



*A Dendroecological Approach to Quantifying Midwestern  
Forest Canopy Gaps and Diversity Change*

Jodi Farrell Sparks\* and James H. Speer  
Indiana State University

Photo: JFS



# OUTLINE

- ❖ Objectives
- ❖ Hypothesis
- ❖ Natural history of one study area
- ❖ Study area locations
- ❖ Methods
- ❖ Results
- ❖ Acknowledgements

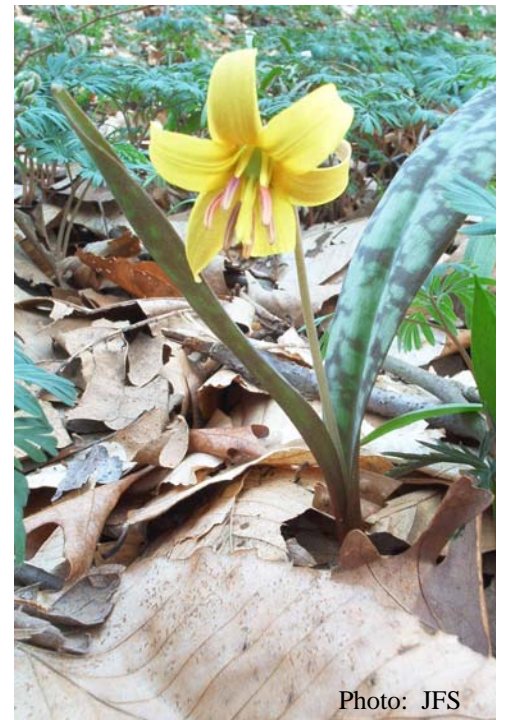


Photo: JFS

# DISTURBANCES

- ❖ Natural
  - ❖ Wind damage
    - Severe winds
    - Thunderstorms
  - ❖ Animals
    - Beavers
  - ❖ Plant invasions
- ❖ Anthropogenic
  - ❖ Trampling



Photo: JFS















# OBJECTIVES

- ❖ Document plant diversity changes in and between study areas
- ❖ Examine species richness for herbaceous and woody species
- ❖ Document disturbance patterns



Photo: JFS

# HYPOTHESIS

- ❖ Increased number of gaps will result in greater diversity of spring ephemerals



