Dr. Elisabeth Brennan
Assistant Professor
Fisheries and Wildlife Program

15 August 2008

Dear Dr. Watson,

Enclosed please find the final report on the "Comparing Moist Soil Seed Production on Private and Public Wetlands in Arkansas" grant I received as part of a faculty research grant from ATU in November 2007.

Thank you very much for funding this project and encouraging wetlands research at Arkansas Tech. I feel that the findings of this study are an important contribution to current wetland management techniques. Indeed, because of the preliminary research conducted in this study we were able to procure funding for a graduate student to continue studying moist-soil seed communities on private wetlands in Arkansas. I also presented the results of this research at the International Society of Wetland Scientists Meeting in Washington, DC in May 2008.

If you have any questions, please do not hesitate to contact me. Thank you again for funding this research grant.

Sincerely,

Elisabeth Brennan

cc. Dr. Richard Cohoon, Dean of Physical and Life Sciences
Dr. Charlie Gagen, Department Head of Biological Sciences

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A. Title Page

Faculty Research Grant Report
Arkansas Tech University

Comparing Moist Soil Seed Production on Private and Public Wetlands in Arkansas

by

Elisabeth Brennan
Assistant Professor of Wildlife Biology
Department of Biological Sciences

15 August 2008

B. Restatement of problem researched or creativity

The Mississippi Alluvial Valley (MAV) contains some of the most important migratory and wintering habitat for waterfowl in North America. The MAV provides wintering habitat for several million ducks and geese annually (Reinecke et al. 1989). Most waterfowl scientists and wetland managers assume foraging habitat is the limiting factor for waterfowl in winter. Given that over 70% of the bottomland hardwood forests that once provided quality waterfowl habitat within the MAV have been destroyed and altered, wetland managers are now focusing on using moist-soil management techniques to increase waterfowl foraging habitat within the MAV (King and Keeland 1999).

Several studies have examined moist-soil seed production on managed public wetlands and their contribution to waterfowl foraging (Kross 2006), however little is known about moist-soil seed production on private wetlands enrolled in the Wetlands Reserve program (WRP). The objective of this study was to evaluate moist soil seed production on WRP wetlands within the MAV of Arkansas and compare them to moist soil seed production on publicly managed wetlands. The WRP was created by the 1990 Farm Bill with the goal of assisting landowners in restoring and protecting wetlands on their property that were previously marginal farmland (Heimlich 1994). Arkansas is second only to Louisiana in total acres of wetlands enrolled in the WRP program (King et al. 2006). A previous study reported WRP sites in the MAV of Arkansas had a moist-soil seed abundance of 329.95 kg/ha with a coefficient of variation of 13.8% (Gann and Brennan 2007). However, due to the low sample size of this study and the fact that it did not directly compare seed production on WRP wetlands to seed production on publicly managed wetlands, further research is needed. In order to effectively manage for waterfowl habitat within

the MAV, knowledge of contribution of WRP wetlands to seed production and waterfowl foraging opportunities is necessary.

C. Brief Review of the Research Procedures

We used a Geographical Information System (GIS) data layer of current WRP sites in Arkansas to determine the highest density of WRP sites in MAV of Arkansas. Monroe, Prairie, White, Woodruff, and St. Francis counties had the highest densities of WRP sites in Arkansas. From these 5 counties, we randomly selected 22 WRP sites (Figure 1). We also sampled six public wetlands on wildlife management areas (WMA) managed by the Arkansas Game and Fish Commission. We sampled these sites from mid-October to early November. At each site we established a transect running either northeast to southwest or northwest to southeast. We used a 10 cm depth and diameter (785.4 cm^3) core sampler to take ten soil core samples along the established transect at random locations. Once sites were sampled, we stored the soil samples at -10°C until processing. Before processing, we combined the samples from each site into one aggregate sample for that site, and immersed the aggregate sample in a mixture of 3% hydrogen peroxide and water for a minimum of 3 hours. After the immersion period, we washed the samples through a series of graduated sieves (sizes 4 [4.75-mm aperture] and 50 [300-µm aperture]) to remove the soil and separate the large vegetative matter from the fine vegetative matter. Once the soil was removed, we dried the large and fine vegetative matter for 24 hours at a constant temperature of 87°C. We removed the seeds and tubers visually from the dried large vegetative matter using tweezers and a lighted 1.25x-magnifying lens. We then evenly distributed the fine vegetative matter over a grid of 100 equal sized cells (0.64 cm^2) and randomly selected a sub-sample of 25 cells. We visually sorted the sub-sample by the use of tweezers and a lighted 1.25x-magnifying lens. We weighed the samples and multiplied the

weights of the seeds and tubers from the fine vegetative matter by 4 (25% sub-sample). We combined the masses of the seeds from the large and fine vegetative matter to get the total mass per site and converted the masses to kg/ha (dry mass) for statistical analysis.

