



9 Forests



Lead Authors

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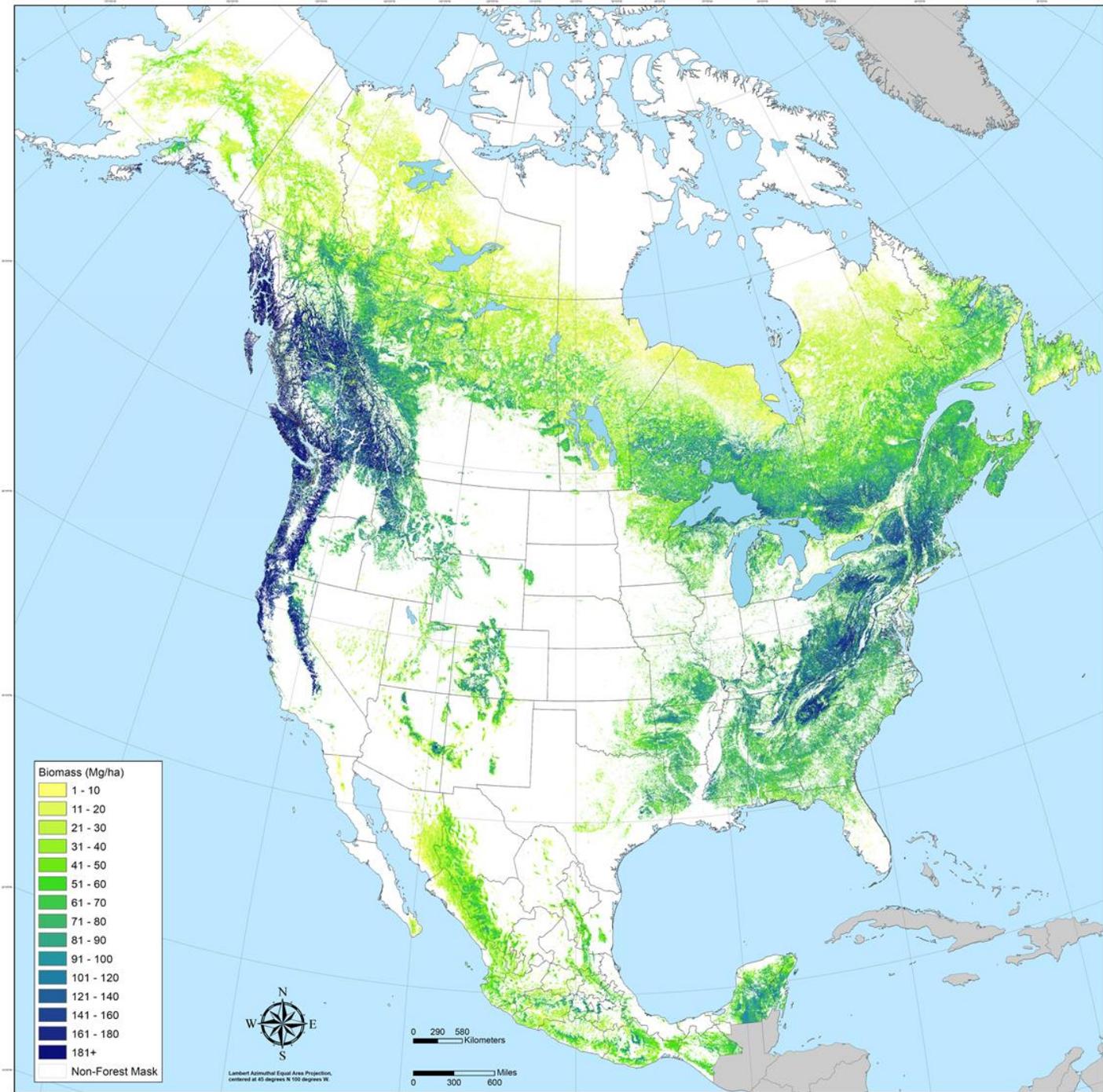
Contributing Authors

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Context

- The major focus of SOCCR2 is North America, with emphasis on the United States
- Focused on the scientific understanding and developments in the decade since the first SOCCR1, 2005-2015
- Carbon (C) cycle processes, stocks, fluxes, and interactions with global-scale C budgets and climate change impacts in managed and unmanaged systems
- Status of and emerging opportunities for improving measurements, observations, and projections of stocks and fluxes in the C cycle, including uncertainty identification

Context – distribution



Context – forest and woodland area

Table 9.1. Estimated Area (in Thousands of Hectares) of Forest and Other Wooded Land in North America in 2005 and 2015

Country ^a	Forestland ^b		Other Wooded Land ^c	
	2005	2015	2005	2015
Canada	347,576	347,069	40,866	40,866
Mexico	67,083	66,040	20,378	19,715
United States	304,757	310,095	15,452	21,279
Total^d	719,416****	723,204****	76,696****	81,860****

Notes

a) Estimates based on FAO (2016b).

b) Defined as land spanning greater than 0.5 hectare (ha) with trees higher than 5 m and a canopy cover of more than 10%, or trees able to reach these thresholds *in situ* (FAO 2010).

c) Defined as land not classified as forest, spanning greater than 0.5 ha with trees higher than 5 m and a canopy cover of 5% to 10%; or trees able to reach these thresholds *in situ*; or with a combined cover of shrubs, bushes, and trees above 10% (FAO 2010).

d) Uncertainty estimates (noted by asterisks) follow the convention described in Treatment of Uncertainty in SOCCR2, p. 16, in the Preface.

