2645

AREA 8, PHASE I REVEGETATION TEST PLOTS
ANNUAL REPORT

November 10, 1999

Submitted by:

Dr. Carolyn Howes Keiffer

Department of Botany

Miami University

We evaluated different planting regimes in restoring a lowland forest that had been converted to pasture several years ago. Species used in this experiment included: *Aesculus octandra*, *Fraxinus pennsylvanica*, *Celtis occidentalis*, *Juglans nigra*, and *Quercus muhlenbergiii*. Eight 20X50m plots were established such that there were two each of four treatments: Control (no additions), Seedlings (120 individuals of 5 species added), Saplings (20 individuals of 5 species added), Mixed (120 seedlings, 10 saplings, each of 5 species). One-third of the seedlings in each plot received a deer browsing tube. Unfortunately the *Quercus* seedlings were not available for the spring planting, but are scheduled to be planted the following spring.

We evaluated growth and survival after one growing season. All saplings and seedlings were scored for survival; browsing, rubbing, and rodent damage October 21-23, 1999. Sapling diameter was also measured with micro-calipers at a height of 1m. This measurement technique is more accurate on young trees than DBH (diameter at breast height) due to the low branching pattern exhibited by field grown trees.

Overall, saplings had a fairly high survival rate (>80 percent), despite the intense drought conditions they faced during this crucial establishment year. Although the high-quality saplings were transported and planted with exceptional care, they received no other maintenance in the months following planting. Survival percentages ranged from 100 percent for *Quercus muhlenbergii* saplings to 45 percent for *Celtis occidentalis* trees planted in the Sapling-only plots (Table 1). With the exception of *Celtis*, there was not a noticeable treatment effect when survival was compared between the mixed plots and sapling-only plots. (Table 1).

The extraordinary survival rate of *Quercus* (100 percent) is especially noteworthy because of the relatively heavy deer browsing which was noted in June of 1999. Deer had browsed nearly all of the lower branches on the *Quercus* saplings. The majority of the apical buds and many lower twigs were

either eaten, or broken off. In addition to the deer damage, vole damage (bark stripping) was apparent on 5 percent of *Fraxinus* and *Aesculus* saplings.

Although the overall survival rate is very high, saplings were categorized as being alive or dead. Many of the trees had tip dieback, branches that were completely dead, and trunks that had been severely rubbed (no bark remaining). It is likely that more trees will later succumb to the transplant, drought, and herbivore damage they faced this year. Trees can enter a state of decline for 2-3 years before they are eventually declared dead.

Table 1. Percent sapling survival approximately 6 months after planting.

	% Survival all Plots	% Survival Seedling/Sapling Plots	% Survival Sapling Plots
Aesculus (Buckeye)	94	92	95
Celtis (Hackberry)	50	55	45
Fraxinus (Ash)	96	98	94
Juglans (Walnut)	70	73	67
Quercus (Oak)*	100	100	100
All Species	83	84	81

* Only saplings were planted

The bare-root seedling survival was very species specific. (Table 2). Survival ranged from an incredible 92 percent (Aesculus), to 0.6 percent (Celtis). Early reports indicated that the majority of the Celtis seedlings (obtained from ODNR) did not leaf out after planting. It is likely that the "dormant" seedlings were damaged or dried out during transport. Many of the Celtis seedlings, which were alive in tubes, appeared to have resprouted from the roots. Although survival of *Celtis* and *Fraxinus* seedlings was greater with tubes, survival of *Juglans* and *Aesculus* was greater without a browsing tube (82 and 92 percent respectively) (Table 2). These high survival rates are quite astonishing considering the

drought conditions and interspecific competition the small seedlings faced from the 3-4 foot tall grass and meadow plants.

Table 2. Percent Survival of Bareroot Seedlings 6 months after planting.

Species	% Survival w/Tube	% Survival w/o Tube
Aesculus (Buckeye)	26	92
Celtis (Hackberry)	38	5
Fraxinus (Ash)	15	0.6
Juglans (Walnut)	33	82

The control plots were carefully surveyed for woody recruits in October of 1999. Only two *Rosa multiflora* plants were found growing through the dense grass. It is possible that some woody recruits were missed because of the dense vegetation in these plots. The plots will be re-sampled in early spring in order to make sure that any woody volunteers have been identified and tagged.

Decisions to be made:

At this point, deer repellants have not been applied to any of the seedlings or saplings. Although one-third of the surviving seedlings are scheduled to have repellants applied this fall and again next spring, it is probably unnecessary at this time. The deer repellant will have no effect on voles (which are causing some damage), and it is likely that the deer will be unable to locate the seedlings amongst the grass. It was difficult for us to locate the seedlings even though they had each been marked with a flag at the time of planting. Many of the flags have been lost, moved, or buried under the meadow vegetation. We intend to remark the seedlings with taller (30-inch) flags later flags later this month.

Because of the poor quality of the *Celtis* seedlings and their inability to leaf-out this spring, a second planting of this species was discussed with DOE and FEMP personnel. Because 38 percent of the tubed-*Celtis* seedlings are alive, I do not believe it is necessary to replant this species during the spring of 2000. I believe that further trampling and soil disturbances will negatively impact the surviving seedlings in addition to completely changing the experimental design. We would end up with a very

unbalanced sample size unless we removed all of the existing *Celtis* seedlings and that option is very counter-productive.

Deer rubbing has extensively damaged several of the trunks of the larger saplings, especially those along the plot edges. The addition of tree tubes or corrugated plastic tubing should be considered around some of the trunks to prevent additional damage.

Concluding remarks:

Overall, I am pleased with the way this project is progressing. I was surprised at the number of live seedlings and saplings and am hoping for a wet, mild winter and spring. If the trees receive adequate precipitation during the next several months, it is possible for the stressed trees to recover and flourish. If mortality figures don't dramatically change, I believe that the project will be a success. It is strongly recommended that the trees be watered early in the next growing season should drought conditions occur again next year.

We are already noticing changes in the herbaceous undergrowth in the "sapling only plots" compared with the mixed and control plots. We have placed a number of permanent markers (rebar) into the test plots and a Botany graduate student plans to monitor the biotic and abiotic changes over the next couple of years. The data from this side-project will be provided to FEMP if requested.