Carbon Sequestration Potential of Non-Commercial Tree Species in the Southeast

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Introduction

Landowner participation in carbon exchange markets has become increasingly popular in the southeastern U.S. Advances in the knowledge of species-specific carbon storage are critical for development of accurate carbon quantification. Woody debris is a major component of the global carbon cycle, and the decomposition of wood is affected by the quality of substrate, climate, and the type and abundance of decomposer organisms. However, variation among tree species is a major factor affecting decomposition and long-term carbon storage that is not well known. To address this knowledge gap, a field experiment was initiated in 2021 to test the decomposition rates across several common, but silviculturally unimportant, tree species common to forests in the southeastern U.S.

Study Objective

Identify species with desirable traits to facilitate long term carbon storage.

Materials and Methods

- Eight different species of wood were evaluated:
  - ERC: Eastern redcedar
  - HK: Shagbark hickory
  - LOB: Loblolly pine
  - OS: Osage orange
  - RM: Red maple
  - RO: Red oak (Cherrybark)
  - SG: Sweetgum
  - WO: White oak
- Decomposition bags with triangular wood cross-sections including bark, sapwood, and heartwood were deployed in random configuration with 18 replicates at three sites (Figure 1a):
  - Holly Springs, MS
  - Starkville, MS
  - Louisville, MS
- Samples were collected at zero, six, and twelve months and evaluated for change in mass, carbon, and nitrogen content relative to initial values (Figure 1b).

Figure 1. (a) Example field site deployment and (b) wood samples after 12 months of decomposition.

Results

- The species with the highest total mass loss on average across all three sites was Red maple (29.8%) closely followed by Sweetgum (28.6%) (Figure 2).
- Osage orange had the least mass loss with an average of only 6.2% after 12 months across all three sites.
- White oak had the highest percent density loss after six months (15.0%) however, had one of the lowest amounts of total mass loss on average after 12 months (11.8%) (Table 1).
- Preliminary data suggests that Loblolly pine has the highest portion of carbon composition (51.5%) however Osage orange has the greatest sequestration potential because it releases carbon the slowest (0.89%/6mo).

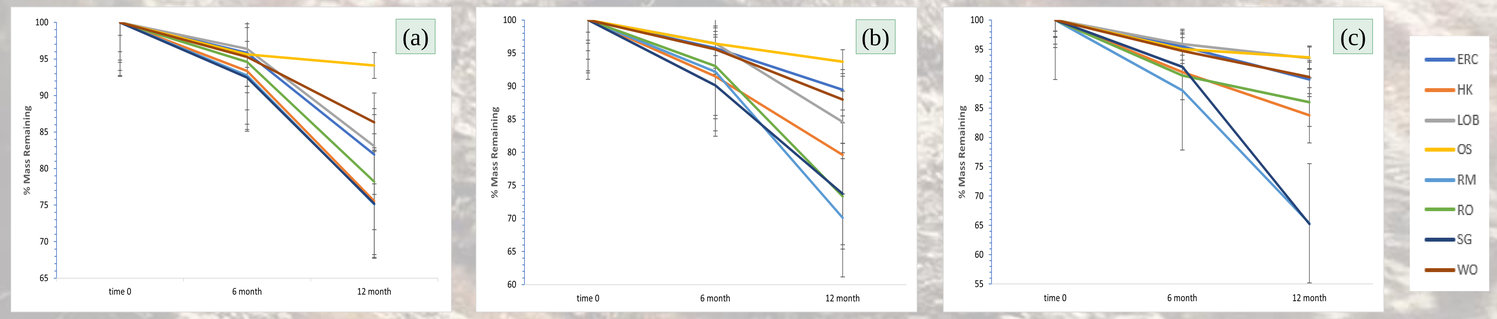

Figure 2. Decomposition mass loss at (a) Holly Springs, (b) Starkville, and (c) Louisville, MS field sites.

Table 1. Wood carbon and nitrogen concentrations at the beginning of the study and after six months of decomposition.

Species	Initial C (%)	6-Mo C (%)	ΔC	Initial N (%)	6-Mo N (%)	ΔN
ERC	50.4	48.2	-2.2	0.28	0.20	-0.08
HK	48.2	45.4	-2.8	0.35	0.32	-0.03
LOB	51.5	49.5	-2.0	0.18	0.13	-0.04
OS	48.3	47.4	-0.9	0.41	0.33	-0.08
RM	47.8	46.6	-1.3	0.17	0.18	0.02
RO	47.4	45.7	-1.6	0.30	0.23	-0.07
SG	48.7	45.9	-2.8	0.15	0.17	0.02
WO	47.6	45.7	-1.9	0.30	0.20	-0.10

Conclusions and Future Work

- On average Sweetgum and Red maple lost mass approximately five times as fast as Osage orange.
- Change in carbon content seems to be directly correlated to decomposition, Nitrogen content seems to be much more loosely correlated to decomposition.
- Additional data collection will occur at 18 and 24 months.
- Carbon/Nitrogen and decomposition data will continue to be analyzed and compared between species.

Acknowledgments

The authors would like to recognize the support of the College of Forest Resources Undergraduate Research Scholars Program, which supported the student worker on this project. We would also like to thank Booth Farms and Spirit Hill Farms for access to research sites. This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S Department of Agriculture, McIntire Stennis capacity grant #MISZ-032100. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture. This publication is a contribution of the Forest and Wildlife Research Center, Mississippi State University.