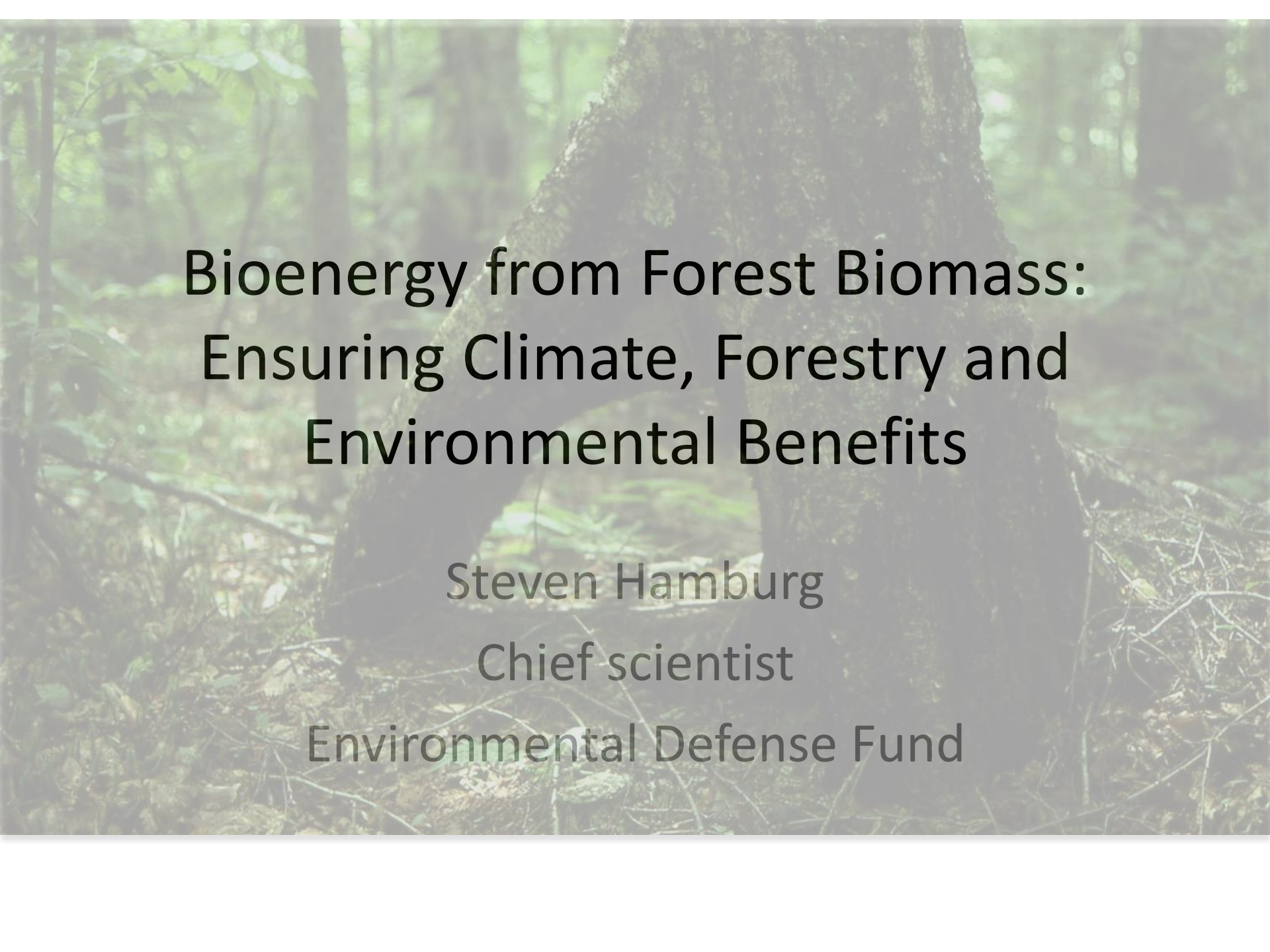


A photograph of a forest scene with a large, moss-covered tree trunk in the foreground. The background is filled with green foliage and other trees, creating a dense forest atmosphere. The text is overlaid on this image.

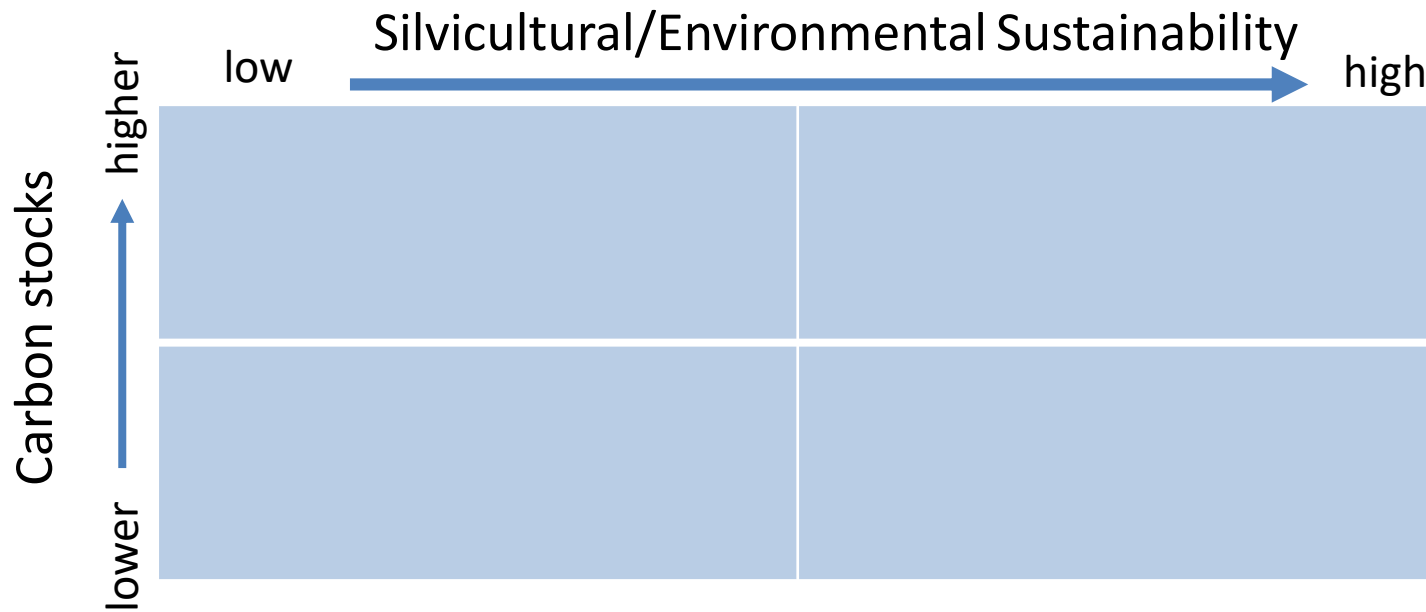
Bioenergy from Forest Biomass: Ensuring Climate, Forestry and Environmental Benefits

