Identifying Fungal Pathogens Associated with Loblolly Pine Needle Damage in the Southeastern USA

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Background

Loblolly pine (*Pinus taeda* L.) is a crucial ecological and economic component in the southeastern USA

It is a dominant species due to its improved genetics features

Intensively managed for timber and pulpwood production

Plantation occupies more than 14 million ha across the southeastern USA (South and Harper, 2016)

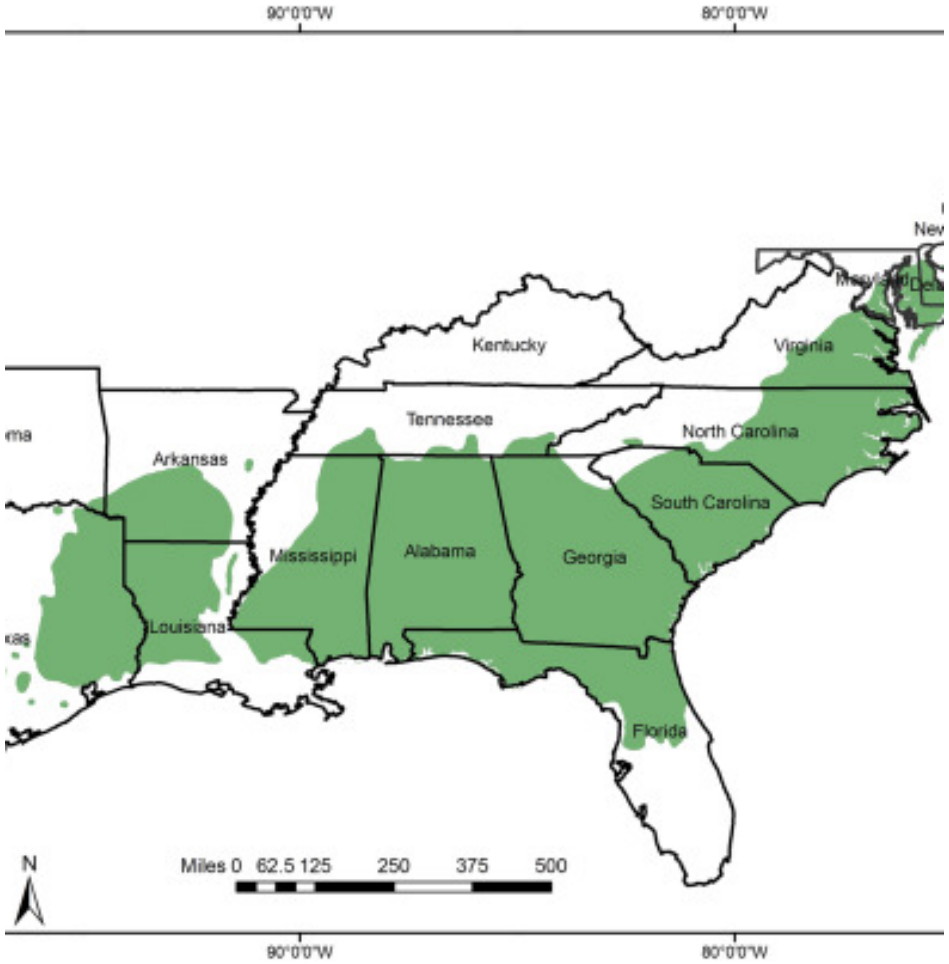
It is projected to increase over 17 million ha by 2020 (Wear and Gries, 2002)

Background

Naturally grows in fifteen southern and mid-Atlantic states

Central Florida northward to Delaware and New Jersey

Westward to east Texas and southeast Oklahoma (Schultz, 1999)