Context – forest C stocks

Table 9.2. Forest Carbon Stocks (in Teragrams of Carbon) by Carbon Pool in North America

Country	Aboveground Biomass	Belowground Biomass	Dead Wood	Litter	Soil
Canada ^a	11,162	2,746	4,683	11,666	19,729
Mexico ^b	1,597	396	2	NA ^c	NA
United States ^d	14,182	2,923	2,570	2,680	28,774
Total^e	26,941****	6,065****	7,255****	14,346****	48,503****

Notes

a) Estimates based on FAO (2010).

b) Estimates based on FAO (2016b).

c) Not applicable.

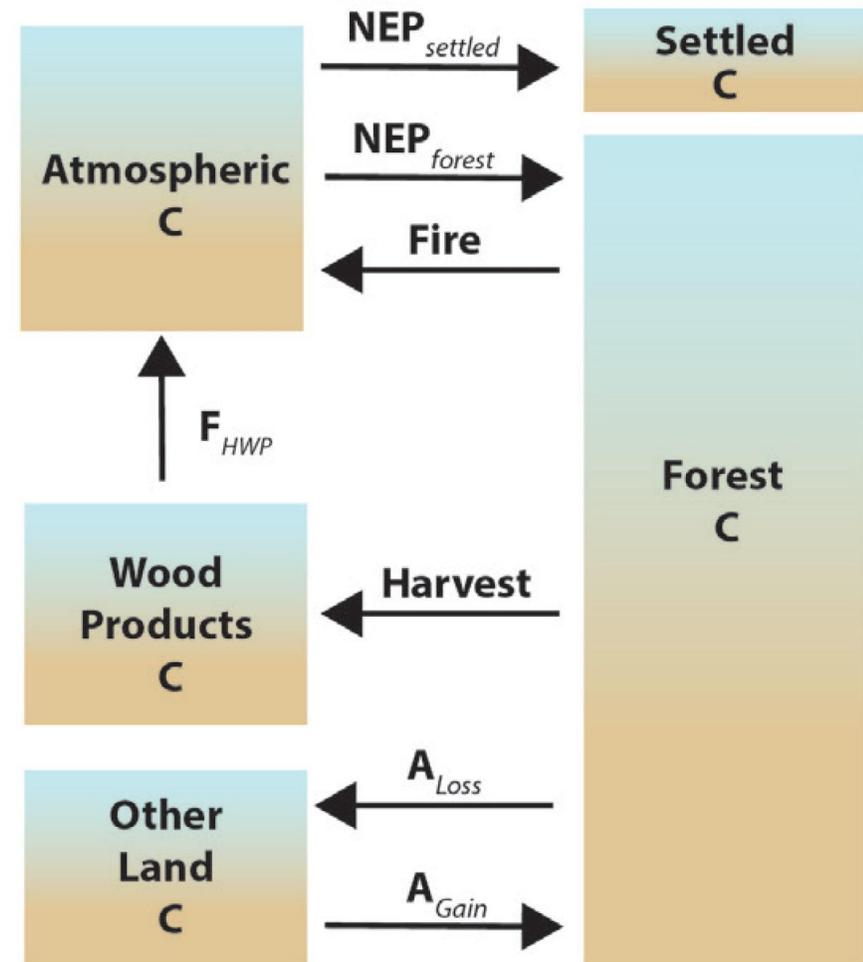
d) Estimates based on U.S. EPA (2018).

e) Uncertainty estimates (noted by asterisks) follow the convention described in Treatment of Uncertainty in SOCCR2, p. 16, in the Preface.

Key Findings

1. Forests in North America are a net C sink
2. Forest regrowth is critical to the C sink
3. Annual harvest removals decrease forest C stocks but are balanced by post-harvest recovery and regrowth
4. Recent trends in some disturbance rates have diminished the strength of net forest C uptake
5. The C sink in North American forests is expected to decline over coming decades

Key Finding 1



Stock Change in Forestlands:

$$\Delta \text{Forest C} = NEP_{forest} - \text{Harvest} - \text{Fire} + A_{Gain} - A_{Loss}$$

Net Atmosphere – Forest Sector Exchange:

