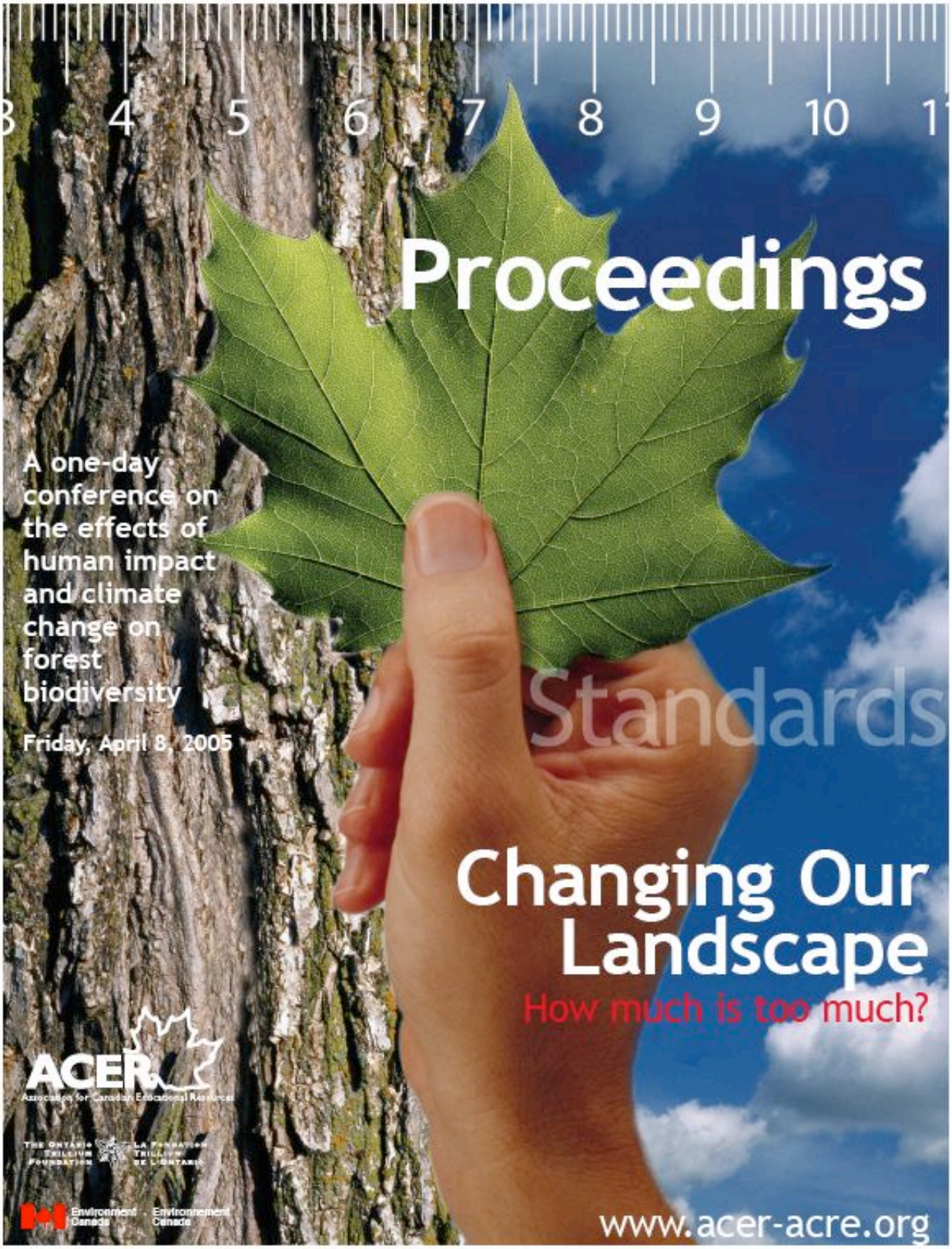
Proceedings
A one-day conference on the effects of human impact and climate change on forest biodiversity
Friday, April 8, 2005
Standards
Changing Our Landscape
How much is too much?
ACER
Associates for Canadian Educational Resources
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Changing our Landscape: How much is too much?

A one-day conference on the effects of human impact and climate change on forest biodiversity

A Report on the Conference Proceedings
Friday, April 8, 2005
Canadian Coptic Centre
Mississauga, Ontario

ACER

Conference Proceedings

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How much is too much?

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Will we be the last generation of biologists to study natural ecosystems?
- Francisco Dallmeier

1. Introduction

Never before have humans had the potential to alter natural systems with the speed and degree of thoroughness as during the twentieth century. In the past fifty years, our species has changed the Earth's ecosystems more rapidly and extensively than in any comparable period of time in human history. And over the past two decades of this environmentally turbulent time, climate change has been recognized as an added stressor to ecosystems worldwide. The Millennium Ecosystem Assessment Report[1] released in late March 2005 states that although evidence remains incomplete, there is enough to allow experts to warn that the ongoing degradation of 15 of the 24 "ecosystem services" examined is increasing the likelihood of potentially abrupt changes that will seriously affect human well-being.

It is indeed timely to ask the question, "How much is too much?" How much can we change natural environments while allowing them to maintain the resilience to rebound, renew themselves, and continue to evolve?

And how can we know how much is too much?

Given the scope and diversity of the work involved in answering this question, it is urgent for members of the Canadian biodiversity monitoring community to engage in fruitful partnerships to evaluate the impacts of human on natural systems. Systematic assessment and reporting provide the scientific basis for actions needed to enhance conservation and sustainable use of the ecosystems, which support our lives. But a broad-based picture of ecosystem change can only be assembled from the work of many players. To make effective collaboration possible, there must be sharable data available on a wide variety of indicators. Equally importantly, there must be directional guidance, to bring this data together to create a composite picture, which can inform planning, decision-making and policy. The UN Millennium Ecosystem Assessment Report[2] is an important model of the use to which data-sharing on a wide scale can be put.

The ACER Conference is designed to serve as a catalyst for stimulating improved cooperation and interoperability within our own Canadian biodiversity monitoring community.

[1] The *Millennium Ecosystem Assessment (MA) Synthesis Report* (219 p.) is the first in a series of seven synthesis and summary reports and four technical volumes that assess the state of global ecosystems and their impact on human well-being. This report is being released together with a statement by the MA board of directors entitled "Living beyond Our Means: Natural Assets and Human Well-being." See Appendix 11.3 for Press Release http://www.millenniumassessment.org//en/Products.BoardStatement.aspx Available at http://www.millenniumassessment.org//en/Products.Synthesis.aspx

1.1 The Challenge of Climate Change

Since the advent of the Industrial Revolution, the concentration of carbon dioxide in the Earth's atmosphere has increased by about 34%, from about 280 parts per million to 376 ppm. Nearly 60% of that increase (60 parts per million) has taken place since 1959.

The 2005 Millennium Ecosystem Assessment Report (MA) points to a reversal in the effect of changes in terrestrial ecosystems on the carbon cycle during the last 50 years. During the nineteenth and early twentieth centuries, global ecosystems were on average a net *source* of carbon dioxide, primarily due to deforestation, with contributions from degradation of agricultural, pasture, and forestlands. About the middle of the 20th century, the balance shifted to make ecosystems become a net CO2 *sink*. Many of the factors which influenced this shift were due to changes in human decision-making: increased afforestation, reforestation, and forest management in North America, Europe, China, and other regions; changes in agriculture practices; and the fertilizing effects of nitrogen deposition and increasing atmospheric CO2 (MA, p. 58). This trend demonstrates that cumulative human behaviour changes can shift large-scale environmental impacts from harmful to less harmful, and towards beneficial.

Despite these improvements the concentration of atmospheric carbon dioxide continues to rise. "*By the end of the century" the MA states (p. 29), climate change and its impacts may be the dominant direct drivers of biodiversity loss and the change in ecosystem services globally."* There is much work to be done.

1.2 Conference Roster of Speakers

The morning session of the conference set the stage for a day of information exchange, idea-sharing and creativity, and looking ahead. A total of nine speakers offered a rich mix of perspectives on environmental monitoring, and some important issues that monitoring is currently being used to address. The presentations offered a synergistic look across players from the international, to the national, to the community level. Individual speakers opened windows onto monitoring projects focused on both rural and urban contexts.

The keynote talk, given by Francisco Dallmeier, director of the Washington-based Smithsonian Institution's Monitoring and Assessment of Biodiversity program (MAB) spoke directly to the conference theme, the effects of human impact and climate change on forest biodiversity. "Issues of environmental transformation are complex," Dallmeier stated, "and when people see communities working together, they have hope."

Don MacIver next summarized the work of the Environment Canada Adaptation and Impacts Research Group that he directs. His group monitors the results of the many pressures – environmental, economic, social, and heritage-related – that have led to a planet in crisis. He too began his talk with hope and an admonition to change: "We have

gained a lot of knowledge, including from Natives, about our natural systems, about how they have evolved over time, and how we must care for them in the future."

Focusing on the local level, Alice Casselman and Marianne Karsh of the Association for Canadian Educational Resources (ACER) spoke on community forest monitoring. ACER's work makes hands-on climate change biodiversity monitoring projects available to a growing body of "citizen scientists." The group's proactive approach combines citizen awareness with the training of new data-gatherers to contribute to the corpus of climate change monitoring information.

A group of panel members gave presentations from four additional monitoring perspectives. The University of Toronto's Andy Kenny spoke on urban forest monitoring, and the critical nature of urban greenspace from a social, economic and ecological perspective. Silvia Strobl from the Ontario Ministry of Natural Resources addressed the issue of standards for combining data sets by different players, with reference to the province's Southern Ontario Land Resource Information System (SOLRIS) and Ecological Land Classification (ELC) programs. Brian Craig of Environment Canada's Environmental Monitoring and Assessment Network (EMAN) continued the theme of standardization in data- gathering, describing a proposed suite of 25 core monitoring variables for the early detection of ecological change. Monitoring rural forests in their diversity of types and ownership, and facilitating decision-making about significant woodlands was the focus of Mark Rowsell's presentation from the Eastern Ontario Model Forest (EOMF).

2. Welcome and Opening Remarks

ACER's Carole Berry opened the day's proceedings by introducing Mississauga Councilor Pat Saito. Councilor Saito welcomed conference participants to Mississauga, and spoke of the importance the City of Mississauga attaches to buying land in order to preserve trees. Recognizing the impacts of the mechanized lifestyles of its citizens, and the effects of heat-trapping gases from fossil-fuel use, Mississauga is setting out to conduct a complete inventory of its 300,000 climate-mitigating street trees, and 50,000 road allowance planting sites. Urban forestry data will play an important role for the municipality in assessing relationships between land use planning and climate change.

Ms. Saito's address led into the presentations, informing the audience that they would next learn how to identify inventory methods: standards, mechanisms and distribution of information.

3. Keynote Speaker

Francisco Dallmeier, Monitoring and Assessment of Biodiversity (MAB)
Smithsonian Institution
Conservation and Research Center, National Zoological Park

The Effects of Human Impact and Climate Change on Forest Biodiversity

Presenter Biography

Dr. Francisco Dallmeier, Director of the Smithsonian Institution/Monitoring and Assessment of Biodiversity Program (MAB), is a conservation biologist with oversight responsibility for the international network of biodiversity research and monitoring sites located in 23 countries. The MAB program is dedicated to the conservation of biological diversity and employs an integrated approach that combines research and training in an adaptive management framework. The program provides scientific information, and builds in-country capacity to foster the sustainable use of natural resources.

