

Forestation Options for Vermont

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Vermont Forests

2017 RPA FIA RESOURCE TABLES FINAL

MAY 2018

Table 1a—Land area in the United States by major class, region, subregion, and State, 2017

Region, subregion, and State	Total land area ^a	Land class							
		Forest land							
		Total forest land	Timberland					Woodland ^b	Other land
			Total	Planted	Natural origin	Reserved	Other		
Thousand acres									
Vermont	5,899	4,511	4,288	35	4,253	206	18	0	1,387
Percent of total land		76.5%	72.7%	0.6	72.1%	3.5%			
Percent of forest land		100.0%	95.1%	0.8%	99.2%	4.6%			

DEFORESTATION – TO REMOVE A FOREST



DEFORESTATION Danville VT 1897



Log Drive White River near Sharon VT ~ 1900

VERMONT DEFORESTATION 21st CENTURY



REFORESTATION TO REGROW A FOREST

New England Forest Cover and Human Population

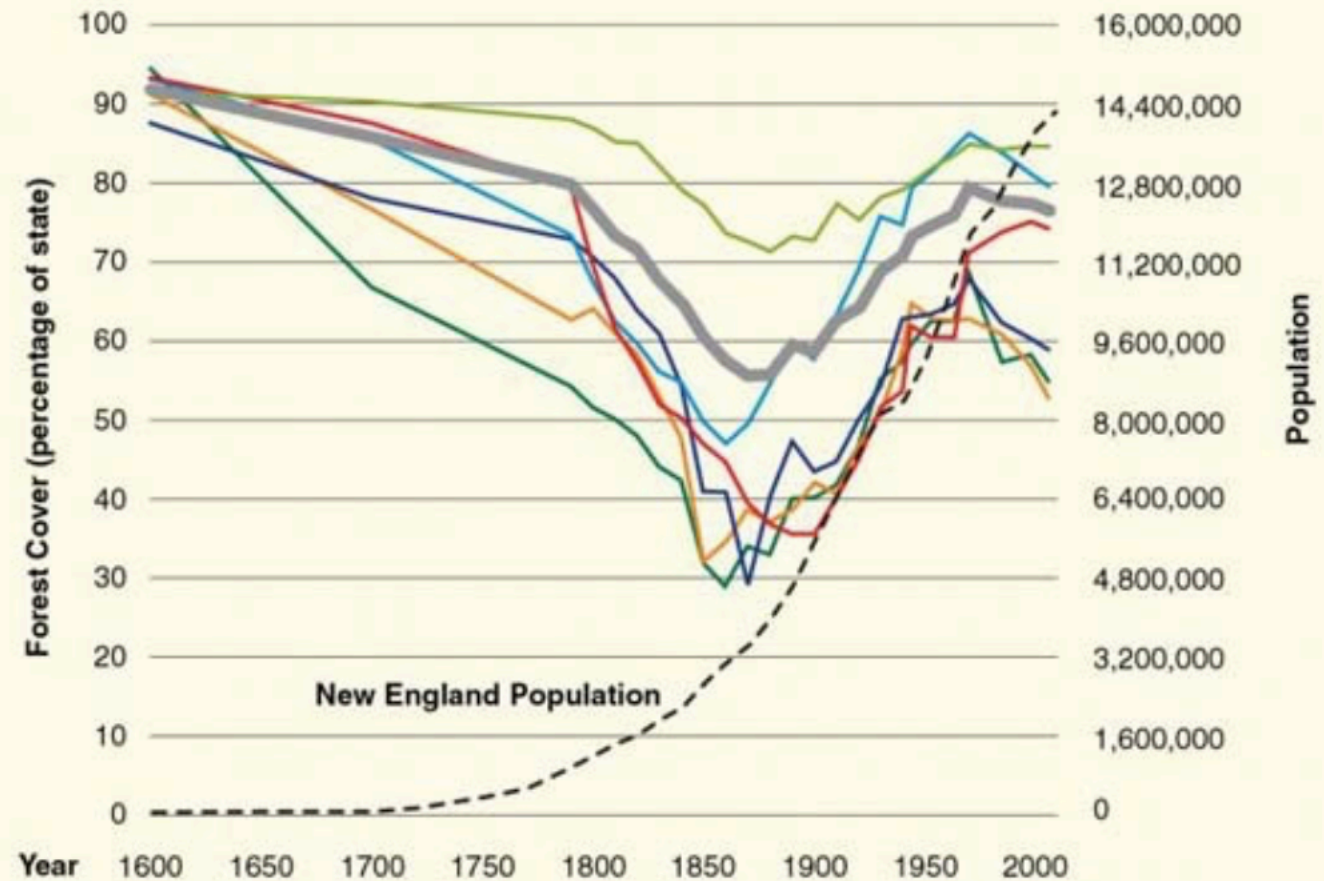
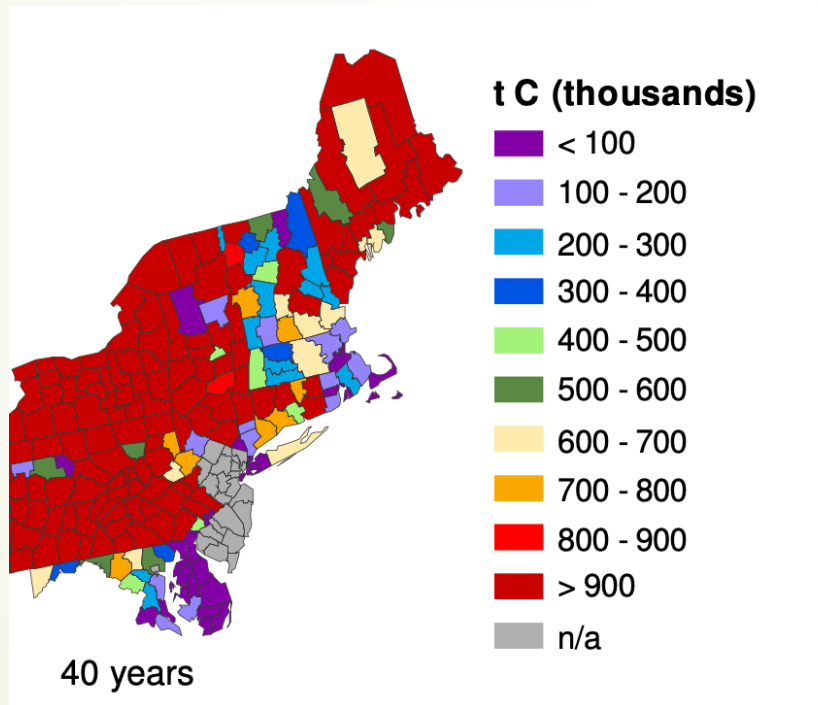


Figure from:

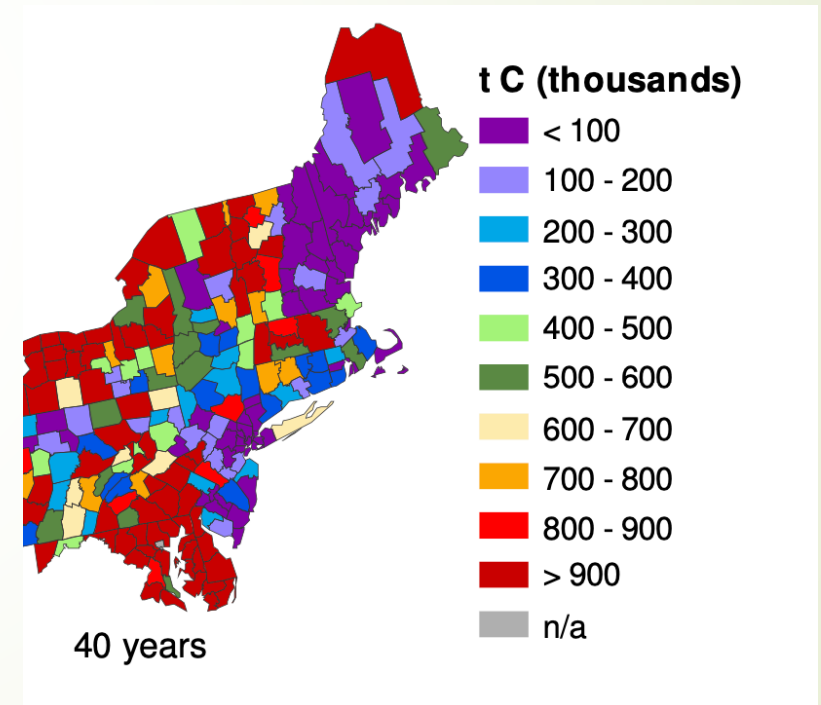
Foster, D.R., B.M. Donahue, D.B. Kittredge, K.F. Lambert, M.L. Hunter, B.R. Hall, L.C. Irland, R.J. Lilleholm, D.A. Orwig, A.W. D'Amato, E.A. Colburn, J.R. Thompson, J.N. Levitt, A.M. Ellison, W.S. Keeton, J.D. Aber, C.V. Cogbill, C.T. Driscoll, T.J. Fahey, and C.M. Hart. 2010. *Wildlands and Woodlands: A Vision for the New England Landscape*. Harvard Forest, dist. by Harvard University Press, Cambridge, Massachusetts. 36pp

