Urban Forest Effects on Atmospheric Carbon

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Conclusion

- If I could only plant one tree to combat climate change, I would plant it an urban area

Trees Effects on Climate Change

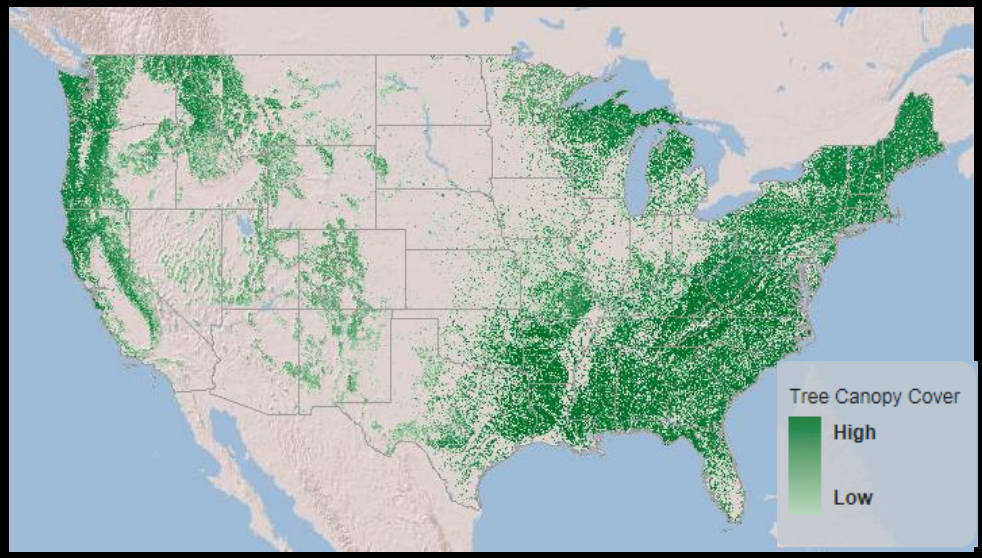
- Sequester carbon
- Release carbon
- Alter climate
- Alter carbon emissions

Urban Tree Carbon Storage and Sequestration

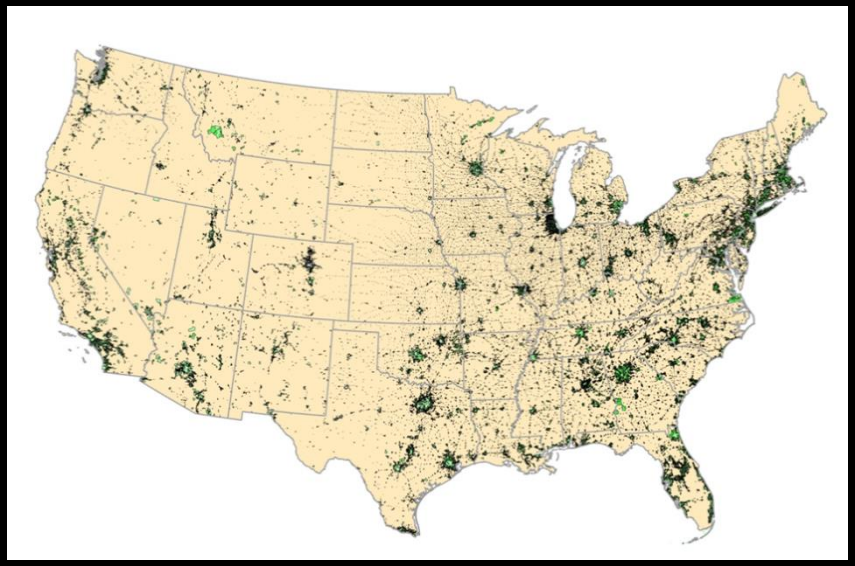
- 206 trees/ac cover
- 34.2 tC/ac cover (stored)
- 1.2 tC/ac cover/yr (growth)

Forest vs. Urban

Tree Cover



Urban / Community Land



US Forests = 33% of area
749 million acres
C storage = 20.2 billion tonnes

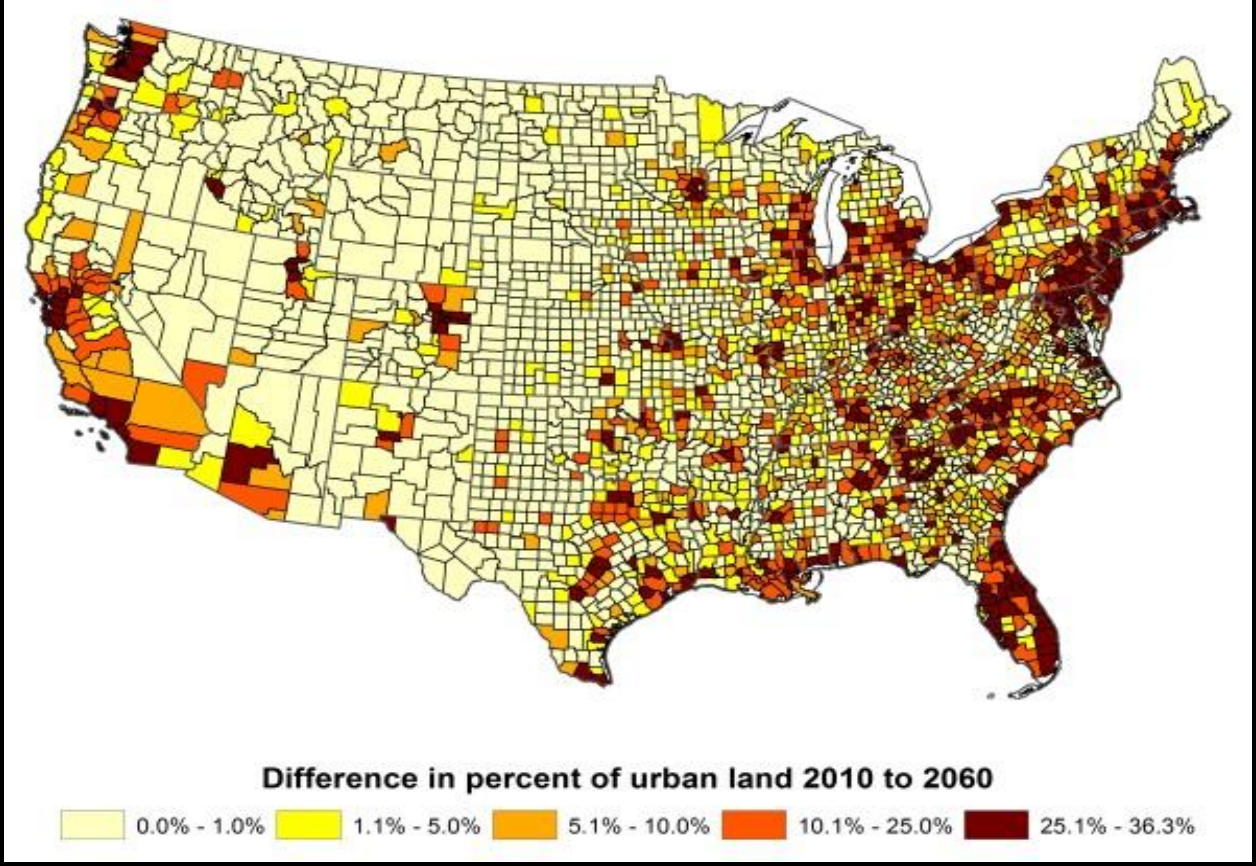
US Urban Forests = 3.6%*
68 million acres
35% tree cover
C storage = 643 milllion t