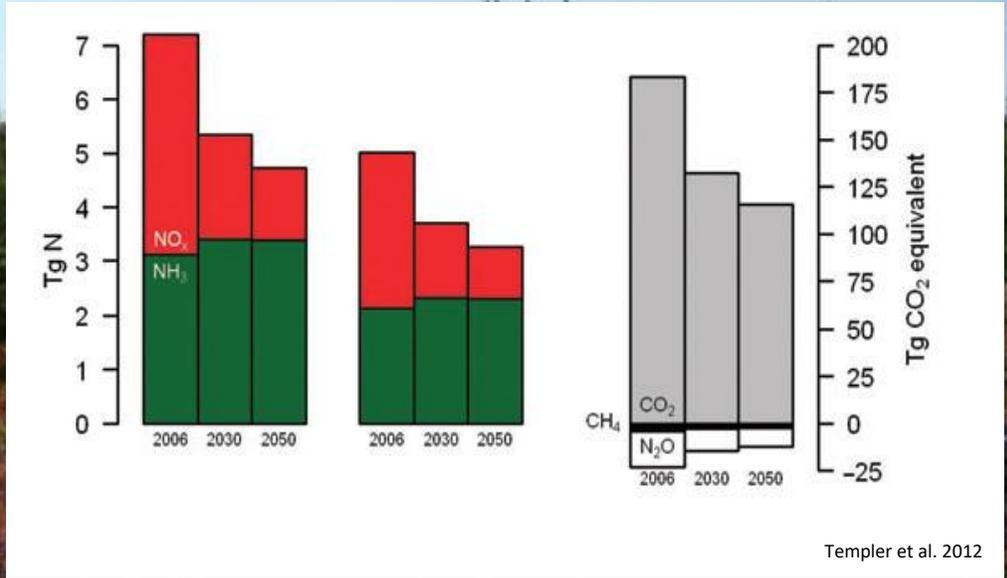
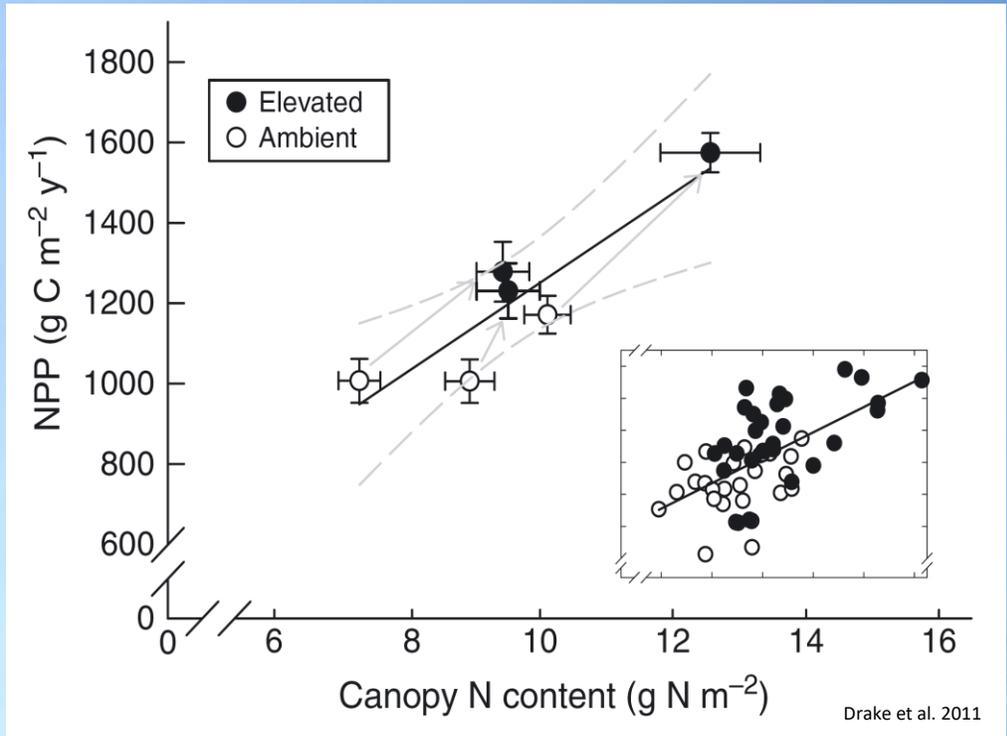
$$\Delta \text{Atmospheric C} = \text{Fire} + F_{HWP} - NEP_{forest} - NEP_{settled}$$

