

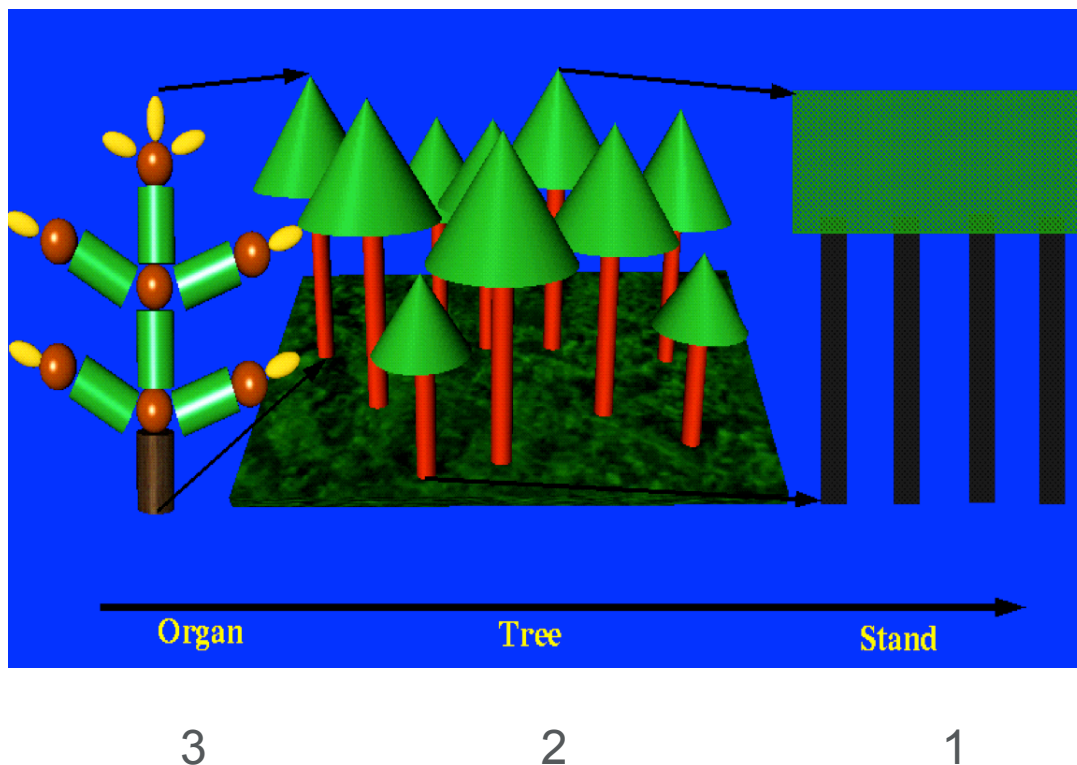
FSPMs and forest dynamics

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Models of stand dynamics

The dynamics of stand growth has been modeled in many disciplines: population biology, forestry, agriculture ...

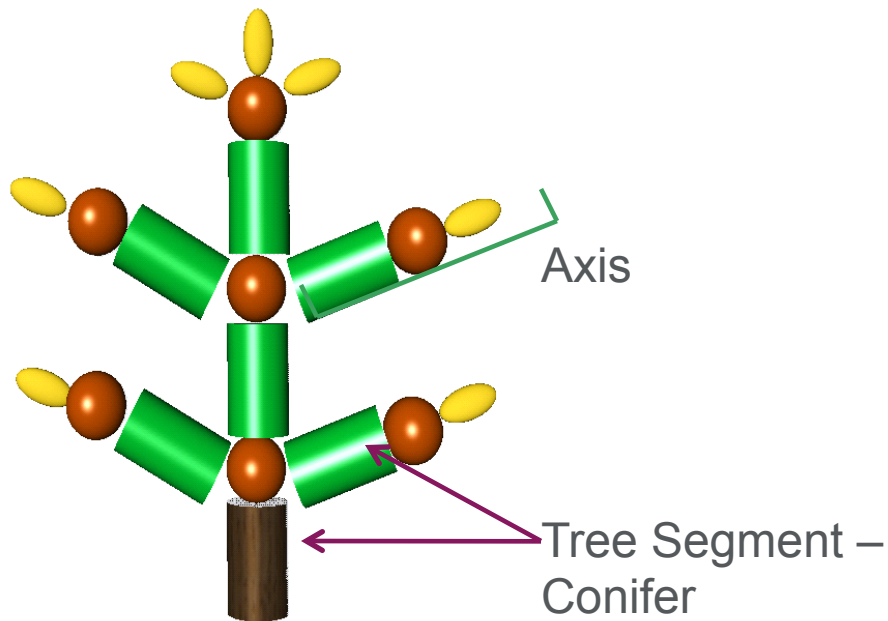
1. Models using stand level quantities e.g. total stem volume or biomass
Individual-based models
2. Trees as individuals
3. Plants as a population of parts → functional-structural models



