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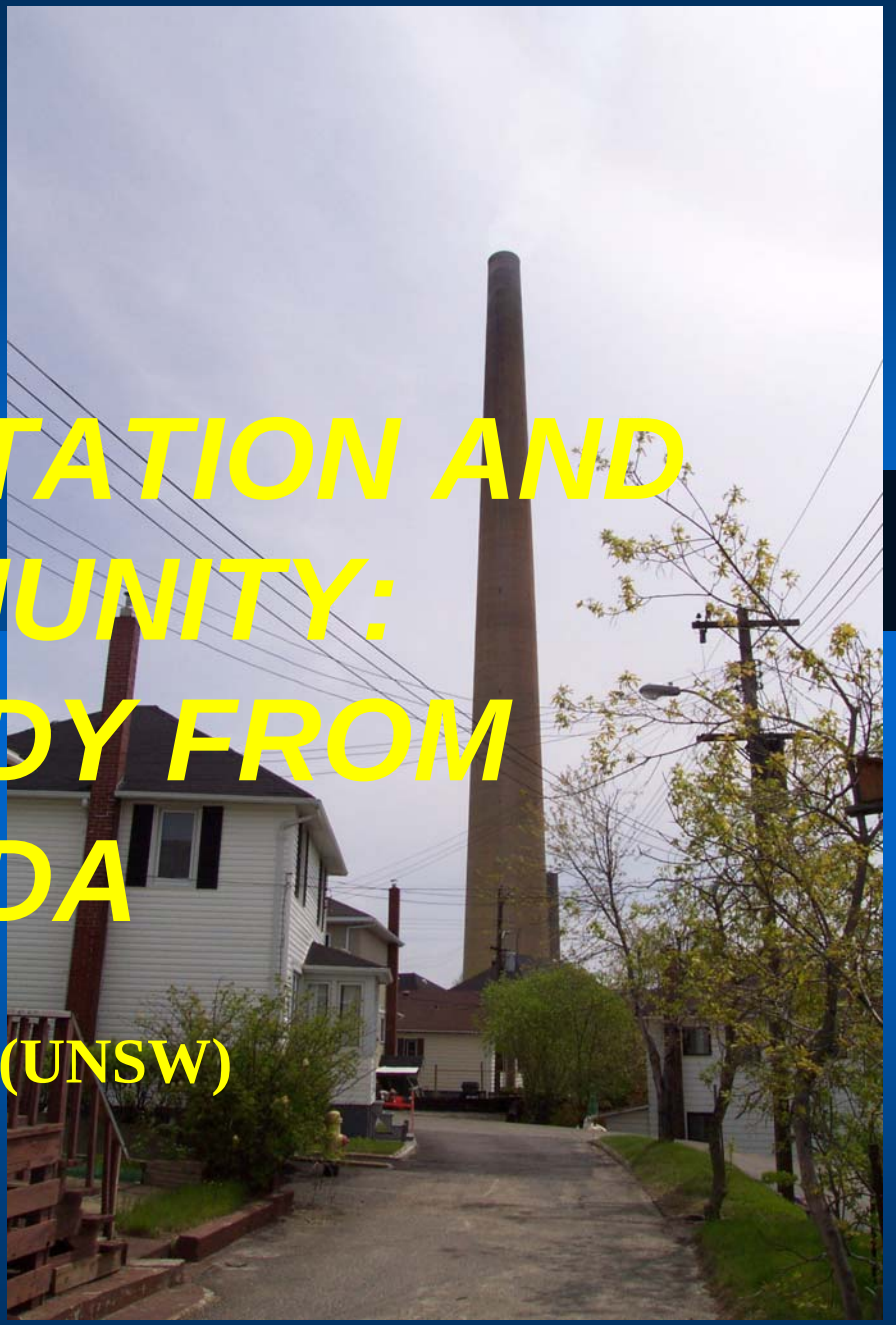
MINE REHABILITATION AND THE COMMUNITY: A CASE STUDY FROM CANADA



David Laurence (UNSW)

MINE REHABILITATION AND THE COMMUNITY: A CASE STUDY FROM CANADA

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ABSTRACT OF PRESENTATION:
The writer recently undertook field research and attended the International Mining and Environment Conference in Sudbury, Ontario. Sudbury is probably the world's principal nickel and cobalt producer. The conference focused on rehabilitation achievements in this famous mining field. Over 80,000 hectares of the Sudbury area has been degraded by forestry, mining and smelting activities. The landscapes around Sudbury have been labelled moonscapes, due in part to the effects of sulfur dioxide emissions, from roasting the nickel sulfide ores as well as conventional smelting activities. Environmental impacts involve massive deforestation, loss of biodiversity, acid soils and acidified lakes. Since 1978, remarkable success has been achieved in remediating the acid soils through a combination of liming and seeding. Over 6 million trees have been planted and extensive grass cover achieved.

