





# Climate Change and Forest Carbon

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Discussion Forum  
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# Topics

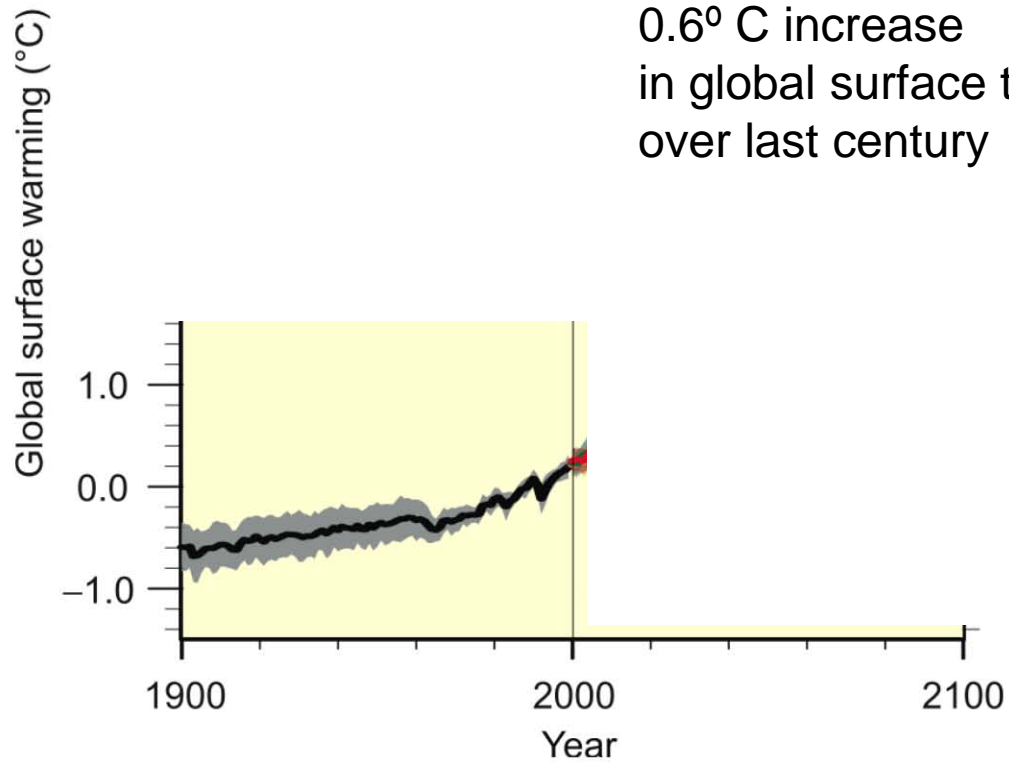
1. Intro to climate change 
2. MFR initiatives 
3. Forest Carbon Offsets 
4. Zero Net Deforestation 
5. Future Forest Ecosystems Initiative 
6. Last slide 

# 1. Climate Change

- Global
  - Observations, Causes, Effects
  - Models, Scenarios and Solutions
- BC
  - A History of Climate Change
  - What to expect



0.6° C increase  
in global surface temperature  
over last century



(Source: IPCC AR4)

# The last 650,000 years

- Plenty of ice ages
- Temperature ‘peaks’ every 120,000 years
- For the last 5000 years, we’re at a ‘peak’

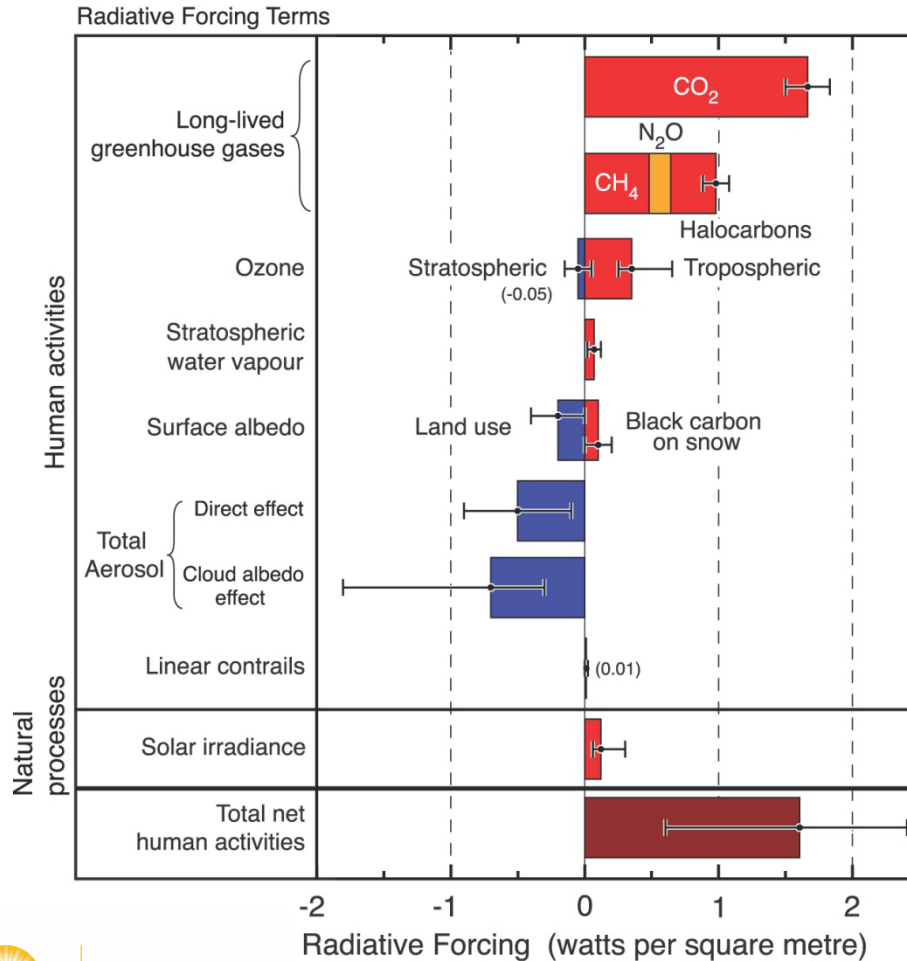
# Causes of climate change

- Earth orbit and axis wobble
  - Solar, air and ocean cycles
  - Meteors, volcanoes
- 

- Surface change (albedo)
- Aerosols
- Ozone
- Greenhouse gases (CO<sub>2</sub>, methane...)

# Global Climate Change

Radiative forcing of climate between 1750 and 2005

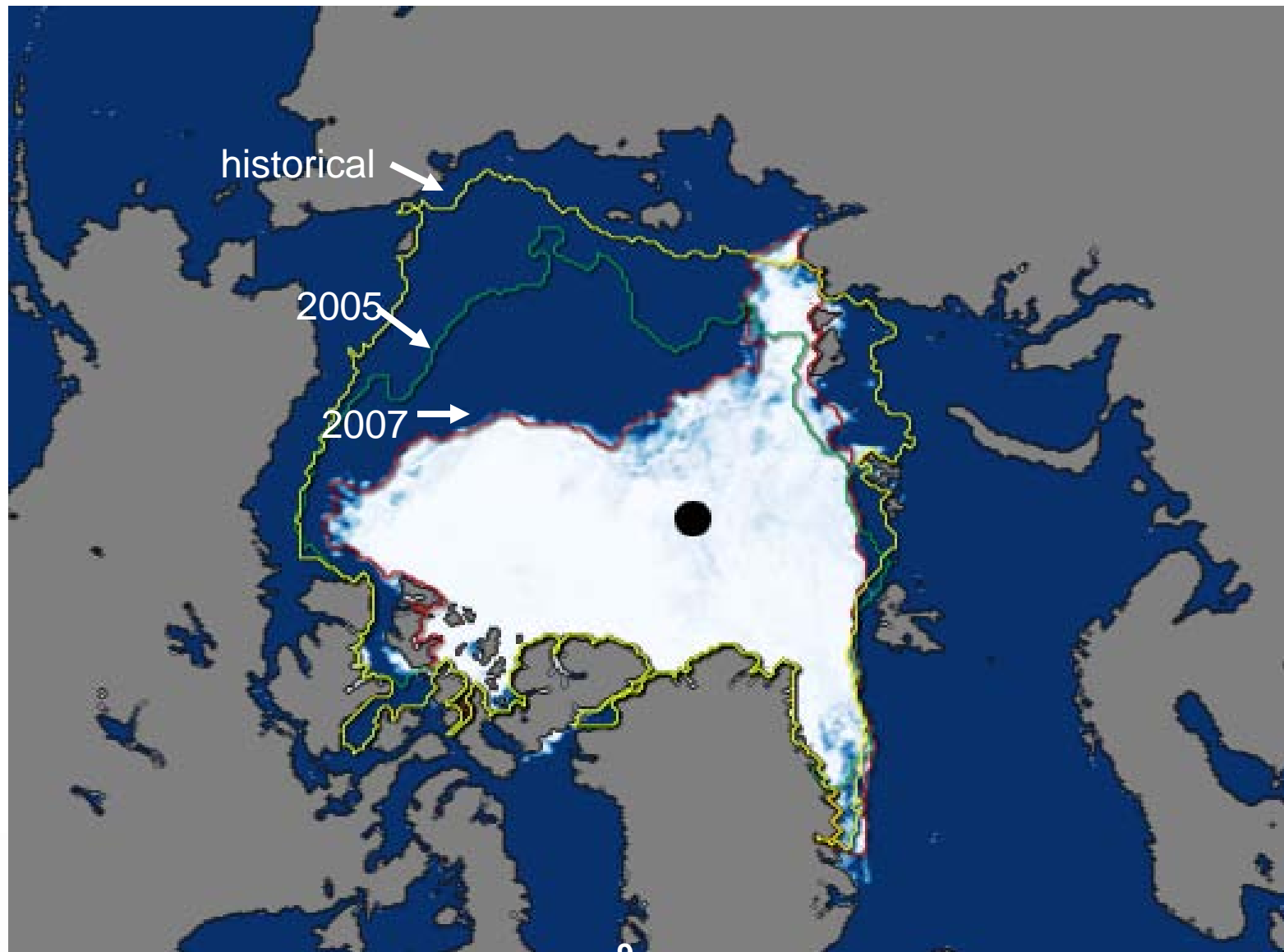


- CO<sub>2</sub> emissions are the main contributor

# Anthropogenic GHGs

- Atmospheric CO<sub>2</sub> from 280 to 387 ppm
- Carbon emissions = 8 Gt/y  
(6.4 fossil fuel, 1.6 land use change)