*conterminous US

Nowak, D.J., E.J. Greenfield, R. Hoehn, and E. LaPoint. 2013. Carbon storage and sequestration by trees in urban and community areas of the United States. Environmental Pollution. 178: 229-236.

Projected urban land increase (2010-2060): +2 million acres/year

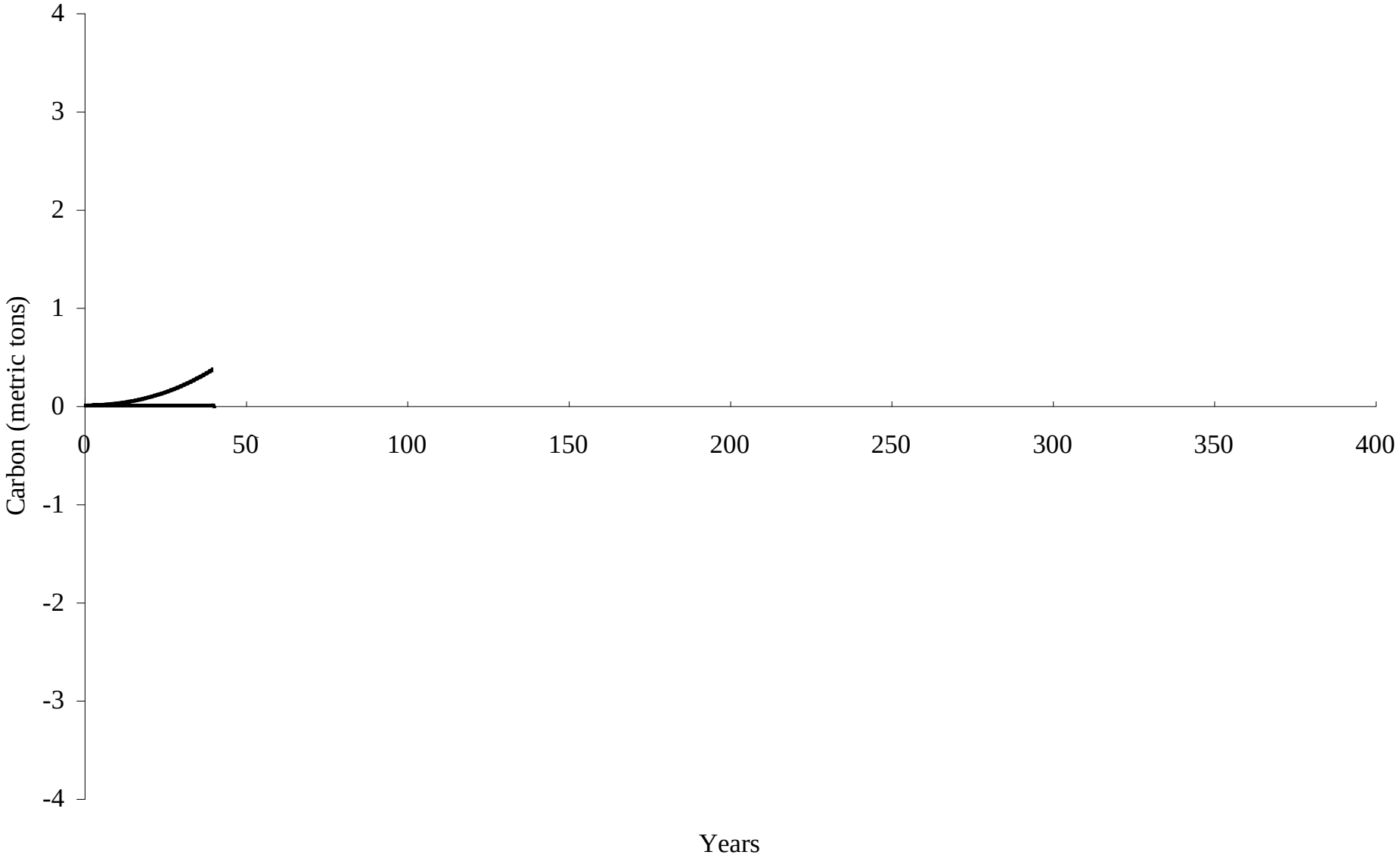
- 2010 = 67.8 million acres (3.6%)
- 2060 = 163.1 million acres (8.7%)