Key Finding 1

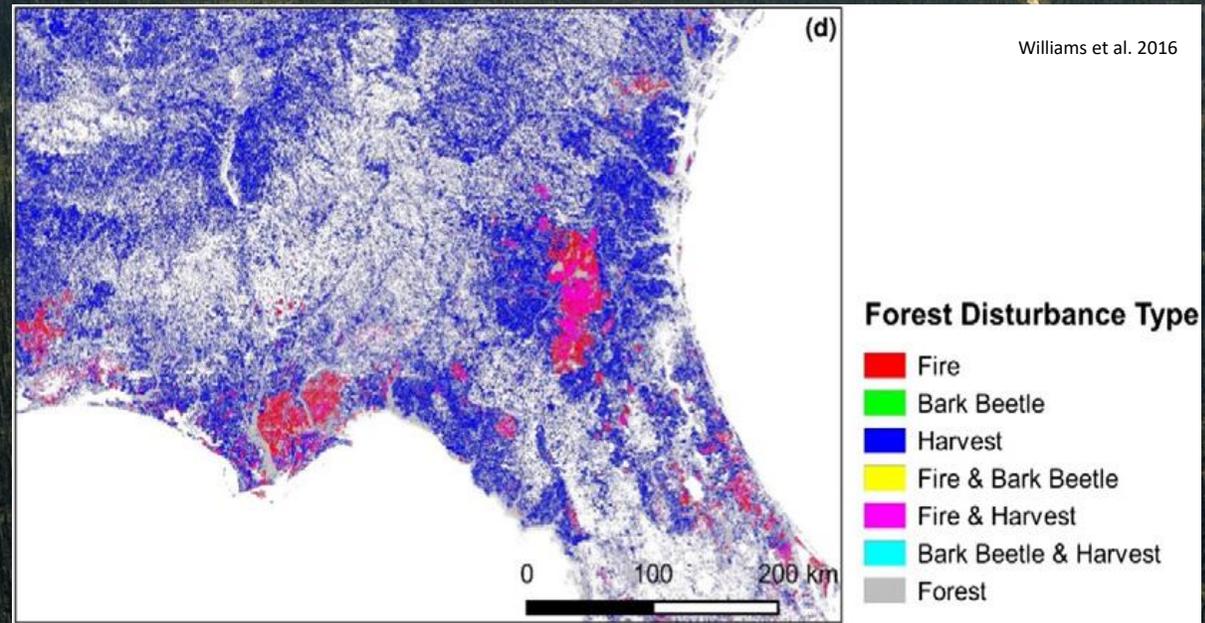
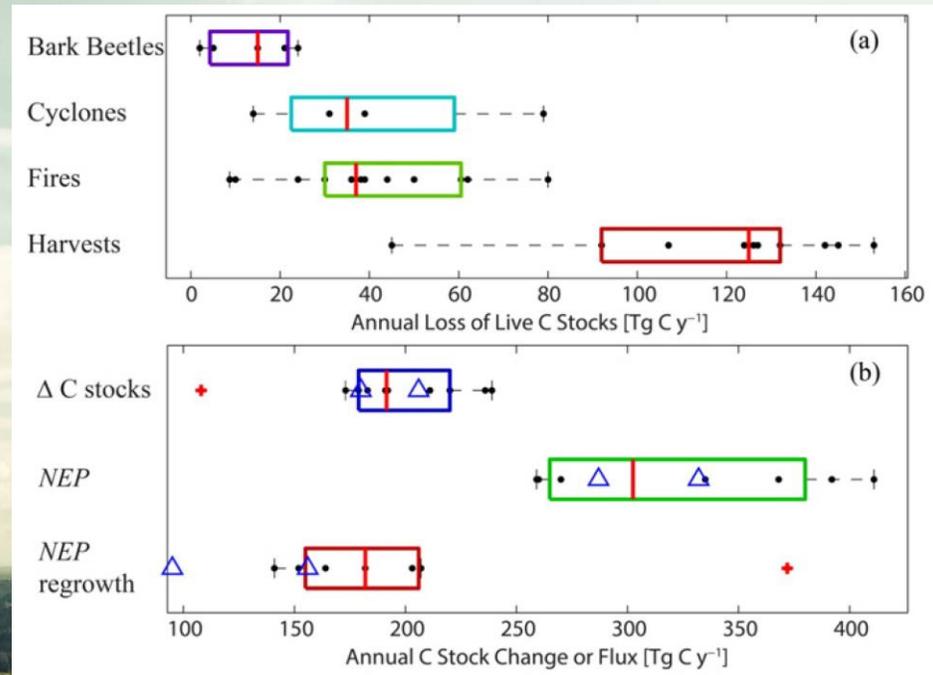
Table 9.3. Net Emissions of Carbon Dioxide Equivalent (CO₂e)^a for Forestlands from Net Forest Gain and Loss, Tree Growth in Urbanized Settlements, and Harvested Wood Products of Domestic Origin, by Country and Expressed in Teragrams of Carbon (Tg C) per Year

Tg C per Year	Canada ^b	United States ^c	Mexico ^d	Total ^k
1. Net Ecosystem Exchange for Forestland Remaining Forestland ^e	-18	-267	-41	-325****
Stock Change for Forestland Remaining Forestland ^e (Δ Forest C)	-27	154	ND ^j	127
2. Net Flux Due to Forest Area Gain and Loss ($A_{Loss} + A_{Gain}$)	3	0	9	11***
Emissions from Forest Area Loss ^f (A_{Loss})	3	23	12	38
Emissions from Forest Area Gain ^g (A_{Gain})	0	-23	-3	-27
3. Settlements Remaining Settlements ^h (Urban; Net Ecosystem Production _{settled})	-3	-24	ND	-27***
4. Emissions from Biomass Removal and Use ⁱ (F_{HWP})	35	89	ND	124***
Harvest Removals of Forest Carbon (Harv)	43	113	ND	155
Stock Change for Wood Products (from Harvest Removals - 4)	8	23	ND	31
5. Forest Sector-Atmosphere Exchange (from 1 + 2 + 3 + 4; Δ Atmos. C)	16	-201	-32	-217****