The area surrounding Timmins, a mining centre north of Sudbury, has also been subjected to adverse environmental and community impacts from mining. In this case, extensive subsidence from collapsed underground workings has impacted on residential buildings and highways. The Ontario government has spent around $40 million in mine rehabilitation principally in stabilisation. The government has committed further funds to cleaning up old workings at Kam Kotia, which exhibits evidence of severe acid mine drainage.

These examples show that, through good science and engineering, and local community commitment, backed by adequate funding, heavily degraded areas can be rehabilitated to self-sustaining ecosystems.

ONTARIO

Timmins

Sudbury

Sudbury 2003 – Mining & the Environment

- May 2003
- 400 delegates, 150 papers
- Canada, USA, Australia, South Africa, + 10 others
- Wide range of topics including remediation, restoration technology, acidic drainage, aquatic toxicity and new technologies
- C$40 million over 4 years government grant for rehabilitation of abandoned mine sites

Mining in a cold climate

Wildlife….

Culture….

Mining heritage

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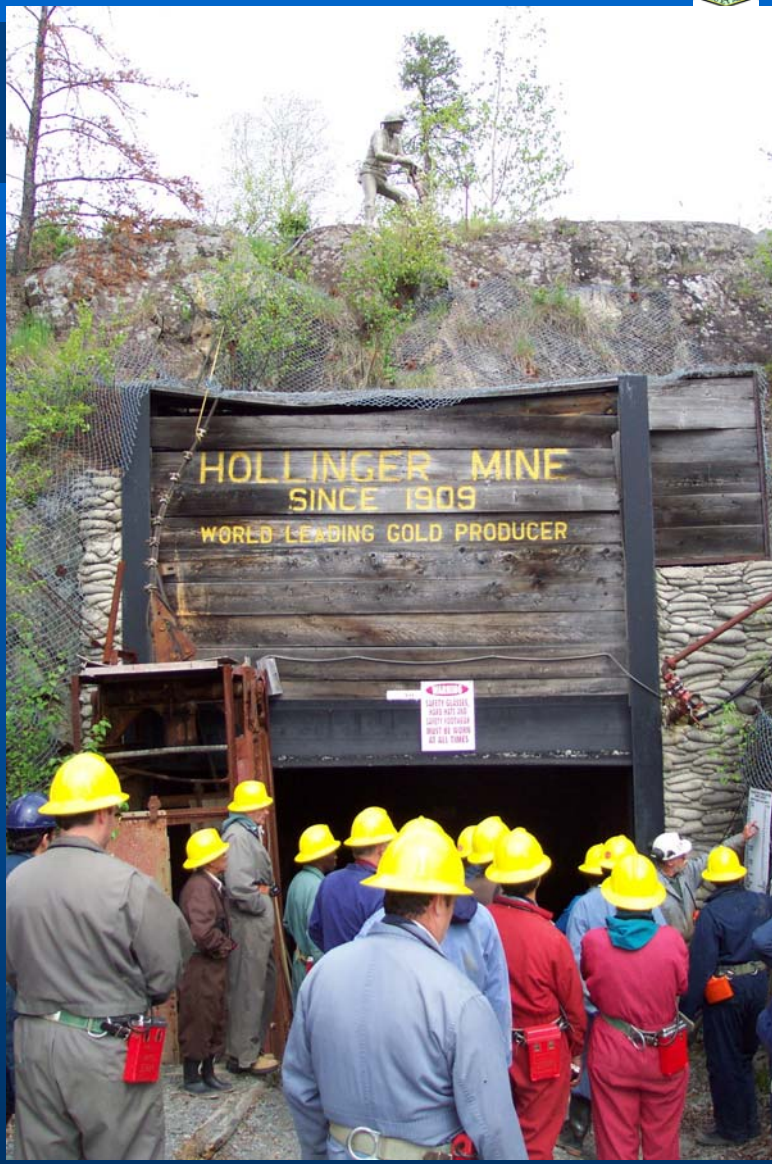
AERIAL VIEW, CONISTON NICKEL MINE, CONISTON, ONTARIO



Ontario mining statistics….

