

Ecological Concepts of Integrated Weed Management

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What is ecology?

- ☼ Relationships between organisms and their environments
- ☼ Ecosystems (organisms + environments) are complex
 - ☼ Many parts, each of which contributes to the whole in different ways
- ☼ What ecology is *not*:
 - ☼ Environmental advocacy
 - ☼ Political activism

Ecologically-based Invasive Plant Management

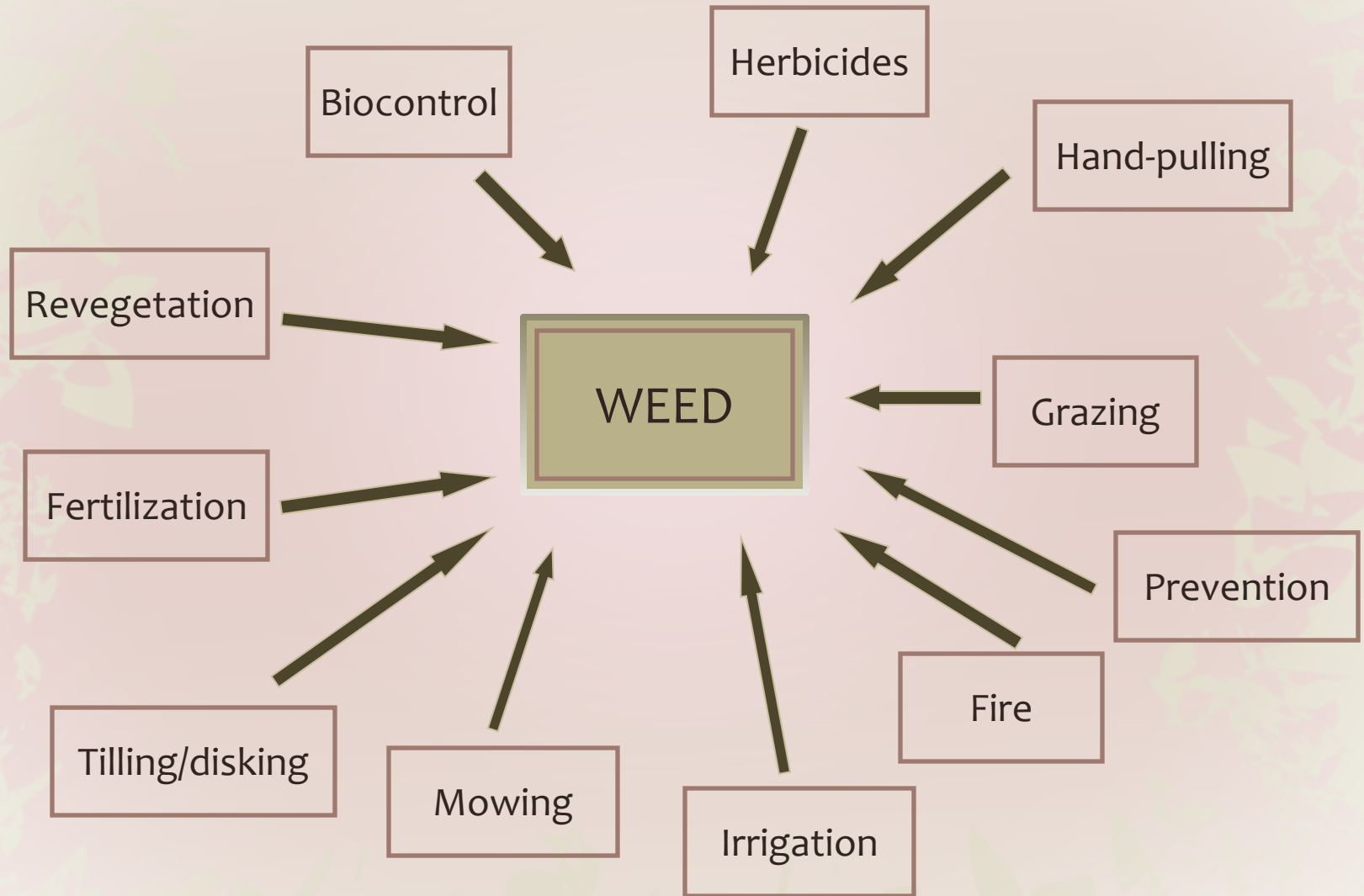
- ☼ Understand how an invasive plant population interacts with itself and with desired vegetation
- ☼ Understand how environment (climate, elevation, aspect, herbivores, humans, etc.) affects these interactions
- ☼ Manipulate biotic and abiotic factors to influence plant community dynamics
 - ☼ Favor desirable vegetation
 - ☼ Disfavor weeds

