in the controlled atmosphere underground at their Creighton mine, Inco, and now Vale, have invested significant resources in emissions reduction technology without which none of these efforts would have had a lasting impact. As an example, Vale is currently implementing $1.0B Atmospheric Emissions Reduction project to retrofit its Sudbury smelter to reduce sulphur dioxide emissions by 85% from current levels. Vale has also committed to support research and follow-up to promote biodiversity in and around Sudbury.

- **Biodiversity Action Plan**

  The City of Greater Sudbury in partnership with Vale and Glencore committed to the development of a long-term action plan in response to the detailed soil survey. The Biodiversity Action Plan, which is considered a "living document" that will be regularly reviewed, defines the vision and prioritized goals for ecological recovery for the Sudbury region. The City ensured active input and engagement of the community through a series of Biodiversity Stakeholder Involvement workshops and 'Have Your Say' sessions. Community input will help in defining environmental values and priorities that will be translated into a clear direction and actions within the Annual Operations and Research Plans.

- **Knowledge Sharing**

  The City of Greater Sudbury is working with Laurentian University to aggregate the significant body of knowledge and experience from Sudbury’s reclamation work with the objective of consolidating it into one marketable document. What is being referred to as the 'Sudbury Protocol' is expected to be completed by December 2017 and will draw from academic, industry and sector experts to provide other mining communities with detailed guidelines, standards and knowledge on strategies to remediate the impacts from the extraction and processing of minerals.

LESSONS LEARNED

Some of the lessons learned from this ambitious program include the following:

01 Early Wins
Sudbury targeted small but centrally located pilot sites near the city centre, next to schools and along transportation corridors approaching the city to showcase its re-greening efforts. This had the combined effect of providing the city with some early wins that raised the profile of the initiative while capturing the interest and motivation of citizens to become involved and to lend their support to the program.

02 Participation
The approach combined technical solutions with active community engagement that generated buy-in for a locally developed response to a problem that affected all citizens. The involvement and on-going participation of key actors (e.g. university scientists, city staff and citizens) provided a sustained commitment and continuity that allowed the initiative to maintain momentum over more than 30 years.

03 Community Engagement
Lastly, nobody tried to assign blame for the problem. Instead they approached it as a joint responsibility that required the full participation of all stakeholders in the community to find a shared solution. This was seen as an important factor that contributed to the program’s success as it turned the focus on bring the community together to collectively solve a problem rather pursuing a protracted legal process that risked dividing the community.

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The Sustainable and Inclusive Communities in Latin America (CISAL) Program is an initiative of the Federation of Canadian Municipalities (FCM) that seeks to strengthen local governments in mining contexts of Colombia and Peru to achieve greater social benefits and sustainable economic opportunities for communities. The Sustainable and Inclusive Communities in Latin America program is undertaken with the financial support of the Government of Canada provided through Global Affairs Canada.