Source: USGS Digital Representations of *Pinus taeda* L. Species Range Maps

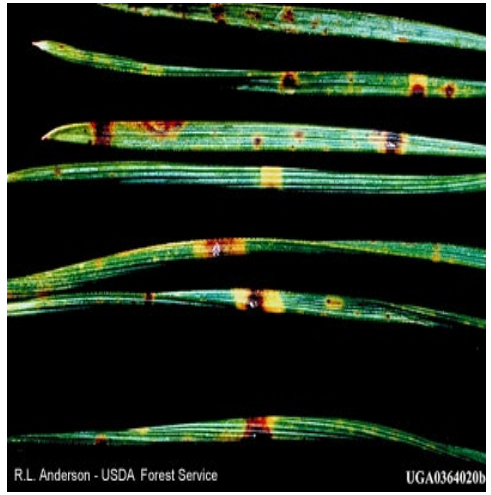
Background

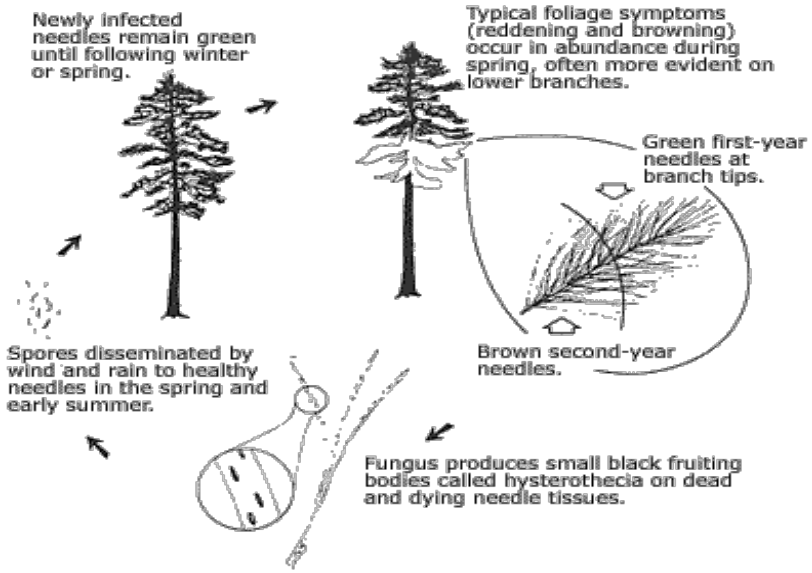
Needle Cast – Infect young current year needles

Yellow to red brown to grayish spots, bands or mottling

Recognized by red brown foliage giving infected trees ‘’fire-scorched’’ appearance

Ploioderma spp., *Lophodermium* spp. and *Scirrhia acicola* commonly cause pine needle cast disease