Treating Symptoms vs. Causes

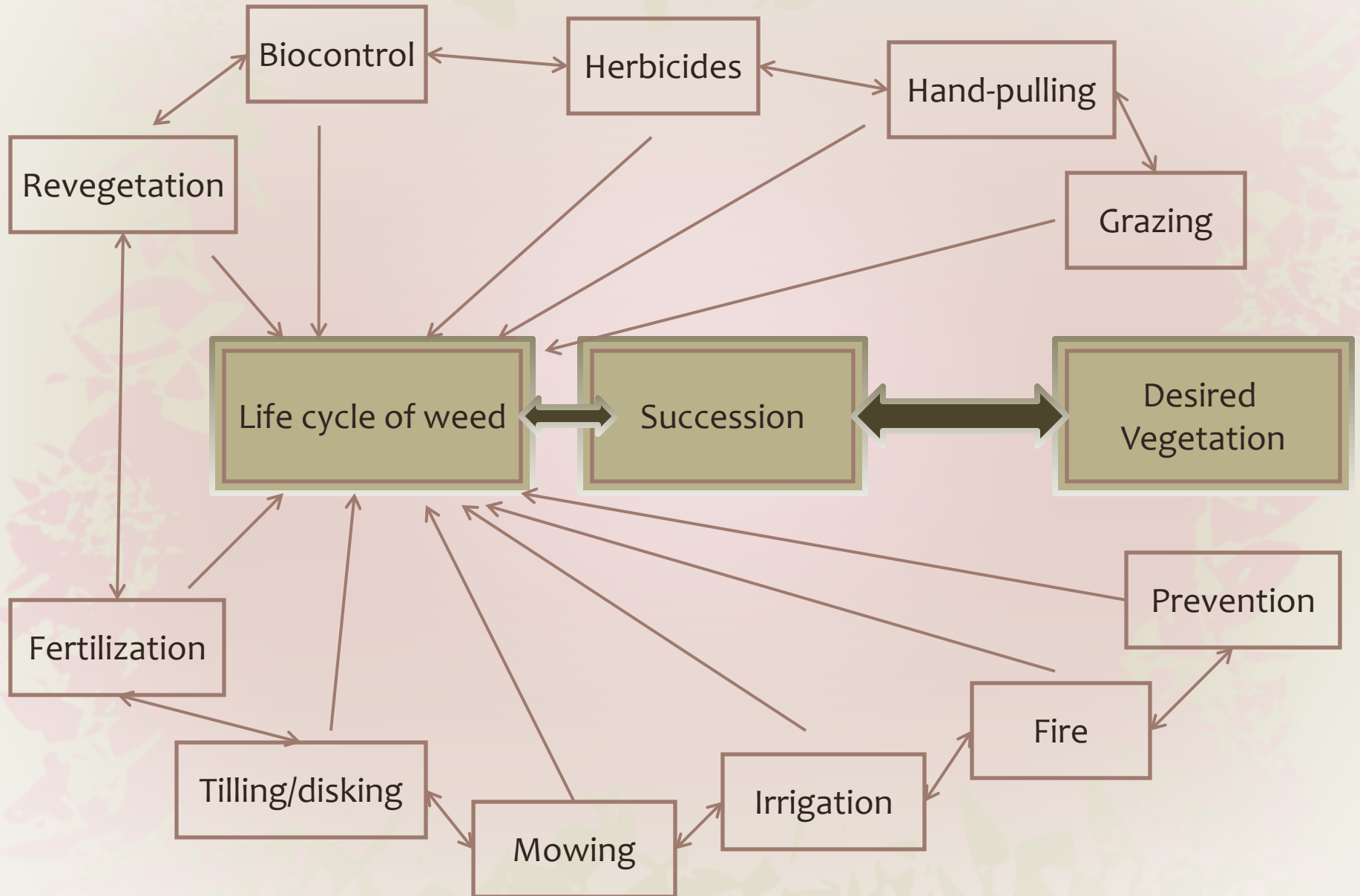


Orthotics control over-pronation

Traditional Management



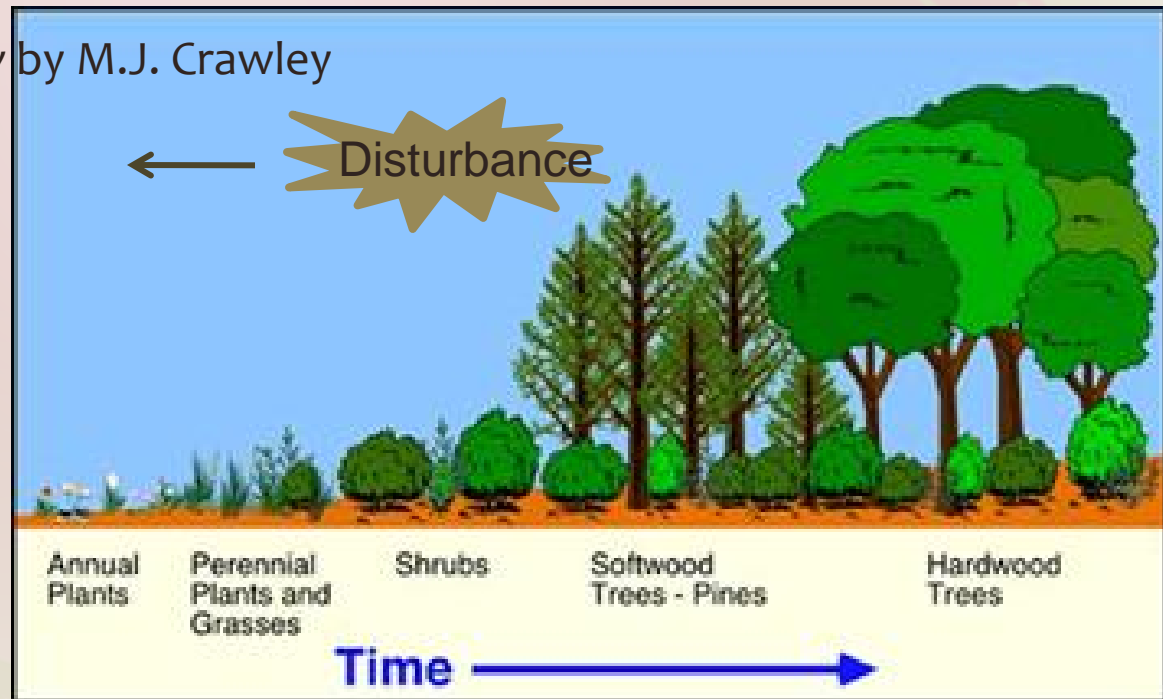
Future Management--EBIPM



Succession

- ☼ Process whereby one plant community changes into another. It involves the immigration and extinction of species, coupled with changes in the relative abundance of different plants.

-Plant Ecology by M.J. Crawley



Invasion is a form of succession!