Photo: JFS



# FOREST PARK BACKGROUND

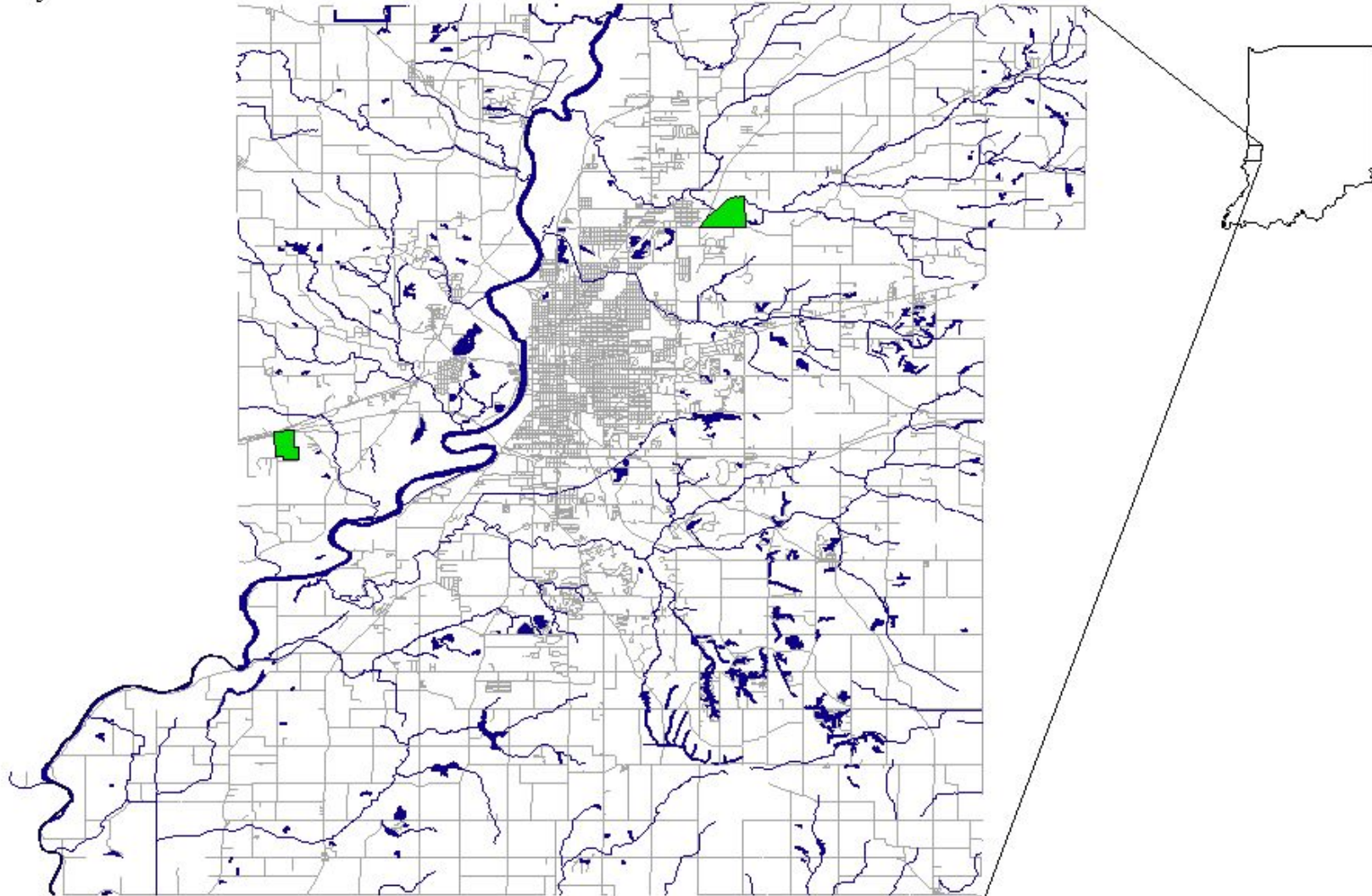
- ❖ First Financial Bank
- ❖ ~200 acres
- ❖ 65 acres of old-growth
- ❖ Beech-maple and oak-hickory
- ❖ No evidence of major disturbances



Photo: JHS



# Vigo County Study Sites



- Forest Park and Kieweg Woods
- Creeks
- Rivers
- Roads

0 4 8 12 Miles

Jodi Sparks  
Esri and U.S. Census  
7 Oct 04



# FIELD METHODS

- ❖ Vegetation surveys in spring 2004
  - ❖ Plot location
  - ❖ Plot sizes
- ❖ Tree cores acquired in fall 2004
  - ❖ Targeted gap sampling-6 plots
    - ❖ Two cores per tree (250 trees)



# LAB METHODS

- ❖ Prepare voucher specimens
- ❖ Mounted and sanded cores
- ❖ Crossdating
- ❖ Gap criteria (release and suppression)





# GAP CRITERIA

- ❖ Release event: Four or more consecutive years with 100% growth increase and must be preceded by suppression lasting longer than 4 years (Adopted from Lorimer and Frelich 1989 and Parshall 1995)
- ❖ Suppression event: First ring must be half the width of the previous ring and the following rings for four or more years need to be below average growth (Adopted from Canham 1985)



