



Canadian Food
Inspection Agency

Agence canadienne
d'inspection des aliments

Canadian Food Inspection Agency



Climate Change and Invasive Alien Species

Ian Campbell

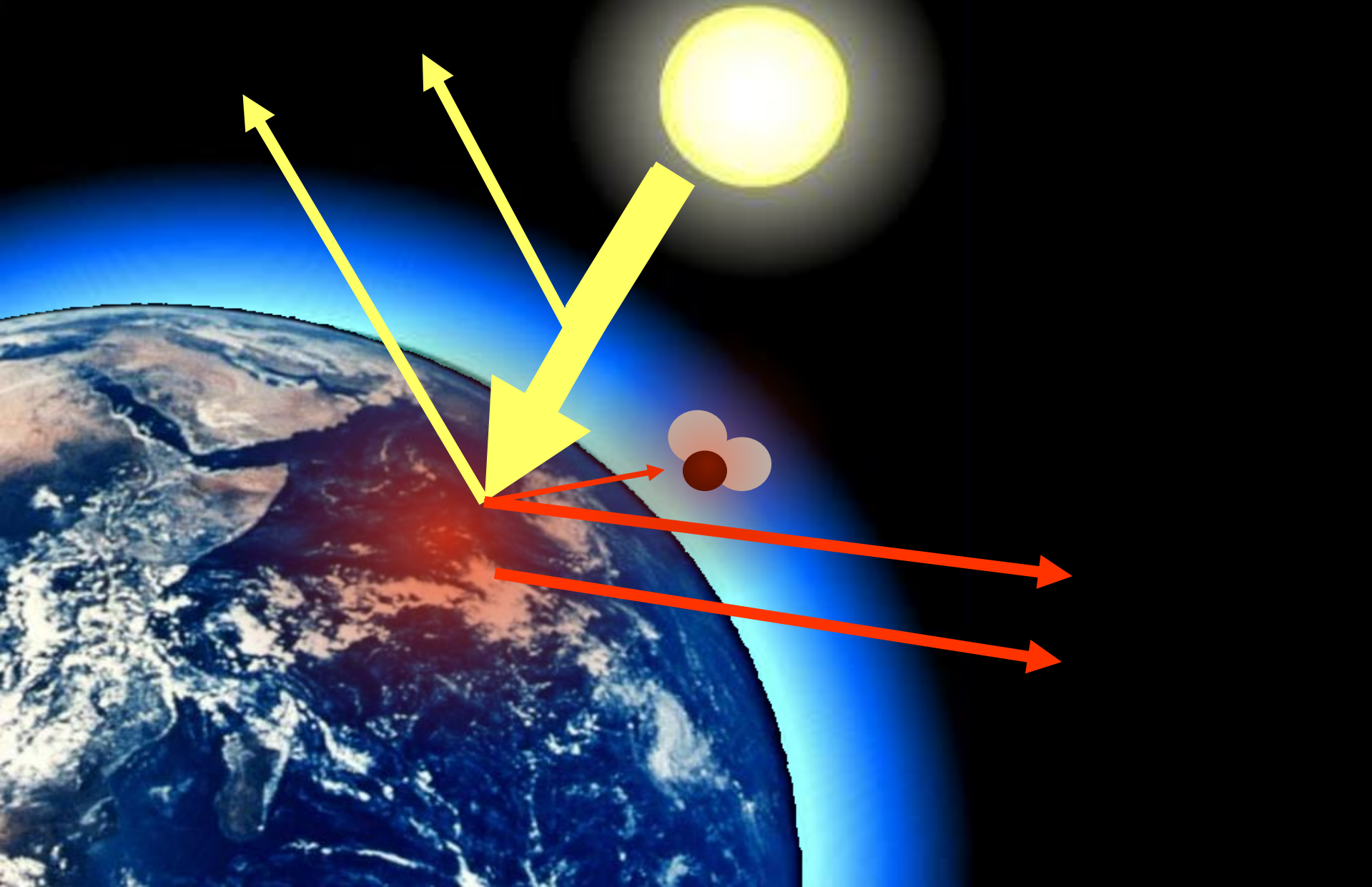
19.VI.08

Canada

Outline

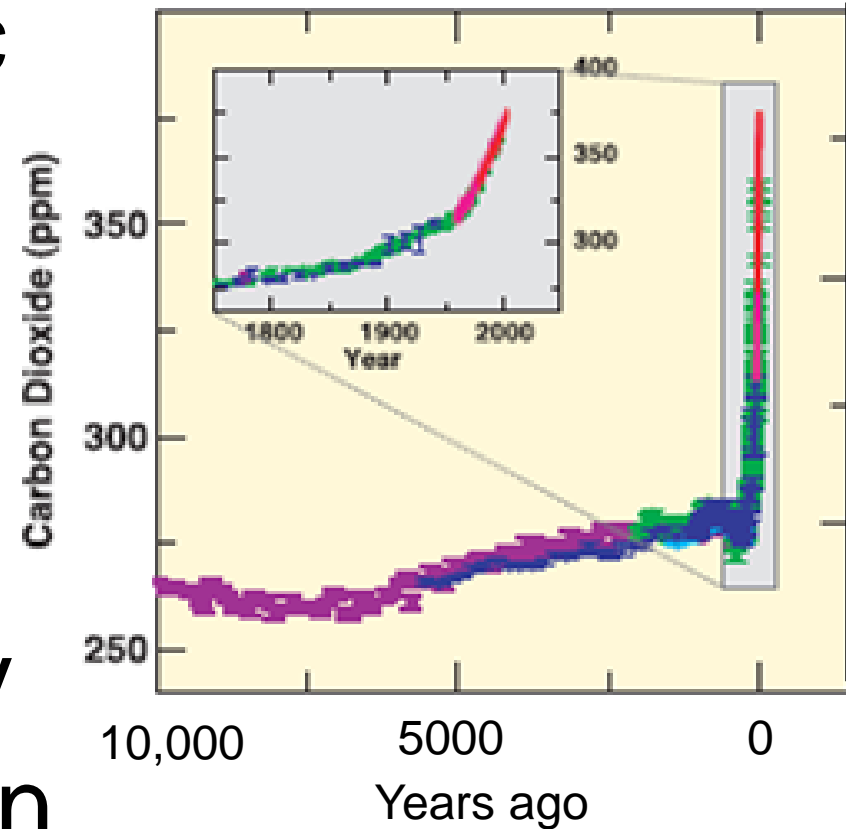
- Climate change science
- Climate change impacts
- Impacts on Invasive Alien Species
- Things we can do to prepare

Climate Change Science



The IPCC (2007) concluded:

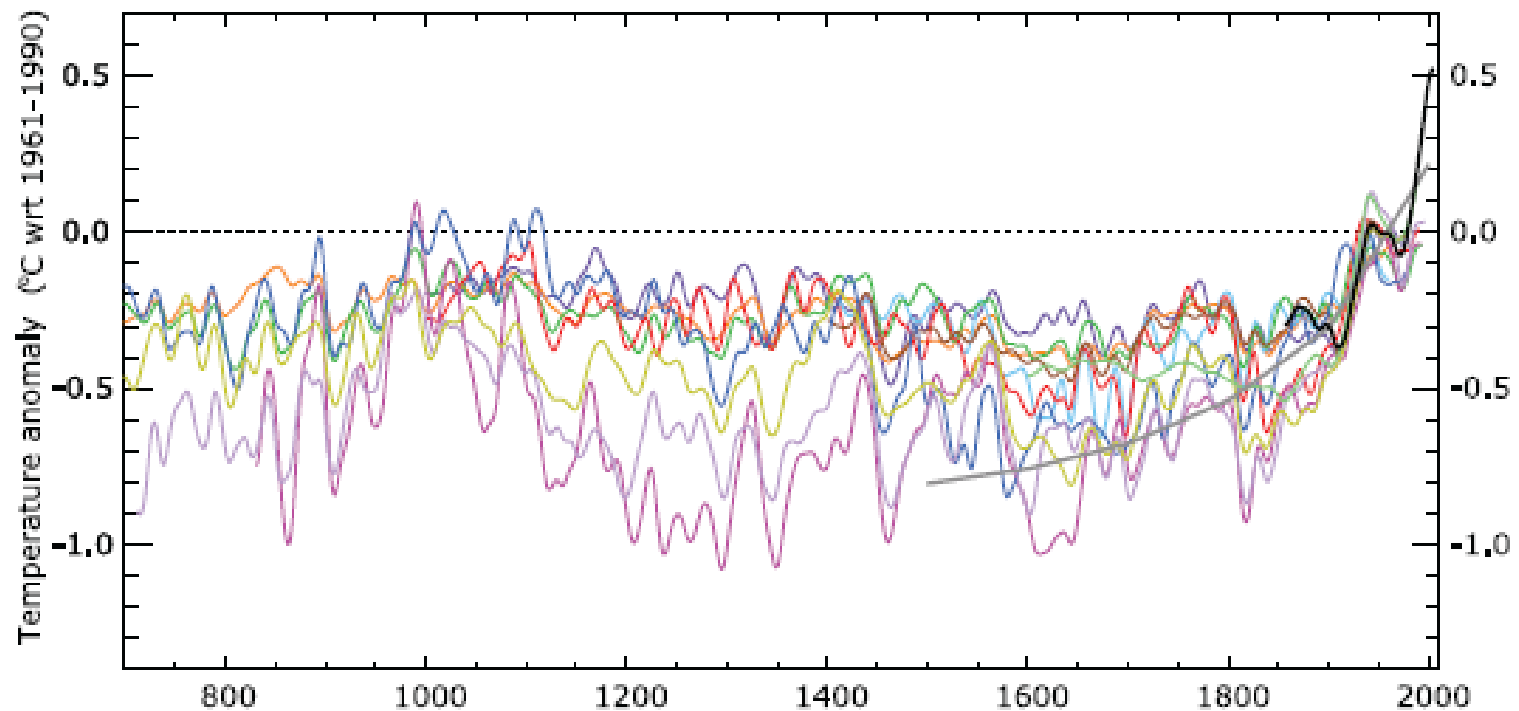
Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 [...]



The IPCC (2007) concluded:

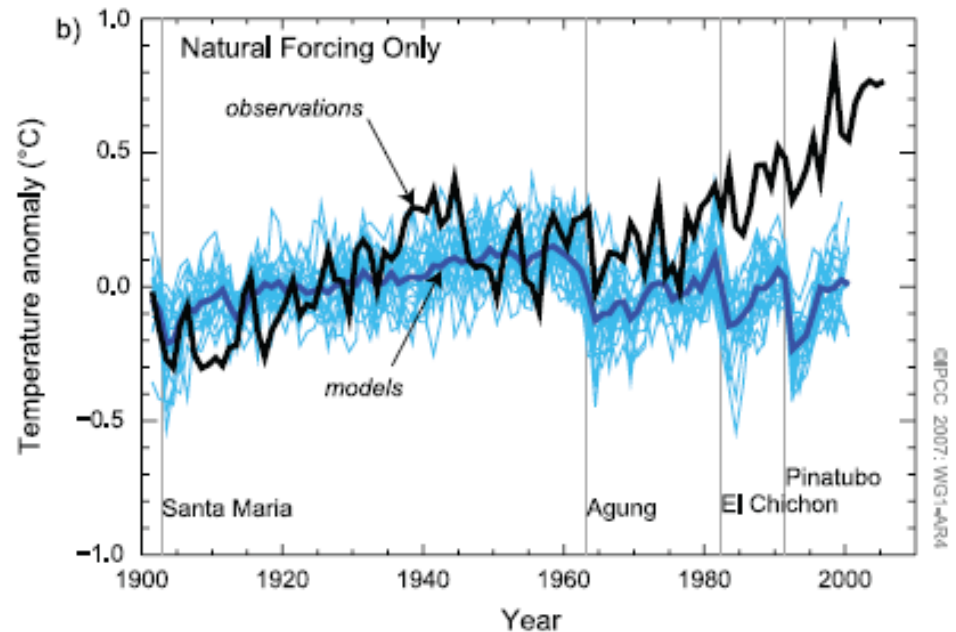
Warming of the climate system is unequivocal [...]

NORTHERN HEMISPHERE TEMPERATURE RECONSTRUCTIONS



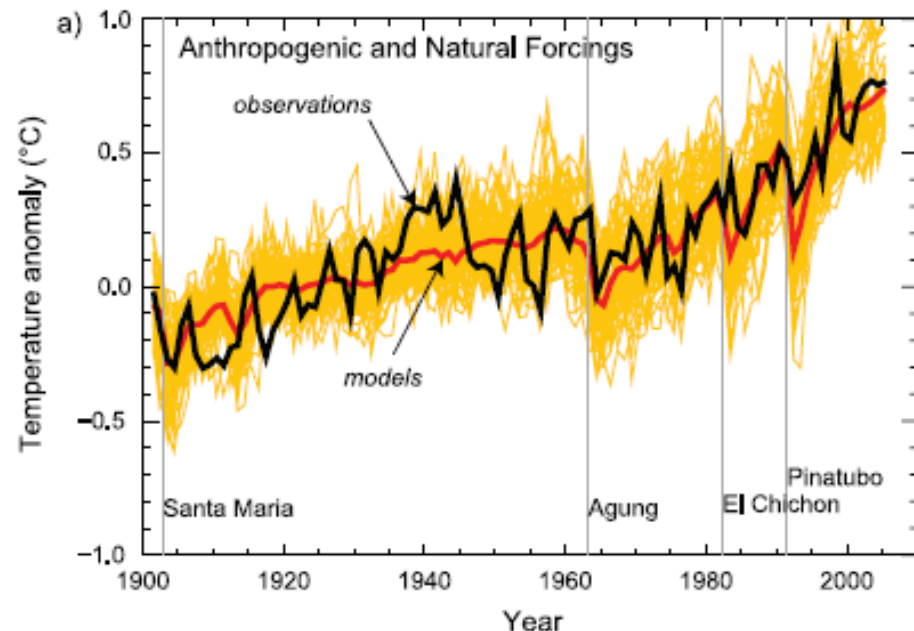
The IPCC (2007) concluded:

The understanding of anthropogenic [...] influences on climate has improved [...] leading to very high confidence that the global average net effect of human activities has been one of warming [...]