- Annual mineral production from Ontario ~ C$5.5 billion
- 23,000 employed in mines, mills, smelters, refineries
- C$5 billion annually
- C$1.8 billion in exports
- World class producer of Co, Ni, Au, Ag, Cu, Zn
- Sudbury area – 14 operating mines
- ~10% of global nickel supply
- > 2 million oz gold per annum

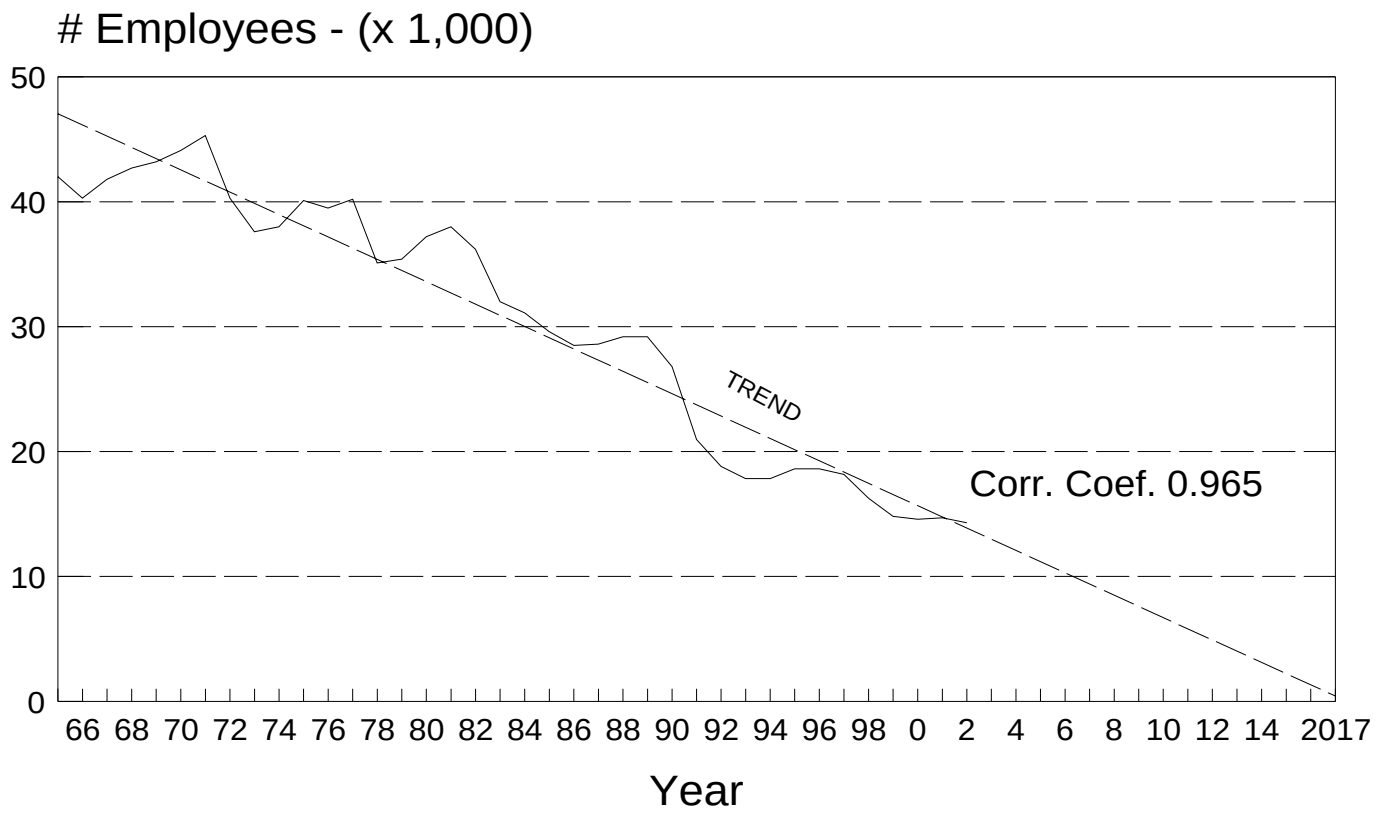
Modern underground mining

INCO – North Mine

Modern underground mining

And open cuts…

