Competitive Research Grant Program

Carbon sequestration and enhanced wildlife habitat resulting from bottomland hardwood afforestation activities

Investigators/Cooperators: Richard Maiers, Changyou Sun, Donald L. Grebner, Andrew Londo, Forestry; Bruce D. Leopold, Jeanne Jones, Wildlife and Fisheries; Michael Cox, Plant and Soil Sciences

Project Goals:

1. Determine soil and vegetative carbon storage for a number of bottomland hardwood species.
2. Evaluate the effectiveness of fertilizer application in southern bottomland hardwoods.
3. Evaluate the effectiveness of herbaceous competition control measures in early growth and survival of planted bottomland hardwoods.
4. Evaluate the costs associated with a number of hardwood establishment procedures, and the subsequent costs for sequestering carbon for each procedure.
5. Establish permanent afforestation areas that can potentially be used for long-term research and demonstration purposes.
6. Evaluate the economic returns for alternative hardwood establishment procedures on a before and after tax basis.
7. Determine the best combination of hardwood species mix and herbicide and fertilizer regime that minimizes damage to seedlings from herbivory.
8. Assess wildlife habitat use among forest regeneration treatments.
9. Determine effects of various forest regeneration treatments on wildlife food and cover plants.
10. Determine which forest regeneration treatment most effectively restricts growth of exotic plant species.

Project Objectives:

1. Report incidence of mammalian herbivory damage by species on seedlings of nine tree species on two afforestation sites in the LMAV.
2. Report seedling mortality of tree species and relate to categorical evidence of herbivory.
3. Determine relationship between seedling survival, herbivory sign, and environmental factors, such as seasonal rainfall, distance from field edge, vernal and autumnal vegetation coverage, and study site location.
4. Determine relationship between seedling survival and hispid cotton rat abundance on two study sites.
5. Determine hispid cotton rat abundance and habitat associations on study sites.

Synopsis of research activities per objective:

Seedlings will randomly be selected (n = 781) from each study site. These seedlings will be a sub-sample of all seedlings selected for the parent project. Tree height will be measured and species identified. Survival and evidence of damage or mortality from herbivory will be recorded throughout the study. Herbivory damage by mammalian species were monitored

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during May, August, and September of 2006 and 2007. Species responsible for damage will be determined according to methods in Elbroch 2003. In addition to monitoring, vegetation measurements were conducted during May and August of 2006 and 2007. Vegetation plots consisted of 1-m^2 hoops centered on seedlings. Percent cover of herbaceous vegetation and of woody vegetation within circular plots were recorded along with stem counts of woody vegetation. Distance of seedlings to field edge were also measured and recorded. Scientists will determine if tree species are preferentially selected for or against by browsing mammals and if mortality rates of trees are disproportionate among species relating to damage by herbivores using Manley's alpha index. The relationship between seedling survival/mortality and environmental factors (e.g., distance from field edge, dominant vegetation) using linear and logistic regression will be tested. To determine density of hispid cotton rats by mark-recapture, Sherman live traps will be placed in grids with 10-m spacing between traps (n = 238) at each study site. Each trap will be baited with a peanut butter-oat mixture for four trap nights. Cotton rats will be removed, weighed, sexed, and marked with a single, 2-mm hole through the right ear. Recaptures will be recorded and not marked a second time. Distance from traps to parcel edge also will be measured. Microhabitat conditions in a 5-m^2 rectangular area around each trap will be surveyed and species of vegetation by percent coverage and average height will be recorded. Cotton rate abundance will be calculated by site using the program CAPTURE. The relationship between seedling survival/mortality and cotton rat abundance using a Chi square test will be analyzed. The relationship of cotton rat occurrence at each trap site as it relates to microsite characteristics around traps using linear regression will be investigated.