Increase greater than size of Montana

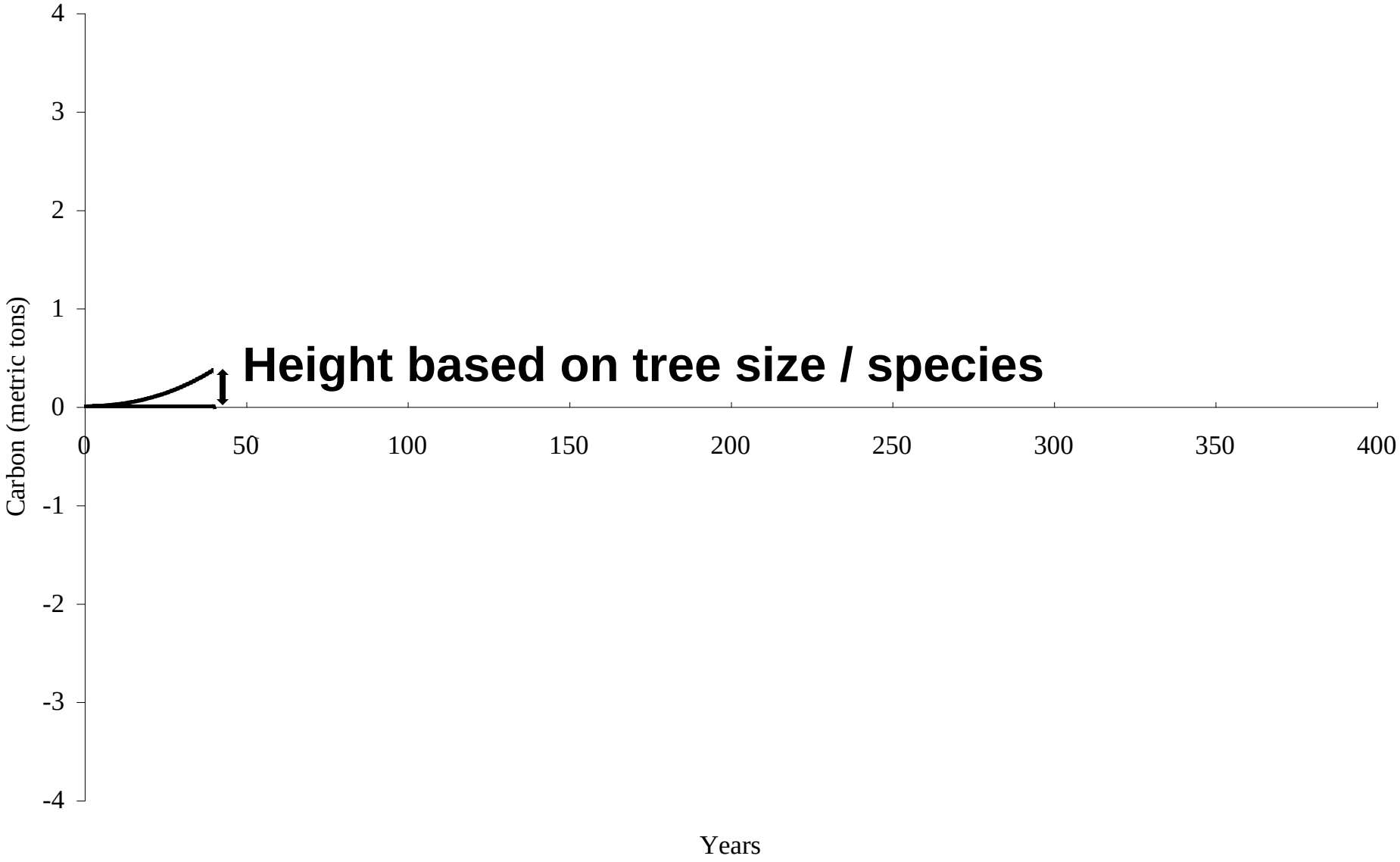
Carbon Release

Sequestration – 1 tree (red maple; 40-year life span)

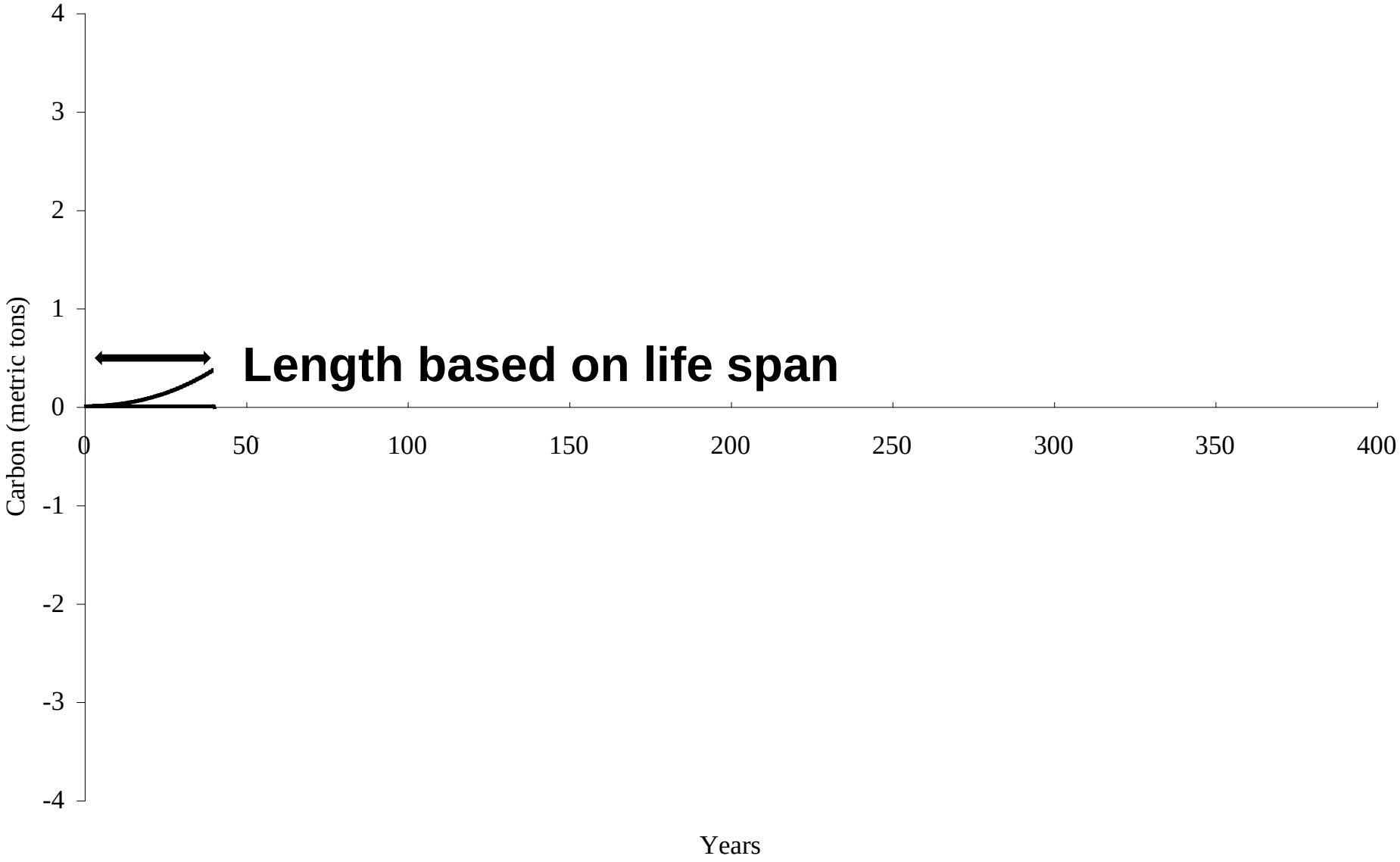


Nowak, D.J., J.C. Stevens, S.M. Sisinni, and C.J. Luley. 2002. Effects of urban tree management and species selection on atmospheric carbon dioxide. J. Arboric. 28(3):113-122.

