



Analyzing and Influencing Carbon Sequestration in Harvested Wood Products

Alan Arnholt, Ben Jones, Hannah X Laws, Kelly Loucks, Eric Marland, Andrew Sullivan

Department of Mathematical Sciences



Abstract

WOODCARB3 expands the capabilities of the WOODCARB2 spreadsheet model by changing to an R package platform. The conversion brings increased capability for data manipulation, analysis, and reporting. It also increases the ease of integration with other datasets. This poster describes some of the results and demonstrates some of the potential for the WOODCARB3 model. Examples of the types of analysis possible include uncertainty analysis, sensitivity analysis, alternate model dynamics, alternate pathways.

Introduction

WOODCARB2 is the current tool used by the US Forest Service to document and calculate the total carbon stocks from harvested wood products (HWP). The statistics package R, being open source in a very active engaged community, is one of the dominant platforms and offers a wide variety of tools and interfaces with other software packages.

Sequestration of carbon in forests accounts for 87% of total CO₂ removals in 2014. Carbon mitigation efforts have thus focused much attention on reforestation, forest management, and forest based products. According to the most recent report to the UNFCCC, an estimated 18.7% of the total carbon in woody materials is contained in harvested wood (HWP and SWDS).

The amount of carbon in HWP and SWDS depend on how much wood is harvested, what types of products are produced, how the products are used, the lifetime of the wood products, and how the wood is processed at the end of its primary product lifetime.

Sources of Data and Equations

- WOODCARB II Software in Microsoft Excel®
Note: Base level data was given in spreadsheet.
- Harvest Quantities:

$$E = mc^2 \quad (1)$$

- Imports, Exports, etc.:
- Decay of HWP:

Methodology (what we did)

- We have translated WOODCARB3 spreadsheet models into an R package.

Uncertainty Analysis

- Information is intended to aid in international discussions and any agreements about managing greenhouse gas emissions and sinks.
- Also provides national level methods and estimates of carbon sinks and emissions associated with HWP.
- The package provides quick accessibility, allowing data to be updated, modified, and manipulated with ease.

