# **Determining Restoration Needs:** Evaluating starting conditions & setting short- and long-term objectives

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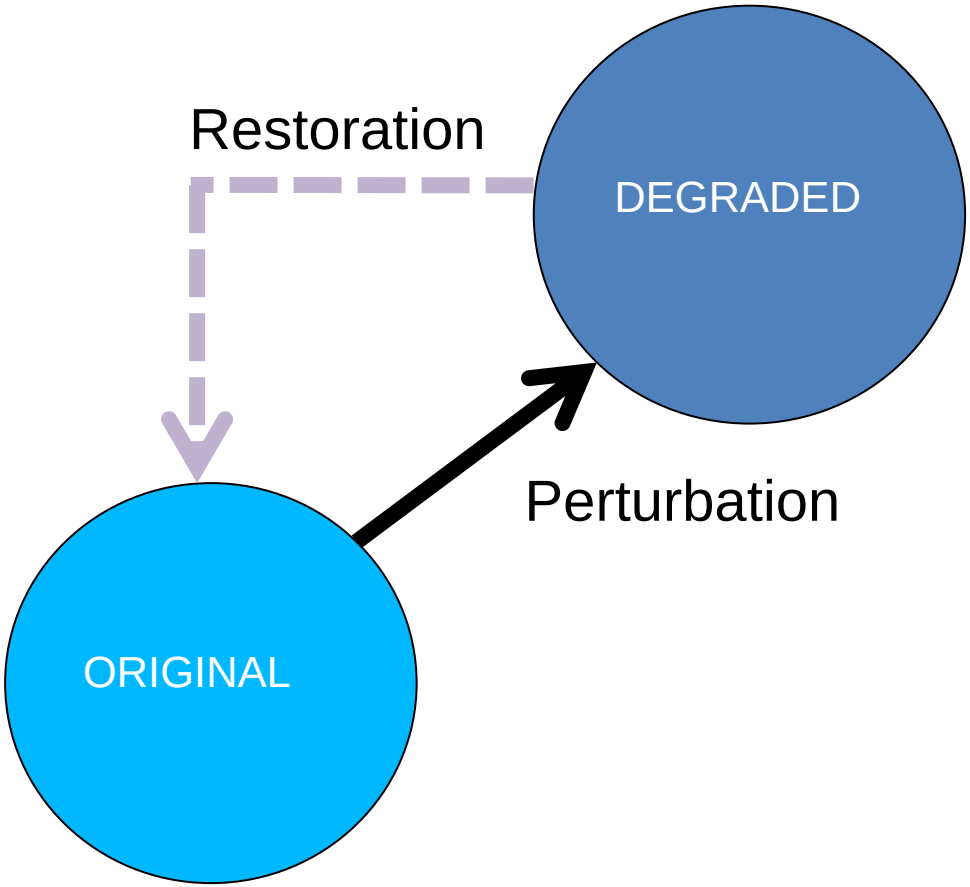
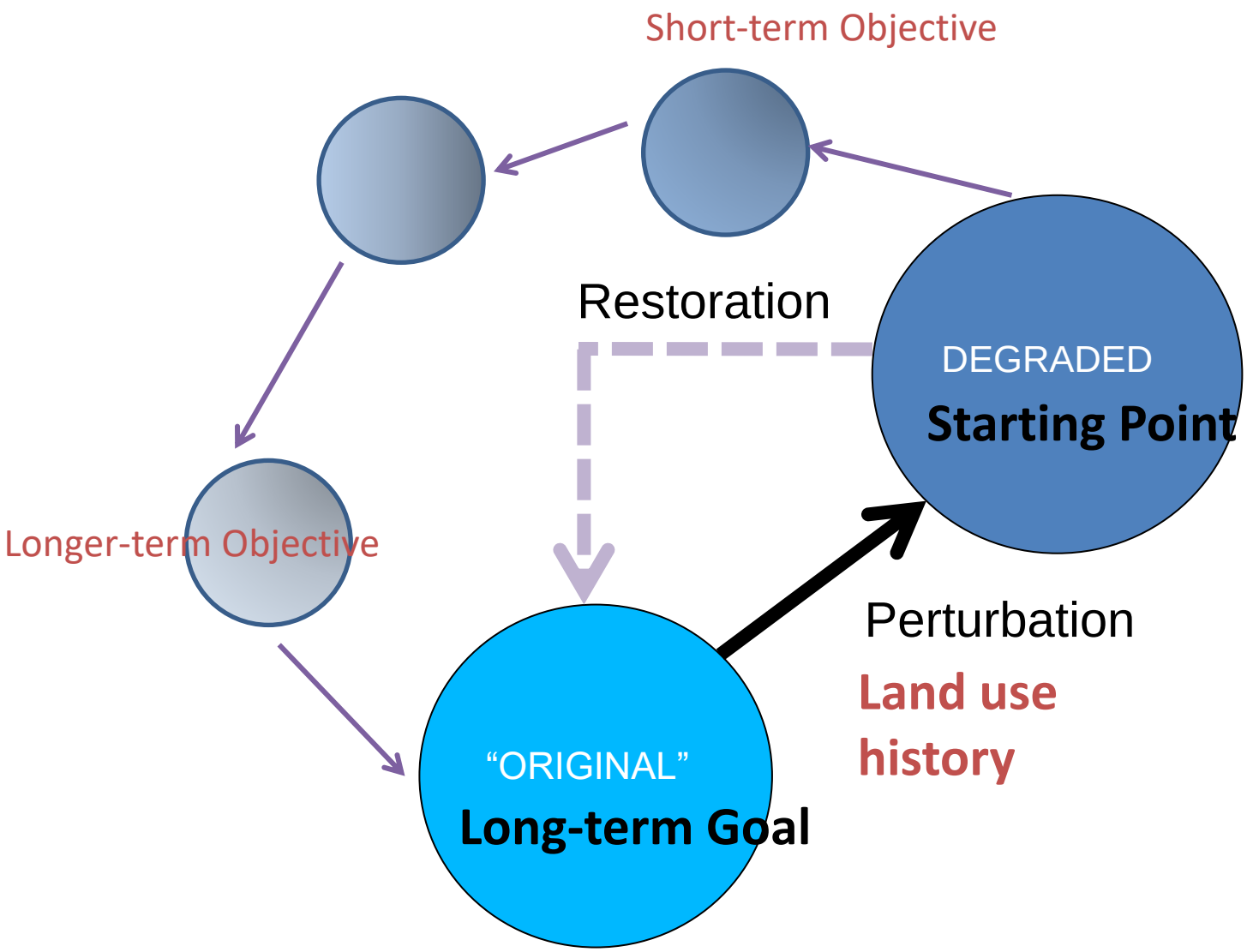
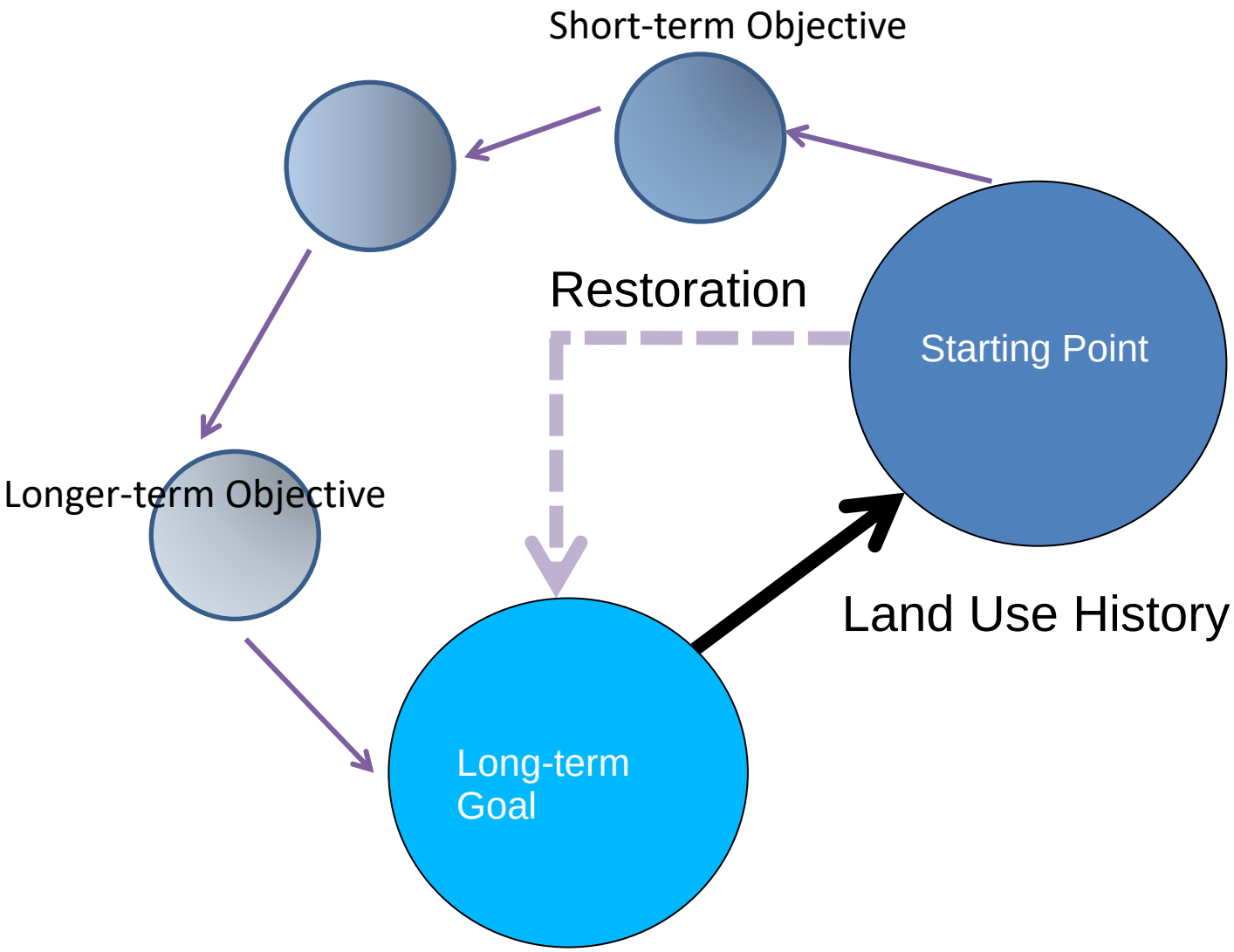