Summary

Looking at issues of biodiversity today, there is both good news and bad news. The good news is that technological advantages and genetics engineering are revolutionizing the way we view biodiversity and making the link between biodiversity and human welfare very clear. Furthermore, mega corporations are leading the way in these efforts while generating unprecedented economic wealth for the world. The bad news is that the speed at which globalization is happening, and the increased demand for more natural resources for the developing as well as the developed world. In this era of rapid landscape modification, biodiversity takes second place, behind raising standards of living and poverty alleviation.

The destruction and degradation of natural landscapes is occurring at a very aggressive pace with nearly 50% of the planet heavily managed by humans, and 100% of it influenced by human endeavor. We are rapidly losing species, and many others are endangered or threatened; our ability to reverse this process is questionable. A critical example is the worldwide decline of amphibian populations brought about by both human and natural causes.

Why should we care? Because humans depend on biodiversity for indispensable services and resources, including food, water, breathable air, a stable climate, waste decomposition, bioremediation, pharmaceuticals, genomics, proteomics, and renewable feedstocks. Several of the critical questions in biodiversity and conservation biology are

related to what species exist, how (and why) biodiversity has changed over time, and how species live and die. We seek to understand their adaptations, distributions and abundance, and the forces that drive ecosystem function and change.

Conservation science contributes to the positive management of the biosphere by protecting areas, restoring natural functions, and managing ecosystems for biodiversity. From the global scale to the site-specific initiatives, there are currently several science and conservation programs contributing to a better understanding and management of natural resources. One of those is NEON. The National Ecological Observatory Network (NEON) is being designed to monitor earth pulse through a network of environmental observatories. NEON is a national US initiative with global implications. Its intended life span is 30-50 years. During that time, it will allow scientists to measure ecological and environmental changes at the continental scale, for the first time. A complementary program, coordinated with 51 nations, has been organized by the National Oceanic and Atmospheric Administration (NOAA) to monitor the oceans and the atmosphere through an international information center. This program will act as a global observation system of natural systems. These global monitoring initiatives are expected to change the way we live, and save millions of lives.

At the local scale there is another important program, the Energy and Biodiversity Initiative (EBI). This program is designed to integrate biodiversity and conservation with oil and gas development. A consortium of four energy companies – Shell, BP-AMOCO, Chevron-Texaco and Statoil – has joined with five environmental organizations: the Smithsonian Institution, Conservation International, Flora and Fauna International, The Nature Conservancy and the International Union for the Conservation on Nature. The aim of the program is to develop strategies and procedures to integrate biodiversity issues into all phases of their operations in order to minimize primary and secondary impacts. Biodiversity Action Plans are one of the tools that this initiative has promoted through the International Petroleum Association.

The Smithsonian's MAB program is working in a network of biodiversity monitoring sites to promote the conservation of biological diversity. It uses an integrated approach that includes research, monitoring and professional training for scientists and land users and managers. One focus is the African tropical moist forest, an area of about 500 million hectares. About 5 million hectares currently are being logged per annum. A network of forest monitoring plots in the region is providing valuable information for the management and conservation of the Congo Basin, and more priority areas for conservation are being proposed. This region houses the remaining rain forest of Central Africa, with some of the richest species diversity on the continent. In the country of Cameroon, for example, 80% of their unprotected forests are in logging concessions and are likely to be gone within the next 20 years. The increased global demand for timber, coupled with local pressure on bush meat and poor landscape planning and infrastructure development, combine with weak environmental laws, poverty and political instability. This combination leads an unsustainable future for this region's forest biodiversity.

Gabon faces similar environmental challenges, but offers a different opportunity because of its low population density and existing revenue from oil development. Two years ago the government of Gabon created a protected network of 13 national parks. Many unique areas were set aside under this new initiative, representing about ten percent of the country. Many of Gabon's ecosystems are substantially intact – with 77% of its tropical rainforest remaining, in addition to savanna, lagoon, wetland, coastal and inselberg systems. The survival of Gabon's forests may be attributed to several factors: the country has attractive resources including extensive oil and natural gas reserves, iron, manganese and uranium deposits, and its population is concentrated inland along major roads. While the human population is sparse over large areas of Gabon, the area boasts some of the most diverse wildlife in tropical Africa.

The goal of the Smithsonian MAB Program in Gabon is to develop advanced models aimed at promoting the conservation of biological diversity in parallel with oil and gas development, and to deliver research and monitoring information for the practical conservation of biological diversity. For the last four and a half years a multi-disciplinary team has been able to generate the most comprehensive biodiversity information for the southern part of the country, an area known as the Gamba Complex. The first baseline assessment of the Gamba Complex disclosed 374 tree species, 42 large and 48 small mammal species, and 455 species of birds. Amphibian and reptile diversity have been recorded at 84 and 96 species, respectively. Survey work also has recorded many species of inland and coastal fishes well as 1,600 arthropod species from 22 taxa. Some of the developed areas are also very sensitive areas for biodiversity that need to be carefully managed.

Applied research will be used to improve or maintain landscape connectivity between industrial areas and the national parks to avoid dangerous isolation of meta-populations of species. A combination of genetics, path occupancy techniques and radio collaring methodologies are helping us to understand critical seasonal patterns of species movements and distribution. Secondary impacts of roads and forest fragments are helping us to set up management and conservation plans locally. All this information will be integrated into a biodiversity monitoring plan for the long-term management and conservation of the area and to serve as a prototype site for a larger network of protected areas within the region.

Training and capacity building has been a critical component of the program. The MAB program has taught the Gabonese skills in biodiversity sampling and monitoring, field and lab research, data management and interpretation, and wildlife management. Several community education programs have been established. In this particular area there is a window of opportunity for conservation, and we are actively developing a communication strategy for local communities. We need to be able to translate the scientific messages to the local stakeholders. It's important to get this information into

the public domain. All stakeholders, public and private interests, need to be part of the conservation and education process.

Our role is to inspire the local communities to reach a new level of awareness in biodiversity conservation. The president of Gabon presented the program last year during the 2004 African Presidents' UN Summit in New York. A new level of conservation awareness is spreading in the region.

In relation to the international forest-monitoring network, we have learned some lessons from the managed forests. Alien invasive species are very common. They prevail in the mature phases of forest development, and are forming the new canopy. We have shown that these "new forests" have fewer endemic species. We recognize that the forest community diversity is determined primarily by anthropogenic activity. Often the tree species diversity retains the same values while the composition is very different. Also, the species richness of wildlife in the forest has changed considerably in many of the areas; and in many cases game species abundance is severely reduced.

There is no evidence that the forest is returning to pre-development conditions. The "new forest" becomes a self-organized community with a significant time lag to recovery depending on the intensity of the land degradation. Forest fragments provide ecological value in the creation of the new forest and the new forest can provide some valuable lessons in coping with climate change.

4. Featured Speakers

4.1 Don MacIver, Director
Adaptation and Impacts Research Group (AIRG)
Environment Canada

Land-Use Ontario

Presenter Biography

Don MacIver has worked at a number of agencies as a meteorologist, climatologist, forester, biometrician and (forest) mensurationist. Outside of work, he is a municipal politician (namely, deputy mayor for Amaranth Township and County Councilor in the County of Dufferin), a farmer, an environmental activist, an amateur ham radio operator and a CANWARN volunteer. Don served as a professor at York University from 1972-1981, and as an adjunct professor at the University of Toronto from 1988-1993. He worked as a biometrician and mensurationist at the Ontario Ministry of Natural Resources from 1981-1986 before joining Environment Canada in 1986as a forest meteorologist and a climatologist. On behalf of the Government of Canada, Don organized and co-chaired the 1998 international IPCC Workshop in Costa Rica on Adaptation to Climate Variability and Change and the 2004, "Building the Adaptive Capacity" Conference, in Lijiang, China.

Summary

We have a planet in crisis. We must look at the life and lifestyle choices we make. We think we are in a community that is sustainable into the future, but there are many pressures: environmental, economic, social – and I would like to add heritage as the fourth pillar of sustainability. We have tremendous pride in our natural heritage here in Canada, with areas set aside to conserve the ecosystems and species we value – including our natural knowledge of indicators of a changing climate. We have gained a lot of knowledge about the natural systems and about how they have evolved over time (including from Natives), and how we must care for it in the future. But today Ontario's climate is actually changing (see climate map of Ontario). The climate change is non-linear: it's getting warmer in some areas more than in others.

Some areas are changing faster than others. When we talk about Ontario in terms of getting wetter, it's true, we are. This is based on information from our observing stations. We now have four categories of precipitation we didn't have in the 1960s. The conclusion is that we have already had an impact on biological systems: it's warmer and wetter, and we're seeing significant impacts. As an example, the Georgian Bay area near Collingwood has warmed from 0.5 – 1 C degrees. One degree is significant in terms of all

biological systems, especially the creation of a climatically hospitable environment to support new invasive alien species. In comparison, the Long Point area hasn't warmed as much, only about 0.3 C degrees. Precipitation totals annually are up 20%, but the seasonal distribution of these increases and evaporation increases due to warming are equally important issues. There's no question this has an impact on coastal zones, wetlands, agriculture and all other biological systems. We are aware of declining lake levels, and of outcries from recreational boaters who can't get out to fish and the need for on-going dredging. This is also a problem for commercial shipping in terms of lighter carrying capacities. There are legal issues when water levels change, too: who owns new property when water levels drop? Under the old British Law – the adjacent property owner owned it. But if it's human-included climate change, who owns it? Does this old law pertain?

In many cases, we have difficulty measuring the creeping changes, and we tend to look at the more visible impacts caused by weather extremes: floods, forest fires, wave erosion and storms, droughts and heat spells, the Saguenay floods in 1995, the great ice storm in 1998. When we talk about impacts on biodiversity, we must be able to evaluate the slowly evolving changes as well as the catastrophic, such as those caused by severe weather – tornados, hurricanes, damaging windstorms, ice storms – that completely disrupt multi-taxa relationships and systems.

For example, under Bill 148, the Ontario Emergency Management Act, two thirds of the 'hazards' mentioned are weather hazards! 446 Ontario municipalities have used weather information to assess risks, which is a major step forward in identifying vulnerable communities. If you go the hazardous web page (www.hazards.ca), you will find where you should live (or not!). Wind can damage wind farms, building and human infrastructures, as well as natural environments. Over the last half-century, we have seen a significant increase in the global costs of great natural disasters, with billions in insurance claims due to violent weather – this is one measure of our adaptation deficit, and it is increasing! We count very heavily on volunteers to gather historical documentation on effects of violent weather. Dianne MacIver, for example, spent three months documenting the history of damaging wind and tornado storms in Central Ontario, and plotted them on a graph over 100 years that shows a significant increase in widespread damaging winds during the last two decades.

In terms of chemical impacts from the atmosphere, we have continuing acid rain impacts, partly due to our proximity to the US. We are continuing to deal with the damage. In addition, Long Point, a world biosphere reserve, has the highest incidence of ground-level ozone from US, a significant impact, and the highest areas of concentration in Ontario. It's very damaging to biological and agricultural systems (tobacco, potatoes, farmers' lungs).

On one hand we are trying to help meet a global goal by slowing the loss of biodiversity by 2010, but the carbon dioxide in the atmosphere is increasing. We must understand the sensitivities, adaptabilities and vulnerabilities of our biological systems under a changing climate. We have been recording temperatures since 1850. When we look at the projections, we see a distinctly warmer climate in the future, and, as a first step, we need

to reduce greenhouse gases, the source of that change. But the gases we put in the air are resident for a long time, and the more urgent question is: how are we going to adapt? We must figure out what is in store for us. This slide shows how stable global temperatures were for many centuries, but also what is happening and can be expected to happen by the year 2100. We need to develop a new series of greenhouse gas emission scenarios based on different views of how society and the economy might evolve over the next century. They include such factors as technological change and population growth, as well as climate change mitigation policies and adaptation actions that are needed now.