Employment - Ontario Mines & Mine Contractors
1965 -> 2002



Source: MASHA (ONRSA)(MAPAO) Monthly H & S Stats.
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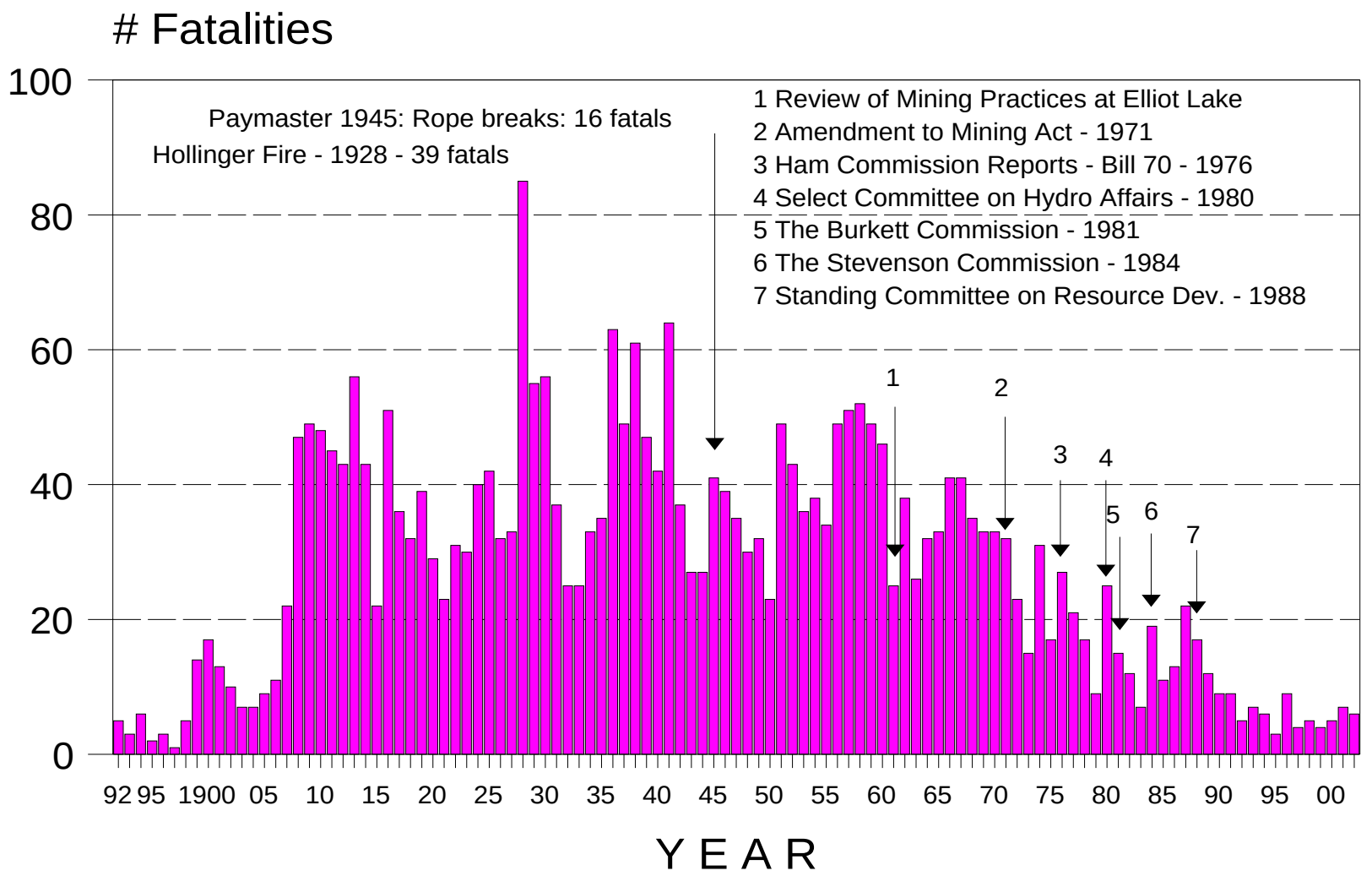
MINING FATALITIES - ONTARIO

1892 -> 12 Feb 2003



Source: Archived records to 1990: MIS - MHSP Data after 1990:
Note: Year-to-date 12-Feb-2003
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Sudbury – a case study