Key finding 2



Key Finding 3

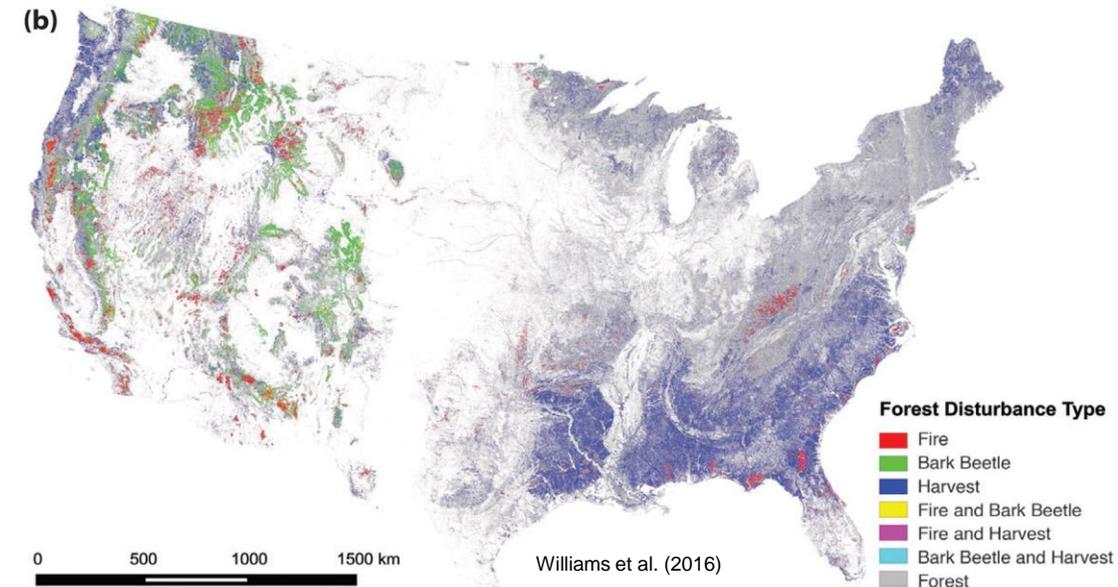
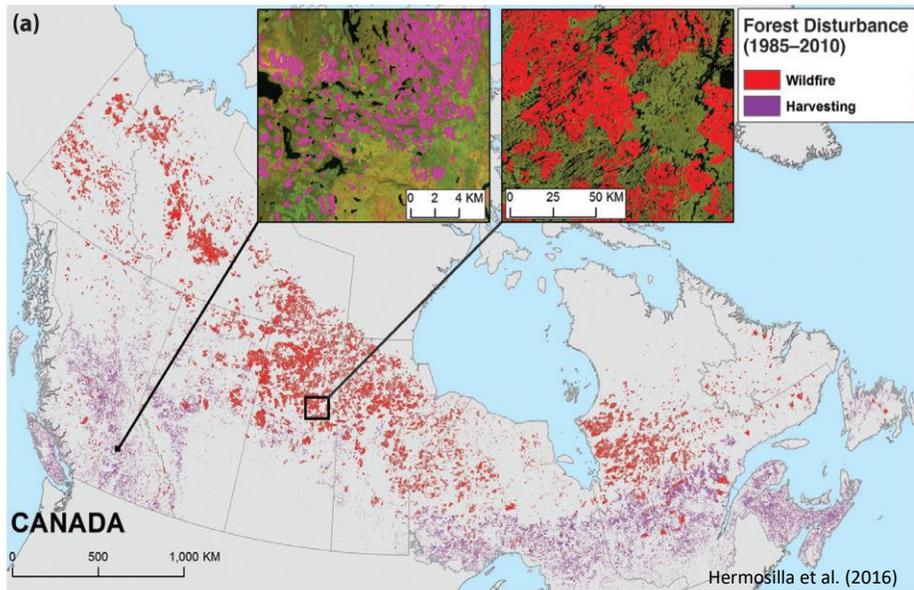
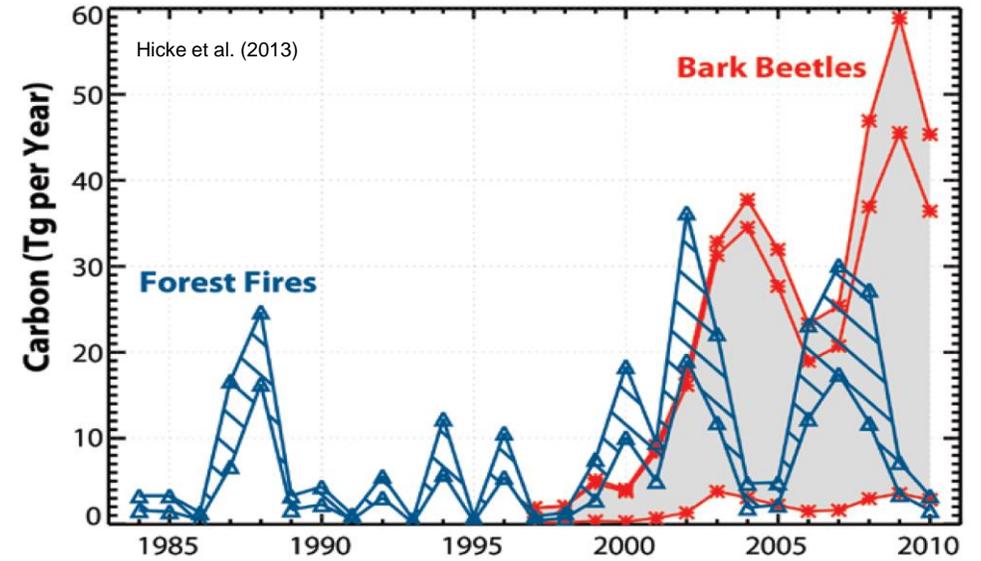
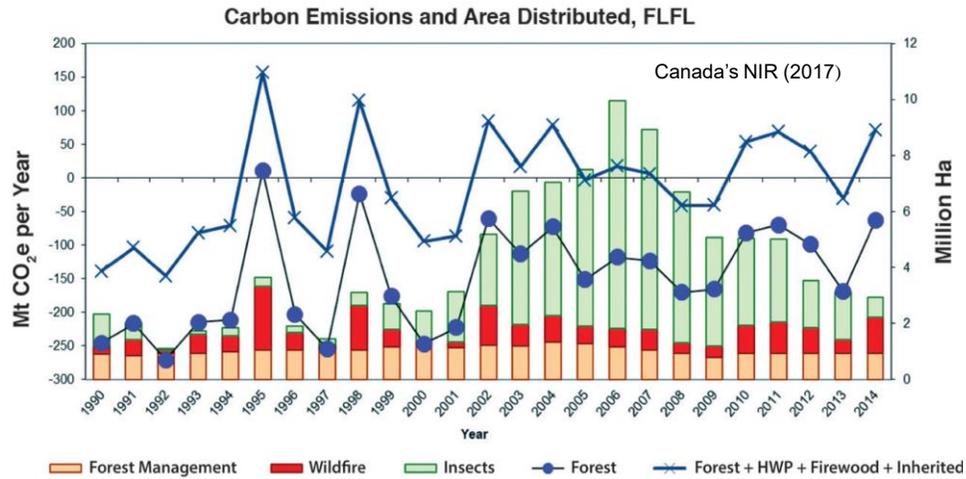