Steven Hamburg

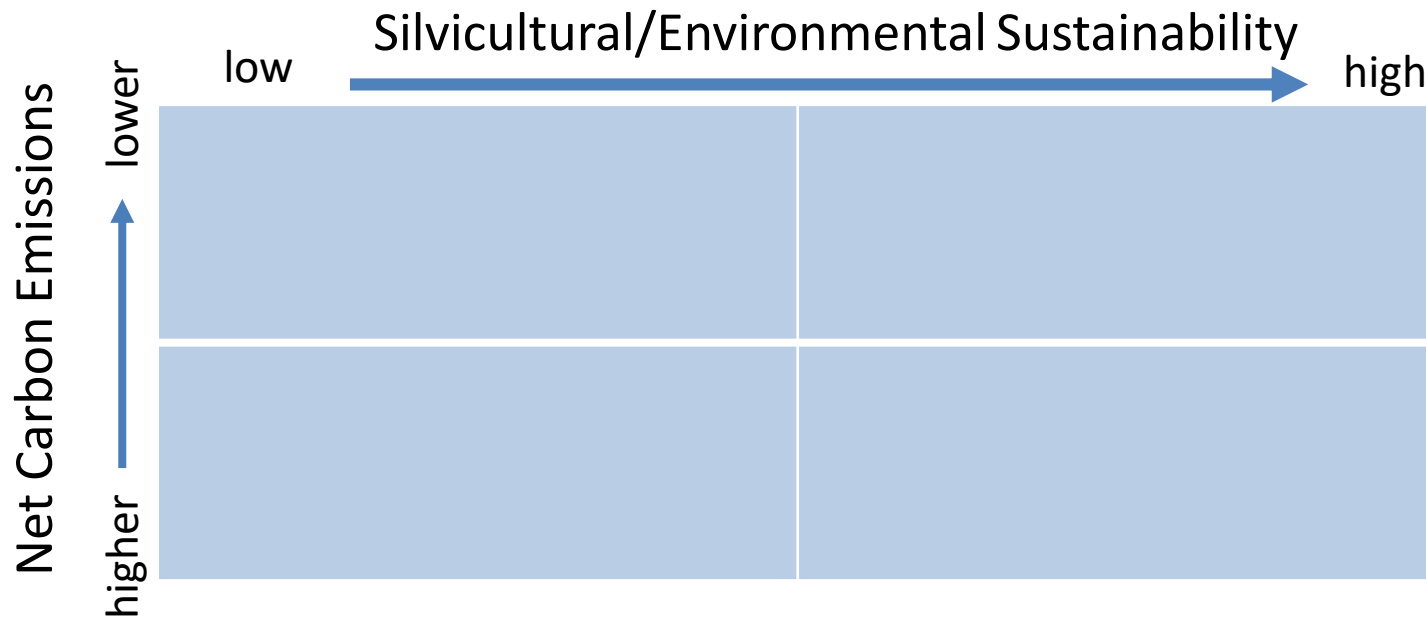
Chief scientist

Environmental Defense Fund

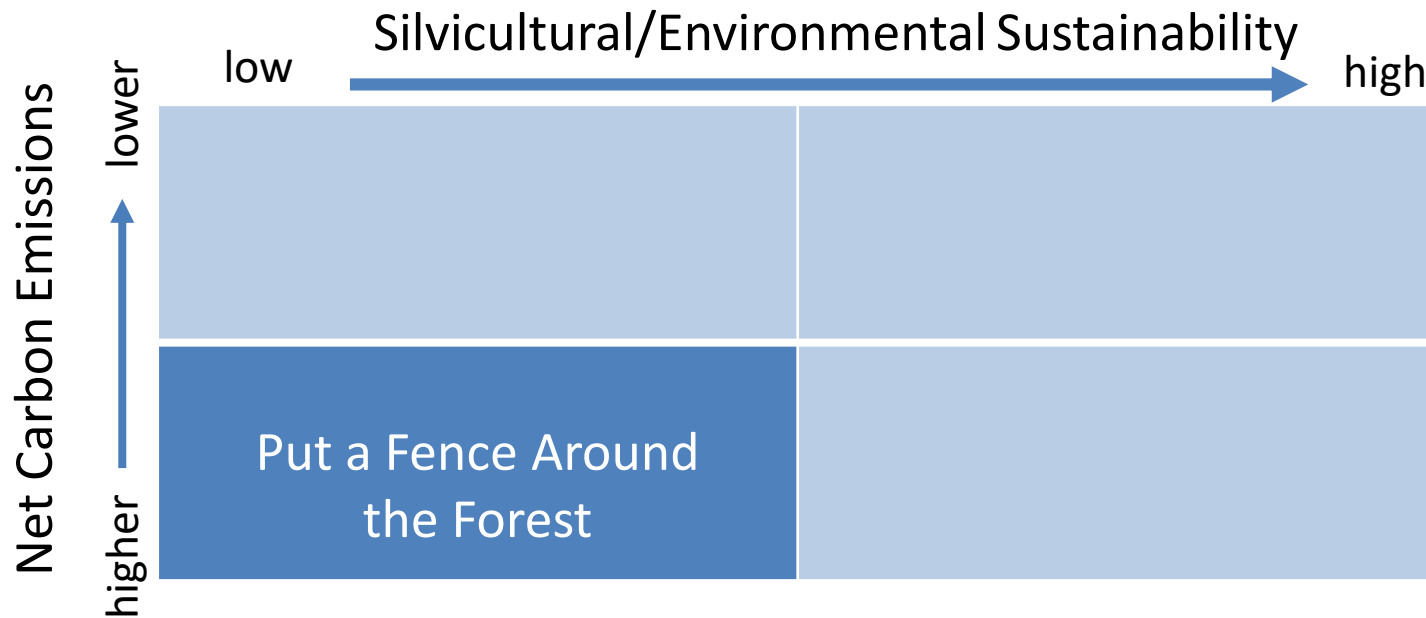
The challenge of ensuring Bioenergy is climate beneficial



