MICHIGAN STATE UNIVERSITY: FOREST CARBON AND CLIMATE PROGRAM

Assessment of carbon management alternatives on production of hardwood products

Chad Papa, PhD, 2024.10.16

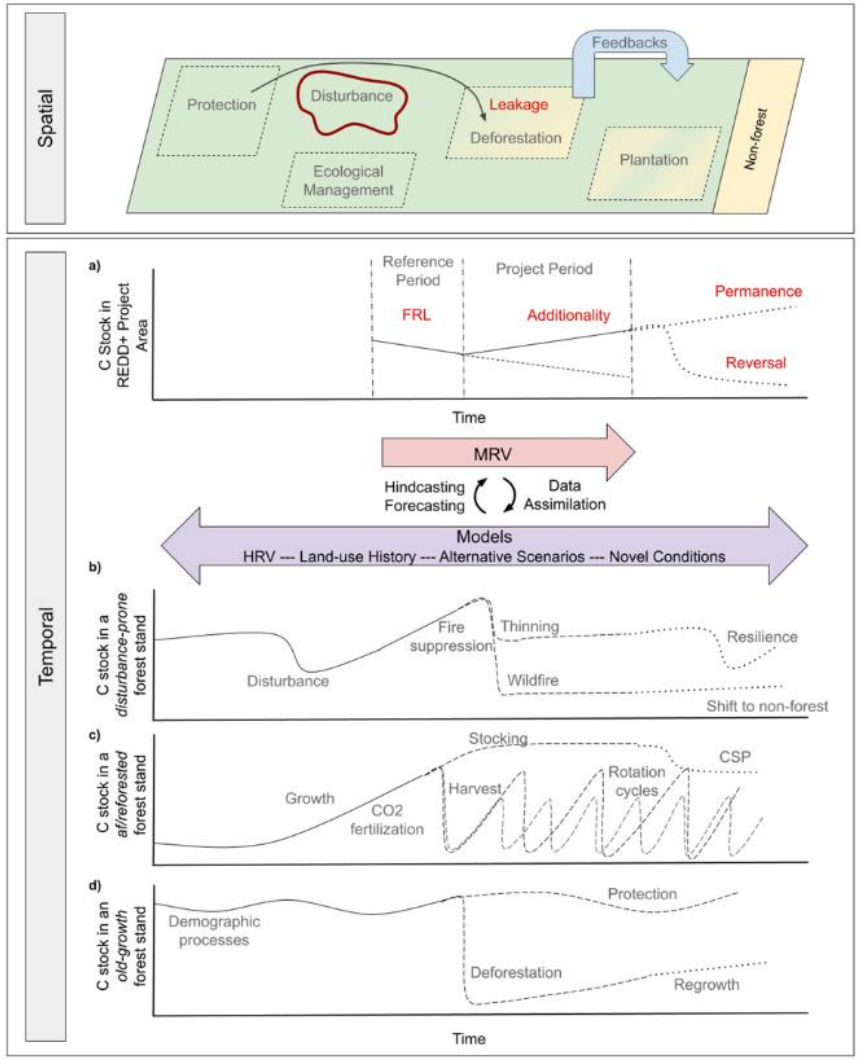
Forest Carbon and Climate Program
Department of Forestry
MICHIGAN STATE UNIVERSITY

Trade-offs between management goals

- Spectrum of forest management strategies
  - Passive vs Active
- Forests are managed for a myriad of benefits and values:
  - Timber (income)
  - Cultural / religious / sense of place
  - Supporting ecosystem services
  - Climate mitigation (potential for income generation)

- Improved forest management (Karakka et al., 2021)
  - Range of silvicultural managed actions including:
    - Extended rotations
    - Timber stand improvements / fuel management
    - Facilitated regeneration
    - Retain stand structural / functional characteristics
    - Partial harvests or other novel harvest regimes