# EFFECTS: Minimum Summer Arctic sea ice is decreasing faster than all model projections



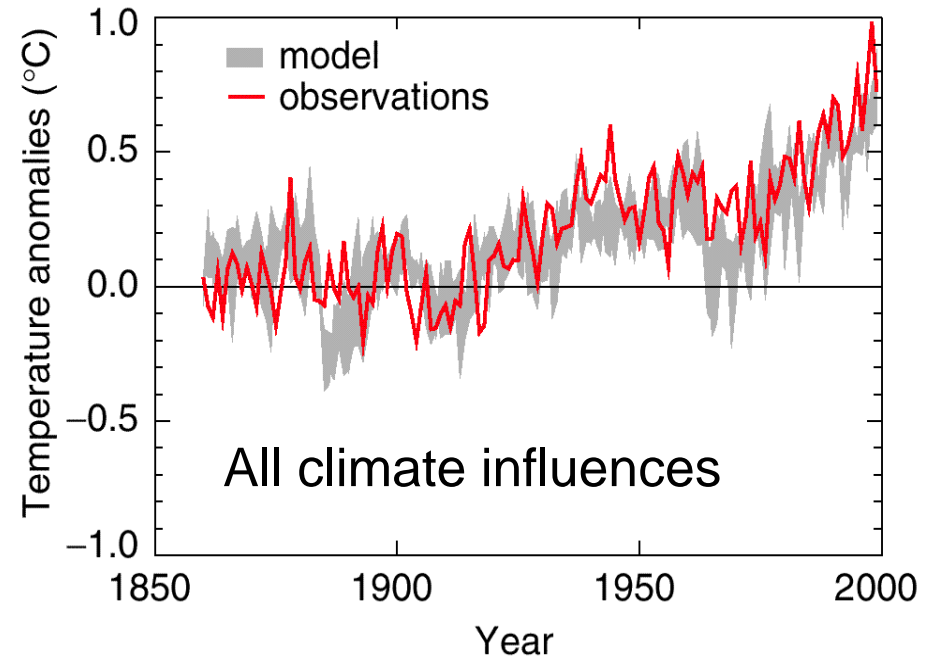
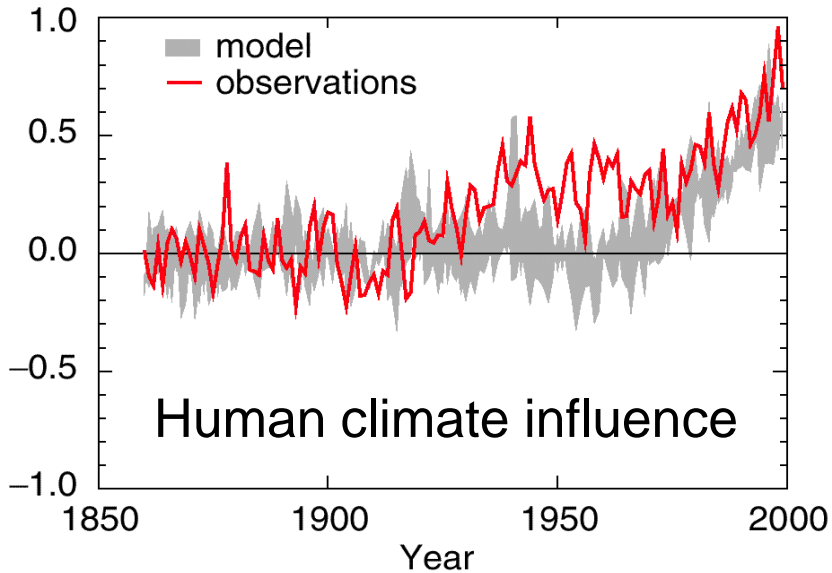
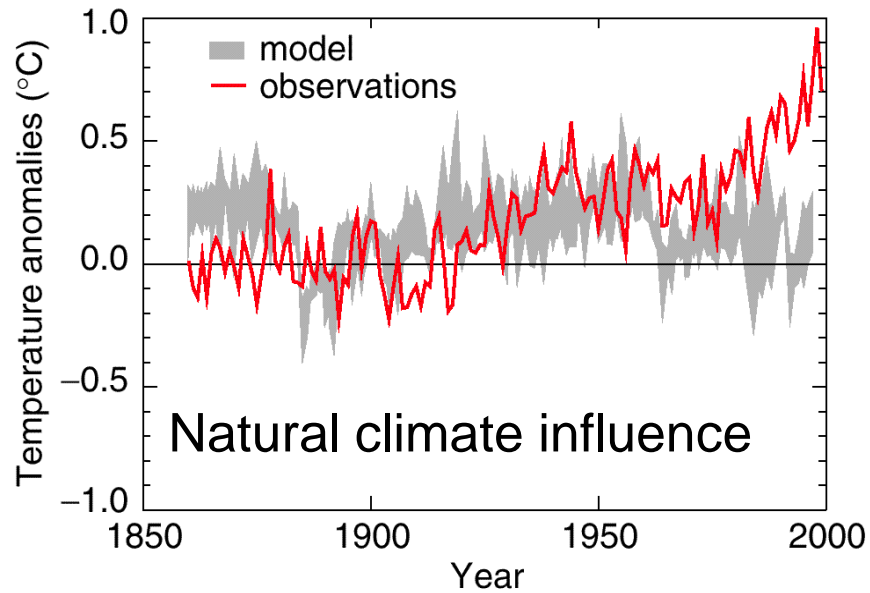
# Greenland is melting

Meltwater stream flowing into a large moulin in the ablation zone (area below the equilibrium line) of the Greenland ice sheet.

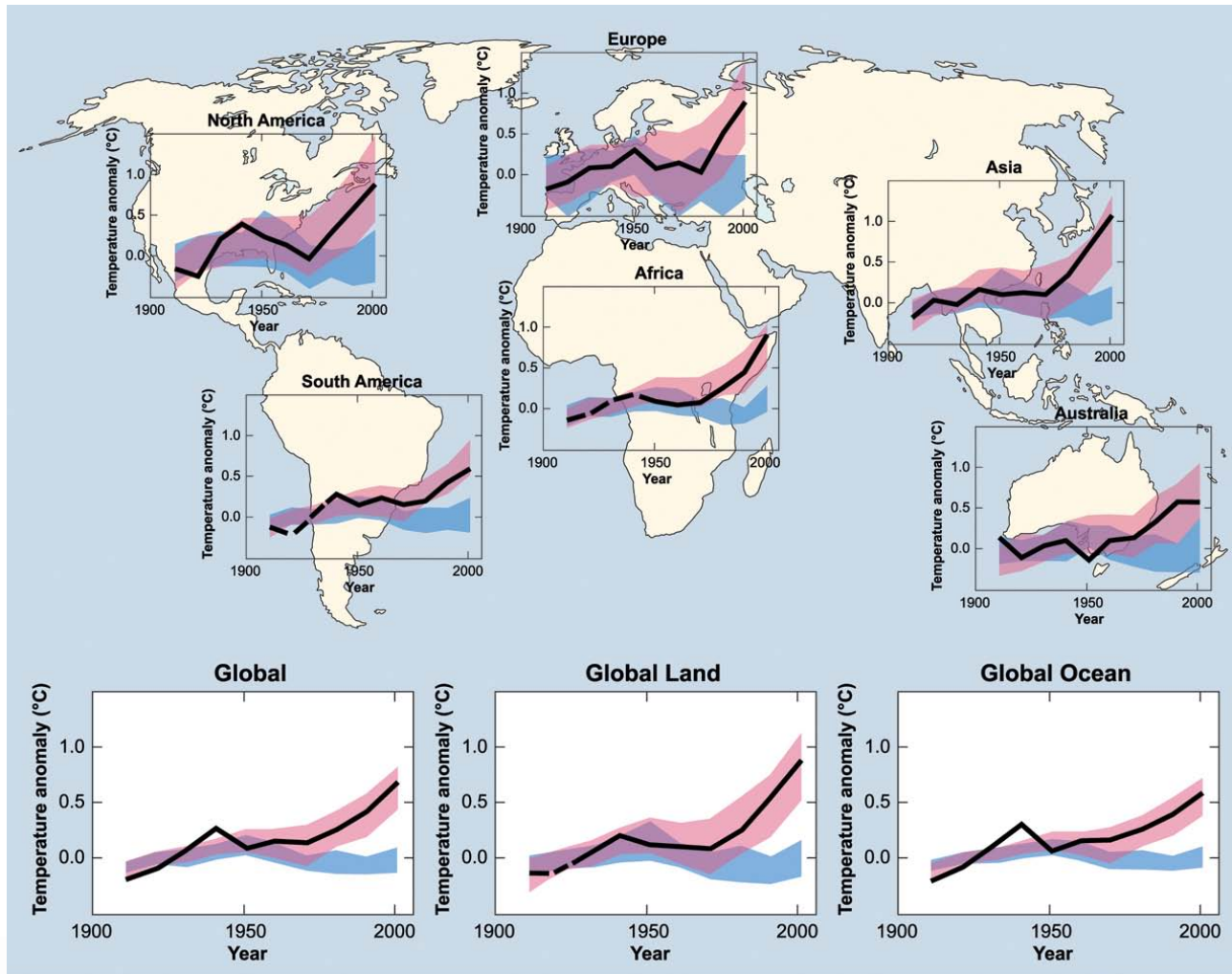
Image: Roger J. Braithwaite,  
The University of Manchester, UK



