

NRI: Robotics, Science and Forestry

Award: 2022-67021-36856

March 2022 – Feb 2026



The Team



Pratik Chaudhari (PI)
Assistant Professor,
ESE, CIS



Vijay Kumar (co-PI)
Professor and Dean,
MEAM, CIS, ESE



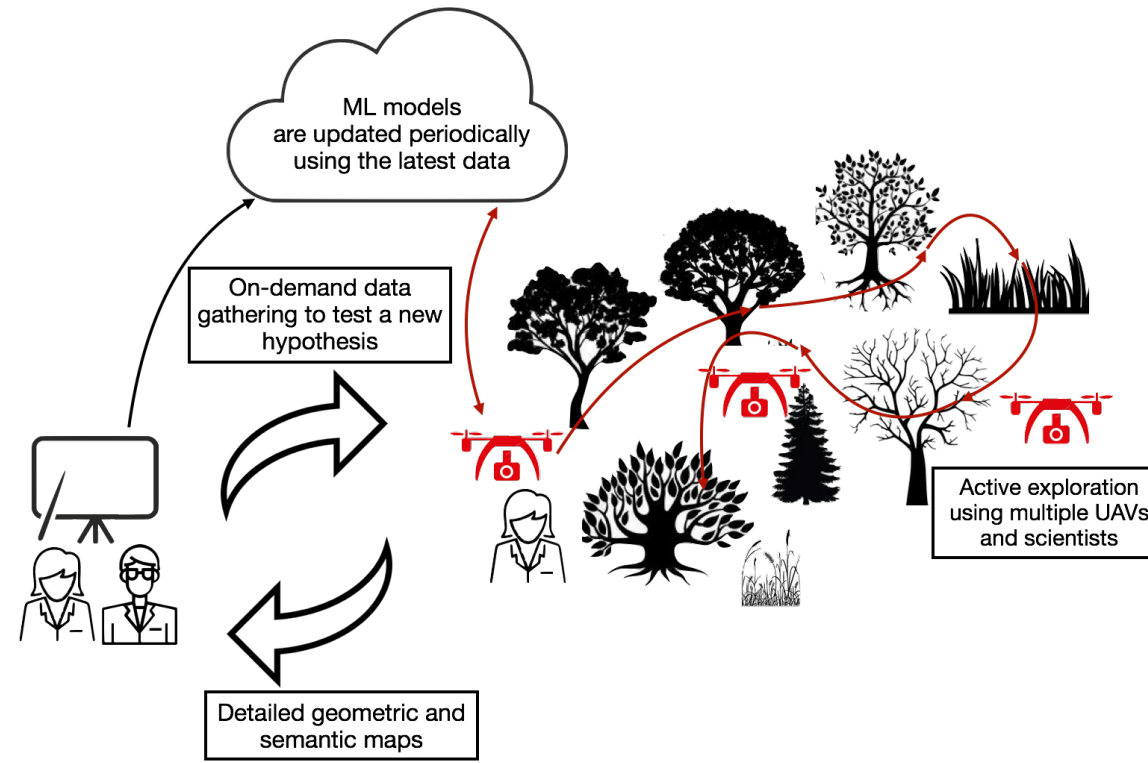
Harold Burkhart (PI)
Professor
Forest Resources & Environmental Conservation