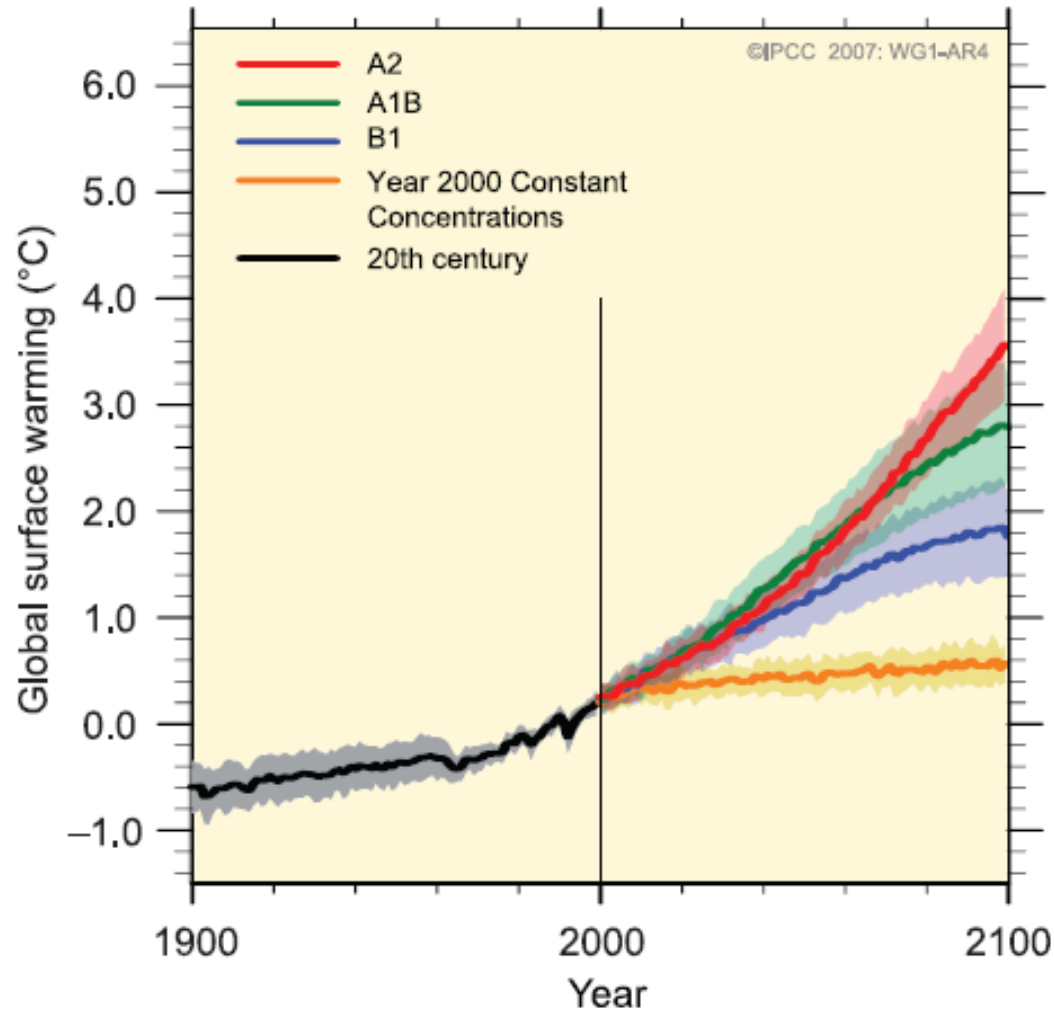


The IPCC (2007) concluded:

Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in greenhouse gas concentrations.



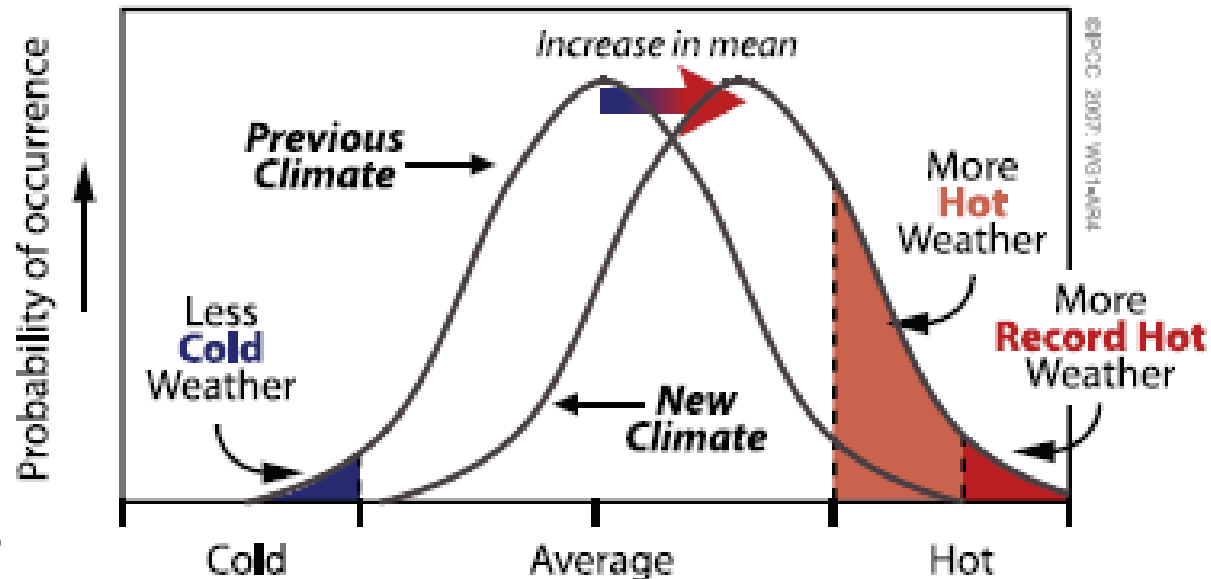
Anticipated Impacts



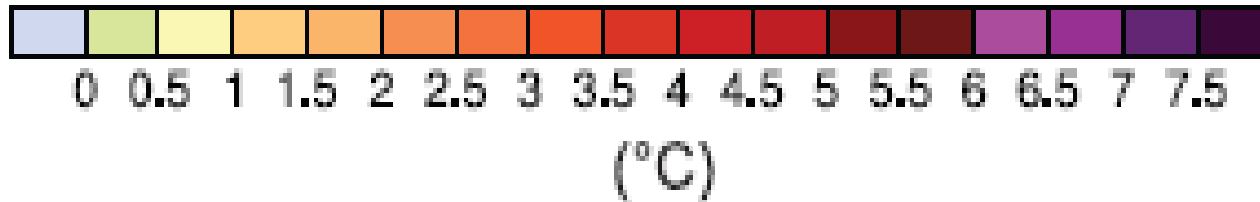
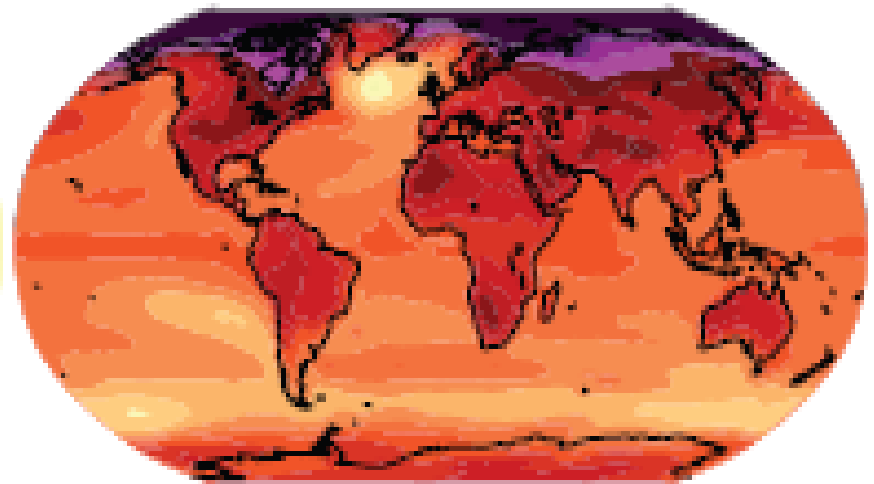
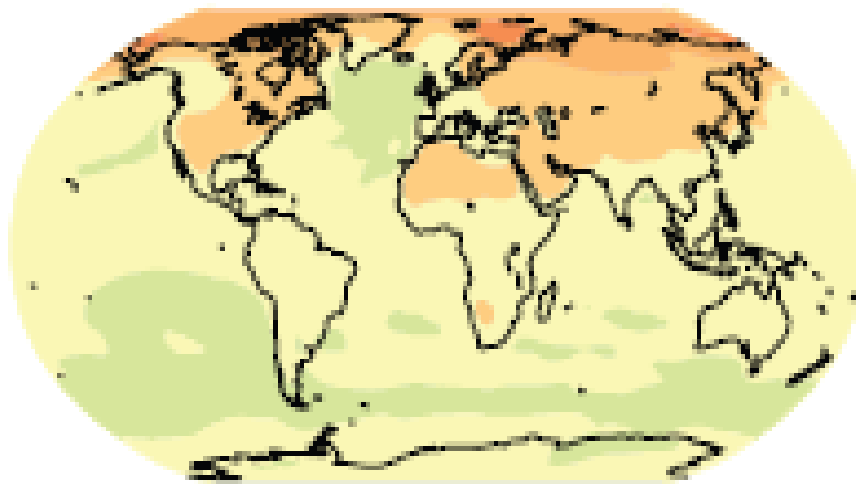
Some direct climate changes

Increased frequency of weather now considered extreme – e.g.

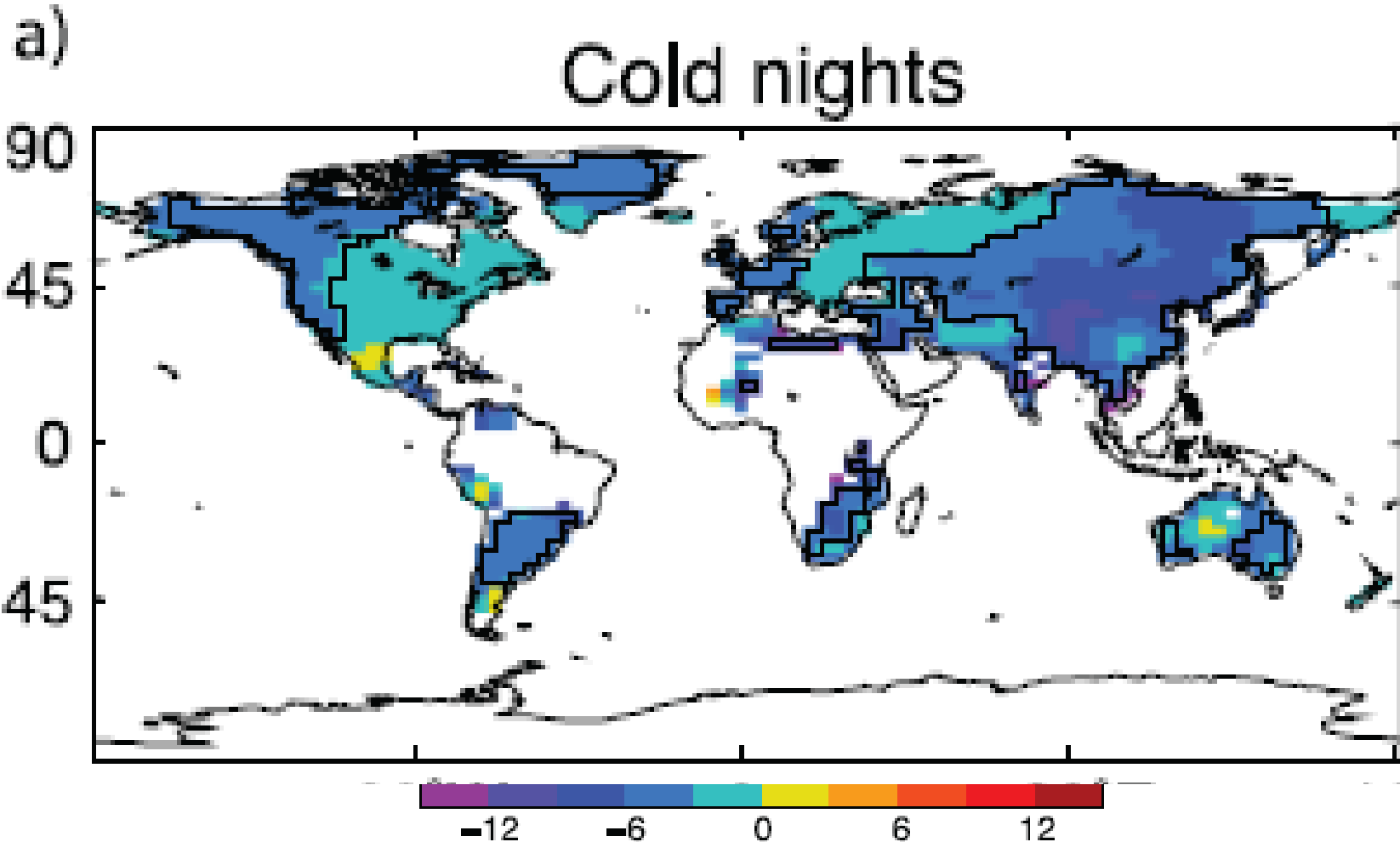
droughts,
floods,
hurricanes,
tornadoes,
heat waves