Pine Needle Cast Life Cycle

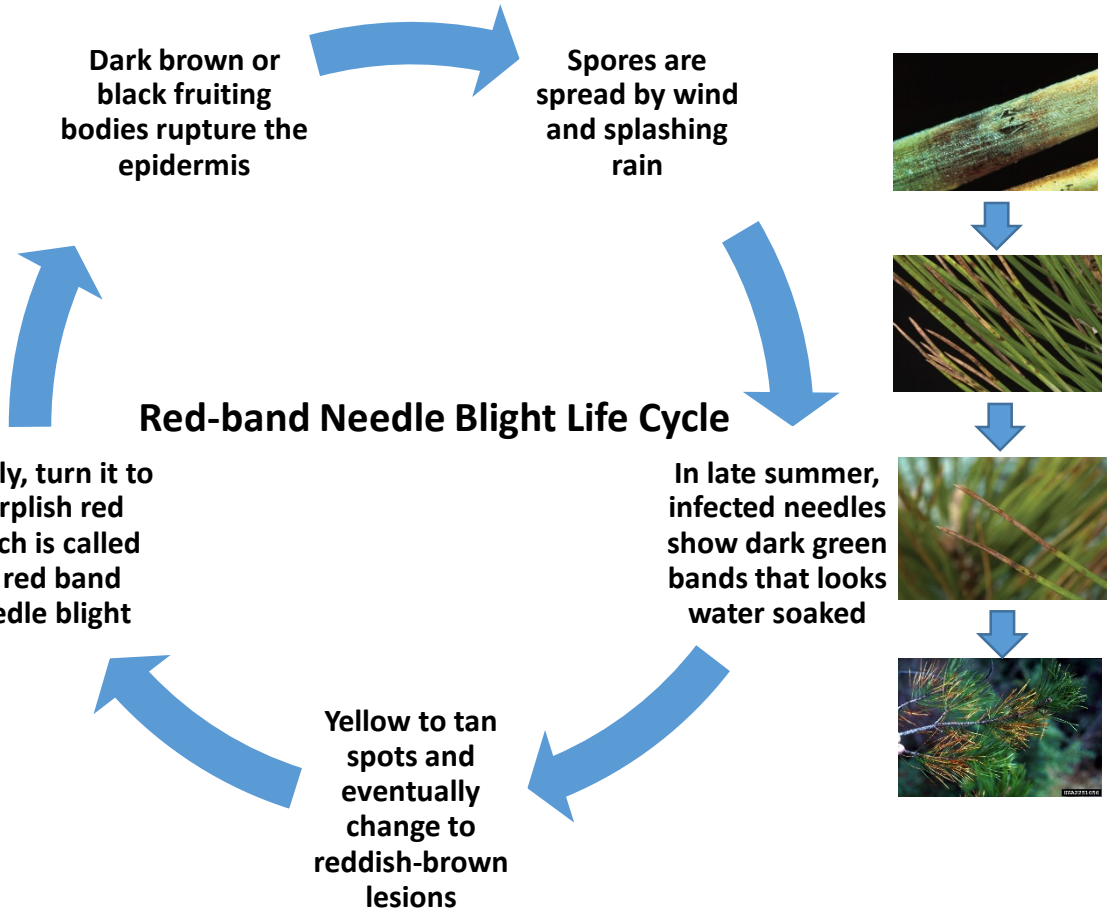
Background

Needle Blight – symptoms are severe in lower crowns

Occurs in dense stands and areas that have high humidity

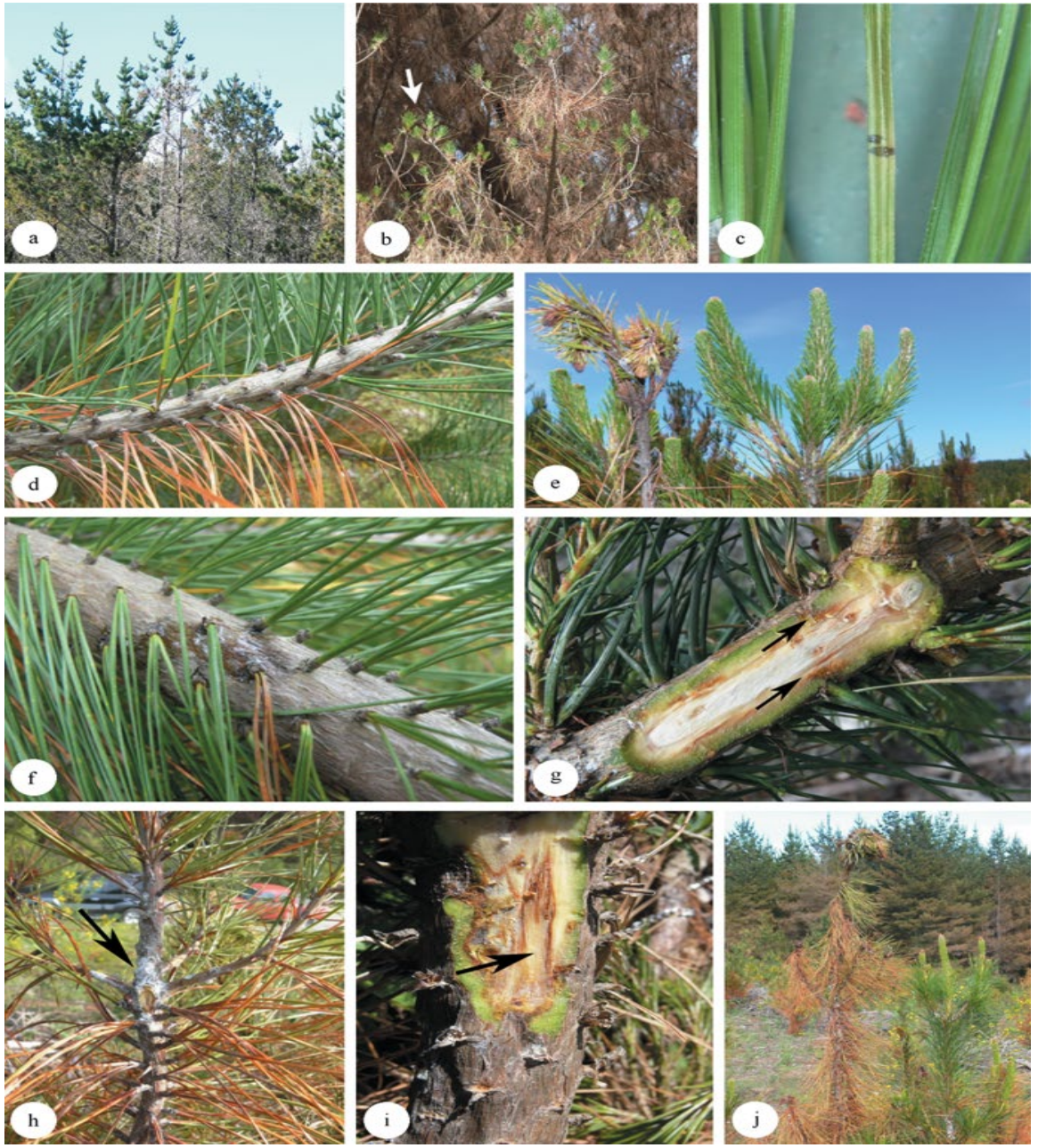
Dothistroma septosporum is well known pathogens of pine needle blight

Needles progressively turn light green, yellow, tan and brown from the tips back



Background

- Phytophthora Needle Blight – causes mortality of seedling, natural regeneration and mature trees
- lower branches of the needles- reddening of past year needles in early winter
- Needles die and turn into gray color and begin to fall
- Present threat to the pine industry