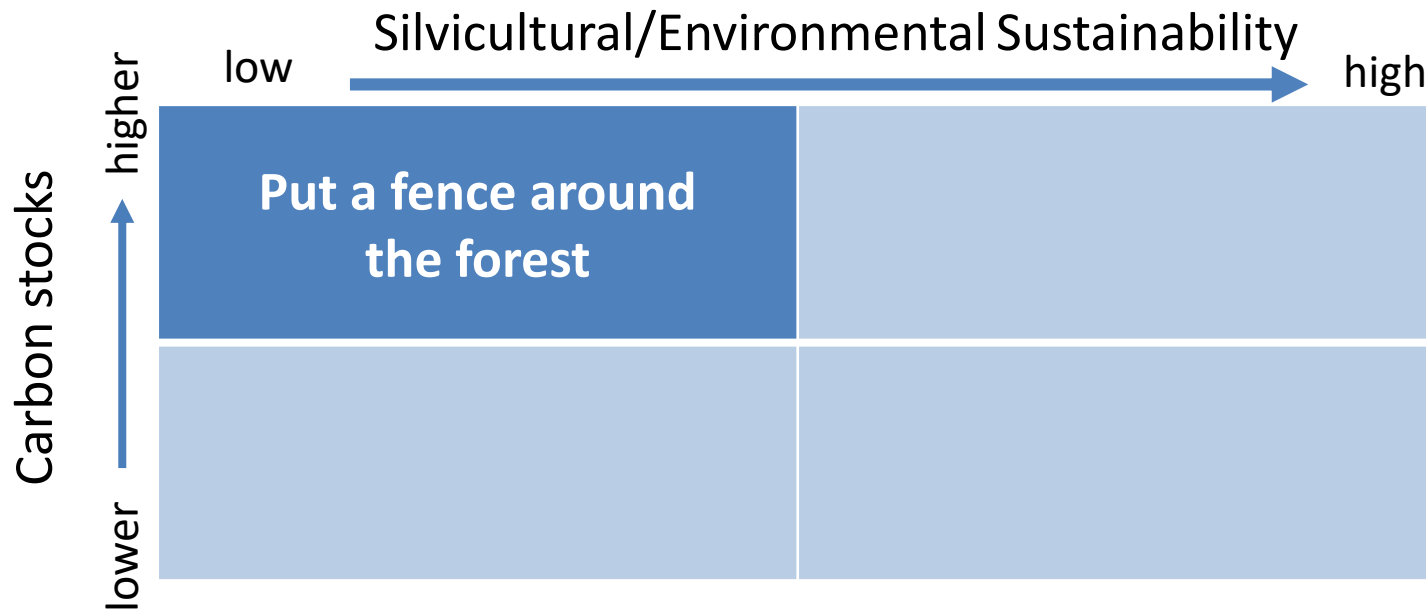
The challenge of ensuring Bioenergy is climate beneficial



The challenge of ensuring Bioenergy is climate beneficial



The challenge of ensuring Bioenergy is climate beneficial



Key issues that need to be addressed

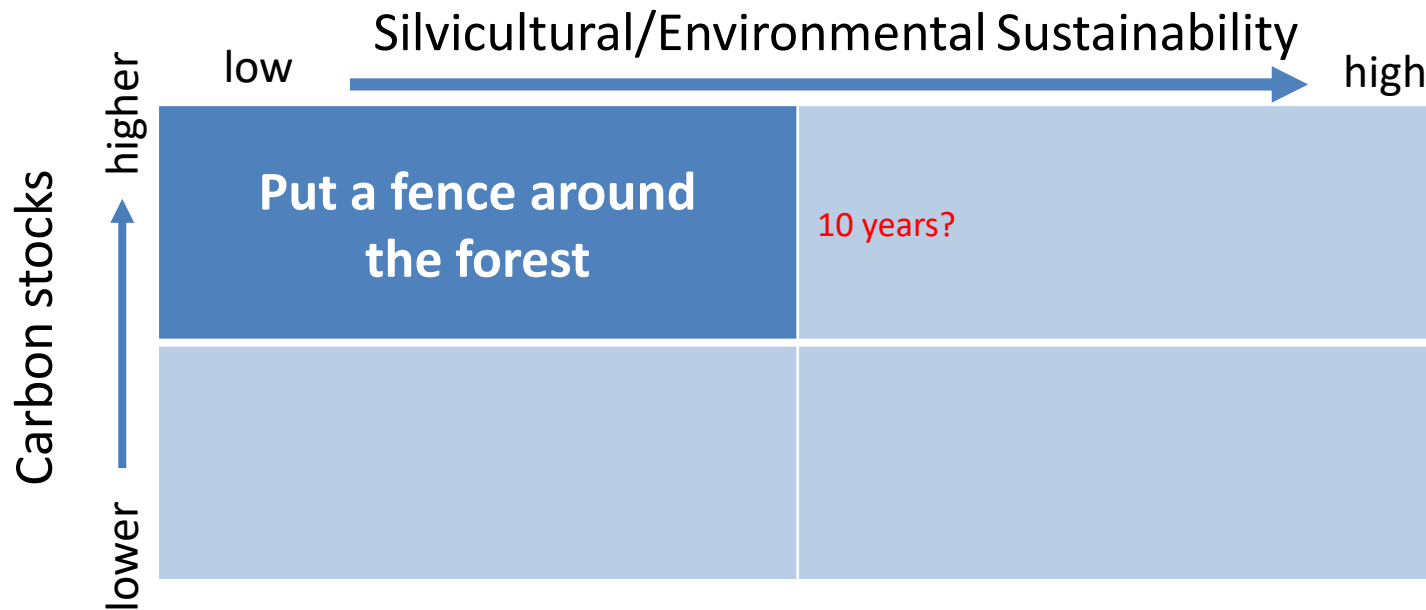
- **Baseline/Counter Factual** has an enormous influence on the benefits you calculate