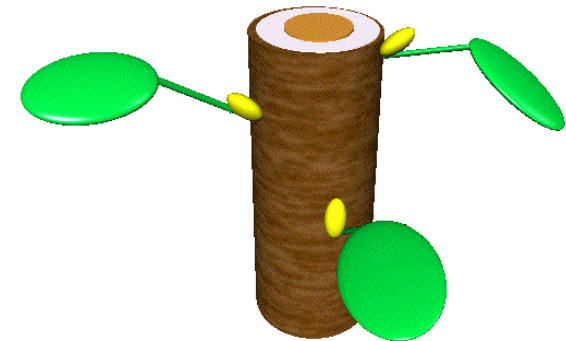
FSPMs

Plants as a population of parts → functional-structural plant models (FSPMs)

Examples of Structural units



Tree Segment – Deciduous tree



Tree Segment



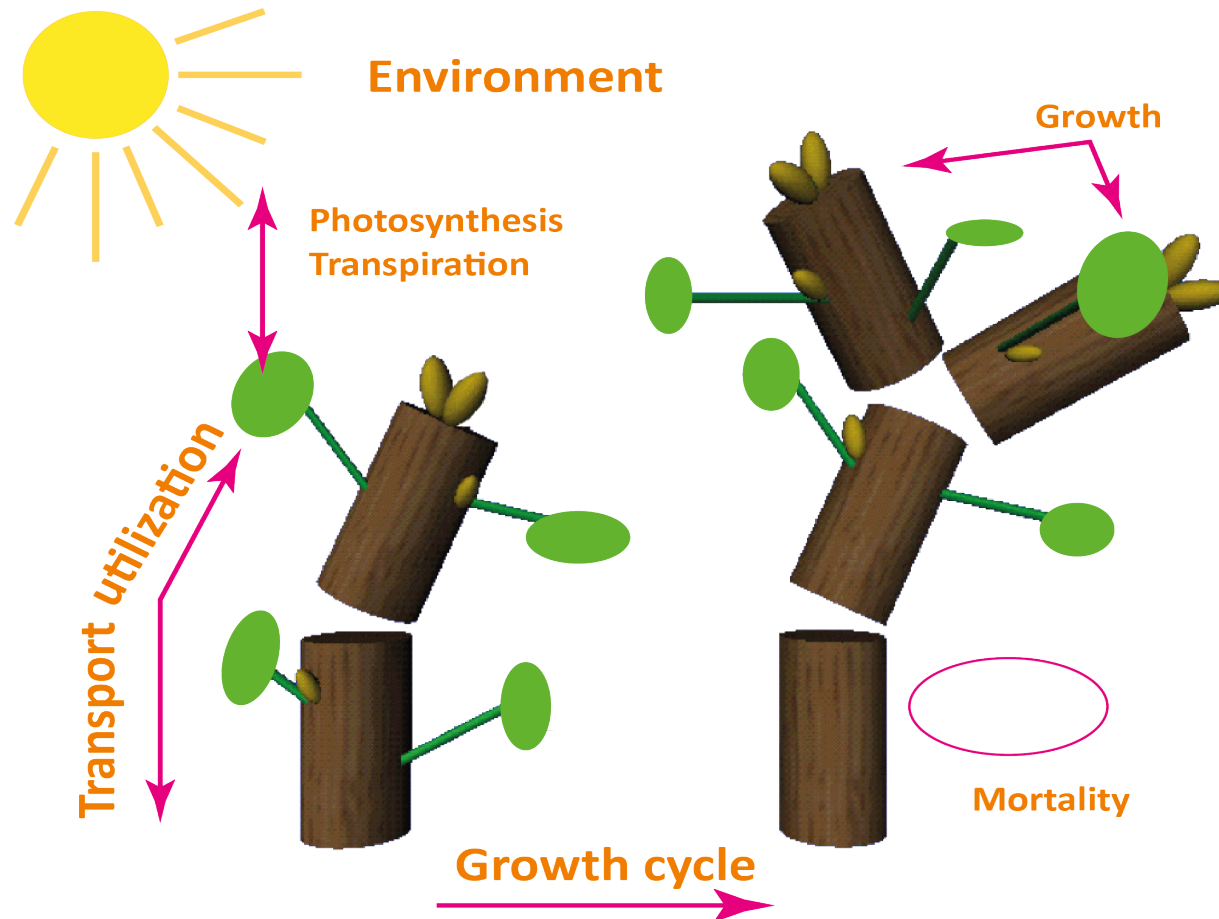
Branching Point



Bud

FSPMs

Plant as a population of parts – modular growth, local control of
1) proliferation of new parts, 2) formation of their properties, 3)
senescence



Functional-
Structural
Plant
Model

FSPMgrowth

FSPMs

(T)LS useful?

