Canada

Guy Fenech – Environment Canada

I will give you a brief update of what we are doing in Canada to address the acid rain problem, as well as give you information about one test case related to the changes in soils, forests and how the trees are reacting.

Acid rain in Canada has certainly had a long history. After several years of scientific concerns, in 1976 the government established the integrated program for long-range transport of air pollutants. Eight years later, we had the first control programs where the seven easternmost provinces agreed to reduce their emissions of SO_2 by 50 percent by their allowable levels by 1994.

Emissions from the United States are certainly a big influence in Canada, and one very important date for us has been the signature 10 years ago last March by President George Bush and Prime Minister Mulroney of the Canada/US Air Quality Agreement, whereby both countries committed to reduce their emissions of SO_2. More recently, our ministers have agreed to update the strategy to address acid rain.

Like everywhere else, our emissions of SO_2 have declined fairly rapidly (Figure 1). The bar graph is the emissions in eastern Canada, the seven easternmost provinces, where the problem resides. The other line is the total emissions for the rest of the country, or for the country as a whole.

NO_X emissions have stayed just about constant, no surprise there (Figure 2).

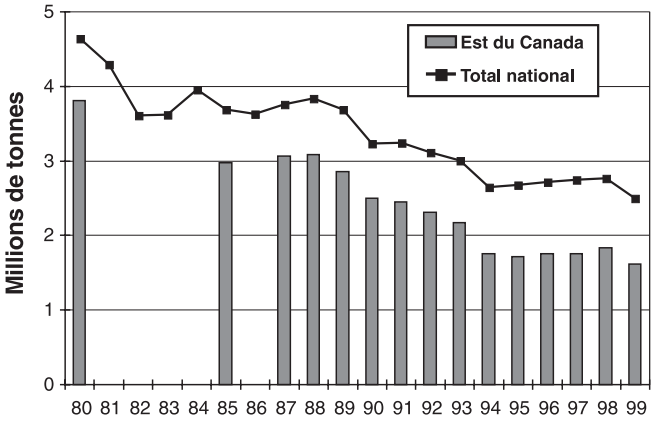

Figure 1. SO_2 emissions.

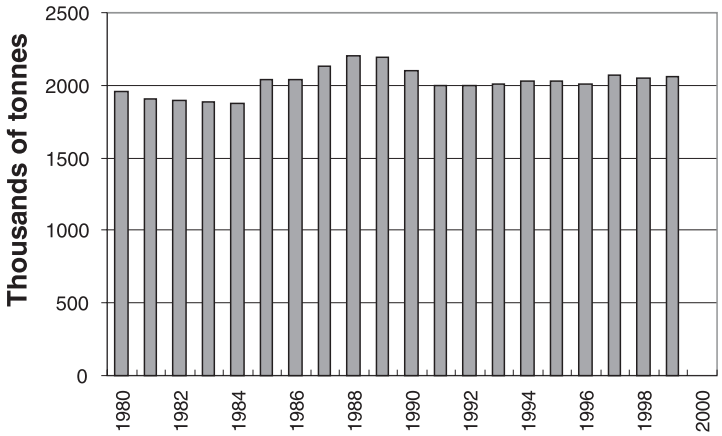

Figure 2. NO_X emissions.

In terms of ecological response first some very good news. There has been some very significant improvement in the area around Sudbury. The deposition in those lakes has been reduced by 80 to 90 percent during the period. There has been chemical as well as biological recovery. Anybody who would be interested in doing recovery work, we have a wonderful lab for you. Just get in contact with me or John Gunn at Laurentian University. We would be delighted to have you there to work on recovery.

The improvements elsewhere have been rather modest. In fact, some lakes and rivers in the easternmost part of the country are still acidifying mainly because they are very sensitive to rain.

For example, the Atlantic salmon rivers of Nova Scotia: Nova Scotia used to have 63 salmon rivers. The salmon runs have decreased in all those rivers. Several of those rivers do not support salmon any more, and predictions are that only two of the rivers may have a chance to support salmon in the long run.

