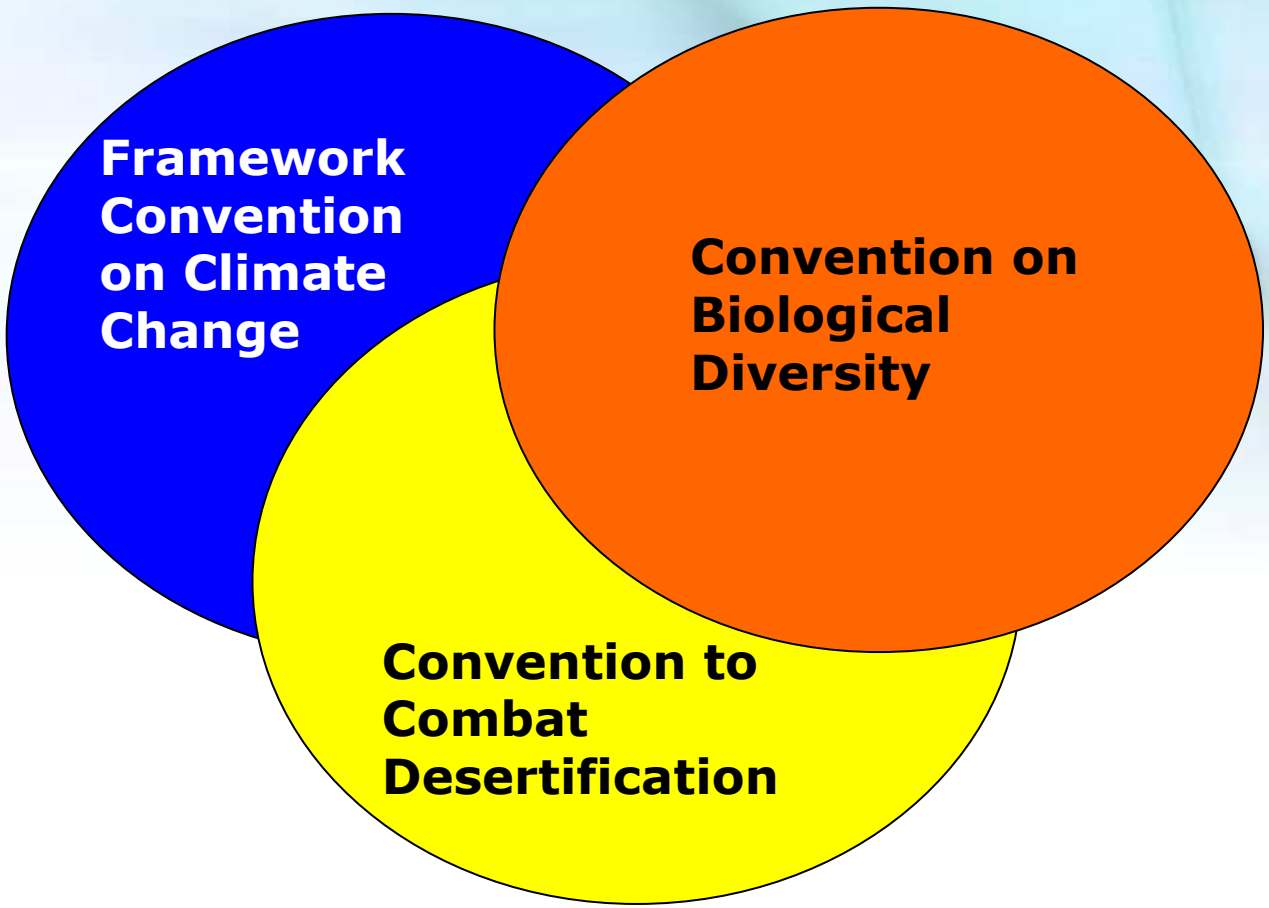
Biodiversity and Climate Change

Don C. MacIver, Director
Adaptation and Impacts Research Division
Environment Canada

Royal Society & UK GECC, June 13, 2007

Synergies


Framework Convention on Climate Change
Convention on Biological Diversity
Convention to Combat Desertification

Dialogue between climate and biodiversity experts

IPCC and CBD

2002 -2003

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COP- CBD 2006

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IAI 2006

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UNESCO 2007

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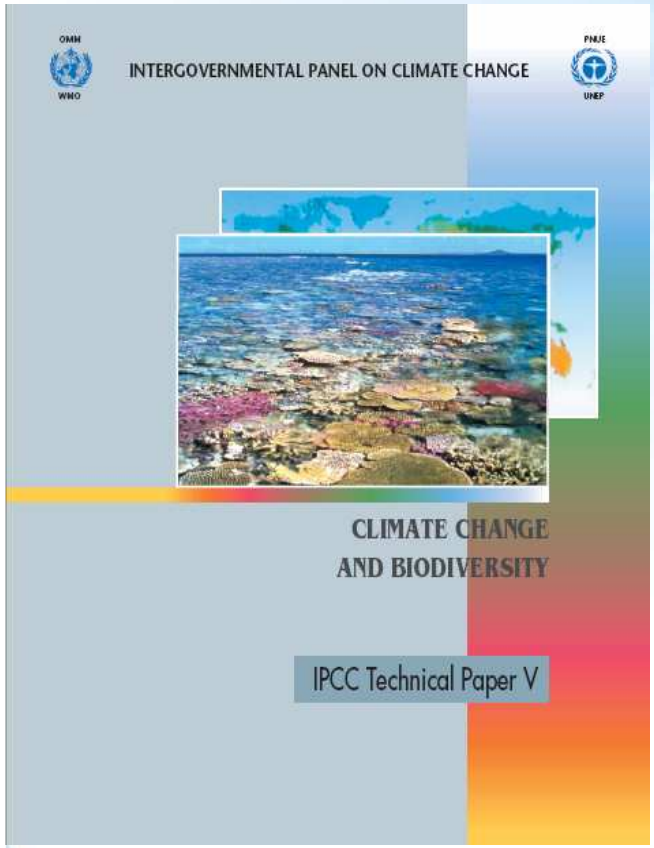
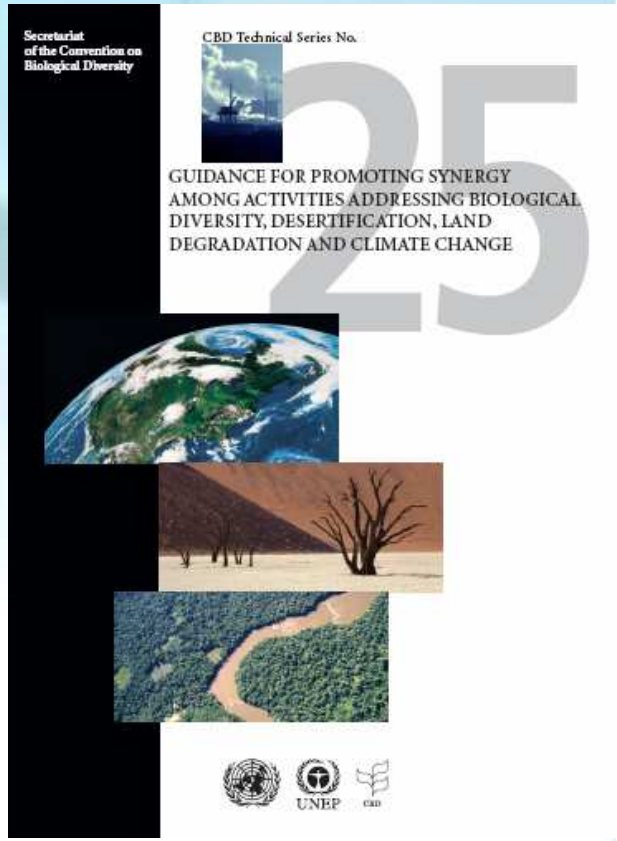
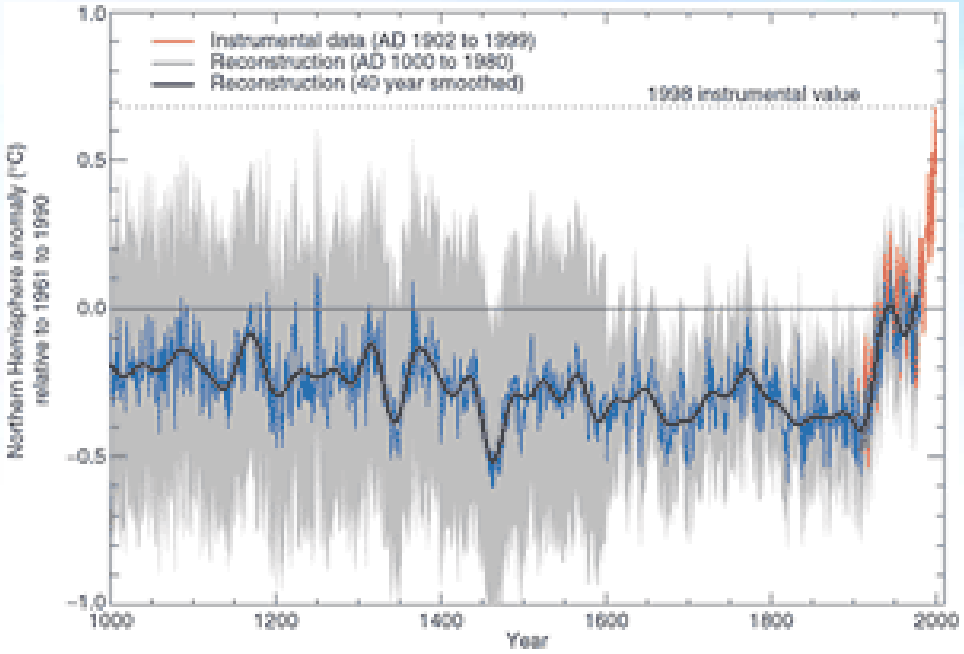
CBD Expert Mtg. 2007

