Pondberry Steckling Response to Hydroperiod and Light Regime: Science-Based Information for Conservation Strategies

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Introduction

Pondberry Ecology

- ✓ *Lindera melissifolia* (Walter) Blume
- ✓ family Lauracea
- ✓ deciduous, broadleaf shrub
- ✓ shade tolerant
- ✓ rhizomatous
- ✓ about 6 feet tall

Introduction

Pondberry Ecology

- ✓ federally endangered
- ✓ endemic to bottomland forests and other low lying areas in the southeastern U.S.
- ✓ considered the rarest shrub in North America
- ✓ colonies
- ✓ ramets
- ✓ susceptible to laurel wilt fungus

Why Study Pondberry?

Yazoo Backwater Reformulation Project

- ✓ Flood of 1927
- ✓ 1941 Flood Control Act
- ✓ last piece of the puzzle

Why Study Pondberry?

Yazoo Backwater Reformulation Project

- ✓ proposed pump
- ✓ environmental impact assessment, dispute

Introduction

U,S. Forest Service Involvement

- ✓ approached by the U.S. Army Corps of Engineers
- ✓ requested to develop a series of studies to better understand the ecology and ecophysiology of pondberry
- ✓ team – U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and U.S. Forest Service (Southern Hardwoods Laboratory and the Delta National Forest)

Introduction

Hypotheses

- ✓ hydroperiod (timing and duration of soil flooding) will not affect pondberry survival or above-ground growth
- ✓ light availability influences survival and above-ground growth to the greatest extent at an intermediate level of light
- ✓ the interaction of hydroperiod and light availability will influence survival and above-ground growth with greatest survival and and growth at an intermediate level of light in the absence of soil flooding