# Climate models - do they work?



# Models and observations

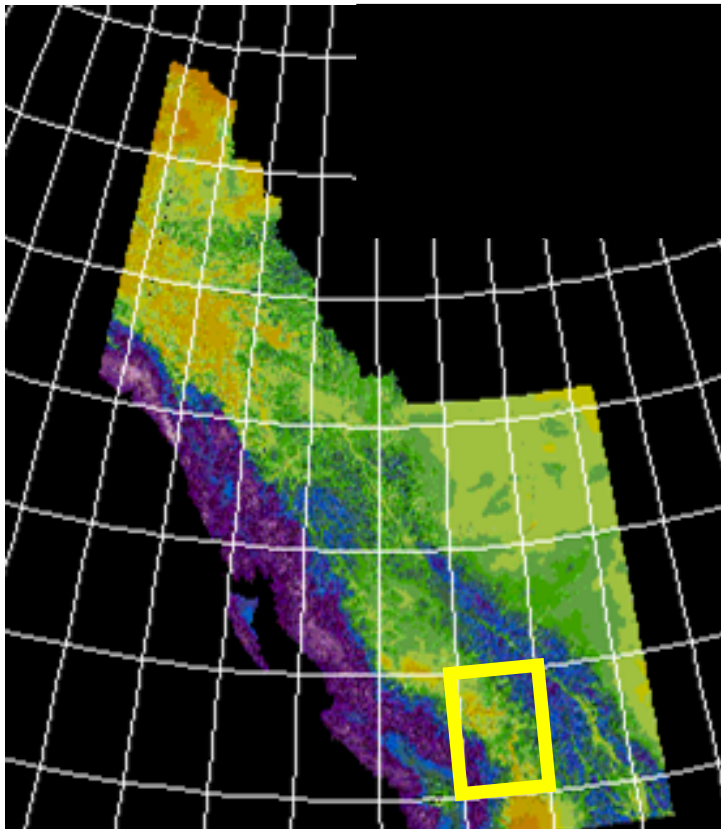


models using only natural forcings  
 models using both natural and anthropogenic forcings

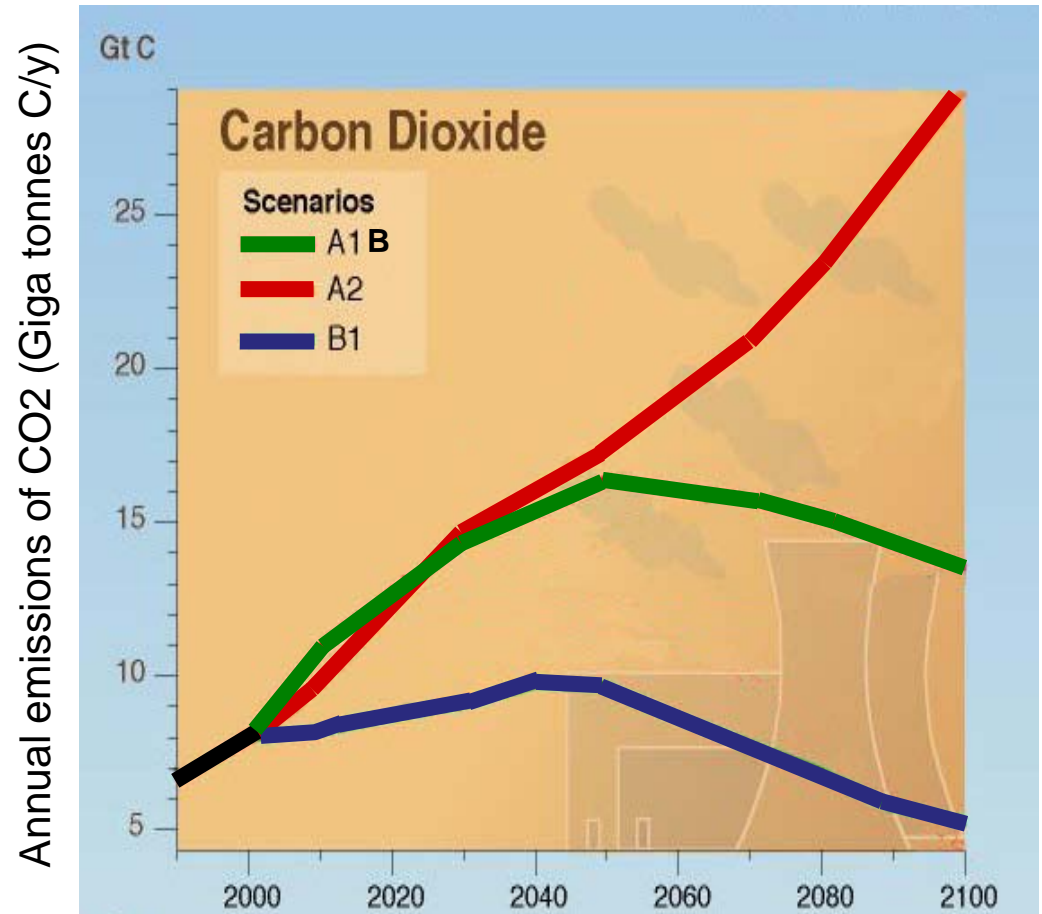
observations

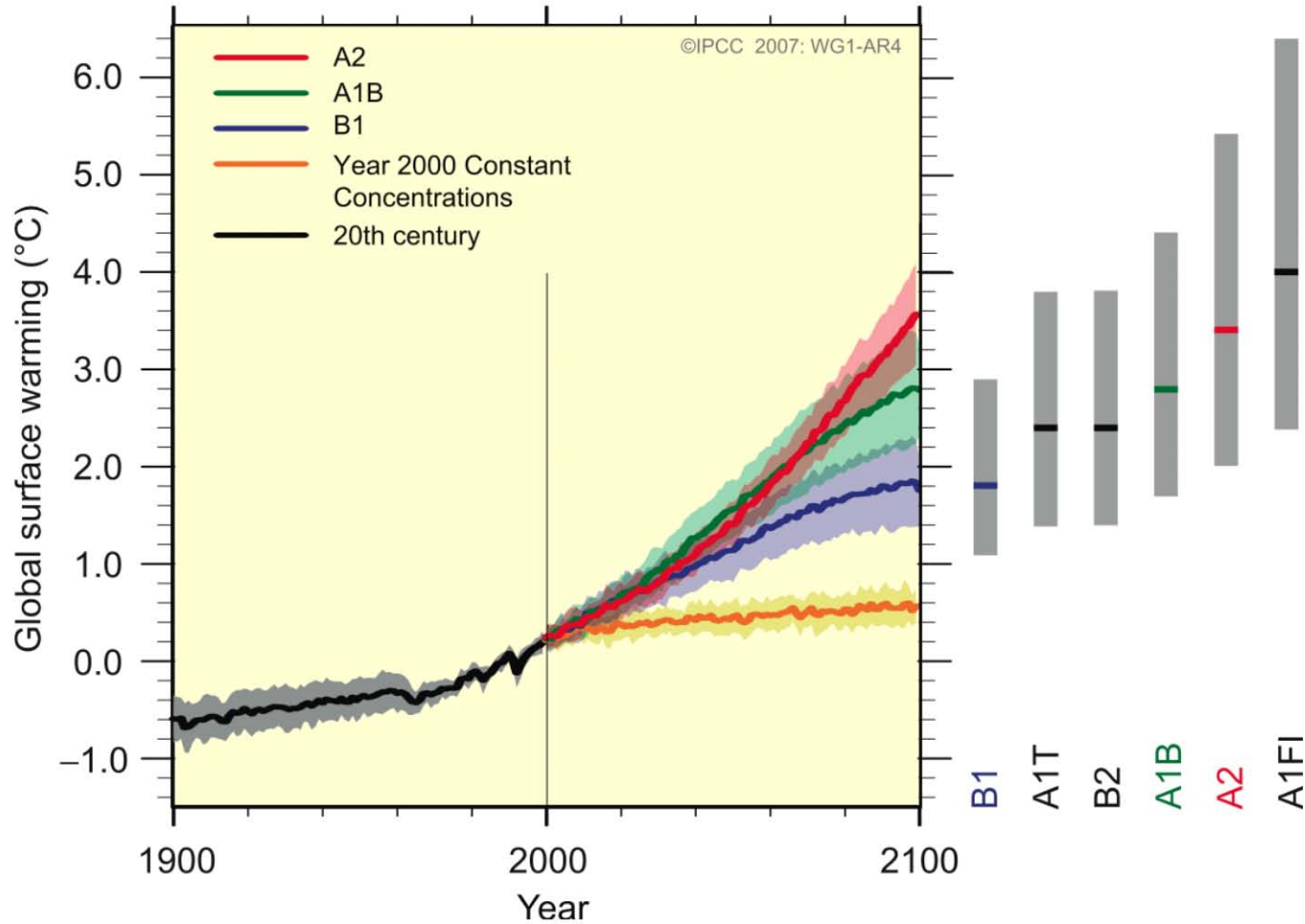
# Predicting future climate(s)