Opportunities to increasing C uptake

- Forest management
- Expansion of forest land area through afforestation/reforestation activities

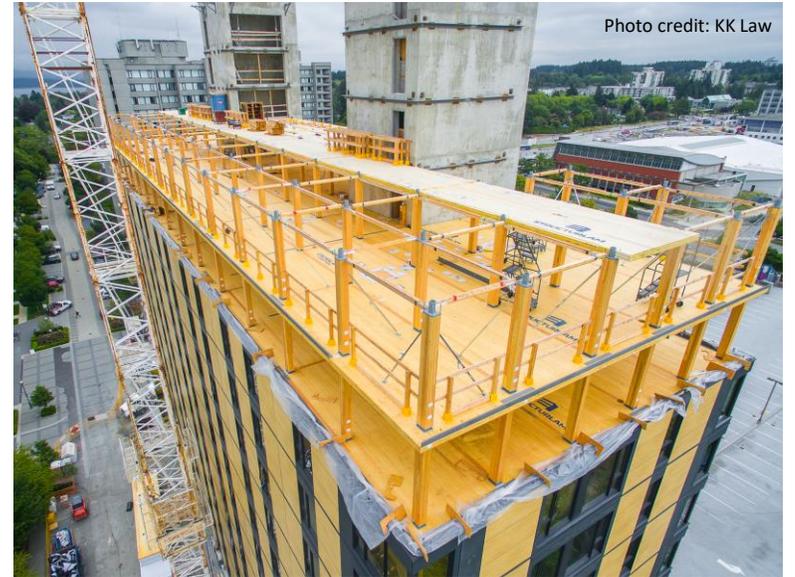


Key Findings 4 and 5



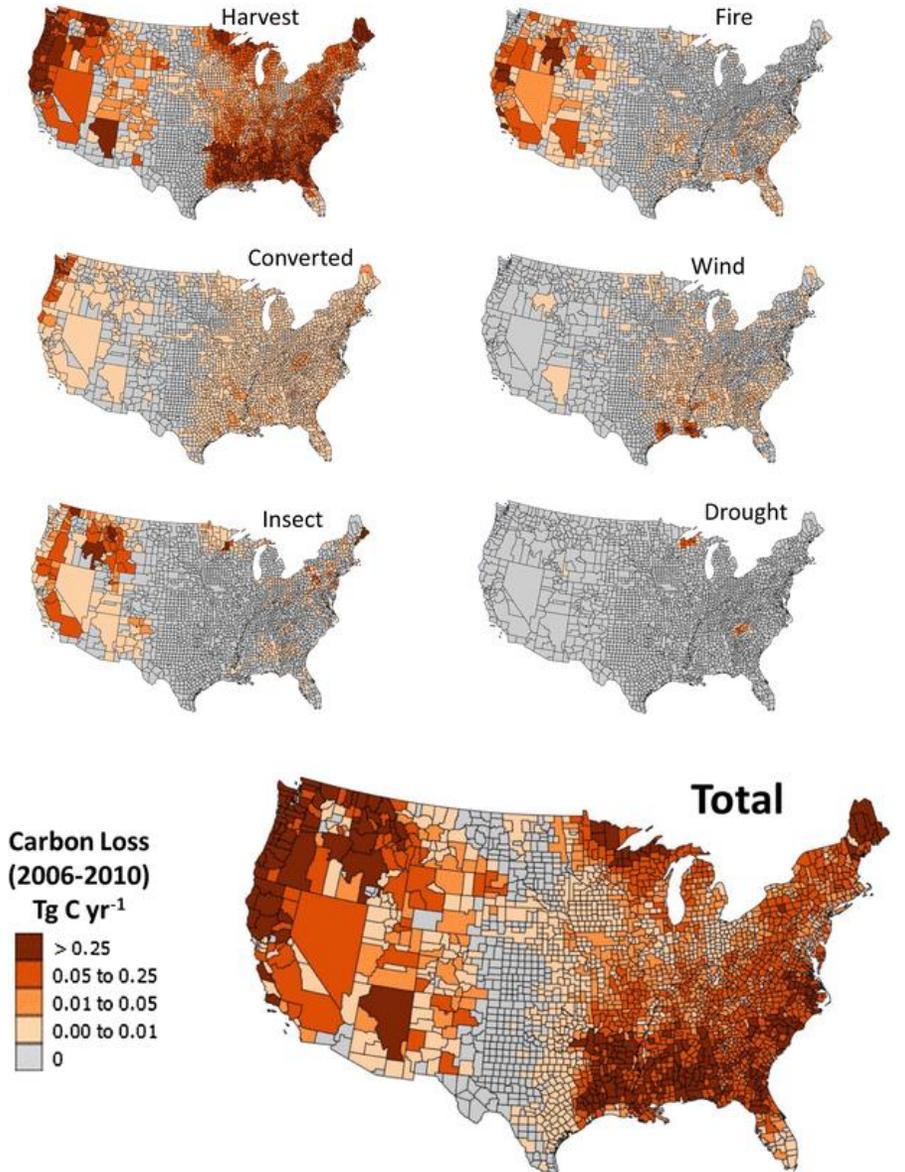
Substitutions and avoided conversion