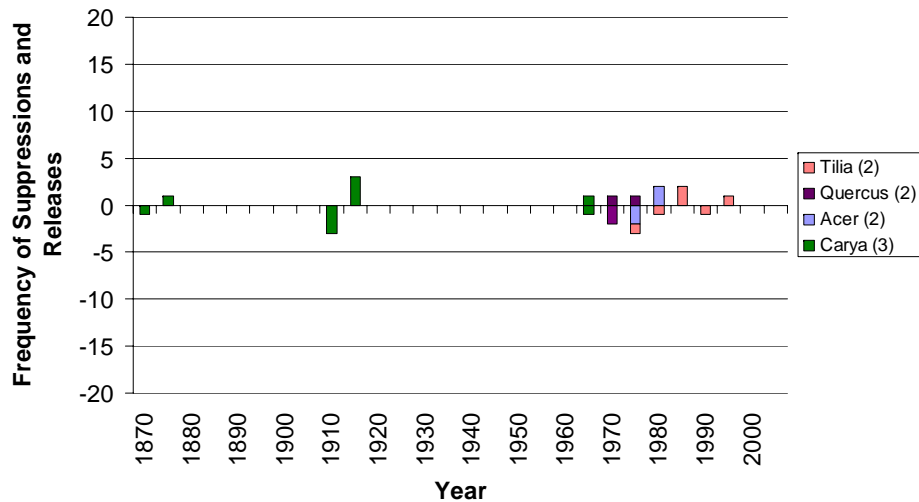


**Suppression**

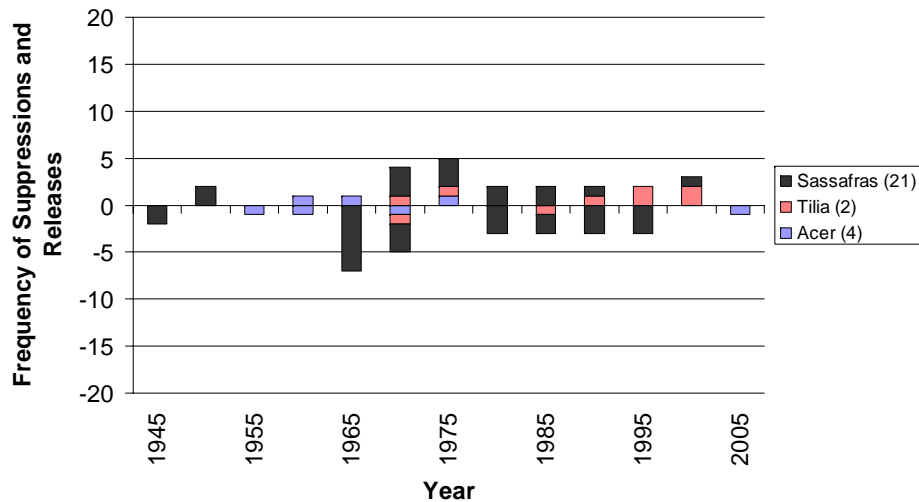
**Release**



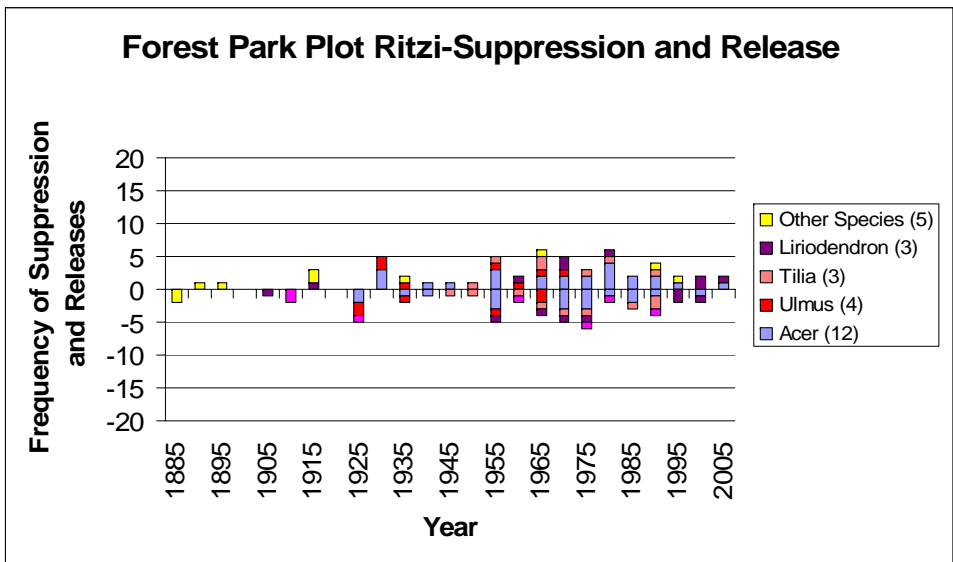
**Forest Park Plot Payne-Suppression and Release**



