Carbon Sequestration Valuation of United States Forests and the Potential for Policy Impacts

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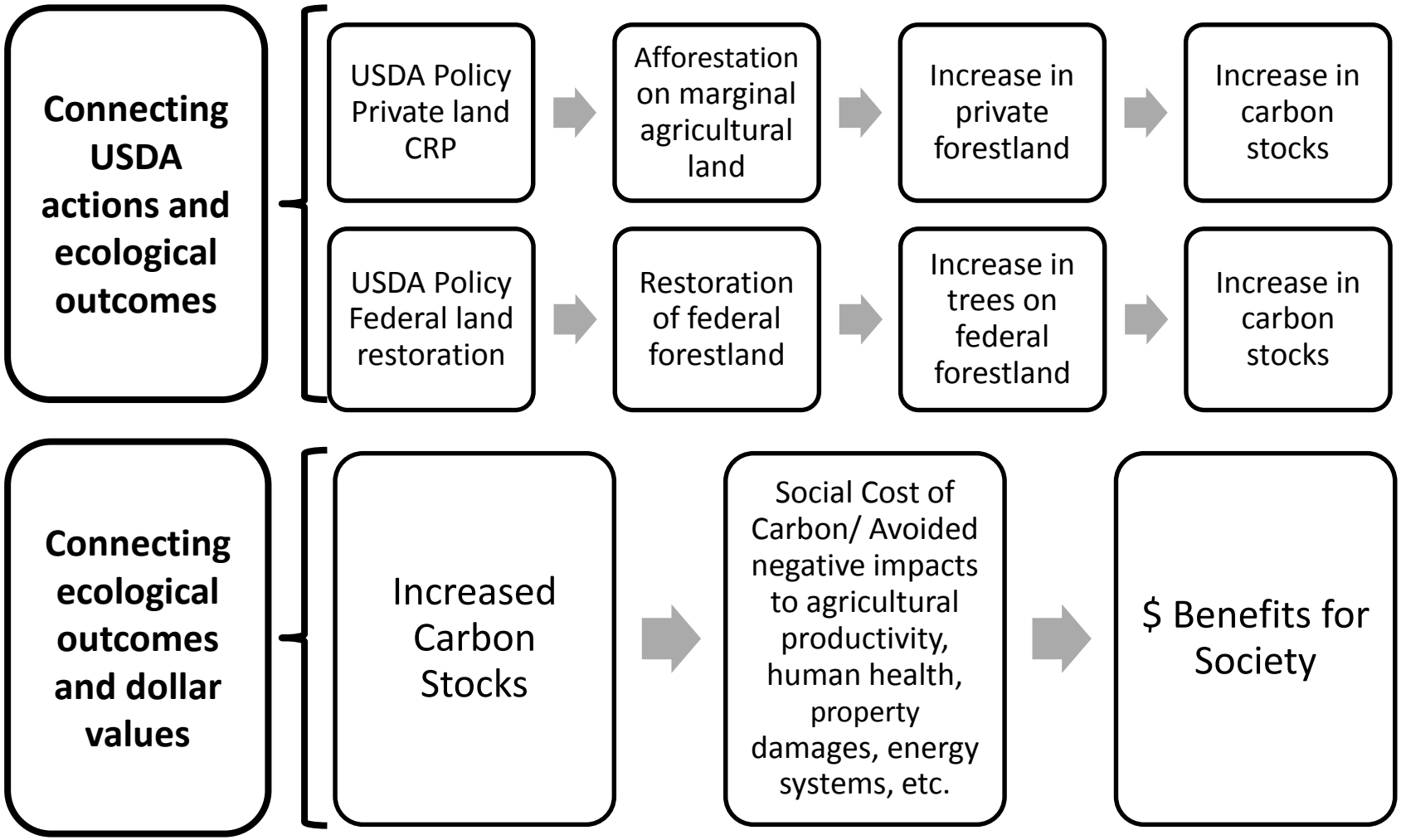
Why forest carbon?