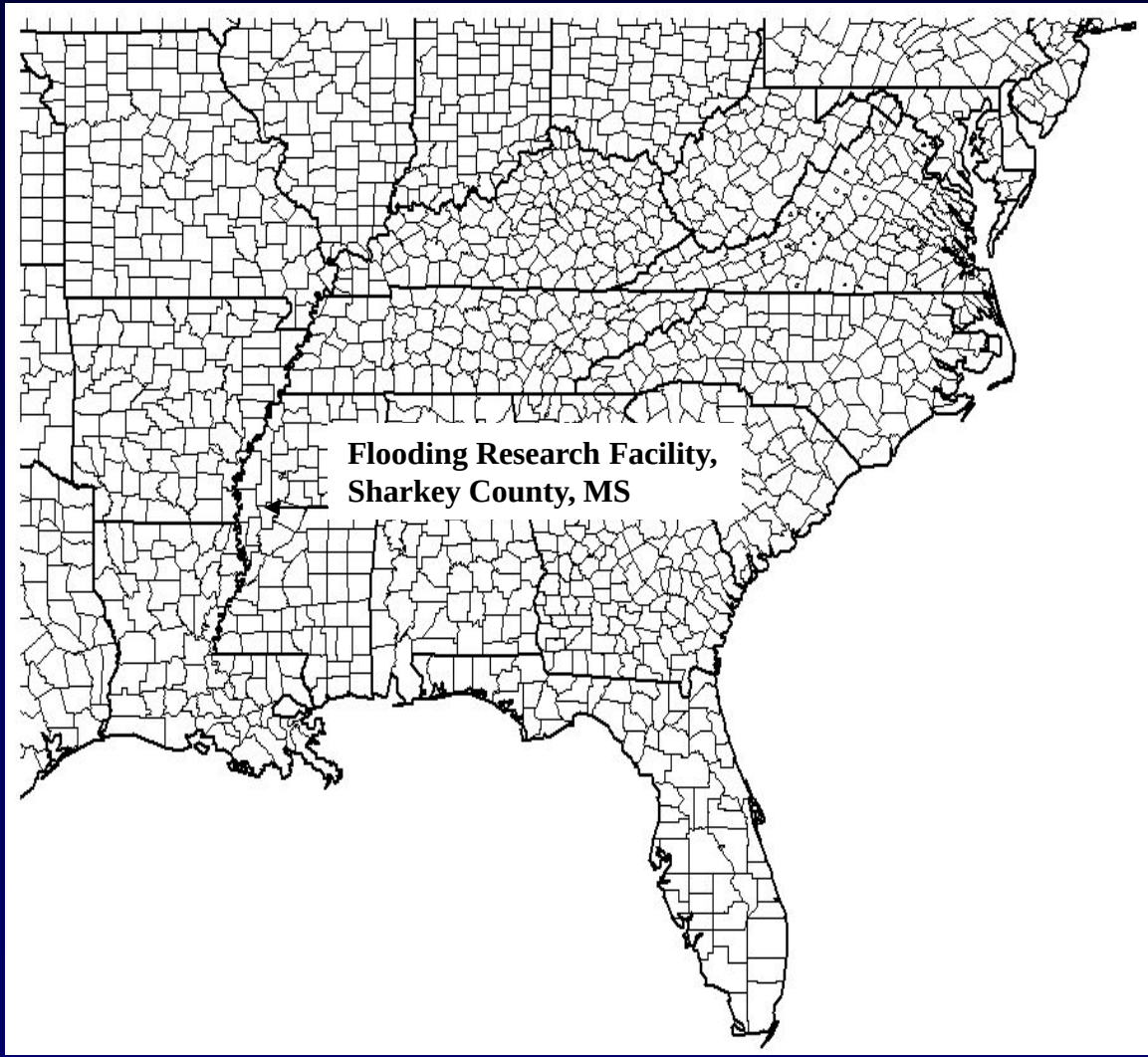
Introduction

General Comments

- ✓ information is vital to inform management strategies aimed at conservation and restoration of this species in floodplain forests in the LMAV
- ✓ provide a basic model for experimentally acquiring fundamental knowledge on plant species biology to formulate science-based management strategies for sustainable conservation of imperiled plant species