Sudbury – A Case Study

(after "Healing the Landscape")

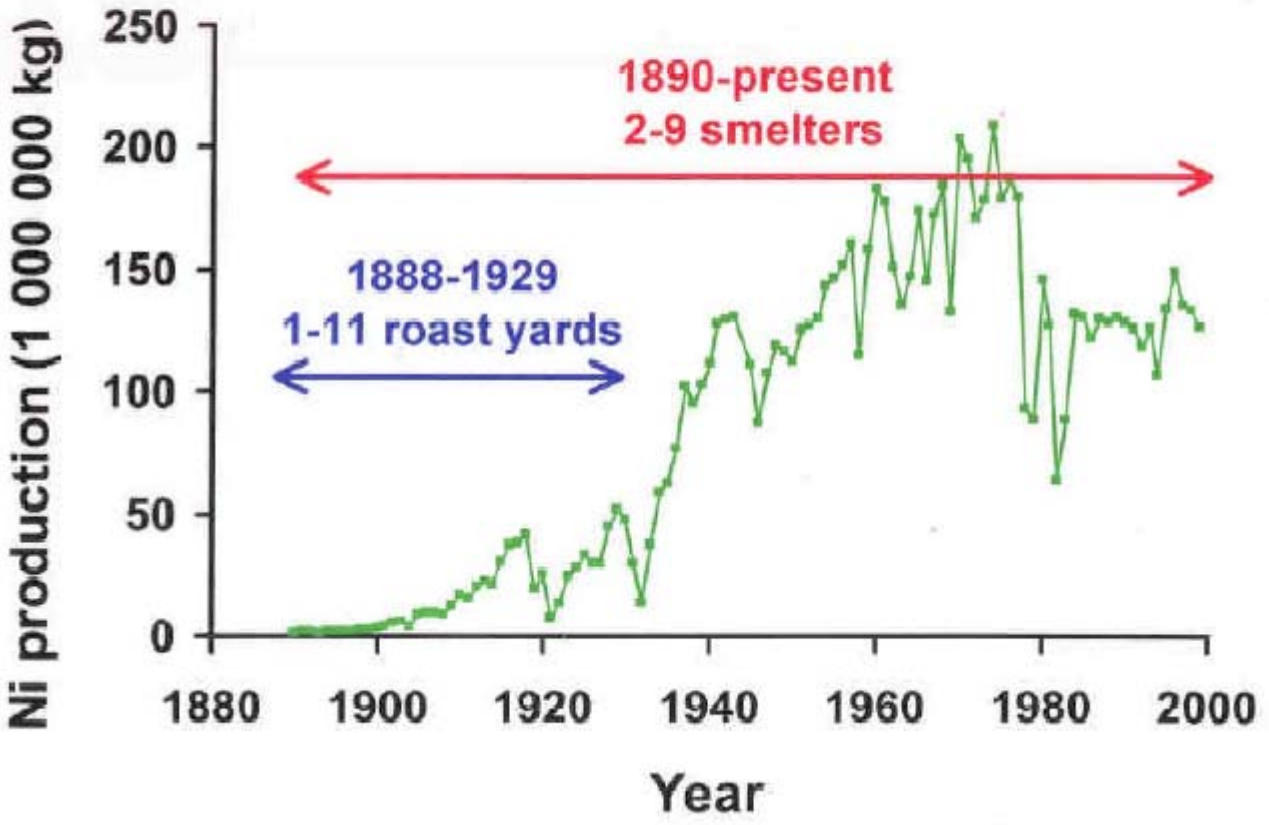
- **400km north of Toronto, Ontario**
- **Precambrian shield – outcrops!!!**
- **Originally forestry – 11000 loggers in late 1800s**
- **1850s - Nickel mining & smelting – INCO, Falconbridge**
- **162,000 residents**
- **By 1970s, ~20,000 ha completely devoid of vegetation and 64,000 ha supported minimal grass and stunted trees.**
- **Described as "moonscape" in 1971 by NASA**