Climate Change and Biodiversity and Biodiversity and Climate Chnage





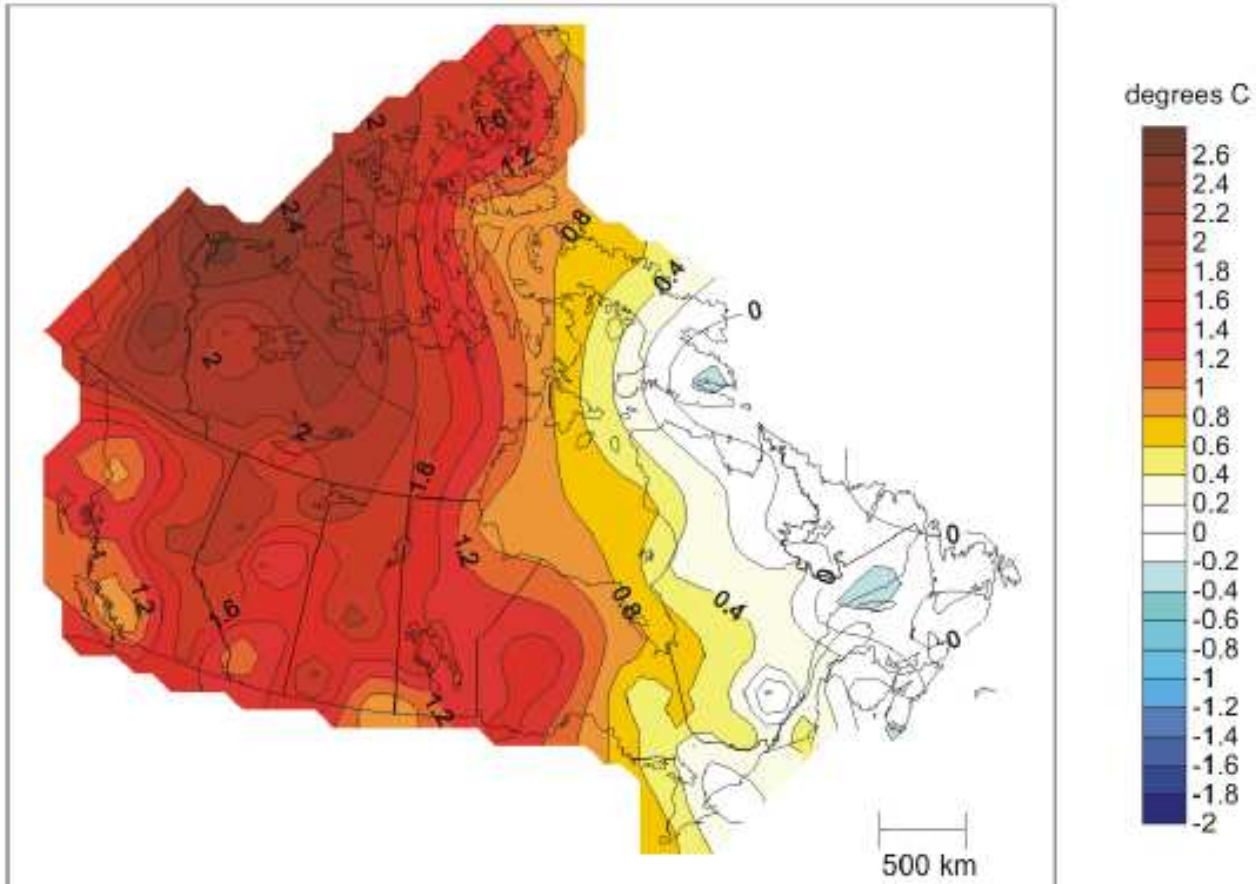
Climate Change



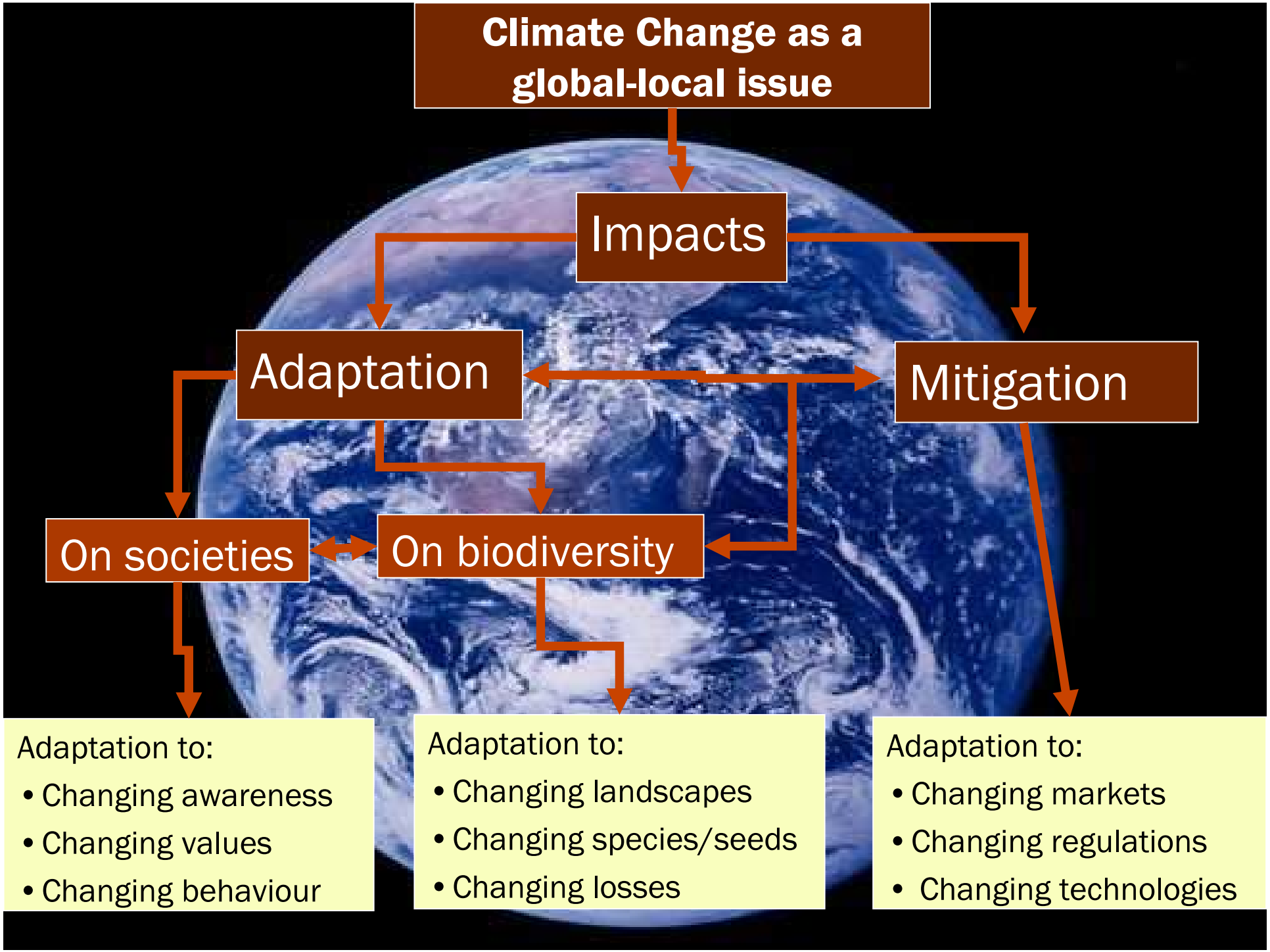
Northern hemisphere temperature observations and reconstructions from tree cores

…one of the major challenges of the 21st Century to conserving biodiversity , combating desertification and ensuring the sustainable use of natural resources