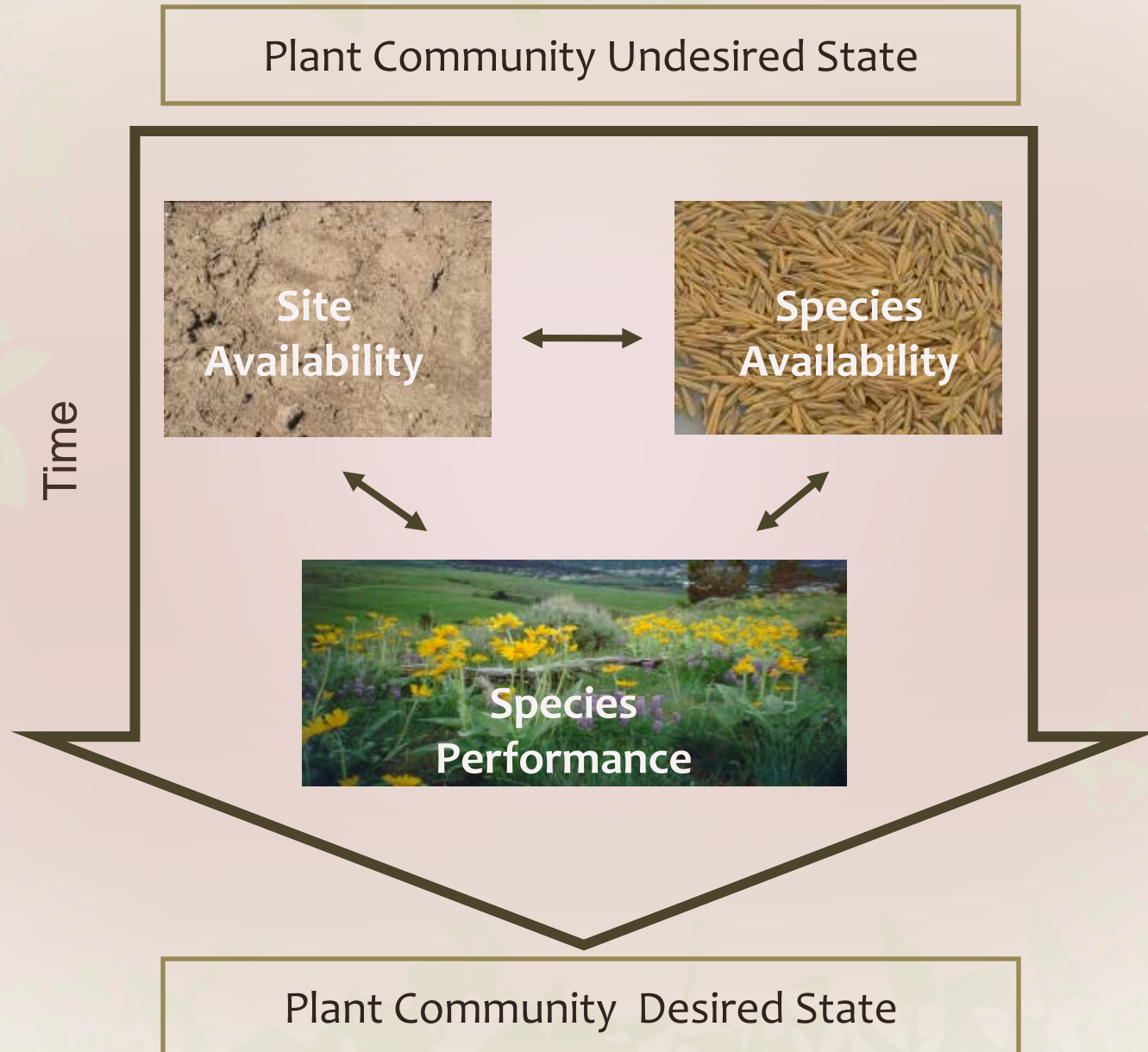
Native species colonization

OR

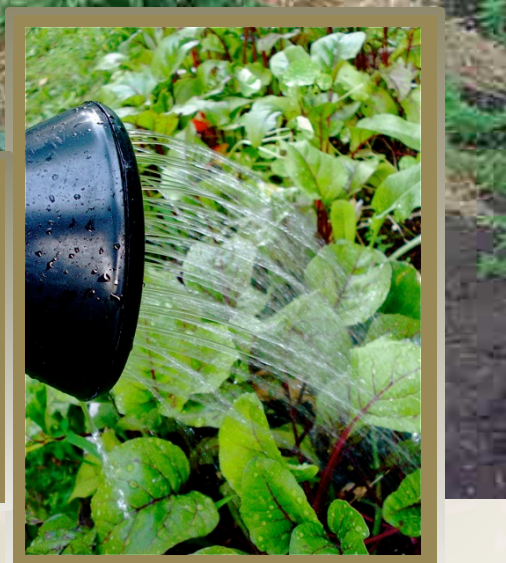


Tansy ragwort colonization

Managing succession



Managing Plant Communities





- Disturbance
 - Size
 - Severity
 - Timing
 - Patchiness
 - Frequency

- Dispersal
 - Vectors
 - Landscape
- Propagule Pool
 - Decay rate
 - Land use

- Allelopathy
 - Soil
 - Microbes
 - Neighbors
- Consumers
 - Identity
 - Cycles
 - Plant defenses
 - Patchiness

- Resource availability
 - Soil
 - Microclimate
- Ecophysiology
 - Germination
 - Assimilation
 - Growth rate
- Life history
 - Allocation
 - Reproductive time
 - Reproductive mode
- Stress
 - Climate
 - Prior occupants
- Competitors
 - Identity
 - Consumers
 - Disturbance
 - Resource base

(Pickett et al. 1987; Sheley et al. 1996; Krueger-Mangold et al. 2006)