Key issues that need to be addressed

- **Baseline/Counter Factual** has an enormous influence on the benefits you calculate
- **Time** matters in figuring out the implications of using different feedstocks

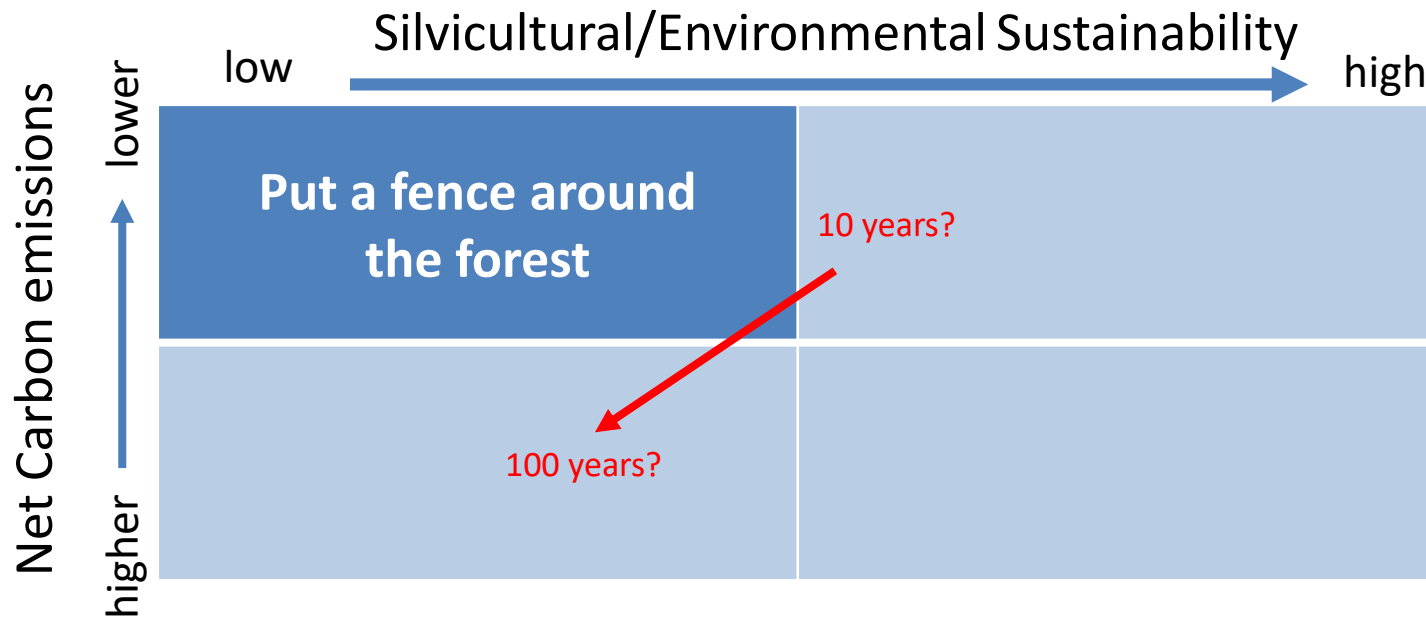
The challenge of ensuring Bioenergy is climate beneficial

Over what period of time ?

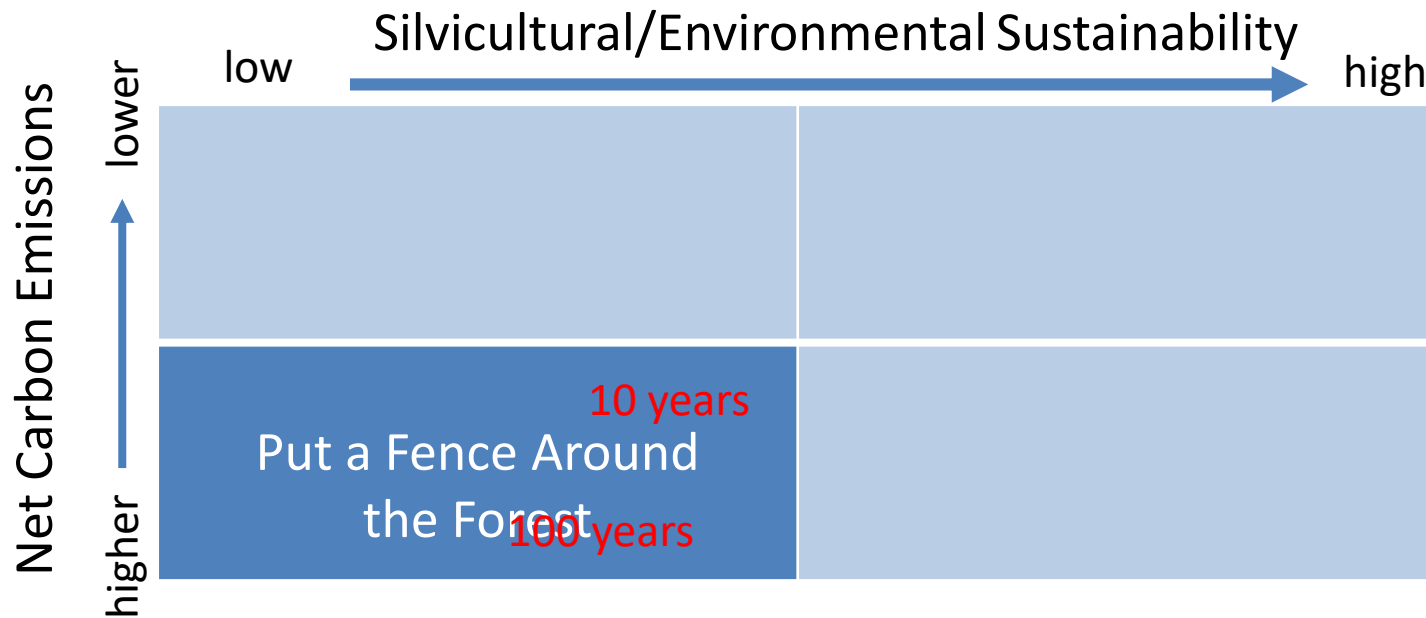


The challenge of ensuring Bioenergy is climate beneficial

Over what period of time ?