Restoration
DEGRADED
Perturbation
ORIGINAL


Short-term Objective
Restoration
DEGRADED
Starting Point
Longer-term Objective
Perturbation
Land use
history
“ORIGINAL”
Long-term Goal


Short-term Objective
Restoration
Starting Point
Longer-term Objective
Land Use History
Long-term
Goal

# What I want to know…

Where is the site located?

- Geography, and ecological space
- What should or could be there?  Which species?
- Reference conditions

What does it look like now?

- Current condition, starting condition

How did it arrive at the current condition?

- Land use history

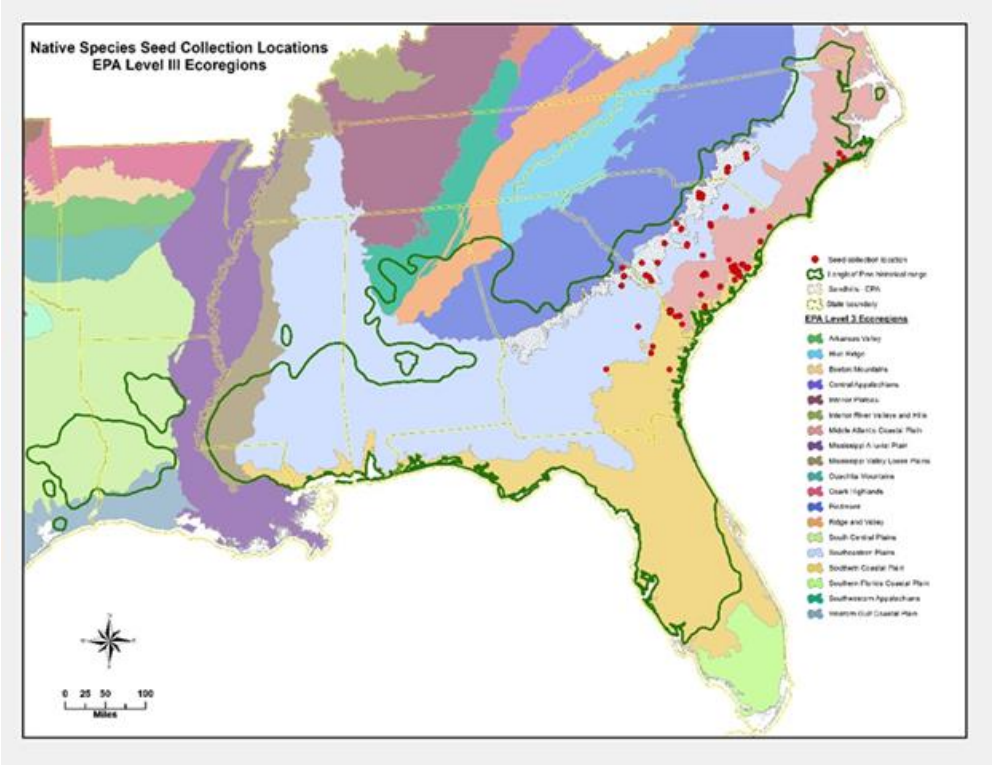
# Geography & site quality determine reference condition

