Site Type Initiative

Initiative to Characterize Principal Factors that Define Forest Site-Types

Mark Kimsey

IFTNC Annual Meeting

April 6, 2010

Site Quality v. Site Type

- A site type is one realization of the many potential realizations of the concept of site quality
  - Site Type: *A geospatially definable suite of climatic and edaphic variables modified by landform that interact to form a plant community with distinct carrying capacity and productivity.*
  - Low carrying capacity/productivity = Low site quality
  - High carrying capacity/productivity = High site quality

Drivers of Site Quality

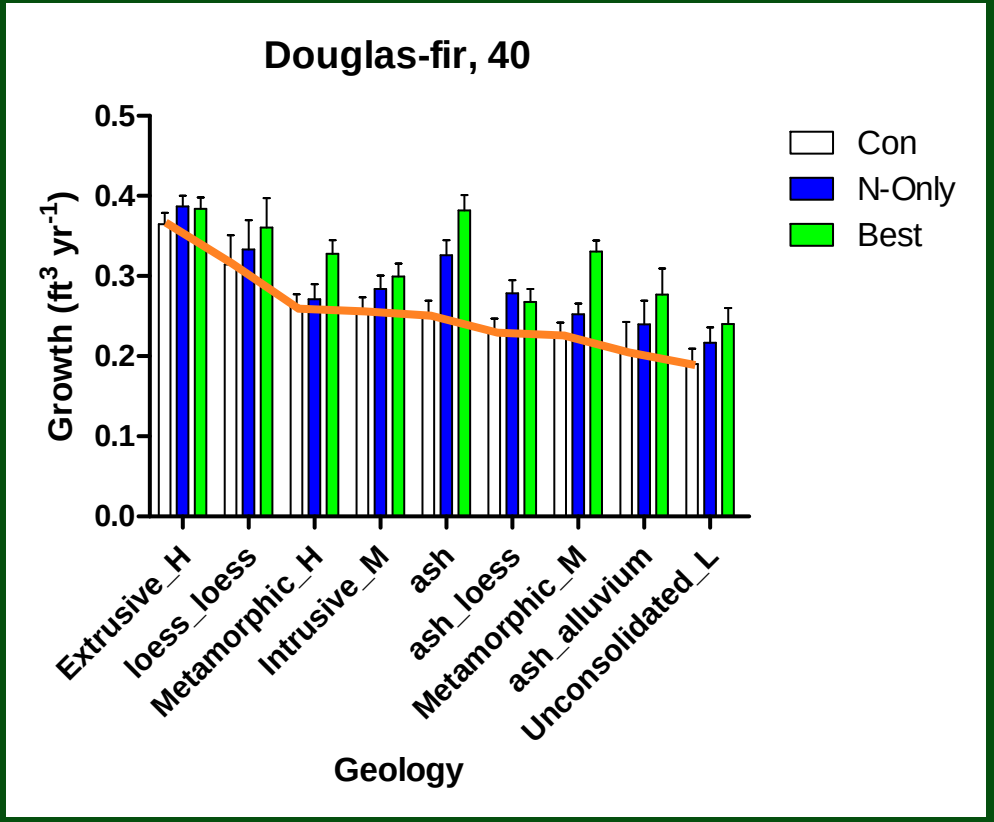
- Principal factors:
  - Light
    - Aspect, latitude, cloudiness, slope
  - Moisture
    - Precipitation, soil available water
  - Temperature
    - Soil/air temperature, elevation, slope/aspect
  - Nutrients
    - Parent material elemental composition, rock weathering, organic matter
- Site quality is an expression of a complex interaction among these factors

Context

- Management decisions based on current knowledge of site quality expressions of these complex interactions
- Ability to accurately predict site quality elusive
  - Process models include site factors that effect landscape NPP
    - Not applicable to the stand level
  - Empirical quantitative models capture 60-80% site variation
    - Typically applicable only to site types and datasets modeled
    - Rarely account for site nutrient status

Relevance

- IFTNC has shown that soil parent material influences site quality



Relevance

- Capture static vs. dynamic site factor effects
  - Static factors remain constant under management and climate change
    - Physiographic position, soil parent material
  - Dynamic factors respond to management and climate change
    - Moisture availability, temperature regimes
- Newly available digital spatial resources
  - Geology and soil layers
  - Climate data