We used PROC SURVEY MEANS (SAS version 9.0) to calculate the mean moist-soil seed mass on both public and private wetland sites and compared the difference between public and private sites using an Analysis of Variance. We also used a linear regression analysis to determine the effect of age of WRP site on moist-soil seed abundance.

D. Summary of findings.

Mean moist-soil seed production on WRP sites was 531.4 kg/ha (SE = 66.3), while mean seed production on WMA sites was 862.1 kg/ha (SE = 111.6). There was no statistical difference between seed production on WRP sites and WMA sites ($F = 3.14$, $P = 0.09$; Figure 2). Age, or time since enrollment into the WRP program did not have a significant effect on moist-soil seed production ($R^2 = 0.02$, $P = 0.55$; Figure 3).

E. Conclusions and recommendations

We estimated that the moist-soil seed abundance of WRP sites in the MAV of Arkansas was 531.4 kg/ha. The WRP site estimate was similar to what Kross (2006) found on publicly managed moist-soil units within the MAV at 496 kg/ha. While the results were not statistically significant, there may be several biological differences between moist-soil seed production on WRP and WMA sites. This difference in moist-soil seed production could have been due to the difference in the management practices of the units. Most of the WRP sites that we sampled were passively managed properties, meaning that no sort of management via soil disturbance or water levels fluctuation were used to promote or reduce certain types of plant growth. In order to increase moist-soil seed production, we would recommend landowners to actively manage their moist-soil units to promote plants that are beneficial to wintering waterfowl.

Arkansas has approximately 77,000 ha enrolled into WRP with approximately 20% (±5) of land being moist-soil units (King et. al 2006). Duck-Energy-Days (DED) represent the average number of dabbling ducks that can obtain the daily energy requirement from a hectare of foraging habitat for a day (K. Reinecke, personal communication). Using the estimated moist-soil seed abundance of WRP sites in the MAV of Arkansas and the number of hectares enrolled into WRP, we estimated that Arkansas' WRP sites provide 63 million (± 15) DED. Even though moist-soil seed production on WRP sites was similar to that of publicly managed moist-soil units, increased efforts should be made to actively manage WRP sites, including seasonal flooding to improve waterfowl foraging opportunities.

Literature Cited

Heimlich, R. E. 1994. Costs of an agricultural wetland reserve. Land Economics 70(2):234-246.

King, S. L., and B. D. Keeland. 1999. Evaluation of reforestation in the lower Mississippi River Alluvial Valley. Restoration Ecology 7(4):348-359.

King, S. L., D. J. Twedt, and R. R. Wilson. 2006. The role of the Wetland Reserve Program in conservation efforts in the Mississippi River Alluvial Valley. Wildlife Society Bulletin 34(4):914-920.

Kross, J. 2006. Conservation of waste rice and estimates of moist-soil seed abundance for wintering waterfowl in the Mississippi Alluvial Valley. Thesis. Mississippi State University, Starkville, MS.

Reinecke, K. J., R. M. Kaminski, D. J. Moorehead, J. D. Hodges, and J. R. Nassar. 1989. Mississippi Alluvial Valley. Pages 203-247 in L. M. Smith, R. L. Pederson, and R. M. Kaminski, editors. Habitat management for migrating and wintering waterfowl in North America. Texas Tech University Press, Lubbock, Texas, USA.