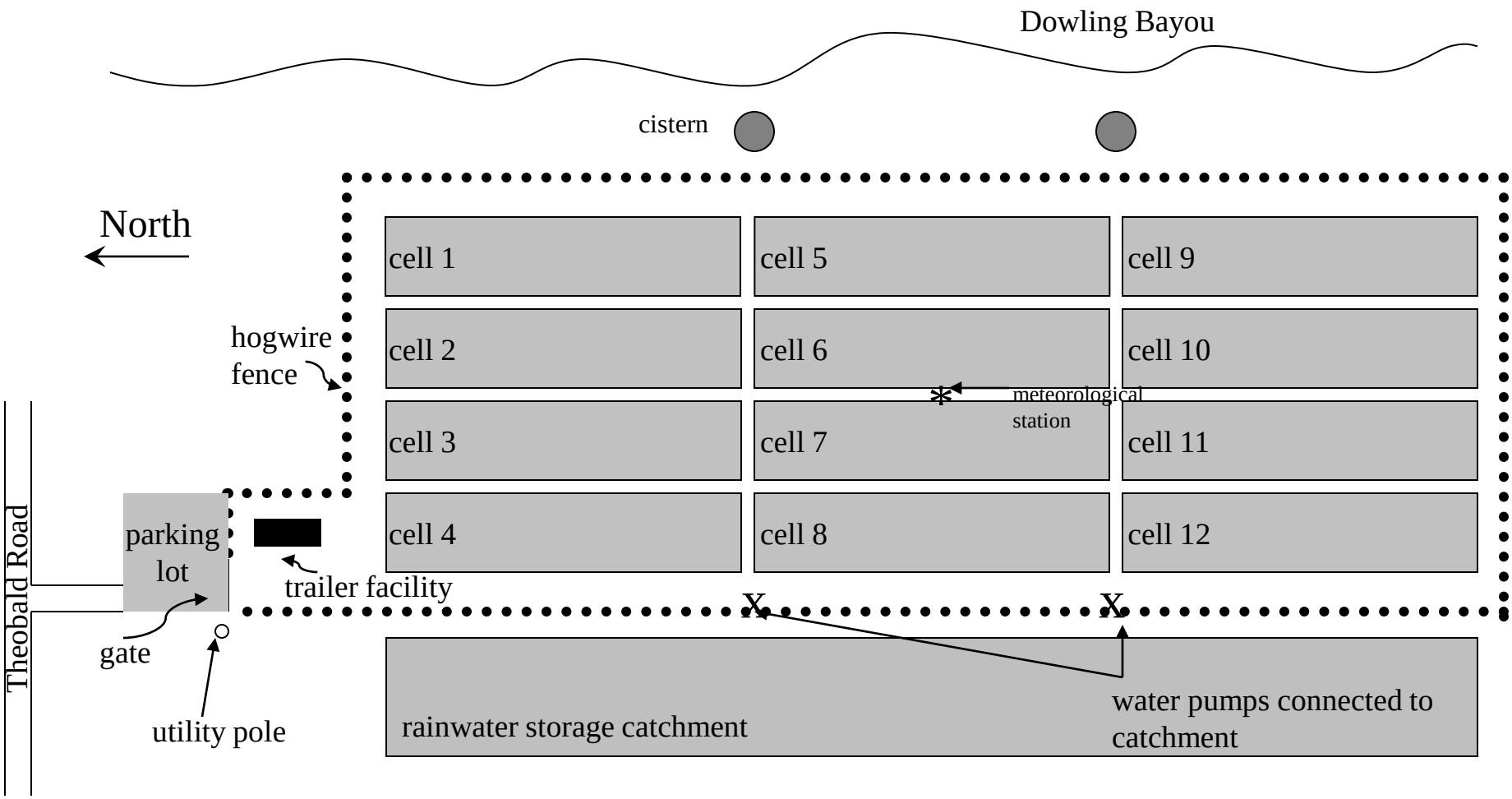
Methods

Study Location



Methods

Flooding Research Facility (FRF)


Dowling Bayou
cistern
North
cell 1
cell 5
cell 9
cell 2
cell 6
cell 10
hogwire fence
meteorological station
cell 3
cell 7
cell 11
cell 4
cell 8
cell 12
parking lot
trailer facility
Theobald Road
gate
utility pole
rainwater storage catchment
water pumps connected to catchment

Methods

FRF Purpose

- ✓ to study the effects of hydroperiod on the survival, growth, and development of plants
- ✓ can combine hydroperiod with other plant stressors, such as light availability
- ✓ controlled treatments on a relatively large scale

Flooding Research Facility

Construction

Flooding Research Facility

Construction

Flooding Research Facility

Construction