Rules for morphological development

Very much: smallest details & detection of foliage challenging

Growth engine (= material part of development)

Less useful, except hyperspectral LiDAR

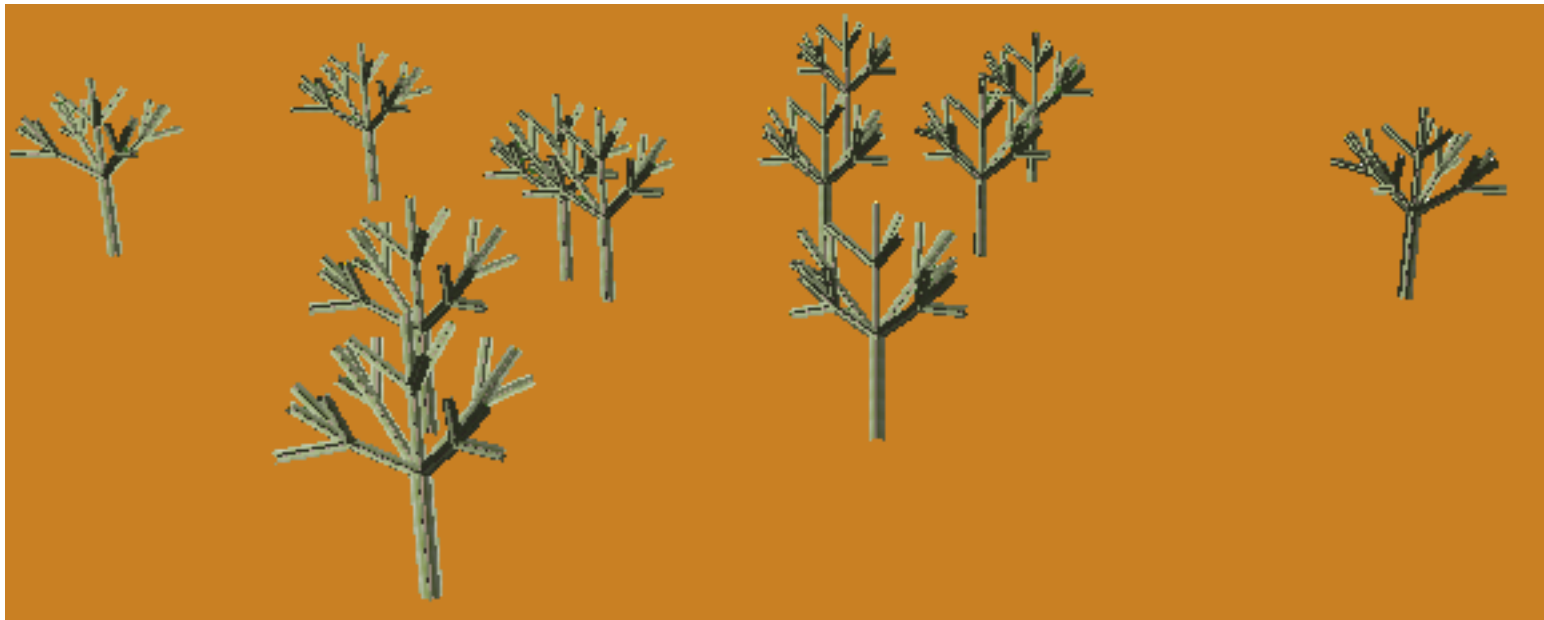
Senescence (mortality of structural units)

Very much: change detection at sub-crown level challenging

Tree stand dynamics

Trees at random locations on a 18 x 18 m plot (about 250 individuals)