Mitigation actions will not alter this overall conclusion - they will only slow the rate at which climate change occurs. We need more than just Kyoto: we will need to adapt. As the climate continues to change, more and more impacts will be felt. We need to develop appropriate adaptation solutions by working in partnerships with many local communities.

Look at the changes projected for 2060, we are talking about a 2-3 degree C. change in some parts of Canada – in a doubled-carbon dioxide atmosphere. We're now talking about modeling at 3 x CO2 curves/levels – what kinds of effects will that have? In Georgian Bay, with a 2-4 degree C. warming – an increase in temperature plus an increase in precipitation means the rains will be much more severe. We will experience floods more severe than Hurricane Hazel. If we look at Long Point, at a 2.6 – 4 degrees C. change, there is not as much increase. In other words, there will be sub-regional changes, so one national prescription for adaptation does not work.

Sensitivity, Adaptability, Vulnerability

We need to use our biological monitoring systems integrated into our atmospheric systems to be able to predict environmental changes. We will need to assess:

€ Sensitivity: the degree to which a system will respond to a change in climatic conditions (e.g., the extent of change in ecosystem composition, structure and functioning).

€ Adaptability: the degree to which adjustments are possible in practices, processes or structures of systems to projected or actual changes of climate. Adaptation can be spontaneous or planned and can be carried out in response to or in anticipation of changes.

€ Vulnerability: the extent to which climate change may damage or harm a system. It depends on a system's sensitivity and ability to adapt to new climatic conditions.

There is much work to do to ensure southern Ontario habitats are protected and reconnected.

We have looked at land conversion, which has its greatest effect in southern and eastern Ontario. Specifically, if we use Dufferin County as an illustration, and an example of "top of mountain" critical ecosystems – you may know the Townships of Mulmer or Mono in the Niagara Escarpment – another world biosphere reserve and a very sensitive

ecosystem to protect. In many cases, people think current maps are the original landscape, but we mapped original survey maps, and learned that all of Dufferin County was formerly covered in wetlands and trees. Is this an area we can use for evidence of changing climate? Yes, because there is no heavy commercial and industrial expansion. Streams in this area, formerly cold-water fisheries, are now warming. Species have changed to warmer-water species. We are inland from marine coasts, with high impacts from tornadoes, fog, freezing rain, in a snow belt from the Great Lakes. We have protected some "corridors" in Dufferin from development. But now we see increasing population pressures, changing water demands, and conservation challenges. Residents are excellent environmental stewards of the land, and clean water continues to flow downstream for millions of urban users. Dufferin has a headwaters charter, a headwaters plan for sustainability, a waste diversion plan, and groundwater management plans to help protect the sensitivity of this region into the future.

Answering the question How much is too much?

A couple of centuries ago, most of southwestern Ontario was covered by forests, such as the Carolinian forests. Today, some of these parts of Ontario, such as Essex-Windsor, have less than 4% of their original Carolinian hardwood forests remaining.

Heat is a tremendous trigger: add too much, and you will change how the system operates. We can look at Toronto and southern Ontario as a climate change laboratory. To adapt to new temperature ranges for humans and animals, we need a heat alert warning system. Heat is also a powerful trigger to growth – and can be linked to the disappearance of wetlands and woodlots. Only 4% of the Carolinian forest remains in Essex-Windsor. The additional heat has reduced frost threats, and supports higher-value agriculture (tomatoes, etc). As we change the landscape, we end up with a higher level of endemic and rare species, by taking away habitat. A subtle warming of a degree or two Celsius could significantly change land use, ecosystems and biodiversity in southern Ontario. These changes have implications for policies dealing with potential losses of critical habitat, native biodiversity and more invasive alien species under climate change.

Adding heat to the system will increase biodiversity. Today's species will be stressed, and new species will come in. We must be very vigilant in terms of our monitoring of multi-taxa to know what is coming in (e.g., introduced pests such as the long-horned beetle and other new diseases (e.g. malaria, West Nile virus, Lyme disease). Another IMAP study looked at climate and biodiversity linkages. The results showed that one or two degrees of warming could, over time, significantly impact biodiversity in southern Ontario, a factor that could likewise affect conservation and land use policies.

Canada can ill-afford the loss of one species. Compared to tropical regions of the world, we don't have enough biodiversity – this increases the pressure to conserve what we have. Don't think that population crashes won't occur again, remember the Chestnut and Elm crashes.

The landscape belongs to all of us. We need strong leadership, along with many partners, to conserve and use it wisely.

Walk the TALK!

4.2 Alice Casselman, President and Founder, Association for Canadian Educational Resources (ACER), and Marianne Karsh, Director, ACER Humber Arboretum Programs

Community Forest Monitoring

Presenter Biography

Alice Casselman is the President and Founder of ACER. A pioneer in enriching Canadian environmental and outdoor education with specifically Canadian content, she has also played an important role in outdoor education, as a founder of COEO, Outward Bound (COBWS), and the Peel Environmental Network. She is a director, and currently president, of Environmental Education Ontario (EEON).

Summary - Alice Casseslman

Our work has been an effort to put everything in context. ACER started because we wanted to do something for students that would extend and enrich their curriculum and make sense in the field. We had been taking students through outdoor education programs for thirty years, but now we wanted to do something that would take us into the next century: something that would let the kids talk to each other when they did experimental fieldwork.

We began with a concept for Environment Canada EcoAction funding back in 1995, so we are now celebrating our tenth anniversary of this concept. We are pleased to share this excitement. Today we work with a variety of partners who share in our growth.

ACER delivers real science: we've created training methods and materials for our "Measure Up" and "Let's Plant" programs, as well as equipment, web-based data entry and training manuals to implement them. From three original plots, we've grown to work with school boards, private landowners, conservation authorities, colleges and agency educational programs. Our own programs allow us to be developers, trainers and educators.

In terms of resources, ACER has produced a full *"Climate Change in Context"* educational package for high schools, as well as a UV resource book and poster entitled "*Solar UV in our World."* Environment Canada provided the funding to help us develop

these materials to give teachers the "big picture."

Our latest major project is a one-hectare planting plot at the Humber Arboretum. ACER, Arborvitae and Humber are conducting a long-term climate change and biodiversity study there, using 76 species in 2100 planned plantings. With the participation of student and community volunteers, and community funders such as TD Friends of the Environment and Rotary, we teach proper planting and follow-up monitoring using protocols that support the UN Biodiversity Strategy. The data tracks success and growth rates over time. We are now analyzing the results of the first three years.

ACER depends on trained community volunteers to undertake and maintain programs. We truly appreciate their time and interest, which makes it all possible. We are also grateful to the funders who support the volunteers' long-term commitment to community-based environmental monitoring.

* * * * *

ACER undertook this conference initiative so that all could share their concerns in data collection and management. We believe that through working together, we can move forward into this new millennium, and make it possible to share the results of our efforts with the general public.

Presenter Biography

Marianne Karsh is a biologist as well as the founder and director of Arbor Vitae, an organization dedicated to teaching environmental values to children, youth and adults.

Summary – Marianne Karsh

I will present some case studies on how ACER works with the community in a truly proactive way. Canada is fortunate to have more than 80 biodiversity plots. A large number of these SI/MAB Biodiversity Observation plots (>25) exist across a Southern Ontario transect along and adjacent to the Niagara Escarpment, from Wiarton at Georgian Bay, to Long Point along Lake Erie. Over the last 10 years, ACER has put in a number of paired research and educational Biodiversity Observation plots in such locations as Wiarton, Mono Cliffs, Boyne River, Albion Hills, and the Royal Botanical Gardens. Sugar Maple is predominant in all of Acer's Southern Ontario stands. Sugar Maple is one of the most important tree species in Eastern Ontario and Quebec in terms of wood products and maple syrup production.

To understand the important impacts on biodiversity in ACER's Sugar Maple plots it is important to place them in context of the global biodiversity. If we look at the

biodiversity of tree species in international sites, we can see that a bioreserve in Asia has more than 50 families of trees, compared with one of our most diverse stands at Long Point (Ontario's Southern most tip on Lake Erie), with 12 families. The difference is a clear indication of how much heat plays into biodiversity.

The number of families is reduced in Central American and Canadian plots. As the climate gets colder, the number of families is much reduced. One plot in northern Quebec represents only a pure black spruce stand, and therefore has only one family.

That's a benchmark – all plots across the globe can be compared to that benchmark. This is biodiversity as it is now. We will look at what may happen with climate change.

One of ACER's sugar maple stands is 100% pure sugar maple, also with only one family, while others have a relatively high proportion of sugar maple (>40%), but mixed with other species. The number of families of trees in mixed sugar maple plots in Ontario range from nine, to only four in the Toronto Zoo plot. That's a plot that has had a lot of people going through it; we can see the impacts of people trampling in the understory.

Our graphing picks up differences in terms of impact and management. Managing for one dominant species such as sugar maple or black spruce reduces the amount of biodiversity on the site, as we can see. More diverse forests are thought to be more resistant to disease and resilient to changes in climate, and therefore healthier in the long run.

What's important in urban diversity? At the Humber Arboretum – unlike the other plots which I just showed you in mature, established stands – ACER's climate change learning lab is in a newly established stand, where we have planted young trees. It is a one-hectare standard plot, subdivided into 25 quadrats. We have some climate change Carolinian quadrats with 12 or more families (mimicking Long Point), others with a mid-range (7 – 11 families), and then forestry quadrats (with 1-3 families). We have had a lot of browsing from deer and mice. In urban landscapes we also have people walking through the area and pressures from development, factors that bear into biodiversity.

We heard from Don MacIver about the potential impacts of a warming climate. What's quite unique about this Humber site is that we're planting so many different species. This is probably the only community planting project in existence that has trained students and young people to plant so many different species of trees and shrubs. We have chosen species to plant in our Carolinian quadrats that are more common to growing zones to the south: trees and shrubs that grow well, for example, in Washington, D. C. Since Toronto is already experiencing a heat island effect (i.e. experiencing a local temperature increase), then growing conditions may well be similar to these warmer areas. As we monitor these trees over time, we will see how they're doing in relation to changes in climate.

We've also developed protocols: How do you monitor? What's the best way to measure over time? We are taking a proactive approach.

I'd like to end by saying that to ACER's credit, we've had tremendous community involvement. Many people are involved, elementary, secondary, university students, and adult volunteers. We've seen tremendous work from all of them.

5. Expert Panelists – Presentation Summaries

5.1 Andy Kenney, Senior Lecturer, Urban and Community Forestry Faculty of Forestry, University of Toronto

Urban Forest Monitoring - "Neighbourwoods"

Presenter Biography

Andy Kenney teaches and researches at the Faculty of Forestry at the University of Toronto. He investigates the impacts of urban development on woodland ecosystems, and the relationship between urban design and the extent of urban forest canopies. He is particularly interested in strategic planning in urban forestry and the involvement of stakeholder groups in the management of this important natural resource. He was the principal author of the recently released Canadian Urban Forest Strategy.