Flooding Research Facility

Repair

Flooding Research Facility

Infrastructure

Flooding Research Facility

Infrastructure

Flooding Research Facility

Infrastructure

Methods

FRF Treatments

- ✓ hydroperiod (2006 and 2007)
  - no flood
  - 45-day flood
  - 90-day flood
- ✓ light availability (2005, 2006, and 2007)
  - 70 percent sunlight (2005 acclimation year)
  - 37 percent sunlight
  - 5 percent sunlight
- ✓ gender (pre-treatment, 2005, 2006, and 2007)

Methods

Hydroperiod

Pondberry Ecophysiology Research

FRF – 7 Areas

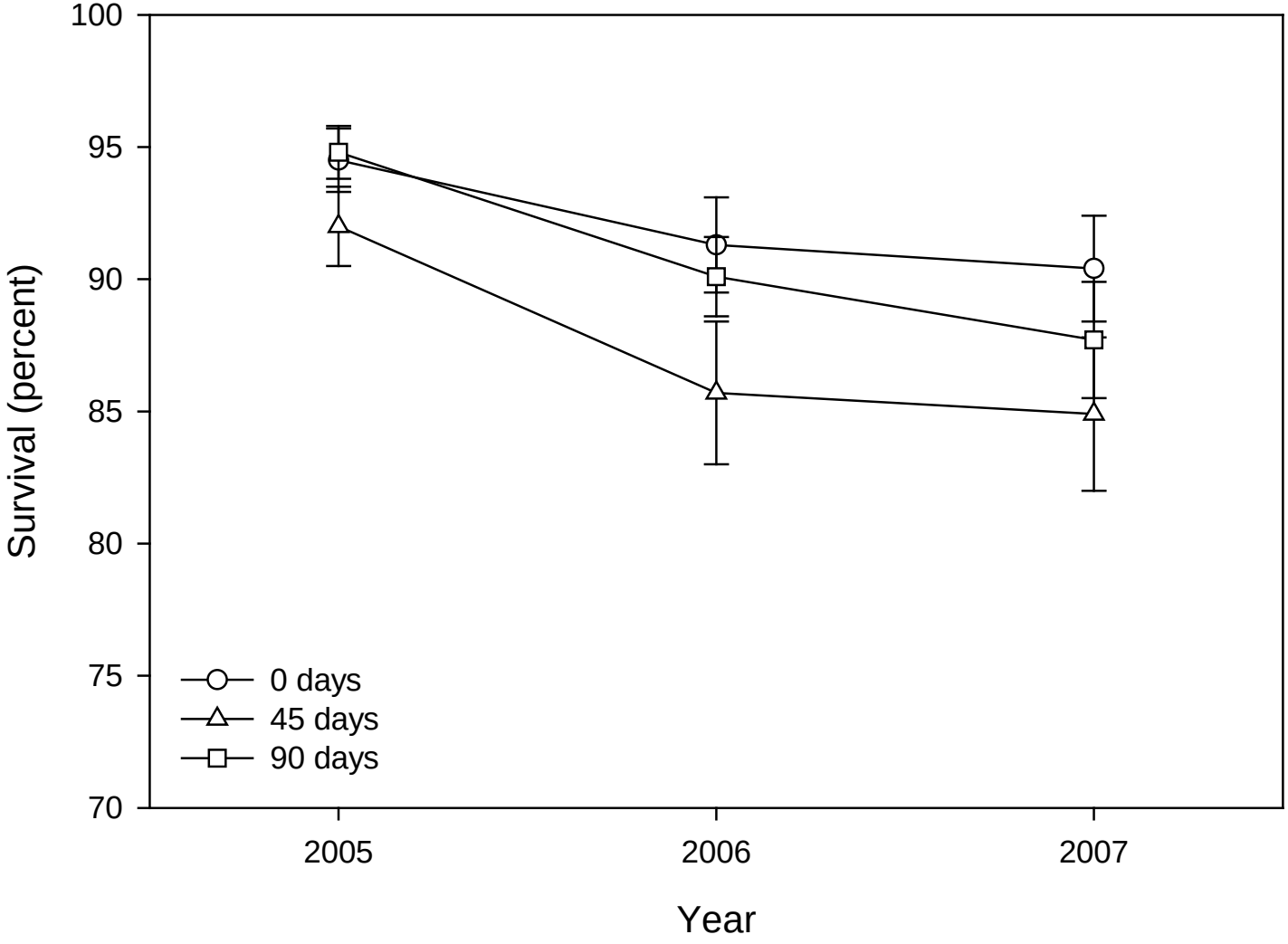
- ✓ environmental monitoring
- ✓ steckling development ***
- ✓ light response of photosynthesis
- ✓ diurnal gas exchange
- ✓ blade anatomy
- ✓ water relations
- ✓ biomass accumulation and distribution