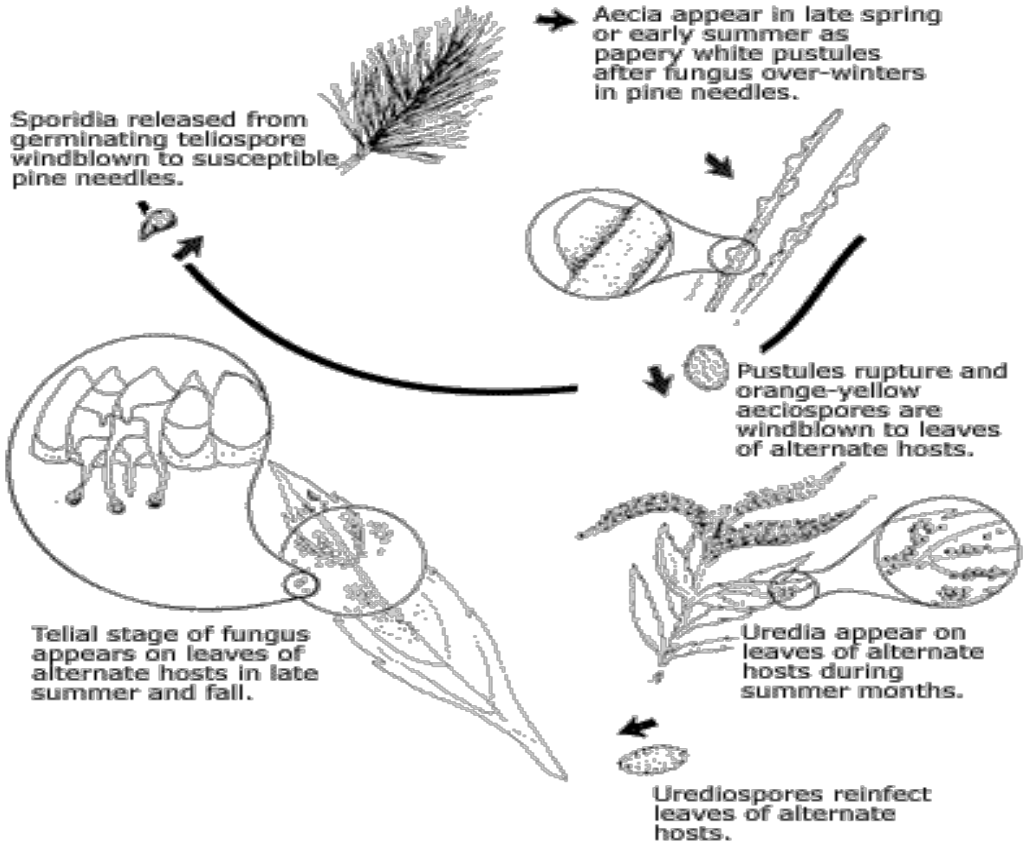
Background

Needle Rust – macrocyclic and heteroecious (up to 5 spore stages and 2 hosts)

Alternate hosts are goldenrod, aster

Coleosporium solidaginis and *C. asterum* commonly cause pine needle rust

All pines are susceptible to this disease



Pine Needle Rust Life Cycle

Background - Present Problem

Needle damage – causing loblolly pine mortality found in the Georgia, Alabama and Mississippi

Extensive needle loss is observed for both regeneration and mature trees

Symptoms includes yellow or brown discoloration of needles

Tree crown looks very thin due to the fall of affected needles

Fungal pathogens are likely to be the causal agents of this disease

Background – Potential Impacts

Alter the ecosystem function and service delivery across the stands

Reduced photosynthesis rates cause stunted tree growth resulting in less merchantable volume production

Repetitive loss of needles eventually leads to tree mortality

Adverse impact on ecosystem process such as carbon dynamics, water balance and nutrient cycling

