

Vegetation Structure

Konrad Wessels
George Mason University

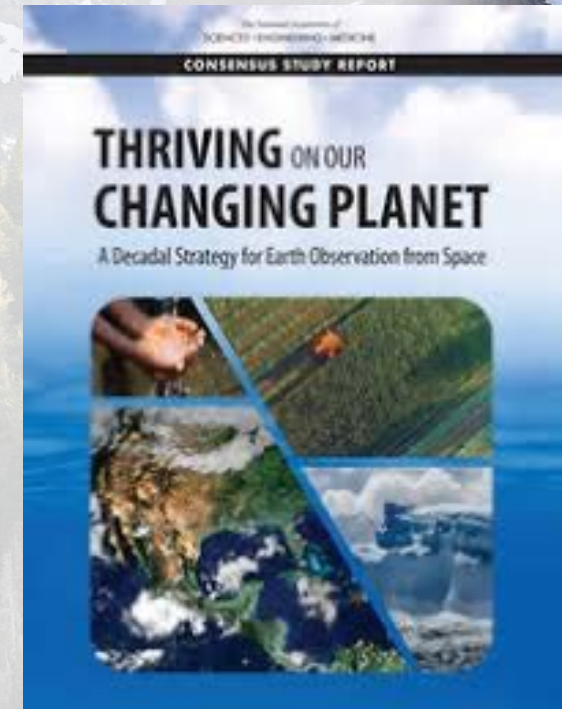
Science and Application Objectives:

- Ecosystem structure and function
- Carbon accounting
- Biomass inventory, dynamics and monitoring
- Biodiversity, Habitat structure and its response to disturbance
- Forest resources management
- Wildfire, fuel, risk and post-fire recovery

Vegetation Structure

Overarching Decadal Survey Questions/Goals:

1. What are the structure, function, and biodiversity of Earth's ecosystems, and how and why are they changing in time and space? (E-1) (most important)
2. What are the fluxes (of carbon, water, nutrients, and energy) within ecosystems, and how and why are they changing? (E-3) (most important)
3. How is carbon accounted for through carbon storage, turnover, and accumulated biomass? (E-4) (most important)
4. Are carbon sinks stable, are they changing, and why? (E-5) (most important)



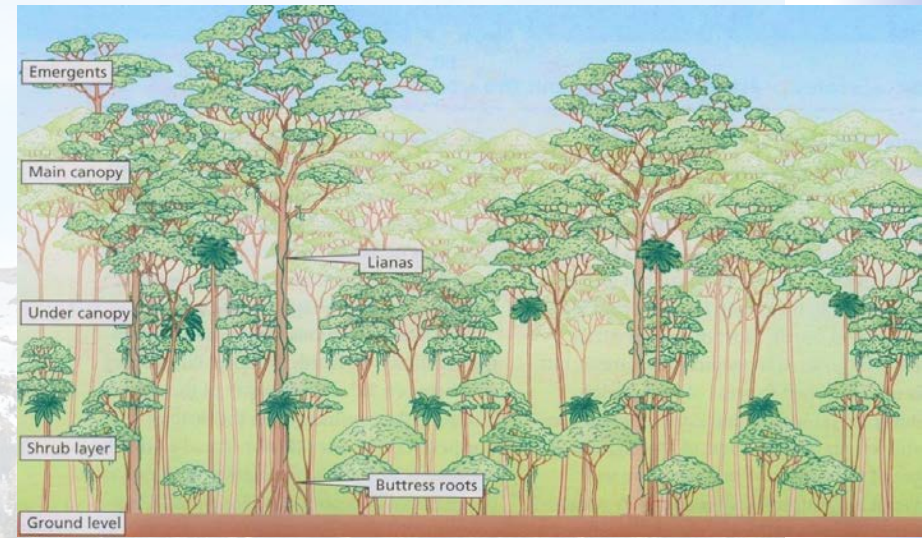
Vegetation Structure

DS Objectives

MI: Most Important

- (MI) E-1b.** Quantify the three-dimensional (3D) structure of terrestrial vegetation and 3D distribution of marine biomass within the euphotic zone, spatially and over time.
- (MI) E-2a.** Quantify the fluxes of CO₂ and CH₄ globally at spatial scales of 100-500 km and monthly temporal resolution with uncertainty <25% between land ecosystems and atmosphere and between ocean ecosystems and atmosphere.
- (MI) E-3a.** Quantify the flows of energy, carbon, water, nutrients, and so on sustaining the life cycle of terrestrial and marine ecosystems and partitioning into functional types.