Climate change is already here…



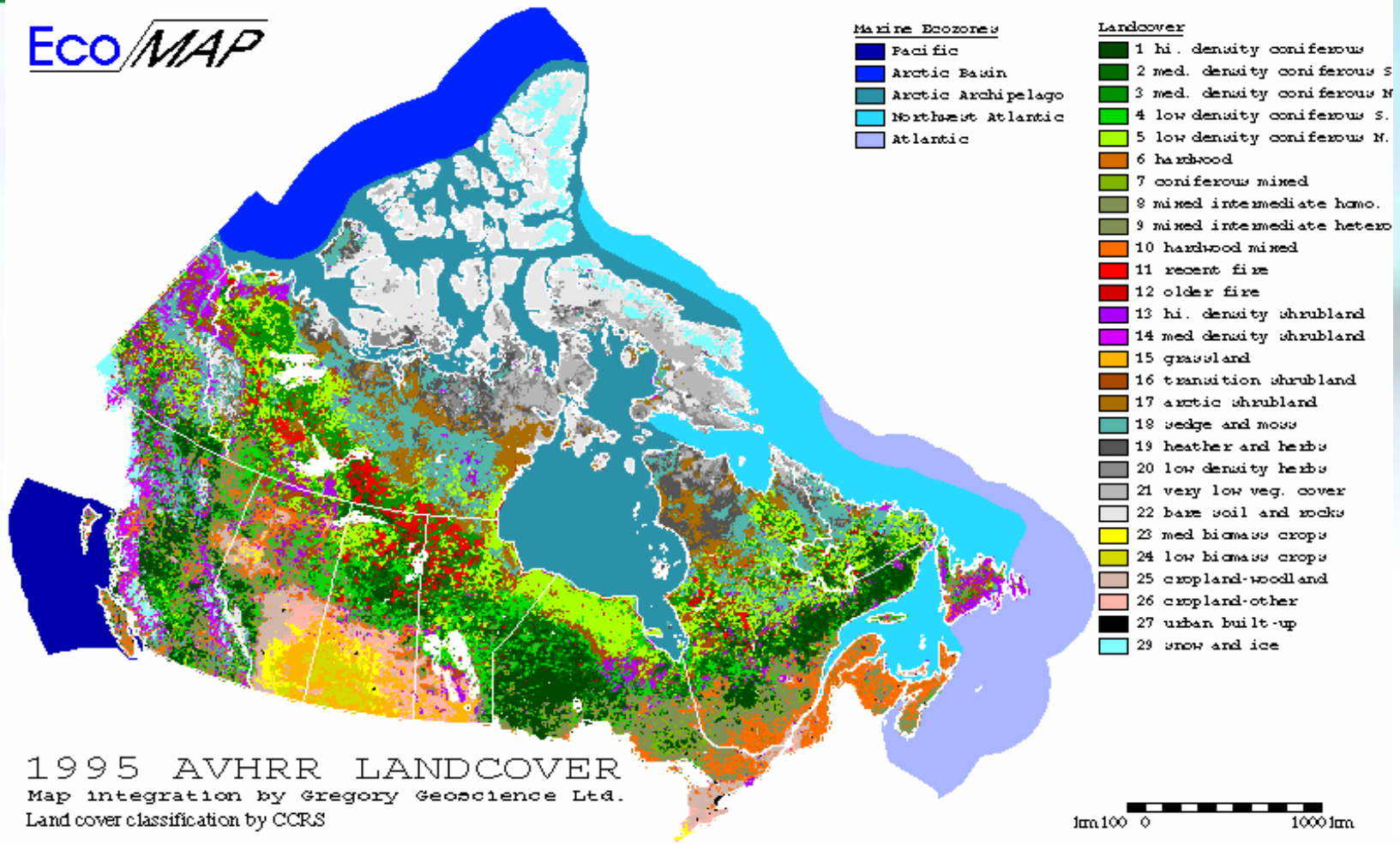
Trend in mean annual temperature 1948-2003


Climate Change as a global-local issue
Impacts
Adaptation
Mitigation
On societies
On biodiversity
Adaptation to:
• Changing awareness
• Changing values
• Changing behaviour
Adaptation to:
• Changing landscapes
• Changing species/seeds
• Changing losses
Adaptation to:
• Changing markets
• Changing regulations
• Changing technologies

Biodiversity

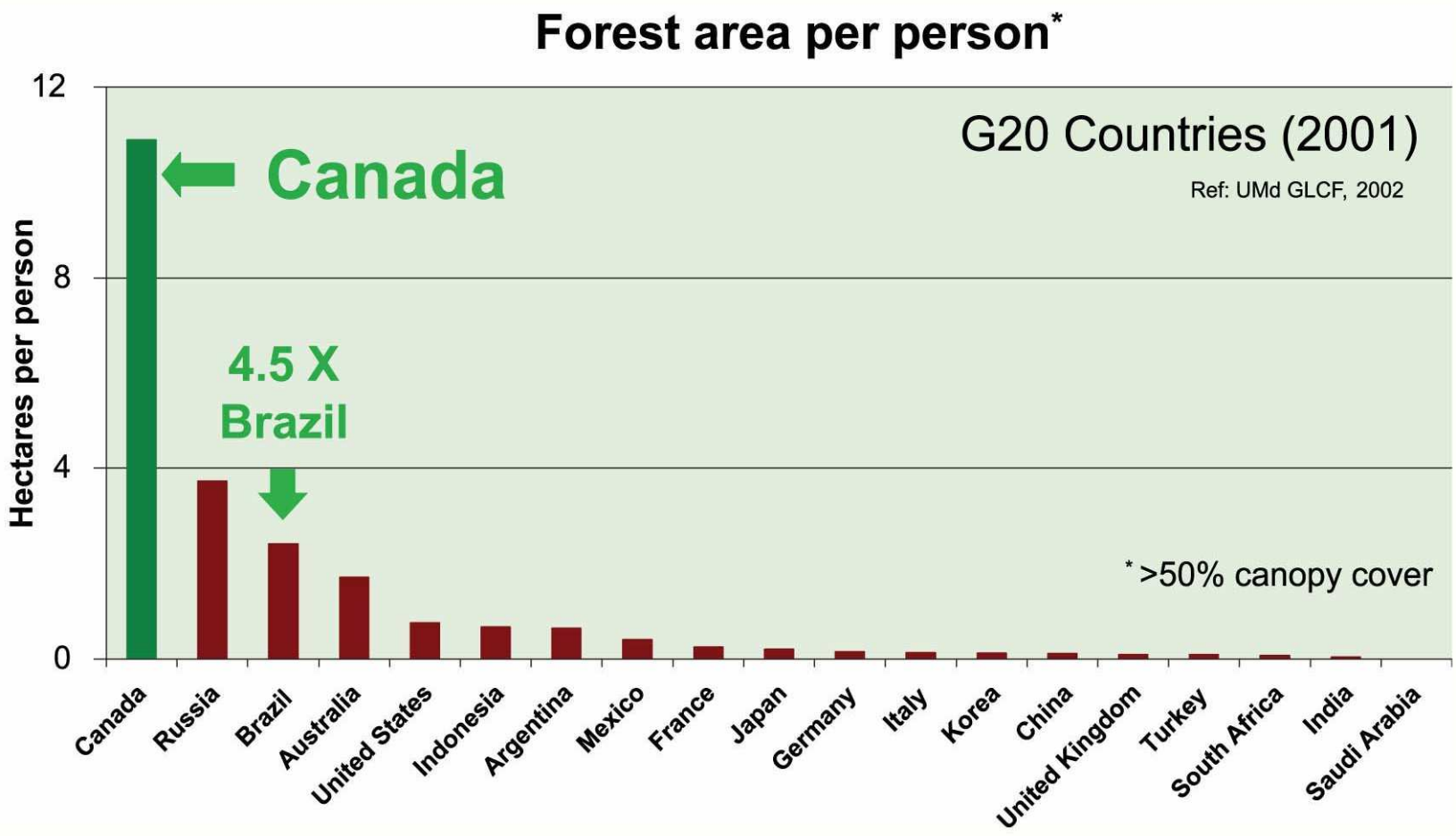
- 30-50% of the earth's surface under direct human management
- 23% of mammals, 12% of birds, 4% of reptiles and 32% of amphibians are 'red listed'
- Habitat degradation—most ecosystems impacted by human activity
- Inadequate biological information exists for good decision-making
- The last generation of biologist to study natural ecosystems?