Summary

The Canadian Urban Forest Strategy defines the urban forest as *"trees, forests, greenspace and related abiotic, biotic and cultural components in and around cities and communities. It includes trees, forest cover and related components in the surrounding rural areas (peri-urban forests)."*

I am looking at things a bit differently in my presentation: the same issues, but with a slightly different context. While many speakers will focus on the monitoring and ultimately the conservation of woodlands and other natural heritage features outside of our "built-up" areas (the peri-urban zone), I will address monitoring in the part of the urban forest within these intensively developed zones.

To 80% of Canadians, the urban forest is their most immediate contact with "nature". The trees, shrubs and related biotic and abiotic elements of the urban forest provide a "sense of place" and relief from the harshness of the built form. Arguably more

important are the many environmental, economic and social benefits that our urban forests provide. These include improved air quality, energy conservation, storm-water attenuation, wildlife habitat, noise attenuation and so on. Property values in well treed communities tend to be higher, and properties sell more quickly. Recent research in the United States suggests that consumers prefer to shop and "part with their money" in commercial areas with trees. Well-treed school grounds not only make more interesting places for children to play, they will be less susceptible to harmful UV radiation. So, if we accept for the time being that healthy urban forests are desirable, where do we stand in terms of stewardship in this important part of our inhabited landscape?

Some of the unique urban forestry challenges we face are:

Biodiversity: Species richness in the tree and shrub component of the urban forests of most communities is high; usually much higher than the surrounding "natural" forest. However, we have relied far too much on relatively few species, most of which are clones selected for specific traits. A landscape architectural or horticultural approach rather than an ecological approach to urban forestry has left us a legacy of Norway maple, green ash and honey locust clones dominating many parts of our communities. I needn't expand on the significance of this problem to this audience; let me simply leave you with three terms: Dutch Elm Disease, Asian Longhorned Beetle and Emerald Ash Borer.

Land and tree tenure: Many people think of the urban forest as the jurisdiction of the municipality. In reality, the community's parks and recreation department (or whichever civic body is responsible for trees) is only a minor player. Between 80 and 90 percent of our urban forests are located on private property. Much of this is in our own front, back and side yards. Not only are these the most common growing environments, they are also the most productive. Streetscapes, be they the so-called "tree lawn" between the curb and sidewalk or the holes in concrete that form the habitat for so many trees, often preclude trees from reaching their genetic potential. So, urban forest conservation must involve the entire community to some level; it is not the sole responsibility of the municipality. While most of the urban forest is owned by private individuals (of course the entire urban forest is owned by private individuals since, as tax-payers, we also own the municipally managed trees) this is far from a homogenous group.

Fragmentation of ownership: You are most likely familiar with the challenges associated with conservation in a landscape dominated by small, privately-owned parcels of land. Balancing private-property rights with the "public good" remains a major challenge to nature conservation in southern Ontario. Now imagine the land tenure of a typical city or village. The residential zones will be comprised of lots, each 10 – 15m wide, under private ownership. These owners will have a wide range of opinions about trees in their personal environment. These opinions will range from a passionate love for trees fueled by knowledge of their ecological roles as cited above, to simply a recognition that they somehow make urban life more tolerable. The neighbours, on the other hand,

may be equally passionate in their disdain for the shade-casting, leaf-shedding, foundation crumbling pests. And not far along the boulevard, you are equally likely to encounter another resident who is unaware that they share the neighbourhood with trees! Engagement of this diverse pool of landowners remains a fundamental challenge to urban forest conservation and management.

Extreme growing conditions: The trees and related vegetation that make up the urban forest grow, for the most part, in very extreme conditions. Confined growing space above and below ground restrict growth. Trenching for access to below ground utilities or for building construction damages tree roots. De-icing salt and other chemicals contaminate soils and injure delicate tissues. Air pollution and physical damage can either kill trees outright or leave then vulnerable to a myriad of insects and diseases ready to take advantage of a weakened tree. Climate change and urban expansion (sprawl and in-fill construction) can only be expected to make this situation worse.

Lack of Knowledge: Notwithstanding the importance of the urban forest and the challenges faces in their stewardship, we know little about this part of our urban infrastructure. Many municipalities don't have an accurate inventory of the resource under the jurisdiction of the municipality and, to the best of my knowledge, none have any detailed information on the 80-90% of the urban forest on private property that makes up the rest of the ecosystem.

So, the challenge we face is to inventory and monitor the urban forest in the face of private ownership, limited (or non-existent) resources and insufficient expertise. How can we get people in communities involved in inventorying trees? The protocol I am about to describe is about more than monitoring – it is about planning and management.

Neighbour*woods*

A number of years ago, Danijela Puric-Mladenovic and I felt that there was a need to harness the enthusiasm that the public has for tree planting, into a much broader approach to urban forest stewardship. We have developed a protocol called *Neighbourwoods* to carry out community based urban forest inventory, engaging lay people to gather consistent, technically correct data in a comprehensive way. The goal is to examine the entire urban forest, and to generate meaningful data that can be applied to a strategy to protect it. As an approach, it is both educational and suitable for strategic management and planning.

As with most inventories, Neighbour*woods* records details about the location of a tree: its species, size, and condition. In the most simplistic approach, the location of the tree is simply recorded as the house address where it is located. Some communities that have applied Neighbour*woods* have taken a much more detailed approach with respect to tree location. The tree is located on a map or an aerial photograph, and this position is later transferred into a computer-based Geographic Information System (GIS). This makes it

possible to create detailed maps which will assist in planning, maintenance, and monitoring of the urban forest. With the advent of relatively inexpensive hand-held computers, it is now possible to record the position of the tree in the field, and immediately transfer this information to the GIS without the need to transcribe the information point by point. While Global Positioning System (GPS) technology continues to improve and become more affordable, our experience is that the accuracy of the inexpensive systems available to most communities is still not sufficient to be of much value in urban forest inventories.

The size of the tree is important for a number of reasons. Larger trees have been shown to have a much greater impact on the environmental services to the community then do small trees. Larger trees also tend to be older, and as such will accumulate more damage. Consequently, monitoring these trees is important to be able to alert authorities if the tree should become hazardous. The description of a tree's size is relatively straightforward. The conventional measurement of diameter at breast height (DBH), or the diameter of the stem measured 1.4 m above ground) is an easy measurement to take in a strongly correlated context with many other important measurements of tree science. In some cases, communities have also chosen to measure, or have estimated, the width of the tree crown and its height.

No inventory could be considered complete without a record of the species of the tree. Species identification in the natural forests of southern Ontario can be a challenge, but when we consider the number of introduced species in the urban forest, the challenge is magnified many-fold. Fortunately, many communities have experienced professionals or amateur botanists within their ranks who can assist with training in species identification.

Trees within the urban forest are usually managed on an individual basis. Consequently, it is important to have a clear description of the condition of each individual tree. Much of the effort that has gone into the development and implementation of Neighbourwoods has focused on reducing the subjectivity associated with assessing tree condition. Trained arborists will often rank tree condition on a simple scale of "Excellent, Good, Fair or Poor." To classify trees using this system with any confidence requires considerable experience. Also, the use of such a scale also fails to provide any explanation about *why* the assessor considered the tree to be Good or Poor. In the development of Neighbourwoods, we have endeavoured to overcome these problems by having the surveyor assess the tree based on a series of condition characteristics using a simplified scale of 0-3 for each. While these characteristics can ultimately be combined into an overall condition rating, details for each characteristic are retained in the database. This makes it possible to create a very detailed description of each tree while reducing the subjectivity and variation among surveyors.

The tree condition characteristics that are included in Neighbourwoods are:

- Unbalanced crown
- Reduced height
- Weak or yellowing foliage
- Defoliation
- Dead or broken branch
- Poor branch attachment
- Lean
- Pruning scar
- Basal scar
- Conk
- Rot or cavity
- Cracks

Time does not permit a detailed description of each, so I'll use the two examples of defoliation and reduced height to demonstrate the ratings:

Defoliation

Rating	Description
0	Tree crown not defoliated (healthy). Allow for minor twig defoliation, which is normal Tree crown not defoliated (healthy). Allow for minor twig defoliation, which is normal in a healthy tree.
1	Between trace amounts of defoliation and less than 1/4 of the crown having lost its leaves - crown slightly defoliated.
2	1/4 to 1/2 of the crown has lost its leaves - crown moderately defoliated
3	More than 1/2 of the crown without leaves - crown severely defoliated.

Reduced Height

Rating	Description
0	There are no signs that tree height has been reduced. Crown has not been topped or pollarded.
1	Less than 1/4 of the crown volume removed.
2	1/4 to 1/2 of the crown volume removed.
3	More than 1/2 of the crown volume removed leaving behind only a few stubs.

We then combine the results on all the factors into a mathematical formula that describes the overall tree condition.

When all tree condition attributes are combined and these are then added to the information about tree location, species and size, a wealth of information becomes available to the community about each tree in their urban forest. This information can then be used to prepare a strategic urban forest management plan for the community, or to develop a long-term monitoring program to assess changes in the structure and function of the urban forest.

5.2 Silvia Strobl, Information Management and Spatial Analysis Unit Ontario Ministry of Natural Resources

Towards the Interoperability of Forest Information: What could OMNR's SOLRIS and Ecological Land Classification Programs Provide?

Presenter Biography

Silvia Strobl is the Coordinator of the Information Management and Spatial Analysis Unit with the Ontario Ministry of Natural Resources Science & Information Branch. She has 15 years of experience working as a science and technology transfer specialist. Over this period she led numerous initiatives for OMNR ranging from intensive forest plantation science, to vegetation management alternatives testing, to development of criteria for significant woodlands evaluation and the production of "A Silvicultural Guide for Southern Ontario's Forests." During 2001-2003 she worked for Ducks Unlimited Canada to develop a conservation program for wetlands in Ontario's forested landscapes. She is a former Chair of the Society for Ecological Restoration.

Abstract: Towards Interoperability of Forest Information--what could OMNR's SOLRIS and Ecological Land Classification programs provide?

The Ontario Ministry of Natural Resources recently released its strategic direction for 2005-2010. Entitled "Our Sustainable Future", the document commits MNR to the Conservation of Biodiversity, State of the Resource Reporting, and a renewed emphasis on science as a basis for policy development and decision-making. The Southern Science & Information Section's Information Management and Spatial Analysis Unit will contribute to this direction by:

- Improving the quality of data available for State of the Resource Reporting in the settled landscape of southern Ontario
- Producing spatial analyses at the landscape scale that integrate numerous data sources in order to better inform resource management and conserve biodiversity
- Facilitating the capture of fine-scale information to improve the scientific basis for integrated landscape management, including natural heritage conservation

The unit is working with other OMNR and conservation partner staff to implement three initiatives, corresponding to each of the above goals (e.g., SOLRIS, the Oak Ridges Moraine Restoration Strategy, and the Southern Ontario Ecological Land Classification). This presentation will explore how these, and future potential initiatives, might facilitate improved interoperability in Information Management Systems among the many conservation organizations in the settled landscapes of southern Ontario thereby moving us towards an enhanced ability to collectively answer the question "how much is too much?"

Summary

I have titled my talk "Towards the Interoperability of Forest Information." By "interoperability" I mean the following. Many of us in southern Ontario, including OMNR and Conservation Ontario staff, consultants and citizen scientists are collecting information about southern Ontario's forests. Are we collecting this information in the same way with standards? For example, do I code sugar maple "Ms" while you code it as "Mh" in your inventory? Are you doing a prism sweep to estimate forest structure, while I measure Diameter at Breast Height for each tree in a 400 metre squared plot? And, are we storing this data about southern Ontario's forests in the same database, and hopefully only in one place? The technology is now available to have a single database about southern Ontario's forests on one server or on a distributed network, but are we taking advantage of this technology? And, finally are we making this data available to others for landscape analysis?