**Forest Park Plot Duchamp-Suppression and Release**

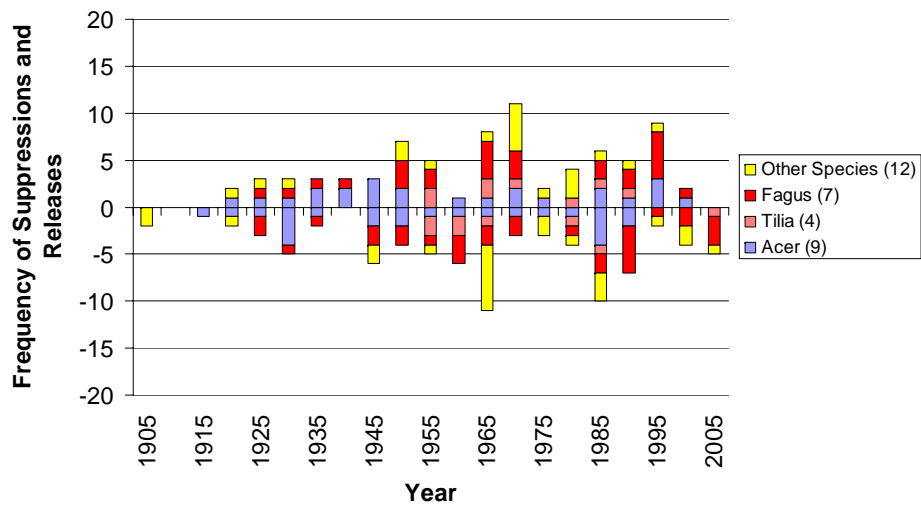


**Forest Park Plot Ritzi-Suppression and Release**

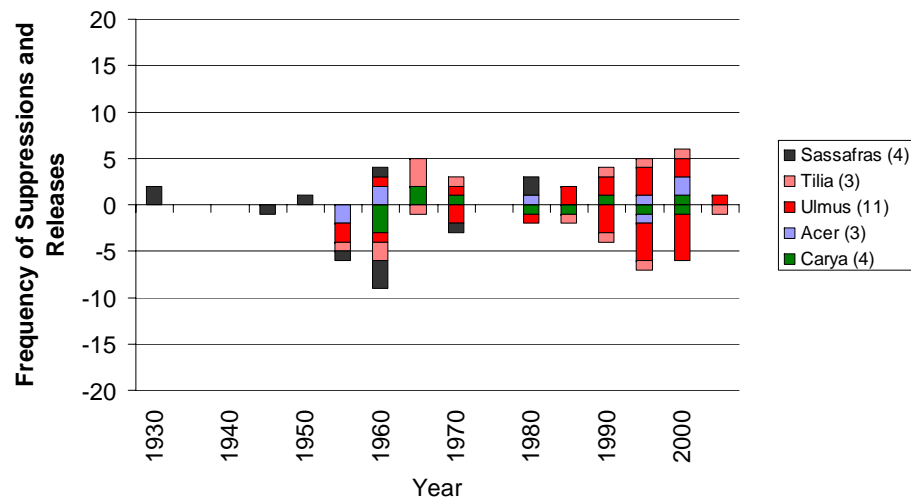




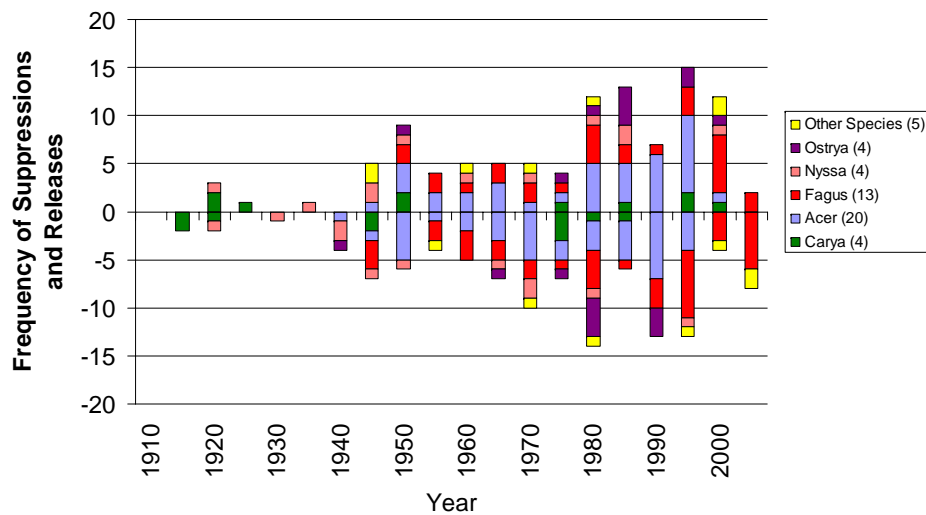
Forest Park Plot Bray-Suppression and Release