The challenge of ensuring Bioenergy is climate beneficial



Timeframe is critical

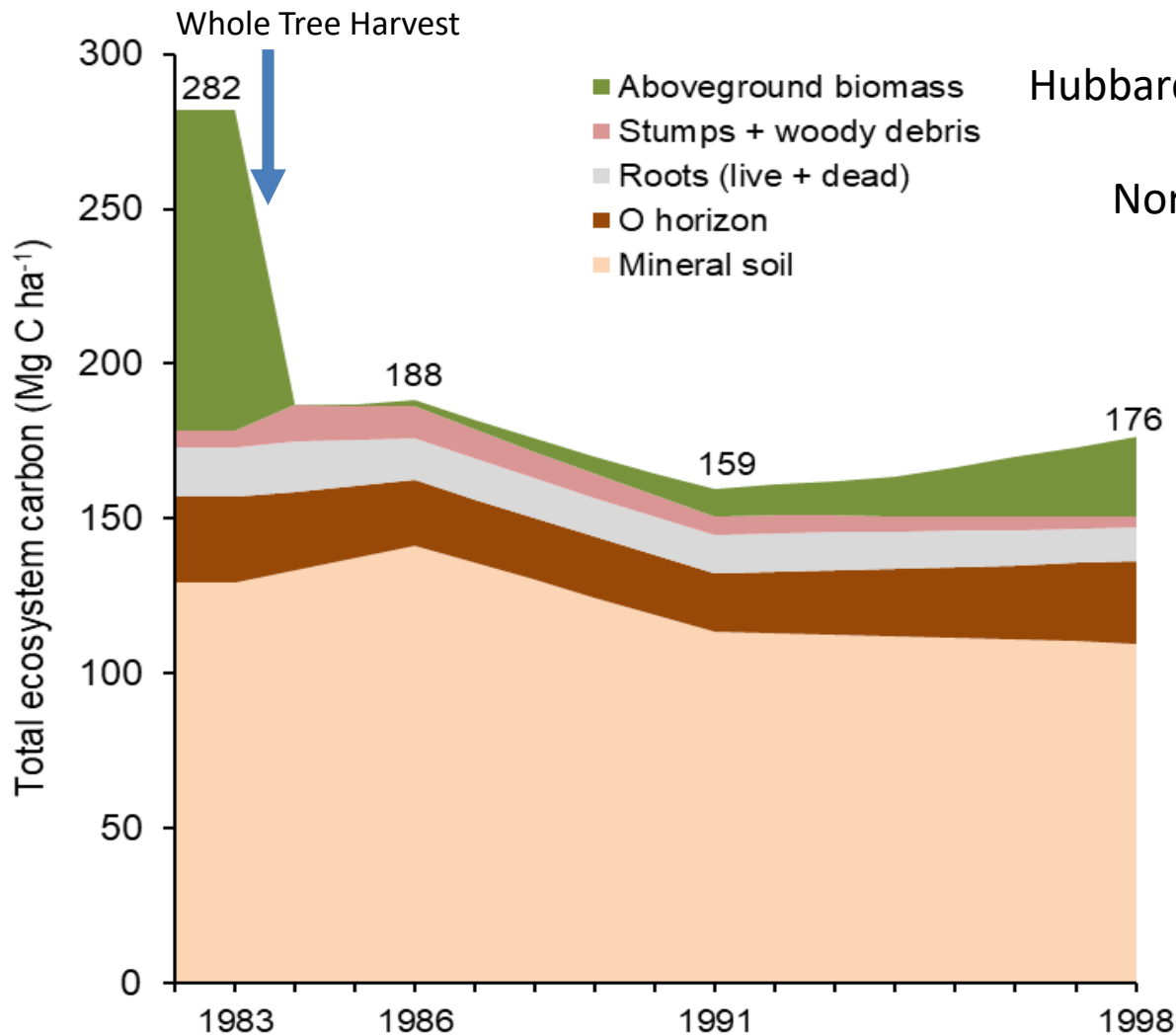
- The climate benefits of bioenergy are different if:
 - Minimize net Carbon emissions to the atmosphere by 2030 - 10 years
 - Maximize use of Mill waste to produce bioenergy
 - Use solid wood products
 - Divert forest residuals that get burned to bioenergy
 - Minimize harvesting of forest materials











Hubbard Brook Experimental Forest
Watershed 5 (22 ha)
Northern Hardwood Forest

15 years post harvest
ecosystem carbon is
About the same as
preharvest

Timeframe is critical

- The climate benefits of bioenergy are different if:
 - Minimize net Carbon emissions to the atmosphere by 2030 - 10 years
 - Maximize use of Mill waste to produce bioenergy
 - Use solid wood products
 - Divert forest residuals that get burned to bioenergy
 - Minimize harvesting of forest materials
 - Minimize net Carbon emissions to the atmosphere by 2050 - 30 years
 - Maximize use of mill waste to produce bioenergy
 - Use solid wood products
 - Use harvesting residuals in regions with rapid decomposition/where they get burned

Timeframe is critical

- The climate benefits of bioenergy are different if:
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 - Maximize use of mill waste to produce bioenergy
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 - Use harvesting residuals in regions with rapid decomposition/where they get burned
 - Minimize net carbon emissions to the atmosphere by 2120 - 100 years
 - Maximize use of mill waste to produce bioenergy
 - Use solid wood products
 - Use harvesting residuals in regions with rapid decomposition/where they get burned
 - Increase harvesting for bioenergy even if it decreases carbon stocks in the short term

