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Alternative methods for fuel reduction and forest restoration

Due to decades of fire exclusion, many southern forests are denser and have excessive quantities of down fuels compared to historic conditions. Recognizing this problem, forest managers have expressed the need for widespread treatments to restore ecological integrity and reduce the high risk of destructive, uncharacteristically severe fires. The ***Fire Fire Surrogate Study*** (http://ffs.fs.fed.us), a national network of long-term interdisciplinary research sites, is designed to increase understanding of the consequences of alternative management practices involving prescribed fire and mechanical/manual "fire surrogates."

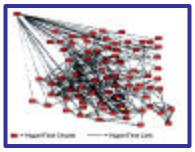
The objective of the Fire Fire Surrogate study is to quantify the initial effects of fire and fire surrogates by comparing **four core treatments**: prescribed fire, mechanical fuel treatments, a combination of mechanical fuel treatments and prescribed fire, and an untreated control. Within a core design, the effects of these treatments on vegetation, fuels and fire behavior, soils and forest floor, wildlife, entomology, pathology, and treatment costs and utilization economics are being examined at 13 sites across the United States.

I am working with **Ken Outcalt** (PI, SRS-4104) at two coastal plain FFS sites, one located in pine flatwoods in Myakka State Park, Sarasota County, Florida and the other located in upland longleaf pine at the Solon Dixon Forestry Education Center near Andalusia, Alabama. I am currently working on a study that compares the effects of fire and fire surrogate treatments on **microbial biomass**. Microbial activity is known to change following cutting and prescribed fire. However, no studies have *compared* the effects of these forest management practices on microbial biomass, nor have any studies looked at their *combined* effects. Microbial biomass can be a useful indicator of soil organic matter quality and nutrient availability, and therefore would be valuable in assessing the overall effect of fire and fire surrogate treatments on forest soils. I am also currently exploring ways of predicting the effects of fire and fire surrogate treatments on emissions. (*Cooperators*: Auburn University)

Using hyperdocuments for knowledge management

Land managers increasingly need improved access to research knowledge that is *thoroughly organized, condensed, and presented in a form that is useful for problem solving.* Hyperdocument technology provides the power to develop organized and compressed knowledge-bases, thereby improving the speed and accuracy with which data, information, and knowledge are managed.

Anyone who has accessed the World Wide Web has been exposed to hyperdocuments—a highly nonlinear and interactive mixture of text, graphics, images, video, and audio. This technology has many advantages that make it well suited for creating and publishing most types of documents: it can be easily accessed, it occupies little physical space, and it can be published cheaply and rapidly. And, unlike linear print media that is static and assumes a single, fixed skill level by the intended audience, hyperdocuments can be easily updated and manipulated to fit a variety of users.



I am currently working with Mike Rauscher (SRS-4101) on two projects that use hyperdocument technology to manage knowledge. The ***Encyclopedia of Southern Appalachian Forest Ecosystems*** synthesizes and integrates the past 65 years of research on southern Appalachian upland ecosystems in a hyperdocument-based encyclopedia system accessible over the Internet. The first version of this encyclopedia is scheduled for release in July 2002. (*Funded by*: National Research Initiative Competitive Grants Program; *Primary cooperators*: D.L. Schmoldt (CREES, USDA); P. A. Flebbe (SRS-4202); Cooperative Extension Service, University of Georgia; Artificial Intelligence Center, University of Georgia).

The second project, the ***Encyclopedia of Southern Fire Science,*** will synthesize and integrate the past 50 years of fire research and translate it into an Internet-based, hyperdocument encyclopedia. This first version of this encyclopedia is scheduled for release in December 2004. (*Funded by*: National Fire Plan; *Primary cooperators*: Cooperative Extension Service, University of Georgia; Artificial Intelligence Center, University of Georgia, Auburn University).

Selected publications:

Kennard, D.K., Rauscher, H.M., Schmoldt, D.L., and Flebbe, P.A., Jordin, B., Hubbard, W.G., Covington, M.A., and Rushton, N. 2001. Using Hyperdocuments for Knowledge Management: An Encyclopedia of Southern Appalachian Forest Ecosystems. IN: Johnsen, Kurt; H. Michael Rauscher, William G. Hubbard; eds. Southern Forest Science Conference Proceedings; 2001, November 2628; Atlanta, Georgia; Southern Regional Extension Forestry, Office of Information Technology: Item 3: 6 pp. [CD-ROM].

Hicks, R.R., Kennard, D.K., Rauscher, H.M., Schmoldt, D.L., and Flebbe P.A. 2001. Silviculture and Management Strategies Applicable to Southern Upland Hardwoods. IN: Johnsen, Kurt; H. Michael Rauscher ; William G. Hubbard; eds. Southern Forest Science Conference Proceedings; 2001, November 26 -28; Atlanta, Georgia; Southern Regional Extension Forestry, Office of Information Technology: Item 3: 6 pp. [CD-ROM].

Spatial variation in fire intensity

Fire intensity can vary at fine spatial scales depending on local differences in fuel loads, relative humidity, and wind. This spatial variation in fire intensity, i.e., patchiness, is a characteristic feature of most fires, and provides a critical mechanism to alter spatial patterns of regeneration. No studies, however, have examined the spatial pattern of fire intensity and its effects on resource availability and regeneration in the fire-prone systems of the southeastern coastal plain. Using geostatistics, I am exploring whether the spatial variation in fuel loads and fire intensity are strong predictors of post-fire variation in soil microbial biomass and plant establishment in longleaf pine forest. Semi-variance analysis provides a means for revealing whether there is a spatial component to variability (is there patchiness?), the robustness of the pattern (how distinct are the patches?), and the scale over which autocorrelation occurs (patch size). This study is currently being carried out within burn treatment plots of the Fire Fire Surrogate Study, located at the Solon Dixon Forestry Education Center, Andalusia, Alabama.