BIODIVERSITY IN CANADA

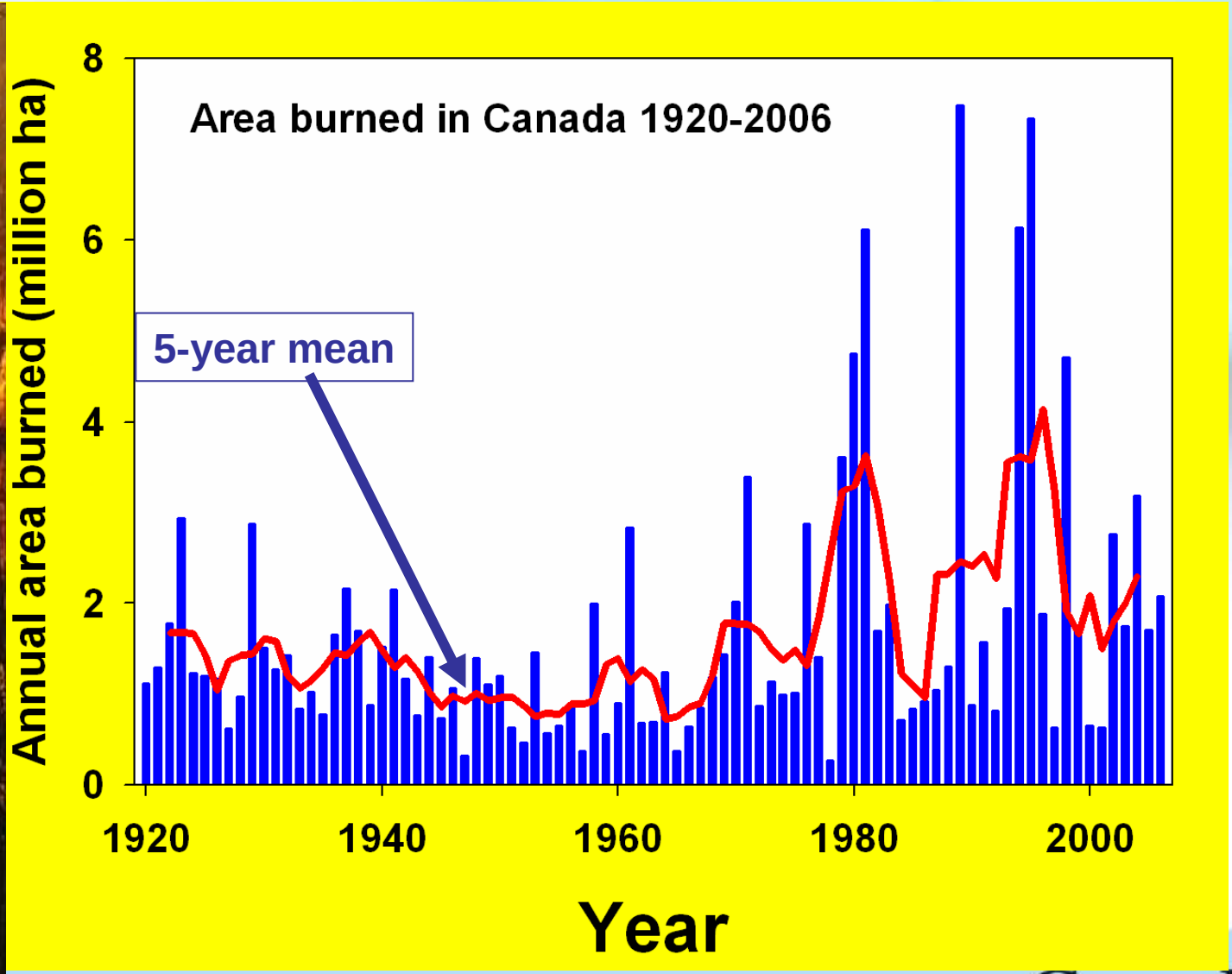


Environment Canada Environnement Canada

Canada

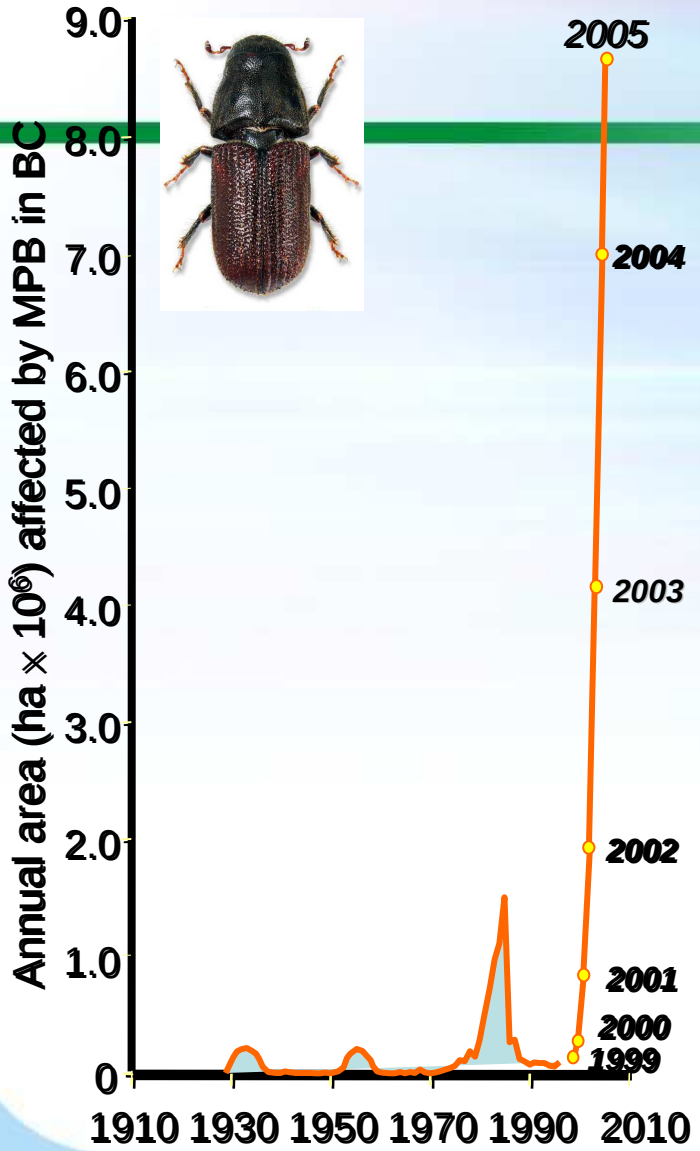

Forest area per person*
G20 Countries (2001)
Ref: UMd GLCF, 2002
Canada
4.5 X
Brazil
* >50% canopy cover
Hectares per person
12
8
4
0
Canada
Russia
Brazil
Australia
United States
Indonesia
Argentina
Mexico
France
Japan
Germany
Italy
Korea
China
United Kingdom
Turkey
South Africa
India
Saudi Arabia

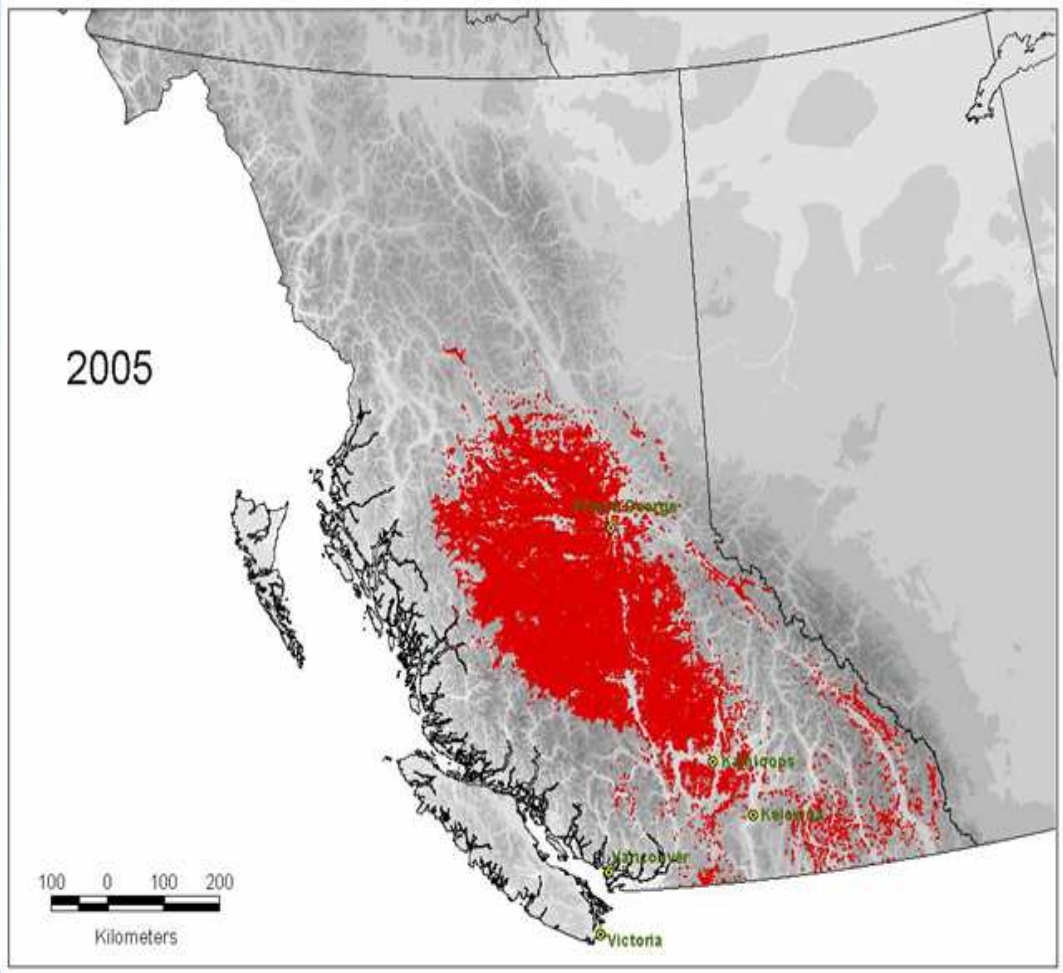
Disturbances: Increasing forest fire trend?