- Long lived wood products
- Forest harvest residues for energy
- Avoiding deforestation
- Capturing mortality and managing fuels to reduce emissions from fire



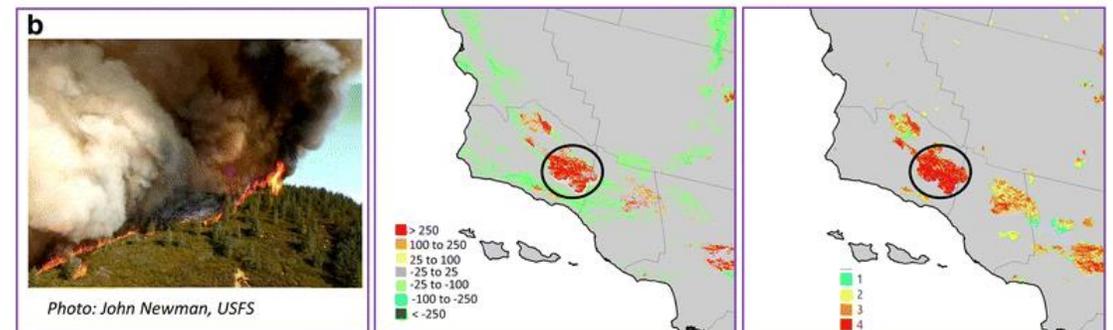
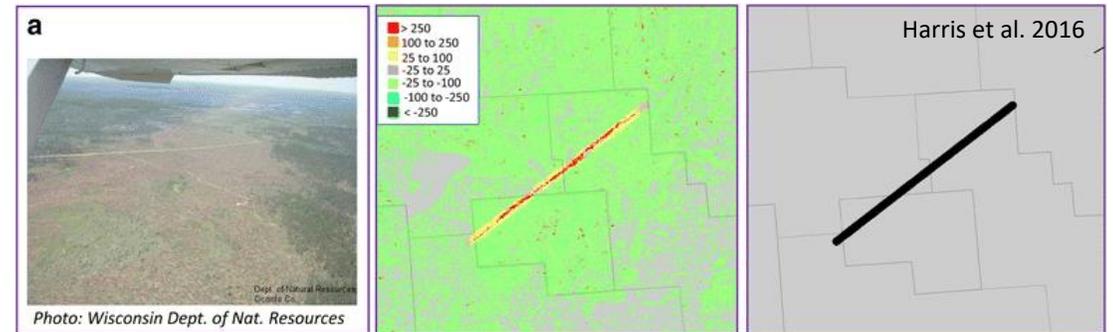
Data and analytical needs for decision support