Opportunities for Improving Carbon Storage through Afforestation

Pastureland



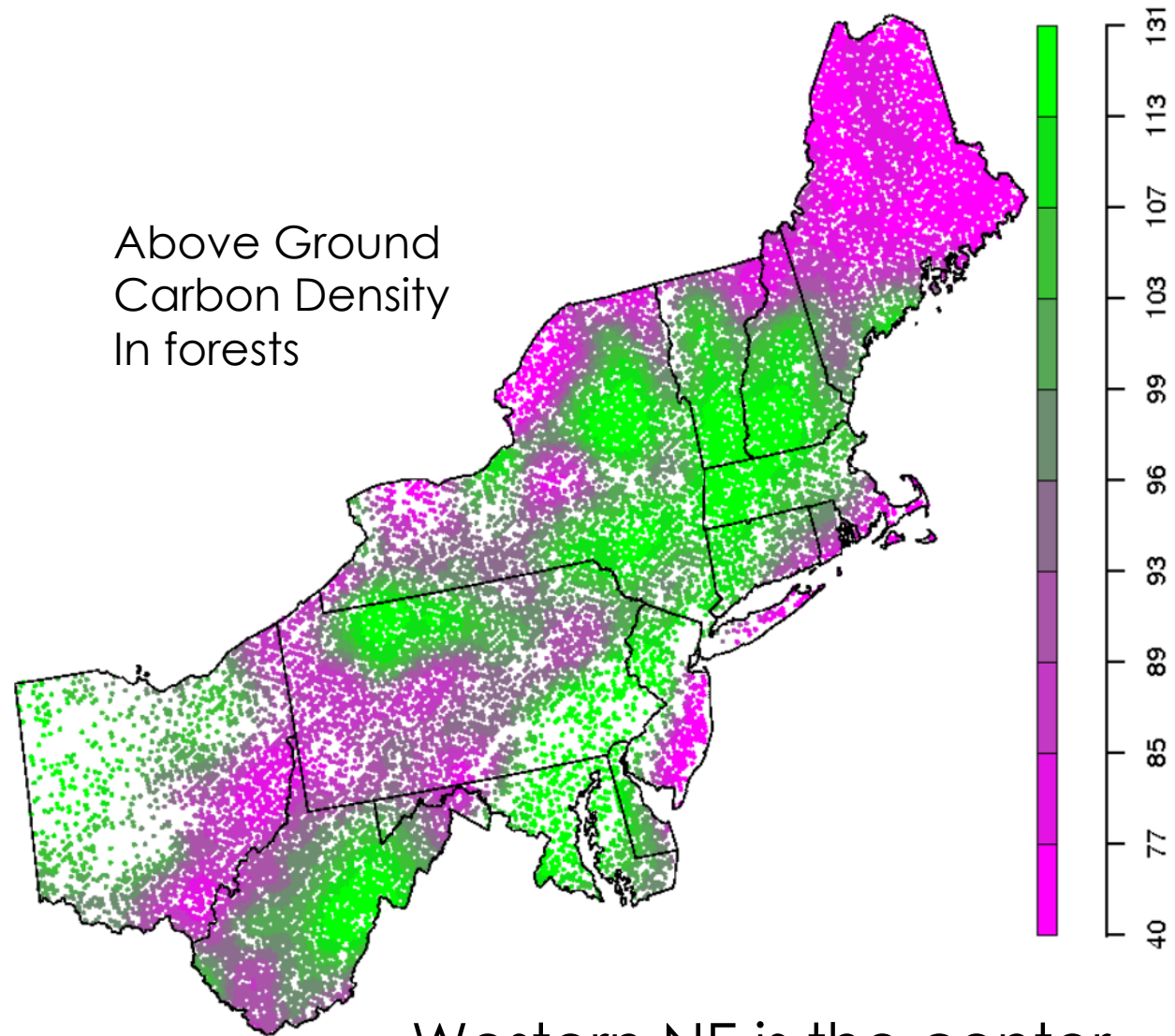
Cropland



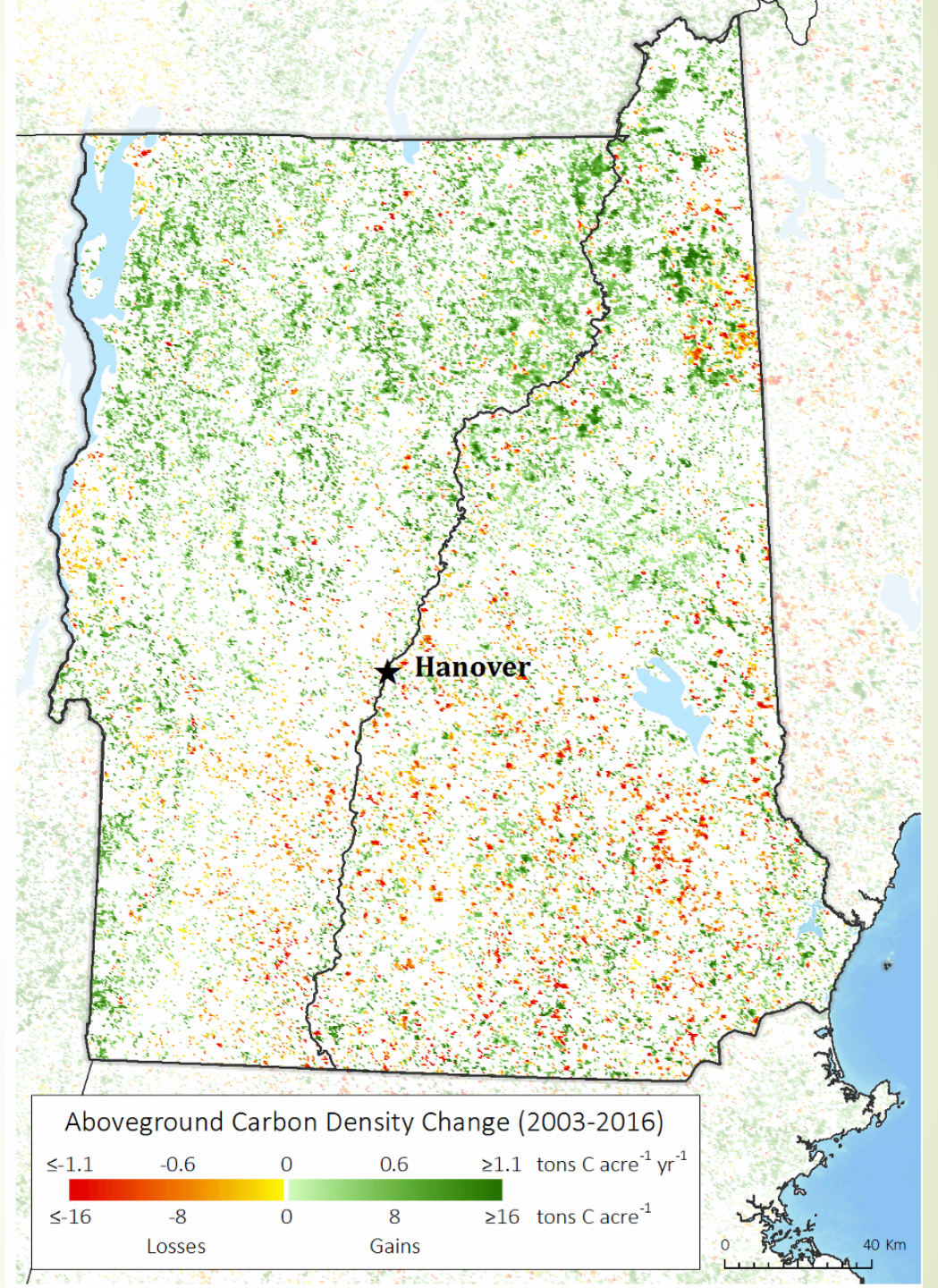
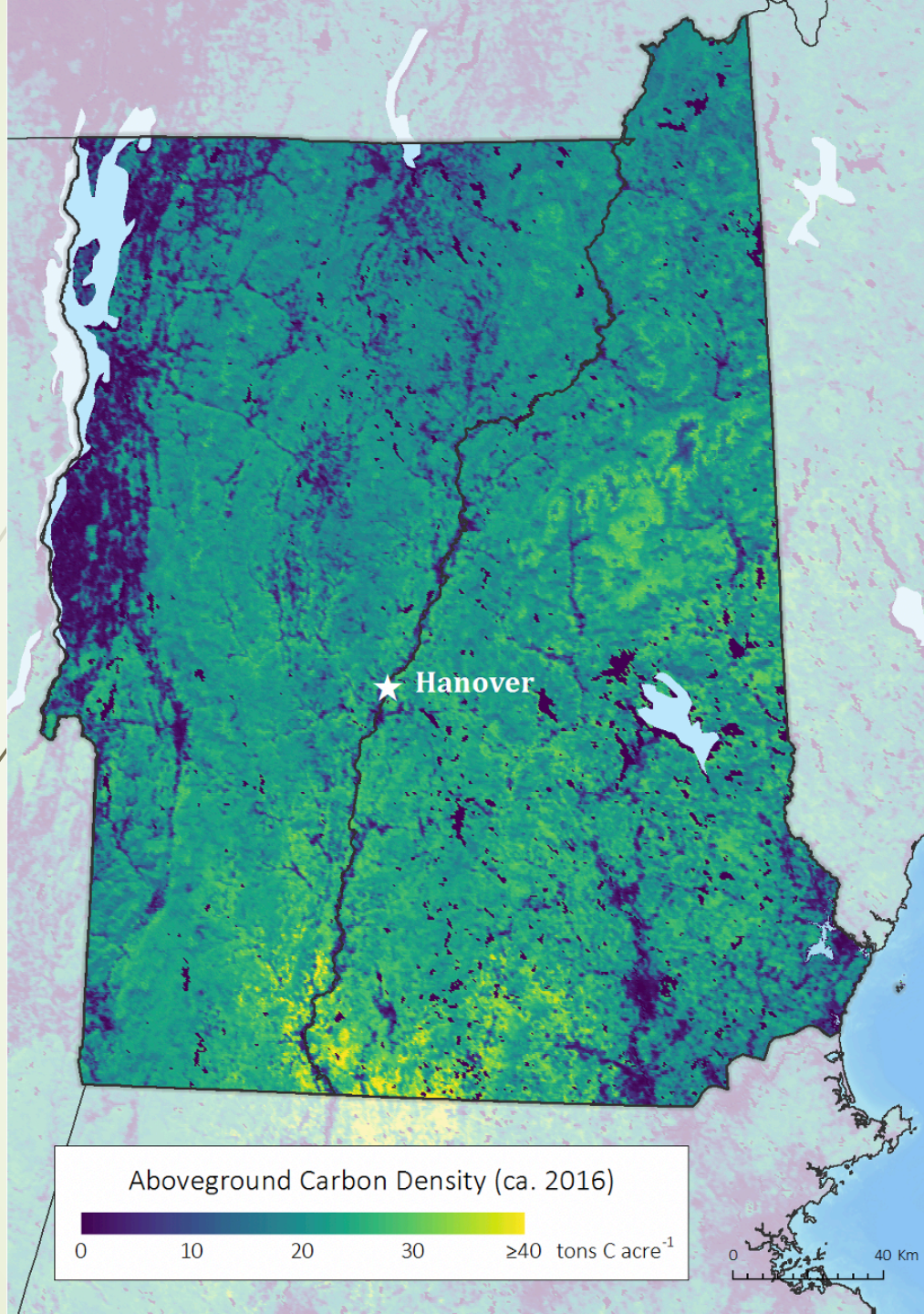
Forest cover in
Northeast U.S.