MNR develops and updates its strategic directions every five years. Recently we released "Our Sustainable Future." This direction is a response to new natural resource challenges, including: growing urban development, particularly in southern Ontario, rising expectations to expand outdoor recreation opportunities, and increasing calls for more accessible information, transparency and accountability on the part of government. Three things that the strategy addresses that I think are relevant to this workshop and audience are:

1. A new focus for MNR in a formal commitment to the conservation of biodiversity. Biodiversity is an essential factor for healthy, sustainable ecosystems which makes it a vital focus for our mission of ecological sustainability, thus all that we do in MNR. OMNR has led the drafting of a Biodiversity Strategy for Ontario with input from a multitude of stakeholders.
2. We will be placing more emphasis on science, improving its support for our policy development and for our decision-making processes.

3. We will institute State of the Resource Reporting. This will be public reporting that provides a sense of the overall condition or health of our natural resources and the factors affecting them.

Related to these strategic directions, our Information Management and Spatial Analysis Unit has three goals (see Table 1) with respect to management of information about natural resources, including forests. I will be highlighting three initiatives that we are working on, one for each of goal.

Table 1: Goals and initiatives of the IM and Spatial Analysis Unit of OMNR's Southern Science & Information Section.

Goal	Example of Initiative
1. Improving the quality of coarse scale data	Southern Ontario Land Resource Information System (SOLRIS)
2. Developing capacity for integrated landscape management modeling	ORM Conservation Priority Areas mapping
3. Facilitating capture and accessibility of standardized fine-scale data	Information System for fine-scale Ecological Land Classification (e.g., vegetation type, ecosite)

1. Improving the quality of coarse scale data through the Southern Ontario Land Resource Information System (SOLRIS)

First, we are improving the quality of coarse scale landcover or use data. SOLRIS Phase 1 uses various sources of imagery from circa 2000-2002 to create a standard snap shot of land cover and use for this time period in southern Ontario.

SOLRIS is updating woodlands mapping in southern Ontario. Currently available mapping dates from the Ontario Base Mapping program, and is over 25 years out of date in some places. By updating all woodland mapping in Site Regions 6e and 7e to 2000-02 landscape conditions, the SOLRIS initiative will finally provide us with the data to report on the State of Forests in Southern Ontario.

We are also updating mapping of provincially significant wetlands, and creating new, previously never available, mapping of urban areas. All this work is being done by 15 different people in different offices. SOLRIS applies rigorous rules to the mapping of each landcover or use theme, to ensure consistency in the final mapping product and to permit valid comparisons across municipalities and watersheds.

In southern Ontario, we're drastically changing our woodlands with our land use decisions. You can see these changes if you overlay existing woodland mapping onto current digital photos. Some woodlands may have changed less drastically, but we don't

know the extent of the effects of surrounding land uses (e.g., such as increased disturbance by humans and pets living in adjacent subdivisions) to the composition and ecological function of remnant woodlands. We do know that reproduction success of some bird species is negatively affected in woodlands adjacent to urban areas.

The final SOLRIS mapping products will provide a seamless land cover and use map suitable for State of the Resource Reporting. It will permit us to begin to answer questions such as, "How much has forest cover changed? What land use did the formerly forest cover change to, agriculture or urban development?" If we don't have an accurate method for tracking this change how can we answer this workshop's theme question, "How much is too much?"

This product will be available for southern Ontario by June 2006, hopefully in time for inclusion into the next State of the Forest report, and just in time to begin the next update of this data to 2005-07 conditions.

2. Developing capacity for integrated landscape management modeling as demonstrated by the ORM Conservation Priority Areas mapping

Second, we are developing capacity to integrate numerous relevant data themes in GIS in order to mine all of this information to improve our decision-making capacity. For example, the Conservation Priority Areas mapping we recently completed for the ORM Foundation provides the more than 50 stakeholders delivering land acquisition, stewardship and restoration programs with geographical priorities to focus their important work. In this way these groups can work together towards "knitting" the fragmented landscapes of southern Ontario together again in order to improve ecological function.

The updated mapping produced through SOLRIS is a key input for developing Restoration Strategies. We have produced a first version of this decision support tool for the Oak Ridges Moraine (ORM). The goal of the ORM strategy is to get "the right activities in the right places" in order to conserve biodiversity and enhance options for people's livelihoods at the landscape level. It will also assist the ORM Conservation Foundation to prioritize ecological restoration projects when allocating funding.

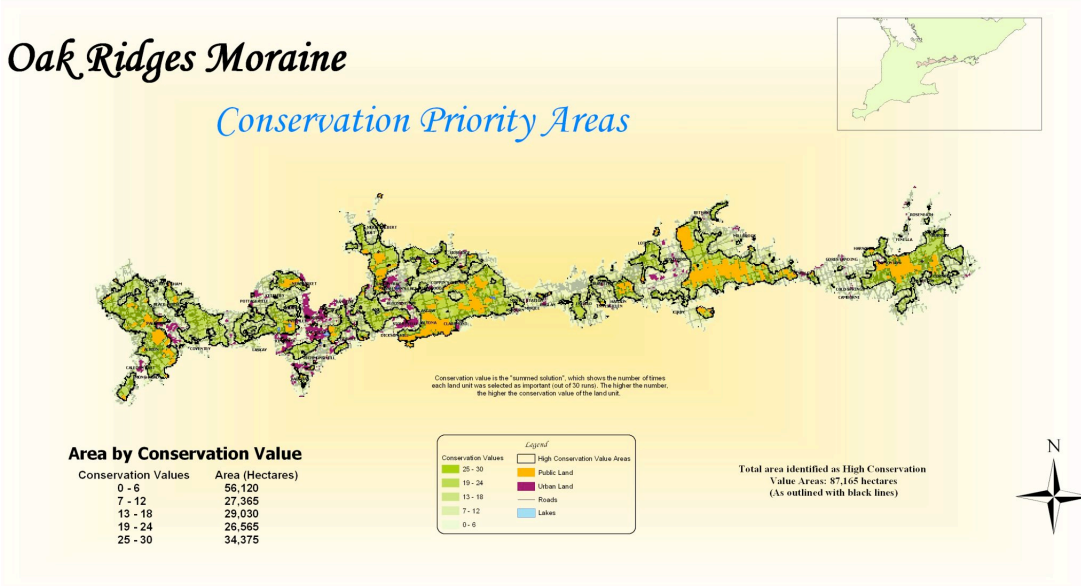
The underlying data themes that were input in this analysis include:

- Existing publicly owned/already conserved land
- Existing forest cover, stratified by soil type with higher weighting to forests on productive clay, silty clay, silty loam and loam soils
- Existing wetlands
- Existing prairie, savanna and sand barren communities, as well as areas with similar soil, moisture and slope regimes that could support restoration of these communities
- Areas of marginal land (that could support restoration and not create conflict with agriculture)

- Areas supporting habitat for species at risk
- Areas with larger average land ownership parcel size

A program that uses a mathematical algorithm was used to optimize several conservation targets in this landscape. Areas that were identified in numerous "runs" of the program as having high conservation value are identified in green on the map shown in Figure 1. Existing publicly owned land is shown in orange, and urban areas are shown in purple. See Power Point.

Figure 1: Map of conservation priority areas for the Oak Ridges Moraine.



Essentially, we could do similar analyses of conservation priorities for any part of southern Ontario with SOLRIS and other available geospatial data. Specific conservation targets (that are relevant to the specific landscape in that part of southern Ontario) could be developed through stakeholder consultations, and could provide input to the underlying data themes used and /or the weightings given to those layers.

Having a comprehensive map of conservation priorities should go a long way toward focusing the various land acquisition, stewardship and restoration activities of the more than 50 stakeholders working in the Oak Ridges Moraine landscape. As well as the coarse scale analysis shown in Figure 1, we also produced a fine scale analysis that permits users to zoom into any of the high conservation areas to determine the restoration priorities for forest, prairie and savanna and wetland ecosystems in that specific area.

In the long term, we would like to have the capability to "grow" landscapes into the future, and map outcomes given various development or management options. This

would provide stakeholders and citizens in a particular jurisdiction with more objective criteria for assessing alternative futures for their community.

One source of data that might help us to "grow" existing forests into the future is OMNR's network of growth and yield data, with over 650 plots established in the Southern Region (i.e., includes central Ontario). Repeated re-measurement of these plots will help us to determine natural forest succession pathways. As well, re-measurement will help us to compare three types of forests:

1. Those being managed through sound silvicultural practices;
2. Those where natural succession (e.g., in protected areas) is allowed to occur;
3. Those subject to bad practices such as clear cutting, or diameter limit or highgrading.

This data will eventually enable us to model land management activities at different scales.

3. Facilitating capture and accessibility of standardized fine-scale data by facilitating the development of an information system for storing and distributing fine-scale Ecological Land Classification (e.g., vegetation type, ecosite) collected with standards by numerous southern Ontario stakeholders

Third, we hope to facilitate the capture and accessibility of standardized fine scale data by many conservation partners in southern Ontario. We are focusing on developing a system and improved database to capture detailed information about the types of vegetation communities using the standard descriptions provided in the Southern Ontario Ecological Land Classification.

Resource managers, consultants and citizen scientists are in the field every day, monitoring the success of restoration activities, mapping wetland boundaries, gathering data for Environmental Impact Statements, conducting life science inventories, and mapping the habitat of species at risk. Many of them are collecting habitat data using the vegetation classification standards outlined in the Southern Ontario Ecological Land Classification. How does OMNR engage these conservation partners to move towards enhanced data exchange and integration of this fine-scale inventory data?

By fine-scale I mean vegetation-type scale data that is normally collected through field visits, or by very experienced air photo interpreters. This information provides more information on the composition and structure of a natural area. So for example, it lets us know whether a particular forest is a Cedar-Hardwood Mixed Forest Type, or a Dry-Fresh Sugar Maple Deciduous Forest Type. This is more detailed information than that provided by SOLRIS (which would only map these areas as mixed and deciduous forest, respectively). Such information is required for site specific planning and management.

Over 30 Conservation Authorities in southern Ontario are collecting resource data slightly differently, and storing it in their own databases. It is currently impossible to

"roll-up" this data for several watersheds or even all of southern Ontario. Similarly, municipalities are collecting data and doing planning at another scale, but for the same areas. We need to develop regional and local networks to engage the conservation partners in southern Ontario to maintain data quality, completeness, and accuracy of key data themes that should be accessible to all. We need to consider how we could collectively move towards "storing the same information the same way, storing it once, and making it accessible to all." Imagine if we had standard fine scale vegetation data available across southern Ontario. We would be better able to evaluate the significance of remnant natural areas based on their species composition, age or structure. We would know where all our sugar maple stands are located, and where all our unique forest stands are located. The Oak Ridges Moraine conservation and restoration priority analysis could have provided more specific decision support to stakeholders, i.e., what kind of forest should this high priority restoration area be restored to? Finally, we would be in a much better position to better answer the question that is the theme of this conference: "How much is too much?"

5.3 Brian Craig, Science Advisor, Environmental Monitoring and Assessment Network (EMAN) Environment Canada

Forest Monitoring with Value Added

Presenter Biography

Brian Craig is a Senior Science Advisor with Environment Canada's Ecological Monitoring and Assessment Network Coordinating Office and is responsible for facilitating the development of a suite of indicators and concomitant standardized protocols and supporting tools for the early detection of ecological change.

