DIVERSE
Adapting Forests to Global Change

THEME 1

Forest Vulnerability

DIVERSE is a Pan-Canadian research initiative dedicated to advancing forest management through innovative approaches that emphasize functional diversity and ecological connectivity. The research encompasses six interconnected themes that aim to enhance forest resilience and sustainable forest stewardship in the face of global changes.

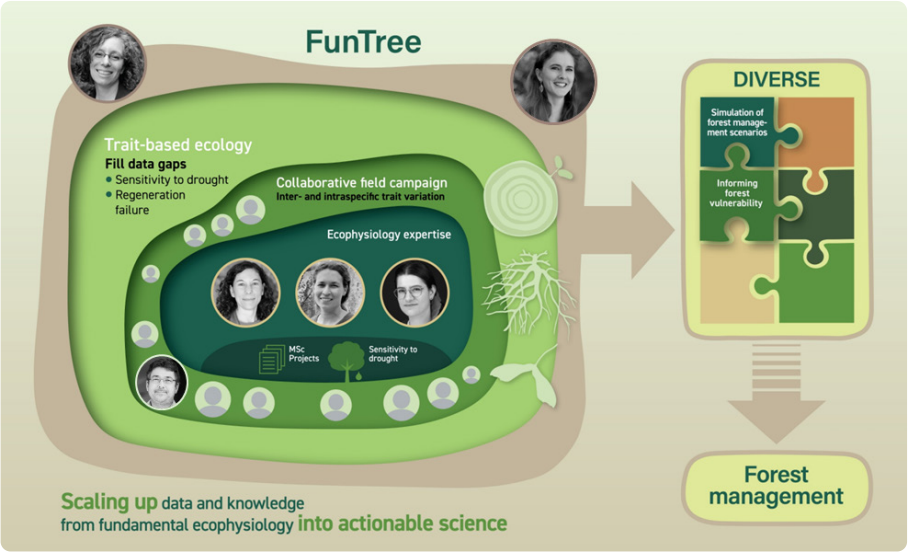
Theme 1 Goals & Objectives

Theme 1 seeks to:

1) Assess the vulnerability of Canadian forests to global changes ;

2) Use functional traits to document tree species' sensitivity to global change stressors ;

3) Develop indices and tools to assist the Canadian forest sector in creating robust climate change adaptation plans.



Value Statement

Assessing forest vulnerability to global changes is crucial for developing effective adaptation strategies and ensuring sustainable forest management. By improving knowledge about the components of forest vulnerability - sensitivity, exposure, and adaptive capacity – this theme enhances our ability to assess risks and foster resilience in Canadian forests.

Scientific Background

The effects of global change, including climate warming and increasing disturbance severity, vary significantly across Canada, and so does the capacity and sensitivity of tree species to cope with these changes.