## Global Climate Models



## Emissions scenarios

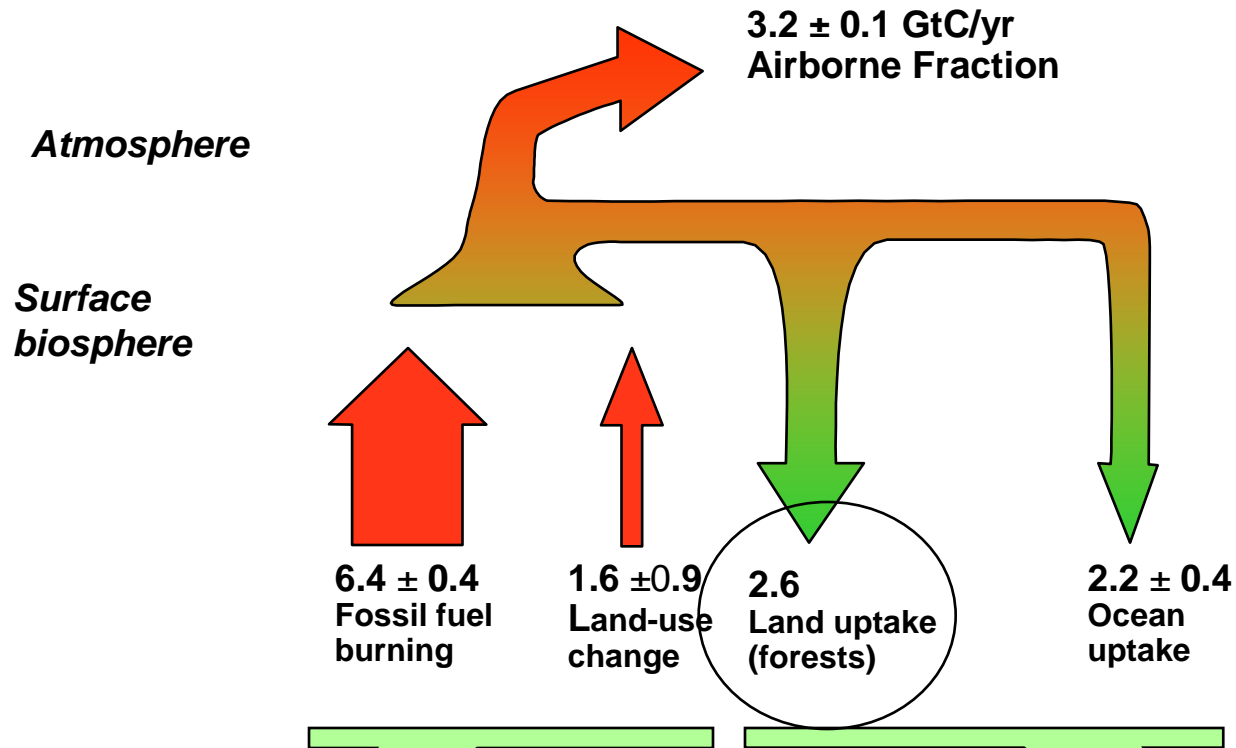




(Source: IPCC AR4)

Expect droughts, floods, maladaptation of trees, loss of ecosystems, food supplies, cities...