His main area of interest is in building community capacity to address biodiversity conservation and sustainable resource use. Brian holds directorships with the Long Point World Biosphere Reserve Foundation and the Canadian Biosphere Reserves Association.

Summary

Networking is one of the most powerful ways of using data from a variety of sources to paint a composite picture of observed complex phenomena. Environment Canada's Environmental Monitoring and Assessment Network (EMAN) role is to create mutually beneficial partnerships to collect, access, integrate, manage, interpret, apply and communicate sound data and information on ecosystem status and trends.

The EMAN has developed 25 Core Monitoring Variables that will work together as a suite, to detect and track change within the environment

The criteria for choosing the Core Monitoring Variable were:

- Monitoring variables are intended to identify changes in ecosystems to trigger more detailed investigations
- Monitoring Variables must be suitable for a range of terrestrial and aquatic sites in ecosystems across Canada
- Monitoring Variables must be cost effective to implement
- Monitoring Variables are preferably a part of and compatible with existing monitoring programs

After extensive consultation with hundreds of EMAN partners across Canada, a suite of core monitoring variables was determined. EMAN core monitoring variables fall into three categories: Abiotic (water quality, stream flow, air quality, soil temperature, permafrost depth, snow-ice phenology and lake sediments); biotic (species richness and diversity, indicator species group, community biomass, community productivity, plant phenology); and cultural (land cover change).

Through extensive consultation with North American experts and Ecological Monitoring and Assessment Network partners, standardized protocols were then developed for each core monitoring variable. The methods also incorporate study design methodologies, and data management and analytical tools. EMAN has also developed a network database for information sharing.

Fifty-seven 20x20 EMAN plots have been established over the past three years by Parks Canada Agency (PCA) and community based monitoring partners. These Ontario Bioregion monitoring plots are located on the Bruce Peninsula, in Georgian Bay and in the St. Lawrence Islands, both inside and outside parks.

There are many forest monitoring plot networks in Ontario: Ontario Ministry of Environment Forest Health Monitoring; Ontario Ministry of Natural Resources Growth and Yield; Canadian Forest Service Acid Rain National Early Warning System and North American Maple Project; National Forest Inventory; and a number of EMAN plots established by Biosphere Reserves, Model Forest, and a host of community based organizations, including ACER.

What should the path forward for Ontario forest plot monitoring be? Can we establish a network of networks? The objective of such a network could be data acquisition for researchers via a central or distributed database system, and information sharing of status and trends reports, exotic species updates, information bulletins (i.e. OMNR Forest Health Bulletins).

5.4 Mark Rowsell, Geographer
Mapping & Information Group,
Eastern Ontario Model Forest (EOMF)

Rural Forest Monitoring: An Eastern Ontario Perspective

Presenter Biography

Mark Rowsell, a physical Geographer, is a graduate of the University of Waterloo and works in the Mapping & Information Group at the Eastern Ontario Model Forest. He is responsible for the monitoring and reporting program looking at the state of eastern Ontario's Forests. Other projects of interest include mapping significant woodlands in eastern Ontario, conducting research on the relationship between forests and water, and updating forest cover information.

Mark is an active volunteer, holding positions on the Grenville Land Stewardship Council, Limerick Forest Advisory Committee, and the Ottawa Forests and Greenspace Advisory Committee.

Summary

The Eastern Ontario Model Forest (EOMF) is a non-profit environmental organization that promotes sustainable forestry in the Great Lakes St. Lawrence Forest Region. It was founded in 1992 by four strong partners: the provincial government (MNR), the federal government (CFS), Aboriginal groups (Mohawk Council of Akwesasne), and private industry (Domtar, Inc.). The remainder of governing partners are private landowners: there is a strong membership of over 350.

EOMF is one of 11 model forests across the country, each representing a national forest region; collectively they are known as the Canadian Model Forest Network. It is also part of an international network of 31 model forests in 14 countries throughout the world.

EOMF conducts work in the Great Lakes St. Lawrence forest region, with a focus in eastern Ontario. Our role is to facilitate decision-making, and provide advice about significant woodlots. We educate, host events, conduct and report on research, support partners, and mobilize conservation efforts.

Forest biodiversity is monitored in rural forests at several different levels of organization:

ecosystem, species, and genetic. There are many stakeholders, and different levels of monitoring that occur at different scales, with a variety of objectives. The rural area in eastern Ontario is important because it comprises the majority of the landscape-dictating landscape structure and pattern.

Forest monitoring is important for several reasons. It provides both historical and current context data necessary for analysis and determination of trends. This monitoring data helps determine the type, time and quality of land-based information. It helps us determine what type of information is necessary for scenario planning; where we want to go. It provides the status and trends on forest health, which helps determine how we are doing relative to the ideal future forest condition.

Good data-gathering provides the basis for developing strategy. The future is data scenario planning: where we want to be. What happened in the past? Are there invasives? What pressures do we want to predict?

How is monitoring today different from in the past? Previously, forest mensuration and inventory was driven by timber value and the forest industry: only forest attributes were collected. Mainly government agencies were involved, and forest monitoring was rarely conducted on private land. The tools available for monitoring were limited compared with today's (GPS, GIS, the Web). Present-day monitoring has changed in both its methods and its goals. Forests are now valued for environmental, social and economic (including NTFP) values. The forest ecosystem as a whole is recognized as important, as well as the trees themselves. This interest requires a full landscape inventory. There are a greater number of stakeholders, including private woodlot owners. And we now have new technologies available to facilitate monitoring and analysis.

In eastern Ontario, forest monitoring is being conducted by many stakeholders. Inventories and observations are being made. EOMF carries out monitoring in a diversity of locations, using a variety of approaches. We are involved in projects in parks, on municipal lands, on industry properties, on established plots, on crown lands, and in conservation areas. We partner with government to monitor long-term health plots. We work with volunteers acting in the role "citizen scientists." We are also involved in forest management and certification with industry, landowners and government, as well as projects on private land and in backyards. Working with landowners is important, as private land occupies 90% of the landscape. However, only a very small percentage of private land is currently monitored.

In terms of methods, biodiversity information is collected at field levels, based on observations, along with aerial and satellite information. The information gathered, however, is not yet standard. Different objectives and financial resource are reasons for compromising on why some things are captured and others are not. The current trend is to record a field observation using a web based mapping program, making it possible to standardize input and recommend a method.

In terms of data, both the MNR South-central Forest Strategy and the EOMF Forest Science Strategy identify forest data as a top priority. In Eastern Ontario, the last forest inventory was done in 1978 – pre GIS, and there is a digital database. The current MNR data for Eastern Ontario for forests (the Natural Resources Values Information System, or NRVIOUS) is from 1988. There are no attributes for this data. SOLRIS (the Southern Ontario Land Resource Information System) will provide more current landscape level information, and replace NRVOUS by 2006-2007, to give us a clearer picture of what things were like in 2000. We are limited in current forest detail.

It is difficult to assess forest quality in terms of species composition and stand dynamics. Forest quality measured in terms of connectivity, shape, and size is possible, but reflects historical status; species richness, however, is difficult to impossible to do. The MNR data was approximately 30-40% complete through SOLRIS in eastern Ontario, at the time this presentation was made.

What about data sharing? There are silos of data, but they are not always intentional. Web-mapping helps, and the advent of shared databases (P2P) is good for sharing data. Another issue is different formats, with meta-data – data about the data – sometimes available, but sometimes not. There are more users of data than creators, and there are also ownership issues. One barrier to data sharing can be cost. In Ontario, the MNR manages a data warehouse where data can be placed. It is operated as a subscription service, however, and to extract data the subscription fee is $1,000, which can be expensive for some groups.

Networks

Here are some examples of networks of interest:

1) The Observer Network – a group of woodland owners who participate in a biodiversity monitoring network. It works to capture some information at the private woodlot/landowner level. The network is based on the principle that indicators can be used to monitor environmental conditions. The approach is to look at people's back yards, and ask, for example, Do you (or not) have salamanders in your back plot? (a good indicator of adequate old growth – the Observer Network identifies species whose presence is an indicator of particular aspects of forest health).

2) Who's Doing What? – a new website called www.whosdoingwhat.com is now available to help people find similar organizations and projects in eastern Ontario. The site can query projects by theme and geographic location. Designed on a bioregional basis, its goal is to promote partnership and transparency, while reducing duplication for people seeking biodiversity information. This website was developed in partnership with the Grenville Land through funding from the MNR.

3) The Stewardship Council – may translate into something that goes across Ontario through the Ontario Stewardship Program.

4) The Watersheds Information Exchange (WIX) - allows members to enter data, download data from many sources. Launched this week, and membership is free.

5) State of Eastern Ontario's Forests – Uses a suite of criteria broken down into indicators, quantifiable measures of forest health: biological, economic, social health, forest cover/type by watershed, organized by age.

6) On-Line Forest Management Tool: Property Management Wizard – a new project. The Forest Project Incentive Program, which offers a tax incentive for sustainable measurement, is now on line. Owners can use it to map their woodlot, record objectives, prepare an inventory plan and record results. We can then ask them if we can use their information to map what's in their yard. This program conforms with the objectives of private woodlot owners, and presents data; it is not a prescription tool. However, it does satisfy many of the requirements under the Managed Forest Tax Incentive Program (MFTIP).

* * * * * *

What does the future offer? I think that in monitoring rural biodiversity we'll see the wireless Web linked to GPS standardized protocols, with data shared through the Forest Info Portal (MNR), a provincial place where all information can be held and disseminated. SOLRIS sets a really important landscape standard with a forest component, with ELC. We will see landscape data (terrestrial, aquatic, constructed) managed together, and married to incentive programs such as MIFTIP with biodiversity monitoring. And I hope to see funding available to sustain and market these monitoring programs. Interested in the State of Eastern Ontario's Forests?
Check out http://sof.eomf.on.ca

6. Luncheon Address

Gord Miller
Environmental Commissioner, Ontario

Choosing Our Legacy

Summary

We recognize that we have reached an environmental situation which constitutes a crisis. The global use of ecological systems is a major cause of humanitarian failures: the fabric of our ecological systems is threatened or failing. The North American paradox is that our economic success comes with the realization that our economic activity is unsustainable, and even self-destructive. Despite this awareness, we are unable to change our ways. Why is there so much resistance to change? The solution to this public policy impasse may lie within educational curricula.

The perception underlying resistance to environmental change is that it will cost us money, jobs, wealth and our lifestyles. Wealth, however, is not itself the end of economic activity. Wealth is the means by which we improve the quality and security of life. Pursuing wealth at the expense of environmental quality is entirely counterproductive to this end.

Canadian values traditionally offered us a measure of the heritage we left to our children and grandchildren. A degraded environment is not consistent with this tradition. Are we prepared to face the issues? How can we act locally? We must not be distracted from what matters. It is important to keep a focus on the landscape and ecosystem levels of organization. Two important allies in effecting change are transparency and public consultation.

What will our legacy be: will we change our ways, or leave the problems we are creating to future generations? We still have a choice, but future generations will not have the same options we have. One thing is for certain: we *will* leave a legacy, and future generations will judge us by it.

7. Afternoon Session: Seeking Synergy
Notes and Interview Matrices from Afternoon Sessions

7.1 After Lunch Plenary:
Insights and Priorities drawn from the morning

The afternoon session of the conference opened with an "open-air" plenary discussion. The facilitator for the workshop section of the conference was Randy French of French Planning Services.[3] This whole-group forum, with the participants seated in one large circle, gave everyone an opportunity to synthesize the information offered by the morning's series of presentations by experts in biodiversity and monitoring.