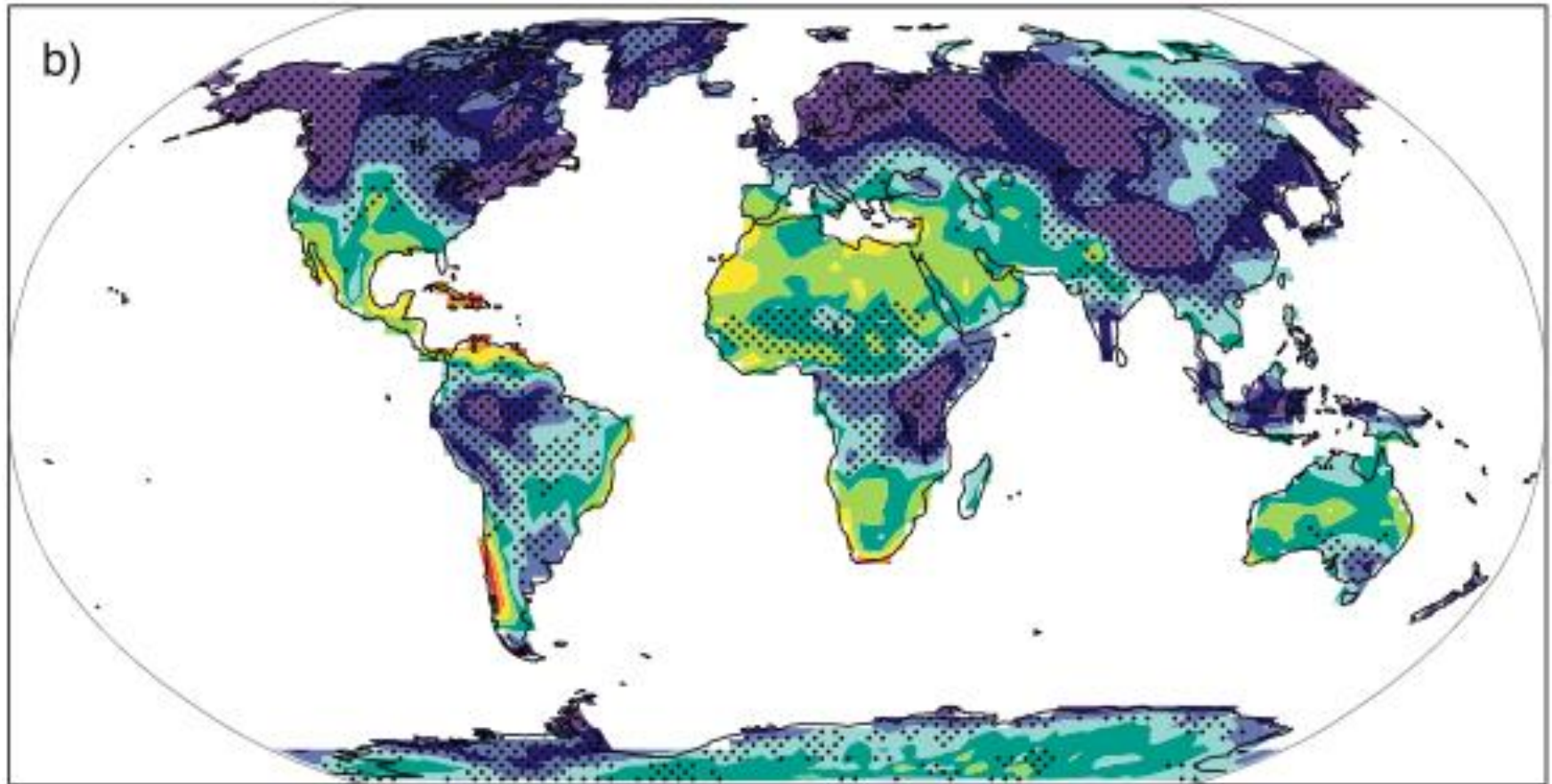
The warming will not be even



Reduced frequency of extreme cold events



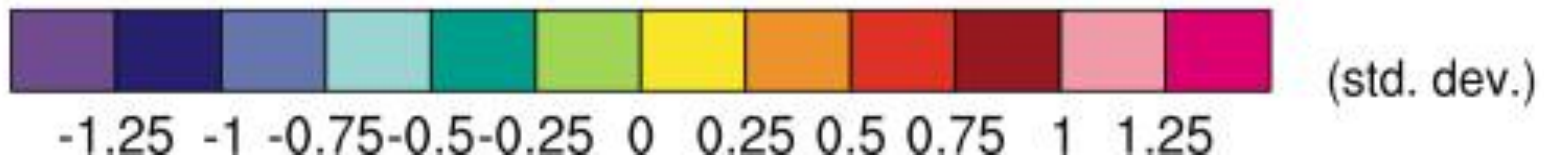
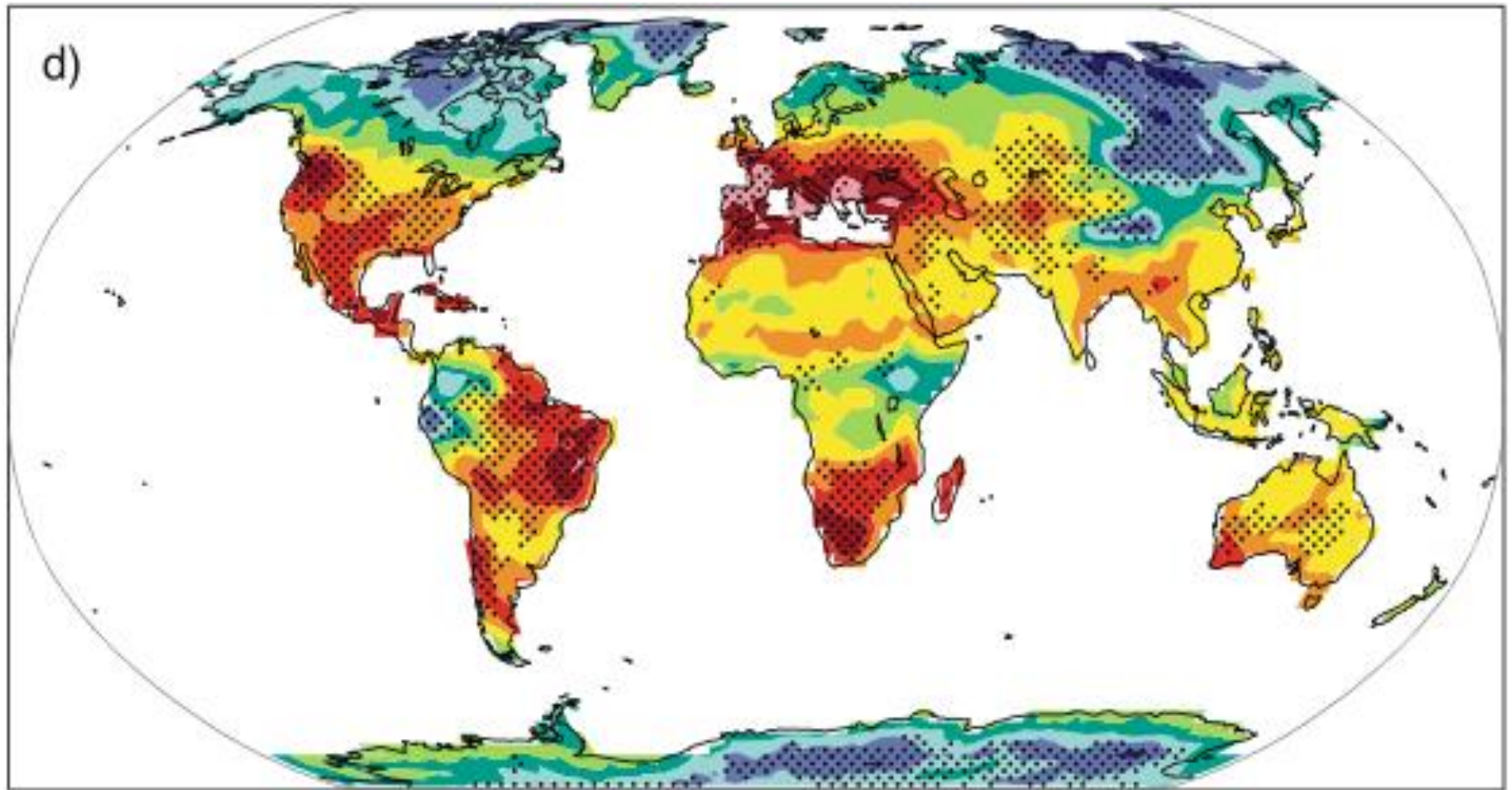
More intense precipitation



-1.25 -1 -0.75 -0.5 -0.25 0 0.25 0.5 0.75 1 1.25

(std. dev.)