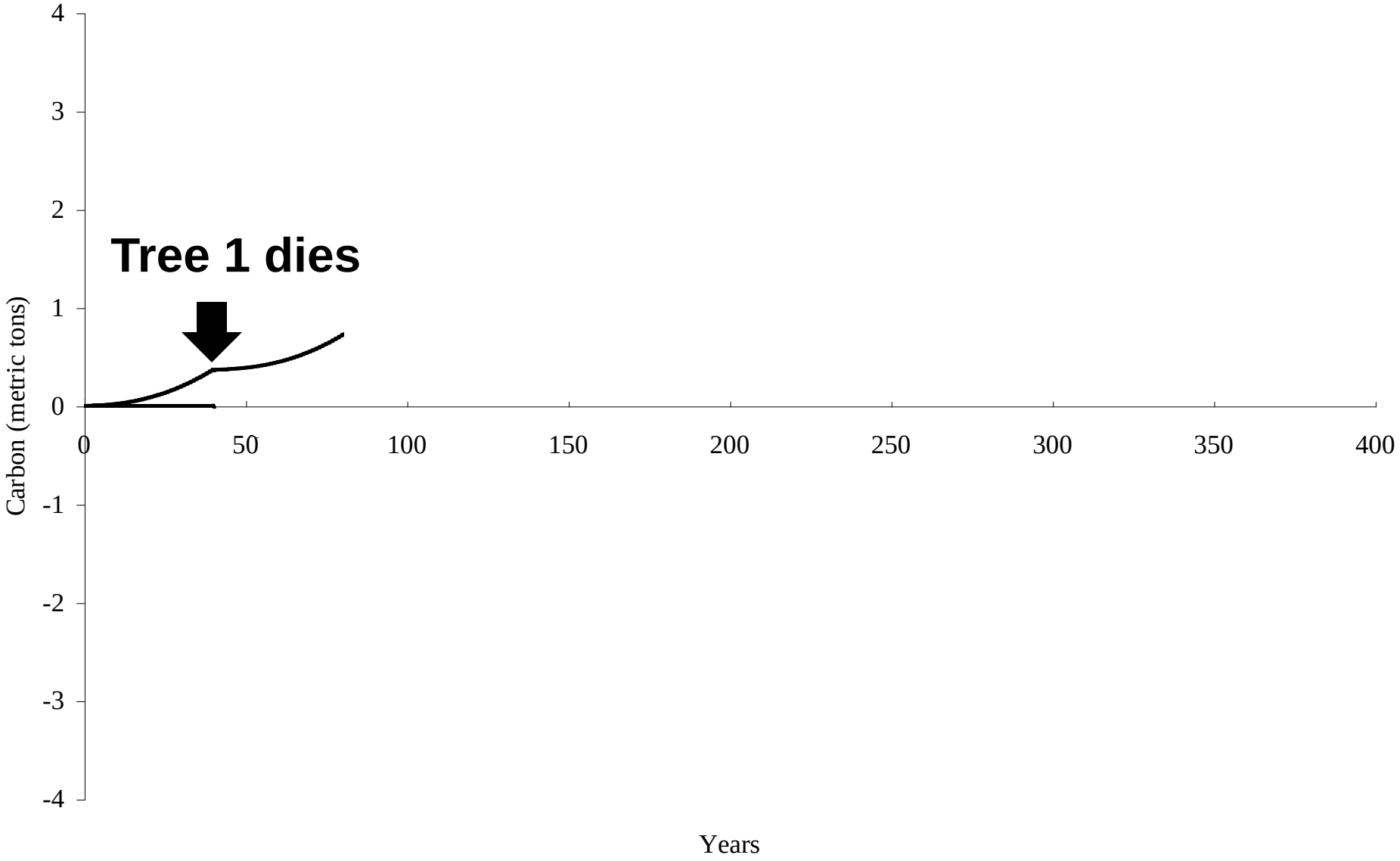
Sequestration – 1 tree



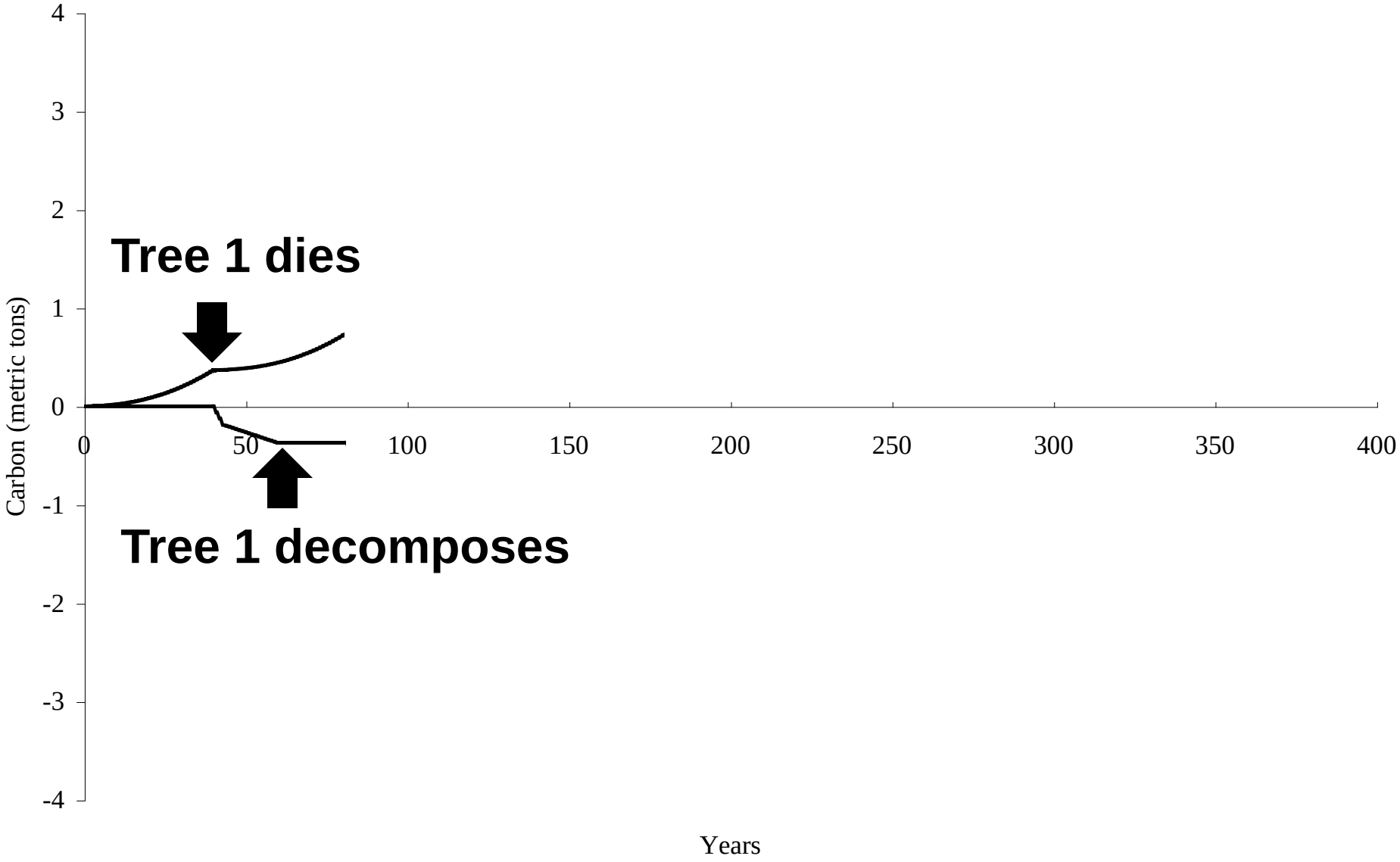
Sequestration – 1 tree



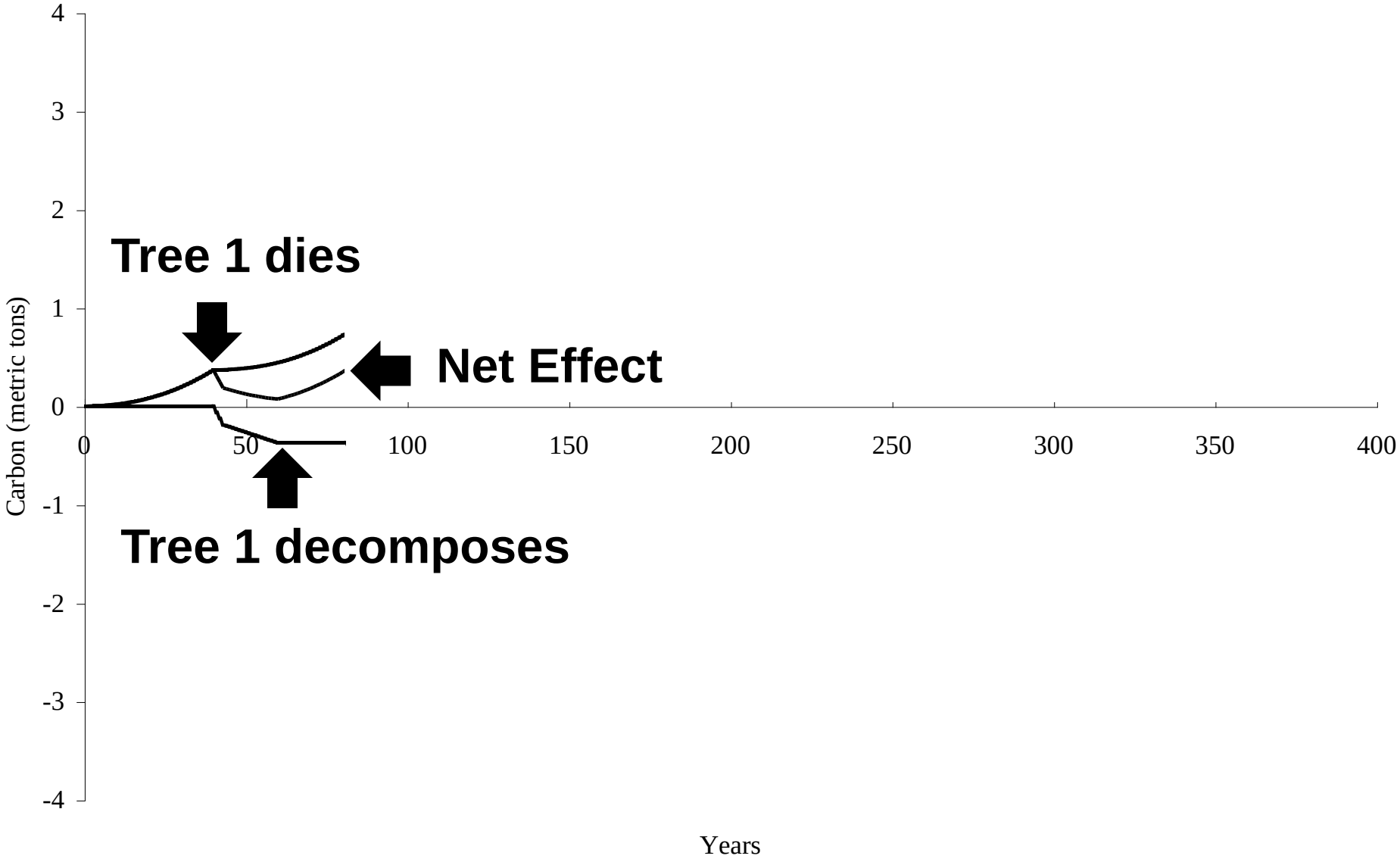
Sequestration – 2 trees



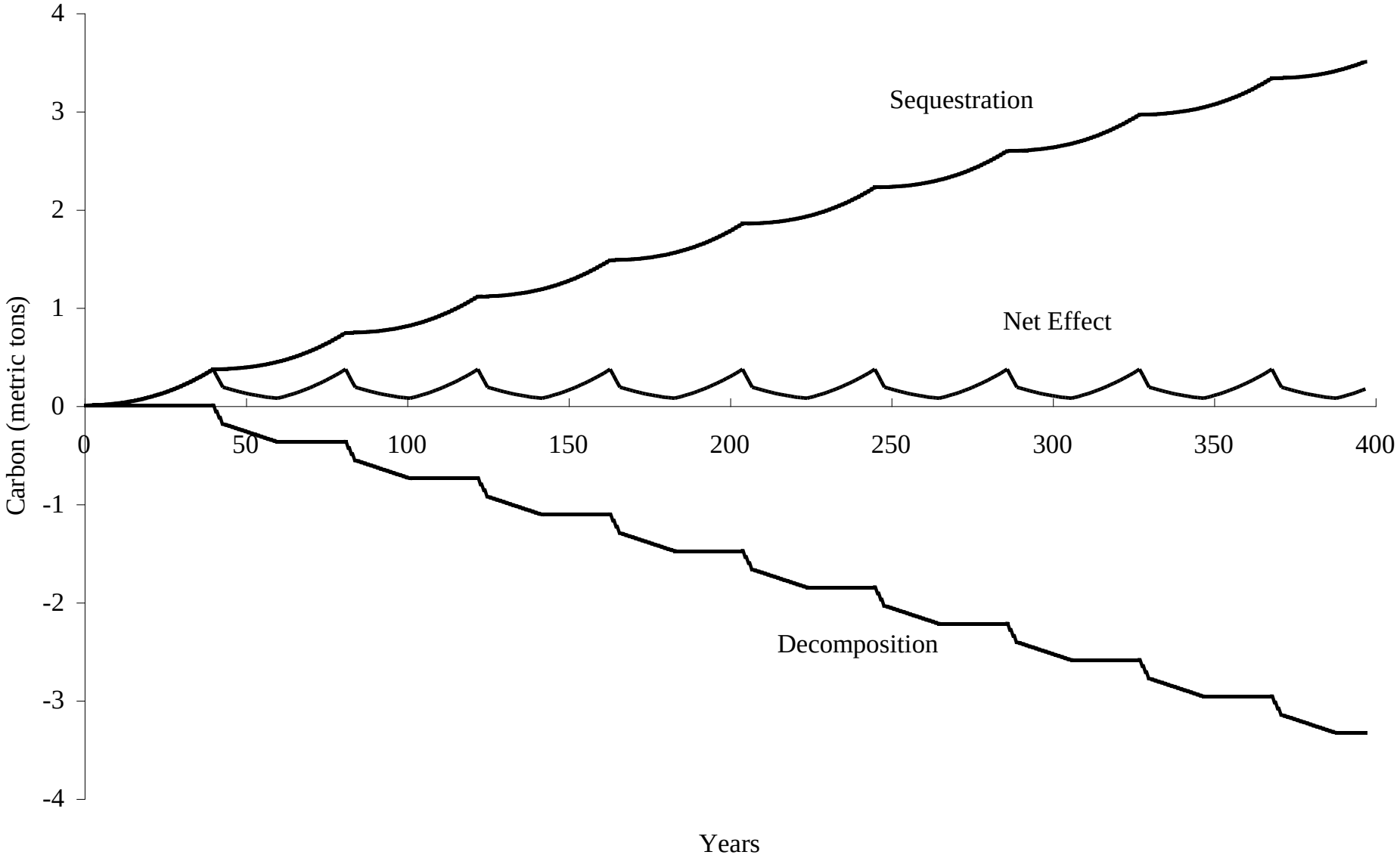
Sequestration – 2 trees