Materials and Methods

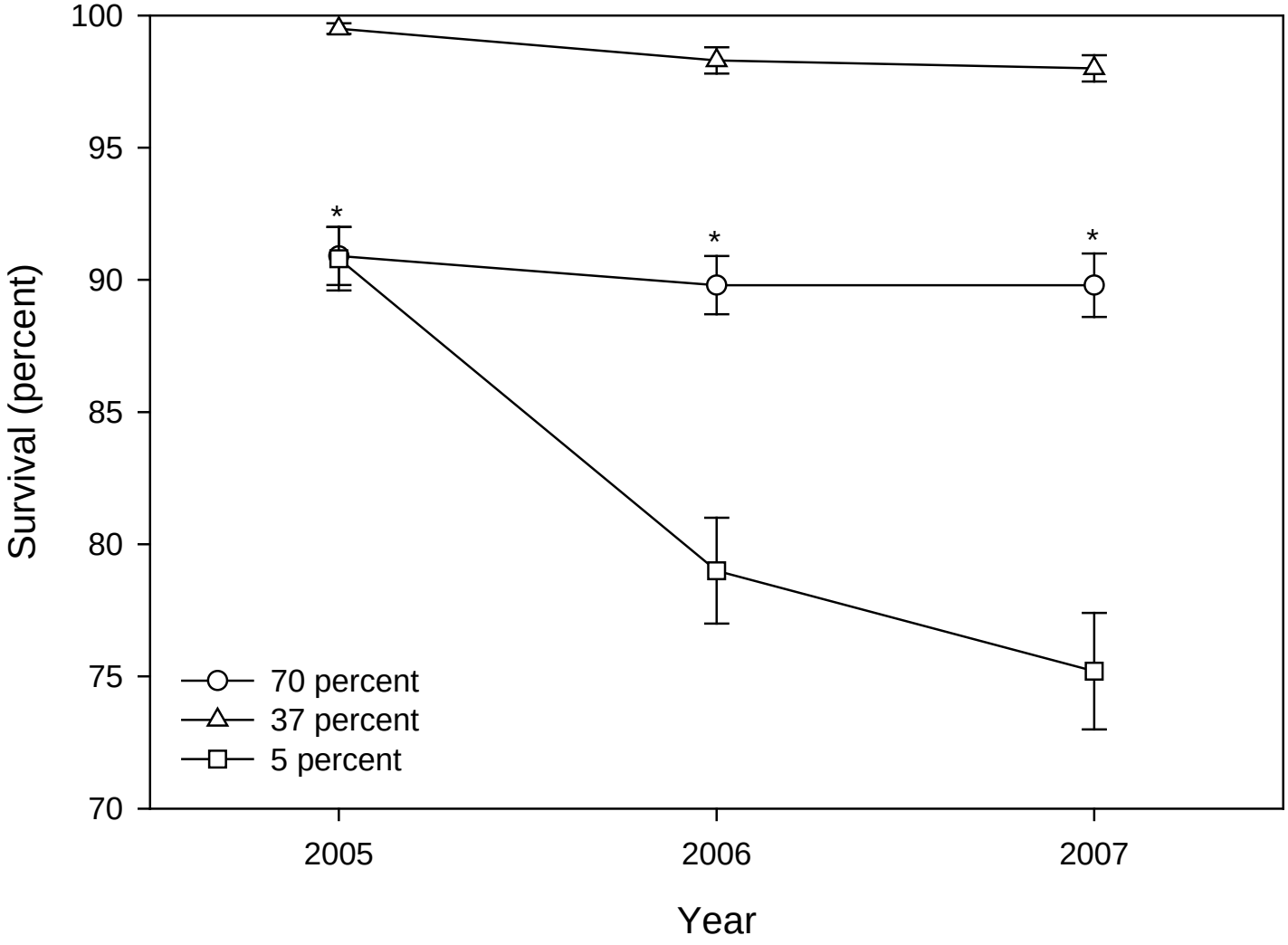
FRF – ***Steckling*** Measurements

- ✓ pre-tmt, 2005, 2006, 2007
  - ✓ length
  - ✓ diameter
  - ✓ number of ramets

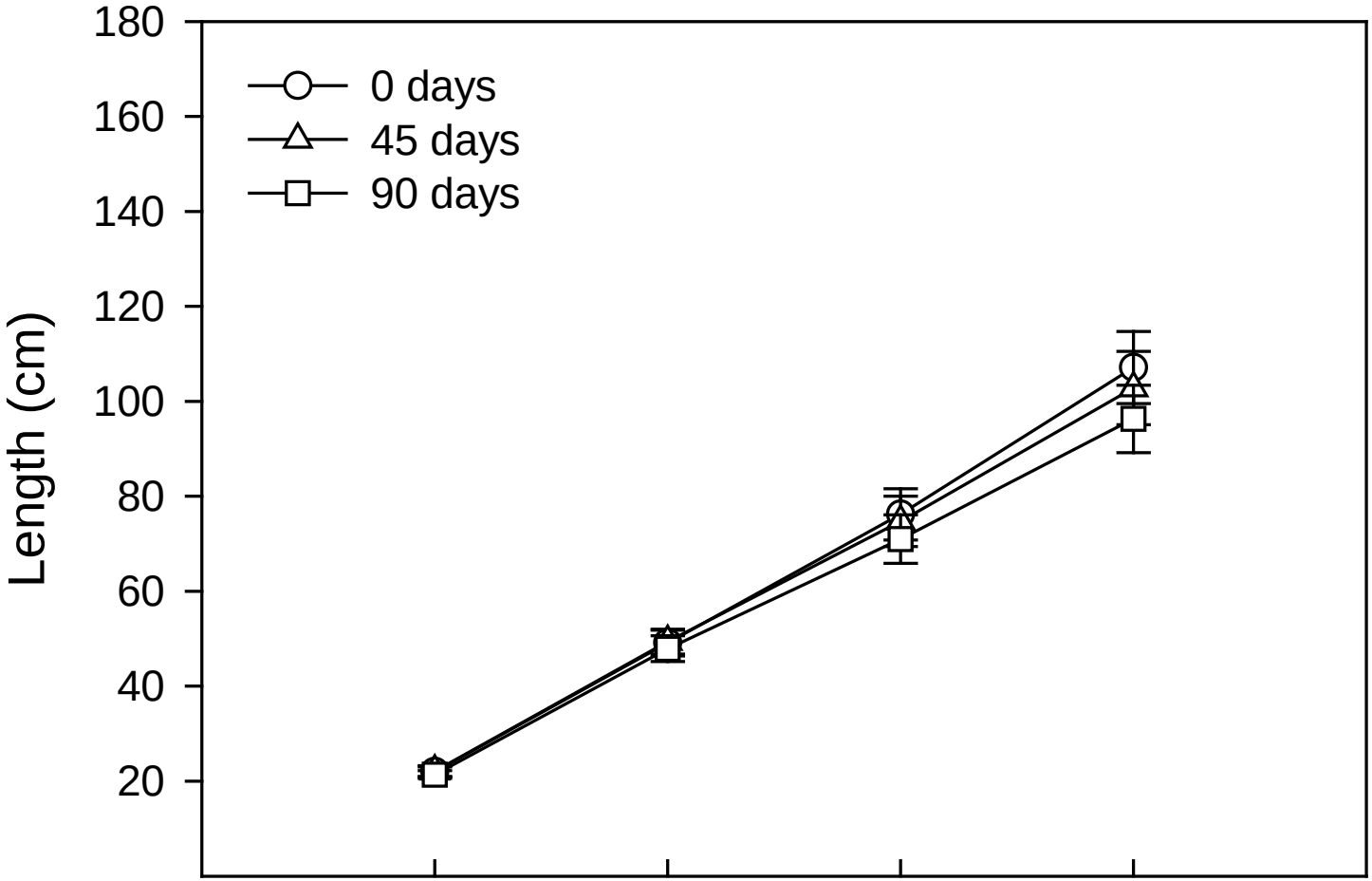
Survival – Hydroperiod



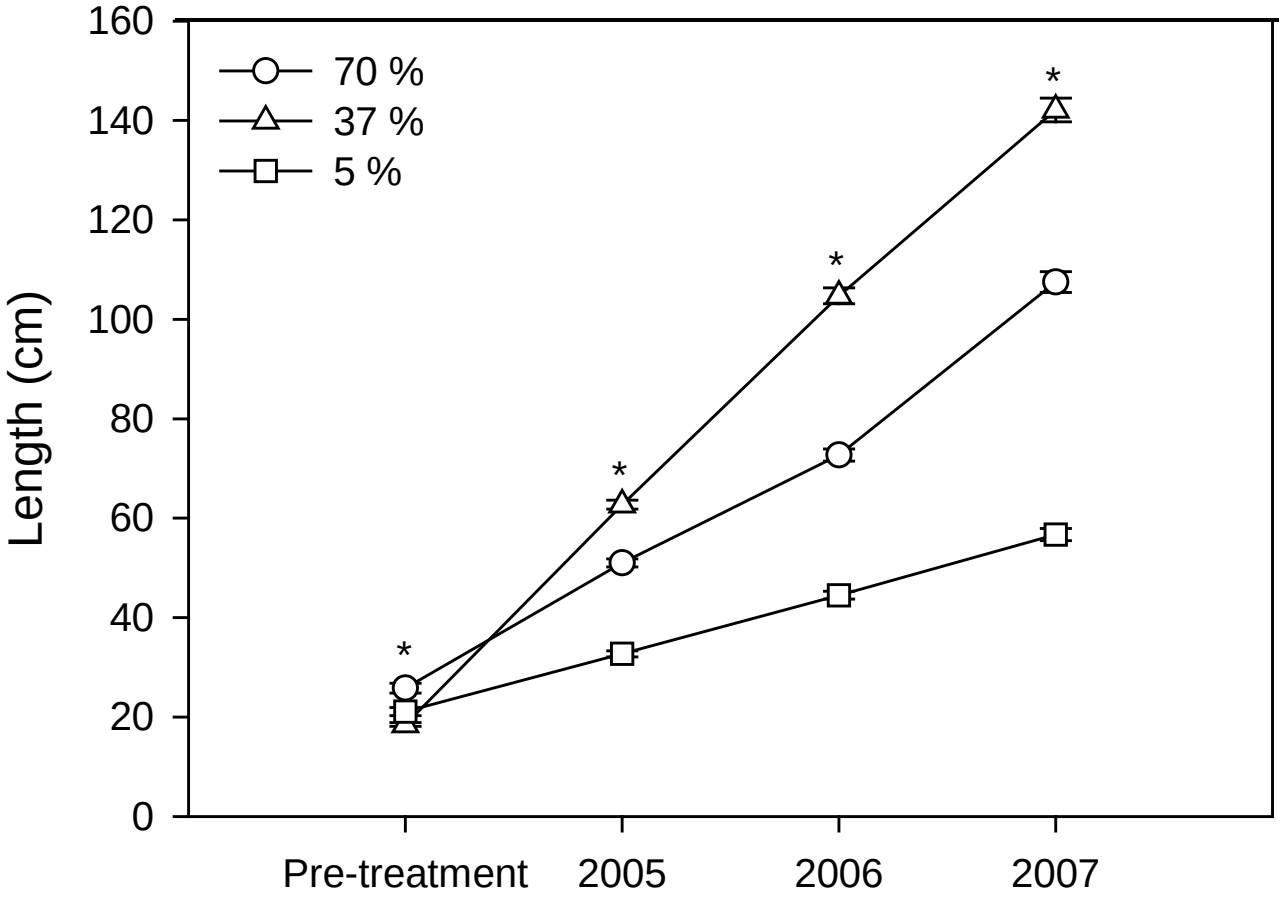
Survival – Light Availability



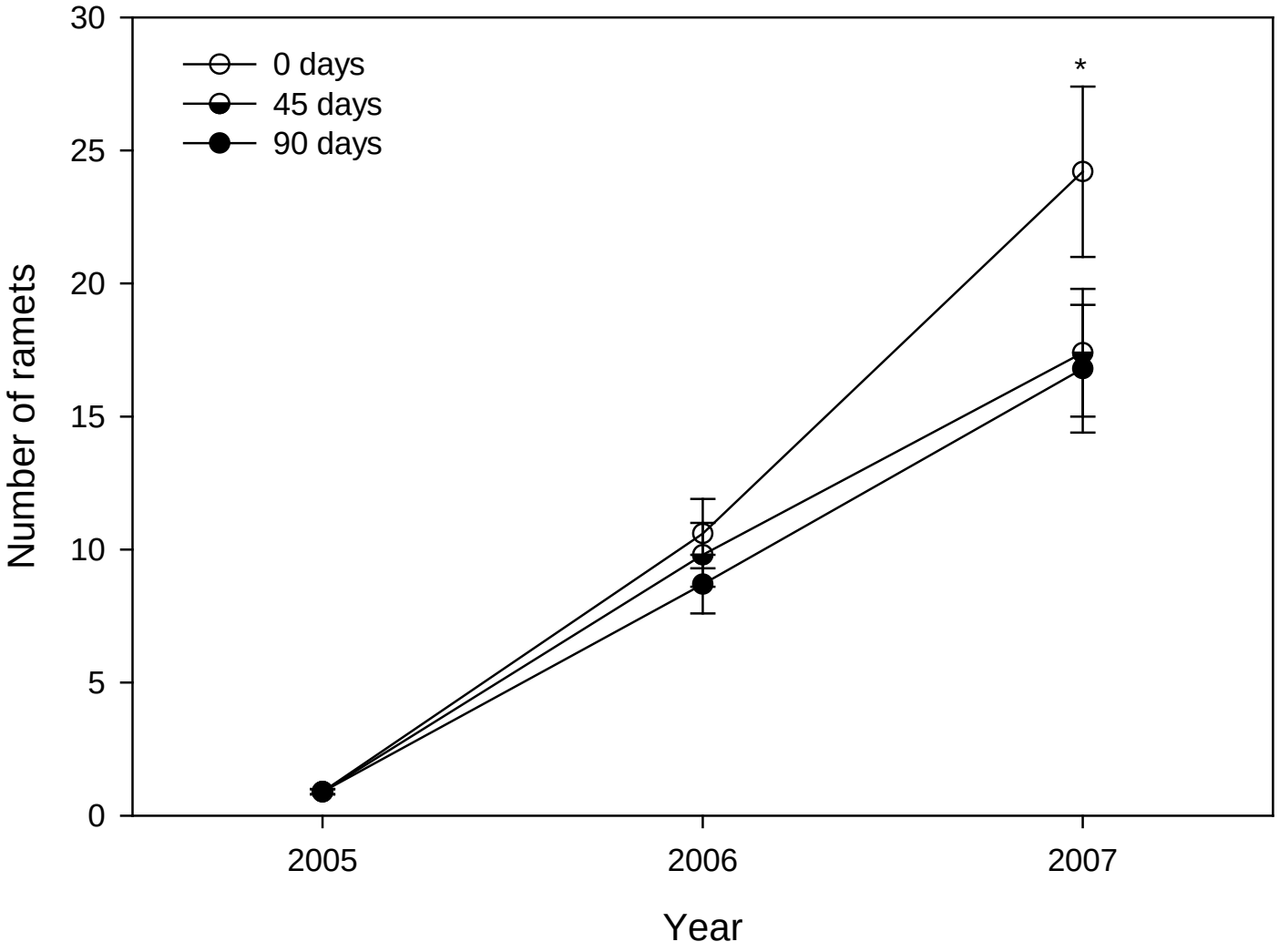
Stem Length – Hydroperiod



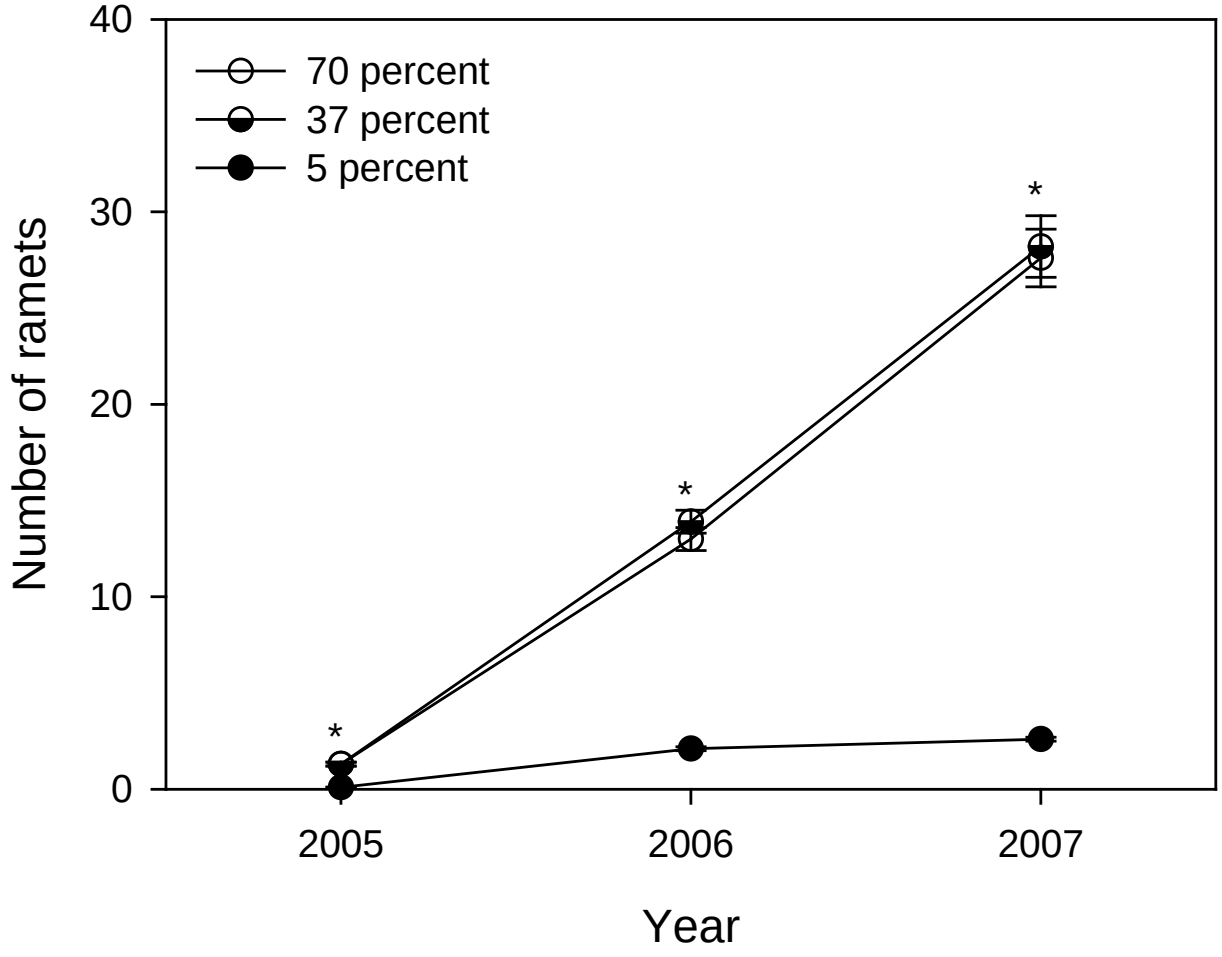
Stem Length – Light Availability



Number of Ramets – Hydroperiod