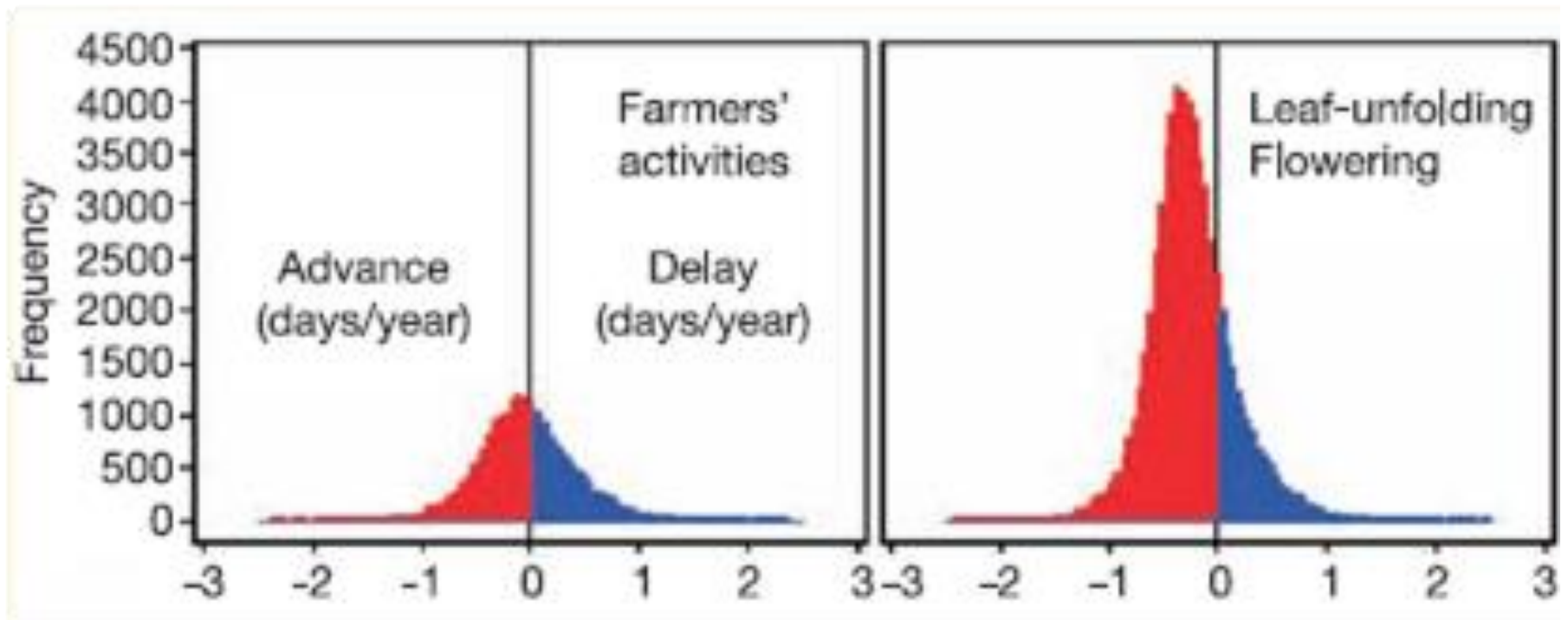
More frequent dry days



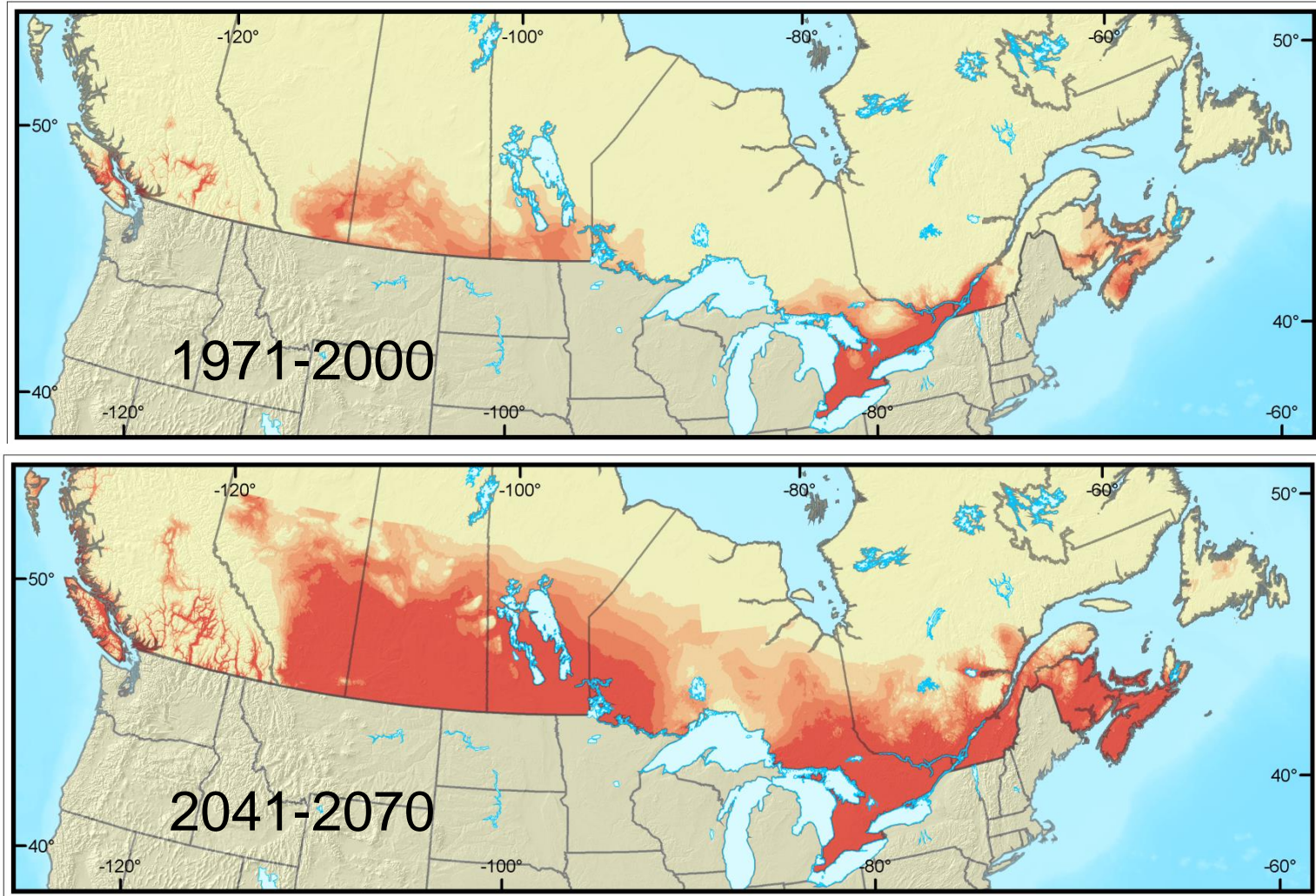
Impacts on Invasive Alien Species

- Changes in phenology
- Pest range shift
- Host range shift and climate stress
- Transitional niches
- Changes in trade
- CO₂ fertilization

Phenology

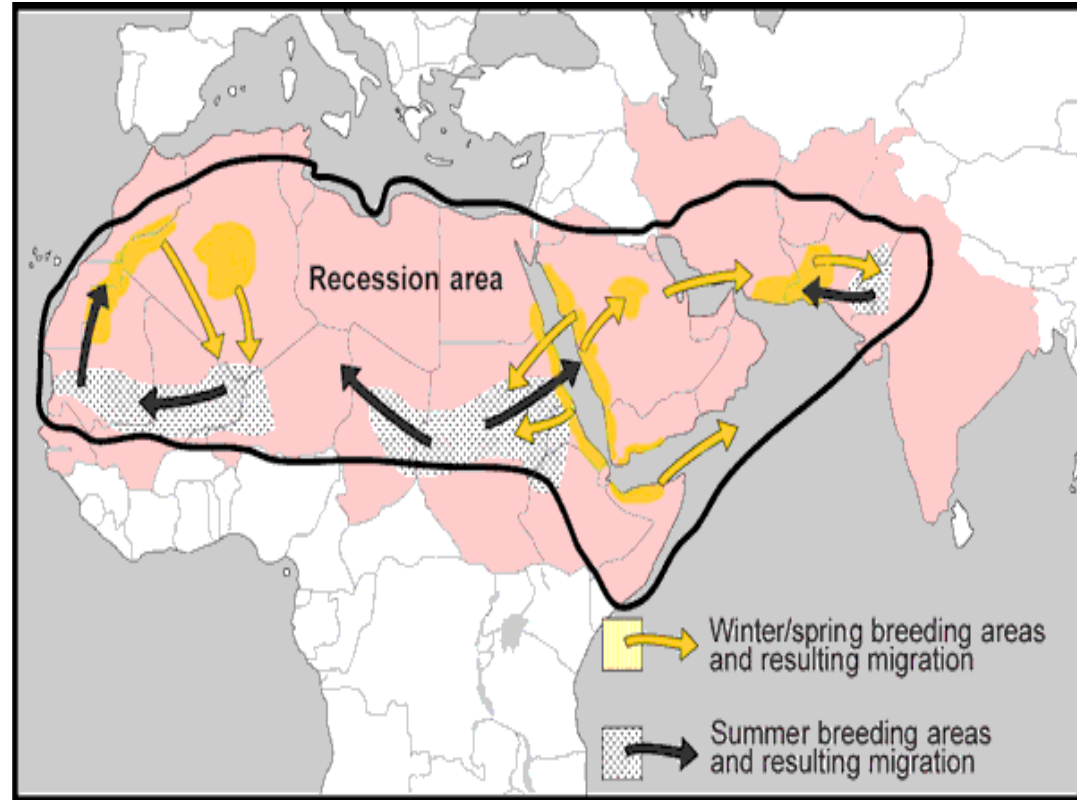
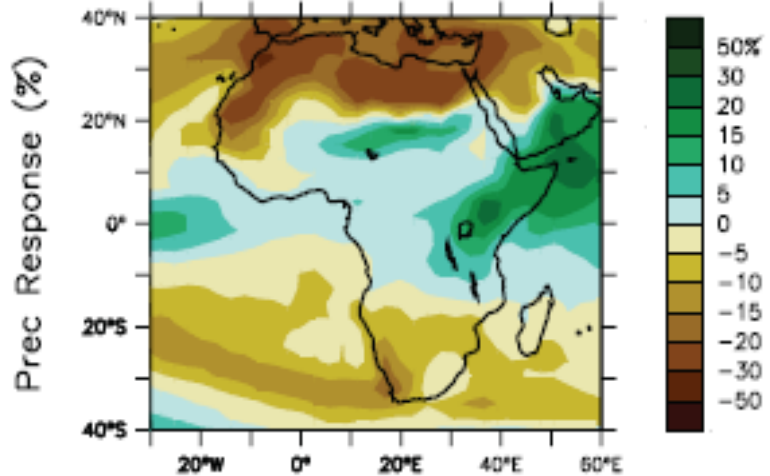
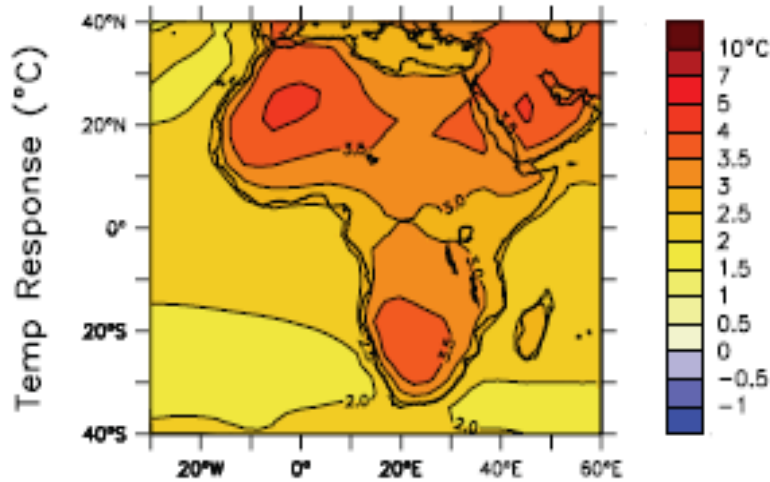


Pest Range Shift

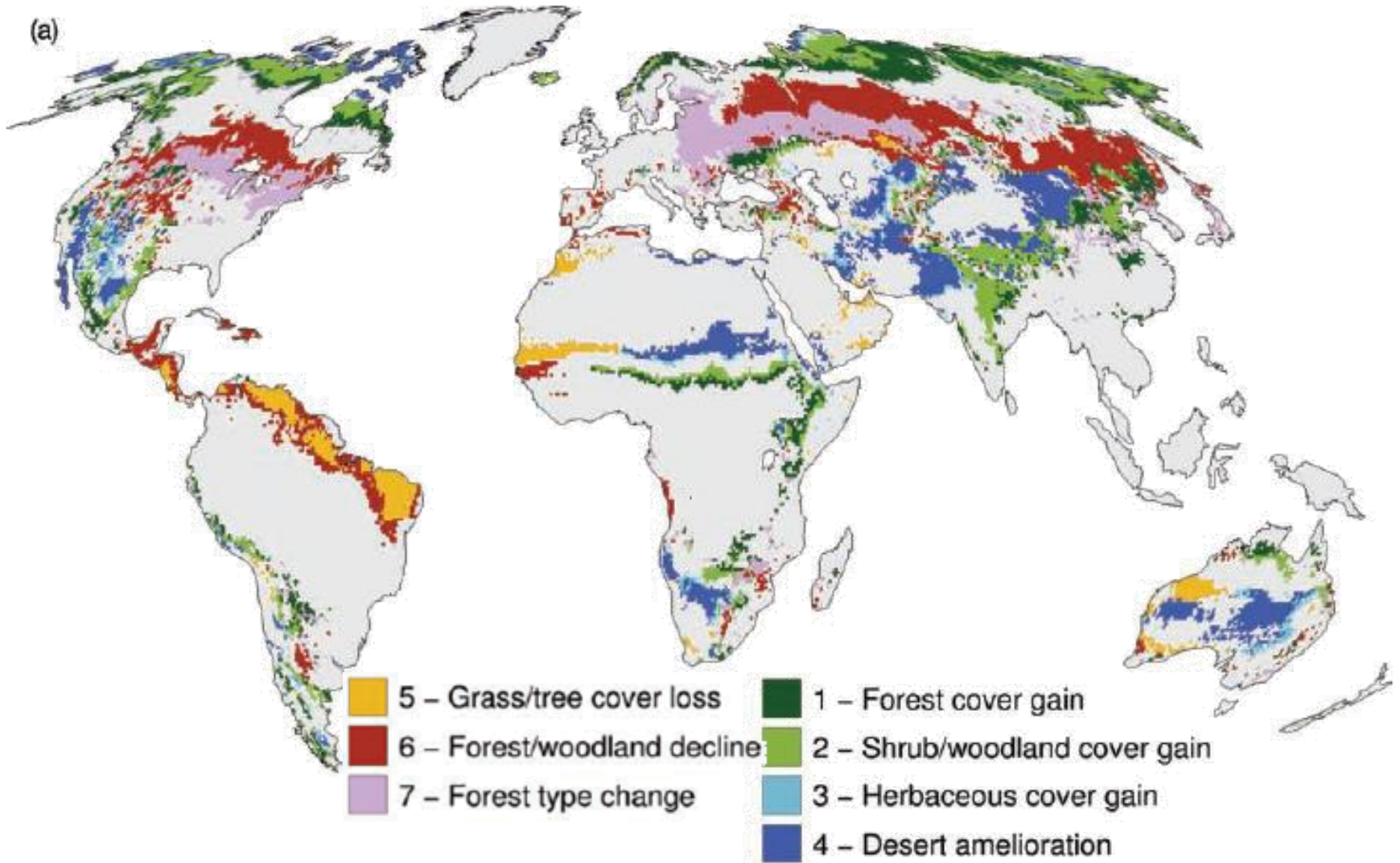


Modified from Jacques Regniere, Canadian Forest Service

Host Range Shift and Stress



Transitional Niches



Changes in Trade : production patterns

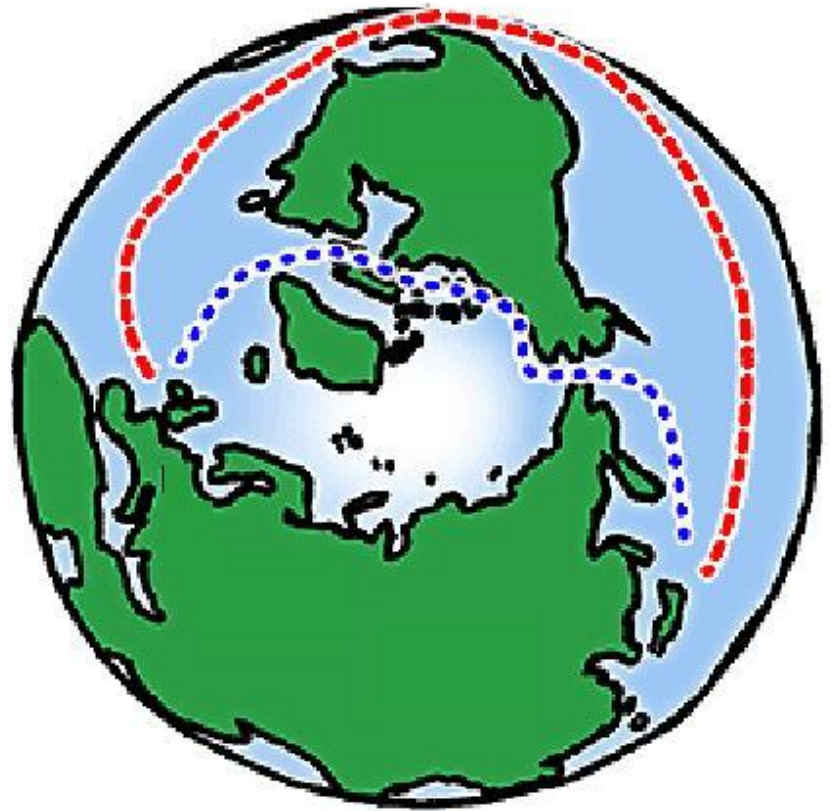
Food and forestry trade is expected to increase [...], with increased food-import dependance of most developing countries.