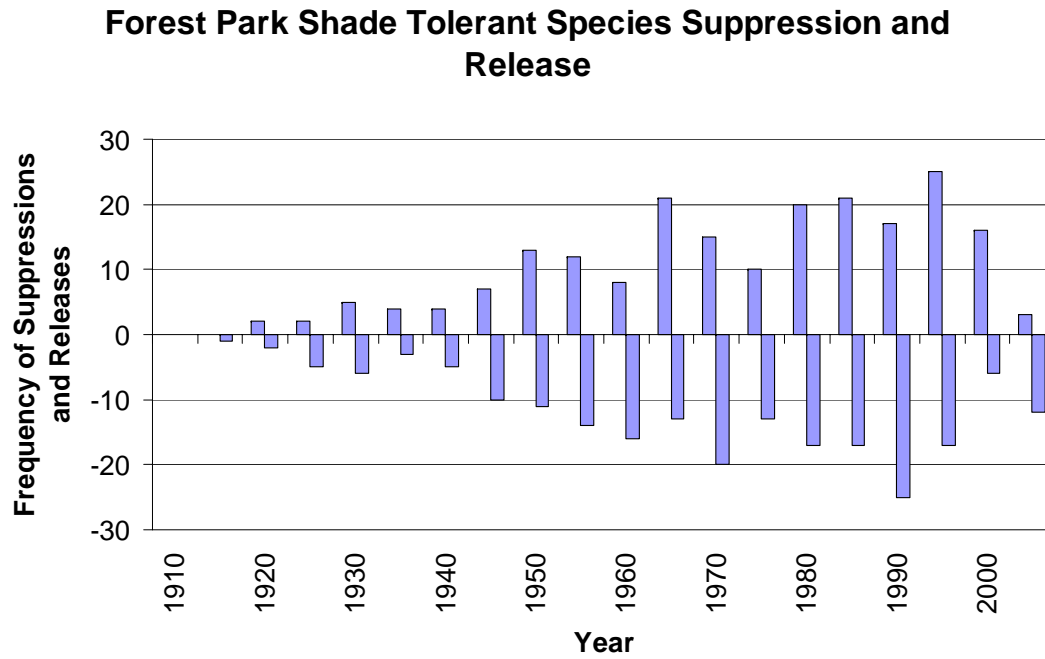
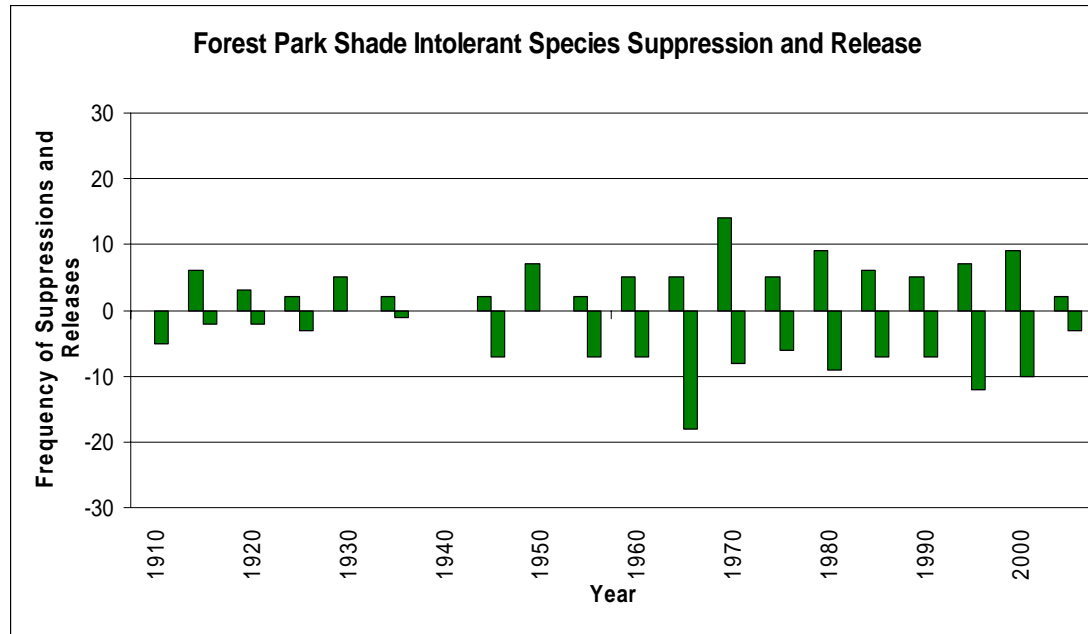