We are extremely concerned about the chemical alterations of forest soils, and I will give you an example of what this means for us.

As other speakers have pointed out, acidifying pollutants do affect human health, human air quality, and contribute to regional haze problems.

Acid rain continues to be a sizeable problem in Canada. What we have done since 1990, in fact, is to evaluate or quantify the sensitivity of the terrain or the sensitivity of the lakes, or the tolerance of the lakes to receive sulfate deposition and we compared the actual deposition to the critical load or the tolerance level, to determine areas where this level is exceeded and by how much (Figure 3).

We have estimated that in order to get rid of this problem, we would need reductions in SO_2 emissions from Canada as well as from the eastern United States on the order of about 75 percent from Phase II of the program.

The Canada-Wide Acid Rain Strategy was adopted by ministers in 1998. Its long-term goal is to meet the critical loads. It commits the provinces to set new eastern Canada SO_2 emission reduction targets. It also commits the federal government to pursue further U.S. reductions. The provinces that do not have an identified acid rain problem have committed to keep their area clean by preventing pollution.

The strategy commits the governments to review the compliance with international commitments on an annual basis. It commits the governments to maintaining an active role in science and monitoring, and for the next assessment report, to assess the role of nitrogen in acidification. Finally, we have to report annually to ministers as well as to the public.

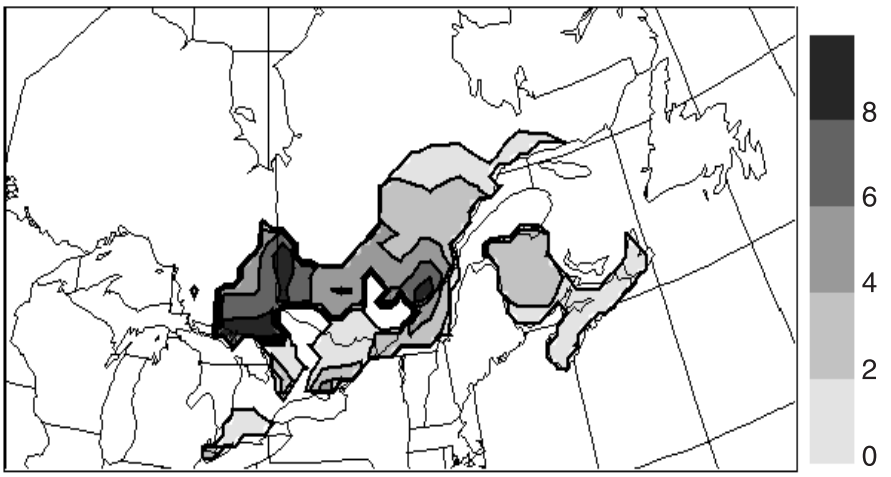

Figure 3. "Exceedance" loads. The area of eastern Canada expected to receive SO_4 deposition above critical loads without further controls beyond provisions in the 1991 Canada - U.S. Air Quality Agreement (in kg SO_4 per ha per year).

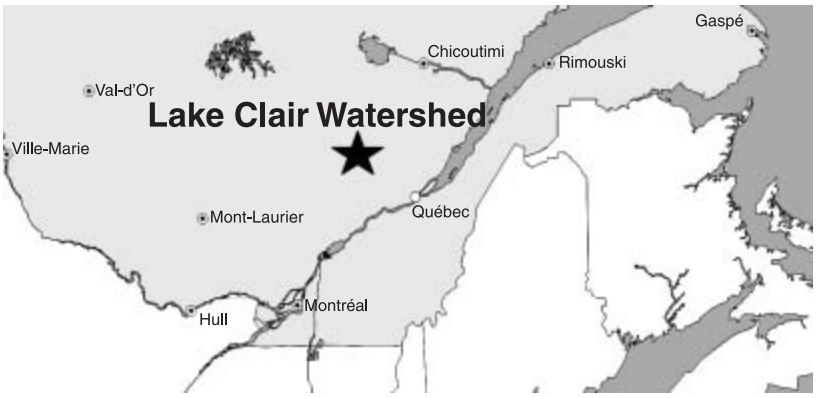

Figure 4. Lake Clair Watershed.