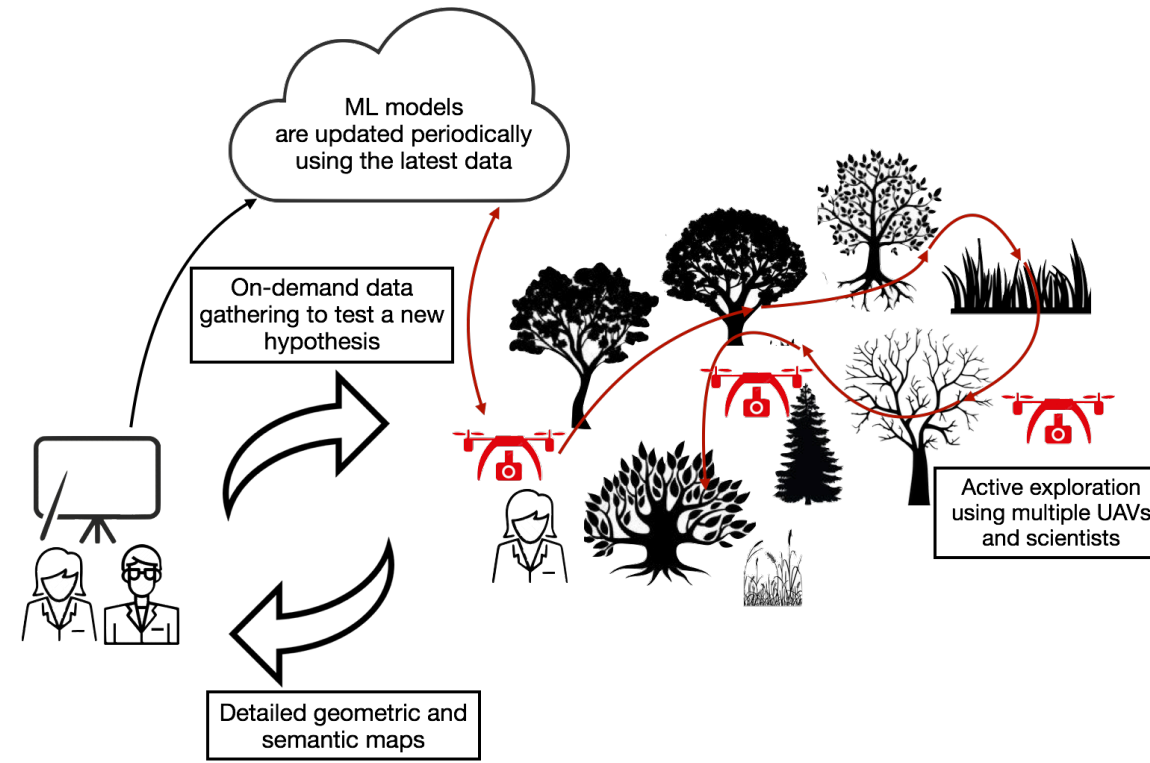
Patrick Corey Green (co-PI)
Assistant Professor
Forest Resources & Environmental Conservation



