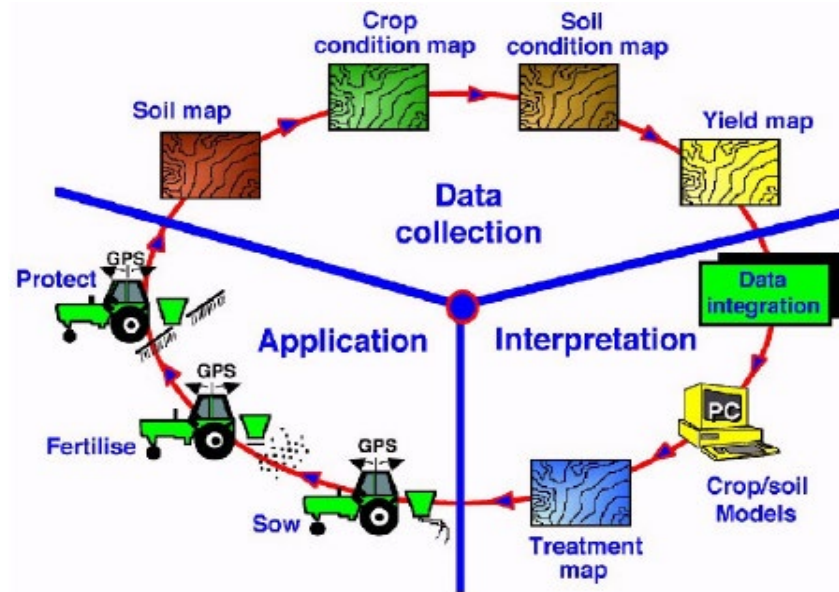# How can "precision forestry" use soils and remote sensing information to better inform management practices?
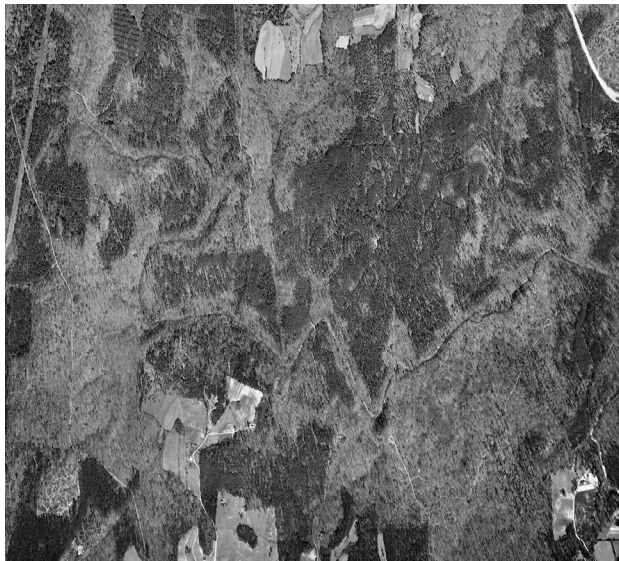
Iván Raigosa-García, Ph.D. student