Variation in physiography

- Outer coastal plain, piedmont, mountains
- Topography, soils, climate patterns

Biogeography

- Wide species distributions contrasted with narrow ones
- Rare species tend to have small ranges (narrow endemics)



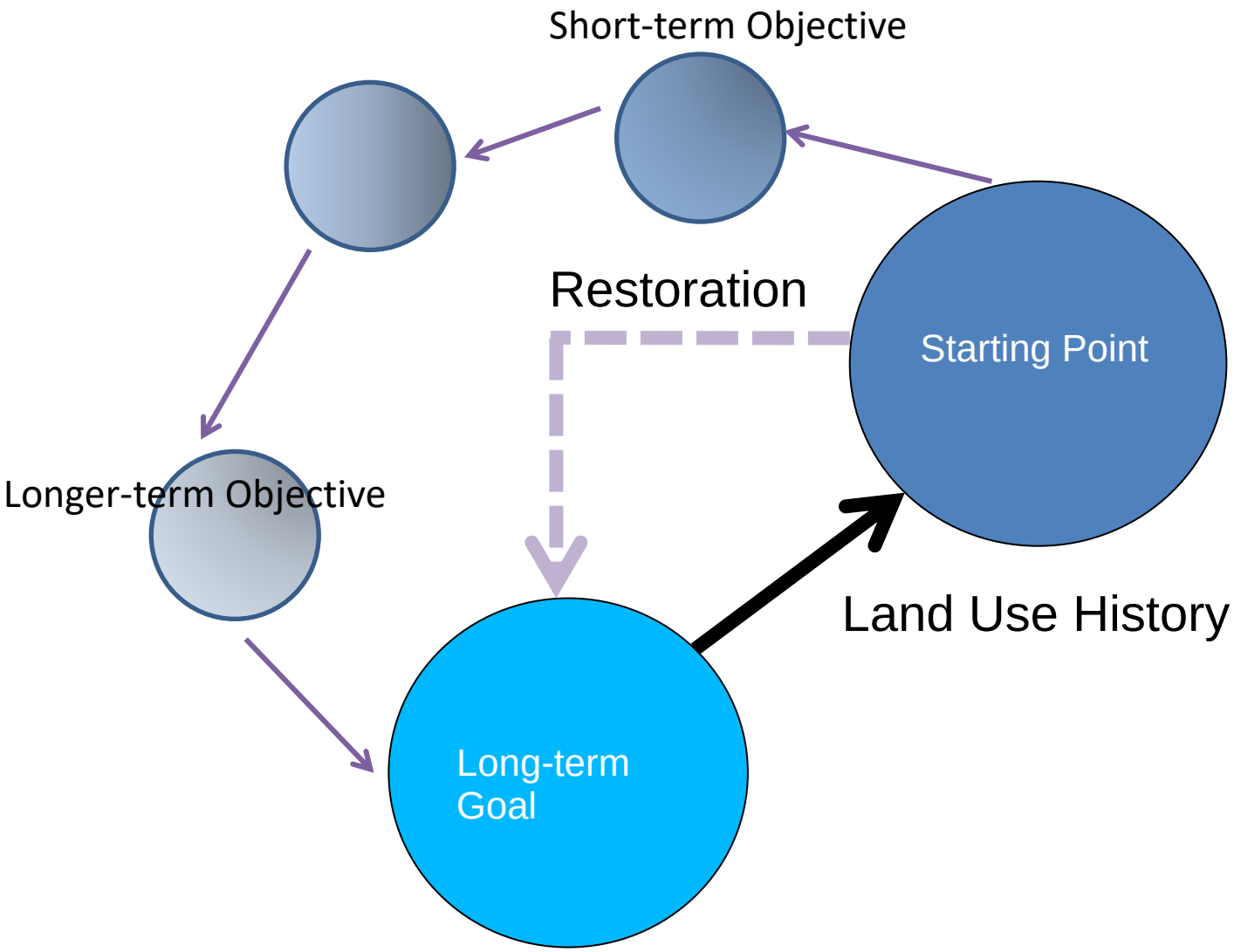

Site quality, especially site productivity, also influence on pathway to desired condition…

# Soil moisture differences produce variation within landscape

Xeric sites
Deep sands
Low species diversity
Low productivity

Mesic conditions
Higher productivity
More legumes

Wet sites
Nutrient poor, boggy
High diversity
Naturally low pine density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# Maintenance condition

Restored site condition that is maintained by minimal or periodic management

# Structural metrics

Nordman et al. 2016. Rapid assessment metrics to enhance wildlife habitat and biodiversity within southern open pine habitats

- Available online:
  - http://www.natureserve.org/conservation-tools/projects/developing-rapid-assessment-metrics-measuring-open-pine-ecosystem-heal-0

Collaborative project with US FWS; defining habitat conditions to support wildlife of open pine communities

Field manual and Project report available

Provides measures for range of habitat types

- Key to habitat types
- Metrics for maintenance and several degrees of condition

# Structural guidelines

Canopy

- Canopy pine basal area: 30-80 $ft^2$/acre
- Pine canopy cover: 30%-65% canopy cover
- Canopy hardwood basal area: <20 $ft^2$/acre
- Stand age structure: basal area >20 $ft^2$/acre flat top, or >14 inch diameter at 4.5 ft above ground level (dbh)