Research Vision and Goals



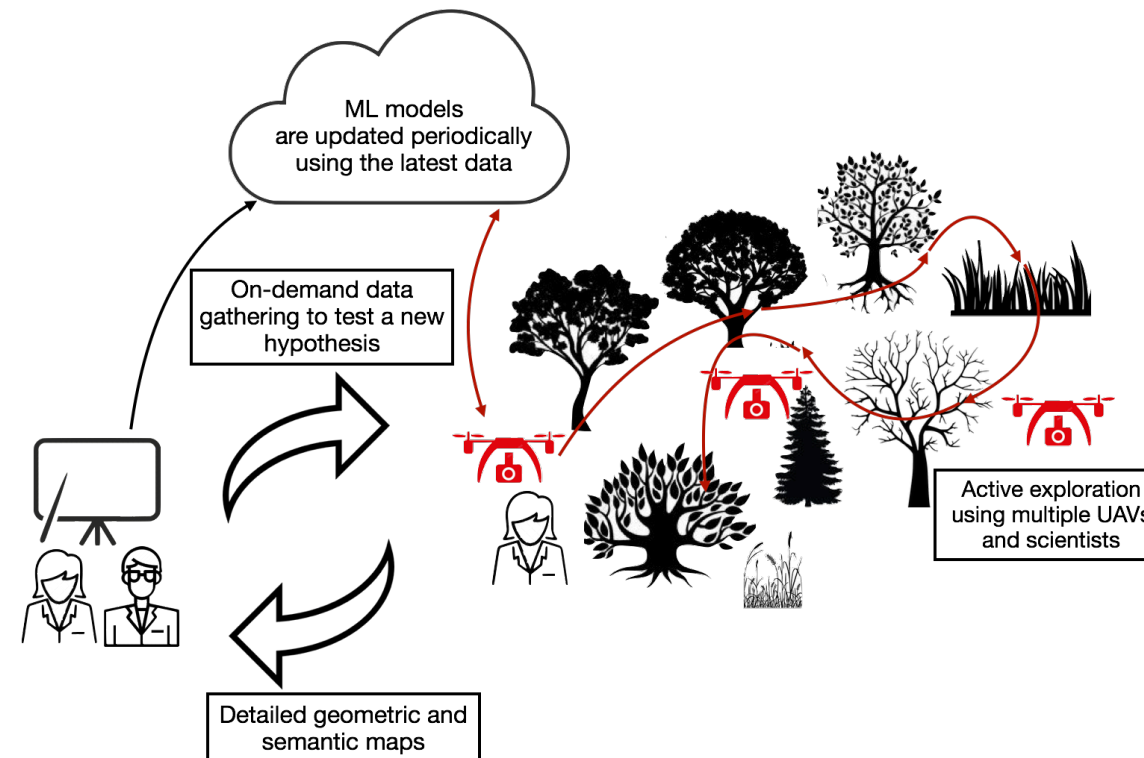
Research Vision and Goals



Thrust A: Large-scale mapping using multiple UAVs (Lead: Kumar, Co-lead: Chaudhari)

Active mapping to gather actionable information over large areas; Scaling up the autonomy stack to map areas of up to 1000 acres; Heterogeneous teams of humans and robots

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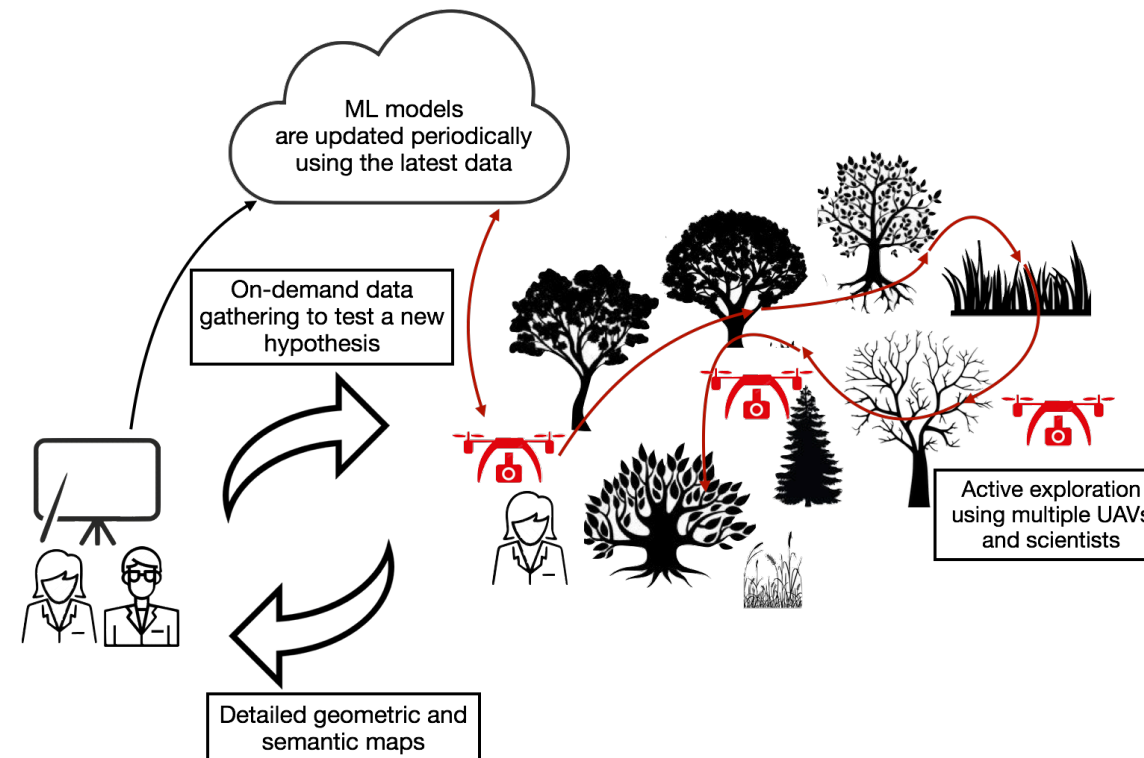
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Combining visual and point-cloud data for building representations of the scene suitably tailored for decision making in forestry; Active semantic scene understanding; Scalable annotation of forestry data