Vegetation structure



- Definition (DS): Spatial distribution of plants and their components on land, and of aquatic biomass.
- Definition: 3D Configuration of above ground vegetation
- Veg structure has vertical and horizontal (spatial) components
- Measurement of vertical component of vegetation structure is an observation gap.

STV Incubation Study Objective



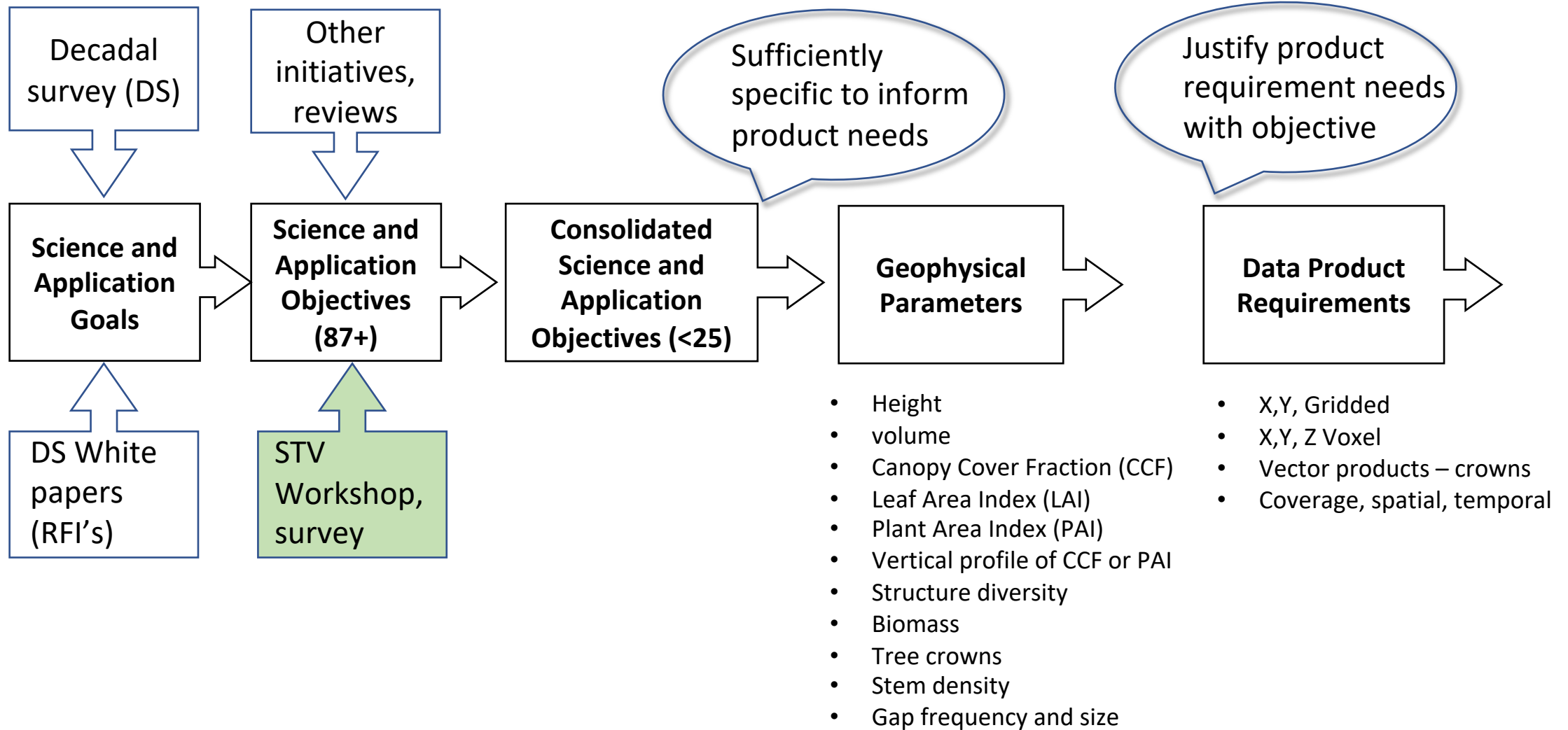
- Identify science and application needs and measurement gaps for: High-resolution vegetation structure products to **significantly improve the understanding of ecosystems**, including carbon stocks and fluxes, and relationships between biodiversity and habitat. (AO A54)
- Expand the Science and application questions and measurement needs expressed in DS.
- Breakout session objective: To collect community input for the study team about science questions and application needs, and data product requirements.
- Clear **justification** of what is needed to do your science and applications