Midstory

- Overall cover: <20% cover woody midstory

# Structural guidelines (cont.)

Ground cover

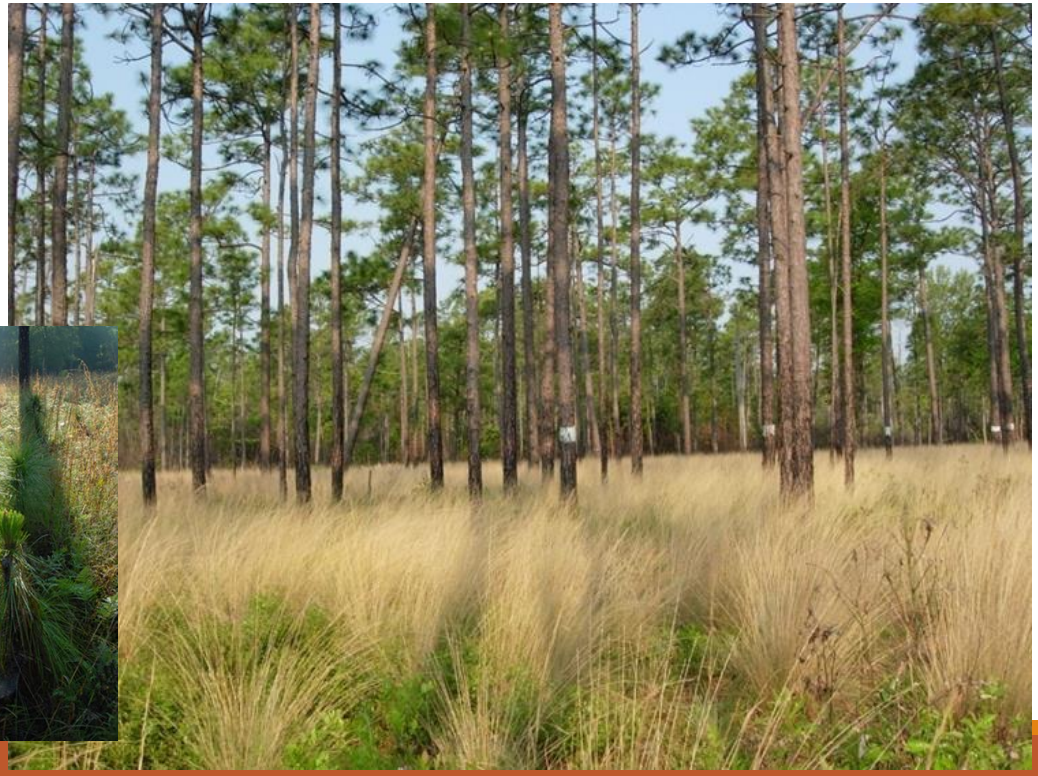
- Overall native herbaceous cover: >40 % cover
- Native warm-season grass cover: >25 % cover
- Longleaf pine regeneration: >1 % cover
- Invasive plant cover: <1 % cover

Widely applicable with exceptions

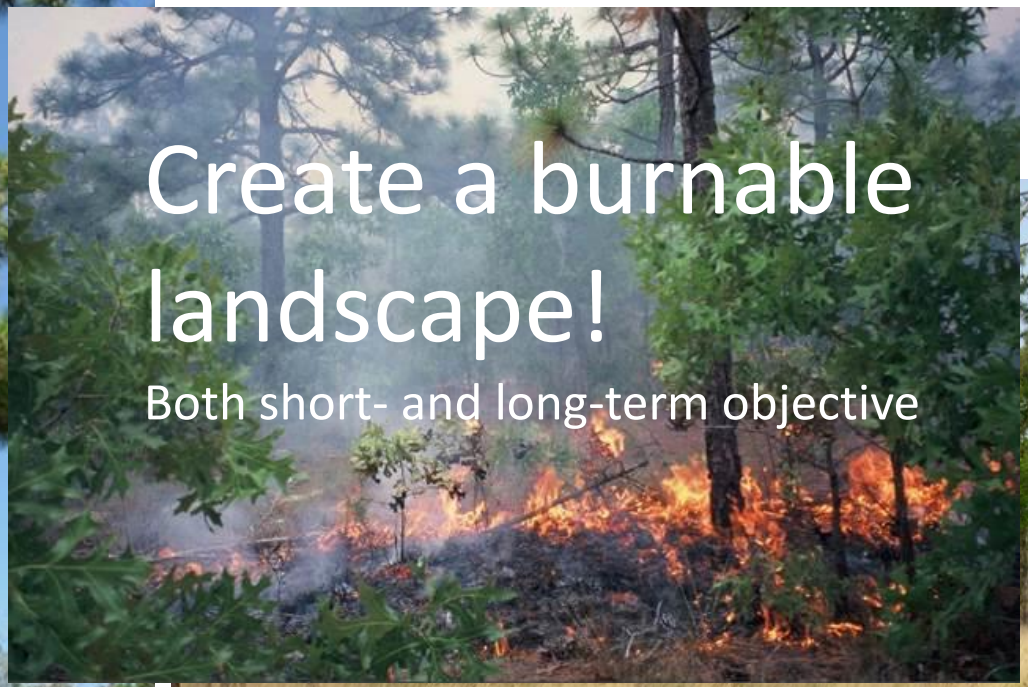
- Wettest and driest sites
- Variable shrub cover expected
- Canopy may include other