To begin the interactive portion of the event, Randy invited group members to highlight salient points from the range of the presenters' material, asking the question, What did you learn today? Selected points were recorded on a flip chart. The highlights of the "open air" plenary follow.

Main ideas: How can monitoring and data-gathering address climate change, and influence learning and behaviour? (does this question belong here?)

Session Theme Question: What did you learn today?

- Climate change is happening.
- The urban forest is affected, not just the rural forest.
- Interpretation of data on climate change is needed, as well as education.
- It is not enough to have data accessible: it must be used.
- "Human management" is called for in dealing with climate change.
- We must educate for the future legacy.

Summary of Comments gathered:

Main ideas: Gathered data should be accessible, streamlined, incorporated and shared. There is a need to work towards a set of accepted standards. Given the urgent nature of such environmental challenges as climate change and invasive species, good data could

[3] Since 1997, Randy French and his company, French Planning Services, Inc., have provided a full range of planning services, from environmental inventories to impact assessments, group facilitation and resource and municipal planning. Recent projects and workshops include preparation of Municipal Resource Information Packages, Lake Plans, First Nation consultation, and the facilitation of workshops on Natural Heritage Areas and Features, Water, Shoreline Protection, Natural Heritage, Living with Lakes and Environmental Action Plans.

provide an important set of "defensible" evidence in support of planning and action. Collaboration is an opportunity to address education and next steps.

- Existing data needs to be incorporated and shared.
- Data should be streamlined.
- Accessibility of data is important.
- We must distinguish between data and information.
- Working together would be facilitated by accepted STANDARDS!
- All data must be groundtruthed.
- There is a need for more volunteers.
- Science and data should be used for 'defendable' decisions.
- Data could/should be used for a wide range of decisions, including planning, etc.
- There is a sense of URGENCY in this work, given the presence of alien species, climate change.
- We must make use of the data and ACT!
- We should address education and next steps.

Following this review, participants framed questions they felt to be important to ask about data and the process of data-gathering as they proceeded.

Main ideas: We need to frame a vision of what we wish to achieve and a rationale for our objectives. Sources and reliability of data need to be assessed and assured.

Questions:

- What's the goal?
- Why? What's the rationale?
- Where you get the information from (your own data)?
- How strong is the knowledge?

The next step in the whole-group process was to begin to identify priorities emerging from the discussion. At this stage, participants offered a short list of priorities, which were noted by recorders.

Main ideas: There is a need to identify key problems in order to define our work's ultimate purposes and set goals. Data-sharing requires free or reasonable access.

Priorities:

- We need to determine a common goal, and what legacy we leave behind
- Identify of the primary problems is
- Free access to data, free base share
- If not free, be accessible price-wise

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7.2 Two Workshop Themes: Sharing Data, Working Together

7.2.1 The Interview Matrix Technique

At the conclusion of the afternoon plenary session, the facilitator broke the group into two circles to prepare for an intensive work session. Randy introduced and explained to the participants the use of a method called the *interview matrix technique.*

This timed, rapid information-exchange tool allows a maximum of information to be gathered from simultaneous working groups in a minimum of time. By pairing rotating "interviewers" and "interviewees" in sub-groups, the method ensures every participant a chance to contribute ideas on selected themes in a one-on-one basis. The reporting-back process then allows participants to summarize and organize the flow of ideas to contribute to followup planning.

Each of the two circles was assigned one of two working themes:

- Theme One: Sharing Data: How we might develop a network to share data on forest biodiversity?
- Theme Two: Working Together: How we might more effectively work together to collect and share data on biodiversity?

The Method in Action

Circle 1 (Theme 1) members were handed yellow theme work sheets. Circle 2 (Theme 2) members were given pink theme work sheets. The theme sheets contained the main theme question (above), followed by four interview questions. In each circle, participants counted off from one to four, and were asked to remember their numbers.

The two circles then subdivided into smaller work groups of four people, one with each of the numbers 1, 2, 3 and 4. Members of these two theme sub-groups were asked to choose a location in the room where they could conduct their "interviews." For a total of 24 minutes, or 8 minutes each, participants conducted three successive one-question mutual interviews, asking the theme question that corresponded to the number they had called out. Each group member asked the same question of each of the other three group members, who in turn asked their question of their partners. Interviewers noted their names at the top of the question sheets, and recorded the responses from their three interviewees. A total of eight questions were asked during the course of the two simultaneous sessions.

In the next step of the process, the 1-2-3-4 number groups disbanded and reformed into new groups of people sharing the *same* number. These two sets of four groups were asked to select group leaders and reporter/recorders, and discuss the answers they had gathered from their interviewees. Responses to the eight theme session questions were

summarized and recorded on flip chart paper for presentation to the theme groups. A spokesperson from each question group was given four minutes to report the group's findings to their whole theme group.

7.3 Introduction to Interview Matrix Sessions

The overarching theme of the day's discussion was the pursuit of best practices in data-gathering and data-sharing to assess human impacts on land, and the impacts of climate change on biodiversity. Facilitator Randy French opened the workshop portion of the afternoon with a reiteration of the conference's objectives.

The impacts of land use and climate change have made the need to share data a high priority. A central aspect of this event is an opportunity to share best practices, to celebrate successes and to seek commonalities in tree measurement data.

There is a need to establish a benchmark for measuring forest biodiversity. This benchmark could be an agreed-upon correlation of data used in historical data systems.

Objectives for the afternoon's discussion are:

- sharing information
- showcase best practices
- put in place a process for collaboration among practitioners
- standards for measuring forest biodiversity
- determine priorities and next steps

7.4 Theme 1: Sharing Data

The first of the two conference workshop themes involved half of the participants in discussion and debate on how best to make data gathered speak a common language, address common goals, and evolve into a coherent network.

How might we develop an Ontario Forest Biodiversity data-sharing network?

Overview - There are many good models or techniques for gathering data to measure forest biodiversity. However, tools for analysis cannot be successfully used until there is a common way of collecting, storing and sharing data**.**

The purpose of this theme was to explore what our information needs are and to identify the barriers that prevent us from sharing data. It also served to help identify current standards and protocols that are used to collect and share information, and to discuss what we have to do to establish a network to share information.

7.4.1 Theme 1: Interview Question 1- Summary Results of Interview Matrix Information Needs

What are our most urgent (top three) information needs? (i.e., what information needs to be collected or shared now?)

Main ideas: Key needs identified included community and landscape mapping in their many aspects, and consistency and quality in the production of data. There was a clear sense of a need for improved funding to support this work, as well as a "champion" to foster leadership and initiative in addressing gaps. Networking and training were cited as essentials in strengthening the monitoring community.

- Community mapping
  - Heritage
  - Social
  - Economic
  - Environmental
  - Recreation, etc.
  - Land tenure?
- Landscape mapping
- Landscape & indicator species
- Data scales & priorities
- Consistency in meta-data
- Data quality/accessibility/defendibility
- Baseline of standardized data/meta-data
- Funding
- "Champion" leadership and initiative
- Networking via conferences, websites, listservs, forums, etc.
- Training and networking across disciplines

7.4.2 Theme 1: Interview Question 2 – Summary Results of Interview Matrix Barriers to sharing data

What are the barriers that prevent the sharing of data?
How do we overcome them?

Main ideas: Barriers to efficient use and sharing of data included uncertainty in identification of sources and their data-gathering objectives, access limitations imposed by owners (including cost), and insufficient technology. There was recognition of resistance to data-sharing in certain cases, due to sensitivity of content.

- Who has what?
- Why did they collect it? (document meta-data, often absent confidence/reliability)
- Limitations enforced by the owner
- Lack of technology
    - Standardization
    - Time
    - Streamlining
- Cost of data sharing and data itself
- Resistance to data sharing
- Data sensitivity
- Policies and workplace environments

7.4.3 Theme 1: Interview Question 3 – Summary Results of Interview Matrix Standards and protocols

What type of standards/protocols for collecting and sharing information currently exist?
What basic information is needed to develop an approach on collecting and sharing data on climate change?

Main ideas: Effective data-sharing would be enhanced by common motivation, goals and values (e.g., assessing and addressing climate change). In practical terms, establishing a set of common parameters including baseline information, indicators, simplicity, ability to replicate, and design methods focused on end-use producing 'deliverables' and findings adaptable for the general public would produce more readily exchangeable findings. Transparency and a clear intent to produce data for future action were cited as valuable attributes in working in tandem on climate change.

- It is beneficial to identify common goals and values, and the motivation to collect data.
- Basic information should include:
    - Time and space: a scale adaptable perspective
    - Baseline: What are you measuring?
    - Agreement on indicators
    - Simplicity
    - Ability to replicate
- End-use should be part of data-gathering design:
    - Who uses data?
    - Design to lead to "deliverables"
    - Relevant to general public
    - Attain vs. measure
- Approaches:

- Transparent assumptions
- Test hypotheses
- No bids
- No agendas
- Website
- Create information that leads to actions

7.4.4 Theme 1: Interview Question 4 – Summary Results of Interview Matrix Actions towards an information-sharing network

What has to be done to establish an information-sharing network?

Main ideas**:** Building a network from a set of disparate data-gathering sources needs coordination. This should begin with a review of current sources, the focus of their research/existing data, and needs yet to be addressed. Government commitment would aid in building cooperation and effective data-sharing among many players. Standards and accessibility are issues that must be central within a coordinating effort. Establishment of a core coordinating group and a central web-based database would make networking and knowledge-sharing possible among participants investigating different aspects of climate change. The issue of property rights, and incentives to collaborate need to be addressed.

- Coordinating
  - Who is collecting what
  - Of existing data
  - What are the data needs
  - (Government commitment)
- Development of standards
  - Data quality
  - Training
  - Certification
  - What is collected and how
- Accessibility to data and software
- One coordinating group with main data website
- Centre for data access for those without own web access
- Promotion/communication/education of the network to all groups collecting data
- Incentive structure to collect and maintain data, share turf – (recognition, financial incentives)
- Addressing intellectual property rights (building on others' data sets)
- Some data accessible to all the public

7. 5 Theme 2 – Working Together

The second workshop theme involved half of the participants in a sharing of best examples and views on how to overcome existing barriers to collaboration. The focus in this theme group was on identifying the features of successful partnering as well as sources of information that might contribute to a clearer picture of forest biodiversity undergoing climate change effects.

How might we more effectively work together to collect and share information on forest biodiversity?

Overview - There are many different agencies, organizations and individuals that are committed to the collection of information on forest biodiversity. A common approach to the collection and sharing of information will advance our capability to understand climate change. The key to success is improving the way we work together.

This theme identifies the key ingredients that are needed to work together effectively and the barriers that impact our potential partnerships. We will identify examples of how we work together and discuss common factors of these approaches. We will also identify databases that are currently shared and identify new information that is needed to understand future impacts of climate change.

7.5.1 Theme 2: Interview Question 1 – Summary Results of Interview Matrix <u>Defining successful data sharing</u>

What are the most important ingredients to the successful sharing of data?

<u>Main ideas</u>: A common purpose (and even excitement), followed by standardization and data accessibility were identified as the main ingredients of successful sharing. Good communication to achieve and maintain these goals is a first requirement.

- Common purpose and goal
- Create excitement
- Standardization
    - Meta-data – how data will be collected
    - Data format: "Like" technologies, same program or shareable format
    - Data is maintained, current and secure
    - Data cannot be altered
    - Collection
        - Method – relevance
        - Measurements
        - Quality – fosters confidence in data
- Availability
    - Public

- Free
- Easy access
- Good download
- Acknowledgement given

- Communication
  - Open
  - Descriptive

7.5.2 Theme 2: Interview Question 2 – Summary Results of Interview Matrix

Barriers to working together

What are the barriers to working together successfully?