- IPCC 2007



Changes in Trade : Northwest Passage

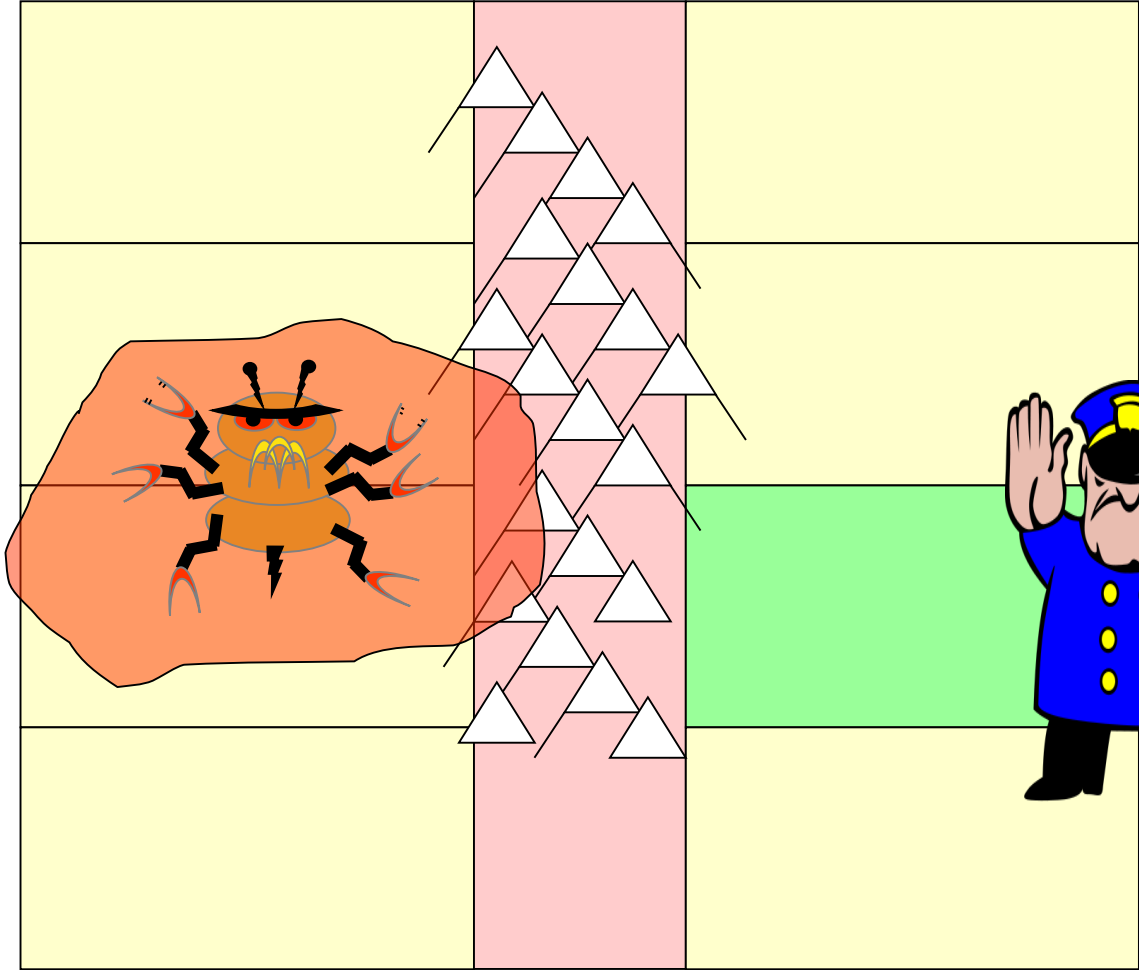
- Changed risk of infestation in transit
- Increased trade between North-Atlantic and North Pacific



CO₂ Fertilization

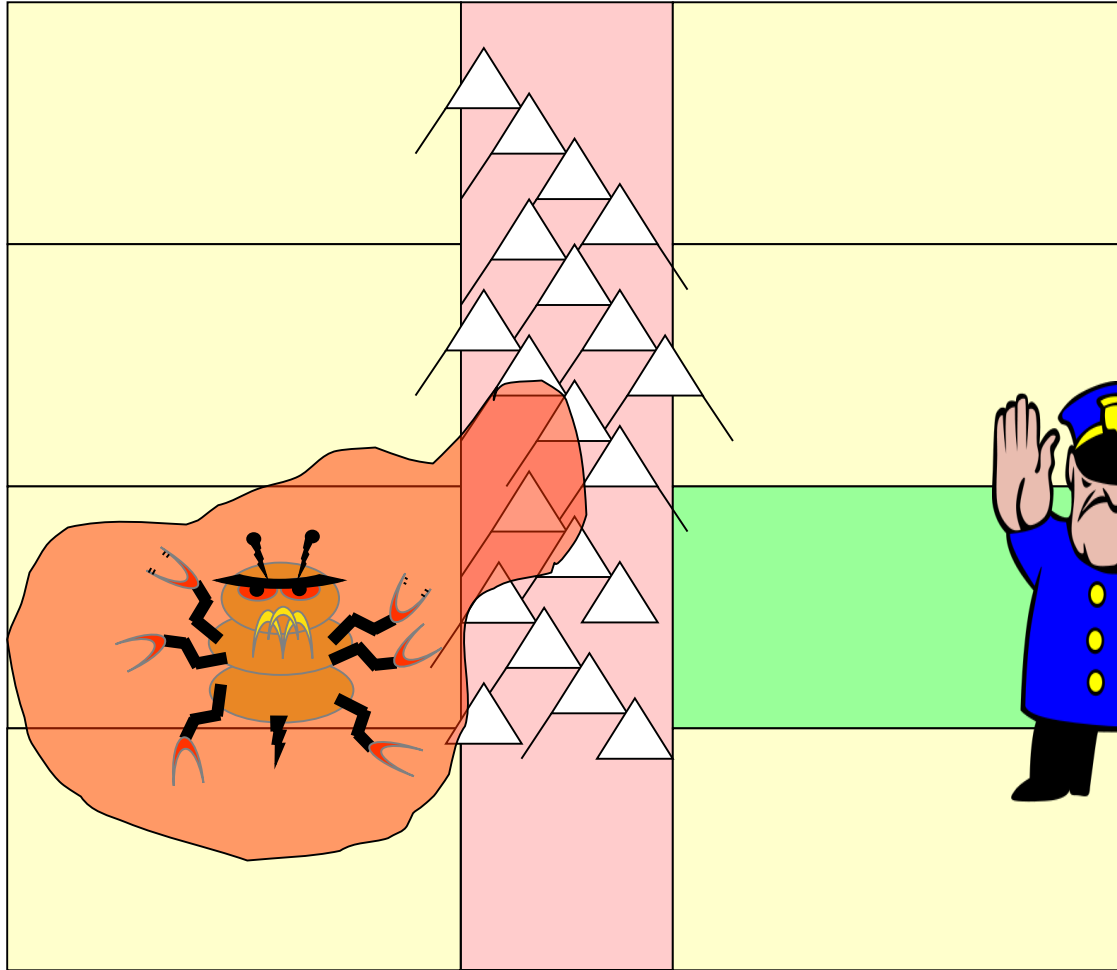
- C₄ plants may be favoured by a more CO₂-rich atmosphere as well as by increased temperatures and drought.
- Few studies of CO₂ impacts on insects.