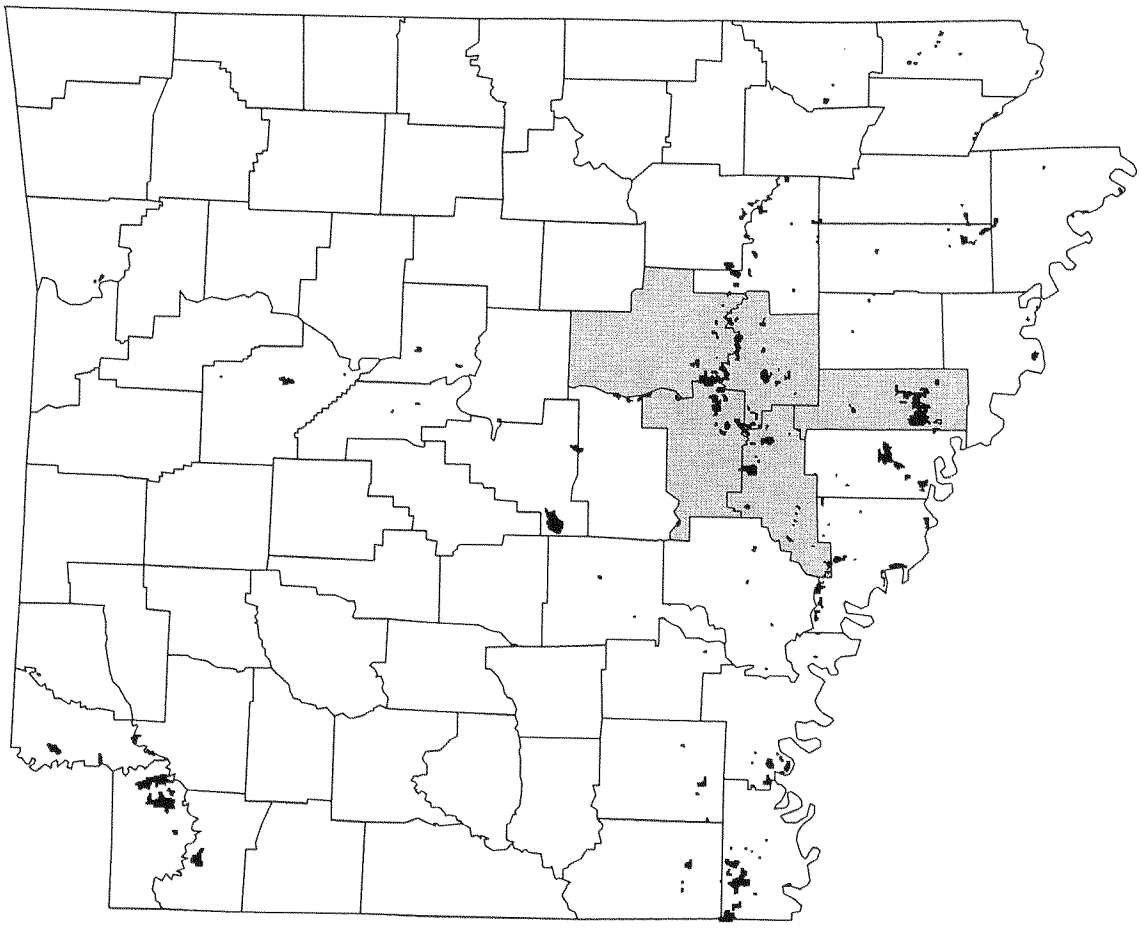

Figure 1. Sampling locations of public (WMA) and private (WRP) wetlands in Arkansas used to evaluate moist-soil seed production.