Competition for radiation



Trees

Duel of trees, age 18



Age 20



Age 22



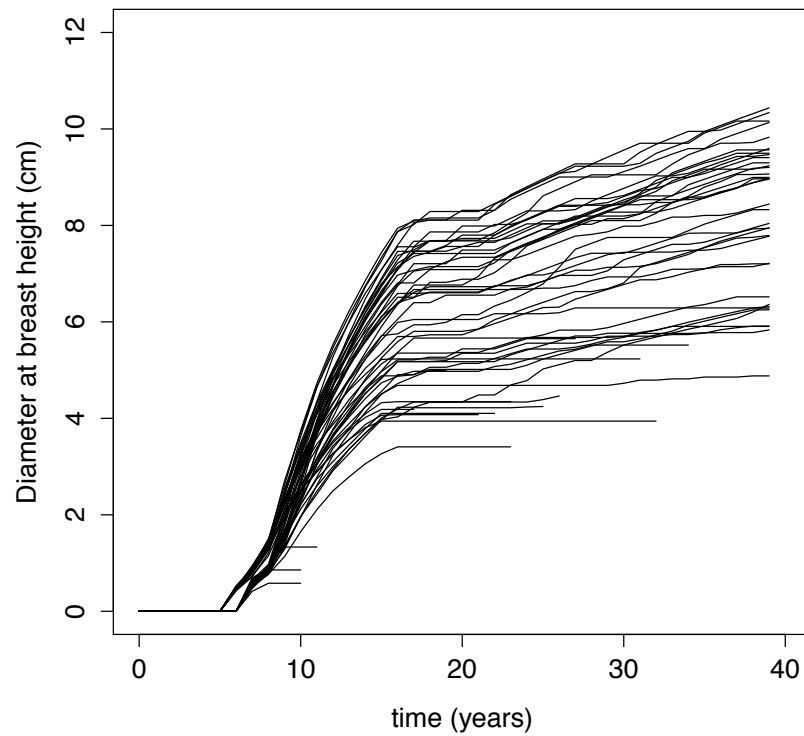
Age 24



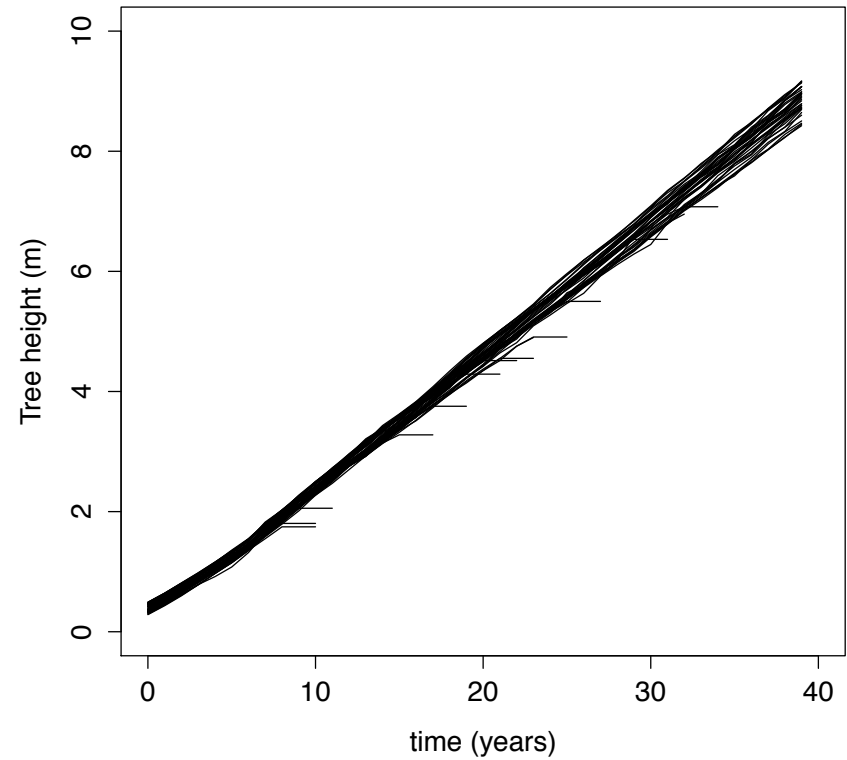
Age 26



Diameters



Heights



Challenges/opportunities

Study of general features (\approx empirical generalizations) observed in stands undergoing competition

- A validated FSPM may be used to study those relationships in different growth conditions
- Which properties/interactions built in the FSPM produce the stand level observed phenomena?

Acid test: getting stand dynamics right

- FSPMs tend to be complex, many unknown parameter values
- Need a large amount of data, still that may constrain poorly parameter values --- possibility of having right answers for wrong reasons
- TLS: both binocular and microscope to forest structure – excellent for model construction/validation
- Challenge: methods for using TLS data in model validation (topology, spatial distribution, their combination)
- Challenge: integration of TLS and physiological data for modeling

Thank you