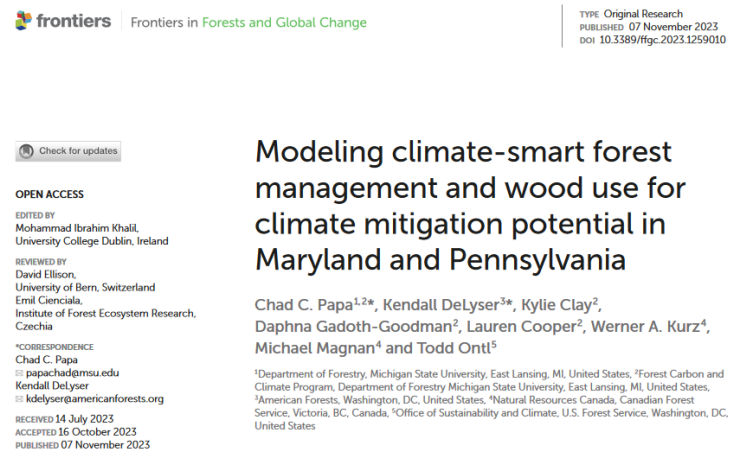
Giebink et al, 2022



Modeling to inform statewide planning and policy

- Participatory modeling project to inform forest policy and planning
- Collaboratively worked with state forest agencies to:
  1. Identify priorities and concerns
  2. Translate narratives and expertise into BAU and alternative management scenarios
  3. Engagement and discussion to explore results and implications to inform programs and policies

- Harvesting practices
- Forest health and regeneration
- Land-use change
- Climate change impacts



frontiers | Frontiers in Forests and Global Change

TYPE Original Research
PUBLISHED 07 November 2023
DOI 10.3389/ffgc.2023.1259010

Check for updates

OPEN ACCESS

EDITED BY
Mohammad Ibrahim Khalil,
University College Dublin, Ireland

REVIEWED BY
David Ellison,
University of Bern, Switzerland
Emil Cienciala,
Institute of Forest Ecosystem Research, Czechia

*CORRESPONDENCE
Chad C. Papa
papachad@msu.edu
Kendall DeLyser
kdelyser@americanforests.org

RECEIVED 14 July 2023
ACCEPTED 16 October 2023
PUBLISHED 07 November 2023

Modeling climate-smart forest management and wood use for climate mitigation potential in Maryland and Pennsylvania

Chad C. Papa[1,2]*, Kendall DeLyser[3]*, Kylie Clay[2], Daphna Gadoth-Goodman[2], Lauren Cooper[2], Werner A. Kurz[4], Michael Magnan[4] and Todd Ontl[5]

[1]Department of Forestry, Michigan State University, East Lansing, MI, United States, [2]Forest Carbon and Climate Program, Department of Forestry Michigan State University, East Lansing, MI, United States, [3]American Forests, Washington, DC, United States, [4]Natural Resources Canada, Canadian Forest Service, Victoria, BC, Canada, [5]Office of Sustainability and Climate, U.S. Forest Service, Washington, DC, United States

Summary and Implications for Decision Makers

American Forests | NIACS | USFS

Forest Carbon and Climate Program
Department of Forestry
MICHIGAN STATE UNIVERSITY

Impact of Forest Management and Wood Utilization on Carbon Sequestration and Storage in Pennsylvania and Maryland

Results for

State of Maryland

Forest Carbon and Climate Program
Department of Forestry
MICHIGAN STATE UNIVERSITY