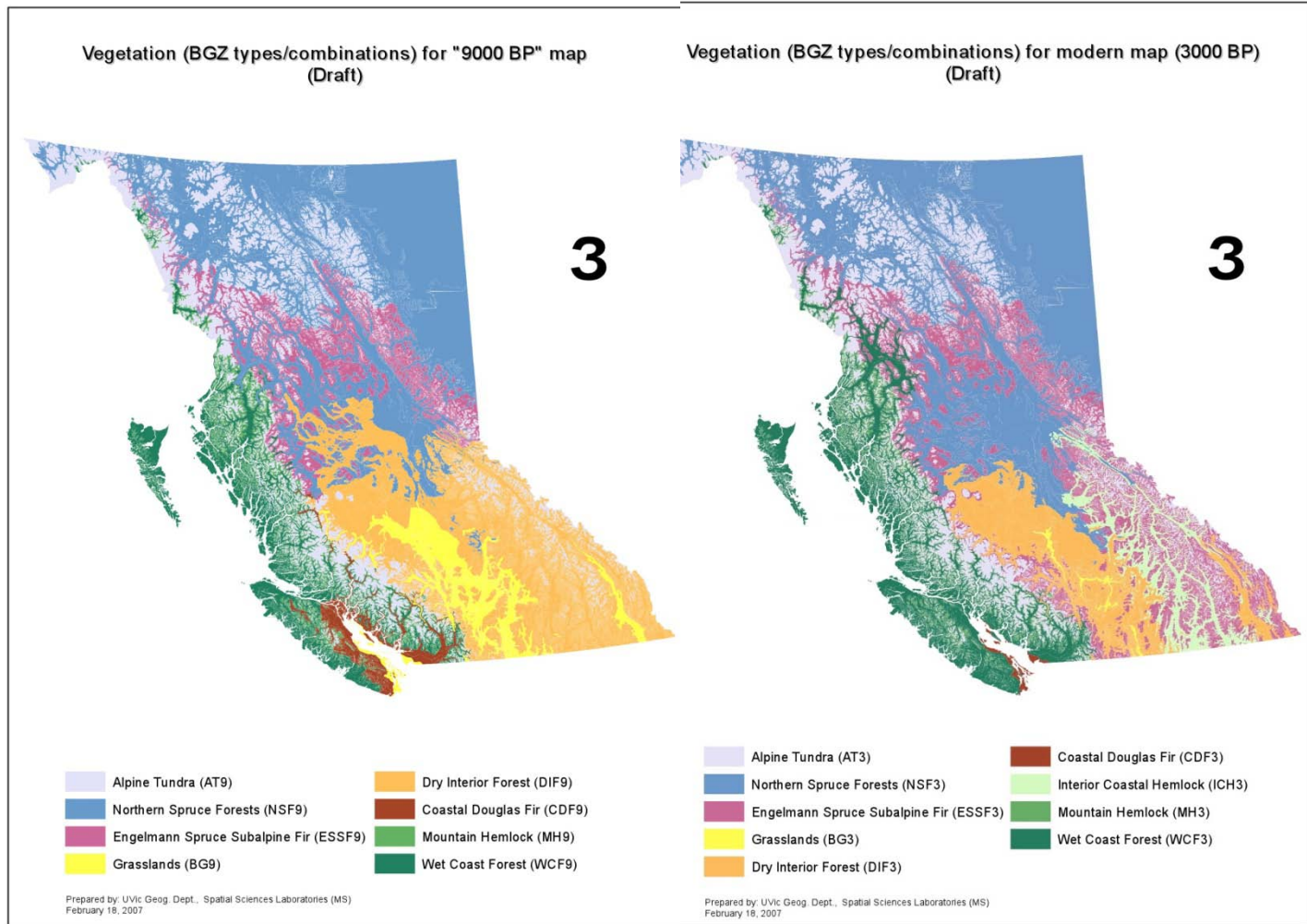
# Solutions: Manage Global Carbon Flows



Reduce emissions

Increase sinks

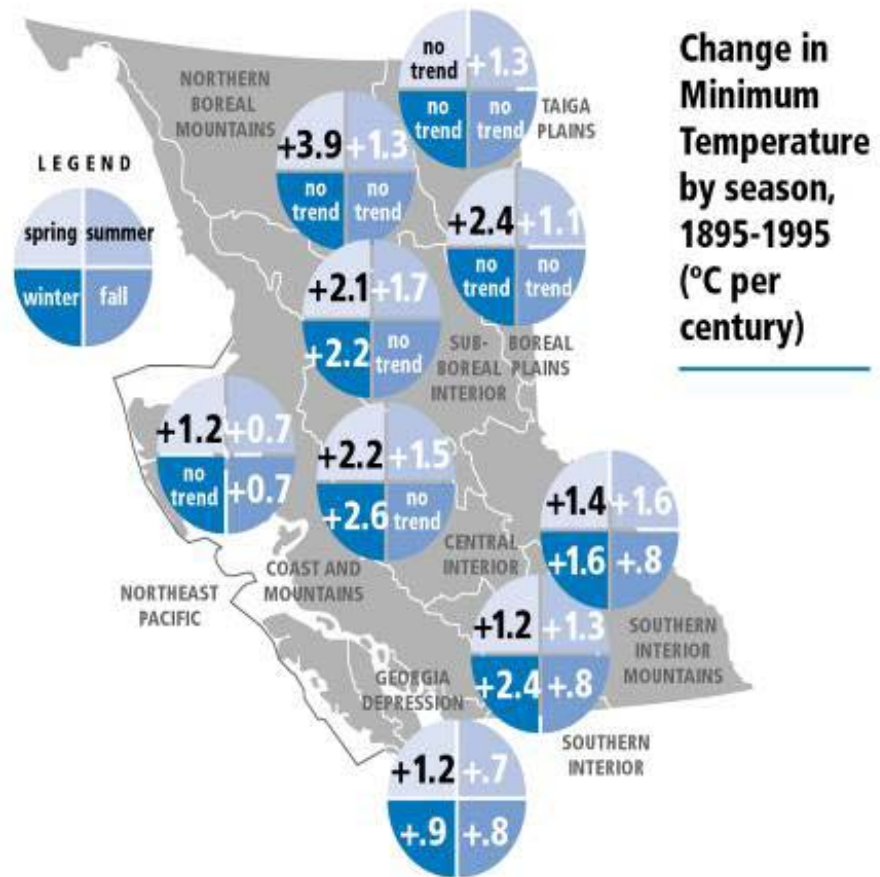
# BC's history of climate change



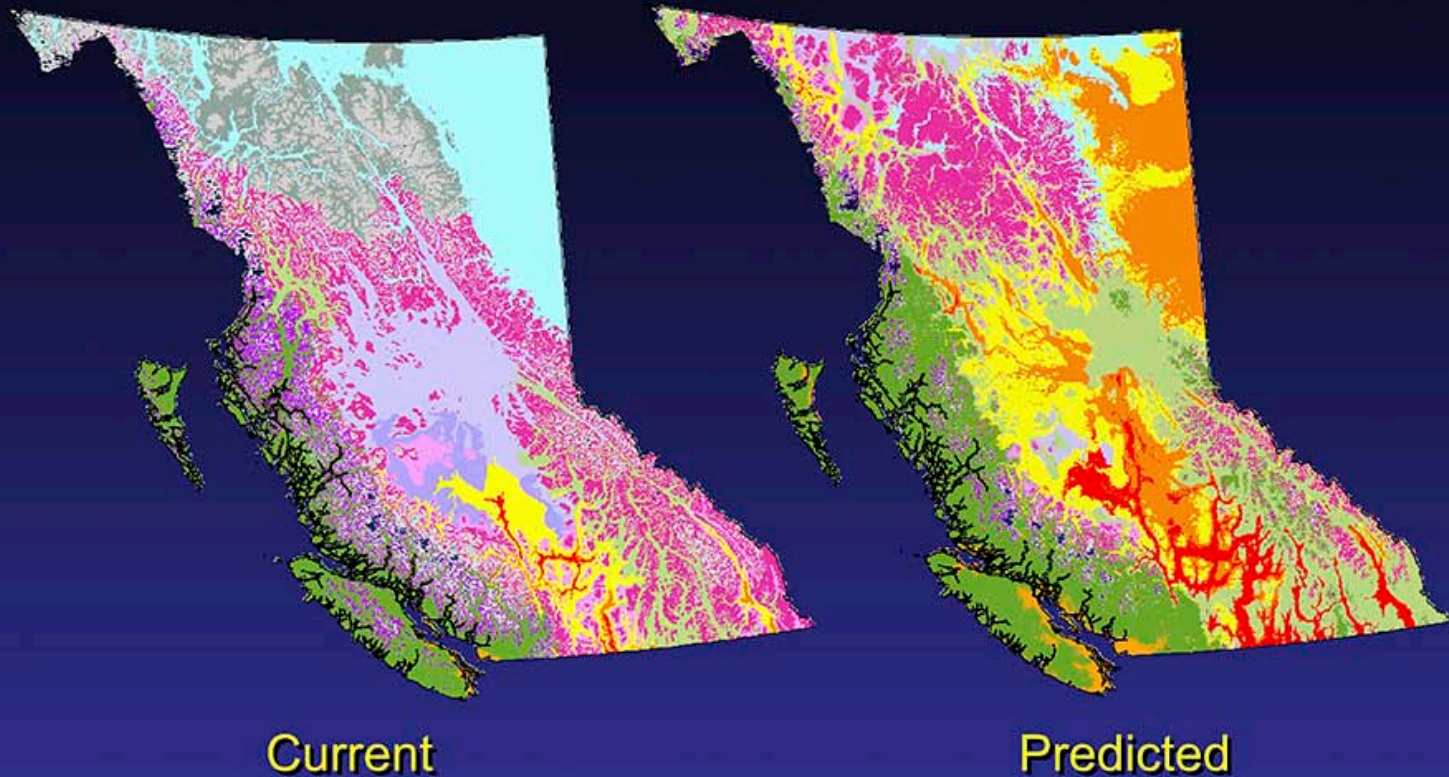
# BC has been warming for 100 years...

- faster in north
- warmer winters
- earlier springs
  
- Compare with global increase:  
0.6° C

## ➤ MPB epidemic



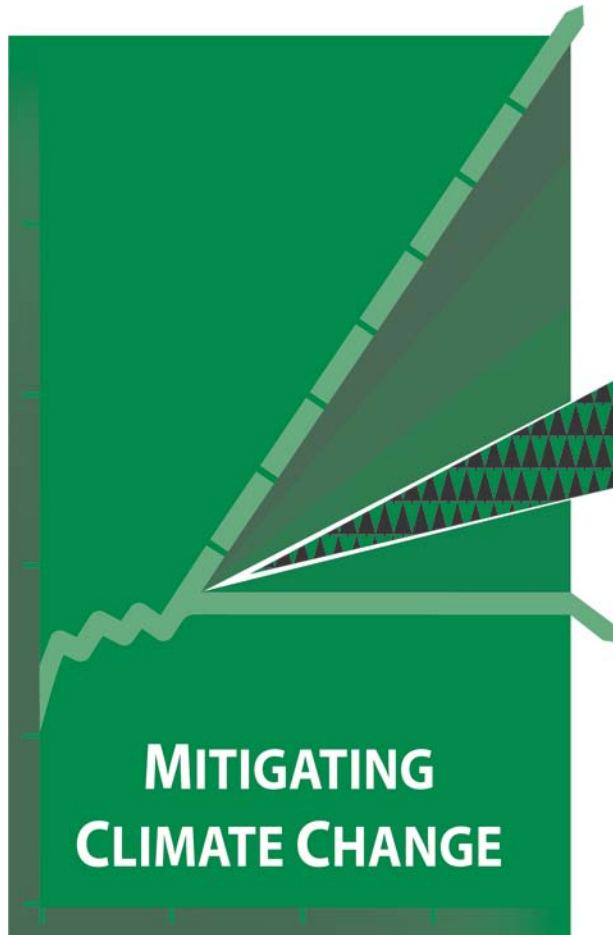
## BEC zone climate envelope (2020s, 2050s, 2080s)



# Climate Change Impacts in BC Forest Ecosystems



## 2. MFR Initiatives



- Mitigating
  - “Avoid the unmanageable”
  
- Adapting
  - “Manage the unavoidable”

# MFR's Climate Change Strategy

1. Reduce Our Carbon Footprint  
(Achieve carbon-neutral government.)
2. Manage Forest Carbon  
(Prevent additional CC.)
3. Assess Impacts, Vulnerabilities, Policy Opportunities  
(Know what we're dealing with.)
4. Help Forest and Range Managers Adapt  
(It's too late to prevent CC.)

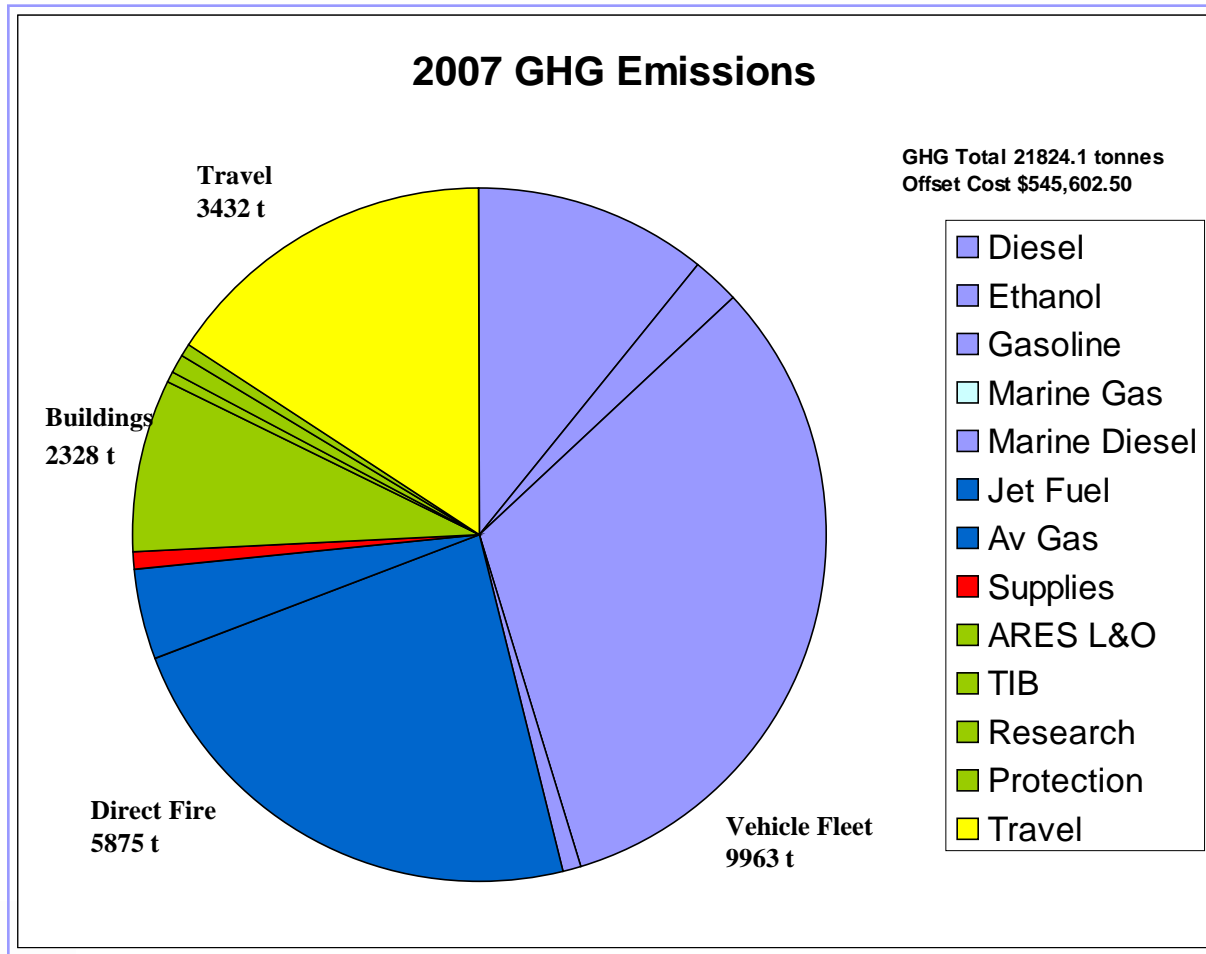
## Mitigating

- Low-carbon economy
- Reducing emissions
  - Green Teams
  - Zero Net Deforestation
- Increasing removals
  - Bigger, faster trees
  - Emission Offsets (carbon credits)

## Adapting

- Knowledge, tools, policies, monitoring
- Work with
  - Industry (FSCASC)
  - First Nations
  - Communities (e.g., MPB)
  - Academia

# Reduce MFR Emissions



# The low carbon economy

## Early days in BC

## Opportunity?

- Everybody wants money for carbon

## Or cost?

- Pacific Carbon Trust – regulated offsets
- Western Climate Initiative – cap and trade
- North American Carbon Market? - cap and trade

## Huge amounts of money

- Redesigning economic engines, built environment

# Why must BC forestry adapt?

- Future climate change is “in the pipe”
- “Sudden” and unexpected impacts
- Complex biogeoclimatic interactions
- Mitigation won’t work without adaptation!