Projected Carbon Contribution

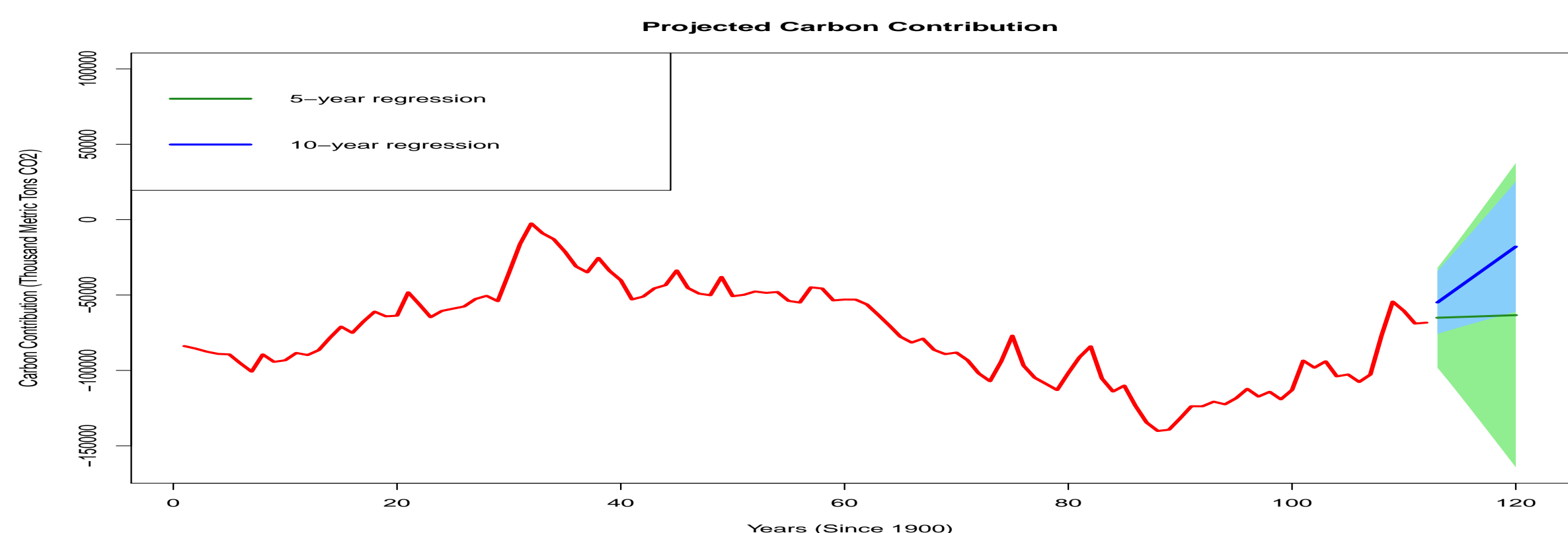


Figure 1: Projected carbon contribution based on five and ten year regressed projections.

Sensitivity Analysis

- Information is intended to aid in international discussions and any agreements about managing greenhouse gas emissions and sinks.
- Also provides national level methods and estimates of carbon sinks and emissions associated with HWP.