Main ideas: Perceived barriers to effective network-building were a lack of understanding of others' viewpoints, resistance to sharing (turf protection), concerns over job security, and competition among players for limited funding. Insufficient time and resources to devote to this work, as well as a lack of communication to streamline sharing capacity were also cited as key impediments to improved cooperation.

How can we overcome them?

Main ideas: Collaboration and network-building would be well served by strong, empathetic communication to come to a better mutual understanding of one another's views, followed by negotiation to address and overcome identified barriers. Education was highlighted as an important way to build common ground between different groups and types of people. Better communication across levels of government as well as establishing funding with a view to addressing long-term problems (such as climate change) would greatly strengthen the potential of monitoring groups and agencies to work together. Entrenching environmental values as related to human health within government policy, and championing this notion to the public would create additional support for the ongoing work of monitoring research.

Barriers to working successfully were identified as:

- Not understanding others' viewpoints
- Resistance (ex: conflicting interests, egos, mistrust)
- Turf protection and job security
- Funding competition
- Lack of time and resources
- Lack of communication: results in repetition, different languages and data systems

Ways of overcoming these barriers could include:

- Strong communication (being empathetic and understanding others' point of view)
- Finding common ground between different groups and types of people (ex: education background)
- Identifying cultural barriers:
    - Competition between levels of government
    - Initiatives are too short-term with governments
    - Government funding: provincial and federal working for the long-term
- Negotiation to break down barriers
- Standardized software and free accessibility
- A champion with a bold, strong attitude to popularize to the public
- A written comment on Theme 2, Question 2:
    - Barrier: too many short-term initiatives i.e. constant change in governments and their agendas
    - Solution: Draft and implement an "Environmental Constitution" with a link to Human Health, for politicians; a policy document to provide common direction and legislation (from national and local levels) that is long term and hard to change. For example, Canadian health care or the American "right to bear arms" are untouchable sacred cows. **It should be the same for environmental values,** and governments measured on related contributions. (Ron Gould, MNR)

7.5.2.1 Theme 2: Interview Question 3 – Summary Results of Interview Matrix Success factors in collaboration

There are many good examples of agencies or people working together. What are the common factors in these examples?

Main ideas: Important factors contributing to effective collaboration begin with common interests and goals, followed by a strong sense of working as a team. Suitable skills and expertise, combined with good communication and well-defined guidelines make networking across diverse groups possible. Success also depends on the availability of resources: information, funding and capacity.

Good examples:

- Red Cross, Churches, Guides and Scouts, teachers in the assessment of students (mechanisms, formal [report cards] and informal/process to exchange information)

Common factors in effective collaboration were identified as:

- Common goals, interests, intent
- Enthusiasm and willingness

- A strong sense of working as a team
- Good communication: open, frequent, 2-way, common language
- Sufficient expertise – skills base
- Well-defined guidelines
- Background information/familiarity with partners – or a way to become familiar
- Objective: process to meet
- Free information
- Sufficient funding, resources and capacity
- Followup: consistency, currency, appropriateness
- Negotiate a compromise
- Motivation for collaboration: what reason do I have to give up/share info? Reward
- Relationship-building – trust and willingness (ties to common language)
- Geographic location – specific easier to share information than broader scope
- Rewards – if I share, will I get something in return? – must know I will gain

7.5.3 Theme 2: Interview Question 4 – Summary Results of Interview Matrix Shared data bases and benchmarks for climate change data

What information or databases are we currently able to share?

Main Ideas: Databases with currently accessible information include:

- Provincial and federal ministries (Environment, MNR, etc.)
- EMAN, plot data of forests
- Ontario Breeding Bird atlas, Breeding Mammal Atlas, Christmas Bird Count, NASA, Ontario Stream Assessment Protocol

What other data should we collect now to set benchmarks to understand future impacts of climate change?

Main ideas: Data that needs to be collected in order to set benchmarks and understand future climate change impacts includes: human impacts on natural areas, social data on private landowners' motivations for maintaining and managing natural resources on their property, information on forest composition across Ontario, responses of indicator species to stressors, human health trends, and Arctic and Antarctic ice and melting patterns.

- Human impact studies on natural areas
    - Assessing current data, analyzing where gaps/overlaps exist
- Social data on private landowners' motivation for owning and managing natural resources on their property
- Information on forest composition across Ontario
    - Fossil records

  - Lake sediment
  - Natural history
  - Interpretation of long-term climate changes
- Response of keystone/indicator species to environmental stressors – causes of mortality
- Human health trends (e.g., esp. respiratory problems, skin cancer, etc.)
- Arctic (and the Antarctic) – ice floes, melting season

Additional Comments/Feedback To Interview Summaries

- More information on the Arctic
- Data index (posting information)
- Demographics
  - Who do we focus on?
  - Impact on data collection
- Look at pollution
- We need new processing of old data to seek a new perspective
- We need people from different areas of expertise
- Key words:
  - Willingness
  - Collaboration
  - Synergies
  - Flexibility
  - Recognition
- Not to limit on:
  - Funds
  - Government changes
- Essence: EDUCATION
  - We need to forecast our own needs
  - Don't destroy nature's capacity to process our waste
  - Planning for a sustainable future: how do we do it?

8. Plenary Wrap-up Session: Burning Questions, Action Items, Next Steps

The last activity of the day brought all the conference participants back into a plenary session. This final session gave everyone an opportunity to raise unaddressed questions, confirm proposed action items, and identify next steps they wished to see emerge from the day's deliberations

In this session, conference participants were first invited to proffer any "burning questions" that arose from the their day of learning and working together. There was a notable leap in this part of the discussion from concluding questions on monitoring and data gathering to the broader perspective of behaviour and lifestyle changes in the face of multi-faceted environmental change.

8.1 Burning Questions

Conference participants posted four 'burning questions' at the conclusion of the day's deliberations.

- What primary problems and data should we focus on for monitoring?
- What constitutes priority data?
- If good networking needs free or freely available data, how can we address the issue of money/cost? What about shareware?
- What can we *do* to bring about needed lifestyles changes on an individual level*?*

8.2 Keys to Success

The next part of the process focused on highlighting key requirements for data sharing and improved networking. Participants indicated that their priorities in this area included:

- Love of and curiosity about Nature
- Being positive
- Collaboration
- Sharing data
- Taking local information
- Gathering data to convince municipality
- The issue is not the amount of data, but rather to use it and to make sustainable improvements.
- Educating and changing life style
- Recognition
- *** Keeping in touch: Participant list (emails) and conference information

8.3 Next Steps

The culminating exercise in the group working session was an exploration of where this representative sector of the biodiversity monitoring community wishes to go in the near future. Let by the facilitator, group members engaged in a discussion to outline practical actions that would advance the work they wish to see become more easily shared and applied.

Suggestions for Next Steps that were proposed were:

- We need committees (e.g., with planners, scientists).
- We need to get politicians to think about the future: 5-10 years from now, petroleum resources. (How are we connected with the politicians?)
- We need better long-term strategies.
- We need defensible data.
- We need better use of the media to communicate the message to the public and politicians.
- We could use or sign petitions.
- We need to educate young people. We need more "living ecology" for children.
- *** (several people) We need to get young people involved with data collection.
- We can support change in the status of environmental education: send letters to bring Ministry of Education under the Environmental Bill of Rights (write to info@eeon.org to participate).

It was agreed that the conference was timely, and that it highlighted the need to address these issues. The variety of 100 participants provided a sound foundation for cooperation. Meeting together inspired participants to work towards data commonalities collected from our changing landscape.

8.4 Written Comments Submitted

Participants were invited to submit written comments if they wished, to be included as part of the day's proceedings. The following comments were offered:

- What about the qualitative aspects of monitoring and data collection? How do we incorporate intrinsic values in urban forestry conservation? Reach out to unlikely volunteers who have very different reasons for wanting to protect species, ecosystems, etc. Not much attention given to this. Very quantitative approach and over-use of words such as "dependable statistics" and "valuable" data.

- The idea of the champion was not to impose ideas on the monitoring community. Instead, the idea of the champion was to motivate, organize and lead the

monitoring community in the organization and standardization of protocols and communication of these protocols and results. The champion (either an individual or organization) would act as a clearinghouse and meeting place for the monitoring activities.

- I think when we've been talking about citizen monitoring we have been talking about two different goals:
  - 1. for the purposes of education, where soft data is acceptable
  - 2. expansion of scientific research using volunteers/citizens – in this case, the data must be scientifically defensible.
    These two very different goals are often very compatible, however in some cases they are not. When they are not, the goal must be clear prior to data collection, in order to avoid disappointment and frustration in the end use of the data.
- Commonalities ⇒ on same page; standardization, accessibility
  - Key to success:
    - recognition that we have the opportunity to collaborate to a broader scope (flexibility) ⇒ requires willingness to contribute to broader goal ⇒ result in synergies
    - try to limit risks
    - don't tie success to funding, government change
- How will the information today be utilized: outcomes/actions?

8.5 Conference Action Item: Forming a Standing Committee

Attendees interested in forming a standing committee to move the concept of data sharing and working together forward met, and discussed how this might be possible. It was decided that ACER would gather a small group should work on this. ACER offered to post progress and findings so that strategic next steps can be determined and acted upon.

9. Suggested Weblinks and Resources

- Smithsonian MAB - http://nationalzoo.si.edu/conservationandscience/mab/aboutmab/default.cfm
- Environment Canada Adaptation and Impacts - http://www.msc.ec.gc.ca/ACSD/airg/index_e.html
- Association for Canadian Educational Resources (ACER) - www.acer-acre.org
- University of Toronto Urban Forestry - http://www.utoronto.ca/forest/ufchome.htm
- Ministry of Natural Resources (MNR) – SOLRIS & ECL Land Classification
- Eastern Ontario Model Forest (EOMF) – http://sof.EOMF.on.ca/
- Environmental Commissioner's Office (ECO) - www.eco.on.ca/
- Selecting Environmental Indicators (EPA 1997) - http://www.epa.gov/
- National Ecological Observatory Network (NEON) - www.neoninc.org
- Environmental Monitoring and Assessment Network (EMAN) - www.eman-rese.ca
- Ecological Monitoring and Assessment Network (EMAN) resources - http://eman-rese/eman/reports/publications/
- UN Ecosystem Assessment Report - http://www.millenniumassessment.org/en/Article.aspx?id=58
- INSnet International Sustainabilty newsletter of current releases on global issues – www.insnet.org
- Woodland Valuation System - http://woodlandvaluation.eomf.on.ca/data.htm
- Watershed Information Exchange (WIX) developed by the *Centre for Sustainable Watersheds,* Natural Resources Canada and DM Solutions - http://www.ontariowatersheds.ca/htdocs/home_t.phtml
- Ontario Geospatial Data Exchange (OGDE)- www.lio.mnr.gov.on.ca/ogde.cfm
- Ontario Stewardship Council - http://www.ontariostewardship.org/grenville
- Resilience Alliance – www.resalliance.org
- Data, state of Eastern Ontario Forests - http://sof.eomf.on.ca/data/data_e.htm

Books

- *Panarchy: Understanding Transformations in Human and Natural Systems.* Eds.: Gunderson, L., and C.S. Holling; Island Press, Washington DC, 2002.
- *Monitoring for Conservation and Ecology.* Ed., F. B. Goldsmith, Chapman and Hall, London 1991.