# A dynamic system: canopy, ground cover linked through fire



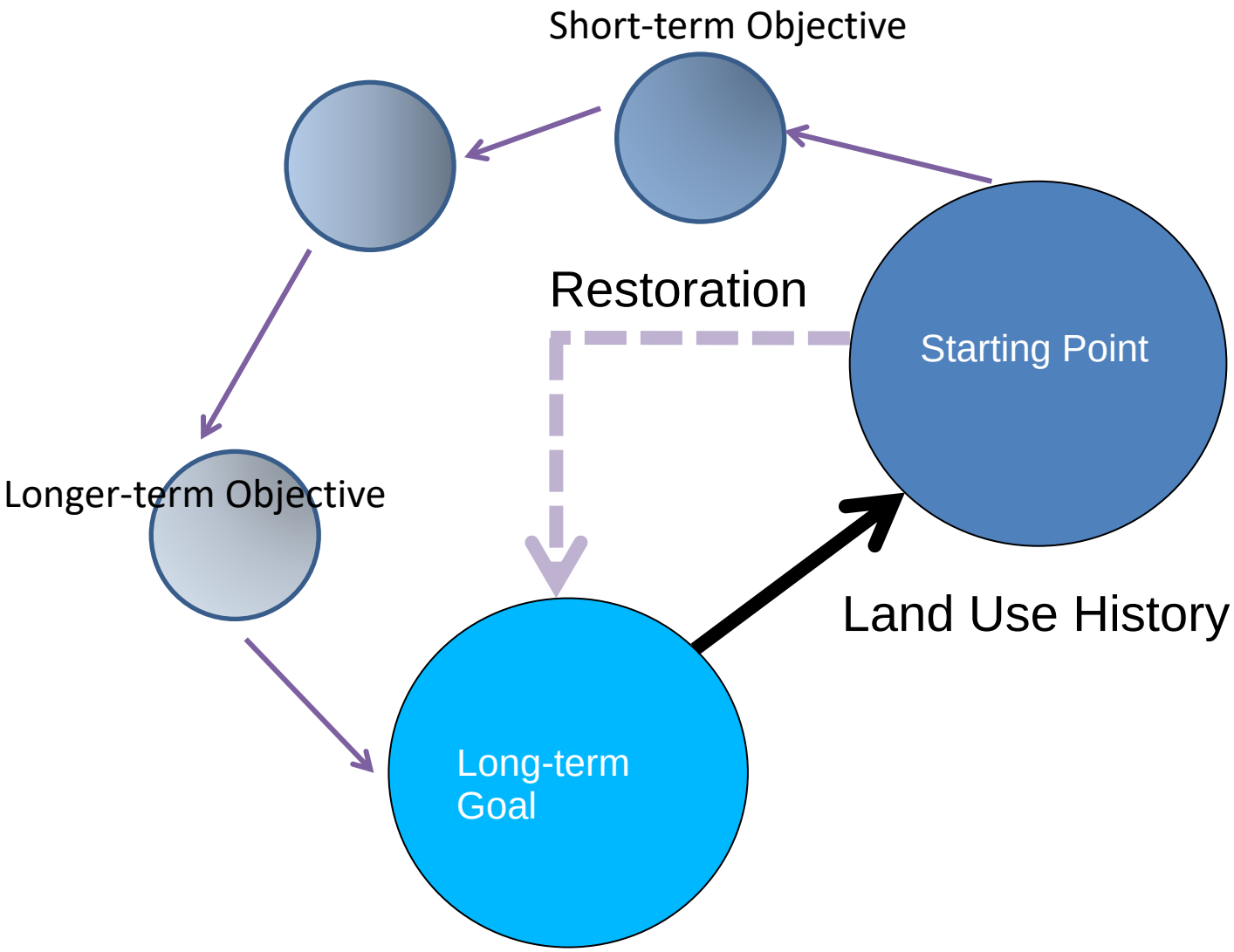


# A dynamic system: canopy, ground cover linked through fire



Create a burnable landscape!

Both short- and long-term objective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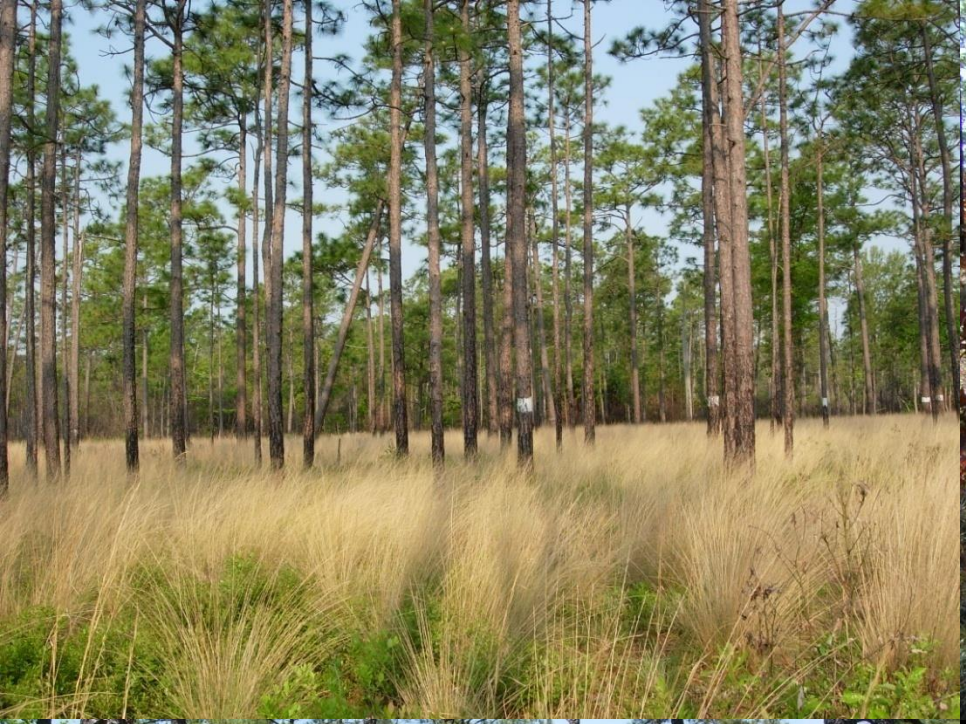



# Land use history created current conditions

- Altered fire regimes
  - Fire Exclusion
- Forest management
  - Plantation establishment, management
- Agriculture
  - Tillage agriculture
  - Animal husbandry

# Fire exclusion effects

- Increased density of hardwoods
- Increased depth of forest floor, litter
- Reduced herbaceous cover
- Loss of herbaceous species
- Fire behavior changed

# Plantations are variable

- Highly variable
  - Depends on intensity of site preparation, fire management, intervening treatments, age of plantation
- Increased pine density
- Change in dominant species
- Decreased or increased hardwoods
- Reduced herb cover with age
- Increased depth of forest floor
- Changed fire behavior, light conditions, below ground competition