American Forests

NIACS Northern Institute of Applied Climate Science

USFS Forest Service

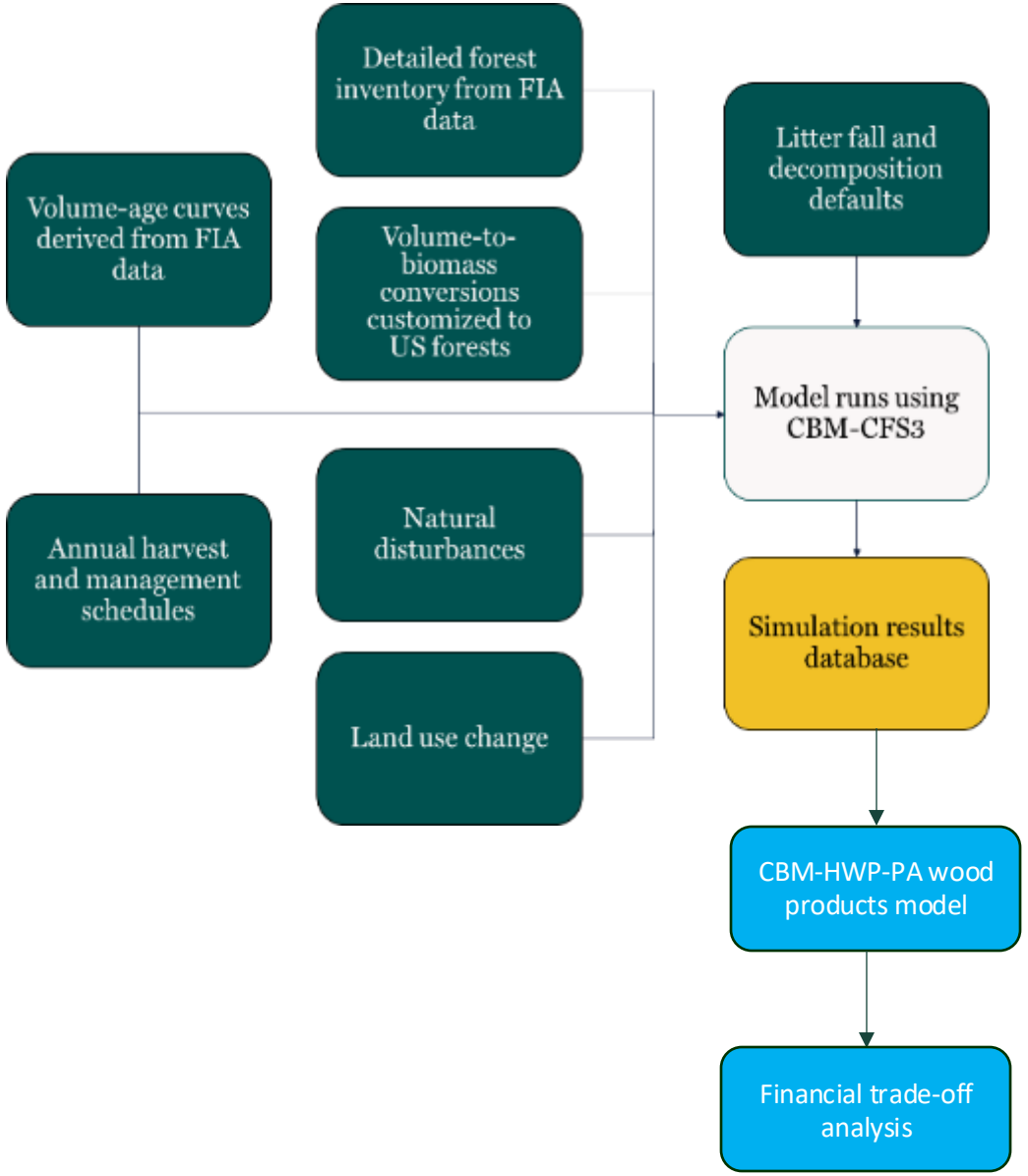
Maryland Department of Natural Resources