Key issues that need to be addressed

- **Baseline/Counter Factual** has an enormous influence on the benefits you calculate
- **Time** matters in figuring out the implications of using different feedstocks
- **Spatial Scale** – stand, woodshed, region

Over time, if carbon stocks are returned to pre-harvest levels...

$$\Sigma \downarrow = \uparrow$$

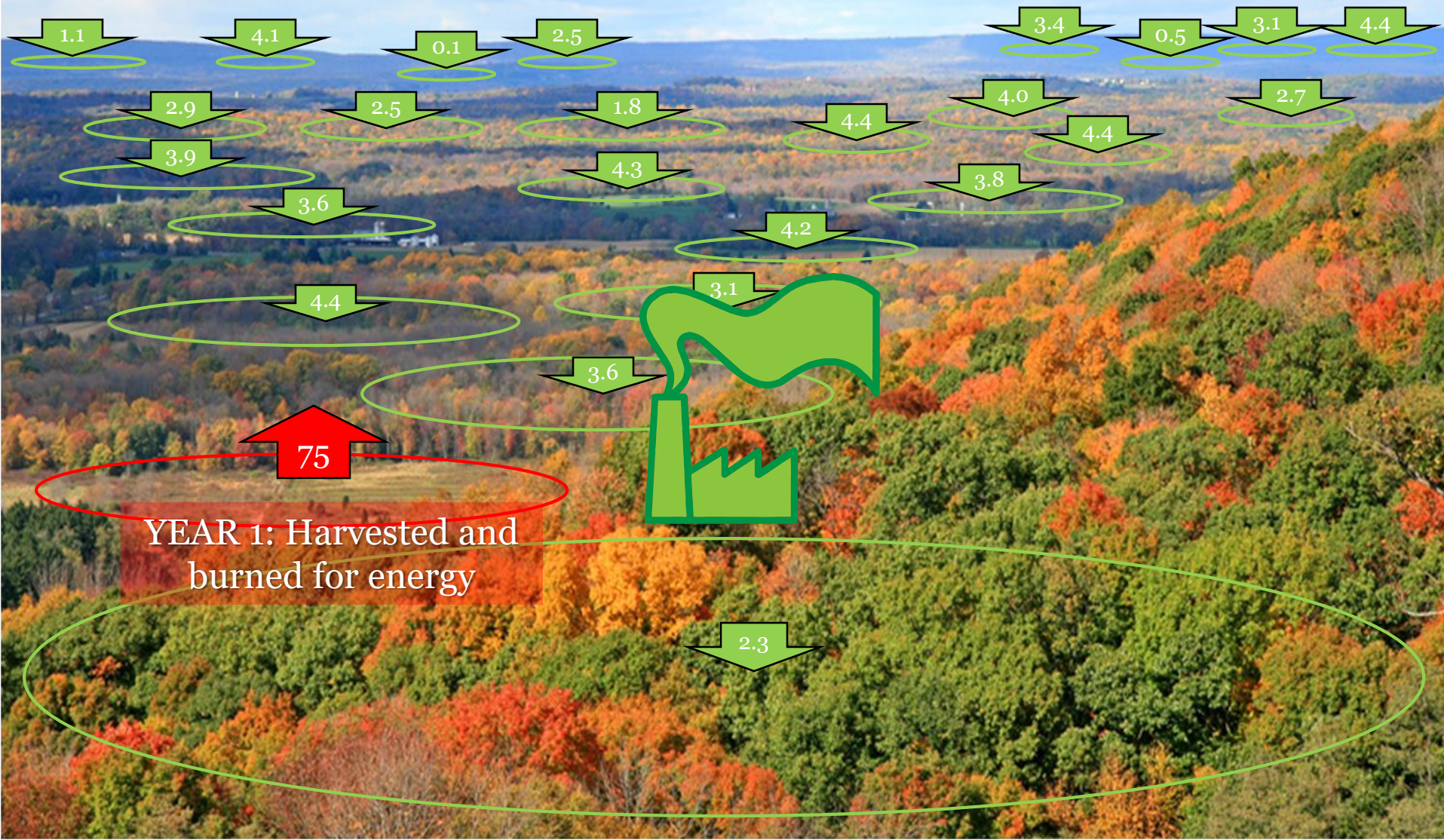
...the net emissions over this time are zero.

Year X, until next harvest

???



Looking at all areas that will be needed to supply wood to
a given operation



Forest regrowth equal harvest at the end of the first rotation –
how you account for the baseline is critical