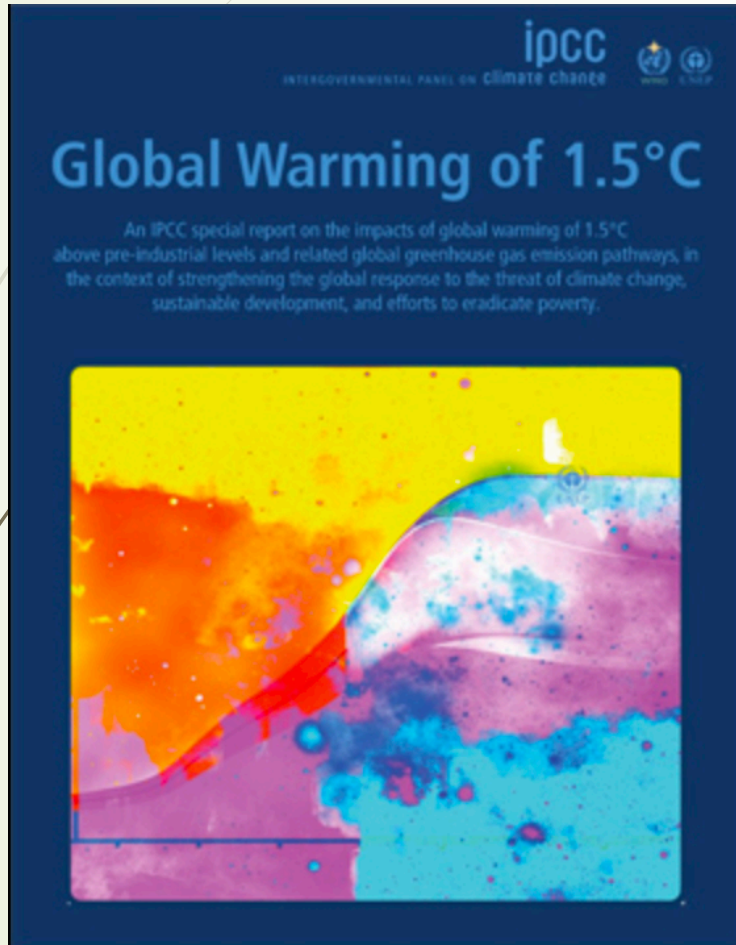
COLE Map
Total Aboveground Carbon (metric tons/hectare)



US Forest Service



IPCC response to limiting temperature rise to less than 1.5° C

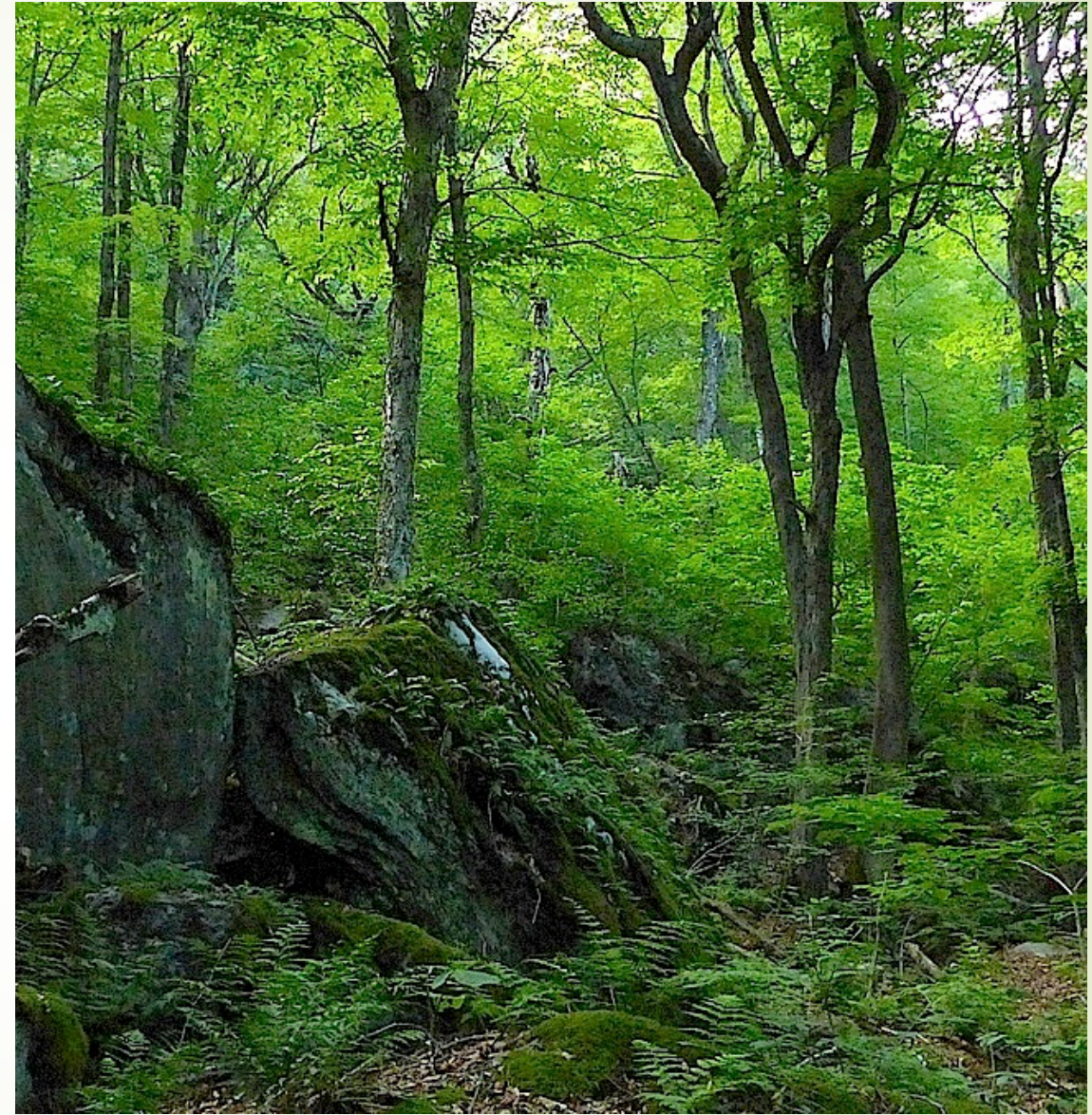


Intergovernmental Panel on Climate Change Special Report *Global Warming of 1.5°C (2.7°F)* October 8, 2018