Now I would like to tell you about one test case about the impact of acid rain on soils and forest. I will talk about the Lake Clair Watershed (Figure 4).

What the Quebec Ministry of Natural Resources has done is to calculate a calcium budget for that watershed, taking into consideration the deposition of calcium, the immobilization, the wearing, the calcium coming from the bedrock and how much is going out from the watershed (Figure 5).

The budget shows that, on average, per year the watershed is losing approximately five kilograms of calcium per hectare per year.

Yesterday, Dick Valentinetti was referring to taking money away from the bank without knowing exactly how much is left in the bank. We have done those calculations now for Quebec, for that watershed. The reservoir of available calcium is estimated to be on the order of 200 kilograms per hectare. If you lose about five kilograms per year, it means that basically you have about four decades left before you run into serious calcium problems.

The Quebec Ministry of Natural Resources took a look at the dendrogeochemistry of a few maples (Figure 6). This is fairly typical here. The x axis goes back to 1920, but from 1920 to the mid-1950s or so, there was no change in the concentration of iron or aluminum in the wood, which probably means, to my simple mind, that the soils were probably quite capable of buffering the incoming acidity. Then, in the second part of the century, the toxic aluminum started to go up. These are the red dots, and the iron also was going up in the wood.

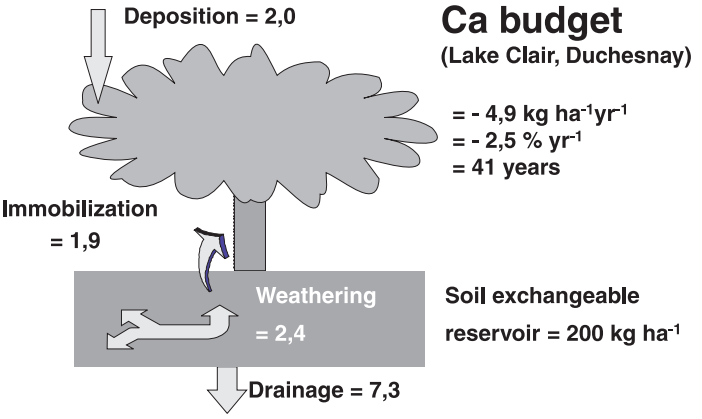

Figure 5. Calcium budget for the Lake Clair Watershed.

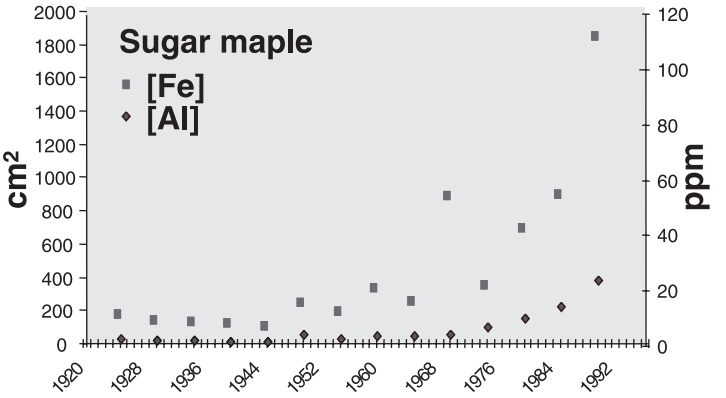

Figure 6. Dendrogeochemistry

In terms of the effects on the tree growth itself, a liming experiment suggests that calcium is the limiting growth factor (Figure 7). Basically they looked at four plots, one reference plot and three other plots to which they applied lime. They compared the growth index for each plot. Before the application of the lime, the four plots were behaving more or less the same. After the application of the lime in 1994, the growth of the reference plot continued with a slight decrease while the other plots showed significant growth and, the more lime was added to the plot, the more the tree responded.