Ecological Framework Useful for Management

Initial Plant
Community

Site
Availability

Species
Availability

Species
Performance

Final Plant
Community



Herbicide

Grazing

Tilling

Hand pulling

Fire

Broadcast
seed

Drill seed

Grazing

Aerial
seeding

Biological
control

Repeated
Spring
Grazing

Hand pulling

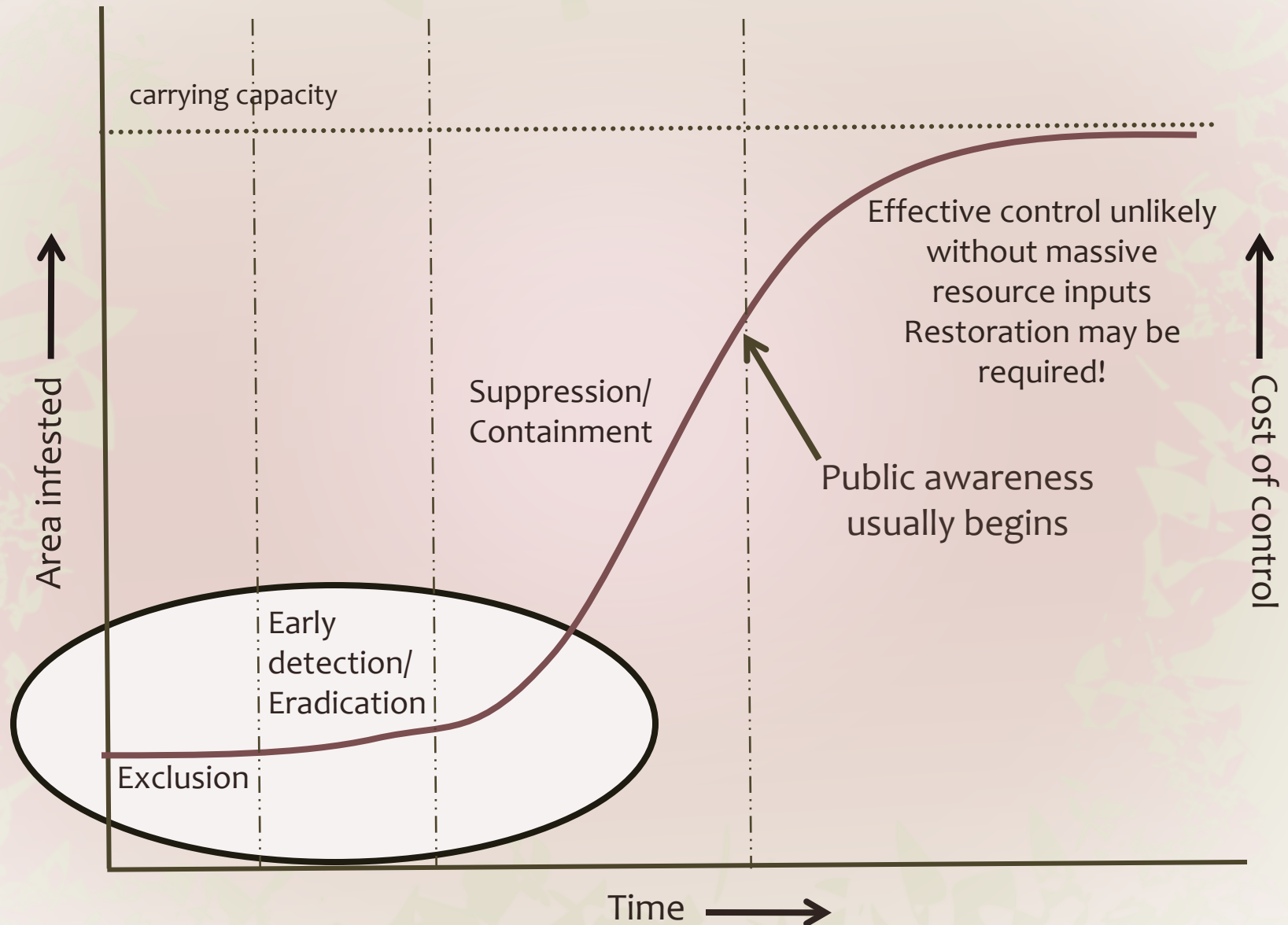
Fertilization

Mowing/cutting

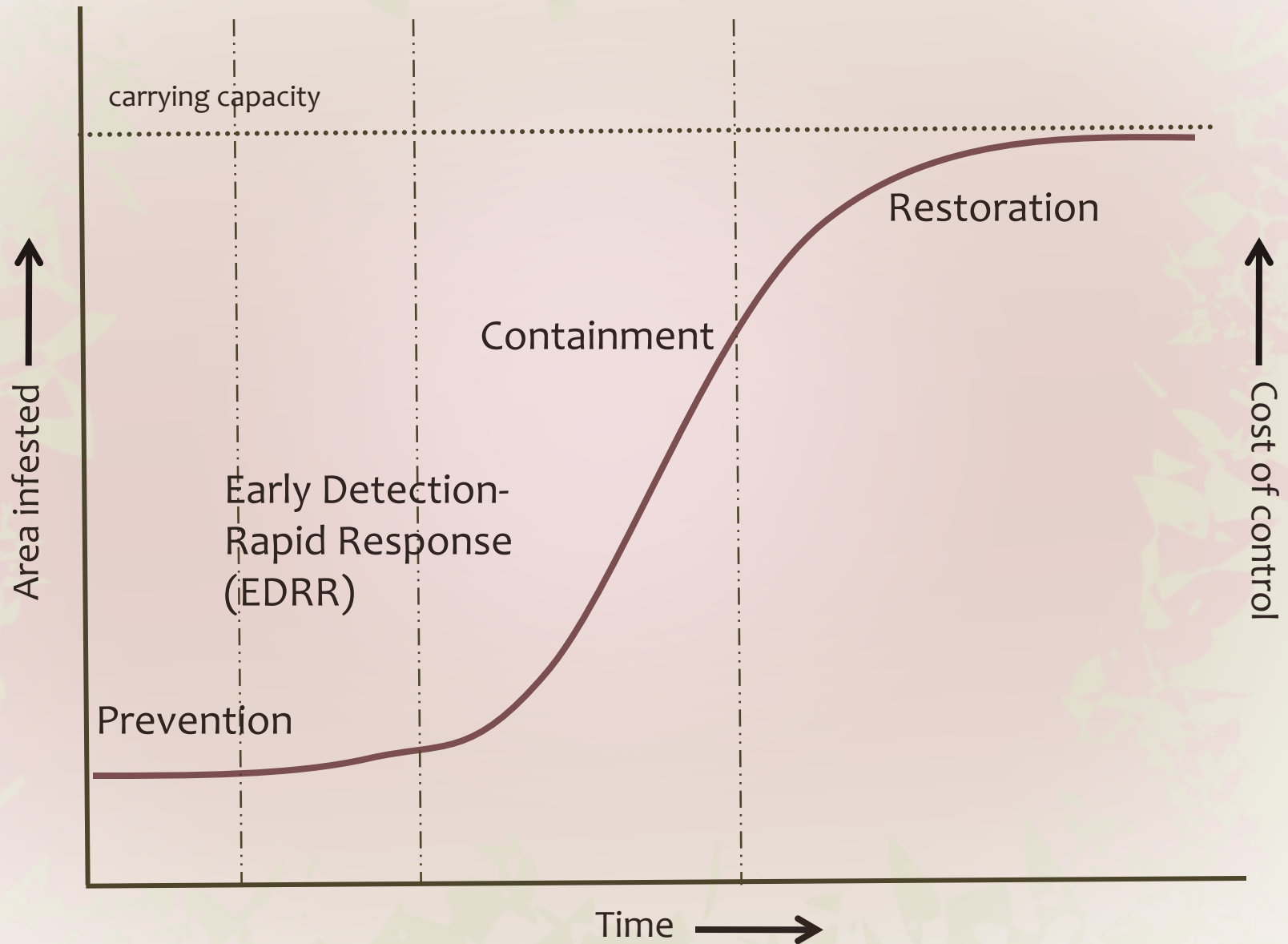
Herbicide