- Improved spatial and temporal characterizations of site productivity, age, management and disturbance history, current structure
- Change products
- LCA of substitution benefits for energy and building materials



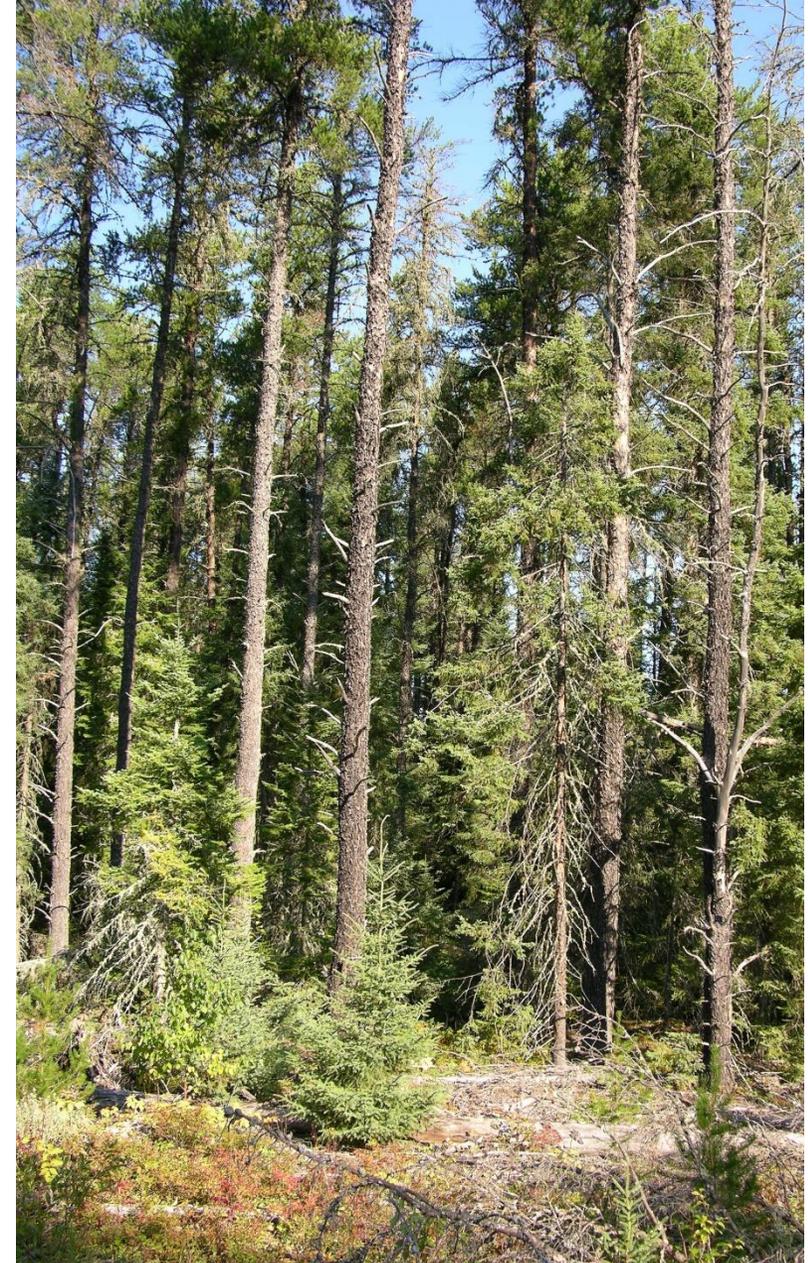
Areas for improvement

- C dynamics associated with land conversions
- Determinants of forest recovery post-disturbance
- Forest responses to rising CO₂ and climate trends and variability
- Full characterization of climate forcings of forest change
- Attribution of changes to specific drivers



Conclusions

- We have come a long way since SOCCR1
- Forests remain a net carbon sink
- Sink strength has declined recently and this is projected to continue
- There are opportunities to maintain and enhance the contribution of forests in offsetting and reducing emissions
- Improved understanding is still needed



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Thank you!

https://carbon2018.globalchange.gov/downloads/SOCCR2_Ch9_Forests.pdf

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