Amiro, B. 2007

Mountain Pine Beetle and Climate Change





CC Adaptation Options for Biodiversity

Adaptation Strategies

- Ensure options are of the “do no harm” variety
- Improve scenarios of future climate change
- Develop National Adaptation Plans - Complete adaptive capacity/vulnerability assessments
- Prioritize intact habitats for protection
- Engage local people in planning
- Design reserves to protect vulnerable life stages
- Respond to changes already inherent in system

CC Adaptation Options for Biodiversity

Planned Adaptation

- Build corridors
- Re-introduce species – eg. role of seed banks
- Assist species regeneration
- Control or eradicate invasive species
- Employ ex-situ conservation if extinction imminent
- Manage for disturbances to the ecosystem
- Account for projected impacts in climate change when designing new protected areas

CC Adaptation Options for Biodiversity

Build Resilience

- Reduce fragmentation
- Protect space, functional groups, climate refugia, and multiple microhabitats in replicated areas
- Maintain a natural diversity of species, ages, genetic diversity, and seed sources
- Provide buffer zones and flexibility of land uses
- Ensure connectivity of habitats along gradients

CC Adaptation Options for Biodiversity

Adaptation Science

- Establishment of corridors
- Reduction of other pressures/threats
- Introduction of species tolerant to salt, drought, pests or higher temperatures
- Rehabilitation of damaged ecosystems
- Multi-cropping, mixed farming, low-tillage cropping, and new seed zones.

CC Adaptation Options for Biodiversity

Technological Adaptation

- Efficient management of rain/snow water
- Changes in timing/type of irrigation and fertilizer
- Improve plant vigor, resilience and health
- Construction of new infrastructure – bldg. codes
- Establishment of aquaculture
- Diversion of fresh water & source water protection
- Seawalls, dykes and tidal barriers & biodiversity
- Bridges to cross inundated areas – eg. wetlands

CC Adaptation Options for Biodiversity

Regulatory Adaptation

- Re-zoning on coastal areas
- Establishment of protected areas
- Natural forest regeneration or avoided deforestation
- Non-chemical control of pest/disease outbreaks
- Establish new seed zones under climate change
- Landscape scale management of water conserv.
- Decrease nutrient enhanced run off
- Increase quality standards – protect freshwater

CC Adaptation Options for Biodiversity

Economic Adaptation

- Changes in grazing management
- Abandonment of agriculture
- Offer incentives or change trade policies to control spread of invasive species
- Eliminate incentives that accelerate habitat loss
- Recover timber impacted by CC driven outbreaks
- Adopt energy efficient technologies in best areas

Sensitivity, Adaptability and Vulnerability

Sensitivity:
Degree to which a system will respond to a change in climatic conditions. E.g. extent of change in ecosystem composition, structure and functioning.

Adaptability:
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:
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.

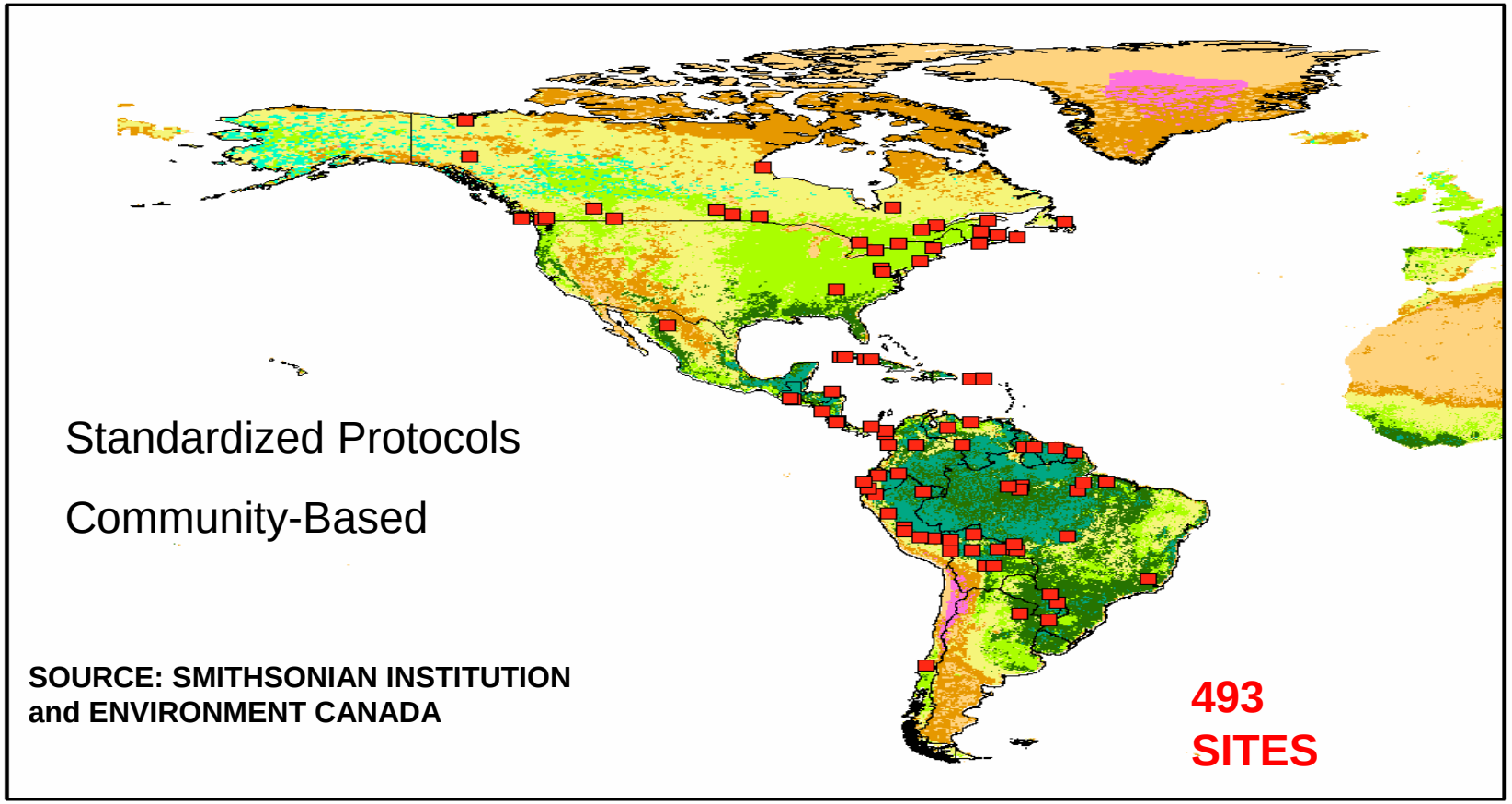
GRID Arendal UNEP
GRAPHIC DESIGN: PHILIPPE REKACEWICZ

Source: Climate change 1995, Impacts, adaptations and mitigation of climate change: scientific-technical analyses, contribution of working group 2 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge press university, 1996.

