Potential Catastrophic Dieback of North American Forests
What is the Price of Uncertainty?

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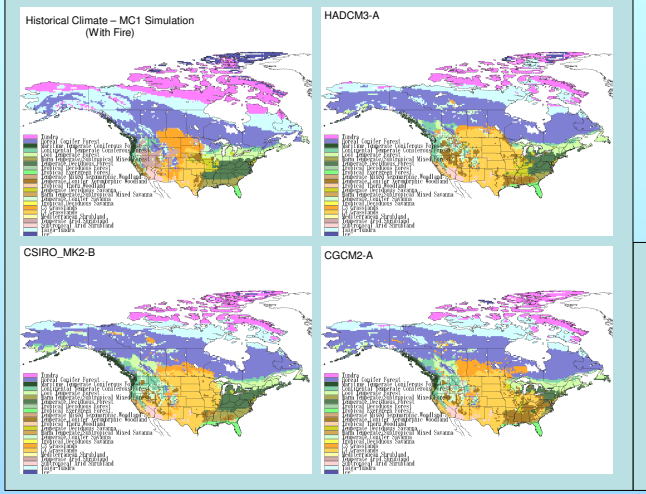
VINCERA
"Vulnerability and Impacts of North American Forests to Climate Change:
Ecosystem Responses and Adaptation"
4 General Circulation Models (GCM)
CGCM2, HadCM3, CSIRO Mk 2 and ECHAM4
2 IPCC SRES A2 and B2 emissions scenarios
3 Dynamic General Vegetation Models (DGVM)
MC1, IBIS, SDGVM
Principal Investigator: David Price (Canadian Forest Service)
Co-P.Ls Ron Neilson (USDA Forest Service)
Ian Woodward (University of Sheffield)
And a host of others

Vegetation Distribution – MC1 Simulations

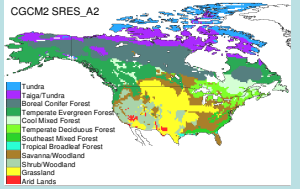


Conclusions

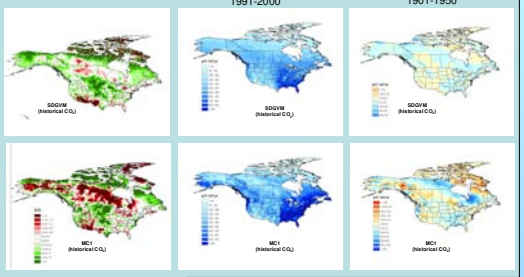
- SDGVM and MC1 are extremely similar under historical Climate
- However, the two models produce opposite results by the end of the 21st century
- The net flux Tolerances are extremely small (high uncertainty)
- The primary uncertainty is the magnitude of the direct CO_2 effect, one model perhaps too high, the other perhaps too low
- If the lower CO_2 effect is more accurate, then North American Forests could experience an early greenup followed by a later 'browndown'
- Lower latitude forests begin to die back first, followed by higher latitude forests
- Vegetation shifts will be very complex, tearing assemblages apart and creating new ones
- Fire Suppression could play a major role in mitigating the negative impacts, but can we afford it?

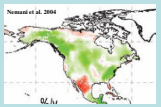
MAPSS Simulation

2071 – 2100



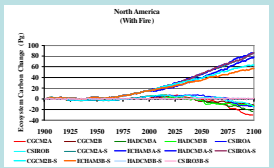
NPP

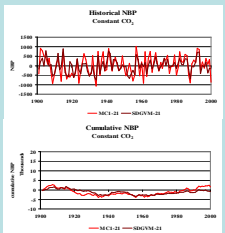


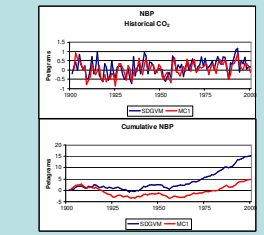


Carbon Gains and Losses

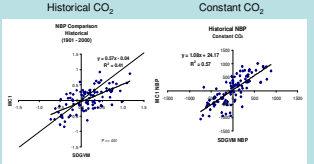
North America
Total Ecosystem Carbon Gain or Loss
Historical and Future



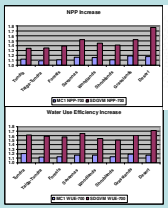


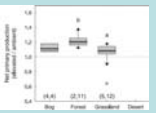


Historical CO_2 Constant CO_2



Direct CO_2 Effect

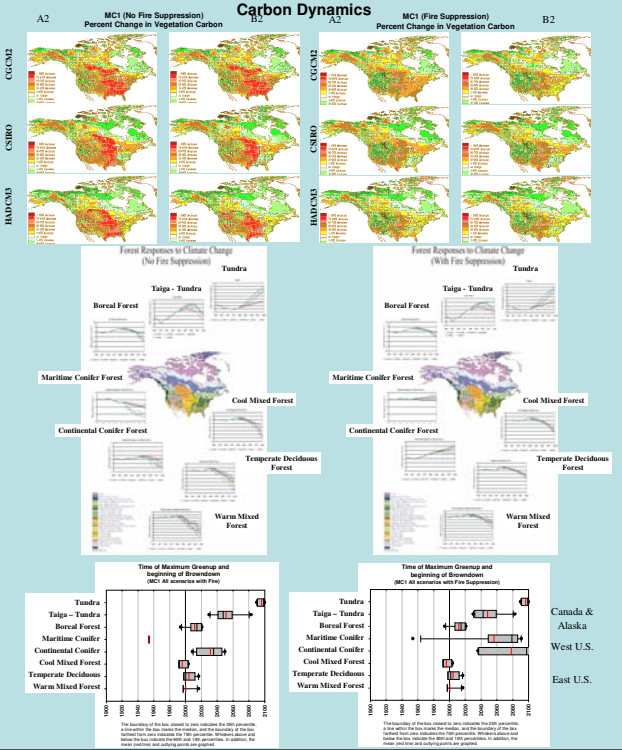




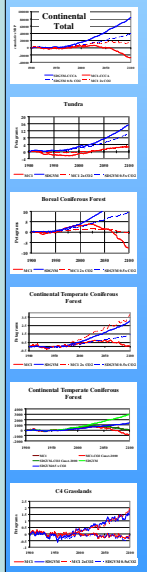
Nowak, Robert S., Ellsworth, David S. & Smith, Stanley D. (2004) Functional responses of plants to elevated atmospheric CO_2: do photosynthetic and productivity data from FACE experiments support early predictions? *New Phytologist* **162** (2), 253-280.

	SDGVM	MC1
NPP-550	28%	8%
NPP-700	44%	13%

Fire Management And Carbon Dynamics



A CO_2 Experiment (Total Carbon Change)



Are There Multiple Stable Trajectories?