Sequestration – 2 trees



Multiple Generations



Tree size, life span/growth rate and decomposition rate affect magnitude of net effects

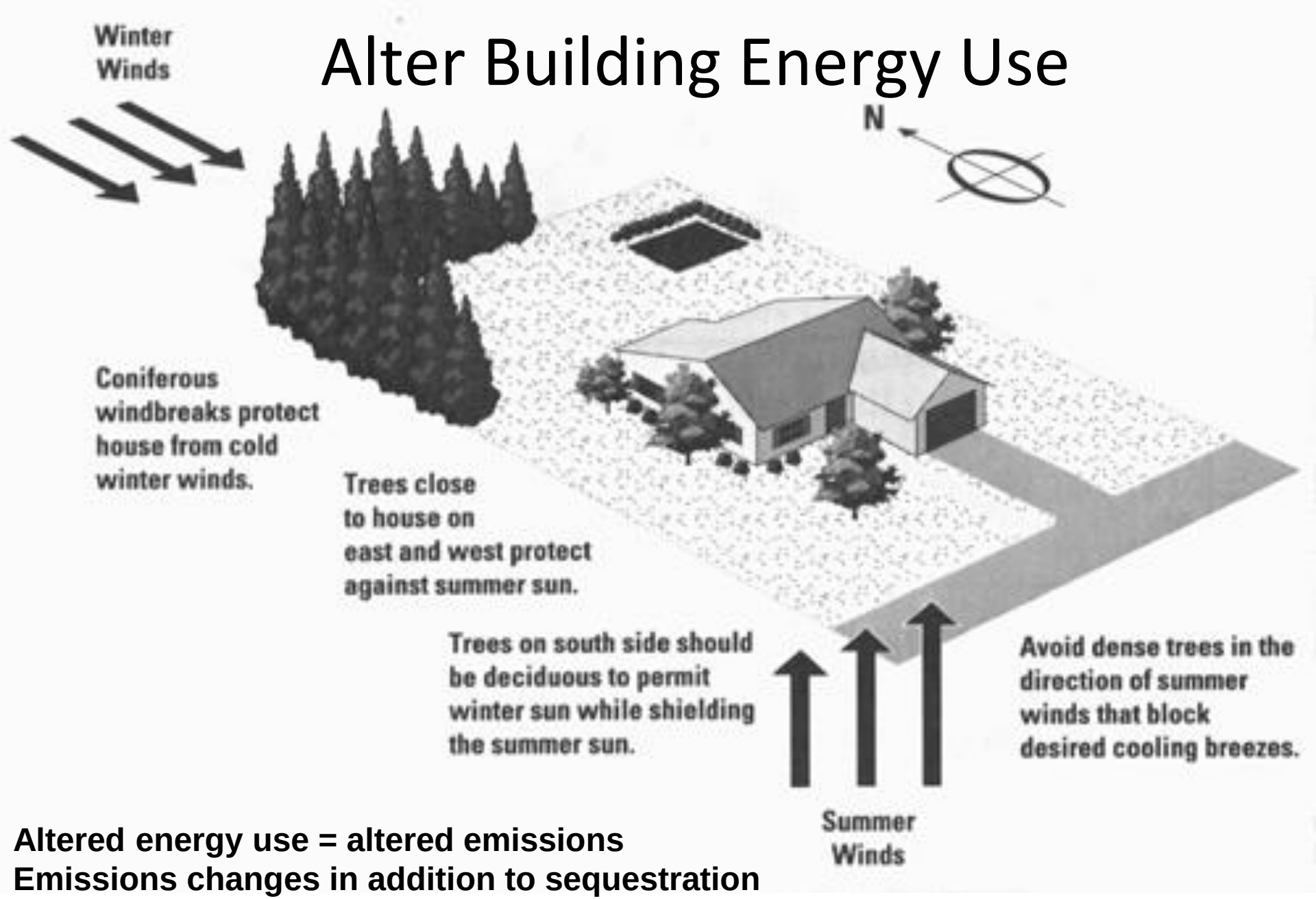
Carbon Release -Waste Wood Utilization

- Accelerated – burning / chipping
- Normal – decomposition
- Decelerated – long-term wood products
- Avoided – utilize wood for energy
- Long-term storage - soils

UN: Cities contribute 70 percent of global greenhouse-gas emissions

A new UN report shows that cities are major contributors to climate change. But are they also the solution?