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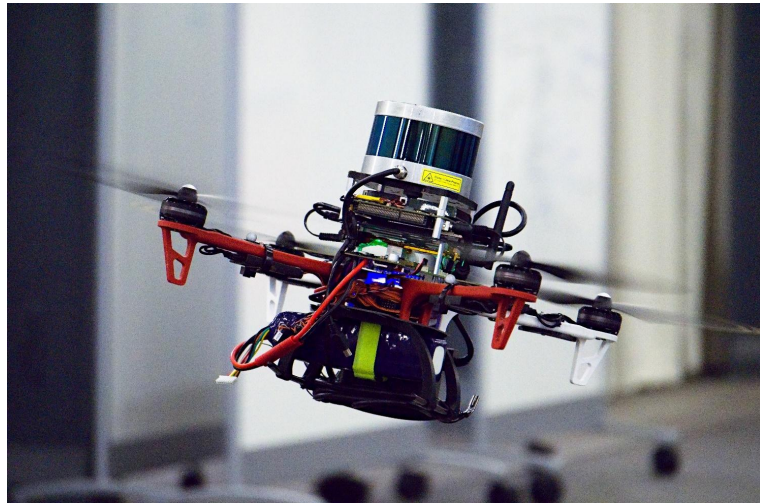
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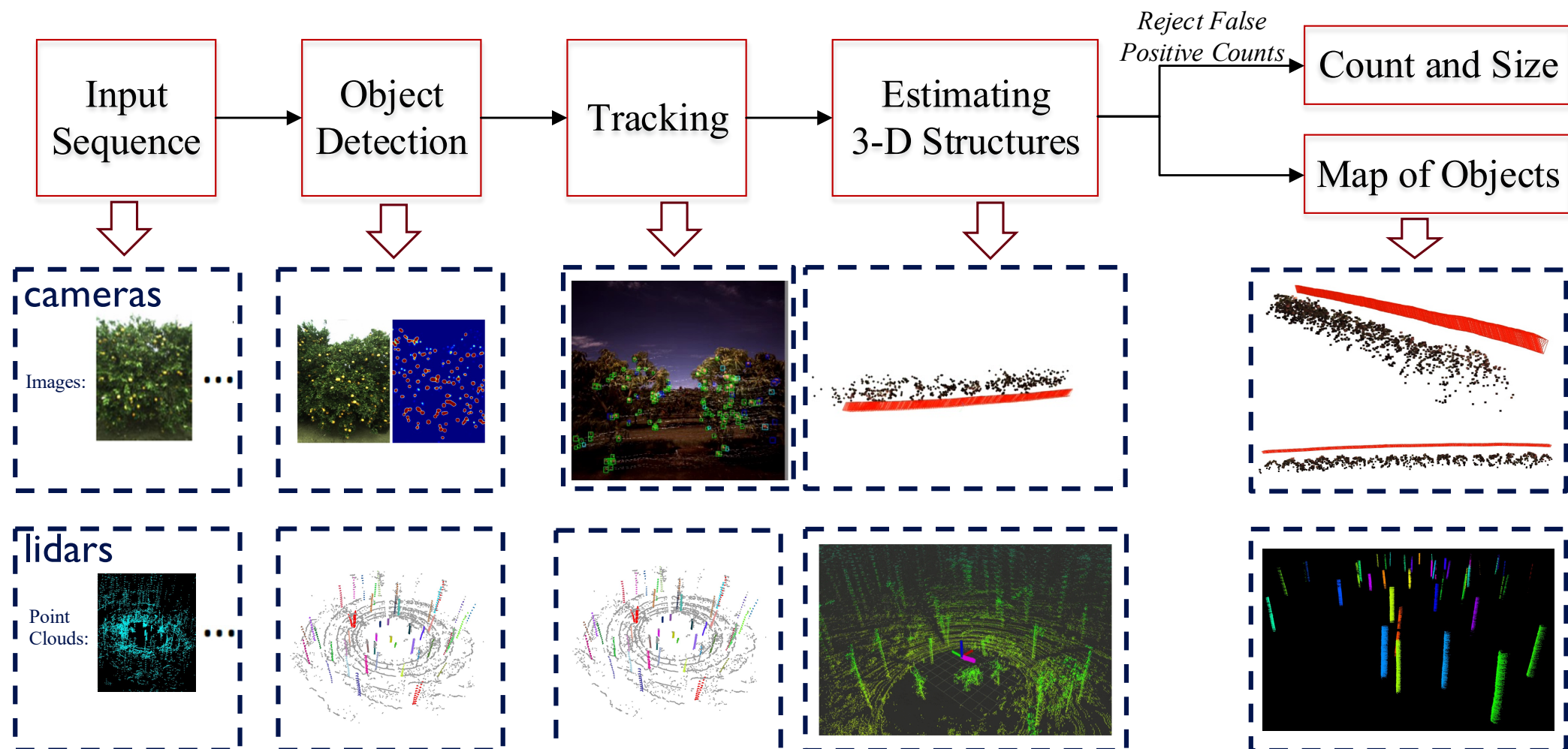