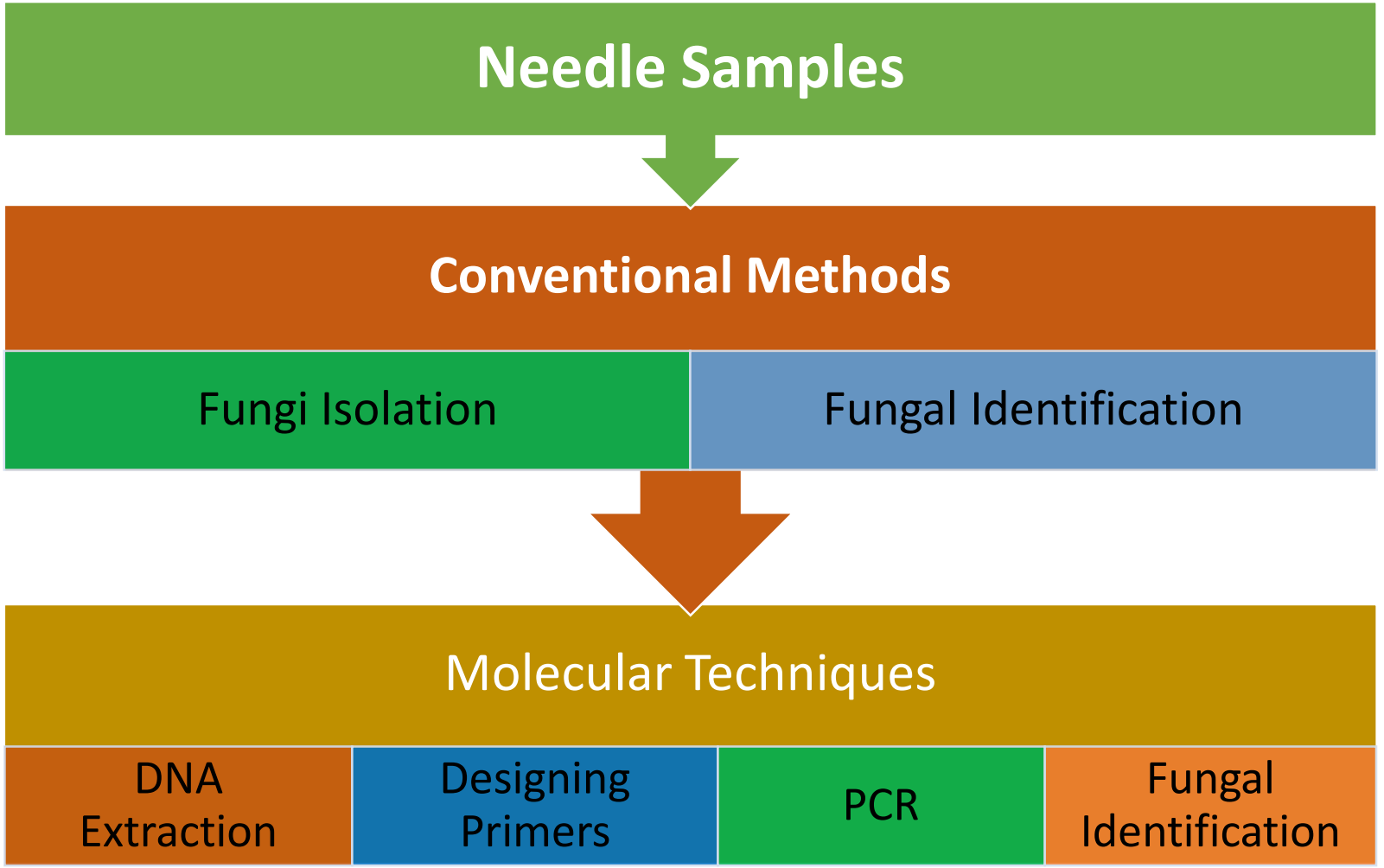
Fungal pathogens are rapidly disseminating which can cause sudden epidemics

Objectives

To survey the incidence and severity of loblolly pine needle mortality across the southeastern USA

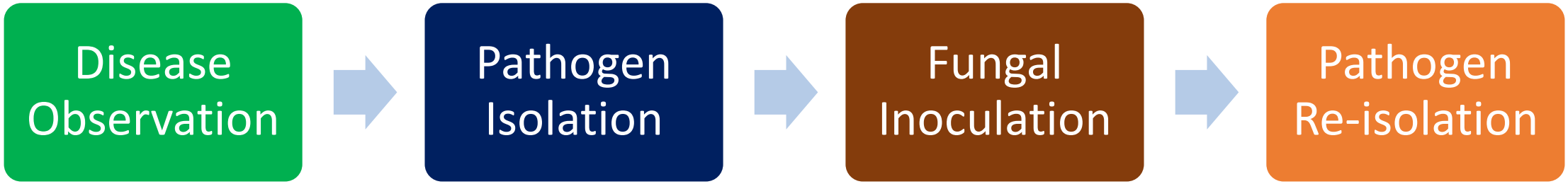
To isolate and identify the fungal pathogens associated with loblolly pine needle mortality in the southeastern USA

Methodology



Methodology

Koch Postulates



Potential Implications of the Study

Understand disease cycle

Control and management regimes based on identified pathogen

Possible insight about the origin of the pathogens

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