Alter Building Energy Use



Altered energy use = altered emissions
Emissions changes in addition to sequestration

Image Source: Lawrence Berkeley Lab

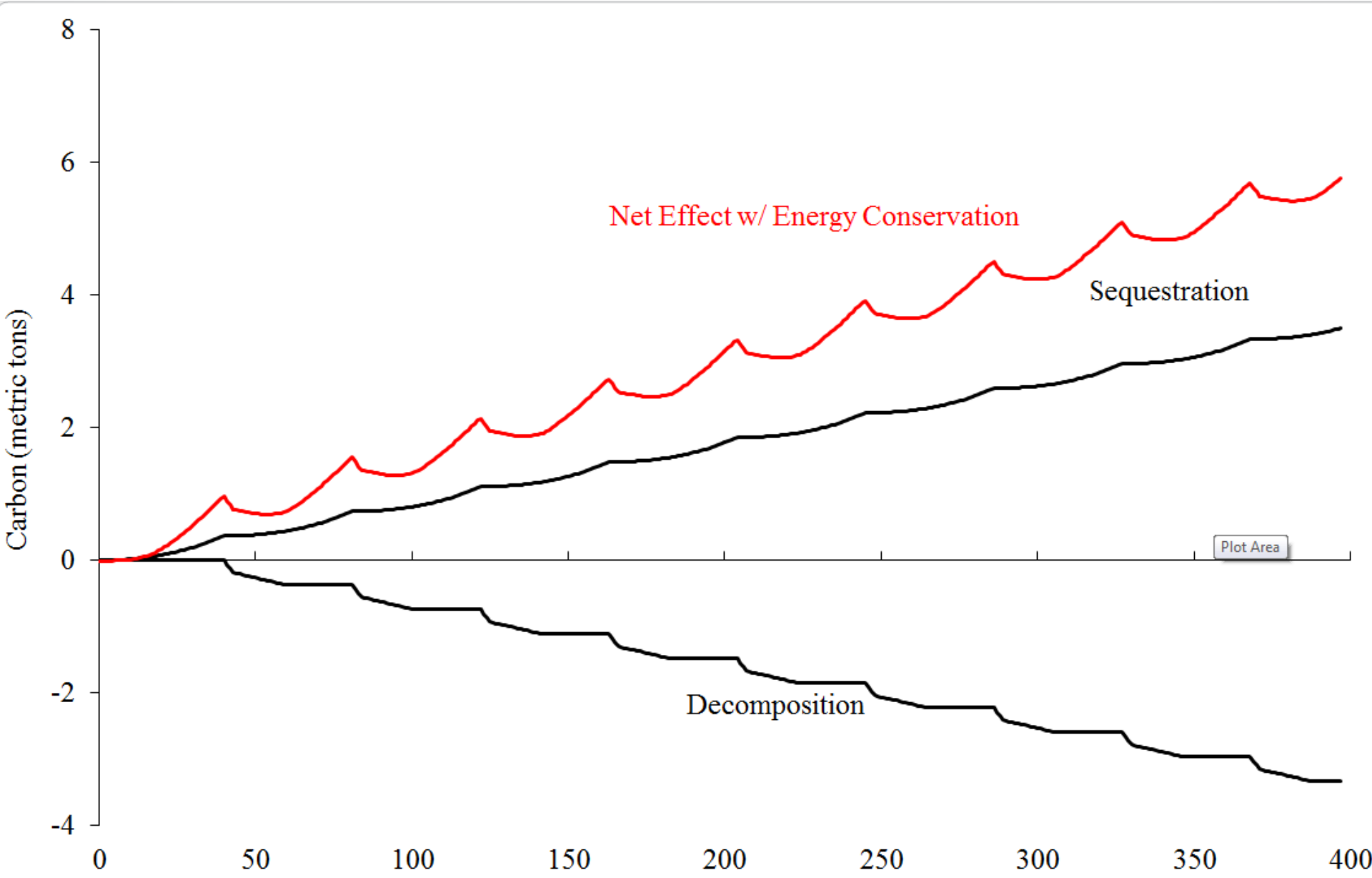
National Building Energy Conservation

- 36 million MWh energy production avoided annually ($4.3 billion)
- 228 million MBTU energy production avoided annually ($2.9 billion)

Pollutant	Tonnes avoided/year	$ millions/year
Carbon dioxide	19,800,000	425
Carbon monoxide	16,200	26
Course PM	1,720	97
Fine PM	4,190	590
Methane	459	0.2
Nitrogen oxides	17,100	161
Sulfur dioxide	45,300	405
VOCs	1,100	1
Total		1,705