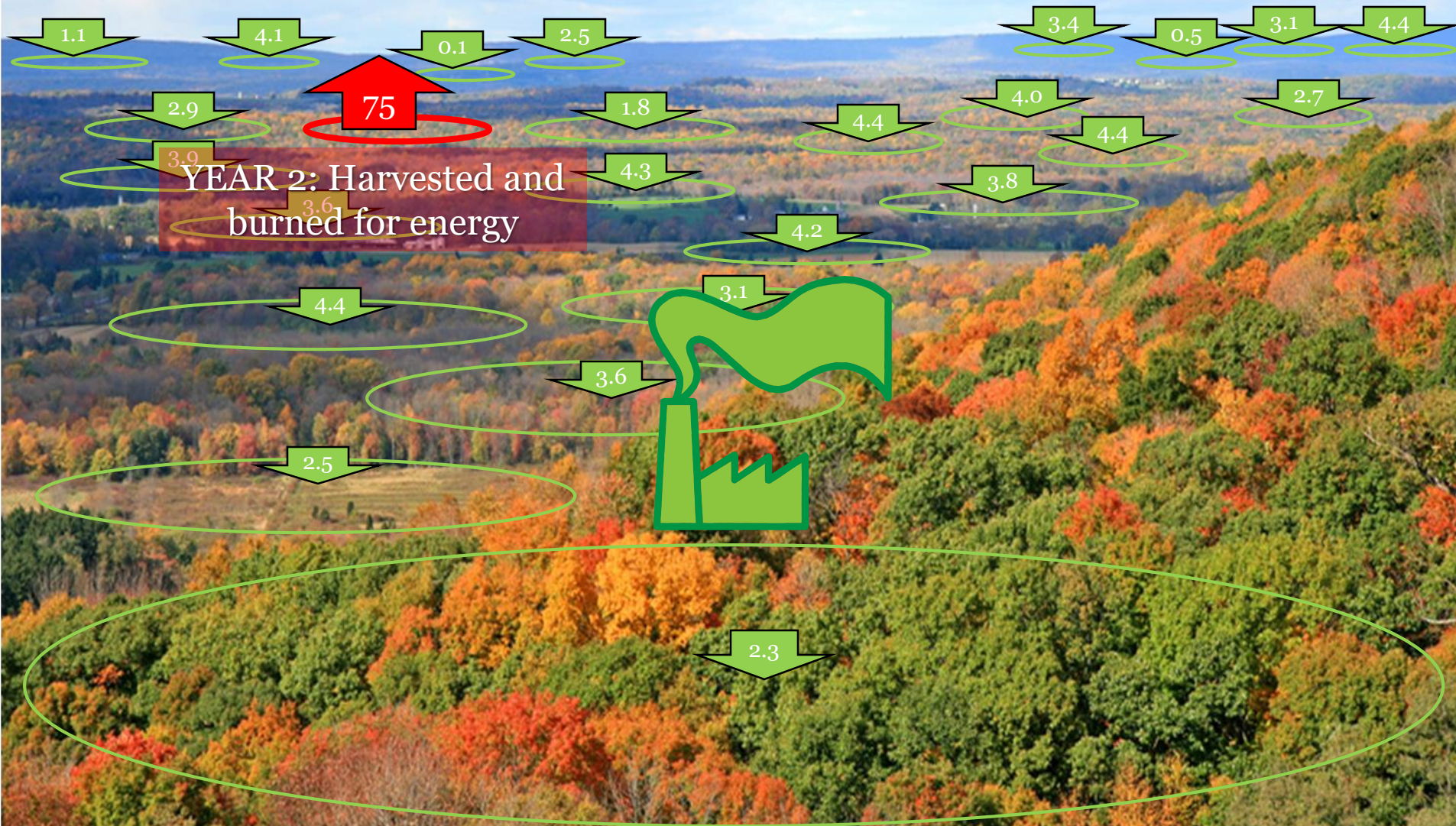
Diagram illustrating carbon accounting for a forest rotation, showing the impact of harvest and energy production on carbon balance.

Carbon Accounting Data (Values in Green Arrows):

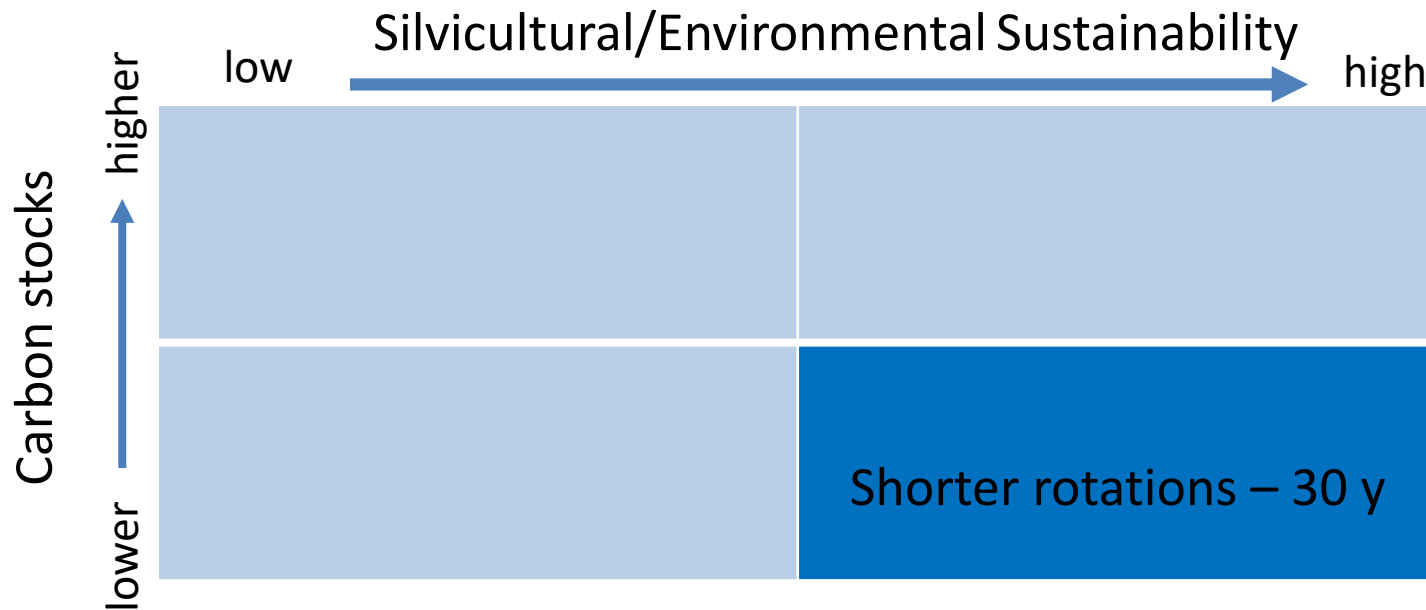
- Initial Carbon Stock (Top Row): 1.1, 4.1, 0.1, 2.5, 3.4, 0.5, 3.1, 4.4
- Carbon Change (Second Row): 2.9, 1.8, 4.4, 4.0, 2.7
- Carbon Change (Third Row): 3.9, 4.3, 3.8, 4.4
- Carbon Change (Fourth Row): 4.4, 4.2, 3.1
- Carbon Change (Fifth Row): 3.6, 2.5
- Carbon Change (Sixth Row): 2.3

Key Event: YEAR 2: Harvested and burned for energy (75 units of carbon released, indicated by the red arrow).