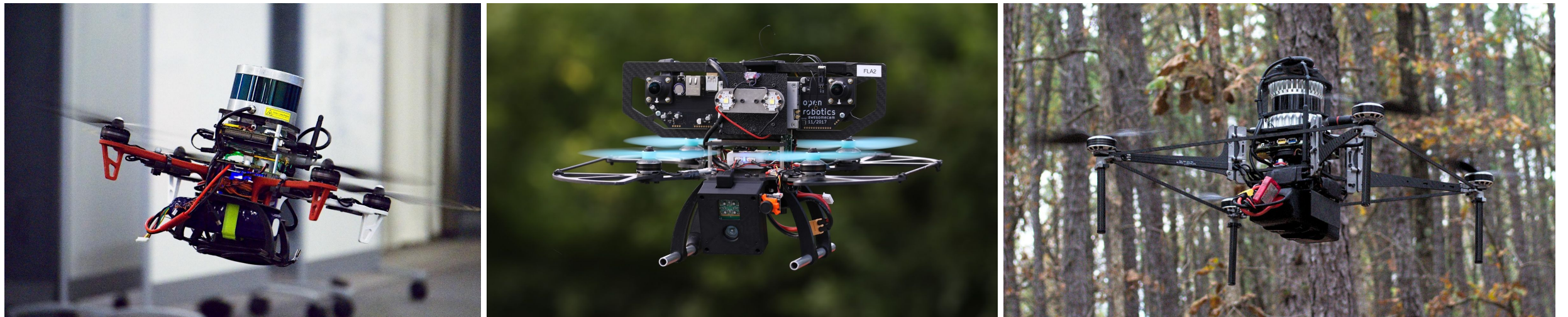
Thrust C: Pairing human-collected ground measurements with UAV data (Lead: Burkhardt, Co-lead: Green)