pennsylvania DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

Canada Natural Resources Canada Canadian Forest Service

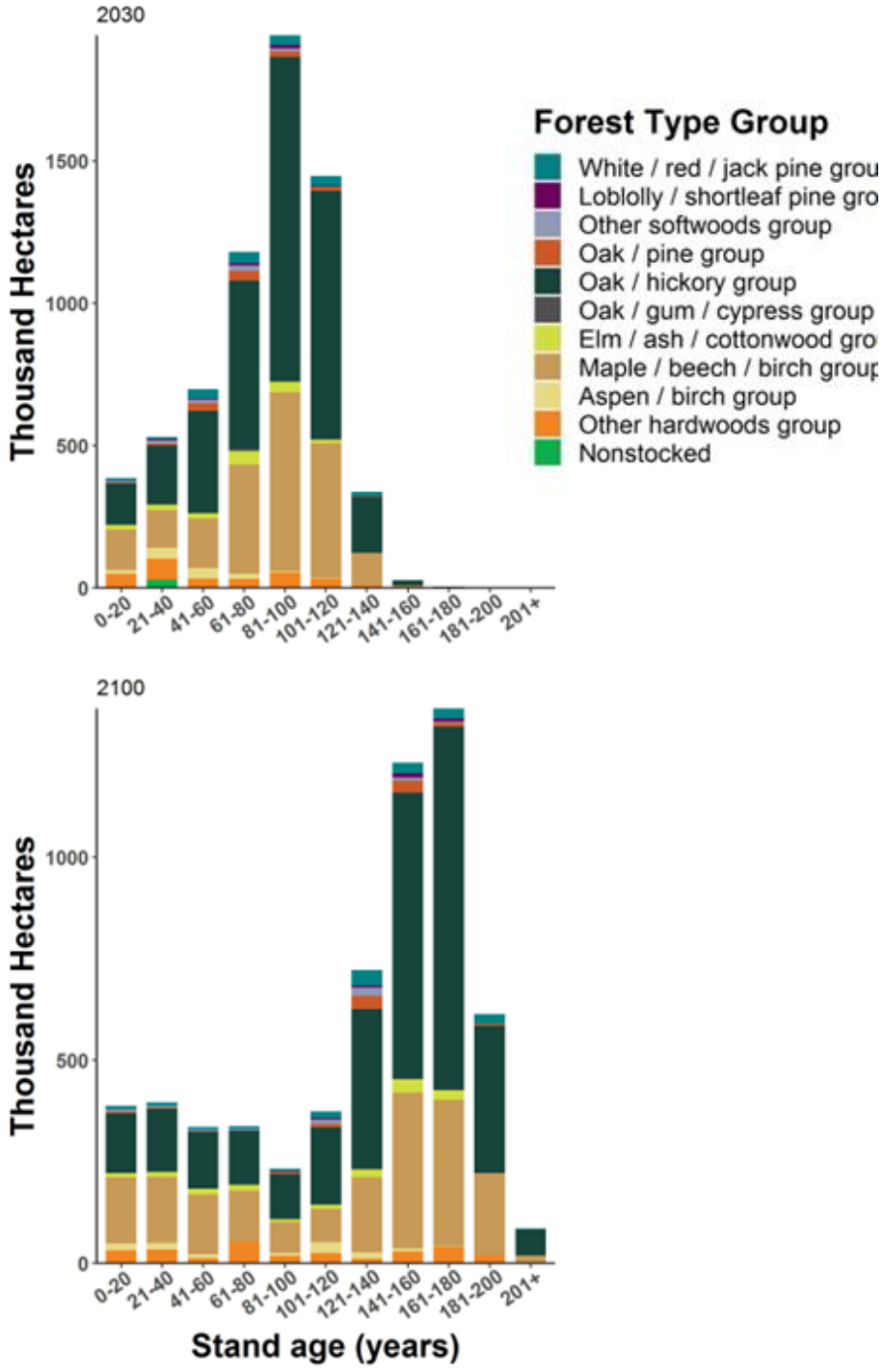
Methods

- IPCC tier-3 compliant empirically-derived processed based model
- Core of Canada's NFCMARS
- Models landscape scale forest carbon dynamics using:
  - Forest inventory data
  - Activity Data
    - Harvest schedule
    - LUC
    - Other natural disturbances
  - Volume-to-biomass estimation
  - Process-based equations for turnover and decay
- Associated framework for harvest wood products built on ANSE framework
  - Estimated positive and negative substitution benefits (Wood displacement)
  - Estimated leakage (63.9%, ranged from 0 - 84.4%)
- Model run from 2007-2100 (2020 model project point