Sensitivity Plot

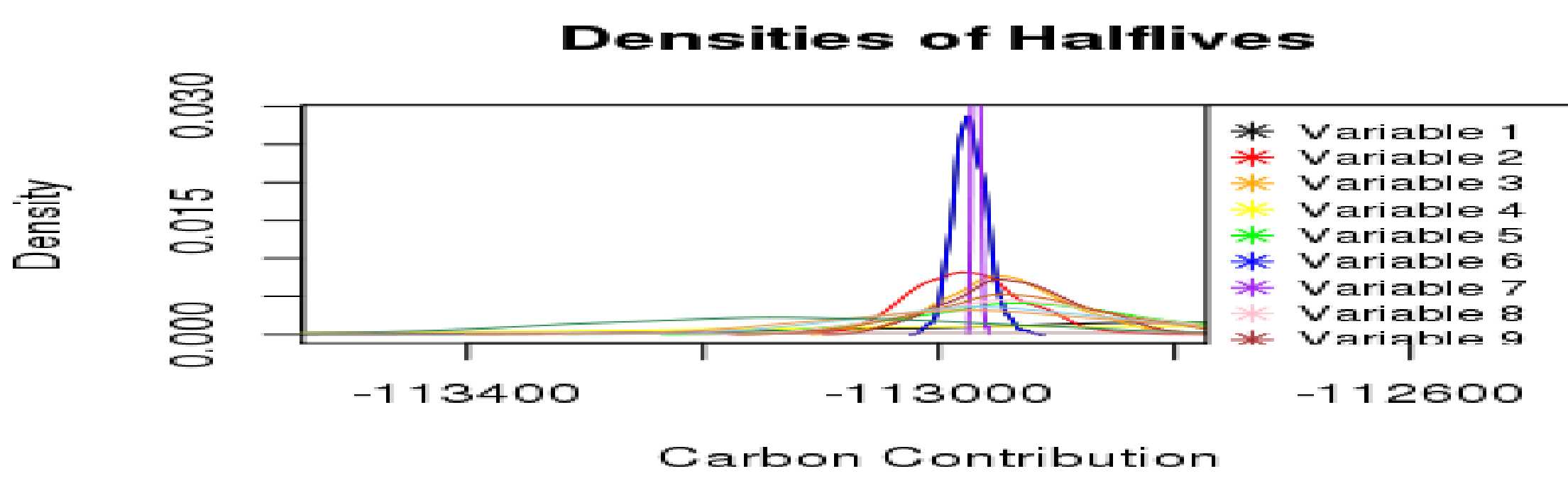


Figure: Figure caption

Total HWP Carbon Stocks with Uncertainty

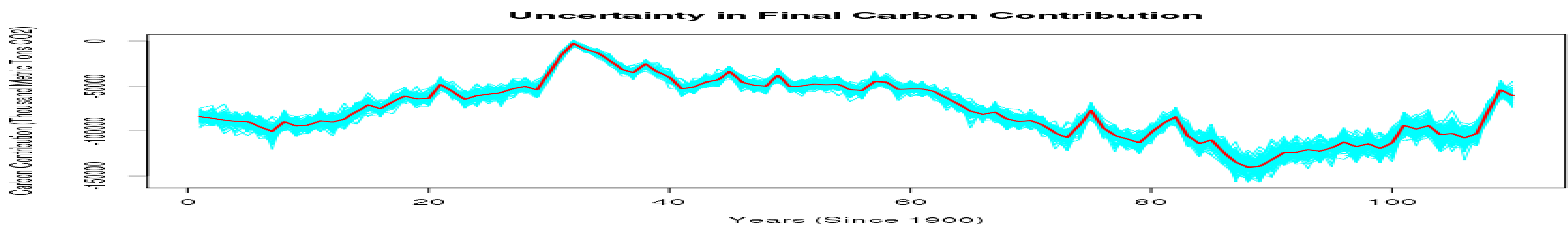


Figure: this is the caption that shows what is in the figure that explains the plot of HWP stocks and provides and envelope of uncertainty around it this is the caption that shows what is in the figure that explains the plot of HWP stocks and provides and envelope of uncertainty around it

Decay

Decay of Hardwood in Multifamily housing

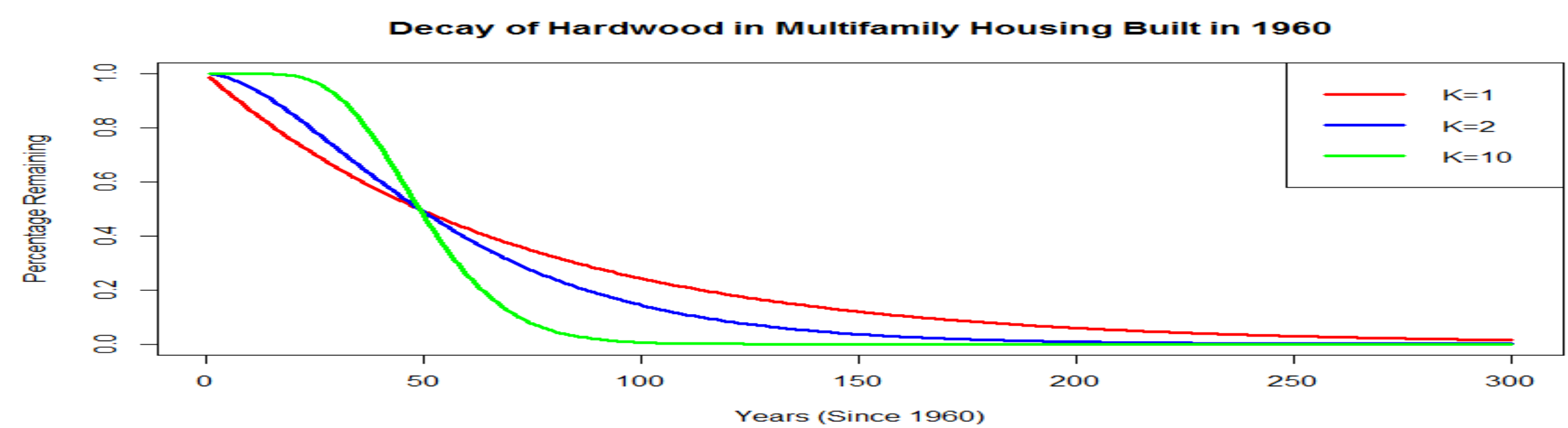


Figure: This figure shows the over effect of the decay function on multifamily housing built in 1960