Application in managed loblolly pine plantations; Applications in diverse forest cover types

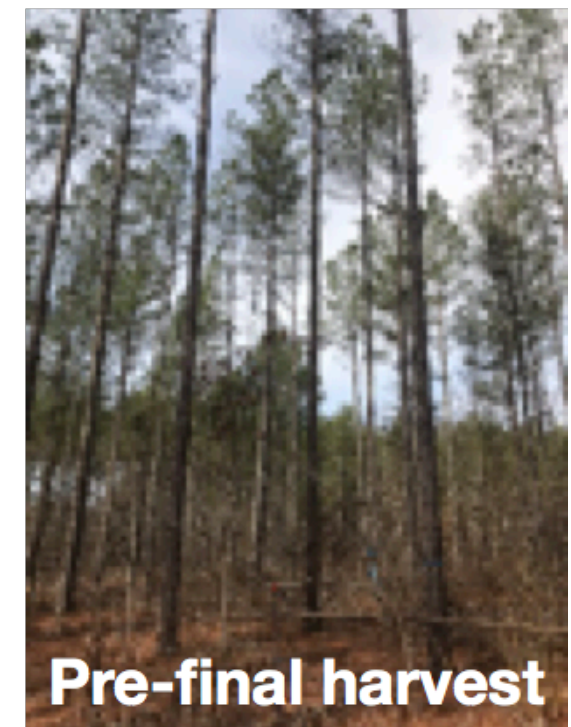
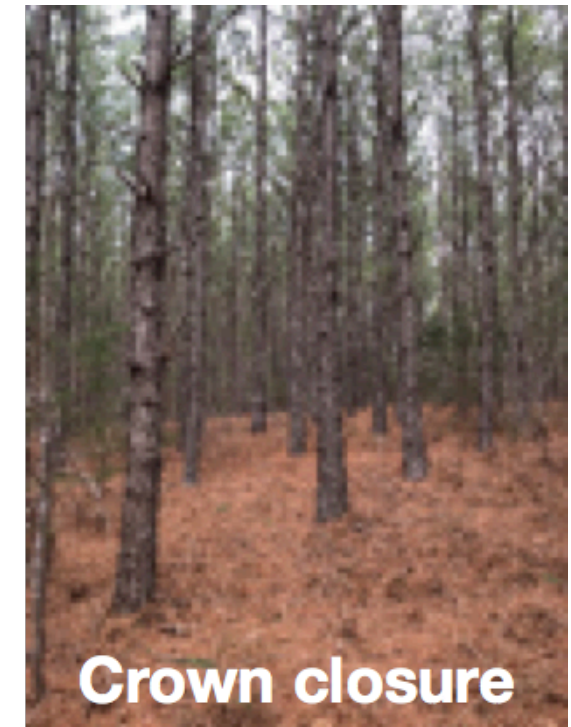