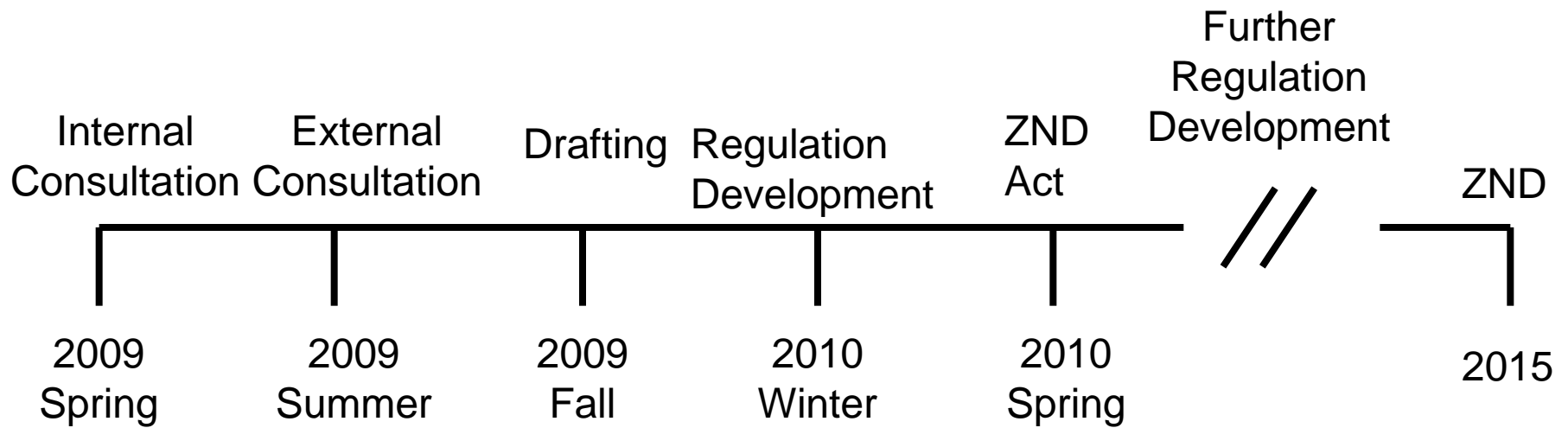
# 3. Zero Net Deforestation

- 1) Vision
- 2) Reasons for ZND
- 3) Defining ZND
- 4) Approaches to ZND

# 1) Vision from 2008 Throne Speech

*“The Province will pursue a goal of zero net deforestation, and work with First Nations, industry and communities to put that goal into law by 2010 and establish a viable strategy for realizing that vision by 2015”.*

# ZND policy development



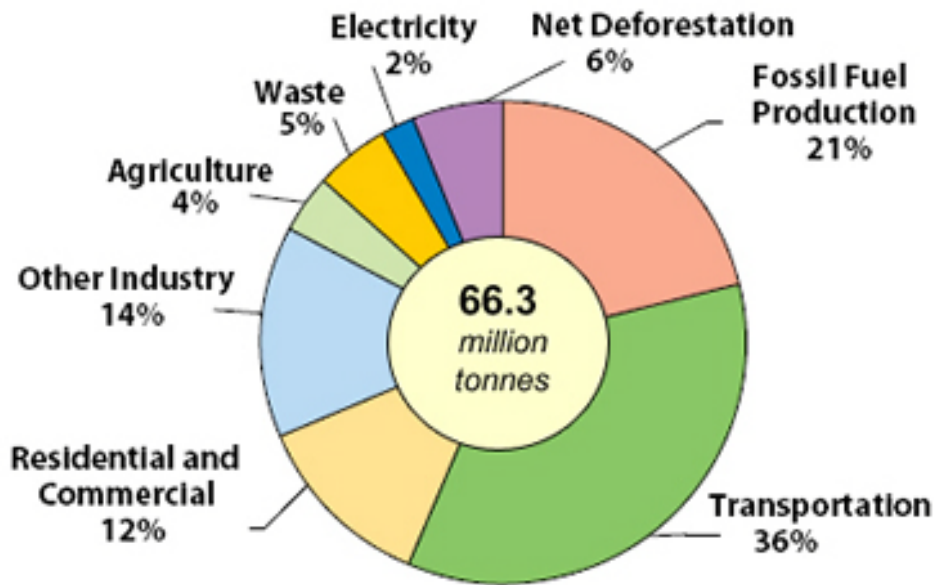
## 2) Reasons for ZND

- a) Global climate change
- b) BC's GHG emission targets
- c) Global leadership



# b) BC's GHG Emission Targets

**B.C. Greenhouse Gas Emissions (2006)**



BC's emissions  
66 M t/y CO<sub>2</sub>e in 2006

Reduction target 2020  
22 M t/y CO<sub>2</sub>e (33%)

Deforestation emissions  
4 M t/y CO<sub>2</sub>e in 2006

➤ **One-fifth of target!**

# c) Global Leadership

## Global

- 3% deforested, 1990-2005
- 0.2% per year
  
- 20-25% of GHG emissions
  
- Huge problems in tropics:
  - Illegal logging
  - Population pressure (subsistence agriculture)

## BC

- 0.3% deforested, 1990-2005
- 0.02% per year (<10,000 ha/y)
  - One-tenth the global problem
  
- 6% of GHG emissions
  - One-third the global problem
  
- Huge advantages in BC:
  - ✓ Stable governance
  - ✓ Manageable growth
  
- **If we can't do ZND, who can?**

# 3) Defining ZND

## Deforestation

**= human-induced (permanent) change of land use from forest to non-forest**

- Examples:
  - Agriculture
  - Urban
  - Forestry (major access roads)
  - Industries (mines, utility corridors...)
- Harvest or wildfire, followed by forest regeneration, is **not** deforestation.

## **Zero Net Deforestation**

**= no net loss of forest area \*\*\***

**OR**

**= no net loss of forest productivity**

**OR**

**= no net GHG emissions from forest land use change**

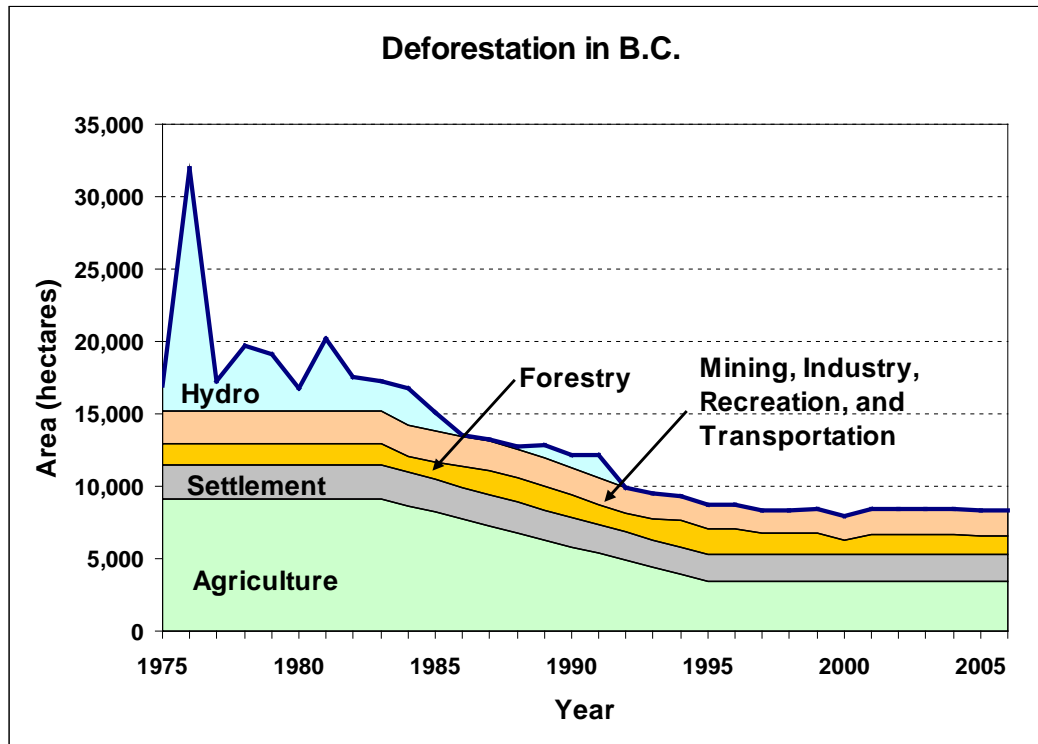
# Possible BC definition of ZND

- We need to achieve ZND using international definitions
- Achieving more using BC definitions would be a bonus

# Deforestation estimates

- Canadian Forest Service methodology
  - UNFCCC definitions
  - National GHG Inventory Report
  - BC GHG Inventory Report
  - 6% and 12% sampling
  - Good methodology
  - May be able to improve on some issues

# 4) Approaches to ZND



Historical reduction to  
~8,000 ha/y  
(4 M t/y CO<sub>2</sub>e)

~60% public land  
~40% private land

# Our approach

- Recognize:
  - Many sectors cause deforestation
  - Value of economic development
- Need to work as a team inside government
- Need to engage people outside government
- Need to be open, flexible, creative
- **ZND by 2015 or bust!**

# Three Approaches

## Avoid

- Think before you deforest
- Directly helps reduce GHG emissions

## Minimize

- Reduce “unnecessary” deforestation
- Directly helps reduce GHG emissions

## Compensate

- Afforest to compensate for “permitted” D
- Area for area will not address GHG emissions!

