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Week 2 Supplementary Paper:
Impacts of Forest Management on Soil in the Ouachita Highlands

Until recently, little has been known about the affects of forest management and harvesting on soils in the Ouachita Highlands of western Arkansas and southeastern Oklahoma. New research has provided glimpses into these affects and has created a platform for which future research may base itself.

Liechty, *et al.* (2002), published a review concerning changes in soil due to forest management practices and conclude:

1. Shortleaf pine-hardwood stands are increasingly susceptible to soil compaction with less than 15% rock content and sandy loam textures when harvested during wet weather
2. Single-tree or group selection harvesting methods concentrates traffic on fewer skid trails, thereby compacting these trails to a higher degree than is realized with other harvesting methods
3. Soil erosion from harvesting poses little risk to reductions in soil productivity
4. Management can alter soil nutrient status and organic matter contents, but these changes should not reduce soil productivity over short periods of time (3-8 years)
5. Fire regimes increases soil availability or contents of some macronutrients, which may increase productivity.
6. Little is known regarding the long term results of forest management on soils

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Encouragement into the following areas of research was provided:

1. Effect of soil physical properties, especially bulk density, on establishment and growth of shortleaf pine stands
2. Focus on soil/ecosystem processes after management practices rather than just characteristics of soil
3. Info needed concerning inputs/outputs, pools, and internal movement of nutrients in shortleaf pine ecosystems

Subsequently, Liechty, *et al.* (2005) conducted research to evaluate the differences in soil chemistry on restored shortleaf pine-hardwood stands and those stands without restoration efforts. It was found that "mineralizable N, total N, C, Ca, and pH of the surface soil were higher in restored stands than in stands without restoration activities" (345). Furthermore, Liechty, *et al.* found that foliar concentrations of N, P, K, and Ca were much higher in restored stands for at least 1 year following a prescribed fire. Thus, it is concluded that shortleaf pine-bluestem restoration activities may have increased nutrient availability and surface soil fertility and productivity.

Liechty's research into the chemical composition of soils and the foliar relationship provide vital insight into the previously unknown nutrient cycle of the Ouachitas. Such a holistic approach to research is necessary to correctly restore entire ecosystems, not just plant trees. The implications of a soil type with higher concentrations of macronutrients is

beyond the scope of this review, but for the common landowner, Liechty et al (2002 & 2005) provides valuable information for sustainable forest management: wet harvesting can create soil compaction, inhibiting biotic growth in these disturbed locations; by using single-tree or group selection harvest techniques, landowners might be able to concentrate the affects of harvesting to previously disturbed areas; management techniques should not alter the short term productivity of soils, and; periodic fire regimes can periodically boost soil availability and productivity.

References

Liechty H.O.; Shelton M.G.; Luckow K.R.; Turton D.J., "Impacts of Shortleaf Pine-Hardwood Forest Management on Soils in the Ouachita Highlands: A Review", *Southern Journal of Applied Forestry*, Volume 26, Number 1, 1 February 2002 , pp. 43-51(9)

Liechty, Hal O; Luckow, Kenneth R; Guldin, James M, "Soil chemistry and nutrient regimes following 17–21 years of shortleaf pine-bluestem restoration in the Ouachita Mountains of Arkansas", *Forest Ecology and Management* , 2005, Volume 204, Issue 2 , pp. 345 – 357