- Forest Service Planning Rule
- USDA Building Blocks for Climate Smart Agriculture and Forestry

What makes this case study different?

- Scale
- Social Cost of Carbon

Conceptual model



Part 1: quantifying and projecting forest carbon

- Forest Inventory and Analysis (FIA) data
  - Forest trends and predictions
  - Observations from over 350,000 monitoring locations across the US
- Wear and Coulston (2015)
  - Projections of future land use and forest carbon
  - Land use and disturbance (e.g. cutting, fire, insects & diseases) derived from plot records are integrated

Part 1: quantifying and projecting forest carbon

Modeled Scenarios:

1. **Reference**: no net gains in forestland in the next decade followed by a slight decline in forest area through 2050
2. **Reduced development**: less conversion to development and no net loss of forest beginning in 2025
3. **USDA afforestation/reforestation policies**:
   - CRP policy in the Eastern US (30 million acres)
   - Reforestation of federal forests in the Western US (about 7.4 million acres)
4. **Fire suppression policy**: 10% reduction of fire occurrence throughout the US

Part 2: applying SCC

Table 1. SCC estimates ($U.S. 2016) per Ton of CO2 Sequestered (Emitted)

	Average Annual Discount Rate			
Year	5%	3%	2.5%	3% discount rate and 95th percentile Equilibrium Climate Sensitivity (ECS)
2015	$13	$42	$65	$121
2020	$14	$49	$72	$142
2025	$16	$53	$79	$160
2030	$19	$58	$84	$176
2025	$21	$64	$90	$194
2040	$24	$69	$97	$212
2045	$27	$74	$103	$228

U.S. Interagency Working Group (2015)

Methods

$$NPV_1 = \sum_{t=0}^{T} \frac{p(t)C_1(t)}{(1+r)^t} \text{ (reference scenario)}$$

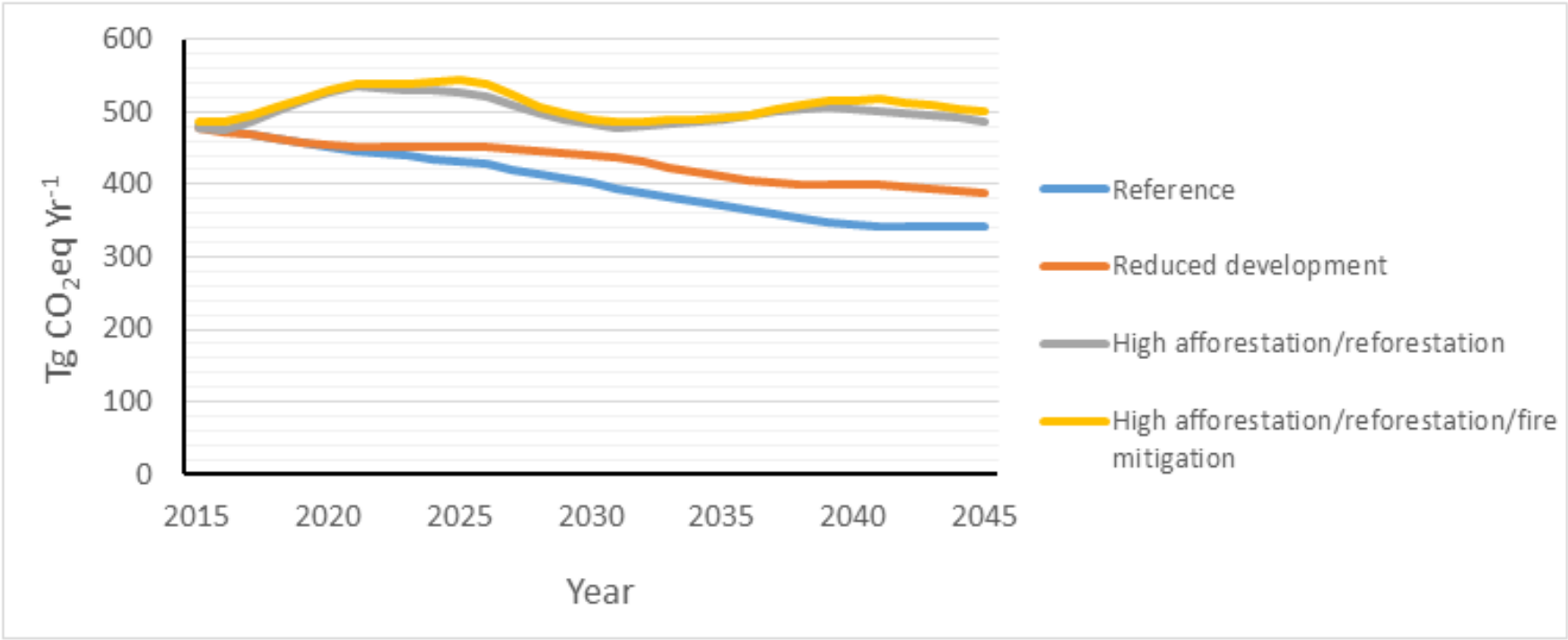
$$NPV_2 = \sum_{t=0}^{T} \frac{p(t)C_2(t)}{(1+r)^t} \text{ (policy scenario)}$$

