PLACE-BASED APPROCHES FOR SUSTAINABLE LOBLOLLY PINE CULTIVATION FOR BIOENERGY IN VIRGINIA

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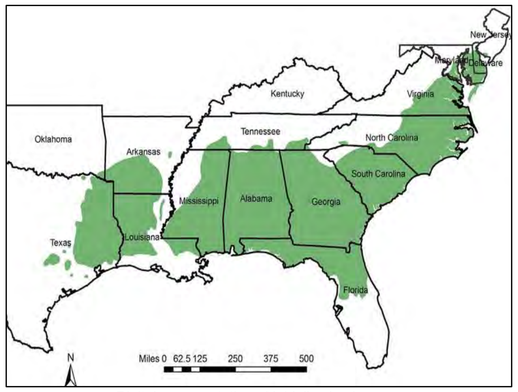
Introduction

The US government has emphasized the need to develop renewable energy sources and biofuels have emerged as a favored alternative. Domestically produced biofuels can reduce the demand for petroleum imports and enhance the country's energy security, diversify energy sources, potentially reduce greenhouse gas emissions, and provide a range of socioeconomic and environmental benefits. Among biofuels, cellulosic feedstocks offer the potential to reduce the diversion of food grains (corn) for energy production thereby eliminating the food vs. fuel debate. Loblolly pine (*Pinus taeda*) is a perennial evergreen tree found throughout southern United States, and is important for commercial timber. It grows quickly, has low maintenance needs, long life expectancy, and is a dependable source of woody biomass.

Digital representation of loblolly pine in http://texastreeplanting.tamu.edu/Display_Onetree.aspx?tid=61

The project aims to design place-based bioenergy expansion strategies that suit specific geographical attributes, are sustainable, economically viable, and socially desirable. To this end, we use geographical information systems (GIS) based fuzzy logic analysis to help better decision making and policy development, benefit the agricultural sector, and support rural economies.



Digital representation of loblolly pine in southern US. *Source: Perdue et al., (2017)*

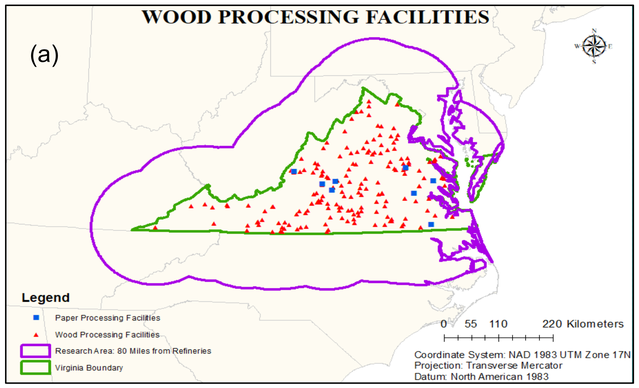
Objectives

- Identify, reclassify and collate biophysical factors that impacts loblolly pine production such as topography, soil texture, regional temperature and precipitation, and land use land cover.
- Use GIS based suitability modeling to identify regions for loblolly pine feedstock that can be used for bioenergy production in Virginia.

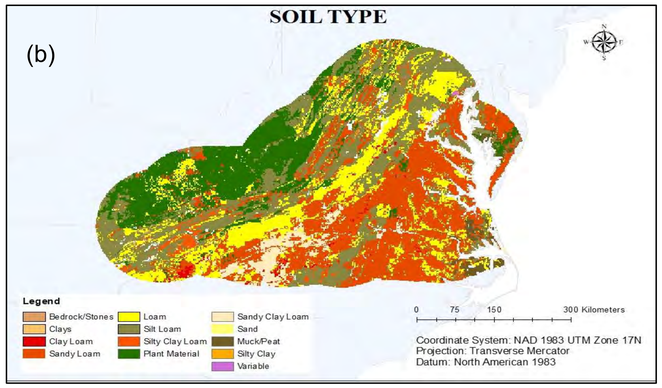
Methods

A GIS based suitability modeling was conducted to identify and allocate loblolly pine supply regions across Virginia, based on precipitation, temperature, slope, soil type, land use land cover. We generated GIS maps using data from USDA, USGS, using ArcGIS®. Potential biomass suitable regions were delineated based on an 80 mile radius centered on each operational wood processing facility (saw mills and paper mills), and above provide an estimate of the total amount of loblolly pine feedstock that can be potentially supplied to these processing facilities. Temperature and precipitation data were obtained from the Parameter-elevation Regressions on Independent Slopes Model (PRISM) Climate Group. Topographic conditions (slope and elevation) were derived from a national elevation dataset (NED). Soil classifications, e.g. percentage of clay, sand, silt, were gathered from SSURGO database and generated using SOILDATA Viewer®.