°C
↑



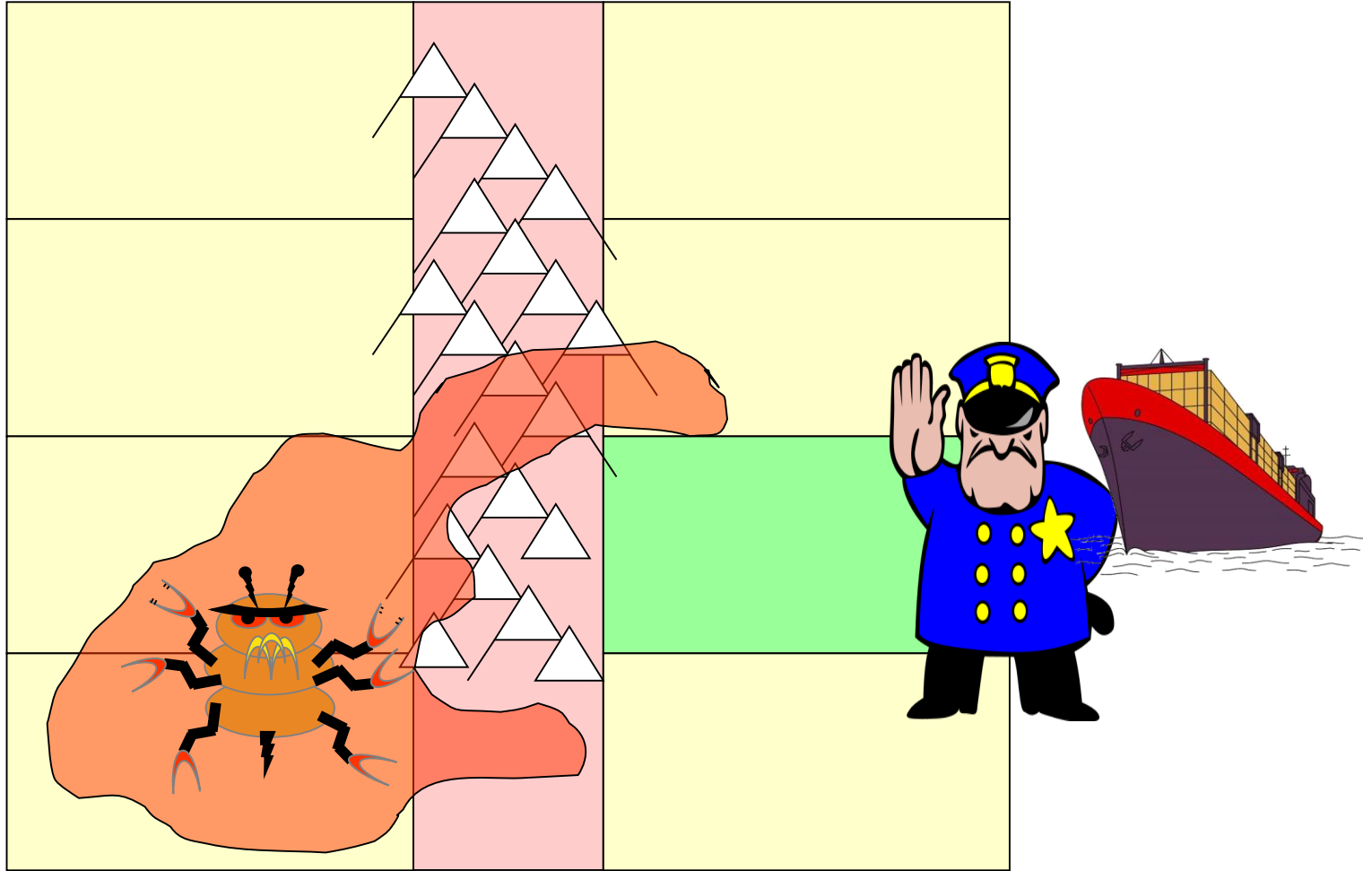
2028

°C
↑



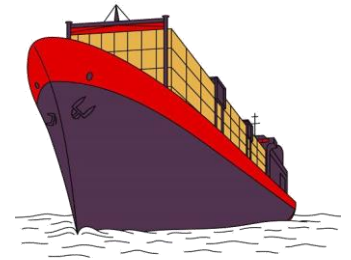
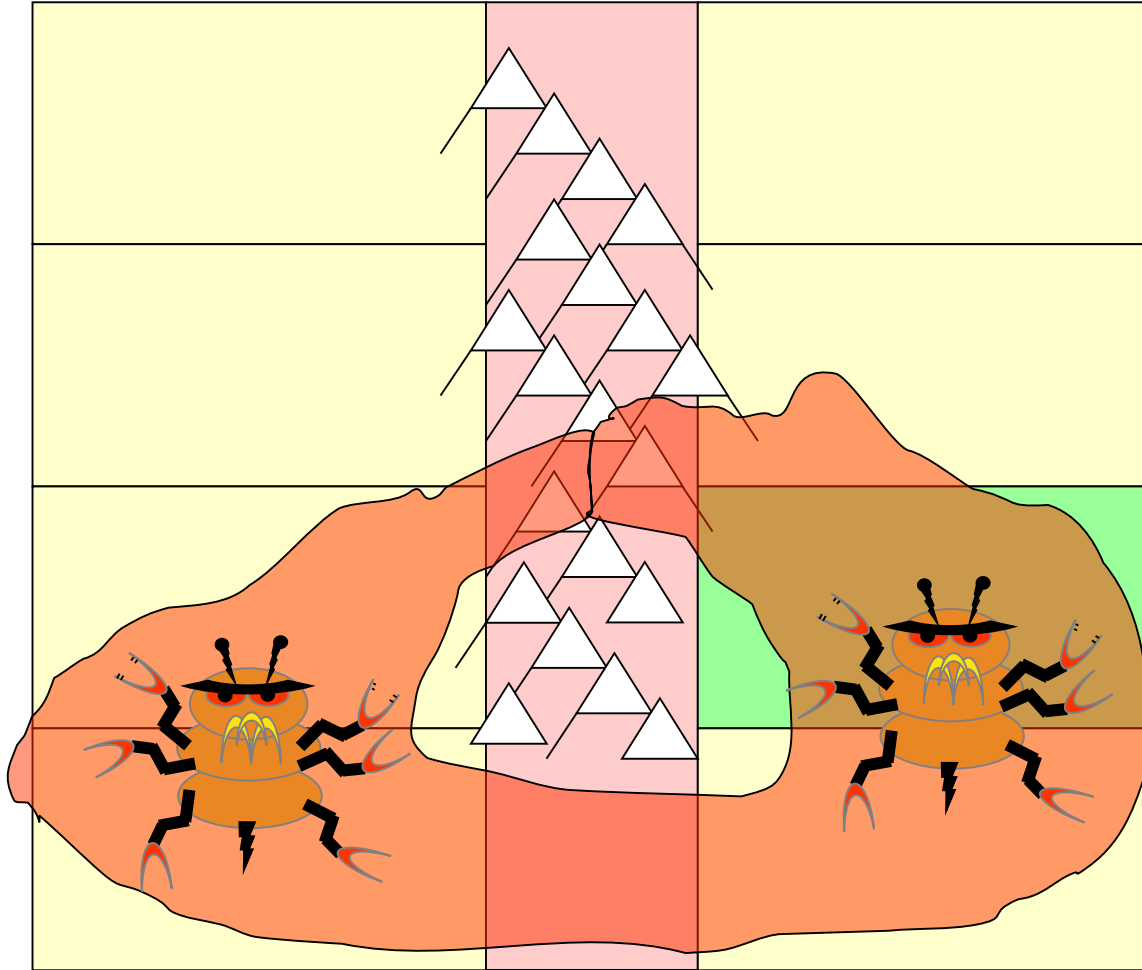
2048

°C
↑



2068

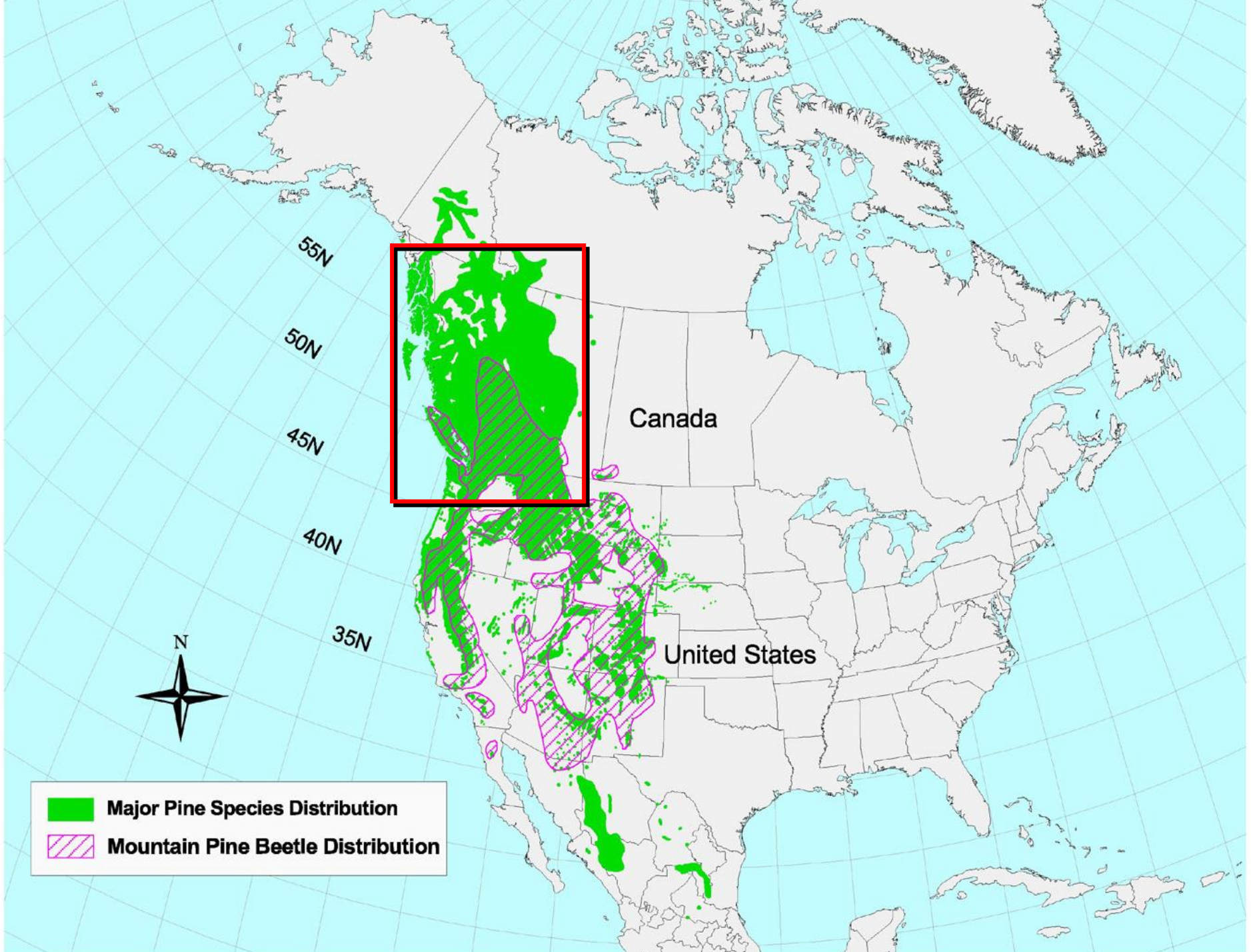
°C
↑

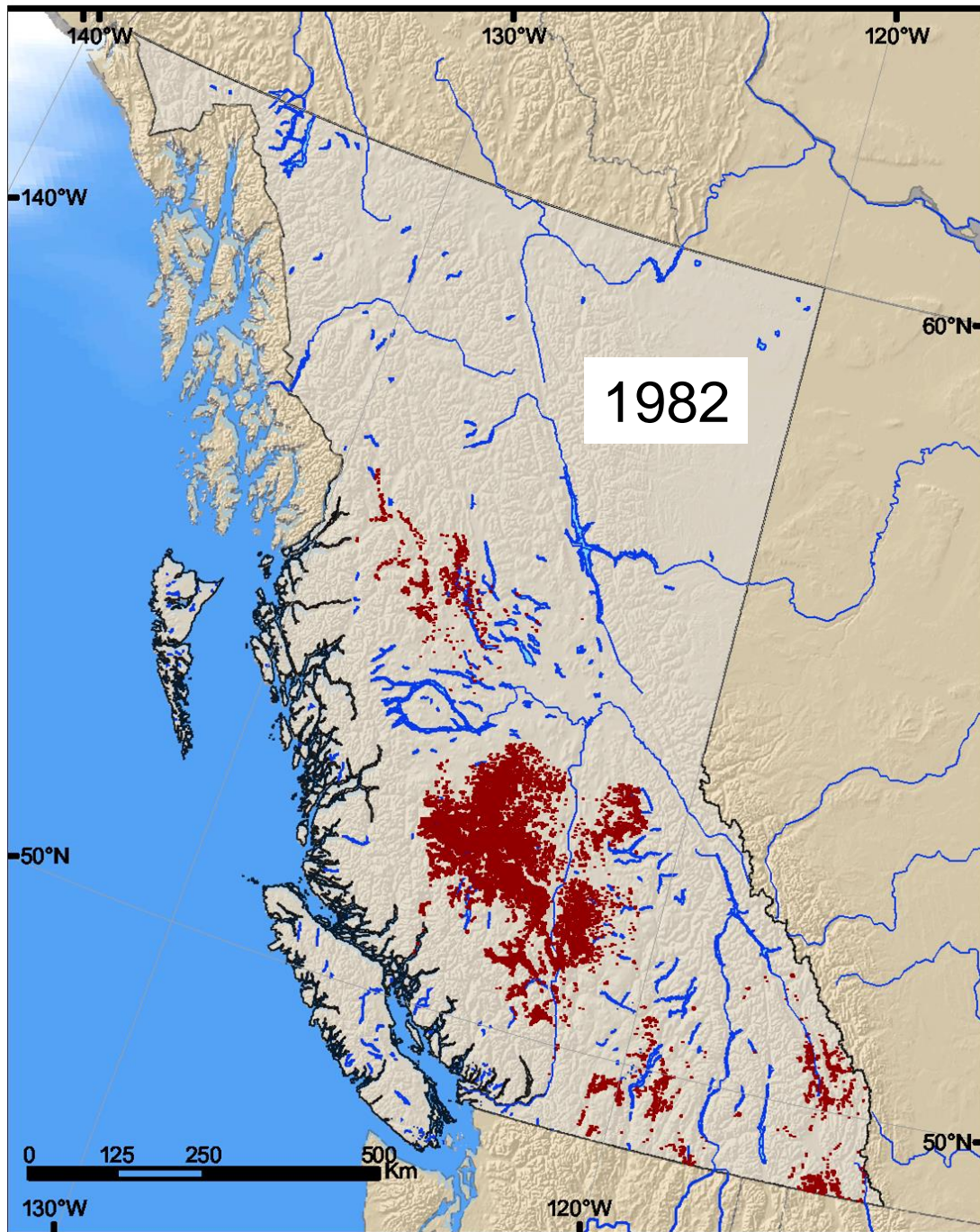


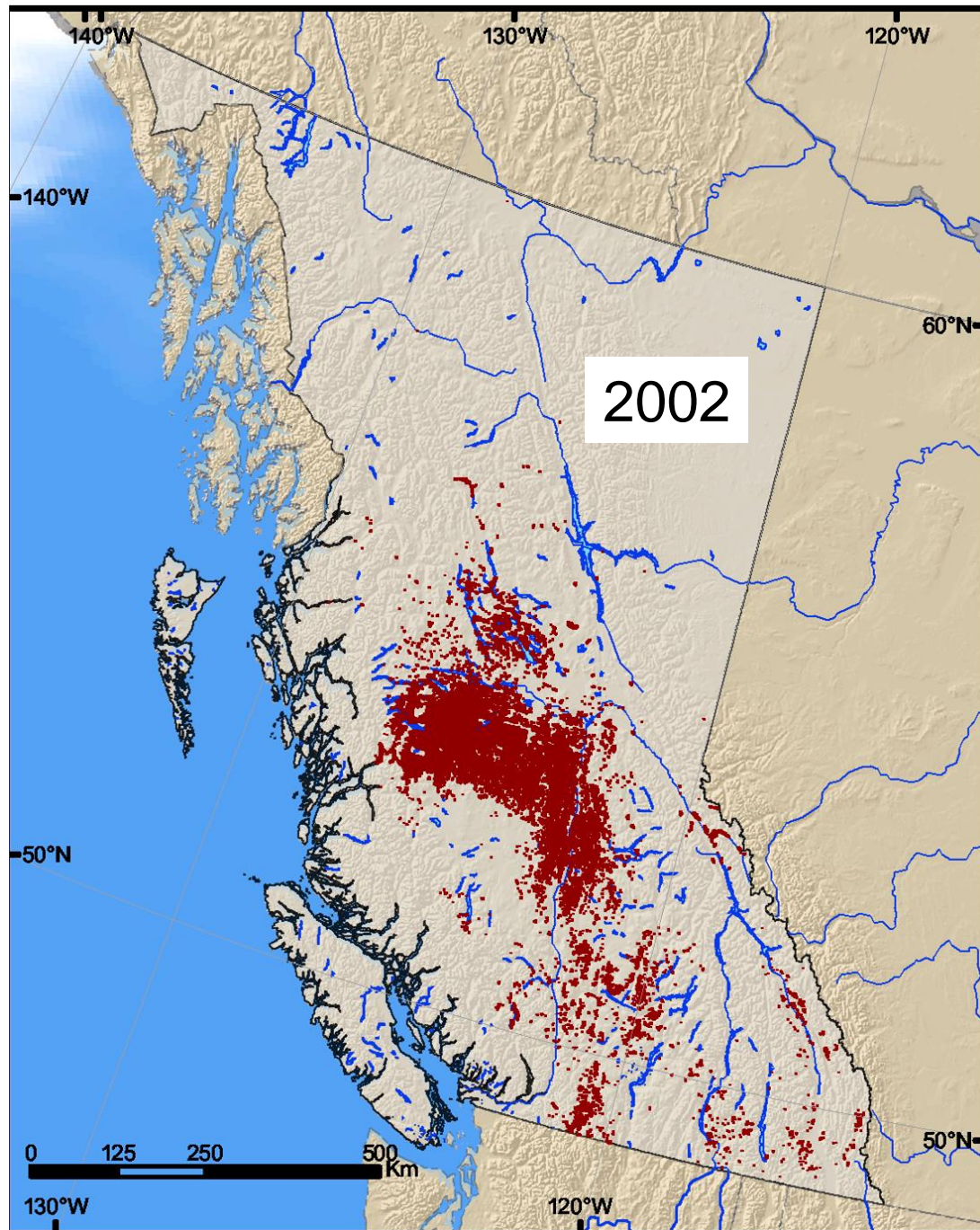
Mountain pine beetle (*Dendroctonus ponderosae*)