Sudbury – A Case Study

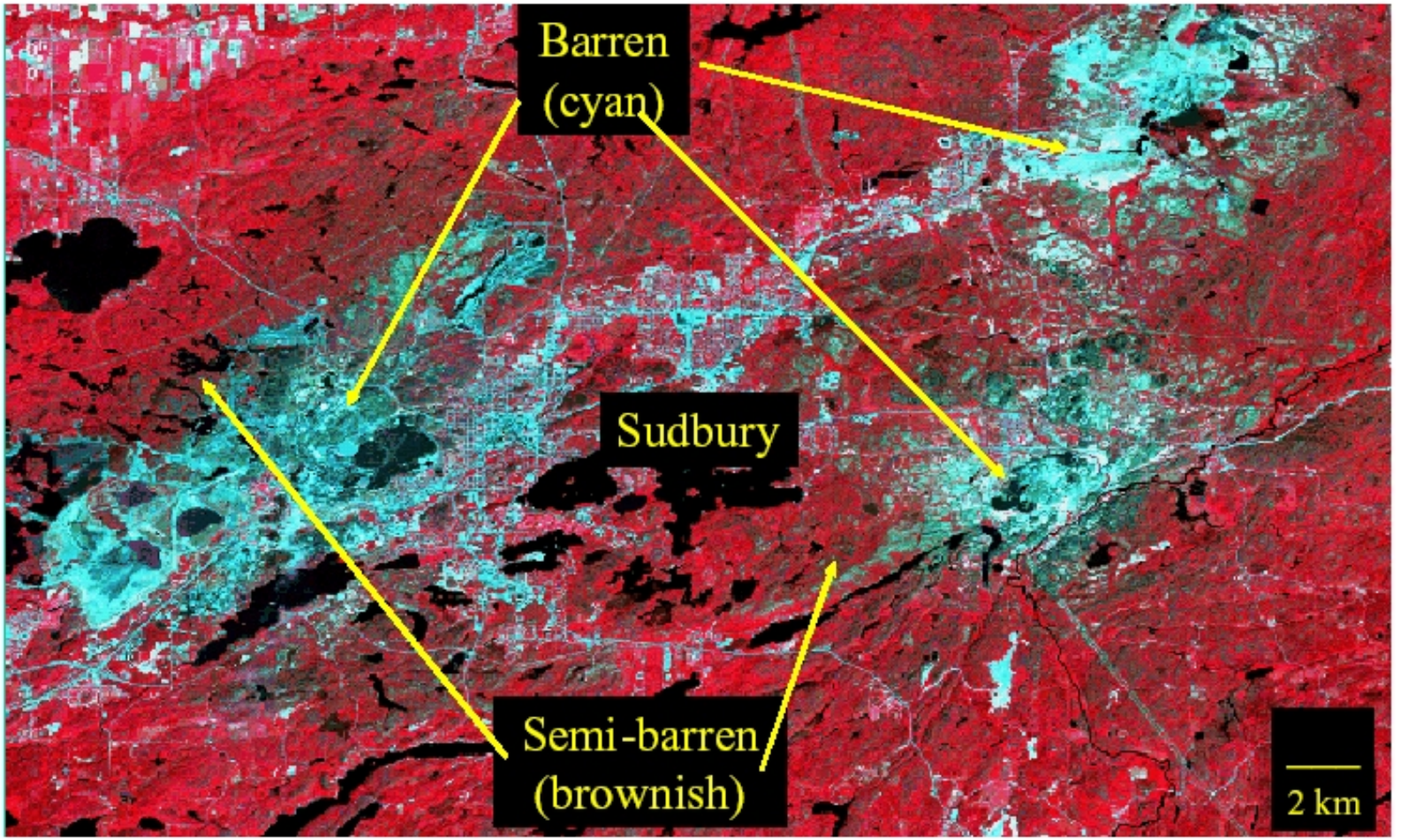
(after "Healing the Landscape")

- **SO^2 from Sudbury > 20% Canadian total ~ 2.5 mtpa**
- **7000 lakes acidified**
- **1972 – "Superstack" built – transferred problem away from Sudbury – INCO became largest source of acid rain in North America**
- **Problem identified as acidic soil, metal toxicity, lack of moisture, low fertility & frost heave**

Nickel Production in Sudbury



Barren: 17000 ha semi-barren: 64 000 ha total: 81000 ha



The Basic Regreening Recipe

Amount of lime added: 10 t / ha

Amount of fertilizer added: 400 kg / ha

Seed mixture: 40 kg / ha

Grasses (75%):

