PERSEUS: Promoting Economic Resilience and Sustainability of the Eastern US Forests

Background

❋ Eastern US forests provide critical ecosystem services (e.g., production of fiber, carbon sequestration, climate change mitigation, freshwater protection, and cultural values preservation), but their long-term sustainability is increasingly threatened by climate change, evolving markets, and land use changes.

❋ This region has experienced the largest increase in non-optimal forest conditions in the past two decades when compared to other parts of the US (Figure 1).

❋ Eastern US forests are predominantly privately owned, while forest landowners lack the basic information and tools necessary to assess, manage, and project important forest ecosystem services and their potential economic value.

❋ More refined and timely information is needed to allow land managers to make informed decisions that will affect the delivery, sustainability, and resilience of forest resources.

Figure 1. Significant shift in the eastern forest system to on-optimal conditions over the past two decades (Woodall & Weiskittel, 2021)

Knowledge Gaps

➤ *Technological gap:* Critical need to effectively capture key data with broader spatial and temporal coverage, while integrating this multi-stream data to produce locally relevant information for sustainable management.

➤ *Educational gap:* Students and professionals lack the skills to work with new digital technologies and large amounts of data.

➤ *Outreach gap:* Landowners and other stakeholders lack user-friendly precision management tools powered by big data and advanced technologies.
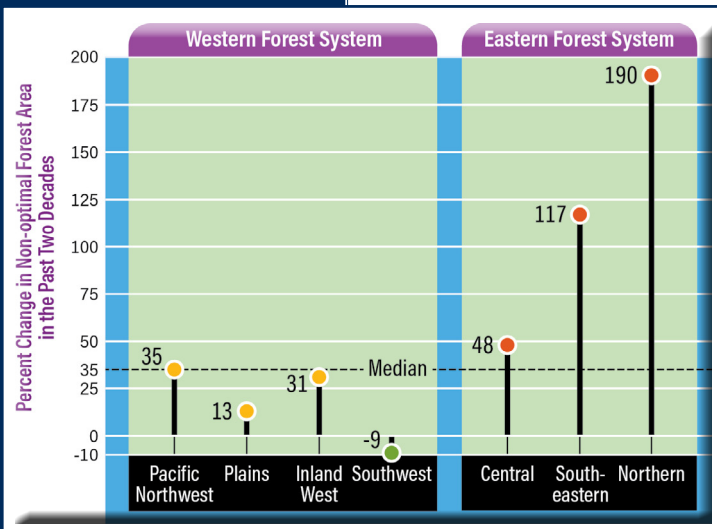
PERSEUS Goals

- Use an integrated transdisciplinary approach (Figure 2) to provide scientifically sound information, outreach, and educational opportunities that will lay the foundation for a long-term paradigm shift in forestry toward data-driven, AI-supported forest management systems that increase both the provision of ecosystem services and operational efficiency.

- Novel measurement and decision-support tools with unprecedented spatial resolution and coverage, allowing for truly data-driven management and policy decision-making to ensure the long-term sustainability of eastern US forests.

- Address critical data and knowledge gaps through a "4M" unified effort of automated measurement, integrated multi-objective modeling, informed and engaged management, and a digitally-competent mindset for students and professionals.

- Decision support tools to empower stakeholders to better understand the potential local versus regional impacts of their decisions on short- and long-term forest productivity and ecosystem services.

- Stakeholder engagement with landowners for in-depth understanding of day-to-day forestry operations needed to help develop these tools.

- "Digital bridge" framework enabling both multi-objective optimization at the landowner-scale for practical tactics (e.g., species selection) and multi-stakeholder simulation and tradeoff analysis at the regional scale for informed decision and policy-making.

- Competency-based, multi-modal education and training system whereby diverse participants can acquire modern skills and knowledge in digital forestry.

Figure 2. Conceptual map of PERSEUS Objectives
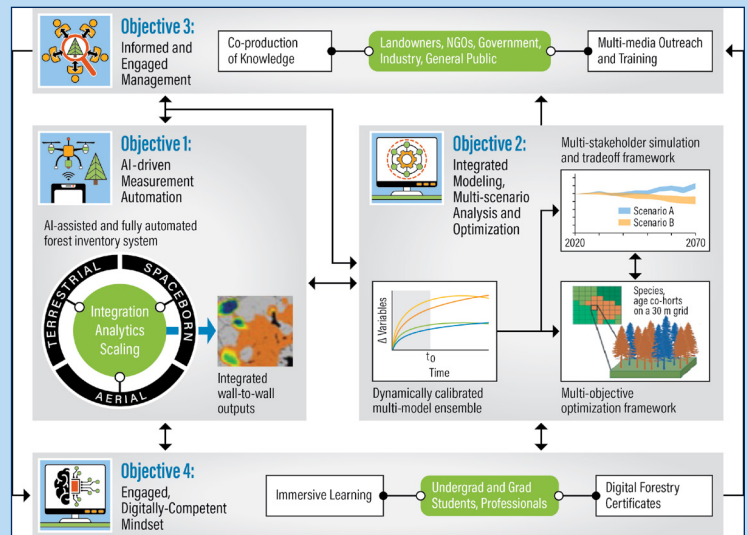
PERSEUS provides the necessary foundation for redefining national forest inventory in the US, while also providing the much-needed ability to project future forest conditions and provided ecosystem services across contrasting scales.
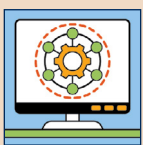
PERSEUS Objectives

1. Evaluate, develop, and integrate remote sensing data and AI algorithms to create a cloud-based geoinformation system that will provide refined, near real-time, and spatially explicit measurements.

2. Construct and apply an integrated framework for modeling current and future forest ecosystem service trends for multi-objective optimization at the landowner-scale, while simultaneously providing multi-stakeholder simulations and tradeoff analyses of forest management at the regional scale.

3. Use research outcomes to engage stakeholders to develop management practices that can improve the sustainability of forest ecosystems in the eastern US.

4. Promote the development of a digitally competent mindset in students and professionals for sustainable natural resources management.

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