To keep temperatures from rising excessively

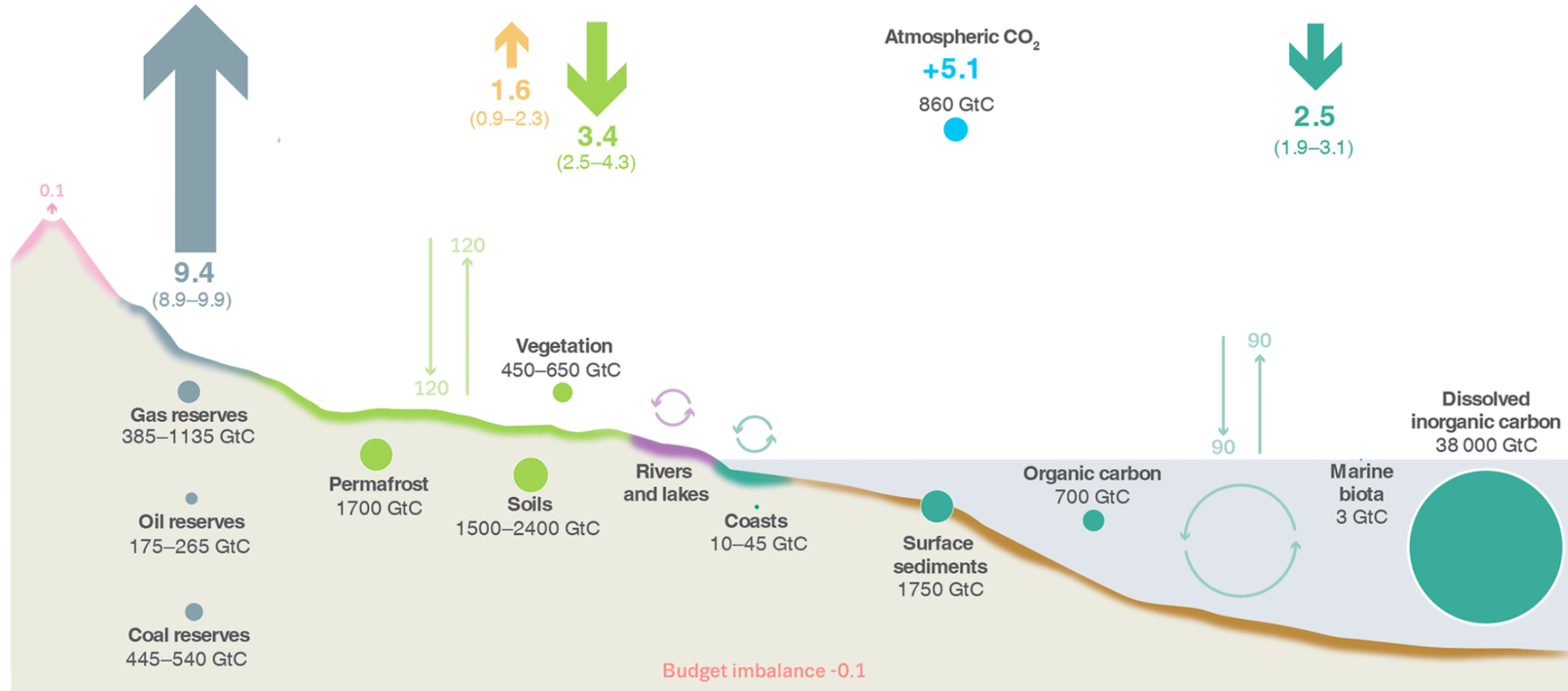
“... global **net** anthropogenic carbon dioxide emissions (must) decline by about 45% from 2005 levels by 2030 ... reaching **net** zero around 2050 ...”

Must simultaneously reduce combustion emissions and increase removal of atmospheric carbon dioxide by forest growth



Forests and soils reduce growth of atmospheric carbon dioxide slowing Global Warming and the rate of climate change