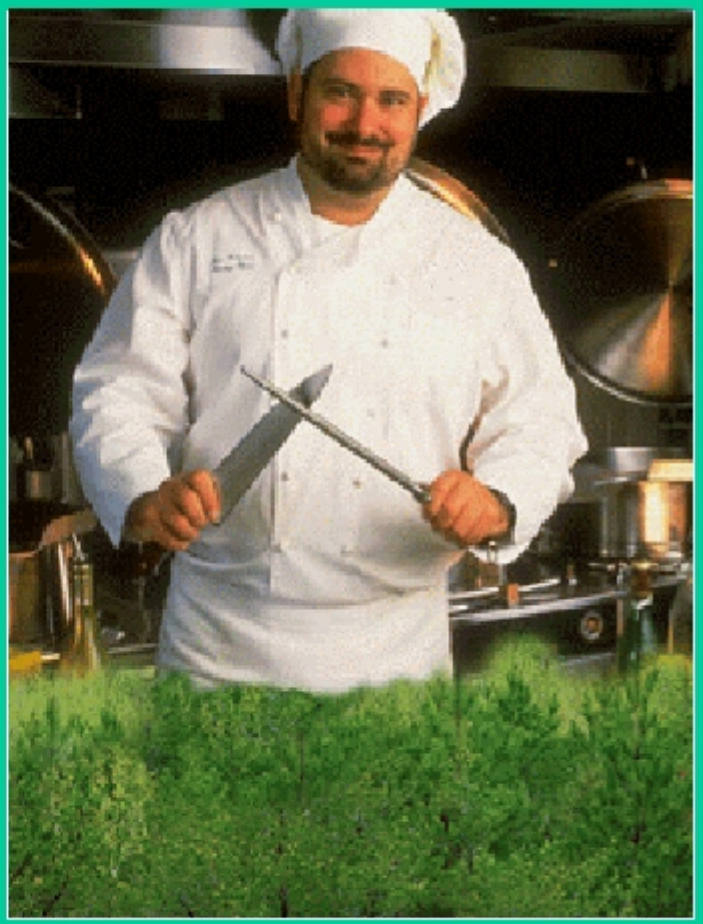
1. Red Top (*Agrostis gigantea*)
2. Red Fescue (*Festuca rubra*)
3. Timothy (*Phleum pratense*)
4. Canada Blue Grass (*Poa compressa*)
5. Kentucky Bluegrass (*Poa pratensis*)

Legumes (25%)

1. Bird's foot Trefoil (*Lotus corniculatus*)
2. Alsike Clover (*Trifolium hybridum*)

Trees Planted (major species): [+10 other]

1. Jack Pine (*Pinus banksiana*)
2. Red Pine (*Pinus resinoasa*)
3. White Pine (*Pinus strobus*)
4. White Spruce (*Picea glauca*)
5. Black Spruce (*Picea mariana*)
6. White Cedar (*Thuja occidentalis*)



Sudbury

Achievements

- 1978
  - potential area for rehabilitation = 29400 ha
  - 5840 ha needed liming & seeding
- 2000
  - 56% liming & seeding completed
  - Tree planting (11 million) – 56% completed
  - Cost to date C$20 million
- 2010-2015
  - major works completed

Achievements

- A recreational walking trail over rehabilitated land opened – the Jane Goodall trail
- Soil pH ~ 4.6-6.5
- Stream pH ~ 5.5-6
- Initial cover 20-40%
- Plant richness – 30-50 species/ha
- Birds > 50 species
- Mammals > 10 species
- ie a self sustaining ecosystem is returning but not all species typical of the forest outside of Sudbury are returning

1981

1987

2000

Timmins

Serious subsidence – eg Cobalt Highway 1987

Timmins

Serious subsidence

Timmins

Serious subsidence

Kam Kotia

- Kam Kotia is a former Cu/Zn mine near Timmins, Ontario
- There are about 6 million tonnes of unmanaged acid generating tailings covering more than 500 ha
- Environmental impacts are locally significant
  - acidic leachate
  - dusting
  - aesthetics
  - physical safety

Kam Kotia

Serious AMD

Kam Kotia

Serious AMD

Conclusions

- Ontario hosts some of the most spectacular examples of the environmental impacts of mining
  - Deforestation, acid soils, acidified lakes
  - Catastrophic subsidence
  - Mine tailings
- Combination of:
  - Good science & engineering
  - Community commitment & passion
  - Adequate funding
- Can result in positive outcomes for community and the environment

Acknowledgements

- School of Mining Engineering
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