# Failure is not an option

- a) Globally, climate change scenarios based on continued GHG emission increases lead to global catastrophes
- b) In BC, not meeting emission reductions from deforestation merely shifts the burden of reductions onto other sectors
- c) Global leadership is a scarce commodity and BC has a good opportunity to lead

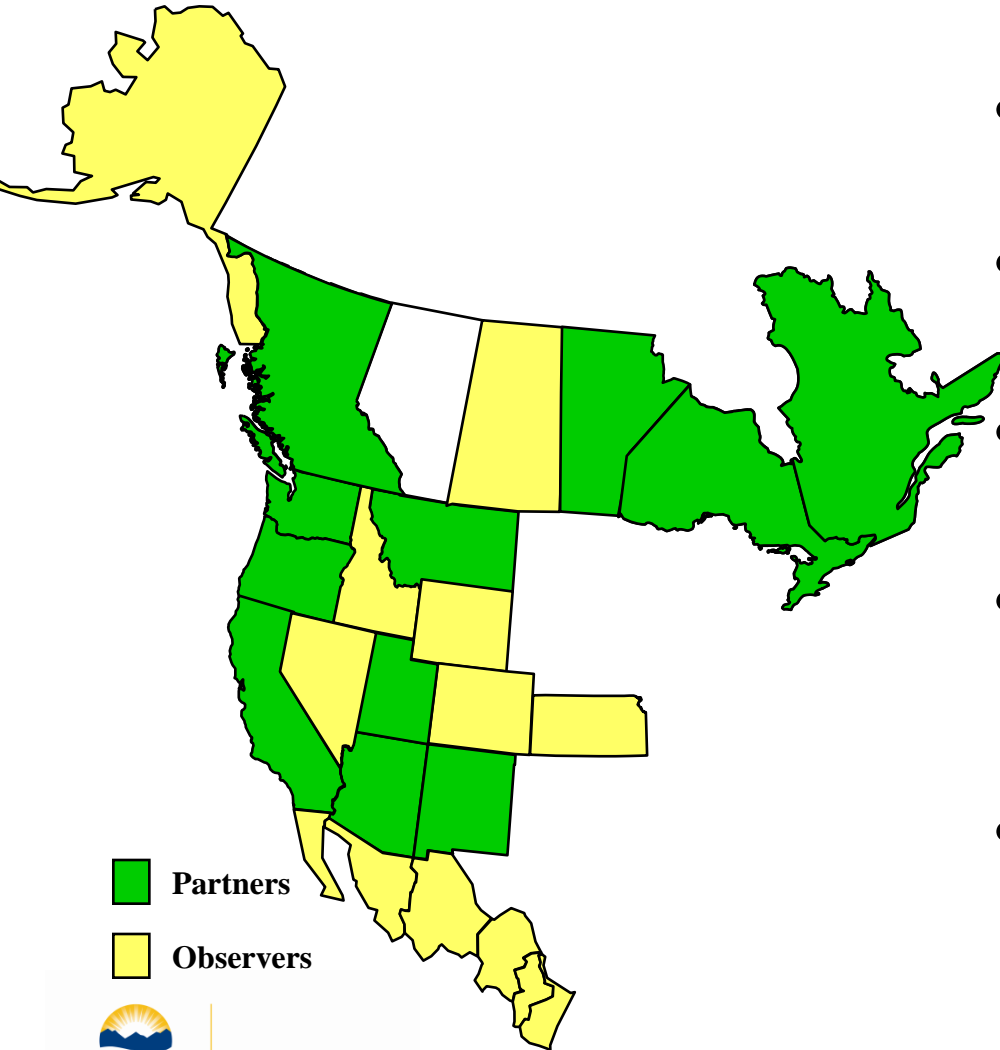
# Forest Carbon Offsets





# BC and Carbon

- Climate Action Plan
  - 66 million tonnes/year CO<sub>2</sub>e in 2006
  - 33% reduction by 2020 (22 M t/y CO<sub>2</sub>e)
  - Carbon-neutral government by 2010 (PCT)
- Forestry Roundtable
  - Include forests in WCI cap and trade system
  - Enable short rotation plantations
  - Establish carbon offset credits

# Western Climate Initiative



 **Partners**  
 **Observers**

- **Cap and Trade System**
- Begins in 2012
- 4 provinces  
(73% of Cdn. economy)
- 7 states  
(20% of US economy)
- Covers 90% of region's emissions

# Canada and UN

- Federal programs still not clear

- IPCC sees a clear role for forests:

A sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fibre or energy from the forest, will generate the largest sustained mitigation benefit.

(IPCC AR4)

# Offset Protocols

- “Recipes” for carbon offset projects
- PCT’s RFI for forest offset projects:
  - Afforestation
  - Using select seed
  - Fertilizing
- To be completed by end of June
- High standard
- High transaction costs
- Potential use in WCI

# MFR's Carbon Activities

- Zero Net Deforestation (Brian Raymer)
  - Offset Protocols (Brian Raymer)
  - Harvested Wood Products (Mark Hafer)
  - Partnerships with industry, PFC, CAS, PCT, FNs?...
- 
- Research (Caren Dymond)
  - Inventory (Graham Hawkins)
  - Timber Supply Review (Christine Fletcher)
  - Silviculture (Kevin Astridge, Al Powelson)
  - Bioenergy (Don Gosnell)

# Forest Carbon Activities

- Removal enhancement
  - Landscape (afforest, reforest, longer R)
  - Stand (select seed, fertilizing)
- Emission reduction
  - Landscape (avoid deforestation, fire)
  - Stand (soil, partial retention)
- Other emission reductions
  - Fossil fuel use (efficiency, bioenergy)
  - Wood products (store carbon, displace concrete/steel)



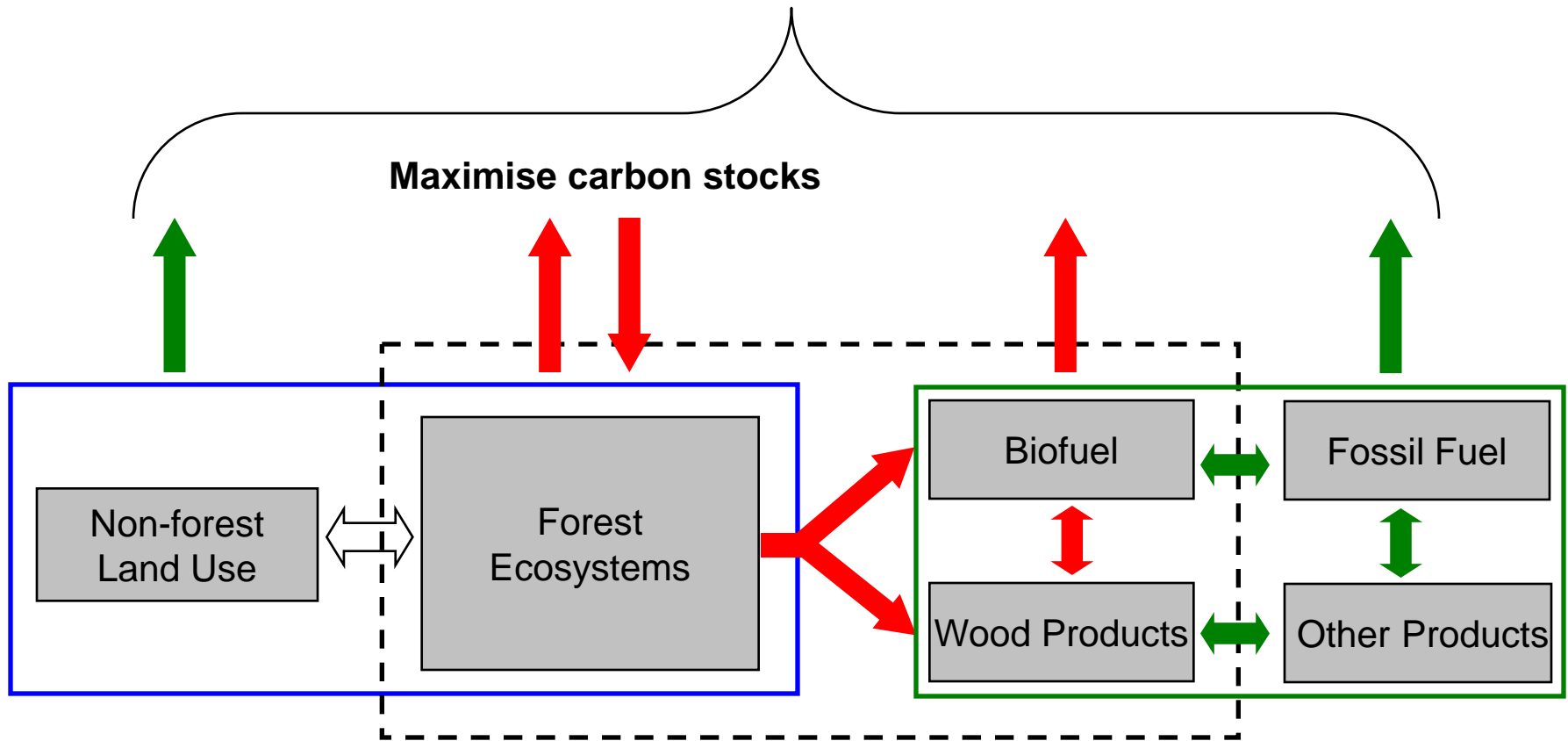
# Who's interested?