Forest Park Plot Crane-Suppression and Release



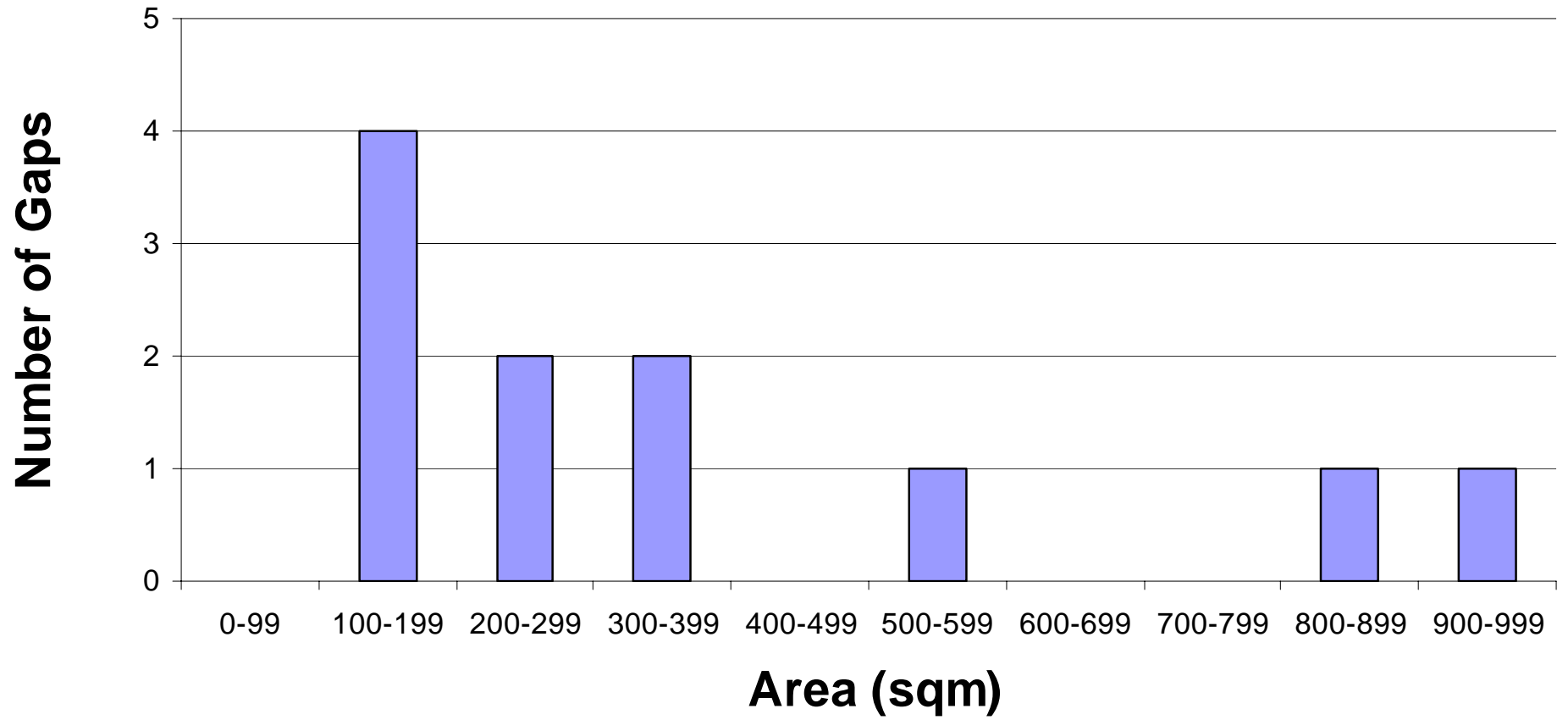
Forest Park Plot Farrell-Suppression and Release



