Center for Advanced Forestry Systems
2020 Annual Meeting Project Progress Report

PROJECT ID: CAFS.19.76

YEAR: 1 of 3

PROJECT TITLE: Assessing and mapping regional variation in potential site carrying capacity

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PROJECT DESCRIPTION:

Maximum site carrying capacity determines the number of individuals of a certain size per unit of area that a defined stand can support and maintain. The attribute is a complex function of species composition, genetics, environmental conditions, and stand structure. Prior research has indicated that maximum site carrying capacity is primarily determined by stand purity (% dominance by primary species), stand origin (natural vs. planted), site index, skewness of the diameter distribution, and an array of site growth limiting factors (climate, soil, relief). To date, forest carrying capacity research is regionalized and utilize multiple modeling approaches, which in turn leads to spatial and species modeling gaps across the US.

HYPOTHESES or OBJECTIVES:

The objective of this research project is to 1) synthesize a nationwide forest measurements database from publicly available data and from CAFS members, 2) standardizing maximum carrying capacity modeling, and 3) provide regionally relevant, national forest carrying capacity models.

METHODS:

Regional forest plot data will be collected for the following general regions: 1) Northwest, 2) West, 3) Northern Rockies, 4) Southwest, 5) South, 6) Southeast, 7) Ohio Valley, 8) Upper Midwest, and 9) Northeast US. Datasets will be collected from the USFS FIA program, State forest management agencies, and industry members. These datasets will be harmonized and associated with site growth factors in a GIS. A common statistical model, such as linear quantile mixed effects, will be used to assess the metric maximum stand density index or SDImax (i.e., forest carrying capacity) as a function of stand characteristics, species purity, and site growth factors within each broad region. Regional statistical site-species models will be imported to a GIS for creating raster maps of SDImax.

MAJOR FINDINGS:

A post-doc was identified and hired at the University of Idaho to lead project management and development. Database acquisition is occurring for the Northwest and portions of the Northern Rockies, soon to be expanded to the other regions identified in Methods. A first draft regional SDImax model for Douglas-fir and western hemlock has been developed for the Northwest.

DELIVERABLES:

The primary deliverables will include 1) a harmonized dataset that estimates the maximum stand density index (SDImax) for a range of study locations throughout US commercial forestlands; 2) an equation that relates the observed site-specific SDImax to various species functional traits, stand attributes (e.g., structure, diameter distribution, site index), and environmental factors (e.g., soils, topography, climate); 3) and a high-resolution (10-30 m) raster map of predicted SDImax based on the factors identified in the developed equation. Annual progress reports and presentations will be provided at annual IAB meetings as well as a final report and presentation. At least three peer-review publications and conference presentations will be expected from this project.

MEMBER COMPANY BENEFITS:

Determination of optimal planting or thinning residual densities are an important management decision that influences stand development and final value. Currently, most regions use a single value of SDImax for each species that guide stand density management decisions and growth and yield projections. However, there is growing evidence that SDImax is highly dynamic and variable across the landscape, which can make optimizing management decision or growth projections difficult. An improved understanding of SDImax variation and the ability to predict it at rather high spatial resolutions will help refine future stand management. In addition, this will allow for the use of a nationally consistent variable for defining management, while currently a wide variety of variables are used.