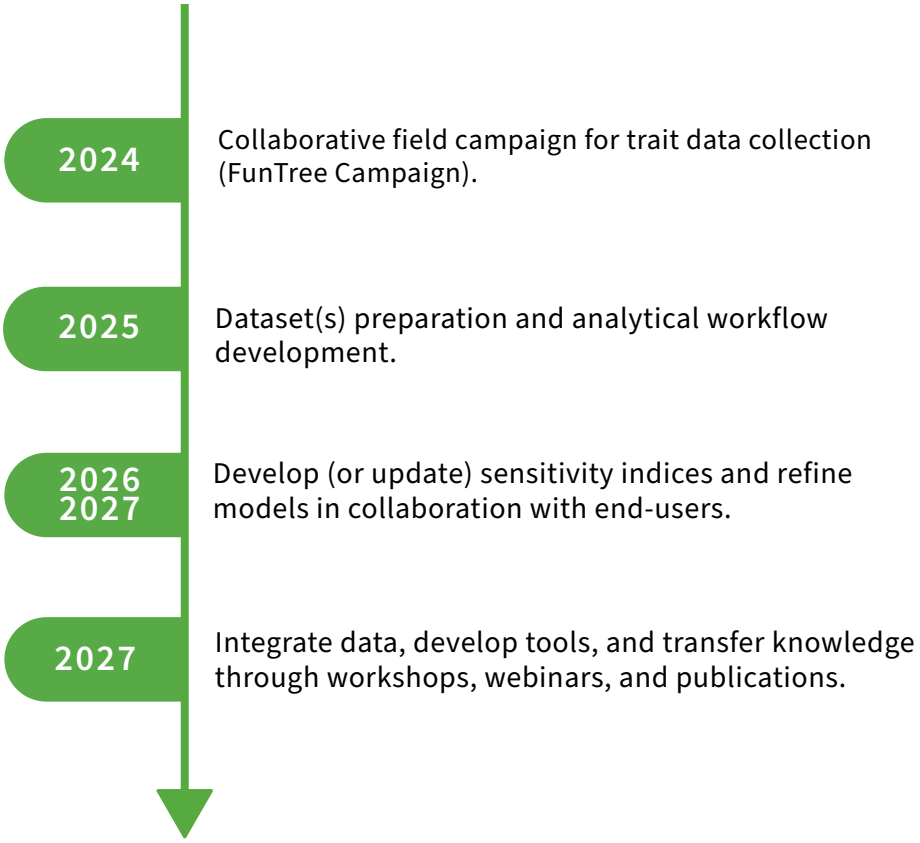
- **Current Gaps:** Traditional vulnerability assessments primarily rely on climatic variables, rarely including ecological data related to species' sensitivity and adaptive capacity. Only a fraction of available ecological knowledge on Canadian tree species is relevant for assessing climate change vulnerability, and the data are often incomplete or geographically biased;

- **Knowledge Needs:** To build resilience, we need extensive datasets on functional traits that govern how trees cope with global change stressors. Collaborative efforts will address these gaps, integrating critical data into models to improve vulnerability assessments.

Methodology

1. **Refining Vulnerability Assessments:** Functional trait data of tree species will be collected across their distribution range, which will ensure the inclusion of intra-trait variability. Field campaigns (e.g., the FunTree Campaign) will gather data across Canada and some regions of the USA, and will be completed using existing databases. More in depth research will be conducted on a small number of tree species to elucidate some key aspects of the relationship between a) Drought and hydraulic traits; b) Regeneration failure and root traits.
2. **Data Processing:**
   - **Species-specific indices** of sensitivity to the main global change stressors. These indices will be built around the main mechanisms by which trees cope with each stressor, and made available for vulnerability assessments;
   - **Ready-to-use dataset** for use in models, subsequently improving models' predictions;
   - **Generated data** available to the research community via international databases to foster and support future larger scale projects.
3. **Developing Visualization Tools:**
   - Combine biophysical exposure estimates (e.g., climate projections) with sensitivity indices to create vulnerability maps.
   - Tools will provide national and regional snapshots of forest vulnerability, helping stakeholders visualize risks and inform adaptive management options.

Timeline



Inter-Theme Links

- **Theme 2:** Tree sensitivity data will guide the identification of suitable tree species to promote across Canada;
- **Theme 4:** Collaboration with researchers who are modelers to integrate trait data into LANDIS-PnET module for simulation modeling.

Project Personnel

Theme 1 is led by a researcher from Natural Resources Canada – Canadian Forest Service, with support from Université du Québec en Outaouais, Université du Québec à Montréal, University of Waterloo, Université Laval.

Highly-Qualified Personnel (HQP): 1 MSc, 2 Post-Doctoral Fellows, and 1 Research professional.

Projected Deliverables

- **Datasets:** Key functional traits linked to drought sensitivity and regeneration failure;
- **Indices:** Species-specific sensitivity indices for major global change stressors;
- **Assessments:** Comprehensive forest vulnerability evaluations;
- **Visualization Tools:** Interactive maps illustrating forest vulnerability at national and regional scales;
- **Publications:** A series of scientific publications on trait variability, drought sensitivity, regeneration failure risks, and forest vulnerability assessments.