Effects of fire and other disturbances on tropical dry forests

The Chiquitania region in eastern Bolivia contains one of the largest and most diverse tropical dry forests in the neotropics. Due to recent expansion in industrial agriculture and settlement, this area is also considered one of the most endangered ecosystems in South America. Consequently, there has been a growing interest on the part of the Bolivian government to discourage the conversion of forests to competing, non-forest land uses by fostering natural forest management practices. Yet, in most managed dry forests in this region, sustainable management is threatened by a distinct lack of regeneration among valuable timber species. This problem may be due to harvesting operations, which, in this region of Bolivia, typically create relatively modest disturbances in residual stands. The majority of commercial timber species in these forests are shade-intolerant and likely require more intense disturbances for their establishment. Therefore, in the mid-1990's, a US-Bolivian funded forest management project (BOLFOR) began to explore additional treatments, such as prescribed burning, as tools to enhance the regeneration of these shade-intolerant species.

As a part of this focus, my doctoral research at the University of Florida examined the effects of fire and other disturbances on forest regeneration at a site in southeastern Bolivia (Lomerio, Department of Santa Cruz, 16°45'S, 61°45W). The forest I worked in was owned and managed by the Chiquitanos, the largest of the lowland indigenous groups in Bolivia. I examined the effects of four treatments (high-intensity burn, low-intensity burn, above-ground plant and coarse debris removal, gap control) on commercial tree regeneration, soils, and community structure and composition over a period of 18 months. The results of these studies, in general, revealed that by reducing competition, exposing mineral soils, and increasing available forms of nutrients, controlled burns can enhance the seedling establishment, growth, and survival of certain shade-intolerant species. However, the high intensity burn treatments in this study changed soil structural properties in ways that could inhibit seedling establishment and growth over longer periods, particularly after the initial increase in soil nutrients returns to background levels. I plan to resample these treatment plots after 5 and 10 years to gain a better understanding of the benefits of prescribed burning at this forest site.

Selected publications:

Kennard, D.K., K. Gould, F.E. Putz, T.S. Fredericksen, F. Morales. 2002. Effects of disturbance intensity on regeneration mechanisms in a tropical dry forest. Forest Ecology and Management. (In press).

Kennard, D.K. 2002. Secondary forest succession in a dry tropical forest: patterns of development across a 50-year chronosequence in lowland Bolivia. Journal of Tropical Ecology 18: 55- 66.

Kennard, D.K., and H. L. Gholz. 2001. Effects of high and low intensity fire on soil properties and plant growth in a Bolivian dry forest. Plant and Soil 234: 119 -129.

Fredericksen, T.S., M.J. Justiniano, B. Mostacedo, D.K. Kennard, L. McDonald. 2000. Comparative regeneration ecology of three leguminous timber species in a Bolivian tropical dry forest. New Forests 20:45-64.

Kennard, D.K., T.S. Fredericksen, B. Mostacedo 2001. The potential of prescribed fire for the management of timber species in dry forests: A case study from Lomerio. *In*: Regeneracion y Silvicultura de Bosques Tropicales en Bolivia. B. Mostacedo and T.S. Fredericksen (Eds.) Proyecto de Manejo Forestal de Sostenible (BOLFOR), Santa Cruz, Bolivia.

Fredericksen, T.S., and D.K. Kennard. 1999. Guia Para la Realizacion de Quemas Controladas (Guide to Conducting Controlled Burns). Proyecto de Manejo Forestal de Sostenible (BOLFOR), Santa Cruz, Bolivia.

Kennard, D.K. 1998. Promising aspects of controlled burns in Bolivian forests. Boletin BOLFOR, Edition No.13., BOLFOR, Santa Cruz, Bolivia.

Fredericksen, T.S., B. Mostacedo, and D.K. Kennard. 1998. Is competing vegetation inhibiting regeneration of Bolivian forests? Boletin BOLFOR, Edition No.13., BOLFOR, Santa Cruz, Bolivia.

Other Selected publications

Chapman, C.A., R.W. Wrangham, L.J. Chapman, D.K. Kennard, and A.E. Zanne. 1999. Fruit and flowerphenology at two sites in Kibale National Park, Uganda. Journal of Tropical Ecology 15: 189- 211.

Stem, M.J., K. Goodell, and D.K. Kennard, 1999. Local distribution of *Chusquea tomentosa* (Poaceae: Bambusoideae) before and after a flowering event. Biotropica 31(2): 7882

Kennard, D.K. 1998. Biomechanical properties of tree saplings and free-standing lianas as indicators of susceptibility to logging damage. Forest Ecology and Management 102: 179191.

Kennard, D.K., F.E. Putz, and M.Neideriholer. 1996. Predictability of decay based on visual assessments. Jou rnal of Arboriculture 22: 249 -254.

Kennard, D.K. 1995. Capparaceae. *In*: Tree Flora of Sabah and Sarawak. Volume I. E. Soepadmo and K.M. Wong, (Eds.) Ampang Press Sdn. Bhd., Kuala Lumpur.