

Future of the North American Carbon Cycle

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Key Findings

- ❑ primary contributor to carbon cycle change over North America is, and will continue to be, emissions from fossil fuel combustion and changes in land cover and land use
- ❑ projections suggest that natural carbon sinks of North America (land, ocean, coastal and freshwater systems) are diminishing in strength and many are at risk into the future
- ❑ accelerated warming in the Northern high-latitudes (Alaska and Canada) is making large stores of carbon in permafrost soils vulnerable to release to the atmosphere by the end of the century

Future emissions from fossil-fuel combustion

Adapted from Table 19.1 SOCCR2

| North America (Tg C) | 2015 | 2020 | 2030 | 2040 |
|-------------------------|------|------|------|------|
| High | 1726 | 1740 | 1740 | 1777 |
| Low | 1726 | 1705 | 1549 | 1504 |

Projections are based on three sources -

- U.S. Department of Energy's Energy Information Administration (EIA 2017)
- Environment and Climate Change Canada (ECCC 2016)
- Organization for Economic Cooperation and Development's International Energy Agency (IEA 2016)

- energy sector and transportation continue to be the largest source of carbon emissions in North America
- by 2040, projections suggest total North American absolute fossil fuel carbon emissions could range from a $\sim 13\%$ decrease to a $\sim 3\%$ increase compared to 2015 levels
- uncertainties in projections \rightarrow future energy decisions and developments, including policies, technologies, prices, economic growth, demand, and other difficult-to-predict variables

Projections of North American land carbon sink

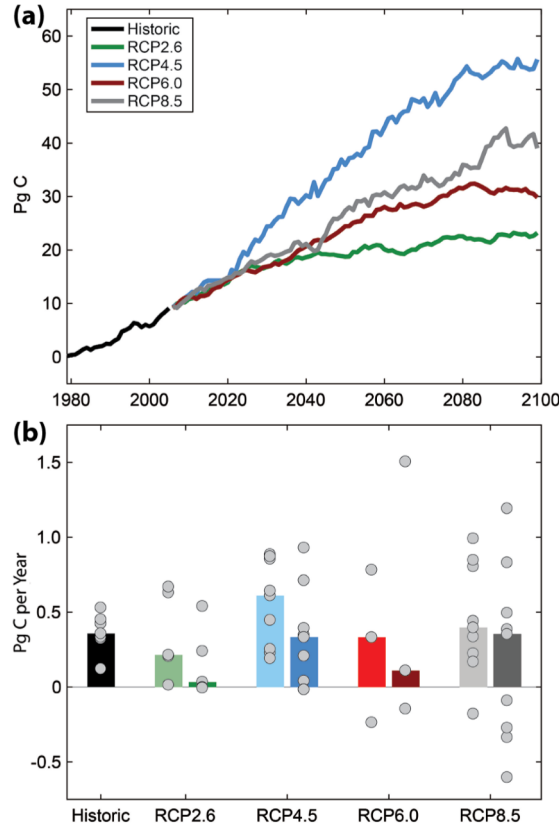


Figure 19.3
SOCCR2

- ❑ by 2050, model projections of net land carbon sink strength range from a slight decrease to a doubling of the current sink strength
- ❑ by 2100, strength of the net land sink within North America is projected to either remain near current levels or decline significantly
- ❑ uncertainty in projections result from combined and uncertain effects of rising CO₂, climate change, emission scenarios and land-use management

Future changes in the Arctic and Boreal carbon cycle

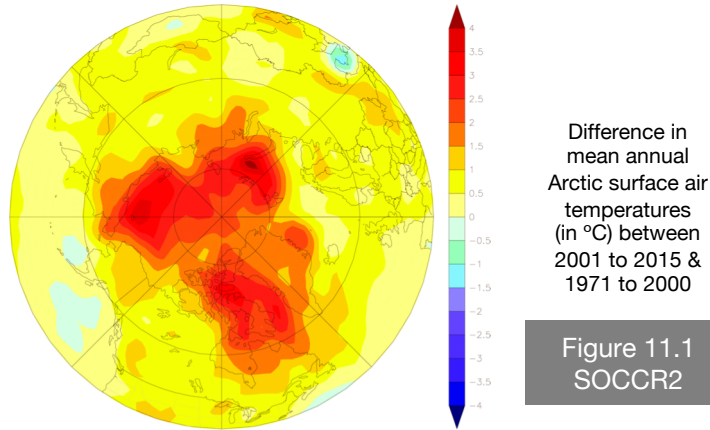


Figure 11.1
SOCCR2

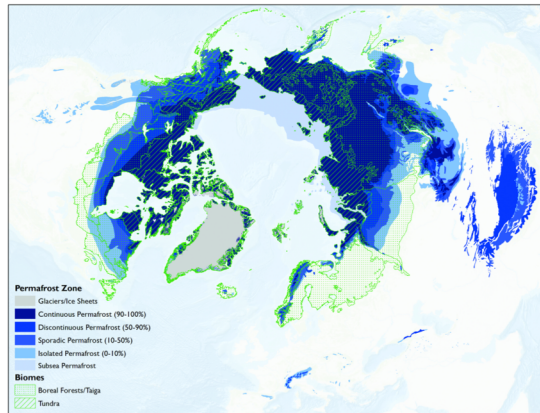


Figure 11.4
SOCCR2

- by 2100, soil carbon losses from the northern high-latitudes (5% to 15% of current soil carbon pool) will determine the trajectory of the carbon cycle
- models project that carbon offsets by vegetation may help regulate the net response of this region to warming
- knowledge gaps → limited measurements of deep permafrost soil carbon, understanding of abrupt permafrost thaw and response of plant growth/species distribution to multiple global change factors

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References

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2018 AGU Fall Meeting SOCCR-2 Session

B43C, State of the Carbon Cycle in North America: Key Findings from Assessing a Decade of Science, Decisions, and Management Impacts

Time :: Thursday, 13 December 2018 @ 13:40 - 15:40

Location :: Walter E Washington Convention Center - 150A