Biodiversity: Partnership with Smithsonian Institution

Smithsonian

BIODIVERSITY OBSERVATION SITES IN THE AMERICAS



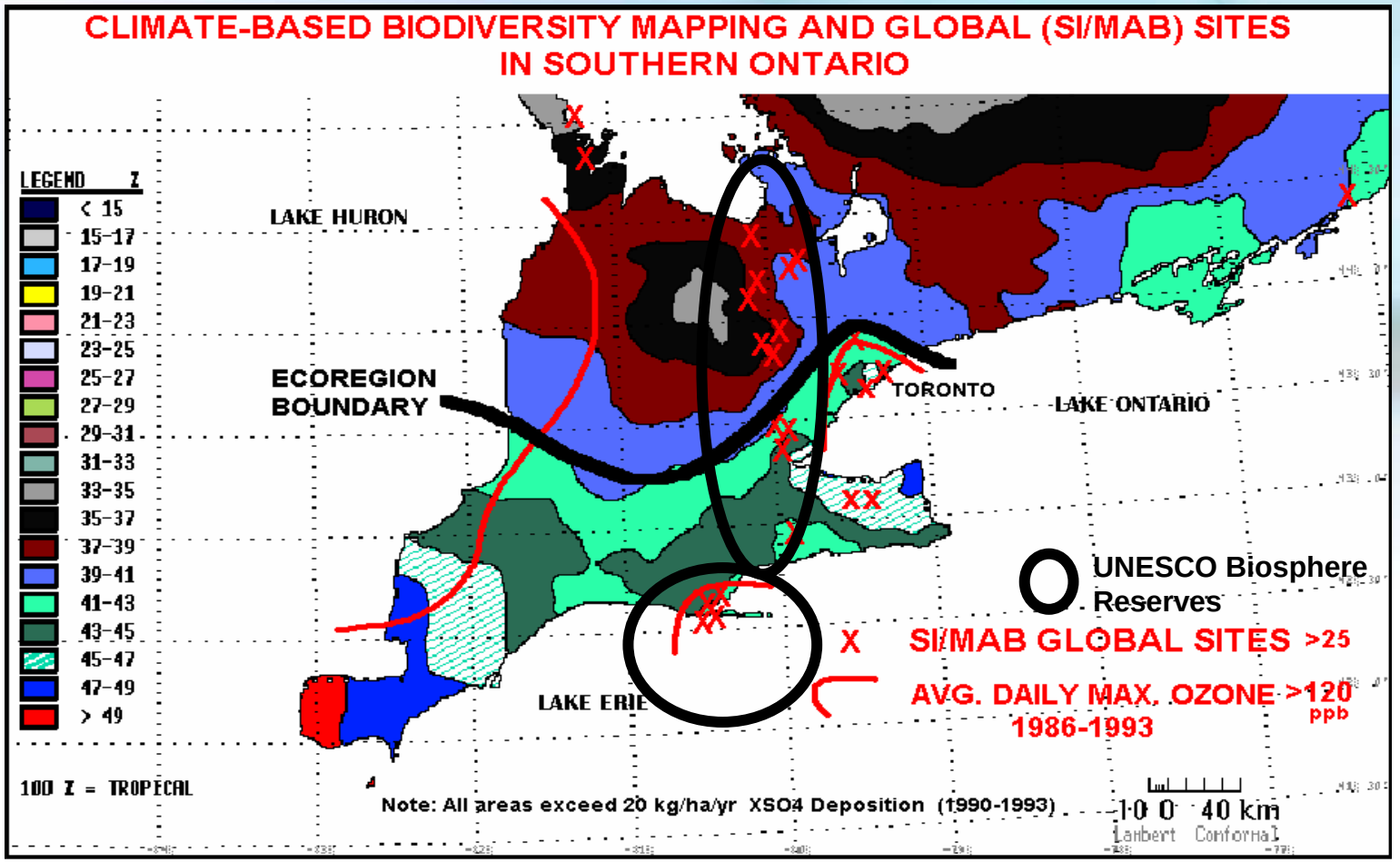
Legend

- Tropical forest
- Alpine desert
- Deciduous forest
- Tundra
- Grassland
- Semi-desert
- Desert
- Evergreen forest
- Sea
- Biodiversity Plots

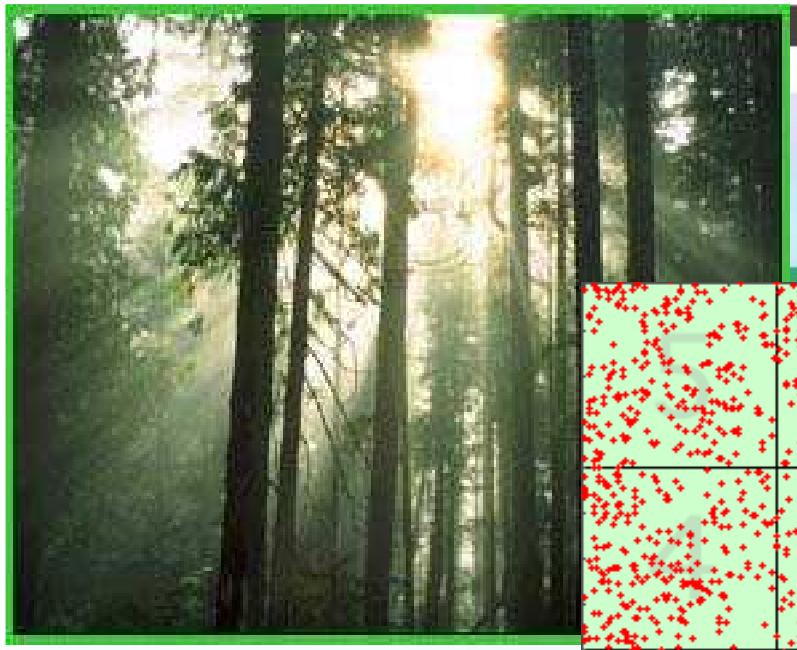
Environment Canada Environnement Canada

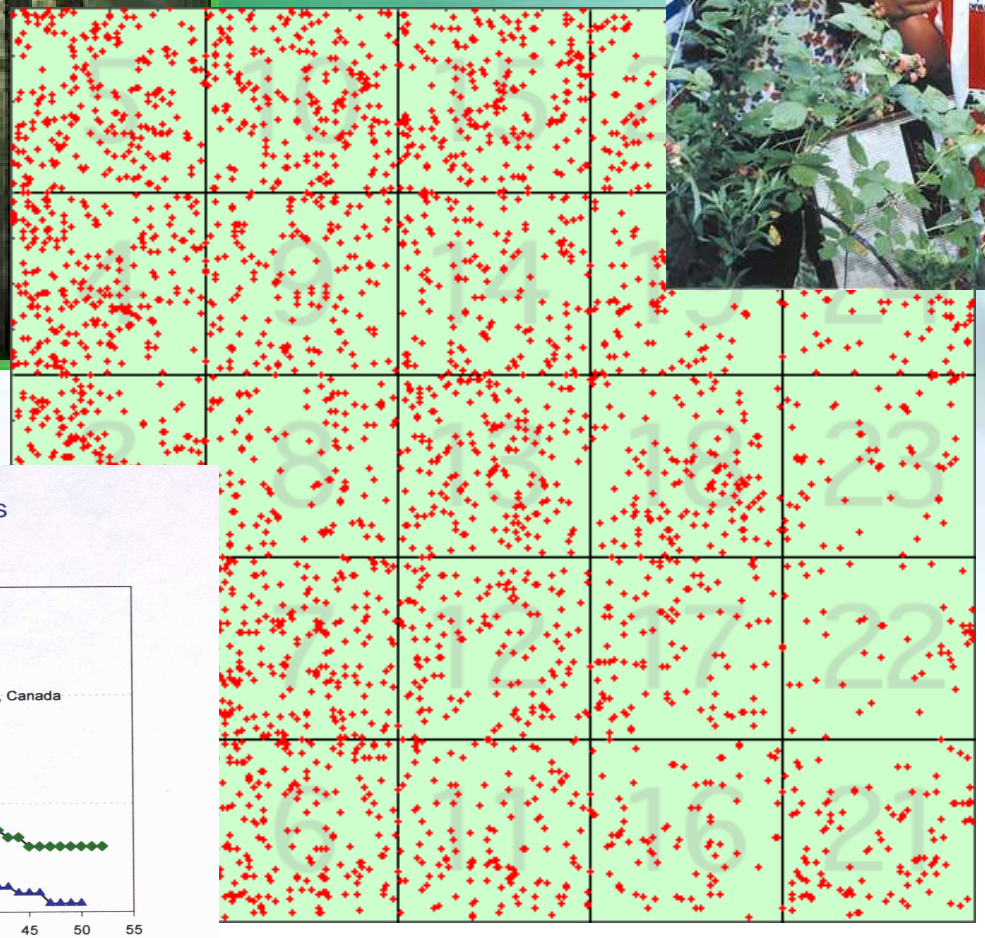
Canada

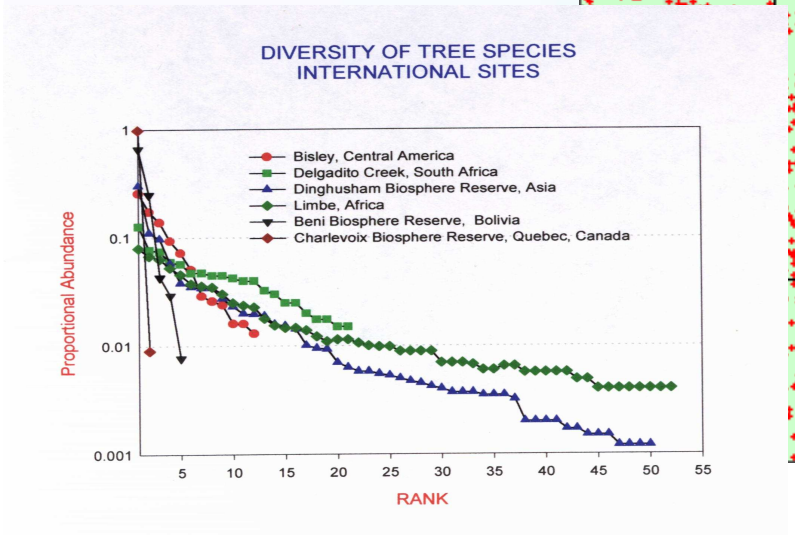
Climate and Biodiversity Using Smithsonian Global Biodiversity Observation Network