The global carbon cycle



Anthropogenic fluxes 2010–2019 average GtC per year



Fossil CO₂ E_{FOS}



Land-use change E_{LUC}



Land uptake S_{LAND}



Ocean uptake S_{OCEAN}

+ Atmospheric increase G_{ATM}

■ Budget Imbalance B_{IM}

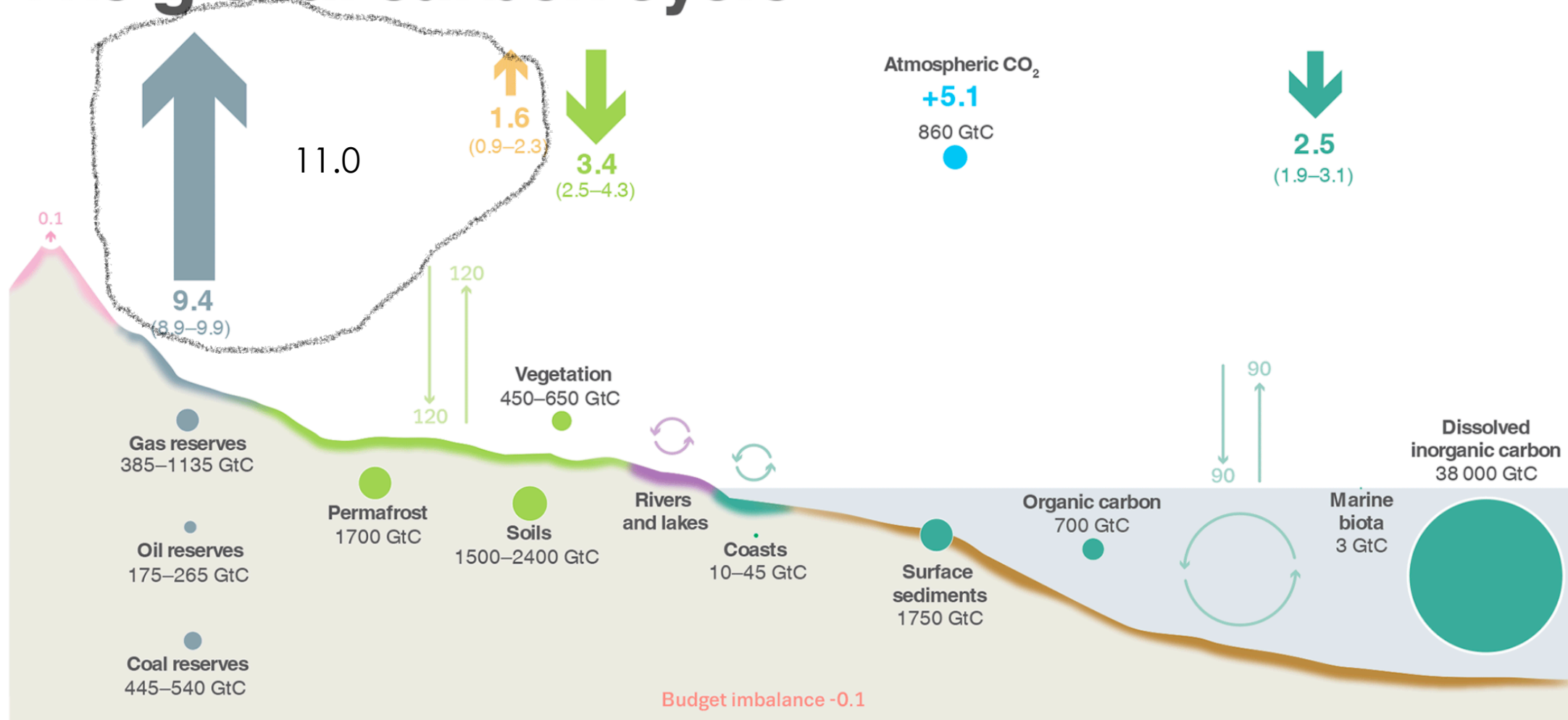


Carbon cycling GtC per year



Stocks GtC

The global carbon cycle



Anthropogenic fluxes 2010–2019 average GtC per year



Fossil CO₂ E_{FOS}



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Land uptake S_{LAND}



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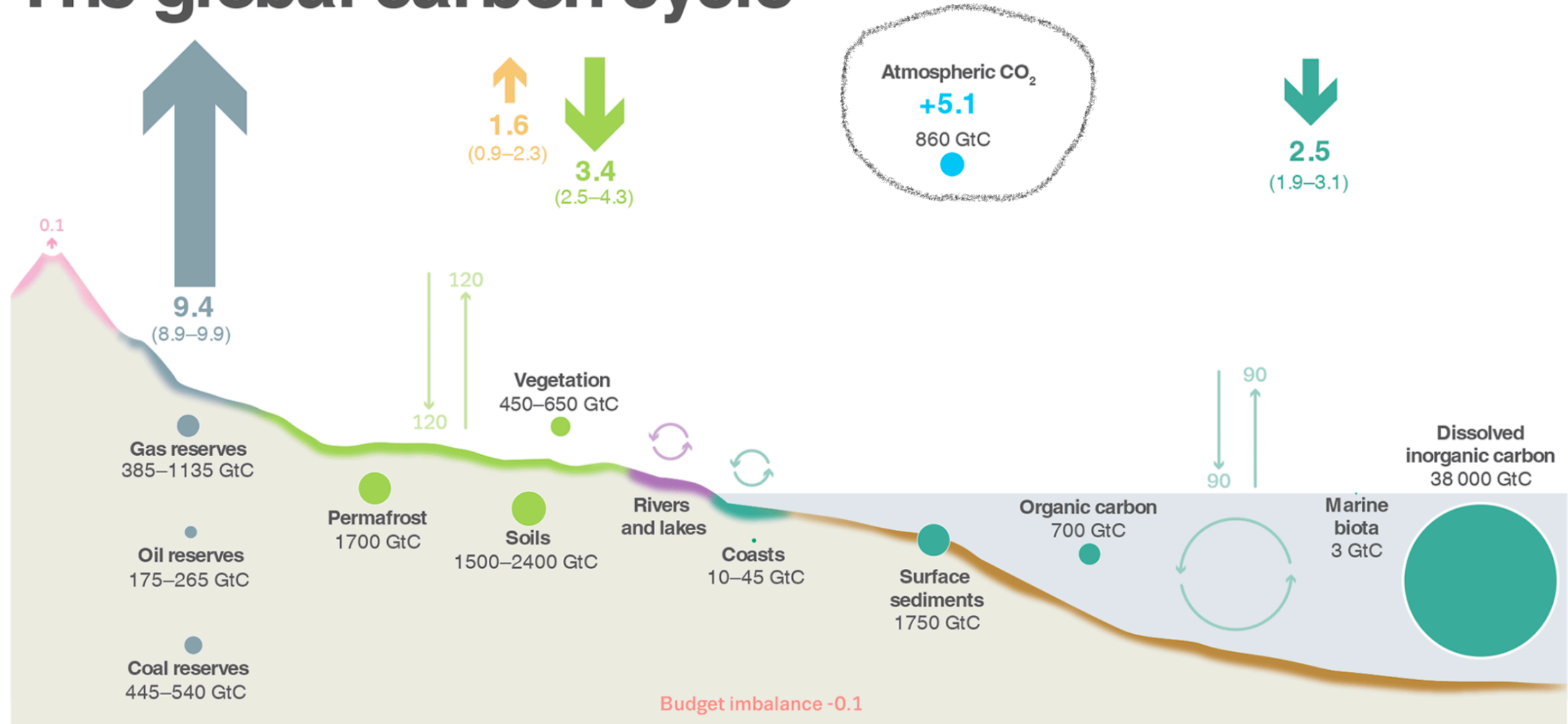
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↑ Carbon cycling GtC per year

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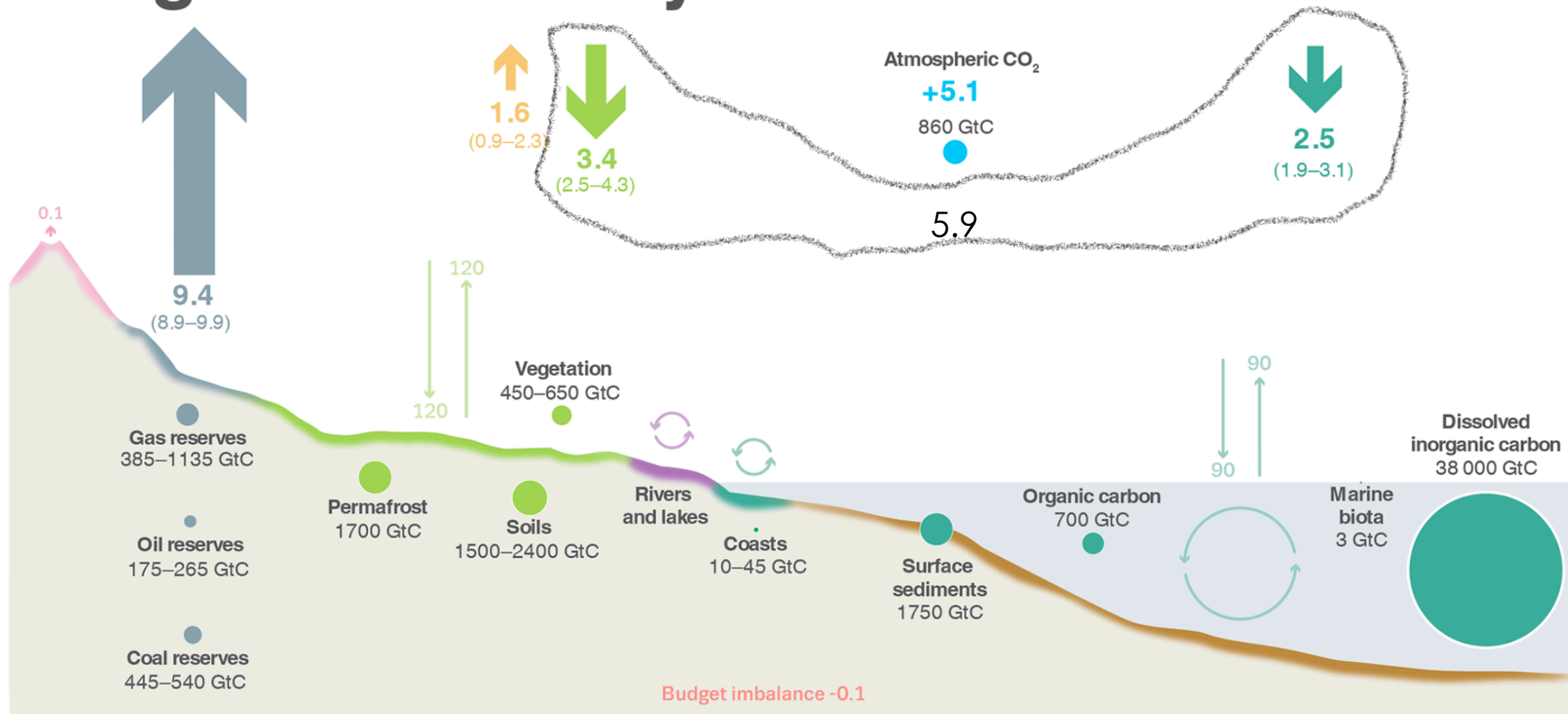


Carbon cycling GtC per year



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Carbon cycling GtC per year



Stocks GtC

Increase carbon accumulation by forests

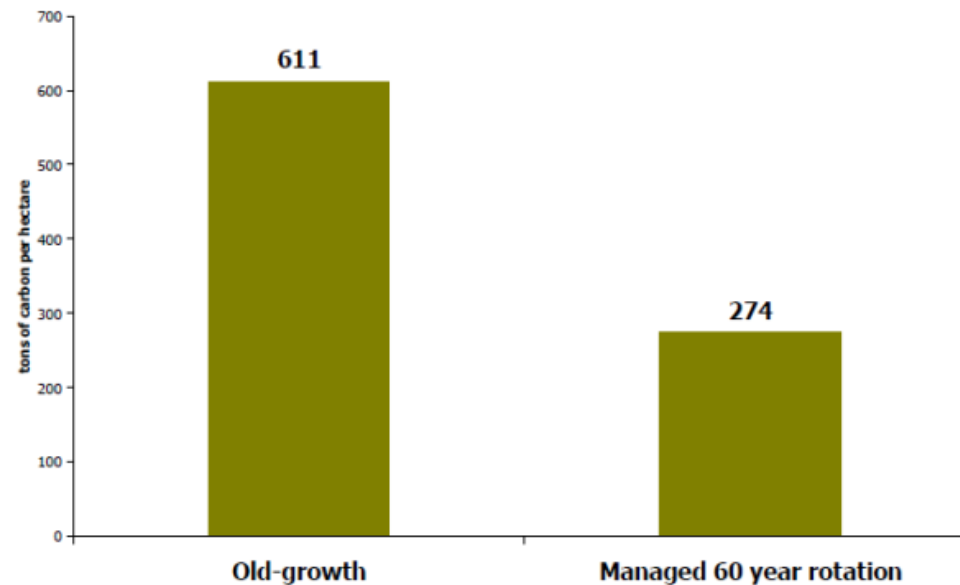
- Altering forest management to let more trees grow would allow global forests to accumulate twice as much carbon
Erb et al 2018
- "...the largest one percent of trees in mature and older forests comprised 50 percent of forest biomass worldwide."
Lutz et al 2018
- The potential for growing forests to accumulate carbon by natural regrowth is better than active management and has been under estimated by 32%
Cook-Patton et al 2020