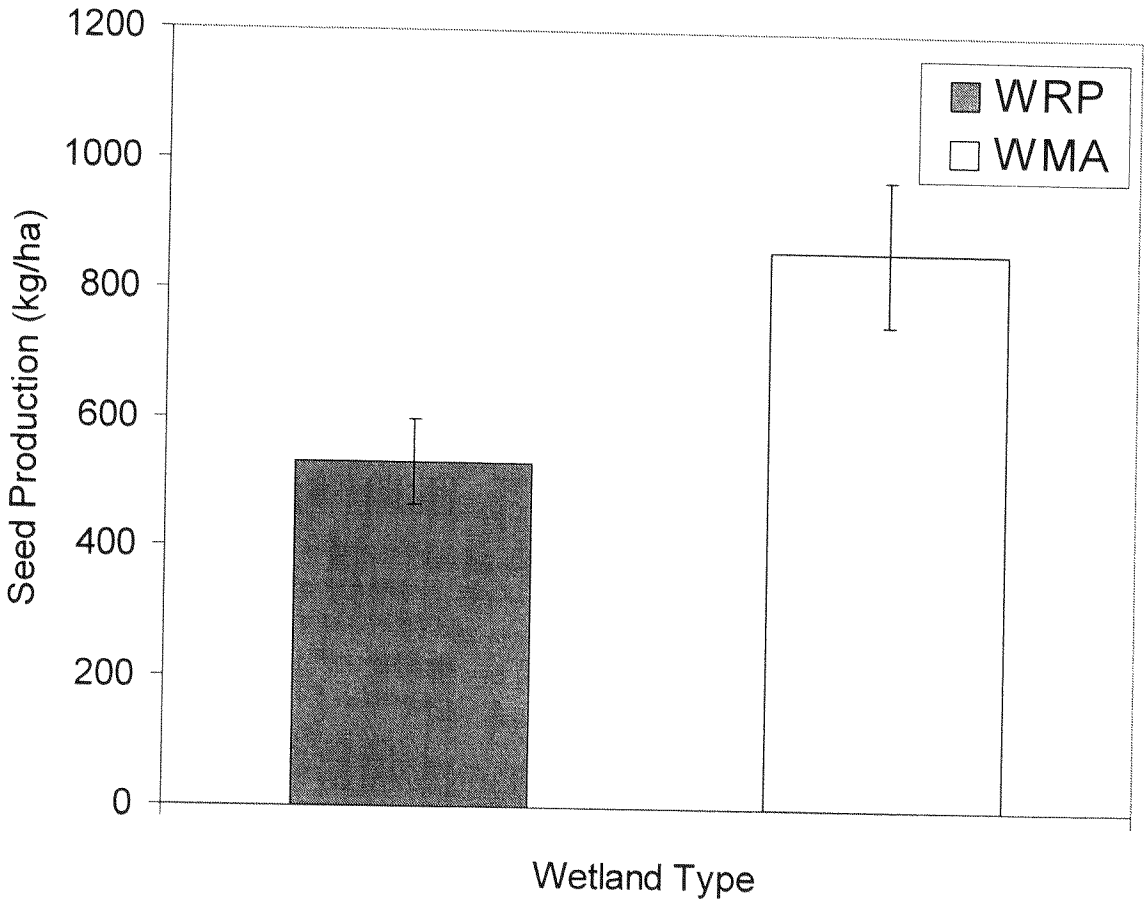

Figure 2. Mean moist-soil seed production on public (WMA) (n = 6) and private (WRP) (n = 22) wetland sites in Arkansas.

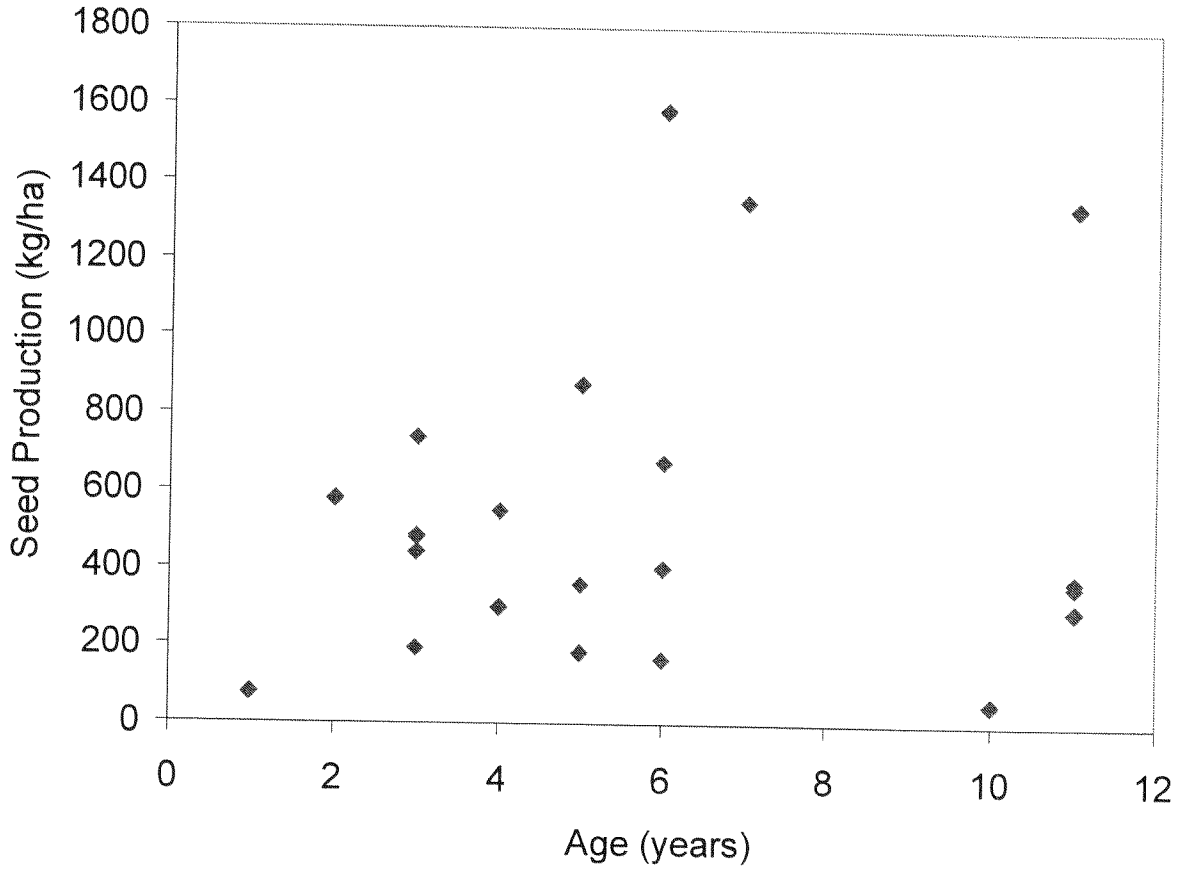

Figure 3. Effect of age (time since enrollment into WRP program) on moist-soil seed production on WRP sites in the Mississippi Alluvial Valley of Arkansas.