# Agriculture

Non-native species

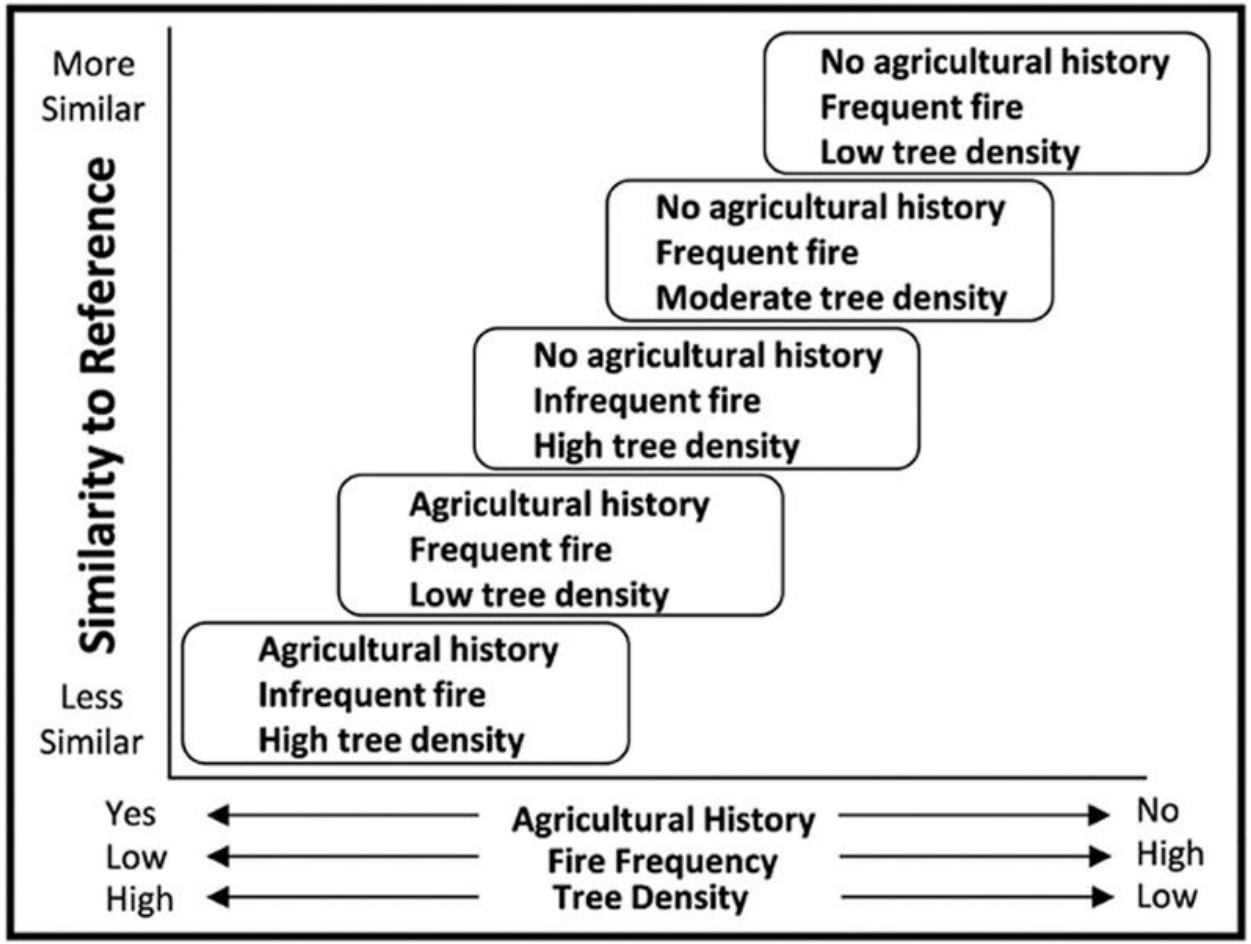
No trees

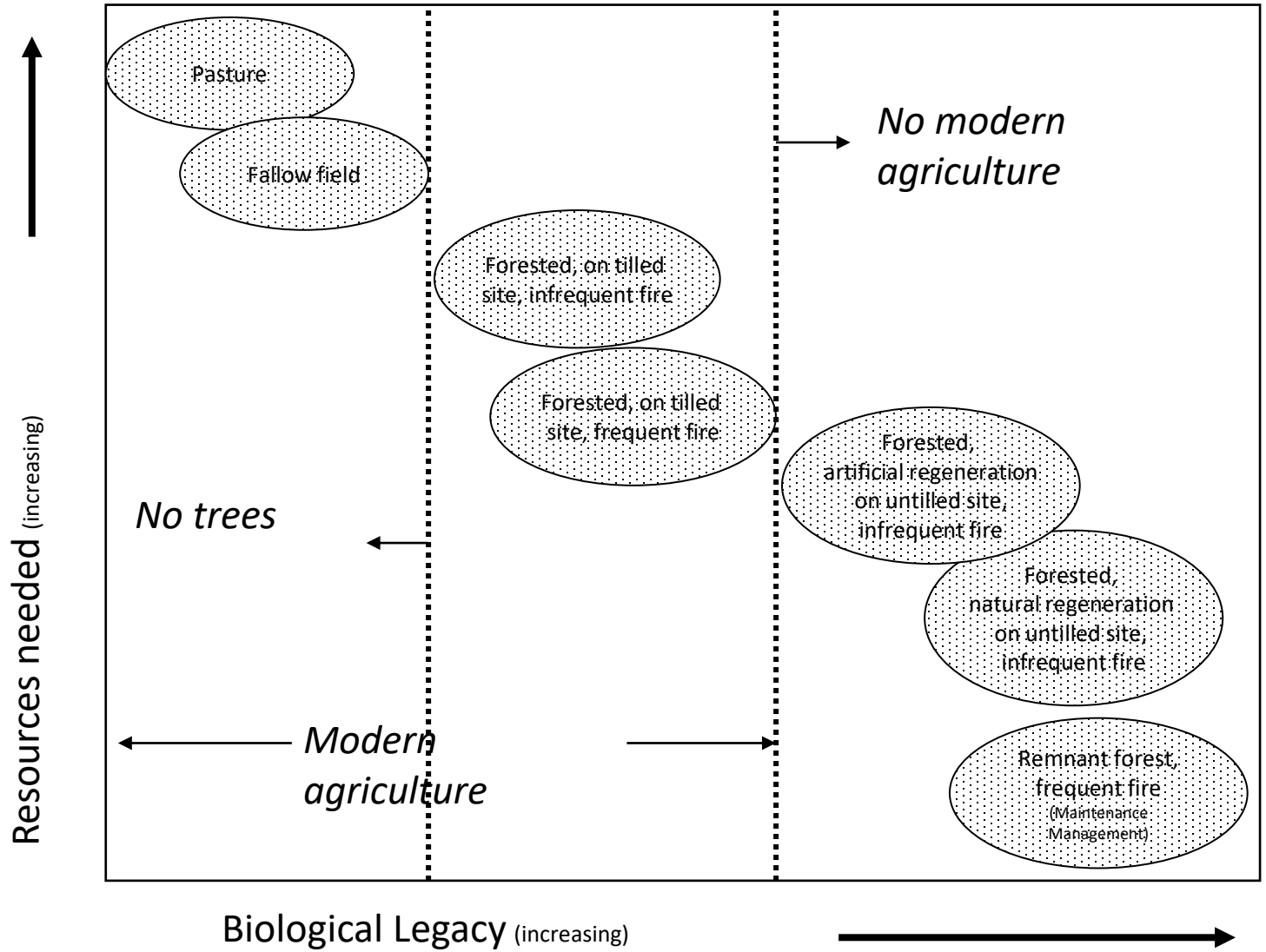
Few desirable natives

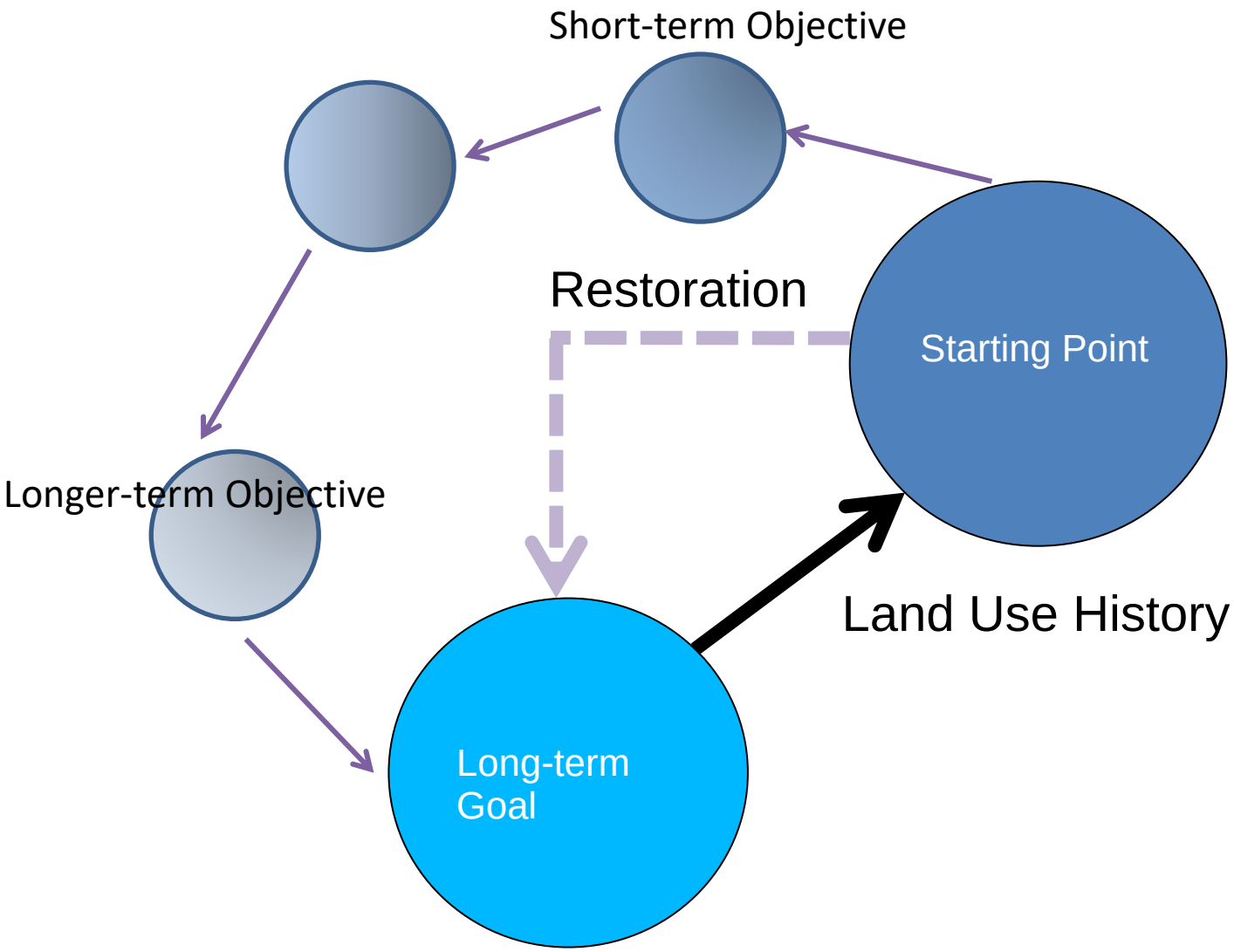
Soils altered

- Elevated Phosphorus
- Reduced Carbon
- Higher pH

# Conceptual Model




Pasture
Fallow field
Forested, on tilled site, infrequent fire
Forested, on tilled site, frequent fire
Forested, artificial regeneration on untilled site, infrequent fire
Forested, natural regeneration on untilled site, infrequent fire
Remnant forest, frequent fire (Maintenance Management)
No modern agriculture
No trees
Modern agriculture
Resources needed (increasing)
Biological Legacy (increasing)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# Goal: multi-aged longleaf pine dominated canopy, herbaceous ground cover dominated by warm-season grasses

## Guiding Strategy: restore/maintain burnable landscape at every stage

Short-term objectives:

- Manage canopy to restore function
- Reduce midstory and shrub component

Medium-term:

- Establish warm season grasses (contiguous fine fuels)

Longer-term:

- Add species to meet specific objectives
  - Legumes for wildlife food and ecosystem function
  - Composites for pollinator support
  - Rare species for biodiversity

# Agricultural fields, pastures

- No canopy
- Little if any natural ground cover species present
- Abundance of exotic species, forage grasses

- Short-term Objectives:
  - Establish native fine fuels in order to reintroduce fire
    - Control/remove exotic species, forage grasses
    - Create mineral seed bed for planting native herbaceous species
  - Establish trees
    - Consider the details of site preparation, planting