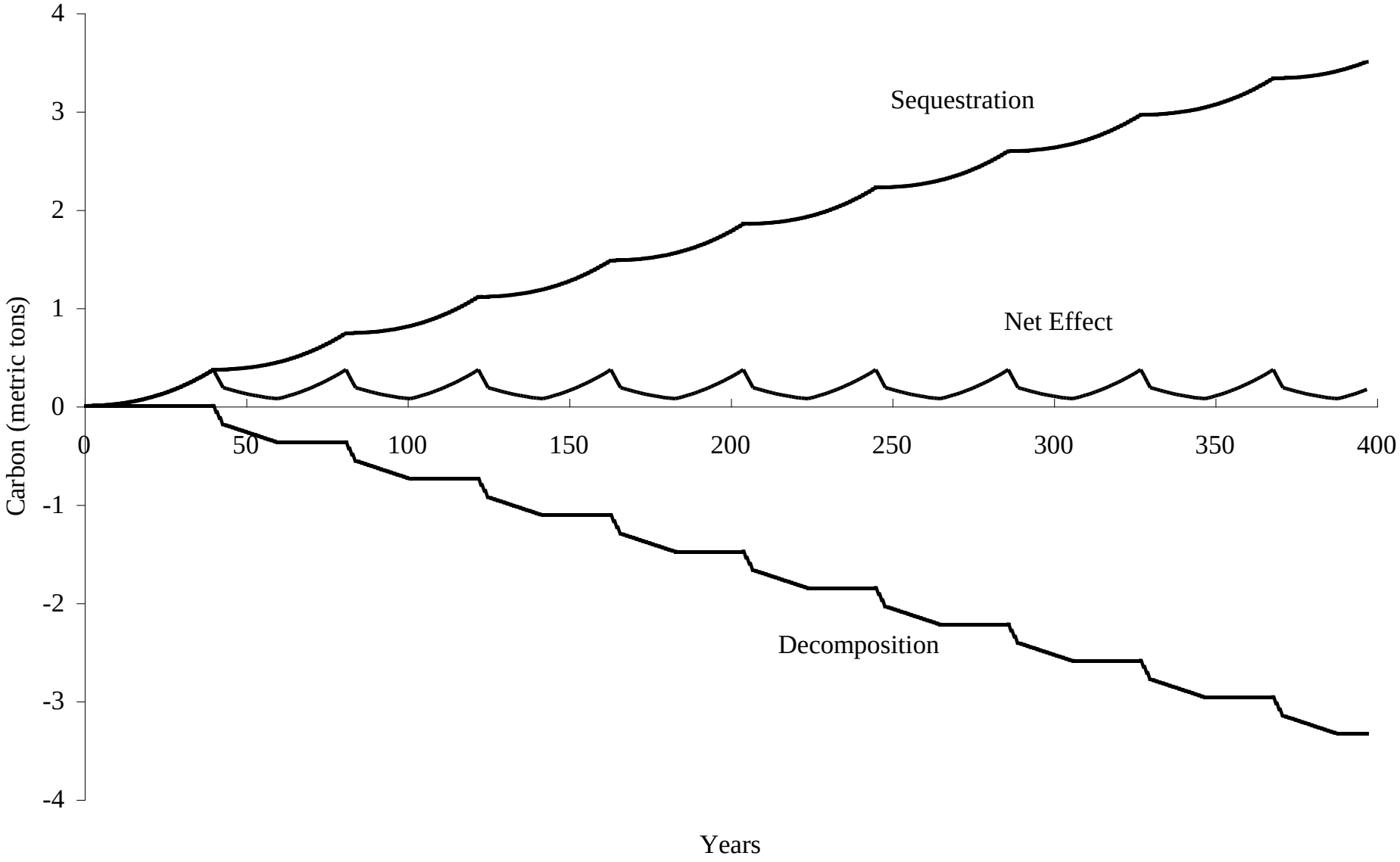
Preliminary results

Energy Effect

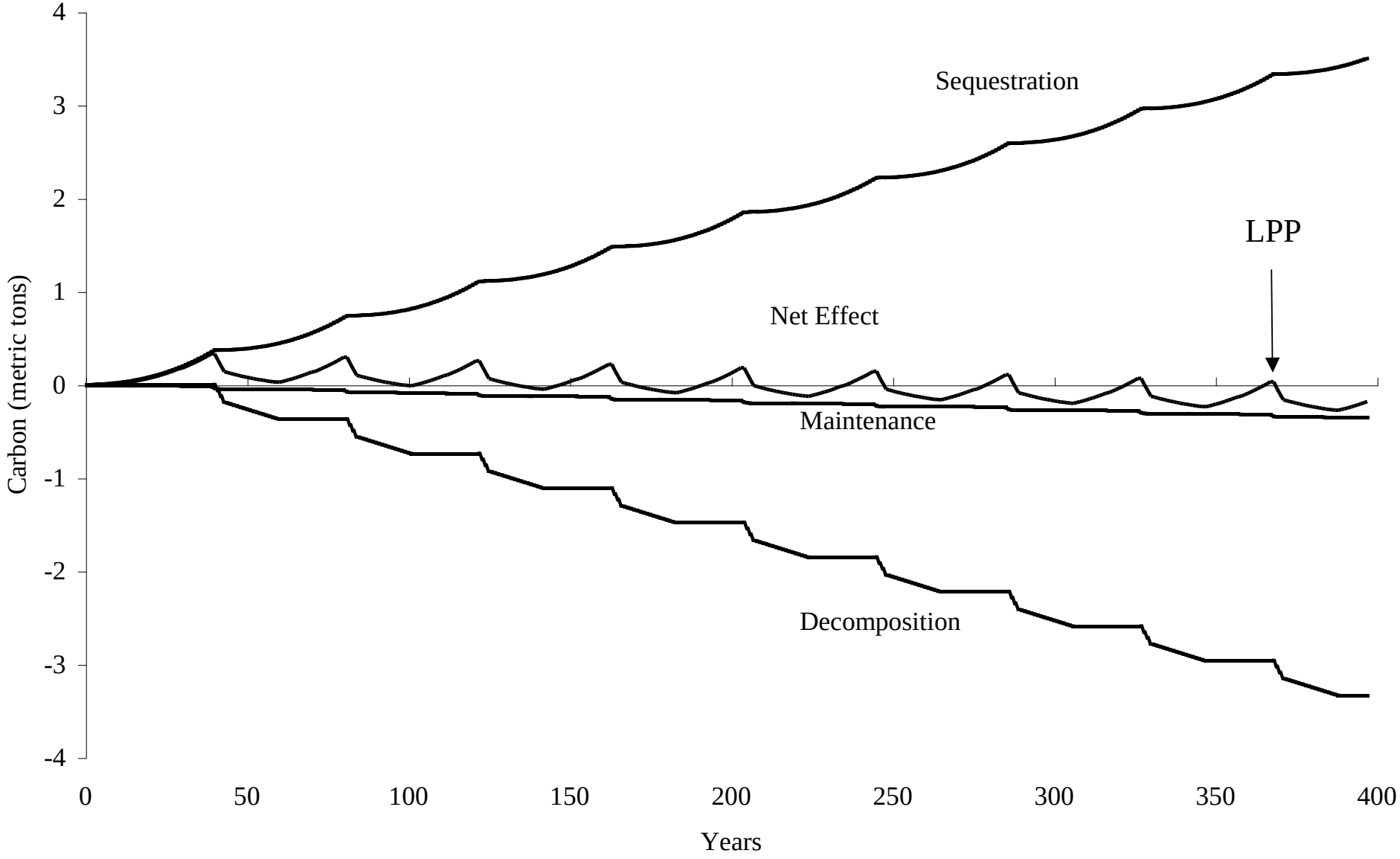


Tree Maintenance

Multiple Generations



Maintenance Effect



Long-lived large trees have longest time to reach last positive point (LPP)

Management Recommendations

- Maintain storage and sequestration
  - Sustain large, healthy trees
- Plant long-lived species
- Use low maintenance, urban adapted species
- Consider projected climate change / insects
- Minimize fossil fuel use
- Plant trees in energy conservation location and use wood for energy or products
- Provide trees ample water

Urban Vegetation Benefits

- Air quality improvement
- Water quality improvement
- Greenhouse gas reduction
- Building energy use conservation
- Oxygen production
- Health benefits
- Cooler air temperatures
- UV radiation reduction
- Wildlife habitat
- Products: timber, food, fiber, ethanol
- Social / Aesthetics
- Noise reduction
- Economic: jobs

Gathering your own data

- Field measurements
  - Carbon storage
  - Annual sequestration
  - Energy effects
  - Projections thru time

www.itreetools.org

Conclusion

- If I could only plant one tree to combat climate change, I would plant it an urban area
- But – I would minimize carbon use to maintain the forest and utilize the wood after death