Carbon storage at forest level

Figure 1

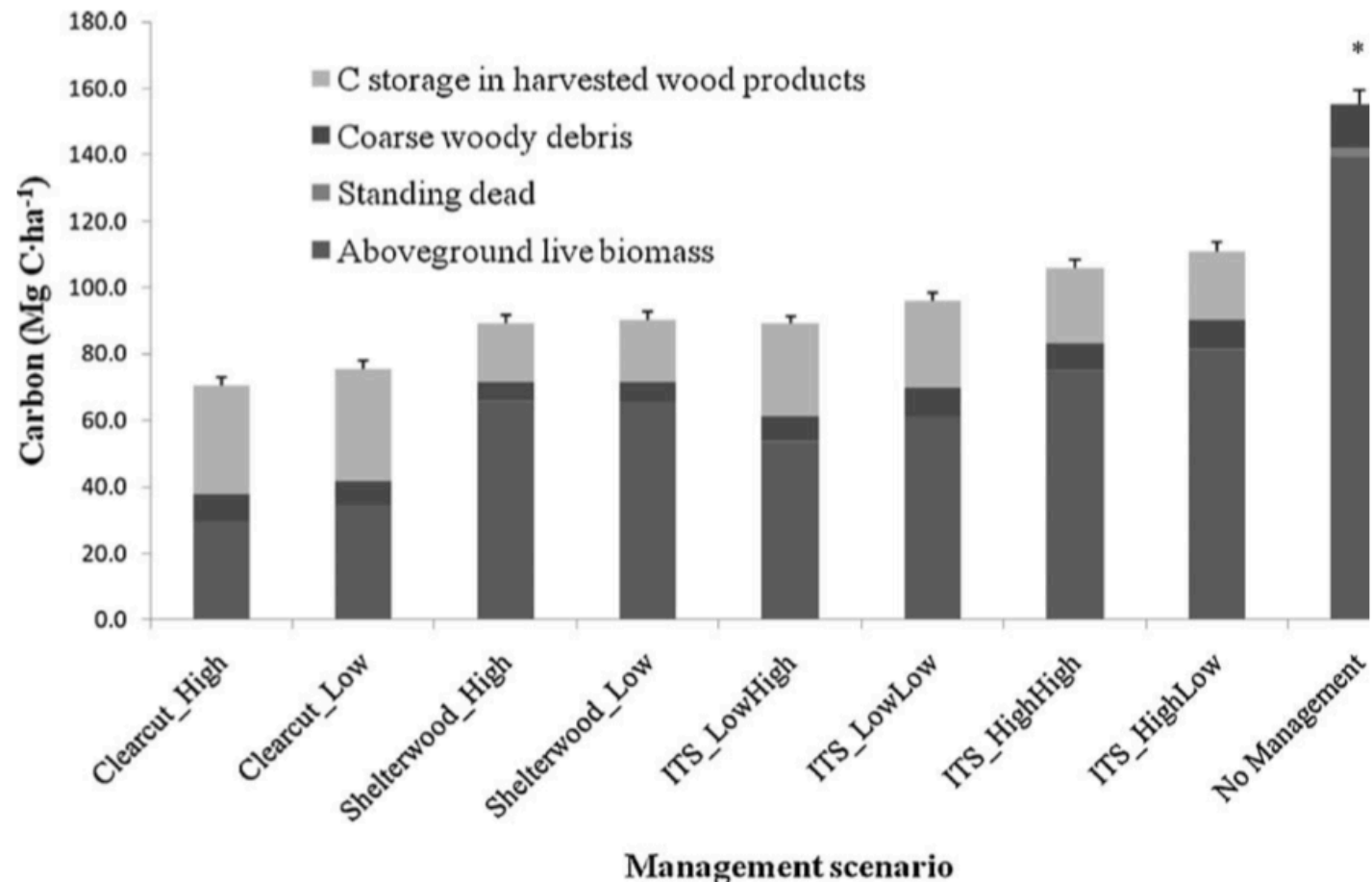
Harmon, Ferrell and Franklin (1990)



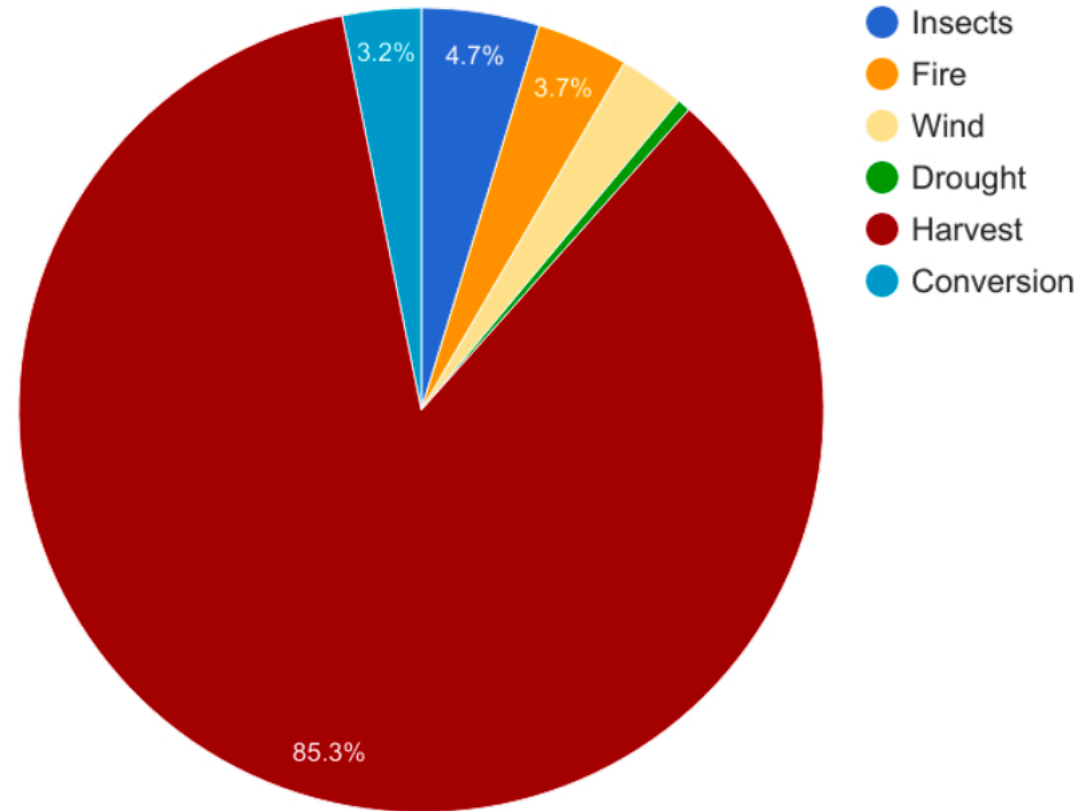
Source: Harmon, Mark E., William K. Ferrell, and Jerry F. Franklin. "Effects on Carbon Storage of Conversion of Old-Growth Forests to Young Forests." *Science*, 9 February 1990: Vol. 247, pp 699–702

Proforestation stores more carbon than managed forests producing wood products

J.S. Nunery, W.S. Keeton / Forest Ecology and Management 259 (2010) 1363–1375



Annual forest carbon loss (Tg C) in the US



US forest harvesting (162 MMtC/y) exceeds US fossil fuel emissions from heating commercial and residential building sectors (149 MMtC/y) Harris 2016