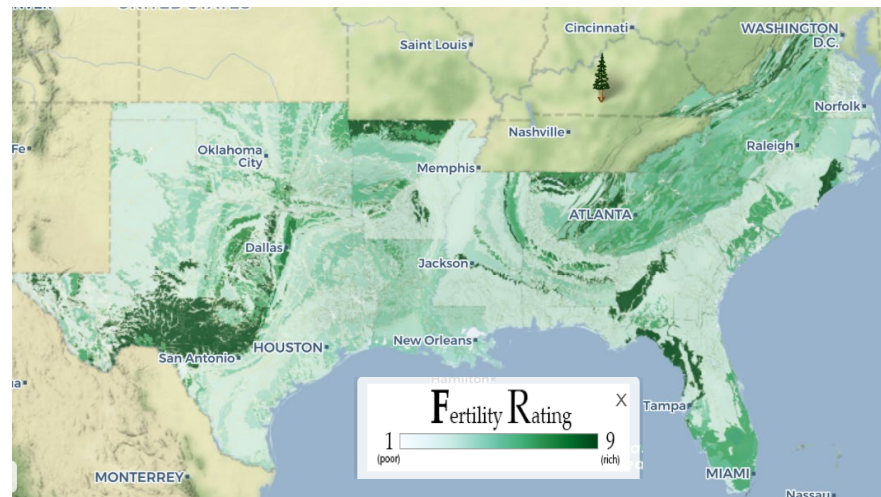SOFAC meeting, August 2022

Precision Agriculture
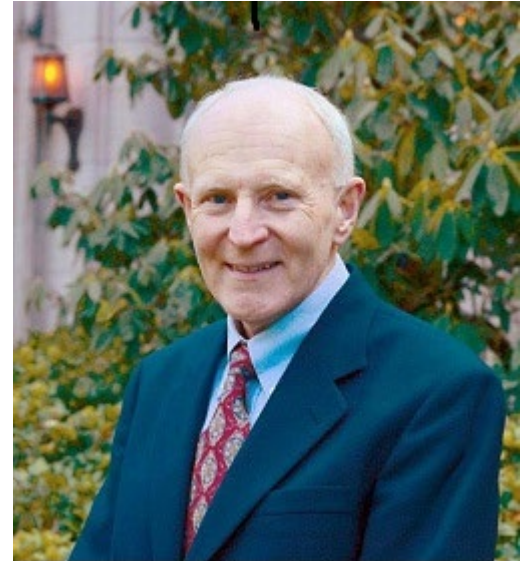
Precision Agriculture ➜ Precision Forestry

Source: https://stories.duke.edu/wp-content/uploads/2018/08/duke-forest-aerial-1955-1.jpg
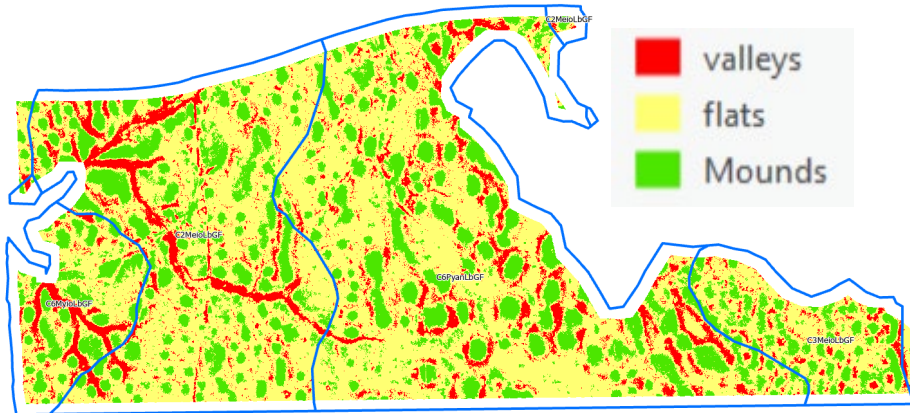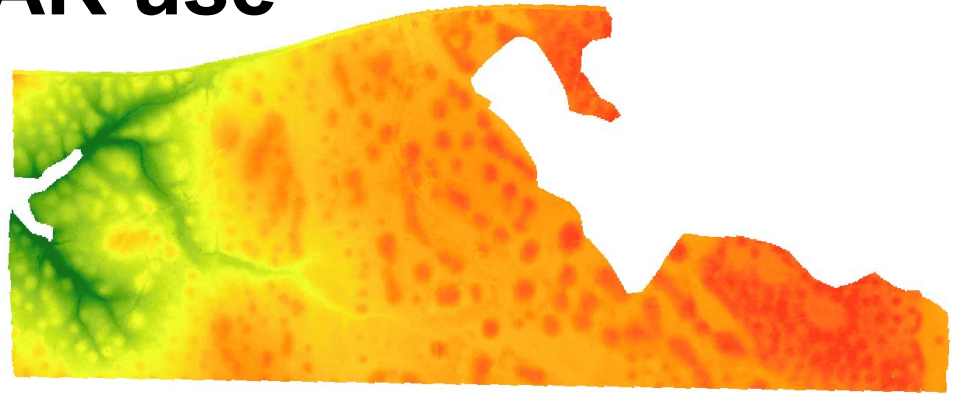
Precision Forestry