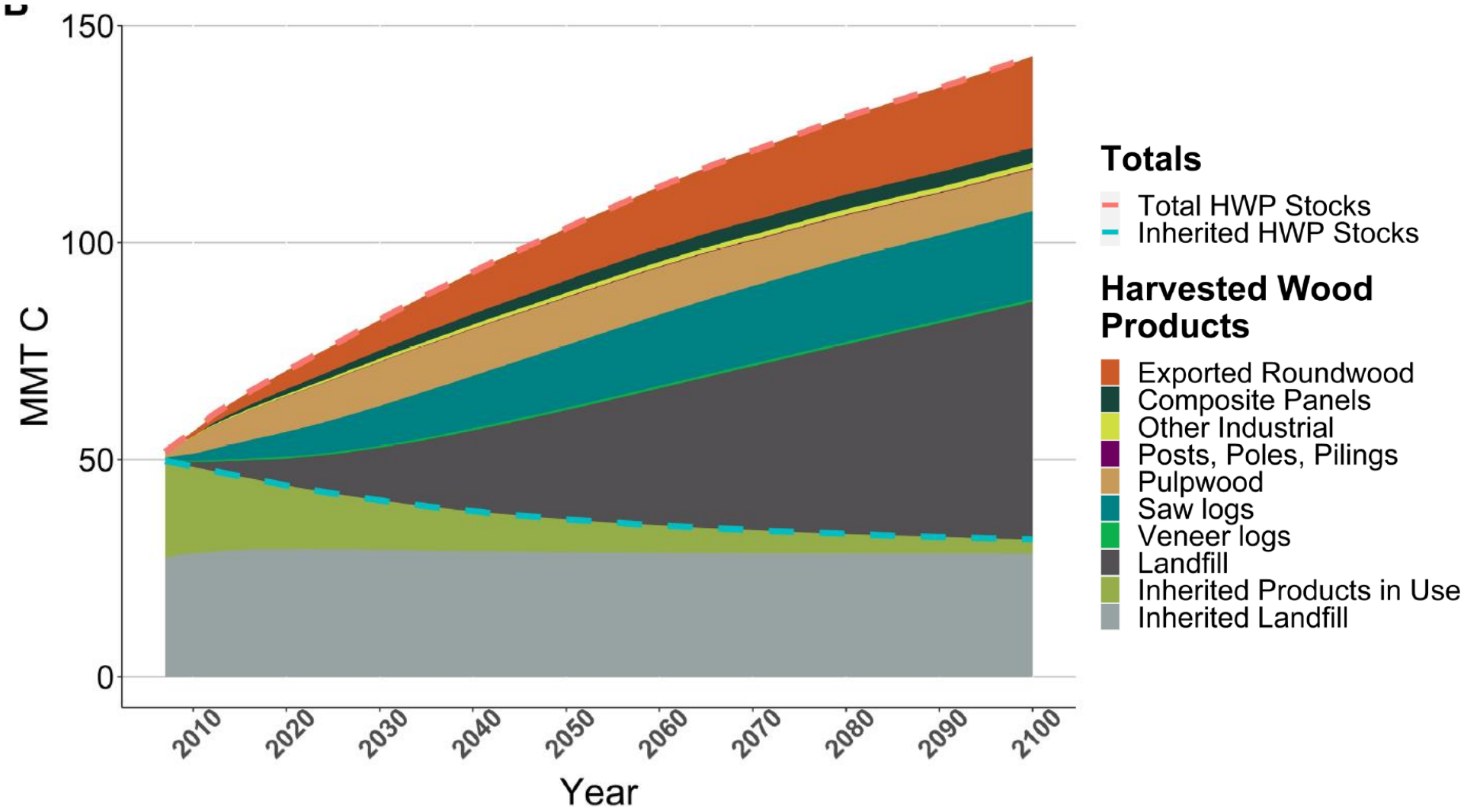


Scenarios

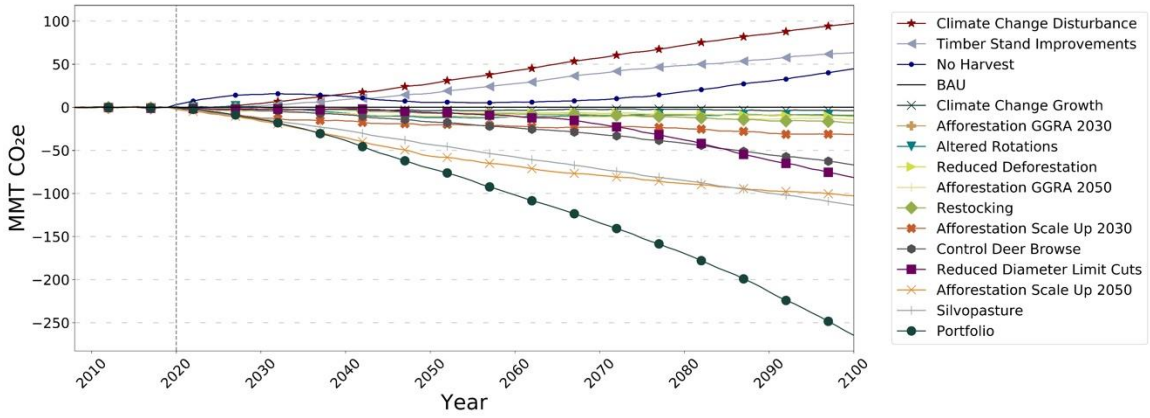
- Altered rotations
  - +30 years on hardwood rotations (except Aspen -10 years)
- Afforestation
  - + 2,376 ac / year - 23,760 ac / year until 2030 or 2050
  - + 15,250 ac / year agriculture to silvopasture conversion
- Timber Stand Improvements
  - + 14,892 ac / year thinned
  - + 25,000 ac / year prescribed fire
- Restocking
  - + 4,508 ac / year of supplemental planting
- Avoided conversion
  - - 5,149 ac / year
- Reduce unsustainable diameter-limit-cuts (high-grading)
  - Reduced DLC practices linearly until 2027
- Controlling for deer browse
  - + 14,459 ac / year of fencing
- Climate Change impacts
  - Growth - +0.3% average increase in biomass accumulation (0.05-0.6%)
  - Disturbance - +10% acres and severity / year
- No Harvest
  - - 100% of harvest practices
- Bioenergy
  - Shift mill residues from pulpwood to bioenergy
- Portfolio
  - Suite of scenarios concurrently