Invasion Progression vs. Management Strategy



Invasion Progression vs. Management Strategy



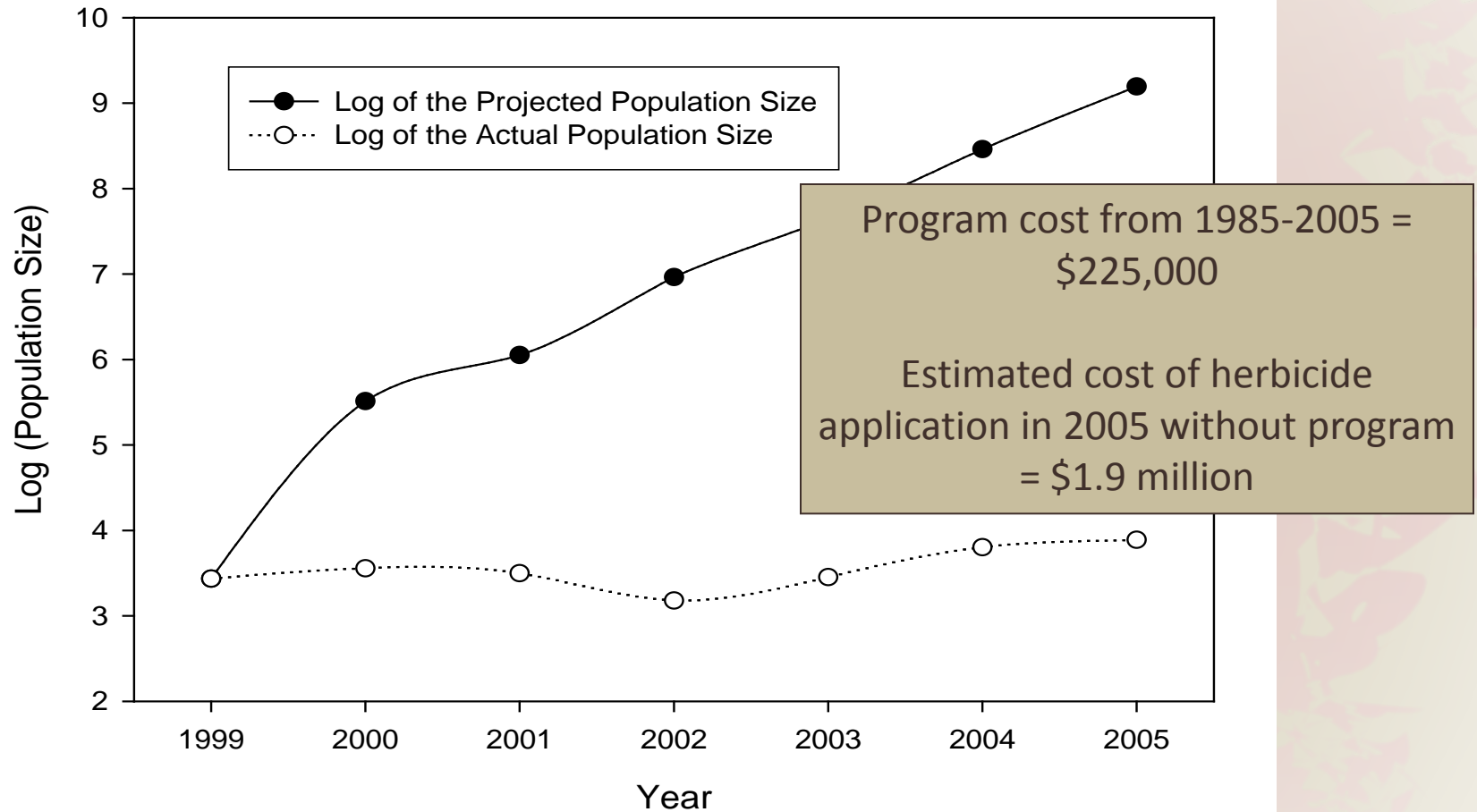
Management Strategies-- Prevention

- ☼ Education and awareness!!!
- ☼ Protect weed-free areas
- ☼ Large majority of U.S. is NOT infested
- ☼ In MT, 7.6 million acres infested/93 million acres total = 8%
- ☼ Limit disturbance (site availability) and weed seed dispersal (species availability)
- ☼ Maintain healthy, competitive vegetation (species performance)
- ☼ Communication among land managers

Management Strategies—Early detection/rapid response

- ☀ Mobile, global society
- ☀ Invasive plants *will* continue to spread
- ☀ Catch infestations early when eradication is still possible (limit species availability)
- ☀ Develop survey and inventory protocol (where are sites and species available?)
- ☀ Prioritize those areas most susceptible to invasion
 - ☀ Highways
 - ☀ Railways
 - ☀ Trails
 - ☀ Water channels