- Mid-term Objectives:
  - Species additions (enrichment)
  - Monitor and re-treat persistent forage grasses
  - Burn to maintain favorable conditions

# A few notes on pastures…

# Cutover areas

- No canopy
- Abundance of natural ground cover species variable
- Short-term Objective: Establish trees
  - Consider the details of site preparation & planting- choose methods that preserve desirable groundcover species
- Short- or Mid-term: establish fine fuels
  - Introduce native grasses when trees are planted, or after first thinning
- Mid-term: manage canopy to maintain favorable conditions for ground cover

# Longleaf Plantations (established)

Through canopy closure, herbaceous species reduced, especially weedy annuals and sort-lived perennials

Shorter-term Objectives:

- Manage plantation through canopy closure, including prescribed fire
- First thinning after canopy closure creates favorable conditions for ground cover species
- Monitor for ground layer response

Mid-term:

- Establish native warm-season grasses

# Gradual conversion of loblolly to longleaf dominance

# Gradual conversion to longleaf canopy

Create openings in which to plant longleaf seedlings

- Ensure openings are not so large that needle fall does not reach entire area (e.g., circular gaps 0.25 acre)

Monitor openings for ground cover response; introduce grasses to supplement fuels Follow-up with prescribed fire necessary, especially on wetter sites

Additional treatments to control woody species likely necessary on flatwoods sites

# Slash pine to longleaf conversion on flatwoods sites more challenging (Flint Rock Preserve/WMA)

# Mixed pine and pine-hardwood forests- the result of fire exclusion

Heavy duff and litter; hardwood fuels in the mix; few residual ground cover species

Short-term objectives:

- Reduce hardwood component
- Establish desirable pine stocking/ basal area
- Reintroduce fire with objective of slowly reducing litter and duff layers

Longer-term:

- Reintroduce native grasses to further establish continuous fuels

# Midstory reduction options

May not be needed in xeric sites with some native ground cover; fire alone

Sub-xeric to mesic sites – removal supports ground cover recovery; various herbicide treatments have immediate effect, as do mechanical options (chop, mow, masticate), but all require follow-up treatments with prescribed fire

Flatwoods and somewhat poorly drained sites – most likely initial treatment required to reduce hardwoods or shrubs, but more complicated; particularly to reduce high woody fuels that when burned kill pine seedlings

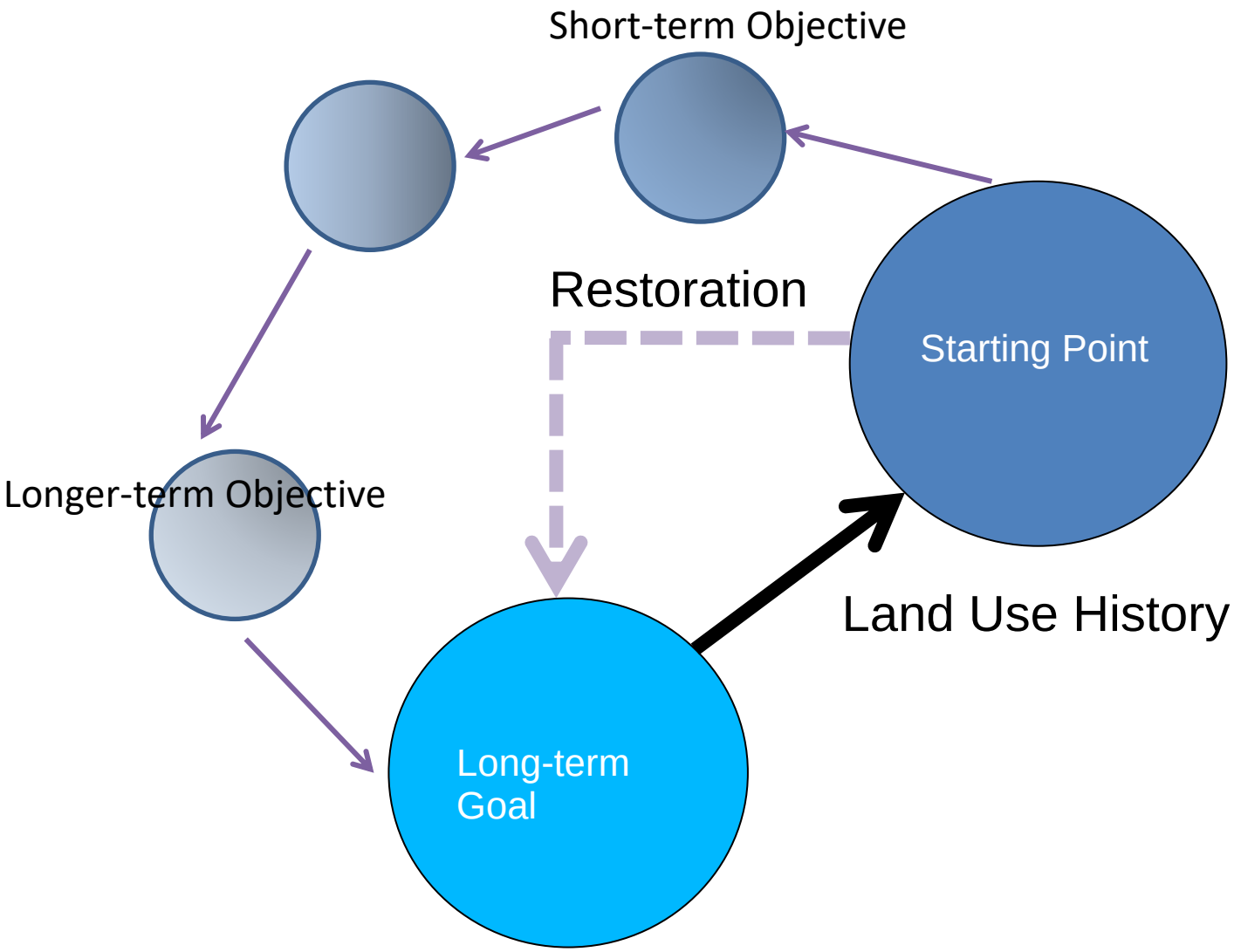
# Longleaf pine-dominated forests

Short-term objectives:

- Modify stocking levels to approach maintenance condition
- Consider harvest to recruit multiple age classes
- Reintroduce fire

Longer-term:

- Reintroduce native species as needed to meet management objectives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Questions?