Number of Ramets – Light Availability



Discussion

Does Soil Flooding Influence Pondberry Survival and Growth?

- ✓ minimally affected by soil flooding imposed in this experiment
- ✓ no hypertrophied lenticels, or adventitious roots
- ✓ no oxidized rhizosphere around soil roots
- ✓ observed flowering, leaf production, and drupe development while flood water present
- ✓ acclimate through physiological mechanisms rather than obvious morphology mechanisms

Discussion

Does Intermediate Light Availability Promote Pondberry Survival and Growth?

- ✓ Yes!
- ✓ 5% light (95% shade) – low growth, few leaves, and few ramets (no fruit)
- ✓ 70% light (30% shade) – under stress, leaf morphology, greater diameter growth
- ✓ 37% light (63% shade) – greatest survival and stem length growth, less stress
- ✓ considerable morphological plasticity

Conclusions

Pondberry

- ✓ soil flooding is not a requirement for development of vigorous pondberry plants
- ✓ soil flooding may reduce competition
- ✓ light availability is the key factor to pondberry survival and growth
- ✓ interaction may be necessary to control competition

Conservation and Restoration

Silviculture is the Key

- ✓ increase understory light availability
- ✓ competition control where hydroperiods are unfavorable

Ongoing Research

Release

- ✓ to determine pondberry response to changes in light availability (release from heavy shade conditions)
- ✓ survival and basic stem measurements
- ✓ complete competition control

Ongoing Research

Release

Questions?

Ph.D. – pondberry hole digger!