C_1 and C_2: CO_2e sequestered
P_t: SCC

- Computed a vector of annual SCC levels ($ per t CO_2) for years 2015-2045 by assigning each SCC estimate in Table 1 to the midpoint of its five year range and interpolating between the midpoint SCC estimates
- Multiplied the vectors of annual carbon sequestration and SCC together and summed to get total NPV ($ million)
- For each year between 2015 and 2045, we multiplied annual carbon sequestration times nominal SCC, and discounted to the base year (2015) to get net present value ($ million)

Results: Carbon Projections

Projected annual carbon sequestration in forests of the coterminous U.S. under different policy scenarios (Coulston and Wear, unpublished)



Wear and Coulston

Results: Dollar values

Present net value ($ billion) of projected CO_2 sequestered in US forests from 2015 to 2045 under alternative forest carbon policy and SCC discount rates

	Discount rate			
Policy scenario	5%	3%	2.50%	3% and 95th Percentile
Reference	110.7	449.7	704.6	1339.6
Reduced development	117.6	480.7	753.6	1433.9
Afforestation and Reforestation	135.1	556.5	872.5	1661.6
Fire Suppression	147.3	566.0	887.5	1690.0

Results: Marginal dollar values

Increase in present net value ($ billion) of each forest carbon policy relative to the reference scenario under alternative SCC discount rates

	Discount rate			
Policy scenario	5%	3%	2.50%	3% and 95th Percentile
Reference				
Reduced development	6.9	31.0	49.0	94.3
Afforestation and Reforestation	24.4	106.8	167.9	321.9
Fire suppression	36.6	116.3	182.9	350.4

Results: Summary

- **There is a high value associated with the impact of both current (reference) and hypothetical modeled policies on U.S. forest carbon.**
- **Changes in USDA policy can have a large effect on the value of carbon stored in U.S. forests.**
- Other things to consider:
  - Additional costs and benefits
    - Co-benefits (water quality, habitat, resource outputs, etc.)
    - Policy costs (estimates are needed for a full cost-benefit analysis)
  - Sources of uncertainty
    - Forest carbon estimates
    - Social Cost of Carbon
    - Voluntary incentives and adoption

Research needs for improvement

- **Continued support of USDA's Forest Inventory Analysis is important.**
- **Support for research and development efforts to improve data on both quantifying and projecting carbon in forests, and estimating the per-ton value of carbon is needed.**
- **Research on private landowner response to afforestation or reforestation incentives is needed.**

Thank you!

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