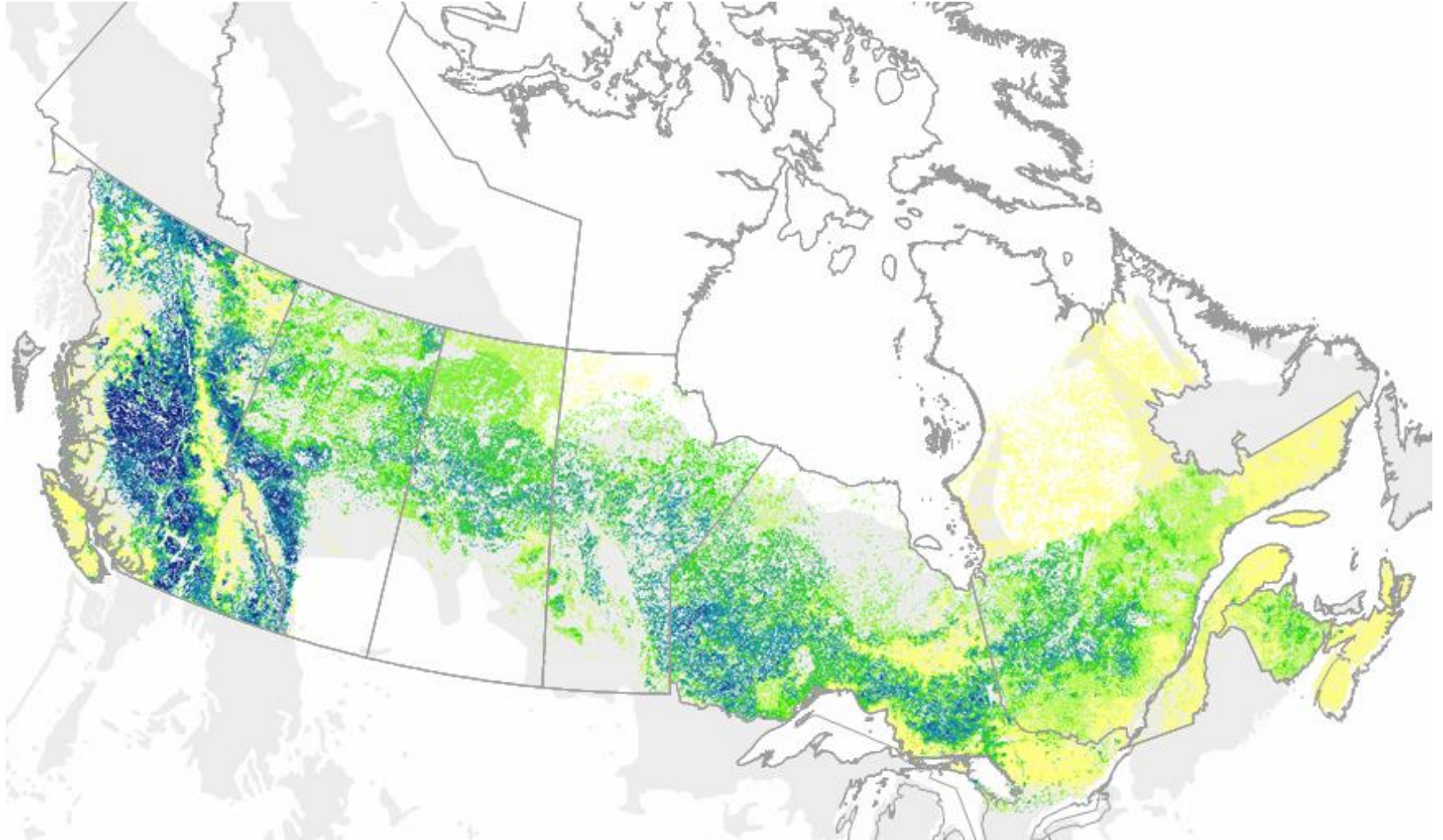
Mountain Pine Beetle slide sequence modified from
Jacques Regniere, Canadian Forest Service