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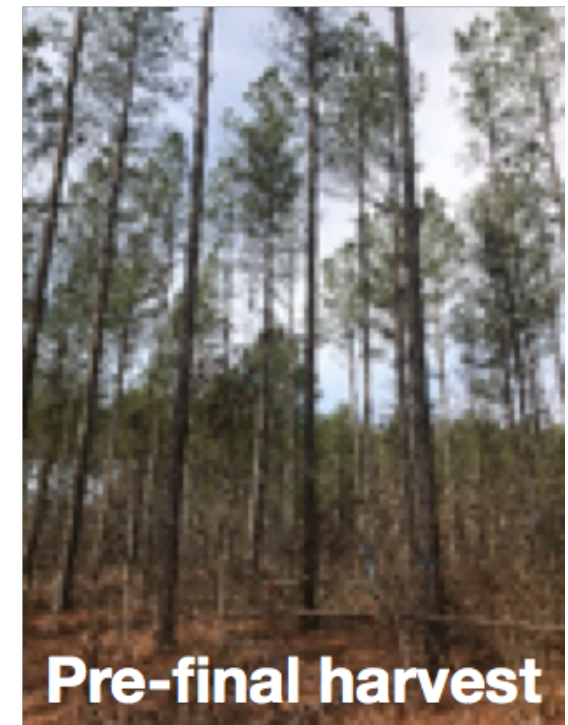
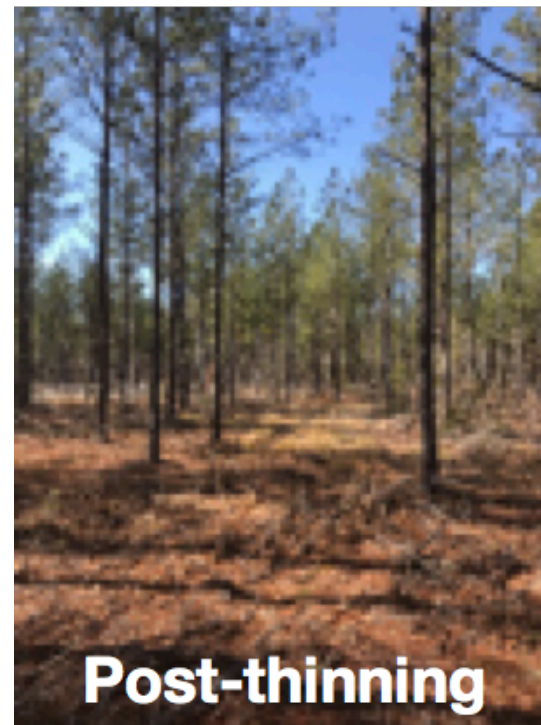
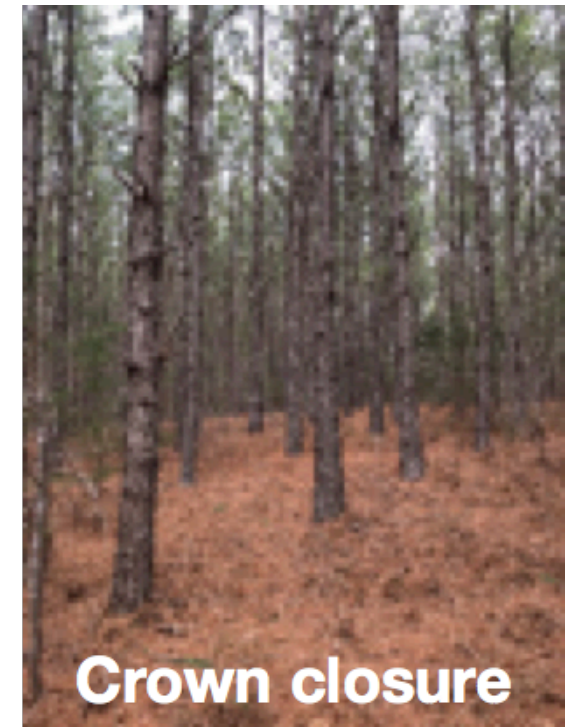
Prior Work: Forestry