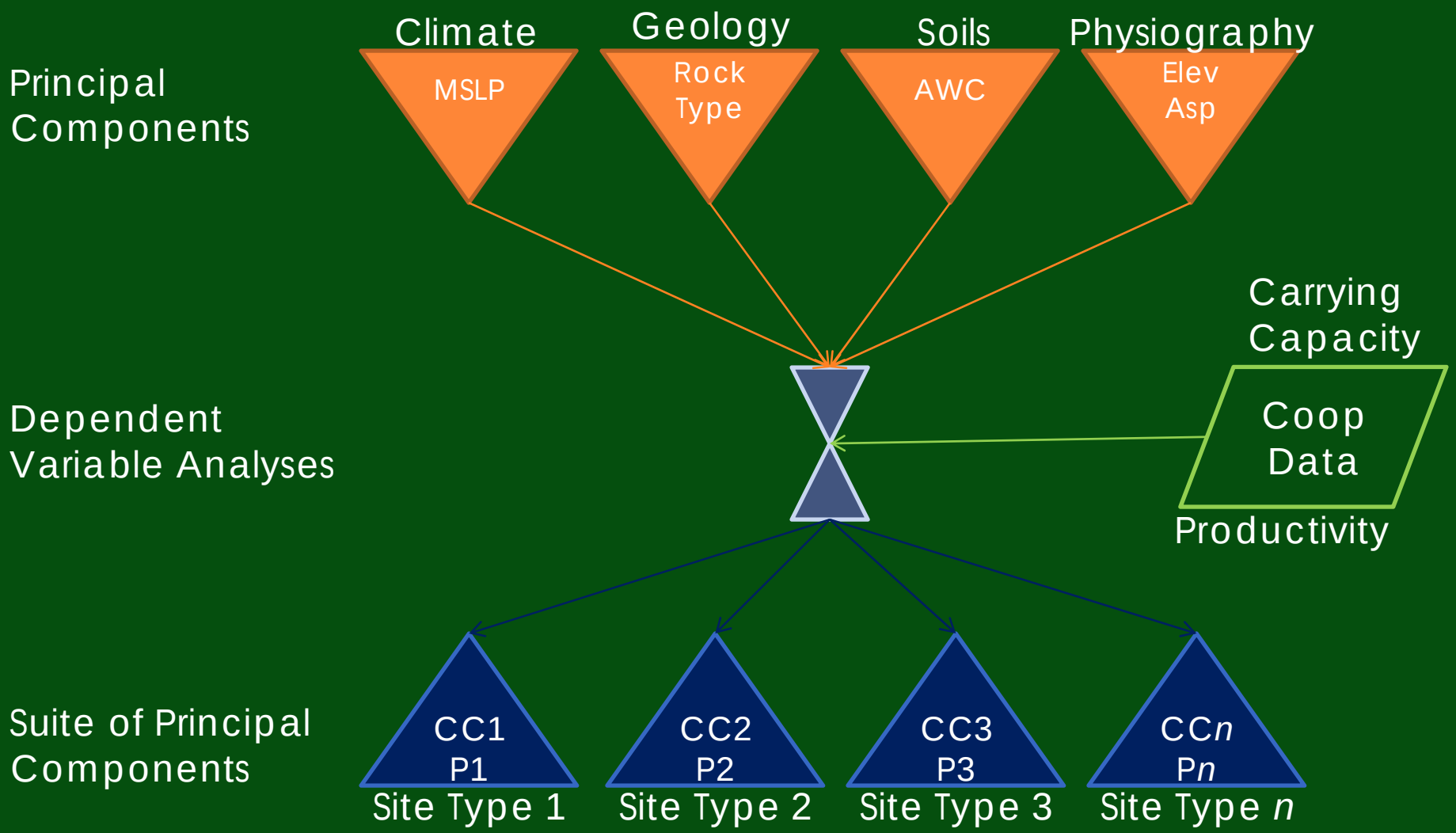
Question?

- Can integrating geology and surficial soils with climate and physiographic variables improve site quality models?

STI Objectives

- Identify site factors driving carrying capacity and optimal productivity
- Develop models to estimate site quality based on these identified factors
- Create regional, geospatial tools that predict site quality

Flow Chart View



Approach

- Collect CFI and cruise data from IFTNC cooperators
- Create two databases:
  - Single Entry: >10,000 plots
  - Multiple Entry: Plots filtered by density and development criteria
- Single entry datasets analyzed for carrying capacity
- Multiple entry datasets analyzed for productivity
- Stand/Plot coordinates linked to geospatial site factor layers

Site Type Measures

- Carrying capacity
  - Stand Density Index
    - Reineke's -3/2 self-thinning boundary line
    - Stratify densities by species and test for site affects on line intercept and slope
- Productivity
  - 2nd log analysis: height/age ratio, PAI volume
    - Control for density effects
    - Control for stand development

Statistical Modeling

- Stochastic Frontier Analysis
- Principal Components
- Clustering
- Linear/Nonlinear regression
  - Multiple Adaptive Regression Splines
  - Geographically Weighted Regression

Model Products

- Predictive Models
  - Mathematical equations defining relationships between site carrying capacity/productivity and site factors
- Geospatial Models
  - GIS-based productivity and density layers developed by predictive models

Management Products

- Define nutrient supply effects on site quality
- Establish which site factors respond to management and/or climate change
- Develop density targets for optimal growth range by site type
- Aid in species selection and target breeding efforts

Project Development

- Project Proposed: 2009 IFTNC SC Meeting
- Technical Advisory Meeting: July 2009
- Study Plan: Winter 2009

- Privacy agreements and data transfer: Spring 2010
- Hire Post-Doctoral Biometrician: May 2010
- Develop databases: Summer 2010
- Density/Productivity Analyses: Fall/Winter 2010/11

- Project Completion: Spring 2011
- Present Findings: 2011 Annual Meeting
- Publish Results: Summer 2011