- Forest Sector Climate Action Steering Committee (FSCASC)
  - Strategy work began in January 2008
  - “Supplier of choice of climate-friendly products and services”
- ENGOs
  - First meeting in February
  - Pacific Institute for Climate Solutions conference in fall 2009
  - “Stop logging old growth carbon banks”
- FNs
  - Haida, Gitxsan, Coast First Nations...
  - “Land stewards that make money from carbon credits”

# Overall Goal for Forest Carbon?

Minimise net emissions to the atmosphere

Maximise carbon stocks



Land-use Sector

Ministry of  
Forests and Range

Forest Sector

Services used by Society

# Wood products considerations

Aim is to minimize net GHG emissions from total system

## 1. Storage

- Wood products
- Char

## 2. Substitution of products with high fossil fuel footprint

- Solid wood (buildings, furniture...)
- Burning wood for energy
- Wood-based biofuels

Need the data and the models

CORRIM

CFS-CBM-HWP

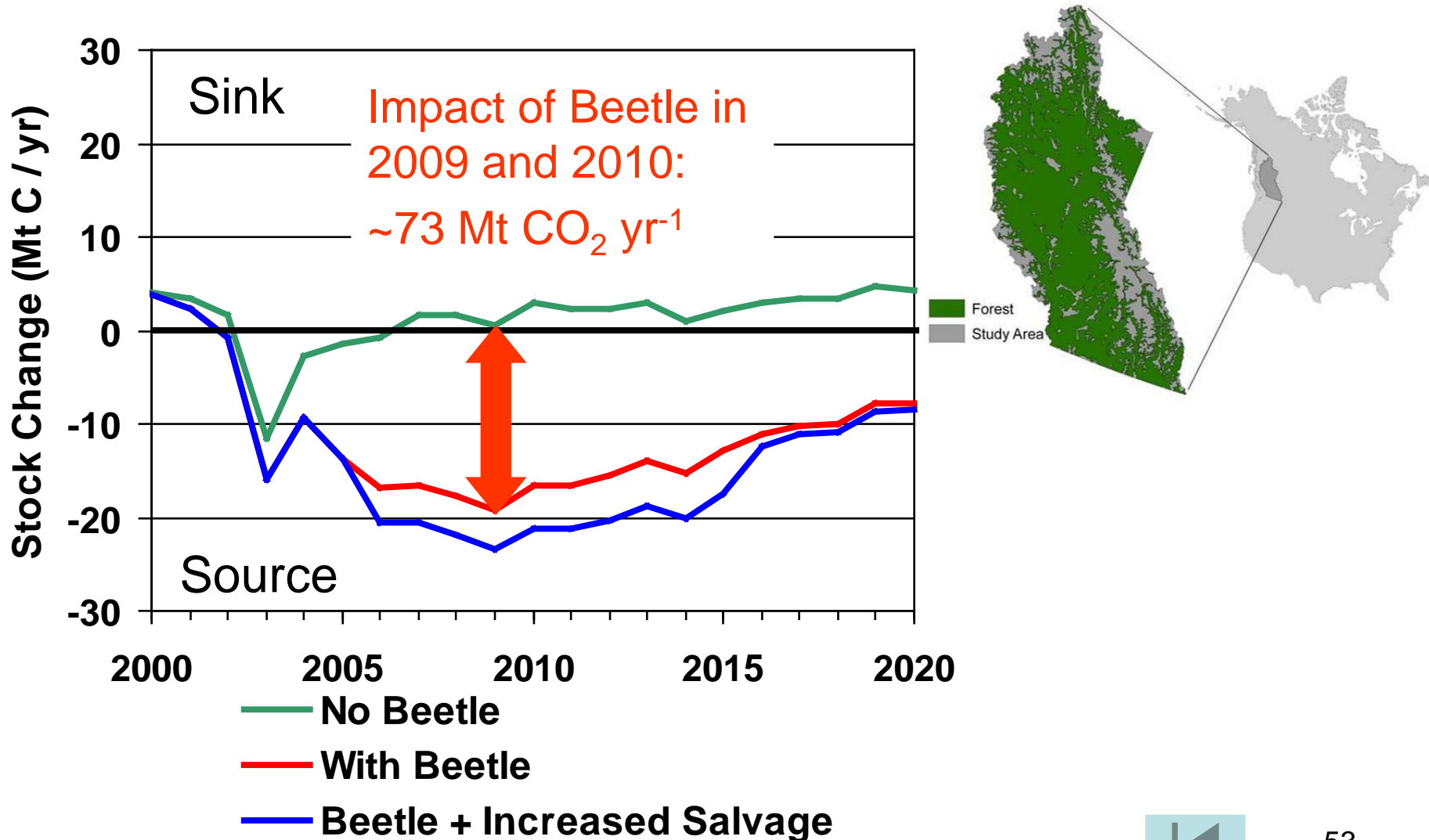
# What are the Opportunities?

- 25 M ha of timber harvest land base (THLB)
- 35 M ha of other forest
  
- Increase wood on the land (increase removals)
  - Add 1 t/ha = 25 M t or 2.5 M t/y over 10 y
- Increase wood products (reduce emissions)
  - Add 1 B bd ft = 1.2 M t/y of wood stored & 2.5 M t/y avoided
  - Add 300 MW biomass fuel = 2.5 M t/y avoided
  
  - Hypothetical Total = 8.7 M t/y

# Limitations?

- Forest carbon can only provide a small part of the needed solution (one of several “stabilization wedges”).
- Prompt reforestation is the norm.
- Less than 1 M ha available for afforestation
- Harvest <200,000 ha/y
  - 0.3% of total forest in one year
  - Only 9% of total forest over 30 years
- Economics of forestry
- Fiscal constraints

# Impacts of MPB (Climate Change) in BC



Source: Kurz et al. 2008, Nature



# 5. Future Forest Ecosystems Initiative



## Purpose:

- Adapt BC's forest and range management framework to a changing climate

## Desired outcomes:

- Resilient ecosystems
- Ongoing flow of ecosystem goods & services

# From science to policy

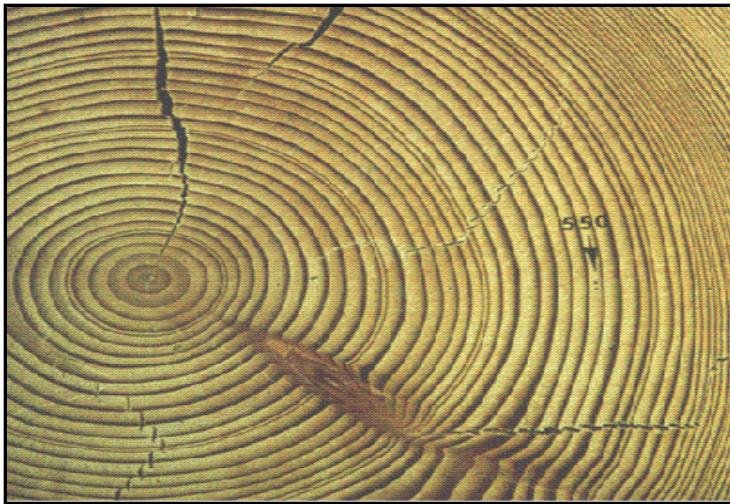
- Build capacity
  - Research, models
  - Tools, strategies, partnerships
  - Policy options
- “Mainstream” adaptation
  - Government facilitates adaptation
  - Industry and communities implement adaptation
  - Assess effectiveness of adaptation

# Structure

- Management Steering Committee
- Technical Team
  - Ministry of Forests and Range
  - Ministry of Environment
- 5 Working Groups:
  - Modeling
  - Monitoring
  - Vulnerability Assessment
  - Interim Policies
  - Communications

# 4 steps of adaptation

<b>Impact Assessment</b>	(biophysical, ecological)
<b>Vulnerability Assessment</b>	(social, economic)
<b>Adaptation</b>	(actions to reduce vulnerability)
<b>Integration</b>	(monitoring, adjusting)



# Activities in 08/09

- **Impact Assessment (biophysical, ecological)**

14 research projects, including co-funding a national study of tree species vulnerability

Other work

- 3 Technical Team workshops in May, Sep, Jan
- Modeling CC impacts on BEC, hydrology
- Monitoring indicators developed, 2 workshops in Nov, Jan
- Impacts study, workshop in Oct
- Resilience (scientific foundation) paper

- **Vulnerability Assessment (social, economic)**

- Policy workshop in March (7<sup>th</sup> workshop!)

# Activities in 08/09

## Adaptation

- Seed transfer rules
  - Species selection tool design
  - Species reporting tool
  - Free-growing policy
  - Elimination of NSR
  - CC and inventory
  - Carbon in TSR
  - Land deletions from provincial forests
- 
- **Integration**
    - Seminars, Newsletter, Sharepoint, Website
    - Policy workshop in March

# FFEI Communications Strategy

- Variety of internal and external audiences
- Some still need simple, basic messages

E.g., adaptation will be a big challenge

1. Partner symposium
2. Technical reports
3. Seminar series
4. Newsletter
5. Extension of research
6. Policy announcements

Seed use

# Climate Change = Uncertainty

- Historical empirical evidence is no longer a reliable guide for future actions
- New principles for managing forests under climate change:
  - Increase resilience
  - Increase diversity across the landscape
- Plan for multiple scenarios

# For More Information

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