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Trees differ significantly in structure; non-crop tree assessment is difficult

Typical methods for estimating forest volume and value use measurements of tree-stem diameters and heights.



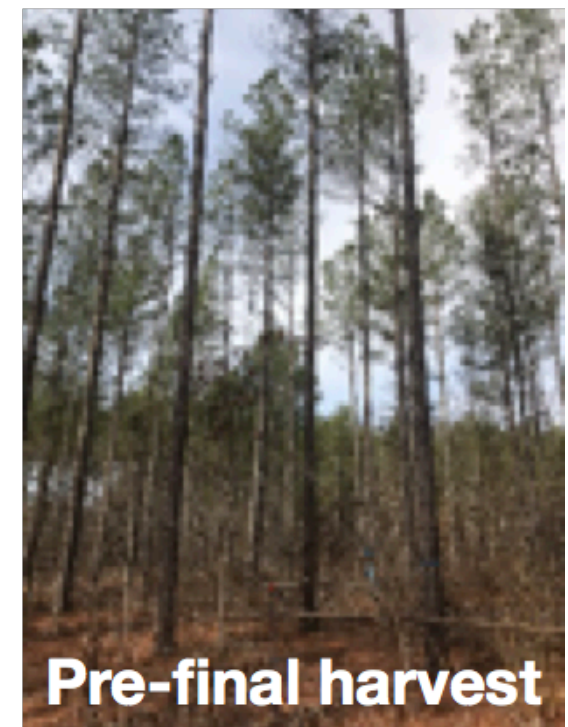
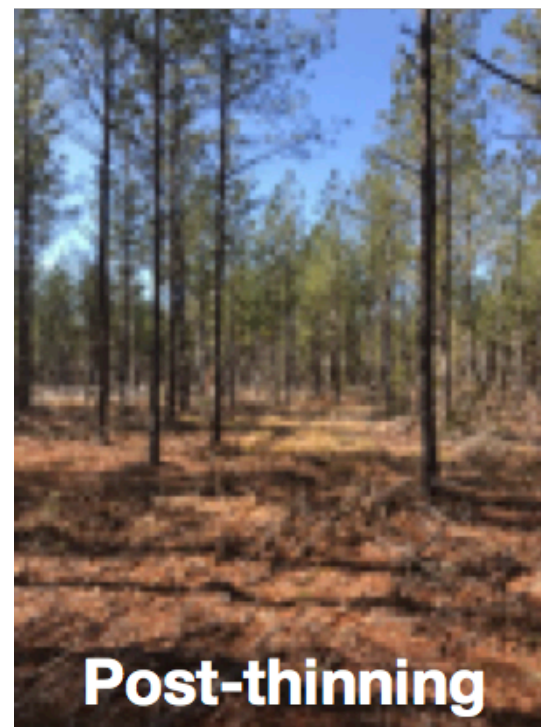
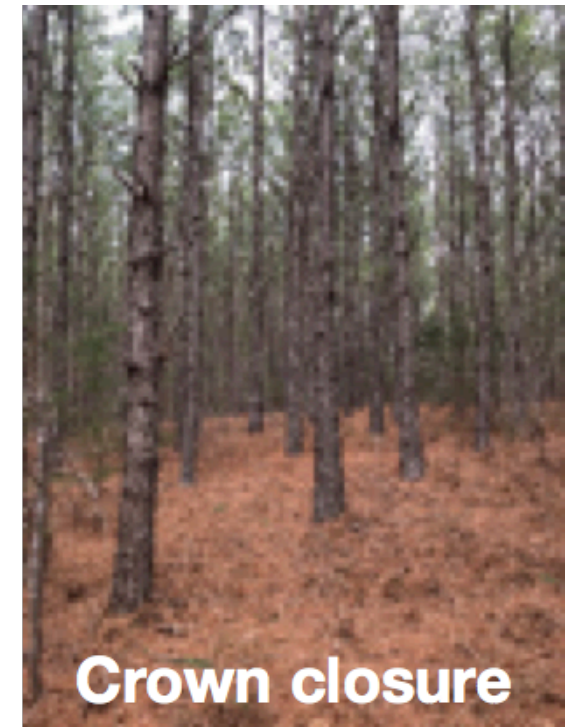
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Need autonomous under canopy flight

Remote imagery has registration errors; occlusions make it difficult to use over canopy flight data



Broader Impacts

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Better understanding of resources and precision agriculture

Forests comprise about 1.5% of the US economy and 5% of manufacturing output. Partnerships with Forest Modeling Research Cooperative (FMRC) and TreeSwift (a Philadelphia startup specializing in forest inventory).

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Outreach

Demonstrations and lab tours to about 1,200 K-12 students/year are Penn. Education for forest growers (56% of the forests in the US are privately owned).