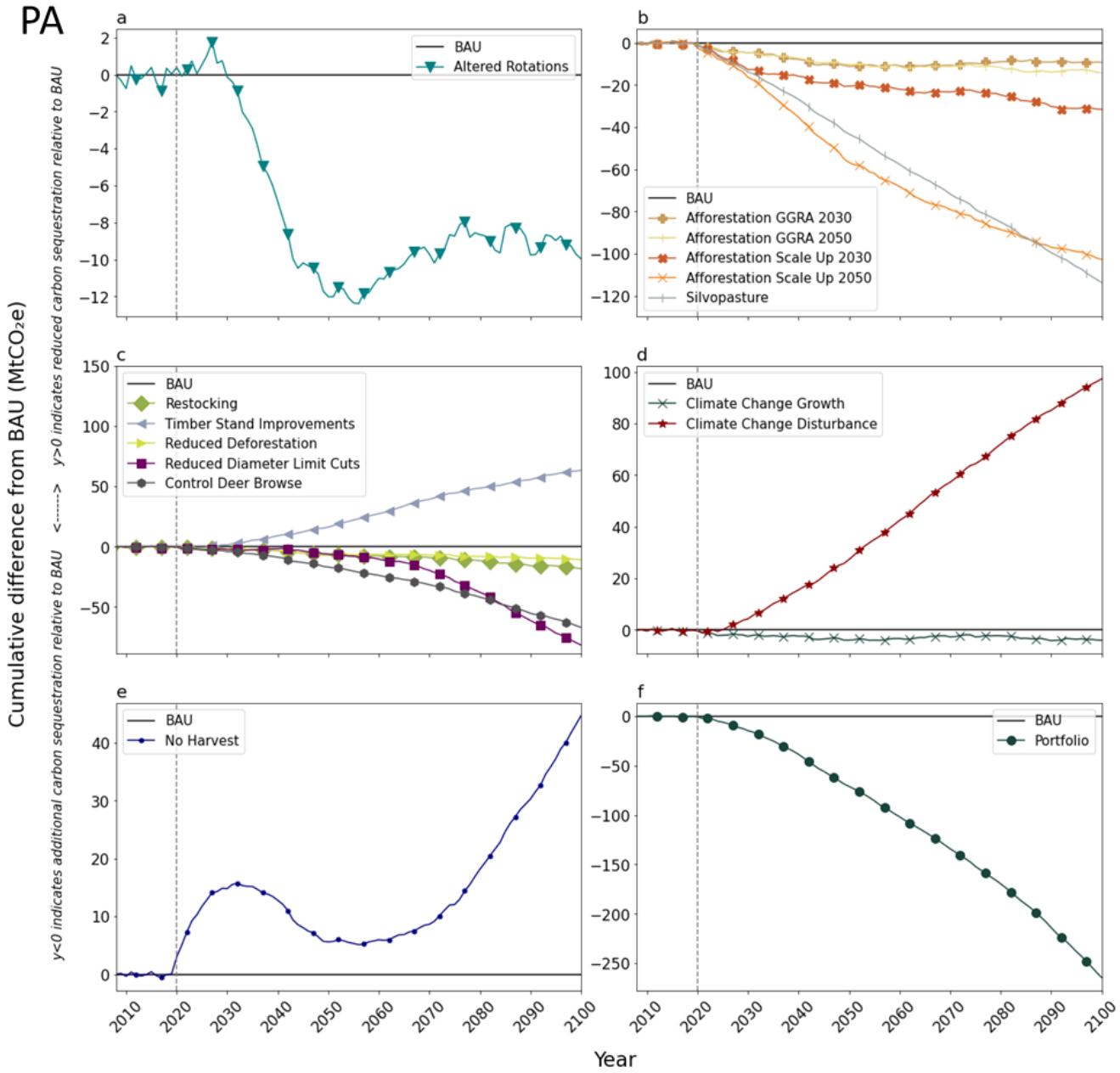


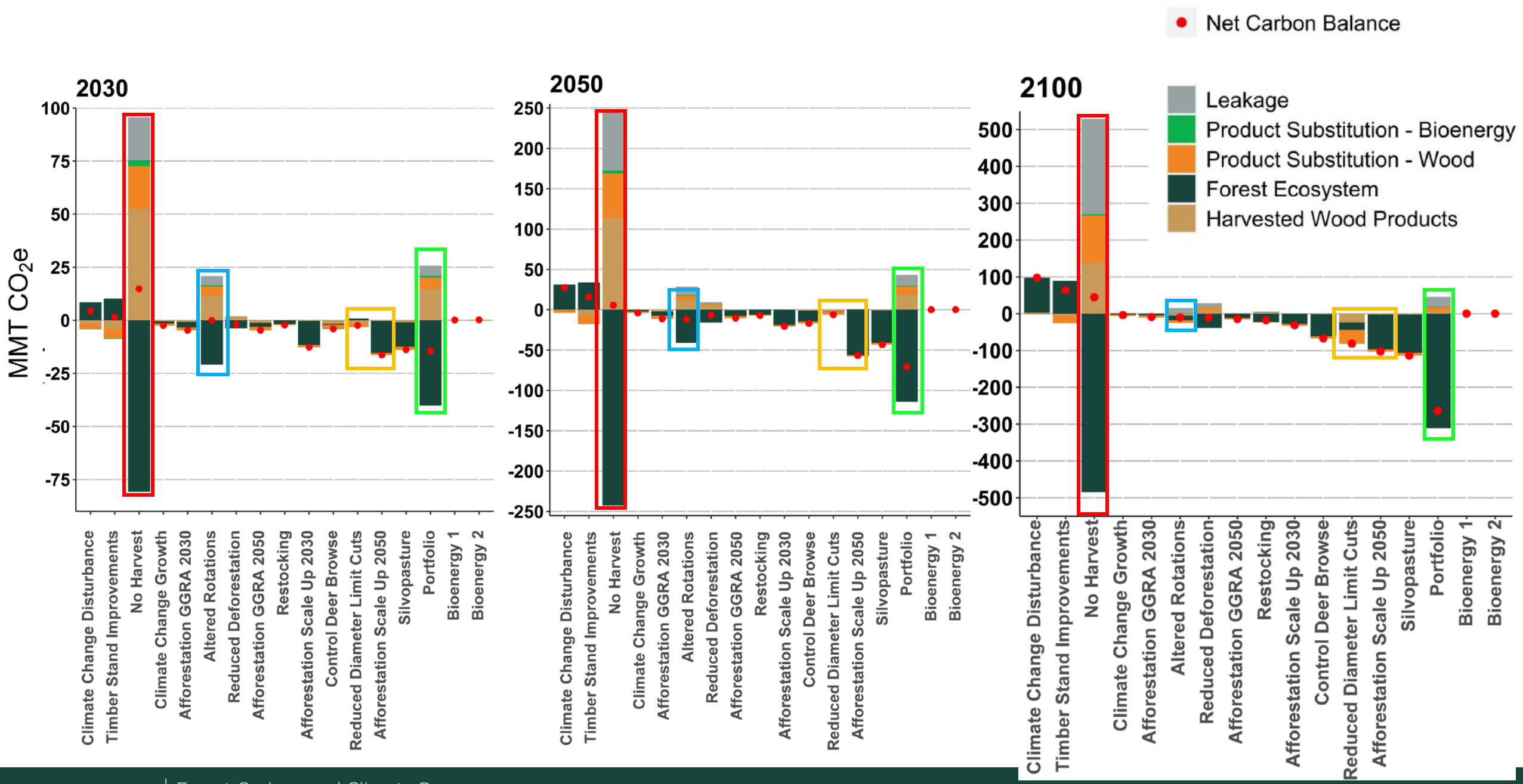
HWP C Storage



Sector-wide cumulative difference standardized to BAU






Net Carbon Balance
2030
2050
2100
Leakage
Product Substitution - Bioenergy
Product Substitution - Wood
Forest Ecosystem
Harvested Wood Products
MMT CO_2e
Climate Change Disturbance
Timber Stand Improvements
No Harvest
Climate Change Growth
Afforestation GGRA 2030
Altered Rotations
Reduced Deforestation
Afforestation GGRA 2050
Restocking
Afforestation Scale Up 2030
Control Deer Browse
Reduced Diameter Limit Cuts
Afforestation Scale Up 2050
Silvopasture
Portfolio
Bioenergy 1
Bioenergy 2

Conclusion and implications

- Forest management and wood utilization can provide substantial climate mitigation benefits without disrupting timber supplies

<u>Final Thoughts / future directions</u>

- Emphasize where there are win-win situations (opportunities vs trade-offs)
- Further need for understanding of the financial implications
- Operational concerns:
  - Industry economic concerns
  - Log size
  - Management costs
  - Lack of regulation and market stability