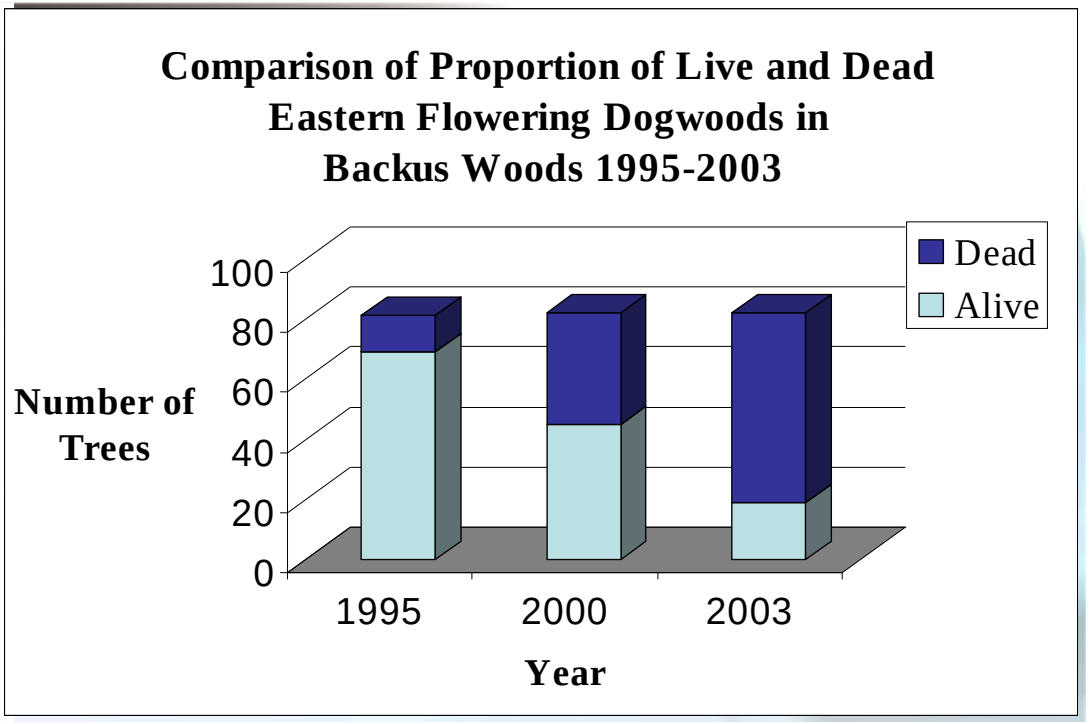


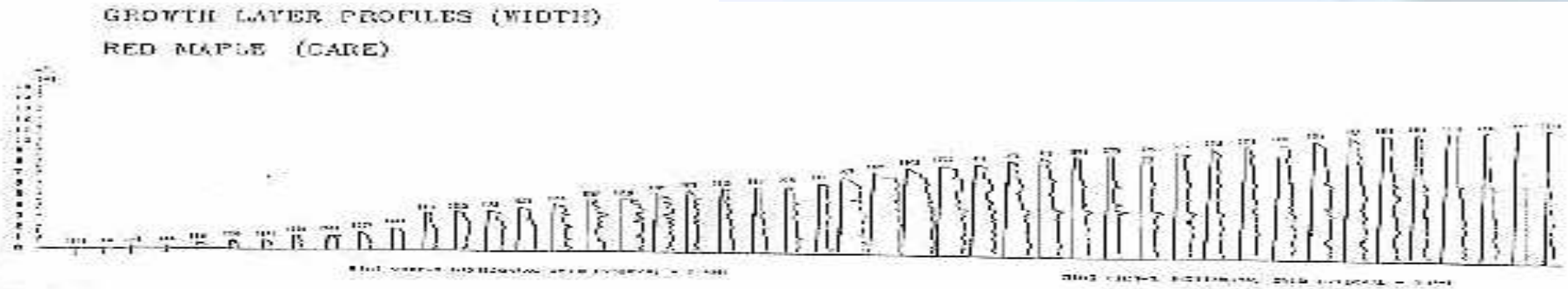
Sources: Atmospheric Change and Biodiversity (Maciver, 1997); 1997 Canadian Acid Precipitation Assessment and the 1980-1993 Ground-Level Ozone and Its Precursors (Data) Assessment (1997), Environment Canada and Science Program

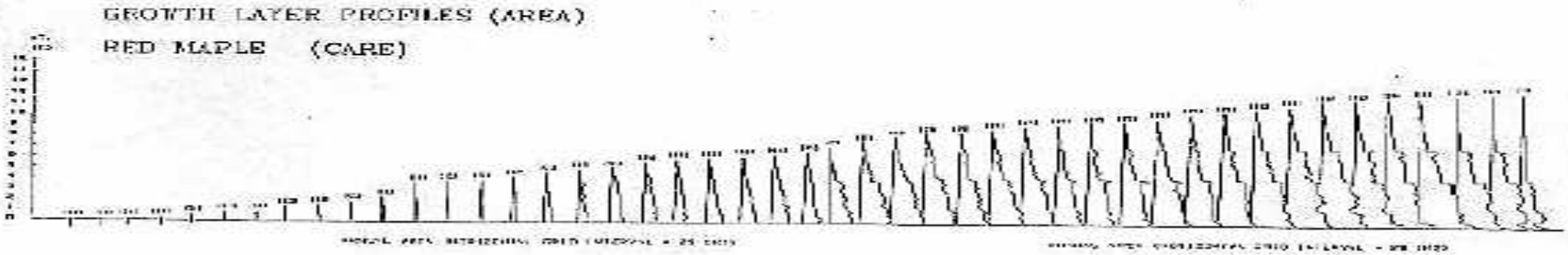




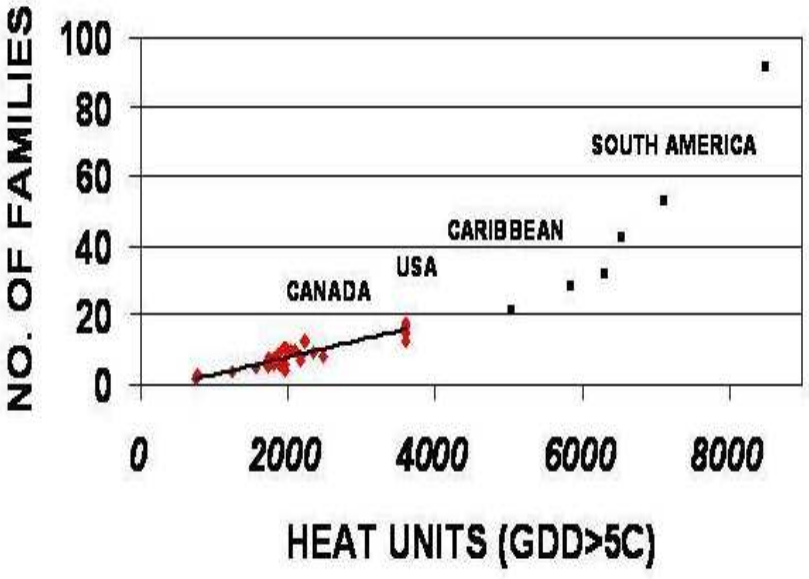

DIVERSITY OF TREE SPECIES
INTERNATIONAL SITES
Bisley, Central America
Delgadito Creek, South Africa
Dinghusham Biosphere Reserve, Asia
Limbe, Africa
Beni Biosphere Reserve, Bolivia
Charlevoix Biosphere Reserve, Quebec, Canada
Proportional Abundance
1
0.1
0.01
0.001
5
10
15
20
25
30
35
40
45
50
55
RANK

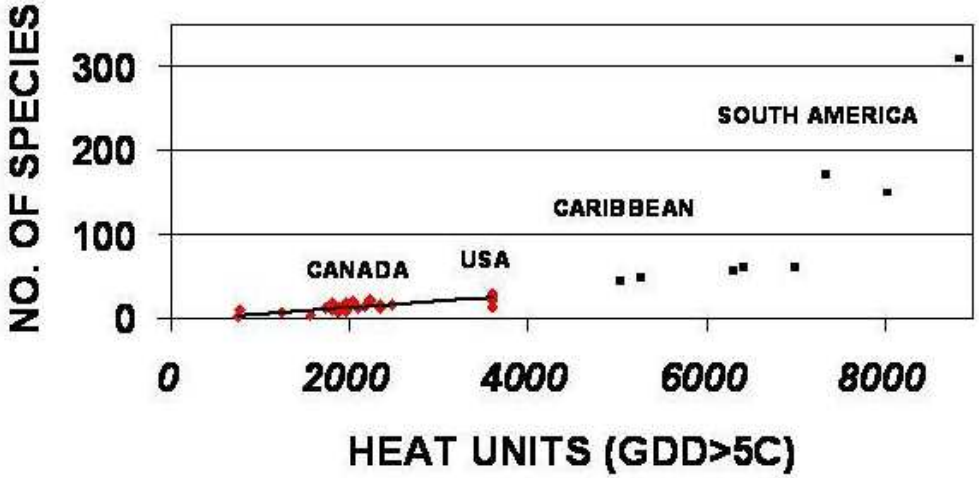

Comparison of Proportion of Live and Dead Eastern Flowering Dogwoods in Backus Woods 1995-2003
Number of Trees
100
80
60
40
20
0
1995
2000
2003
Year
Dead
Alive