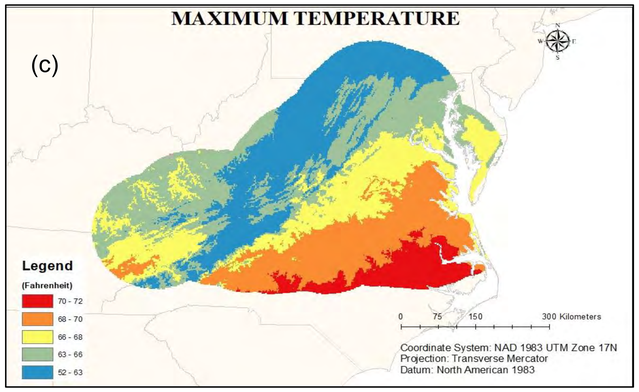
Results and Discussion



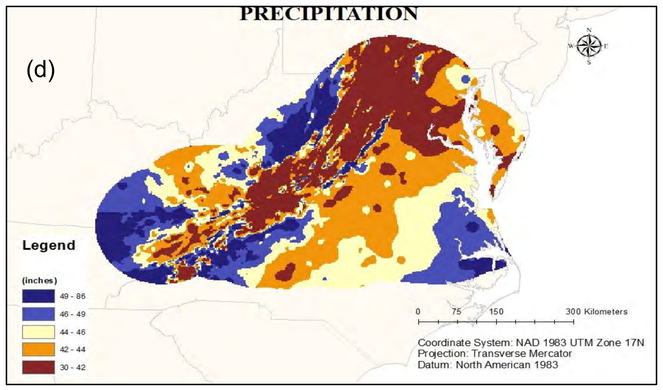
(a) This map presents a distribution of wood processing facilities in Virginia with an 80 mile buffer



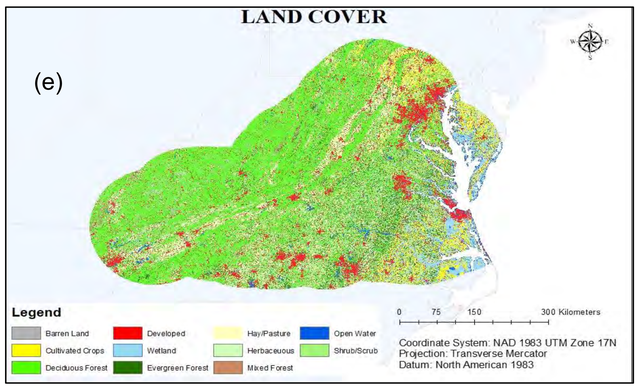
(b) Soil type map describes spatial distribution of soil classification in the study area



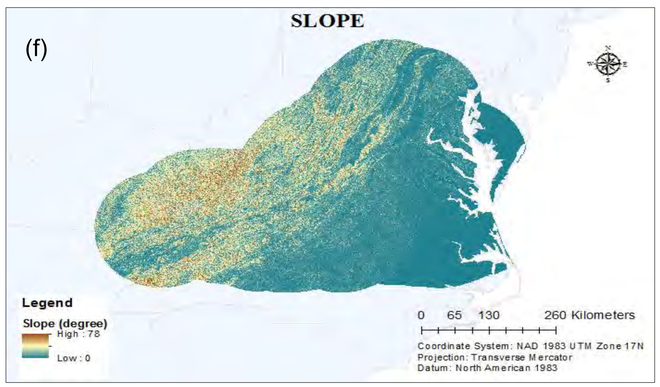
(c) This map shows the maximum annual temperature range for the period 1980 to 2010



(d) This map illustrates the average annual rainfall for the study area between 1980 to 2010



(e) This map shows the land use land cover over the study area



(f) This map describes the degree of slope in the study area

These layers will form the basis for delineating ideal growing conditions for loblolly pine and be inputs for generating fuzzy overlay functions. The rasters were resized to 30m resolution and projected from WGS to the regional coordinate system, which could introduce approximation errors. Soil classification data for two counties were not available and were thus not reflected in the corresponding raster layer. We assume that loblolly pine can be sourced from regions that are located within 80 miles from the wood processing facilities to optimize transportation costs

Future Work

We will designate information pertaining to optimal growing conditions for loblolly pine in Virginia and neighboring states. Based on the analysis of the raster data we compiled GIS maps that represent the biophysical factors that delineate regions that are suitable for loblolly pine production in Virginia. Our biophysical suitability modeling involved identifying possible influential biophysical factors that impact loblolly pine cultivation, reclassifying data to identify areas that are suitable and ones which are not, and finally collating these data into one logical result of optimal biophysical suitability. These raster layers form the basis for delineating growing conditions for loblolly pine in Virginia and be inputs for generating fuzzy overlay functions.

Acknowledgment

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