Forest Bioenergy Emissions

MCNEIL
POWERPLANT
BURLINGTON VT

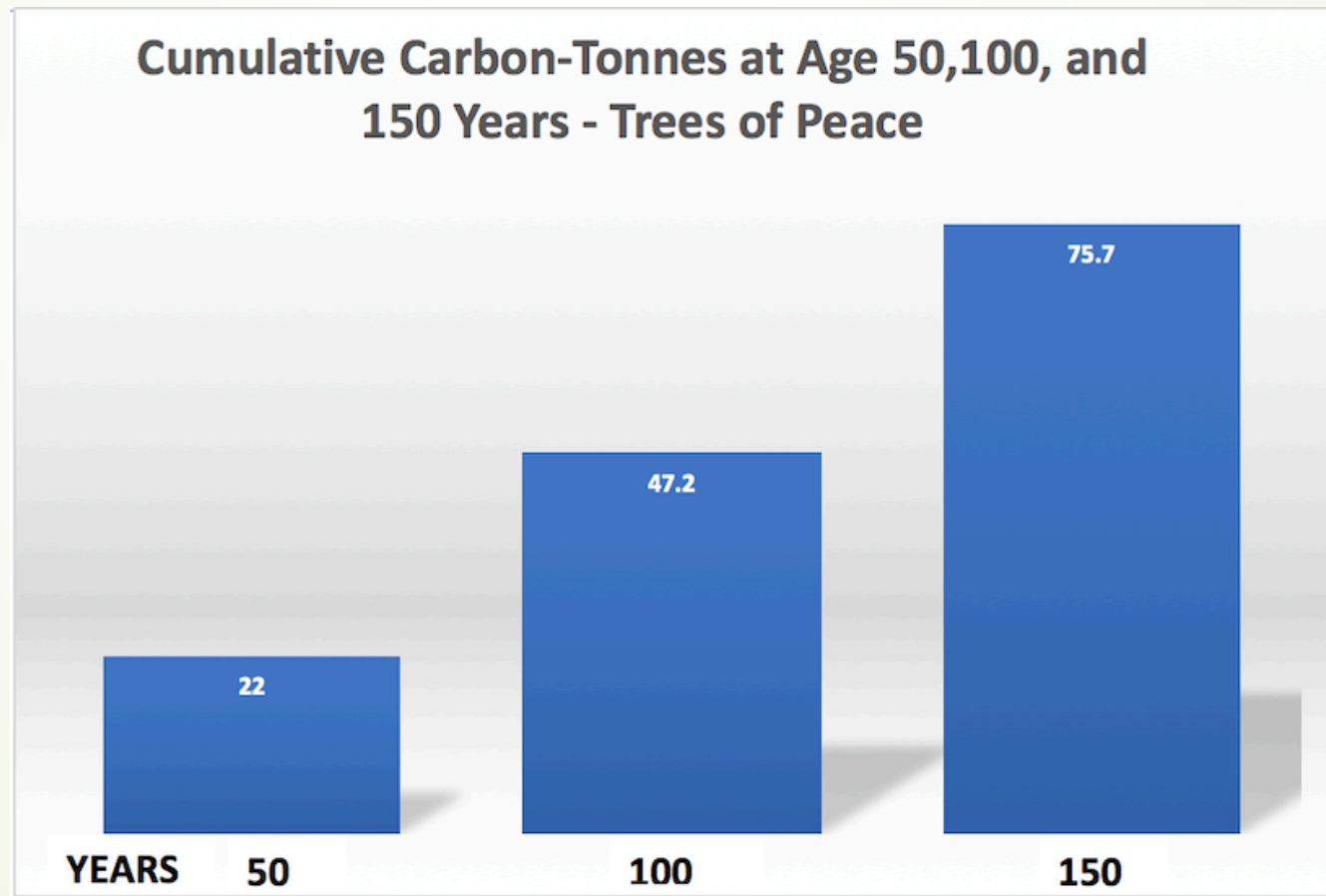
FOREST BIOENERGY
ADDS AS MUCH
CARBON DIOXIDE TO
THE ATMOSPHERE AS
COAL

FORESTS DO NOT
REMOVE IT FOR A
CENTURY



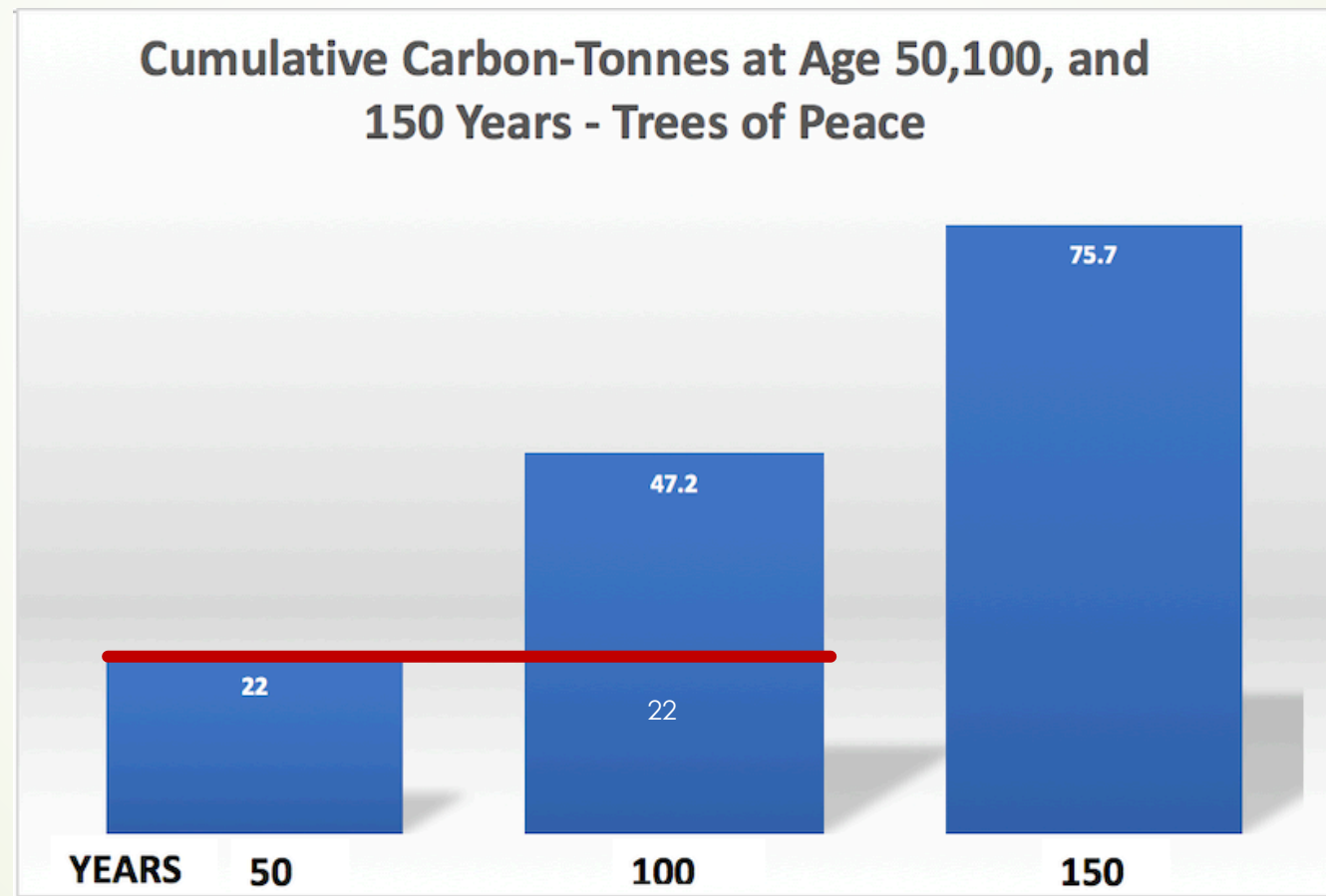
Accumulated carbon in a one acre stand of white pine in Western Massachusetts

Tons
per
acre



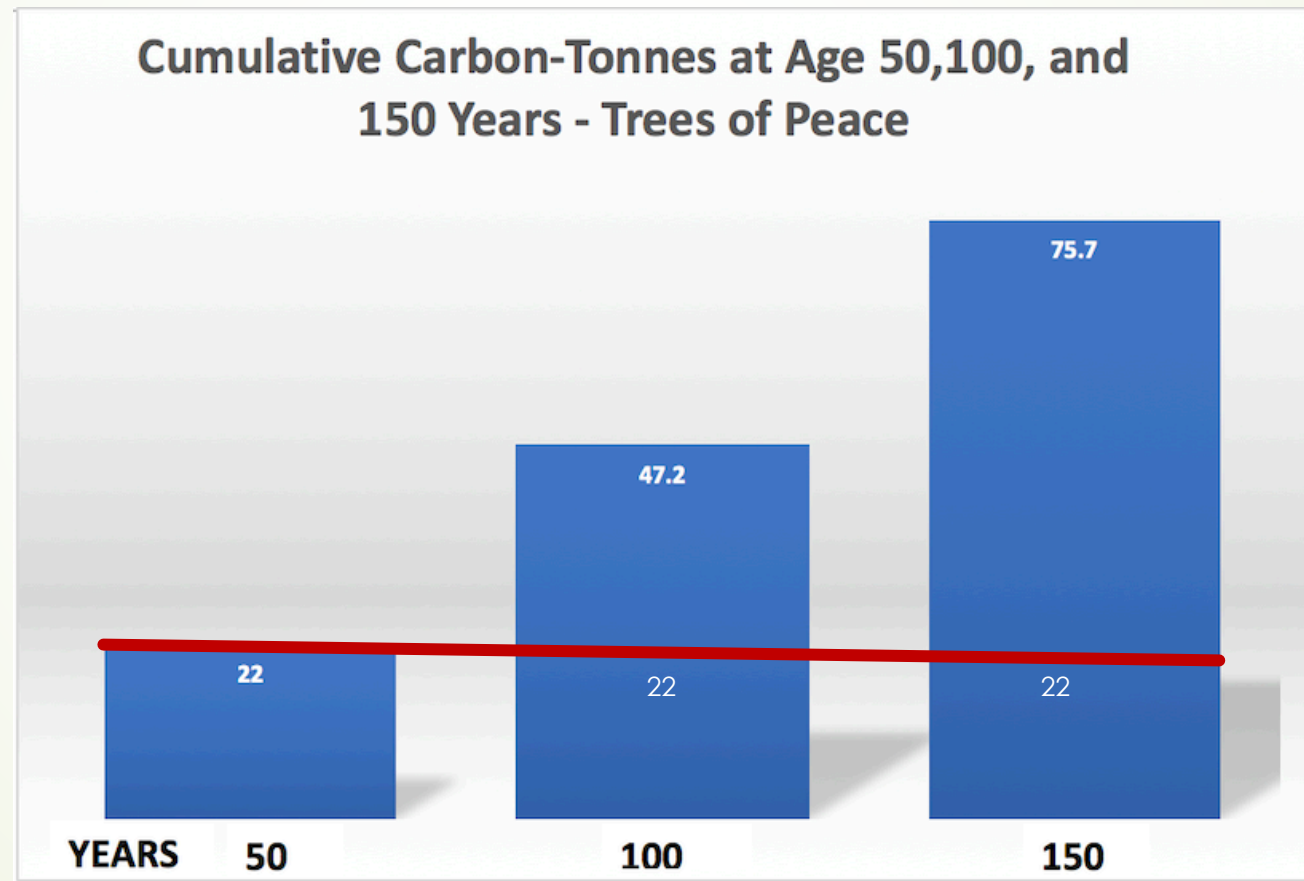
Why “carbon neutral” is not enough and bioenergy is not helping to meet climate emergency