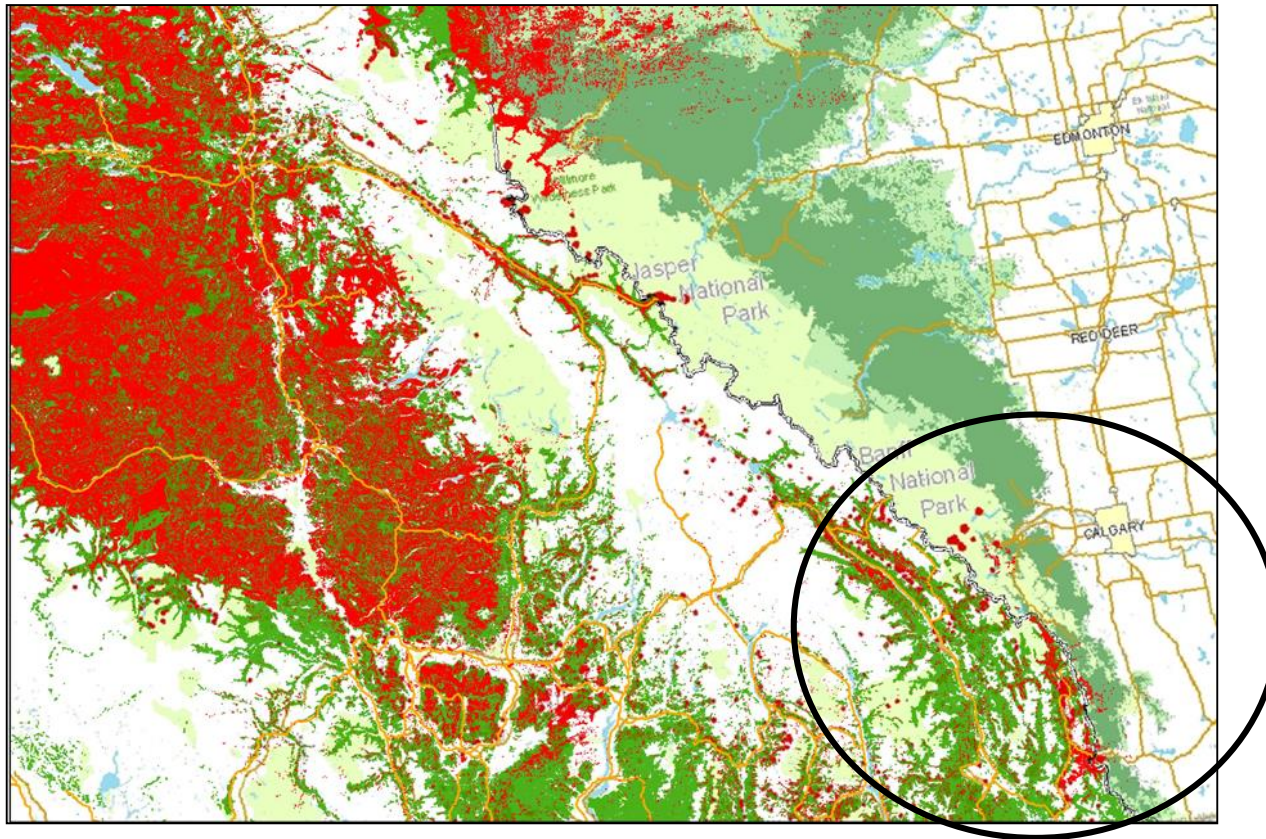


Pine distribution in Canada



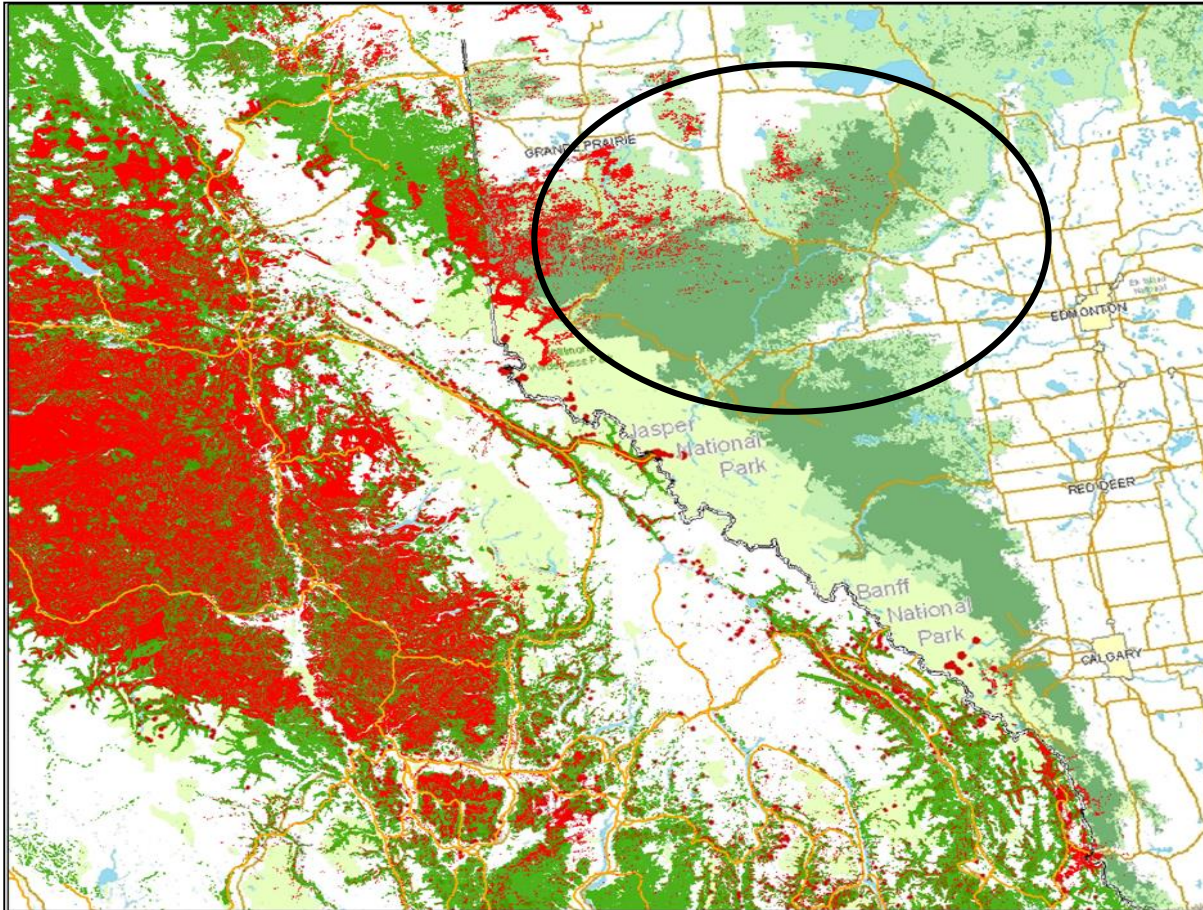


Mountain pine beetle did cross mountains in 1982

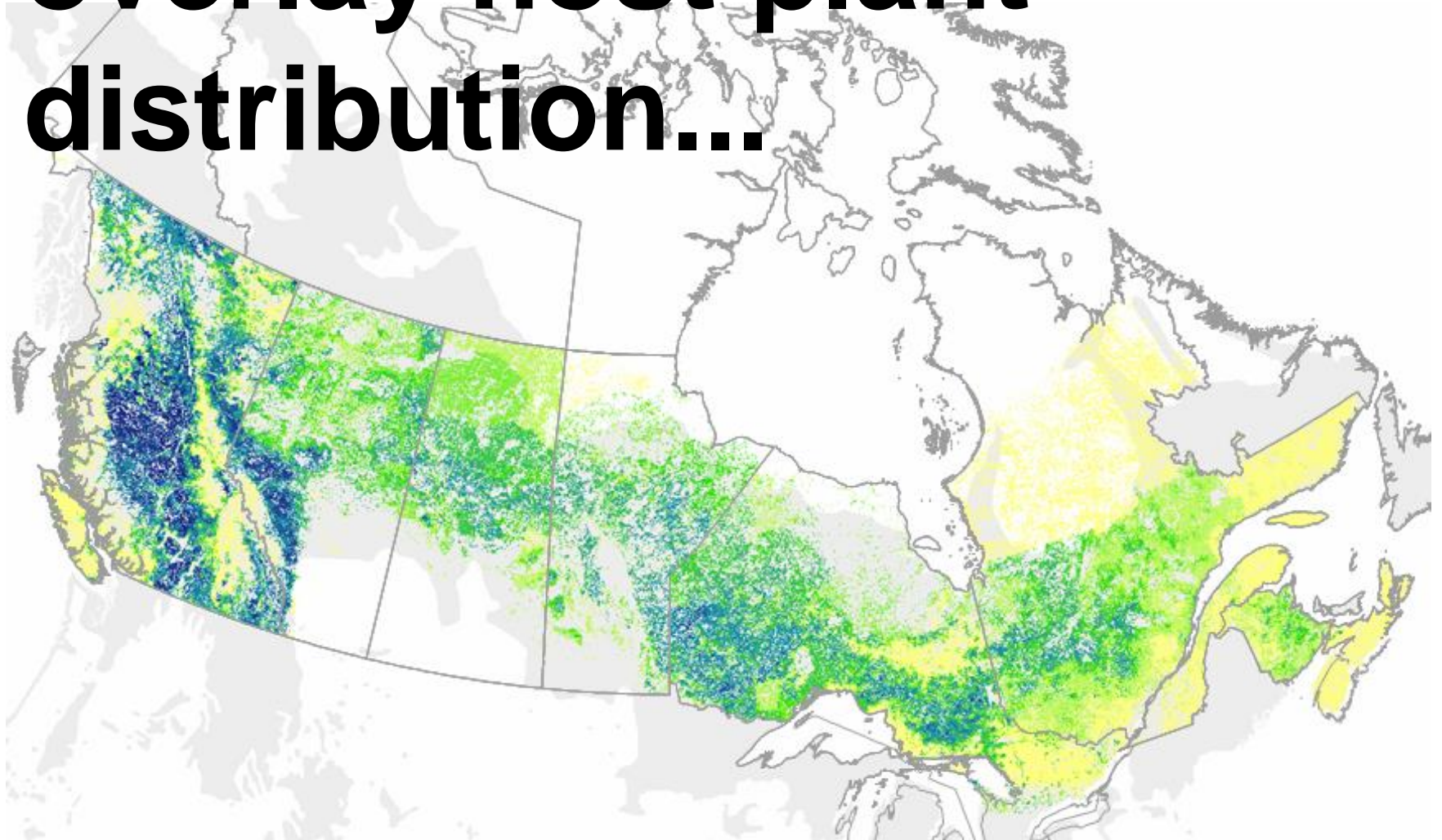




Crossed again further north in 2006



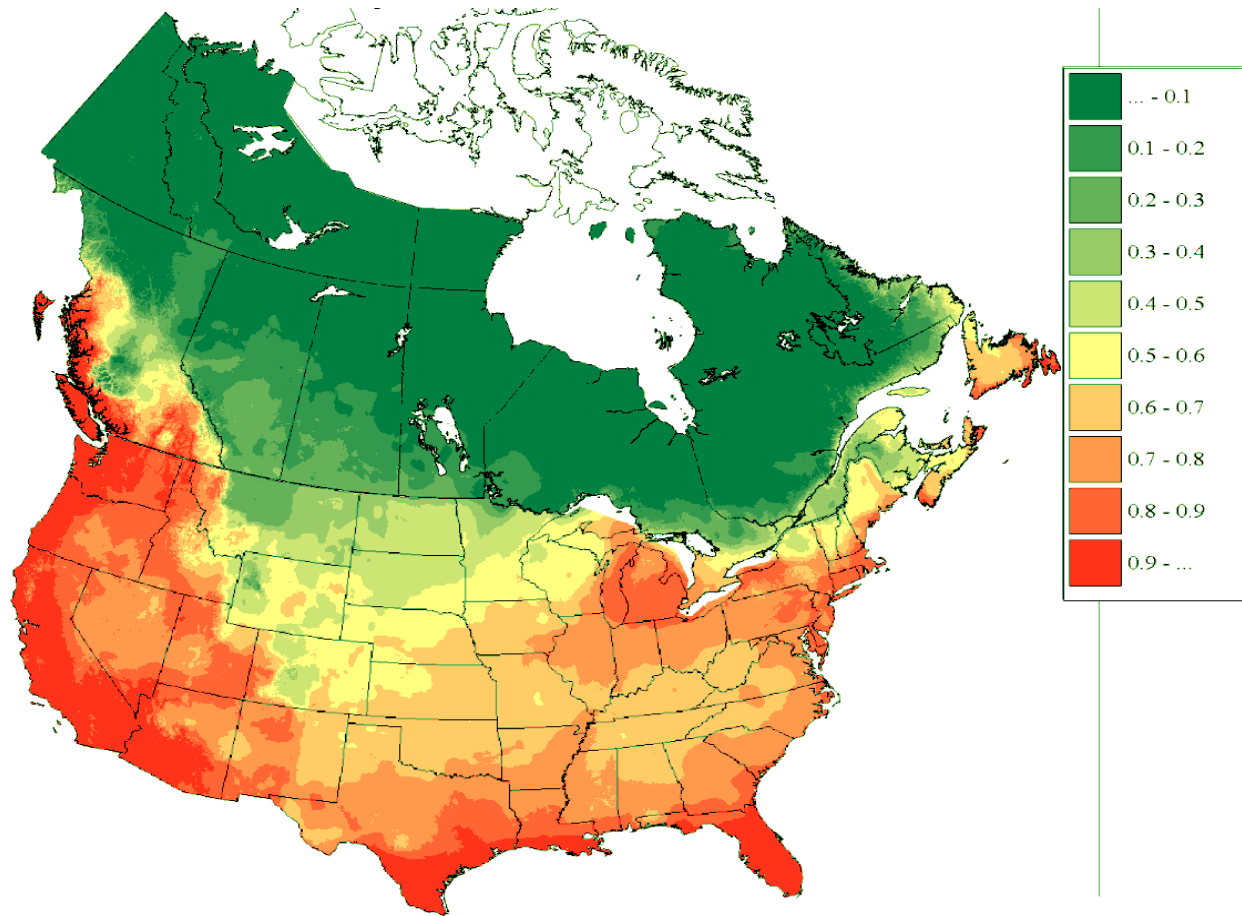
**To predict future spread,
overlay host plant
distribution...**



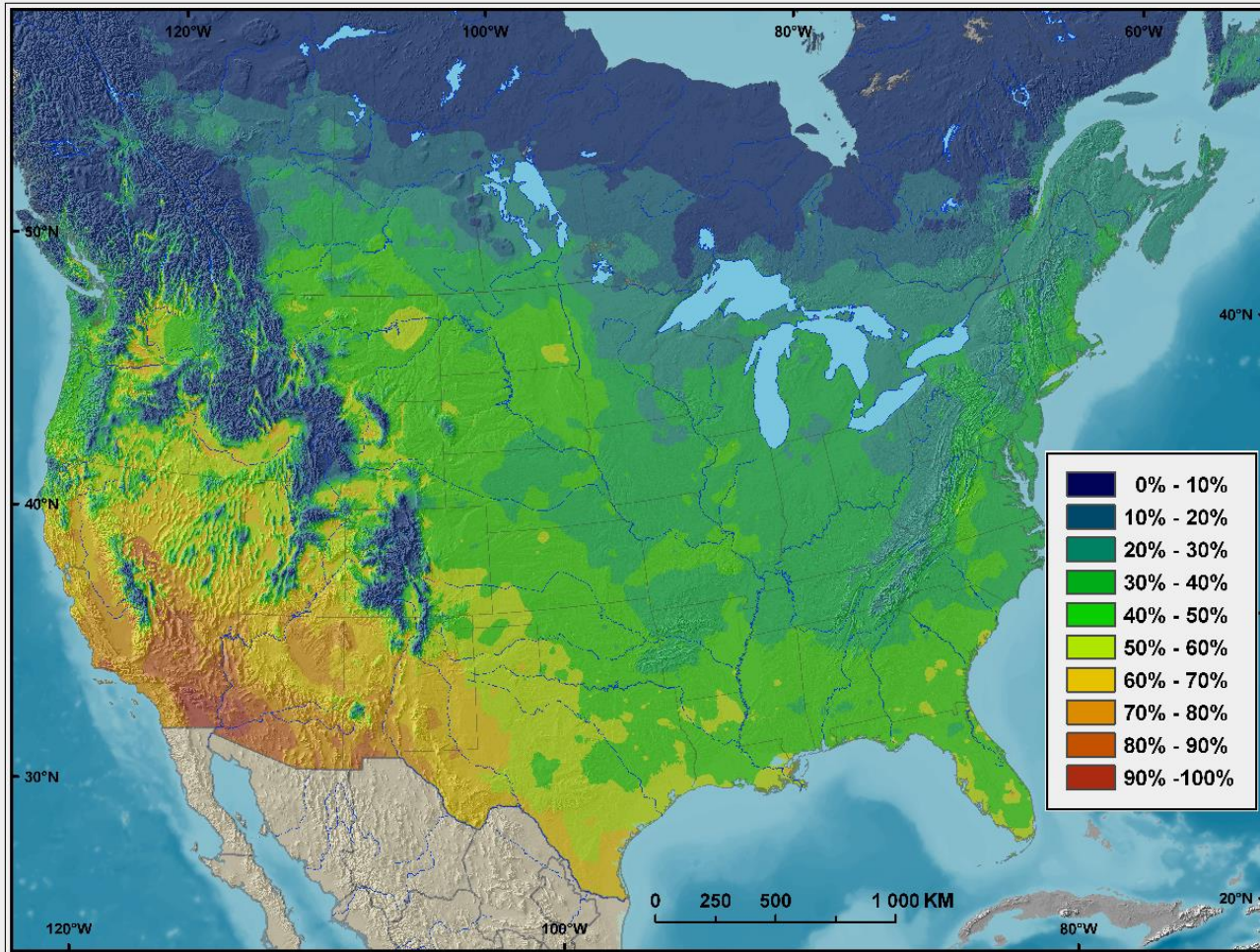
Source: D. McKenney and D. Yemshanov, unpublished results of host distribution research based on CanFI and EOSD data.

...With Cold Tolerance...

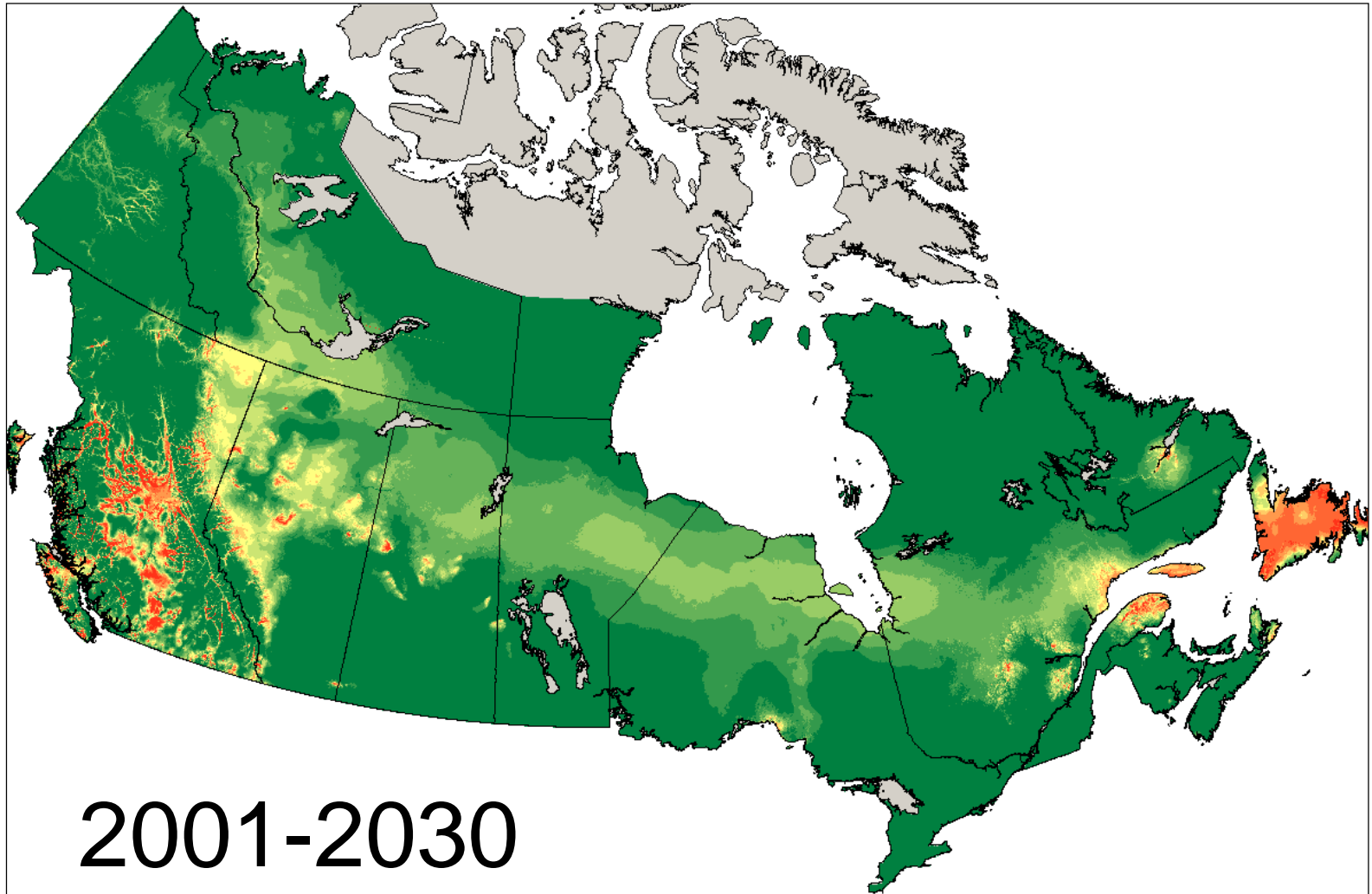
2001 - 2030



...and Drought...



...and changed phenology



What Can We Do To Prepare?

We need to think about how to incorporate climate change in risk management

What Can We Do To Prepare?

We need climate modelling and impacts modelling

What Can We Do To Prepare?

We must examine our definitions and assumptions

Thank You

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