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Development of a web-based application for agroforestry planning and tree selection

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Abstract

Agroforestry is currently being promoted in the Southeast United States as a land use strategy that can provide additional products and income as well as environmental and conservation benefits. For effective agroforestry planning, landowners and extension agents require information on potential tree and shrub components as well as geographic information for specific sites. The Southeastern Agroforestry Decision Support System (SEADSS) is a web-based application being developed to assist landowners and extension agents in the Southeast United States evaluate potential sites and suitable tree and shrub species for agroforestry planning. SEADSS offers on-line access to county-level spatial information, such as topography, hydrology, soils and land use, which are essential in evaluating potential agroforestry sites and suitable species. SEADSS links a geographical information system component with a subtropical tree/shrub database, which enables the user to query for biophysically suitable and economically and managerially desirable trees and shrubs. Species selection is achieved through Structured Query Language queries that are called and executed using Active Server Pages. When the end user selects a county and location of interest, climate and soil parameters are passed to the database and queries select the trees and shrubs that satisfy the biophysical parameters. Furthermore, the user can narrow the search for appropriate species by selecting particular management, propagation, product and services criteria within the web-based application. Tree and shrub species results are hyperlinked allowing the client to view additional species-specific information including access to documents and photographs. The SEADSS prototype was initially tested by Alachua County, Florida extension agents and will undergo a thorough testing and evaluation phase with a group of Northwest and Central Florida extension agents and landowners. Based on recommendations from targeted end users, SEADSS will be updated and expanded to provide an efficient agroforestry extension and planning tool.

Keywords: Agroforestry; Species selection; Decision support system; Geographical information system

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1. Introduction

Landowners in the Southeast United States are presently being encouraged to adopt agroforestry practices as a land use strategy that can provide additional products and income as well as environmental and conservation benefits (Workman et al., 2002). Agroforestry, the intentional combination of trees or shrubs with crops and/or animals, is a land use approach which aims to optimize biological interactions between system components and in turn, reduce soil erosion, decrease energy and chemical inputs, improve water use efficiency and quality, and increase productivity and economic returns for landowners (Peters, 2000). The concept of agroforestry is regarded as a bridge between agriculture and natural resource conservation (Rietveld and Irwin, 1996). Integrating agroforestry into the rural landscape offers a means to increase tree cover, which improves aesthetics, biodiversity and conservation in addition to the livelihoods of rural communities.

Several agroforestry systems are being promoted in the Southeast United States with different economic and environmental objectives. These systems are categorized into five major types of agroforestry practices (Association for Temperate Agroforestry, 1997; Williams et al., 1997). Alley cropping entails the planting of crops in alleys between widely spaced rows of trees. Trees planted in single or multiple rows can be utilized for pulpwood, lumber, firewood, fencing, fruits or nuts, depending on the species, while cash crops, such as corn, squash, hay or cotton, provide a steady income source (Workman et al., 2002). Silvopasture, which is the most common agroforestry practice in the Southeast, involves intentionally incorporating trees into livestock or forage production systems (Zinkhan and Mercer, 1997). Trees in silvopastoral systems provide shade for animals and wildlife habitat and economic benefits can include timber or supplemental feed (Williams et al., 1997). Windbreaks are rows of trees typically planted around homes, farms, fields or pastures and incorporated into crop or livestock systems as a means of wind and frost protection or used to help reduce dust, odor or noise (Brandle et al., 1995). Windbreaks also provide cover and food for wildlife (Wight, 1999). Riparian buffers are vegetative strips that include trees and/or shrubs along streams and waterways (Williams et al., 1997). Within agricultural landscapes, riparian buffers have a crucial role in reducing runoff and controlling agrochemicals and nutrient loads in the water, which help improve water quality and reduce soil erosion (Schultz et al., 1995). Trees and shrubs within riparian buffers can also provide a variety of timber and non-timber products. Finally, forest farming is the practice of utilizing already forested land to produce specialty products which in the Southeast include pine straw, honey, shiitake mushrooms, saw palmettos, herbs, wildflowers and berries (Workman et al., 2002). Different agroforestry options depend on a landowner's land use and economic and environmental needs.

Research and extension efforts promoting agroforestry technologies in United States began in earnest in the 1990s as a means to implement sustainable agriculture and maintain small family farms and private landowners as important economic and social components in rural landscapes. In the Southeast, non-industrial private landowners are an important economic source of forest products, owning over 70% of forested rural lands (Zinkhan and Mercer, 1997). Additional production of forest products with agroforestry technologies on agricultural lands that are underutilized or out of production shows a lot of economic promise for rural areas in the Southeast. The United States Department of