To my mind that tells me that the trees were really starved for calcium.

There has been significant progress in addressing the acid rain problem in both countries, but much more is needed.

Much more is needed in terms of significant additional emission reductions. There will be some co-benefits. The benefits will not be only to the ecosystems, but they will be also related to better air quality.

Another point that is very important is that monitoring must continue to verify that the programs are having the desired effects.

In the future we will formalize the new targets that deal with the provinces. We will complete the targets for the eastern provinces and there will be some activities to keep the areas clean.

And, we will reassess the situation in 2004. Thank you.

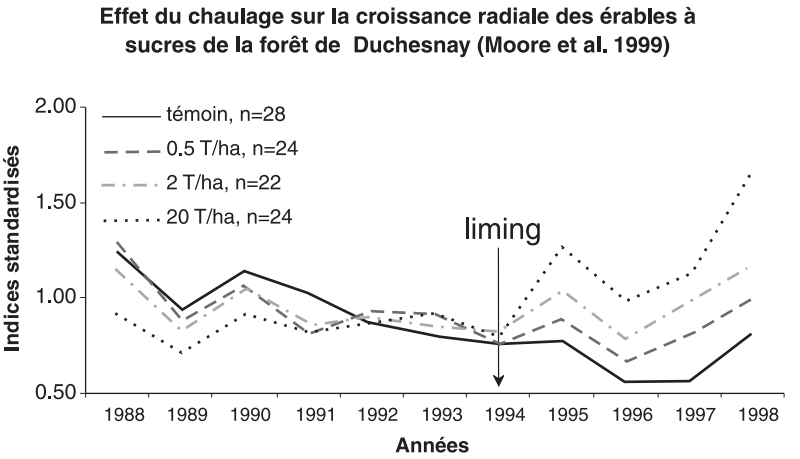

Figure 7. Tree growth response to liming suggests that the calcium is the limiting growth factor.

QUESTIONS

MR. LEWIS: My name is Preston Lewis. I am with the New York State Department of Environmental Conservation. One of the things that is very helpful to me in the work that I do is the scoreboard, the EPA scoreboard that is on the internet. Does Canada have anything that is comparable?

MR. FENECH: I am not familiar with the EPA scoreboard.

MR. LEWIS: It is basically the Phase I and Phase II units in the Clean Air Act, and what their emissions are annually.

MR. FENECH: I know we report emissions on a regular basis, an annual basis. I am not 100 percent sure about the media on which it is reported. I know it is reported in an air quality report that we do every second year, and it is probably available on the internet also, but I would have to check on that one.

MS. BAUM: I am Ellen Baum with the Clean Air Task Force. I was curious about the map on critical limits that you showed, given that you have begun your talk talking about Nova Scotia rivers having such a problem with salmon reproduction, yet Nova Scotia didn't show up as exceeding critical limits.

MR. FENECH: The map is for the problem as it is in 2010, after all programs are in place, both in Canada and in the United States.

Nova Scotia rivers are exceeding the critical loads now. However, the exceedence will be reduced over the years. Even after the implementation of Phase II, Nova Scotia will continue to exceed critical loads, not by much, between zero and two kilograms per hectare for sulfate.

That is not much, but they are in exceedence. Those rivers are expected to continue to acidify and not recover.

MR. FRANKLIN: I know that national salmon stocks are having problems with interference from farm salmon. Is there any possibility that some of the problem in Nova Scotia may be interference from farm salmon, or is it clear that it is purely ecological effects on the rivers?

MR. FENECH: There are certainly two components. One of the components is related to the salmon habitat which is acidified, which has caused a decline in previous years.

There is something that is relatively new, which is the return rate of the salmon. The return rate has dropped significantly in the past few years. The reason for the reduced return rate is unknown at the moment. I don't know whether it is competition by other genetically modified salmons, or it could be also because that salmons which reach the ocean are not in enough good shape to survive the trip.