# HARDWOOD ESTABLISHMENT ON COMPACTED MINE TAILINGS AFTER SUBSOILING AND NATIVE GROUND COVER SEEDING

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**Extended abstract**—Since 1930, approximately 2.5 million ha have been disturbed by surface mining in the United States. On many mine sites reclaimed since the Surface Mining Control and Reclamation Act of 1977 both compacted soils and aggressive nonnative plant communities are common, and sites may require remediation in order to establish forests (Burger and others 2013). Planted grasses and legumes can compete strongly with planted tree seedlings, and there is a need to identify herbaceous species that are compatible with reforestation (Franklin and others 2012). Browse damage to planted tree seedlings can be extensive in the Southeast and may also be influenced by the composition of herbaceous vegetation.

An experiment was established to test for tree growth and establishment in four vegetation treatments on 8 ha of an old reclaimed mine site in northeastern Tennessee. Soil compaction was first relieved by subsoiling to a depth of 1 m. Bare-root 1-0 seedlings of 15 tree and shrub species were planted on a 2.4-m by 2.4-m spacing in late winter of 2015 (table 1). The herbaceous treatments were applied immediately following tree planting: 1) herbaceous control using an application of glyphosate herbicide in a 0.5-m radius around each planted tree in late spring, 2) seeding with a mixture of herbaceous annuals and perennials preferred by deer, 3) seeding with a mixture of herbaceous annuals and perennials that are not preferred by deer, and 4) untreated control. Pre-treatment composition of vegetation was surveyed in August of 2014 and was dominated by nonnatives with a total herbaceous cover of 93 percent. The composition of herbaceous vegetation was monitored in May and August of 2015.

Herbaceous cover was reduced to 66 percent across all treatments in May, and by August both seeded and control treatments had returned to initial levels (82–93 percent), while herbicide treatments still had significantly reduced cover (78 percent). Subsoiling did not reduce the frequency or dominance of lespedeza (*Lespedeza cuneata*), but did reduce the presence of tall fescue (*Festuca arundinacea*) from 52 percent of plots to 13 percent and its dominance from to 34 to 4 percent of plots. At the end of the first growing season, the percentage of tree and shrub seedlings with obvious signs of browse damage varied from 9–64 percent (table 1). Binary logistic regression was used to test the effect of species and treatment on browse damage and survival. Seeding herbaceous species attractive to deer decreased the likelihood of deer browsing damage to planted seedlings, with 33 percent of seedlings being browsed. The highest rates of browse were seen in the treatment with low palatability herbaceous species seeded (45 percent) and herbicide treatment (43 percent), while the control treatment was intermediate with 37 percent of seedlings browsed. Survival and browse damage of trees, but not shrubs, was assessed in February of 2017, at which time survival averaged 38 percent and browse damage was similar to that seen in 2015. The planting of deer-preferred herbaceous species may be a viable strategy to reduce the incidence of browse damage to tree seedlings on young reforestation sites in this region.

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**Table 1—Planting density of tree and shrub species, percent survival of trees (Feb. 2017), and percentage of seedlings browsed (Aug. 2015 and Feb. 2017)**

| Species | | Stems/ha | Browse 2015 (%) | Browse 2017 (%) | Survival 2017 (%) |
|---|---|---|---|---|---|
| *Quercus rubra* | northern red oak | 82 | 64 | 63 | 38 |
| *Quercus muehlenbergii* | chinkapin oak | 82 | 39 | 49 | 35 |
| *Liriodendron tulipifera* | yellow poplar | 82 | 9 | 8 | 37 |
| *Quercus alba* | white oak | 82 | 16 | 25 | 37 |
| *Quercus palustris* | pin oak | 41 | 48 | 55 | 48 |
| *Cornus amomum* | silky dogwood | 41 | 43 | -- | -- |
| *Liquidambar styraciflua* | sweetgum | 41 | 13 | -- | -- |
| *Physocarpus opulifolius* | ninebark | 41 | 40 | -- | -- |
| *Prunus americana* | American plum | 41 | 24 | --- | -- |
| *Quercus falcata* | southern red oak | 41 | 35 | 38 | 32 |
| *Cephalanthus occidentalis* | buttonbush | 41 | 53 | -- | -- |
| *Callicarpa dichotoma* | beautyberry | 20 | 40 | -- | -- |
| *Corylus americana* | hazelnut | 20 | 35 | -- | -- |
| *Pinus strobus* | eastern white pine | 14 | 4 | -- | -- |
| *Castanea dentata* | American chestnut | 7 | 56 | 66 | 24 |

Note: shrubs were not assessed in 2017, and too few sweetgum and pine were measured to report results.

## LITERATURE CITED

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