Significant findings/results per objective to date:

Common Name	Scientific Name	a	Number of Dead Trees					
			Cotton Rat	Pine Vole	Eastern Cottatail	White-tailed Deer	Other Causes[b]	Unknown Causes[c]
Green Ash	*Fraxinus pennsylvanica*	2	0	0	0	0	1	1
Common Persimmon	*Diospyros virginiana*	0	0	0	0	0	0	0
Cottonwood	*Populus deltoides*	161	0	0	0	0	161	0
Red Mulberry	*Morus rubra*	32	6	0	1	0	8	17
Sycamore	*Platanus occidentalis*	2	1	0	0	0	0	1
Nuttall oak	*Quercus nuttallii*	11	5	1	2	0	2	1
Sawtooth oak	*Quercus acutissima*	4	3	0	0	0	1	0
Water oak	*Quercus nigra*	1	1	0	0	0	0	0
Willow oak	*Quercus phellos*	13	7	0	1	0	4	1
Unknown oak	*Quercus sp.*	93	17	7	5	0	28	36
Unknown spp.	N/A	51	1	3	3	0	2	42
Total all trees	N/A	370	41	11	12	0	207	99

[a] *N* represents total number dead trees.
[b] Other Causes- includes but not limited to: drought, planting error, and human accidents.
[c] Unknown Causes- tree was absent at time of data collection.

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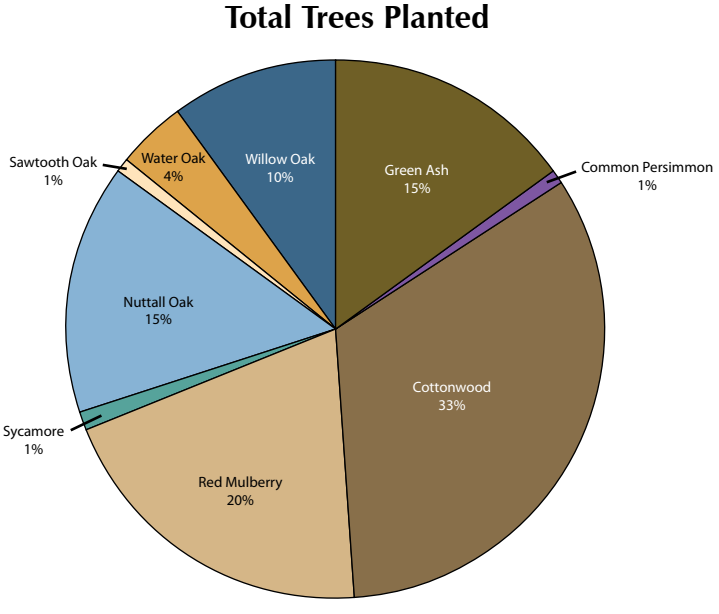
Table 2. Number of surviving seedlings planted for hardwood reforestation and associated damage in Greenville and Cleveland, MS (2006).

Common Name	Scientific Name	a	Undamaged	Number of Dead Trees			
				Cotton Rat	Pine Vole	Eastern Cottontain	White-tailed Deer
Green Ash	*Fraxinus pennsylvanica*	86	84	1	0	0	1
Common Persimmon	*Diospyros virginiana*	8	8	0	0	0	0
Cottonwood	*Populus deltoides*	29	29	0	0	0	0
Red Mulberry	*Morus rubra*	89	67	16	0	6	0
Sycamore	*Platanus occidentalis*	5	4	1	0	0	0
Nuttall oak	*Quercus nuttallii*	82	65	9	6	2	0
Sawtooth oak	*Quercus acutissima*	3	1	1	0	1	0
Water oak	*Quercus nigra*	24	14	6	3	1	0
Willow oak	*Quercus phellos*	50	35	8	6	1	0
Unknown oak	*Quercus sp.*	33	27	2	4	0	0
Unknown spp.	N/A	2	1	1	0	0	0
Total all trees	N/A	411	335	45	19	11	1

[a] *N* represents total number of surviving trees.



List post-docs and graduate students with title of thesis or dissertation, if completed, and estimated graduation date:

Edwards, K.E. 2007. Herpetofauna communities and habitat conditions in temporary wetlands of upland and floodplain forests on public lands in North-Central Mississippi. Thesis, Department of Wildlife and Fisheries, Mississippi State University.

Harris, Tyler. Anticipated graduation in 2008. Thesis, Department of Wildlife and Fisheries, Mississippi State University.

Nero, B.F. Anticipated graduation in 2008. Carbon sequestration resulting from bottomland hardwood afforestation in the Lower Mississippi Alluvial Valley. Thesis, Department of Forestry, Mississippi State University.

Sumerall, D.C. 2007. Measuring the biological and economic effects of wildlife herbivory on afforested carbon sequestration sites in the Lower Mississippi Alluvial Valley. Thesis, Department of Forestry, Mississippi State University.