Tons
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acre



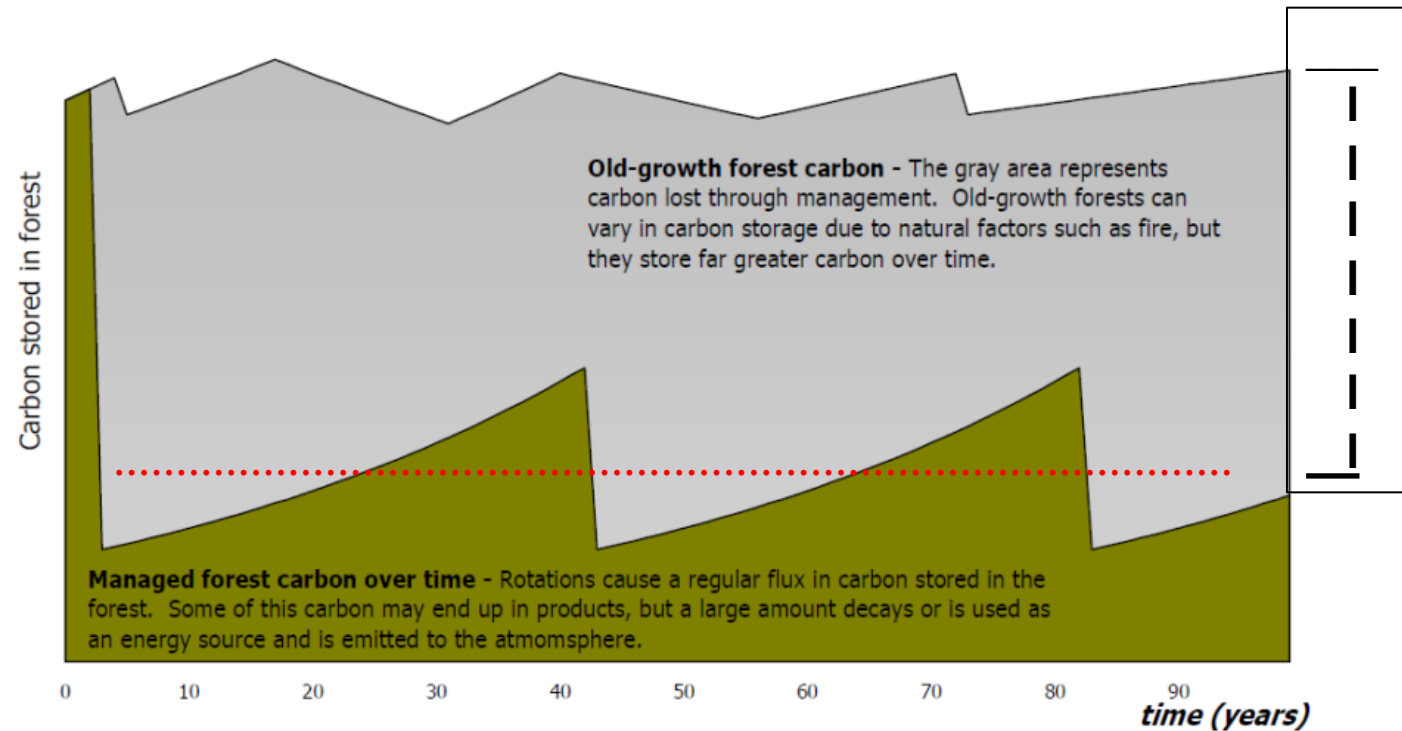
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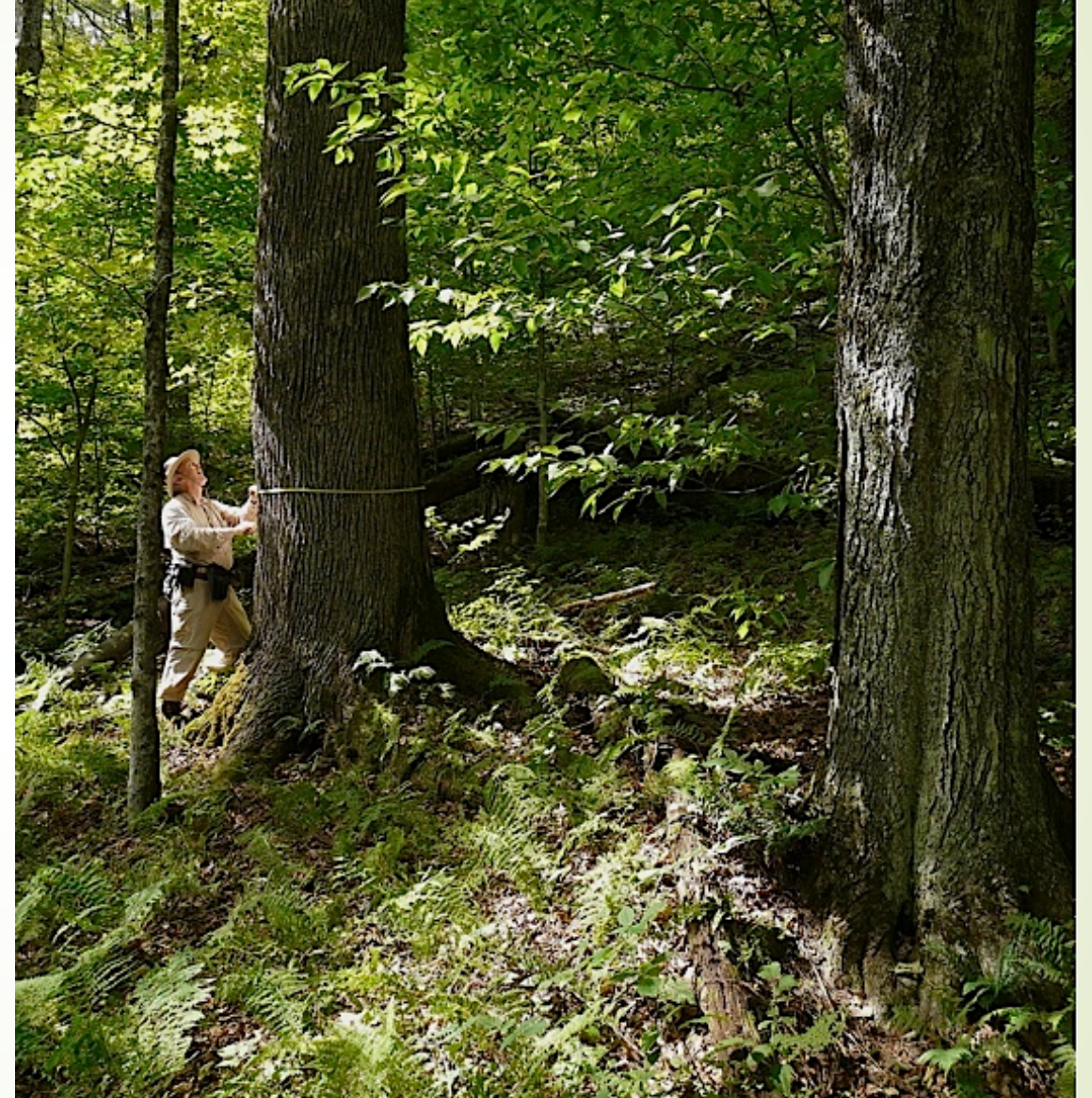


Carbon storage in a sustainably managed forest

Carbon Loss from Old-Growth or Mature Natural Forest Logging (model)



Source: Harmon, Mark E., William K. Ferrell, and Jerry F. Franklin. "Effects on Carbon Storage of Conversion of Old-Growth Forests to Young Forests." *Science*, 9 February 1990: Vol. 247, pp 699–702



Old Growth Forests in New England store lots of carbon



Planting trees is good
Letting them grow is better

Proforestation Management
allows forests to reach their
biological potential for
carbon storage in trees and
soils

Larger trees accumulate the
most atmospheric carbon
over time, and store the
carbon in the wood of their
trunk and limbs
and in soils

Establish two designated types of forests



Strategic Forest Carbon Reserves
and Ecosystem Services



Industrial production forests

A third structure for forest management

Family scale and land trust owners that are paid by the state to manage their forests to support ecological services

Some might be paid at a different rate to lengthen rotation times to store more carbon and allow for older successional stages

This would be an additional set of criteria for receiving a property tax reduction under Use Value Appraisal that requires management for logging

Vermont forester David Brynn has proposed a similar category for family farms



Strategies for closing the sequestration gap

Preventing deforestation, the draining of wetlands and soil loss and restoring them are essential to avoid irreversible and catastrophic climate change

Proforestation management is far more effective than “planting a trillion trees” and is among the least costly options for removing and storing additional atmospheric carbon dioxide