Overall Decay

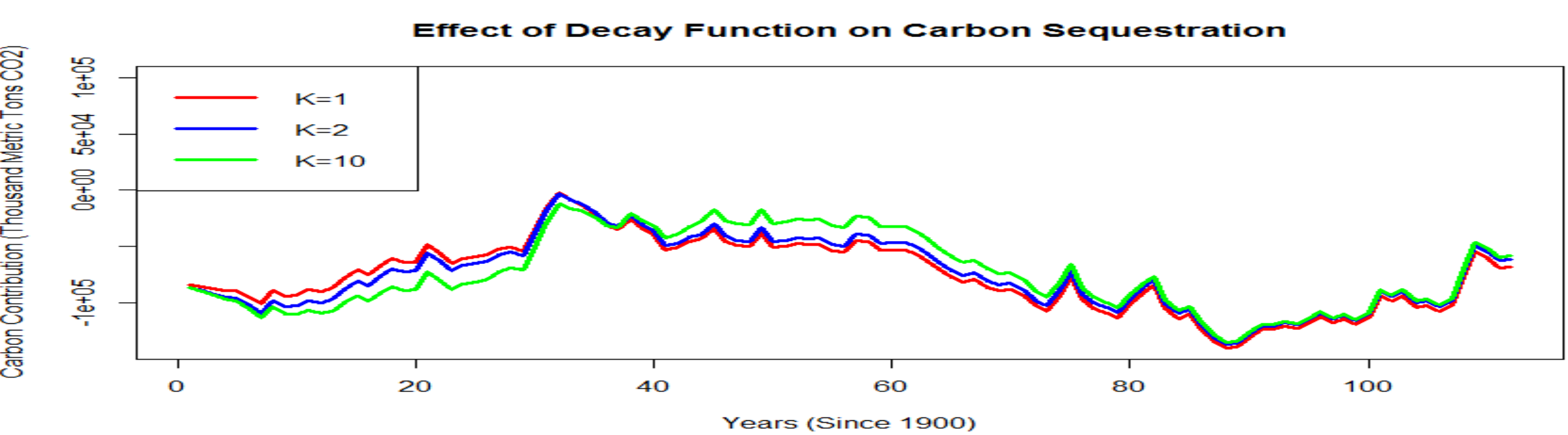


Figure: This figure shows the over effect of the decay function on Carbon Sequestration

Half-life Table

	Half Life	1990	2000	2010
House.SingFam	78	49326.235419467	68293.9690705363	68979.3356929374
House.Multifam	47.6883539937108	98724.8007179637	2380.01084123663	1756.75603211151
House.MobHom	38.0284145354606	2464.77182796007	3144.91873212116	2541.73812080947
Res.Upkeep	23.1334540304859	167096.425781801	172797.319502826	114967.800311367
New.Nonres.AIRR	38.0284145354606	8152.82786078133	11060.9009578503	9388.66651628773
New.Nonres.Rties	38.0284145354606	229.784233076707	198.847980482318	147.299589391645
New.Nonres.Rcar.Repair	38.0284145354606	4.44463060175416	4.87489633259149	3.94217079348497
Manu.HouseFurniture	38.0284145354606	5175.20002571365	9369.04368951025	8638.16275595599
Manu.CommFurniture	38.0284145354606	1180.03262578815	3612.23906154734	3657.69430872661
Manu.OtherProducts	38.0284145354606	4477.50357441808	6835.53919323388	5908.85840045406
Shipping.Tot	38.0284145354606	10878.7494765968	13989.006528278	11874.617876221
Other.Uses.Tot	38.0284145354606	12834.9814511951	18264.2846333669	16991.3669561707
Other.Industrial.Tot	38.0284145354606	34036.325290149	31405.3383220674	26583.7797251829
Paper	2.53087281800454	6391552.24965238	3603762.53086556	139374.493167519

Figure: Figure caption

Discussion

- Targeted changes in average half life can increase total stocks.
- End of life dynamics make a big difference in stock size.
- Sensitivities help channel reductions in uncertainty.

Acknowledgements

This work was funded by a Research Joint Venture Agreements with the USDA Forest Service, Northern Research Station and the USDA Forest Service, Southern Research Station.

Contact Information and Package Access

- Email: marlandes@appstate.edu
- Online link: WOODCARB3R package

