Silvopastoral practices sustain timber and forage production in commercial loblolly pine plantations of northwest Louisiana, USA

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Abstract. Four forage management treatments, bahiagrass, common bermudagrass, Coastal bermudagrass, and timber only were established in 26-year-old loblolly pine plantation. Pine growth data were collected in 1984, 1990, and 1995, and forage production was evaluated at 21-day intervals from April to October from 1991 through 1995. Forage management practices improved timber production, increasing five-year merchantable volume growth by 13 m$^3$ ha$^{-1}$. Mean five-year forage crop yields differed among treatments ($P = 0.05$) with daily dry matter yields averaging 39, 46, and 48 kg ha$^{-1}$ for bahiagrass, common bermudagrass, and Coastal bermudagrass, respectively. Forage nutritional quality did not differ among forage crops. Forage management treatment future net values were computed for a 5% real interest rate. Although the future net value for bahiagrass and common bermudagrass exceeded Coastal bermudagrass, the mean forage crop future net value was similar to the timber only treatment.

Introduction

In the southeastern United States, evidence suggests that Native Americans practiced ‘forage forestry’ by burning the woods to stimulate forage growth and to guide animal movement (MacCleery, 1992). These practices were adapted and used for livestock grazing during colonial times. Low density grazing of native forage in natural forests and planted pine plantations is still practiced throughout the southeastern United States. However, few landowners are aware that improved forage crops can be grown in commercial pine plantations by combining forage and timber management practices.

On soils typical to the Upper Coastal Plain of the southeastern United States, intensive management practices can enhance the annual growth of improved forage crops. Coastal bermudagrass (Cynodon dactylon) annual hay production averages 17,235 kg ha$^{-1}$ when nitrogen fertilizer is applied at 560 kg ha$^{-1}$ (Eichhorn, 1989). At similar fertilization rates, Coastal bermudagrass can support stocker steer liveweight gains of 900 to 1,100 kg ha$^{-1}$ (Green et al., 1989). Coastal bermudagrass forage production under the canopy of 30-year old mix loblolly (Pinus taeda L.)-shortleaf pine (Pinus echinata Mill) stand was maintained with fertilization, weed control, burning, and periodic
timber removal (Clason and Oliver, 1984). These management practices supported seven months of grazing at four animal units ha\(^{-1}\) (AUH) and produced 1.7 m\(^3\) ha\(^{-1}\) of lumber annually for 16 years.

Forage management practices can enhance growth of high-valued, solid wood products. Excellent sawtimber yields have been obtained at tree stocking rates recommended for adequate forage growth. Clason and Stiff (1980) reported 29-year sawtimber yields at 250 trees ha\(^{-1}\) (TPH) were 23 percent higher than 750 TPH, and individual tree volumes were four times greater. Herbaceous and hardwood vegetation suppression, which increases growth significantly in young pine stands (Nelson et al., 1981), would be maintained by forage management and subsequent grazing. Allen (1987) indicated that older stands usually respond better to nitrogen or nitrogen plus phosphorus than to phosphorus alone. Williams and Farrish (1995) determined that diameter increment increased an average of 24.5 percent over the control treatment during the two years following fertilization in 25 and 30-year old loblolly pine plantations. Jokela and Stearns-Smith (1993) found that cumulative stand basal area and volume growth response of fertilized 14–17 year old loblolly and slash pines (Pinus elliottii Engelm.) were greater than the unfertilized pines after eight years.

Biological and financial feasibility of establishing, growing, and grazing improved forage in commercially productive pine stands has been demonstrated (Clason, 1995). Coastal bermudagrass silvopastures were found to be acceptable land use management options because timber and forage growth benefited from fertilization and competing vegetation suppression. Although compatible management practices optimized short-term timber and forage yields, financial potential of a silvopasture depends on maintaining timber and forage production continuity on a sustainable basis. Therefore, timber and forage growth data from existing silvopastures growing under a mature loblolly pine canopy were used to evaluate longterm biological and financial implications of silvopastoral management.

**Methods and procedures**

Tree within four forage management treatments, Pensacola bahiagrass (B), common bermudagrass (CM), Coastal bermudagrass (CB), and timber only with no forage management (T), which had been established previously in a thinned 20-year-old loblolly pine plantation as part of a silvopasture study (Clason, 1995), were thinned at age 26. The predominant soil type of the study area was a Darley gravelly fine sandy loam (Typic Paleudults, clayey, kaolintic, thermic) with a loblolly pine 50-year site index of 26 m. The loblolly pine plantation was planted in 1964 at a density of 1,680 TPH and thinned in 1984 and 1990 to 247 and 124 TPH, respectively. Bahiagrass and bermudagrasses, were selected because they are the recommended improved forage crops for northwest Louisiana (Faw, 1985) and have performed well under a