Decadal Survey to STV incubation study



- User needs influenced by recent experience with specific data products and instruments.
- But what do we really need to address our science questions and applications at various scales?
- Default answer: 1m CHM, everywhere – currently not feasible
- We need to focus on what is actually needed to answer the science and application objective at a specific scale.
- This workshop focusses only on the science question, biophysical parameters needed and the properties of the data products – does NOT address the measurements, sensors, architectures, which will be covered in later workshops.

STV SATM Process: Veg structure

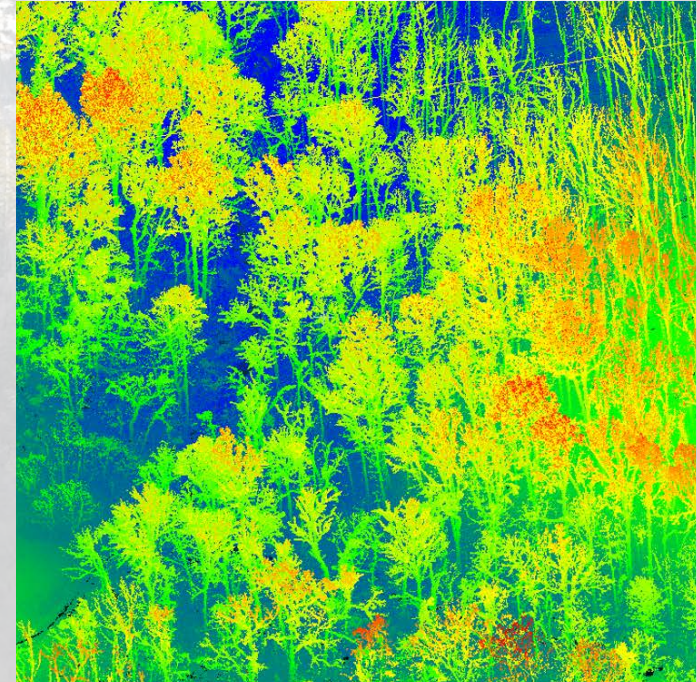


Summary of science and applications objectives

- Ecosystem structure and function
 - Carbon accounting
 - Biomass inventory, dynamics and monitoring
 - Biodiversity, Habitat structure and its response to disturbance
 - Forest Ecosystems, REDD+, Agroforestry, Commercial forestry, Deforestation monitoring
 - Wildfire, fuel, risk and post-fire recovery
 - Agriculture
 - Wetland monitoring
-
- Applications interweaved with science objectives
 - Seek additional questions from workshop / survey
 - Need to be consolidated to < 25 questions / applications – transfer to SATM for full description

Physical Parameters: Vegetation structure

- Height
- Canopy Cover Fraction (CCF)
- Leaf Area Index (LAI)
- Plant Area Index (PAI)
- Vertical profile of CCF or PAI
- Structure complexity
- Biomass
- Tree crowns
- Stem density
- Gap frequency and size



Data Product requirements

- XY
- Coverage, Spatial, temporal, accuracy, latency, change,
- Gaps:
 - Widespread, high resolution, 3D Vegetation structure
 - Biomass
 - Change – e.g. regrowth,

Summary

- Main challenge: Expressing data product requirements for 3D structure parameters in relation to science & applications objectives