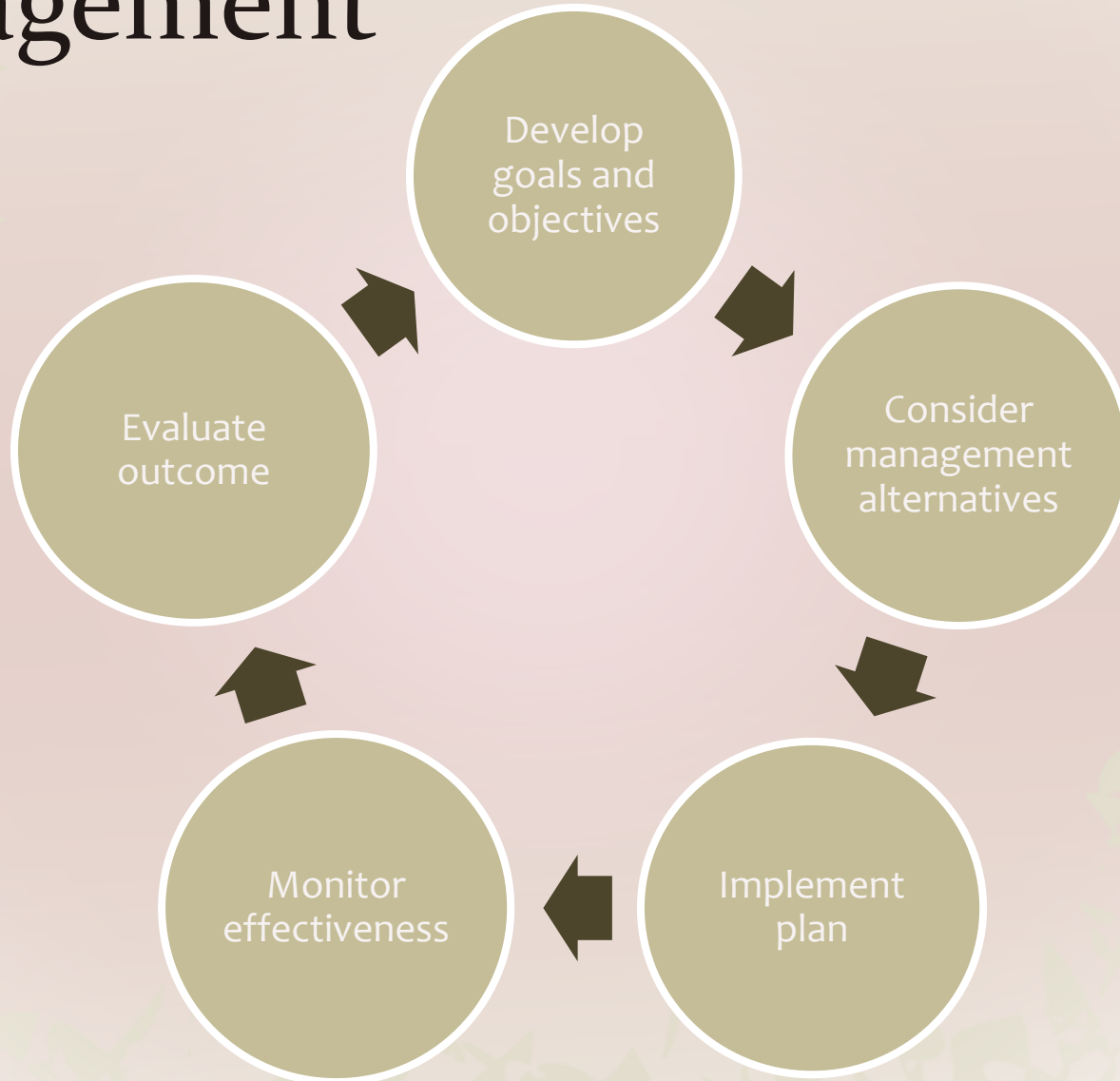
EDRR in Montana—Dyer's Woad



Management Strategies-- Containment

- ☼ Integrated Weed Management
 - ☼ Application of multiple control measures that complement one another (address all 3 causes of plant community dynamics)
- ☼ Mechanical
- ☼ Biological
- ☼ Chemical
- ☼ Cultural

Containment—Adaptive Management



Management Strategies-- Restoration

- ☼ May be necessary if area has been dominated by invasive plants for a long time
- ☼ Control weedy species (site availability and species performance)
- ☼ Introduction of desirable species through revegetation (species availability)
- ☼ Difficult and unpredictable—but often necessary!

Summary

- ☼ Treat cause of invasion, not just symptoms
- ☼ Identify and manage most influential ecological relationships that are leading to invasion and encouraging persistence of invasive plants
 - ☼ Site availability
 - ☼ Species availability
 - ☼ Species performance

Summary

- ☼ Gear management strategy toward stage of invasion
- ☼ Prevention
- ☼ Early detection/Rapid response
- ☼ Containment
- ☼ Restoration
- ☼ Adaptive management

Questions?