GROWTH LAYER PROFILES (WIDTH)
RED MAPLE (CARE)


GROWTH LAYER PROFILES (AREA)
RED MAPLE (CARE)

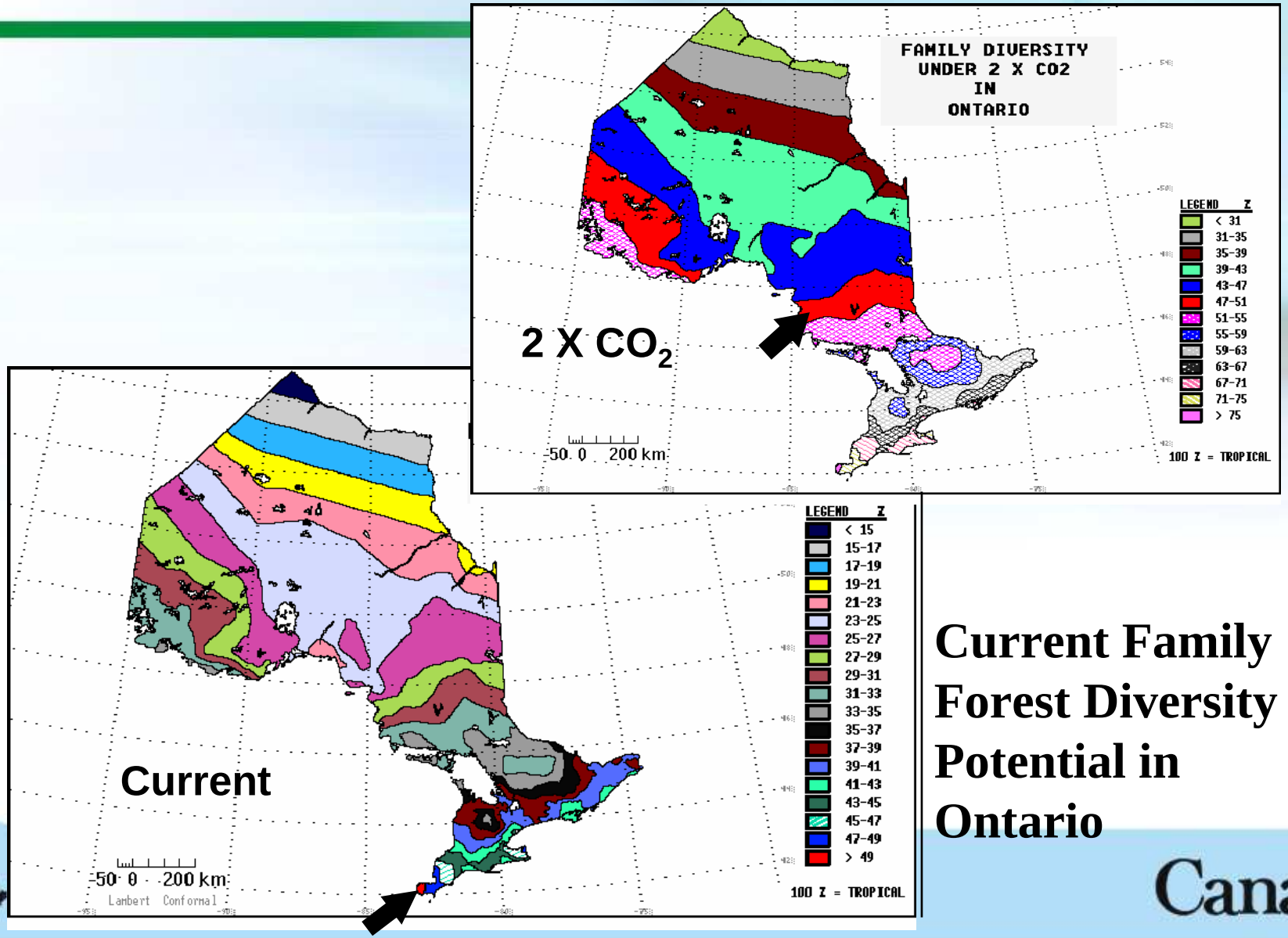
Climate and Biodiversity Using Smithsonian Global Biodiversity Observation Network





"Canada can ill-afford the loss of one species"

Biodiversity:Changes in Family Forest Diversity in Ontario under 2XCO_2 Climate Warming

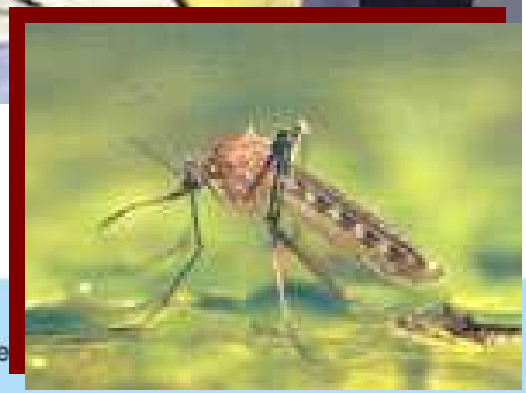


Current Family Forest Diversity Potential in Ontario

Canada

Increased risk of new diseases

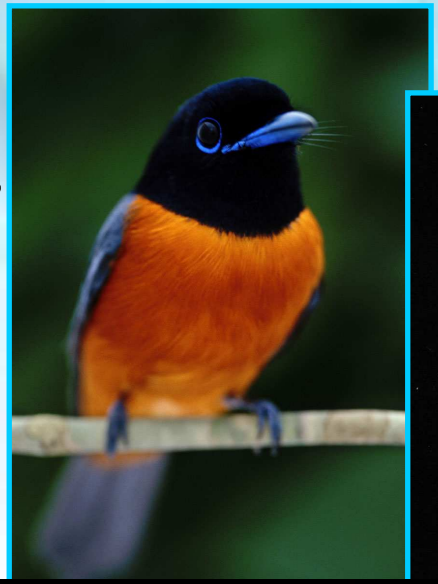
West Nile Virus

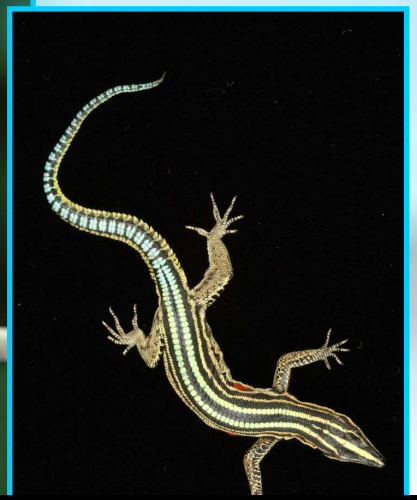
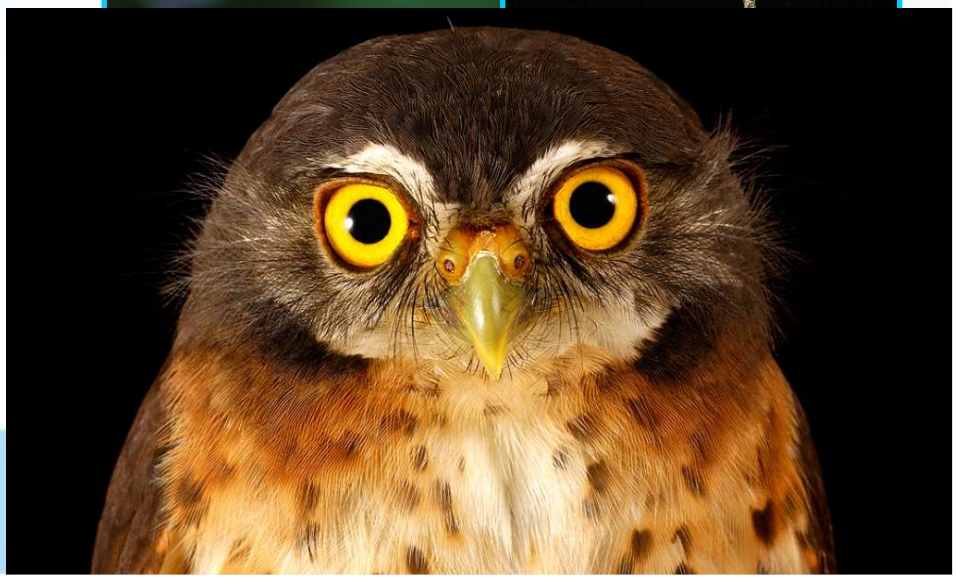


Lyme Disease

Developing actions on biodiversity, adaptation and climate change

- Global Biodiversity Monitoring Network –Community Partnerships
- Sound Science and Partnerships
- Extract lessons learned
- Improve methods, tools & training
- More adaptation solutions
- Document best practices
- Disseminate this information





UN Global Biodiversity Organization?