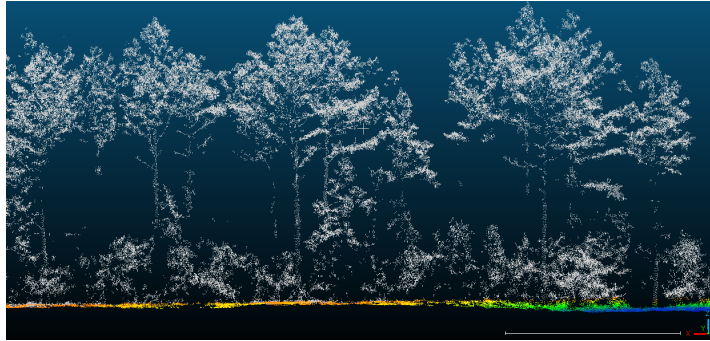*The goal of precision forestry is to deploy high-resolution data to support site-specific tactical and operational decision-making. This allows for highly repeatable measurements, actions and processes to grow and harvest trees, as well as to protect and enhance riparian zones, wildlife habitat, aesthetics, and other environmental resources.*

Professor B. Bruce Bare
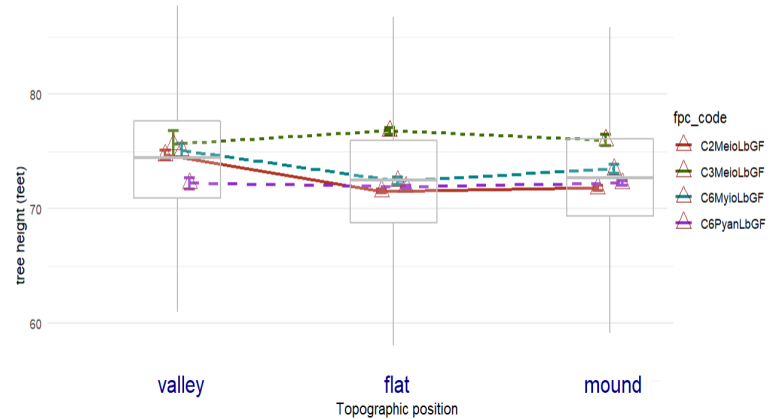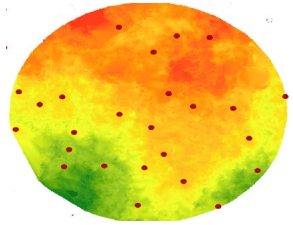*University of Washington*

LiDAR use

valleys
flats
Mounds

Tree height ~ Soil* Topographic position

fpc_code
C2MeioLbGF
C3MeioLbGF
C6MyioLbGF
C6PyanLbGF

tree height (feet)

valley   flat   mound

Topographic position

Precision Forestry Data

- Integration of remote sensing, soil, microtopography and climate data to to yield and growth models like FASTLOB

- Possibly changing the definition of stand

$$y = \phi \left[1 - exp\left(-\beta\left(Age\right)\right) \right]^{1/1-\gamma}$$

with:

$$\hat{\phi} = 235.994 - 112.423(pH) + 2.193(S) + 0.176(N)$$

$$\hat{\beta} = -0.123 + 0.545(T_e P_r)$$

$$T_e P_r = \frac{T_e}{P_r} x100$$

$$\hat{\gamma} = 0.92$$

Ramirez, Orrego, Restrepo (2020)

Financial Analysis

$$LEV = \frac{\sum_{j=0}^{t} CF_j (1+i)^{t-j}}{(1+i)^t - 1}$$

- Incorporate uncertainty to productivity maps.
- Uncertainty in LEV calculation due to:

Timber price variation, fertilizer prices, other costs.

Some questions:

- Where to apply fertilizer? (tree by tree basis depending on soil~topographical position).
- Where to plant?

Conclusions

- We could know now what is the growth response of every tree to its microsite conditions and the interactions among different levels of each variable. (a ridge position may be beneficial if the soil is poorly drained, for example)

- We could know what is the tree growth response to fertilization. Is it worth it? When we analyze stumpage price, fertilizer price and another cost.