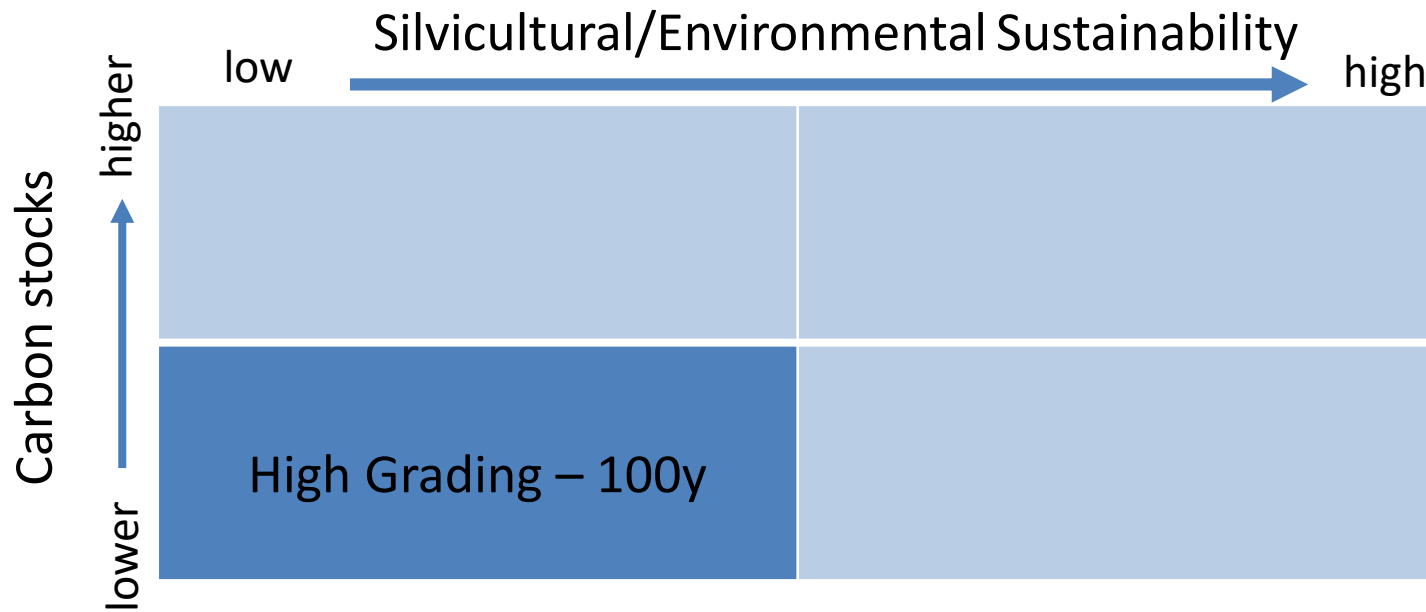
Energy Production: A green factory icon with smoke is shown, representing the conversion of harvested wood into energy.



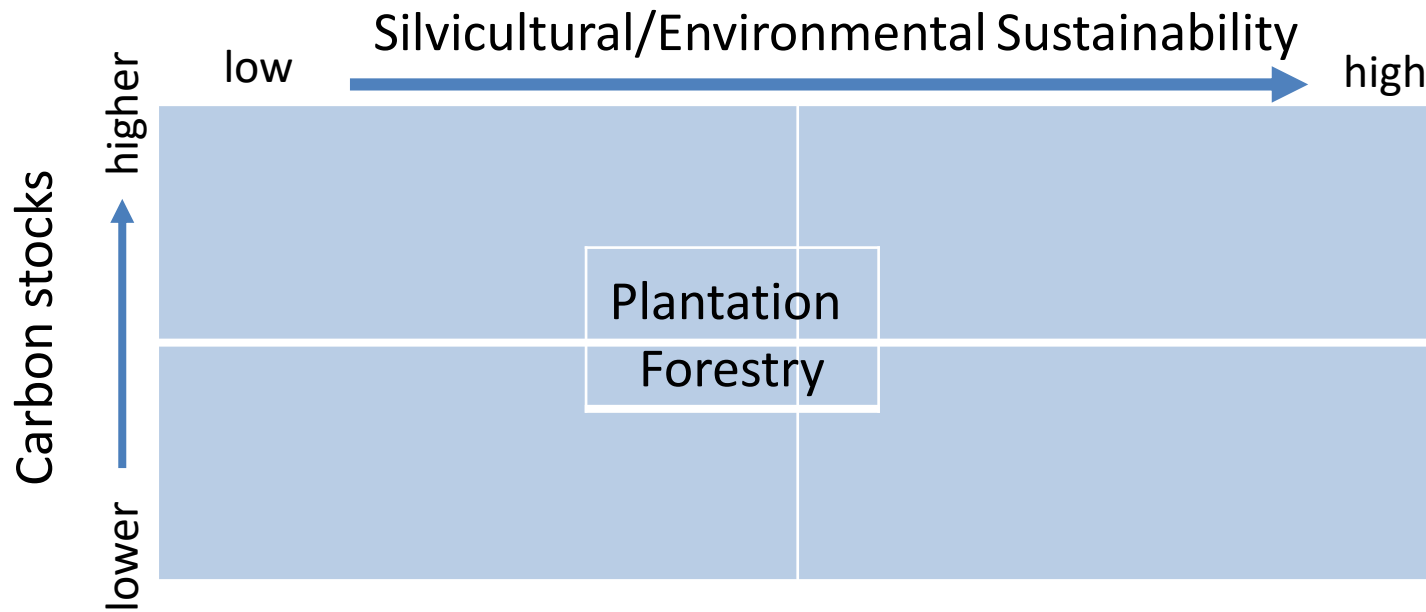
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Historic aerial photography - Bald Mountain, 1942



General considerations

- Don't confuse plantation silviculture with forestry in general
 - In US <10% of managed forest lands are planted
 - Environmental benefits of natural generation are large
- Silvicultural sustainability is critical
 - Pressure for selective logging can easily lead to high grading
 - Whole trees as a category – destructive notion
 - We need to avoid history repeating itself
 - Plantation-based silviculture not relevant in protecting most terrestrial carbon stocks
- Net emissions not gross emissions are what matters
- Selection of appropriate counter-factual baseline is critical
 - Use of coal to generate electricity is not appropriate comparison

General considerations

- Need to consider carbon stock changes versus carbon flows
- Need to define timeframes of interest
 - The implications vary widely with differing timescales

**Bottomline need to agree on objectives before we
can agree on an accurate bioenergy Carbon
accounting approach**