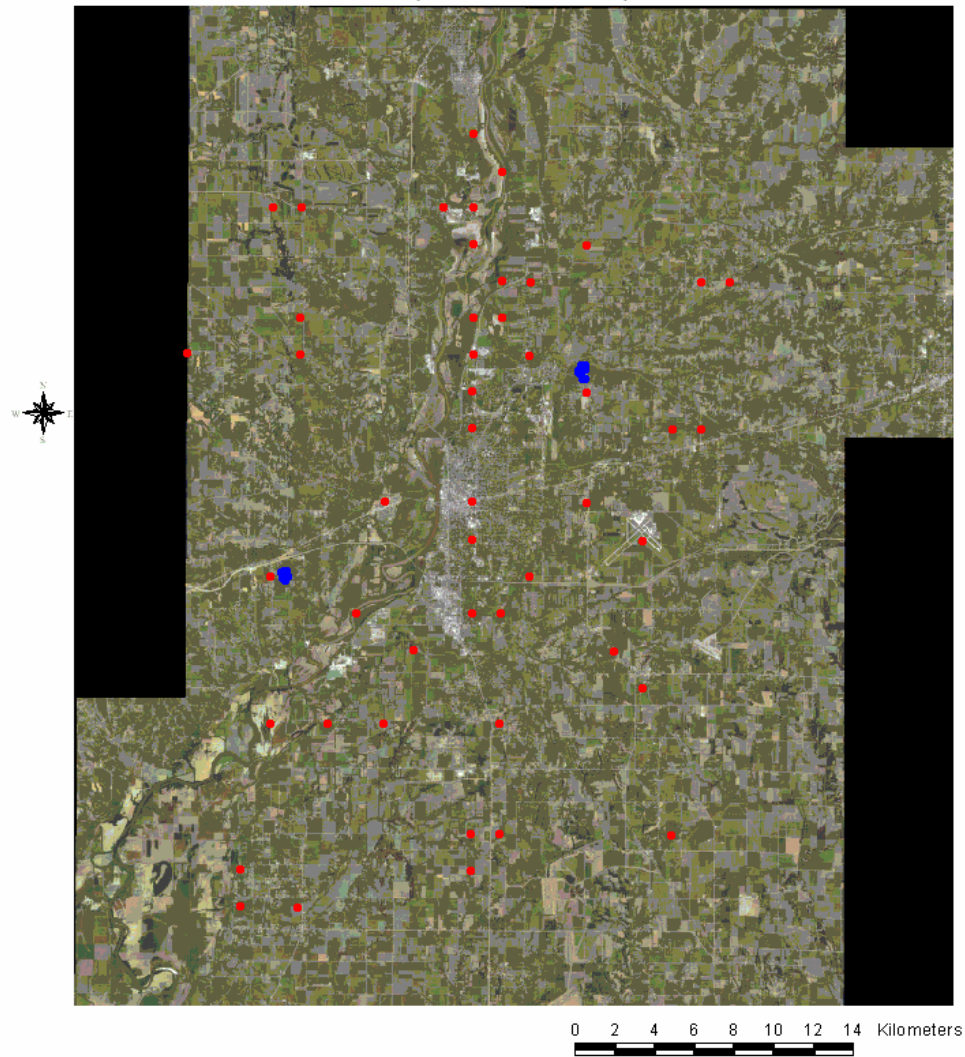




# Gap Area Frequency at Forest Park



# Thunderstorm Events for Vigo County, Indiana (1970-2004)

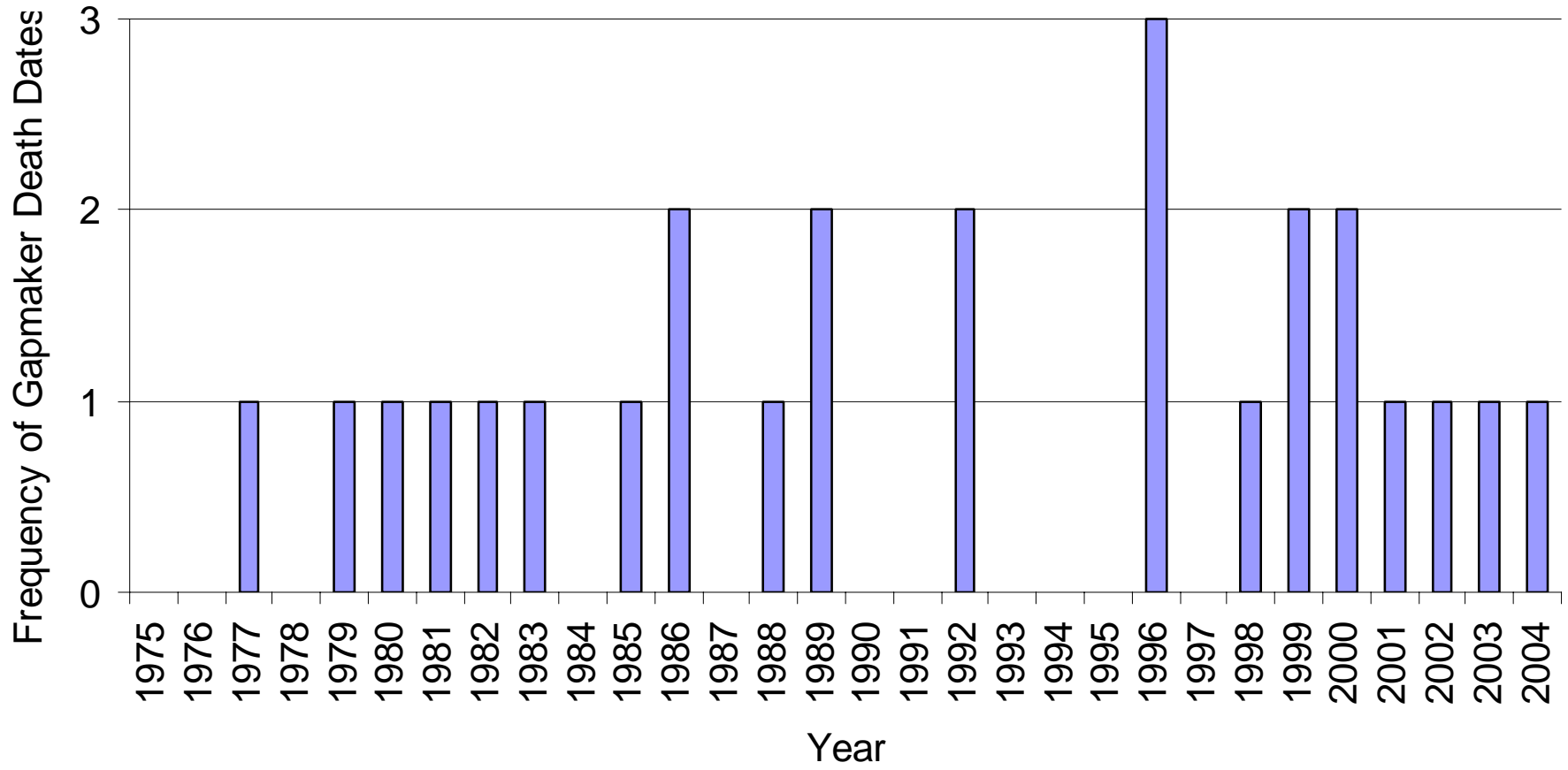


- Storm\_data.shp
- Kieweg\_sites\_gps.shp
- Fp\_cmnt\_gps\_pts.shp
- Brin\_heid-\_kiweg.shp

Data: JFKS and USDA  
Date: 18 February 2005  
Author: Jodi Sparks



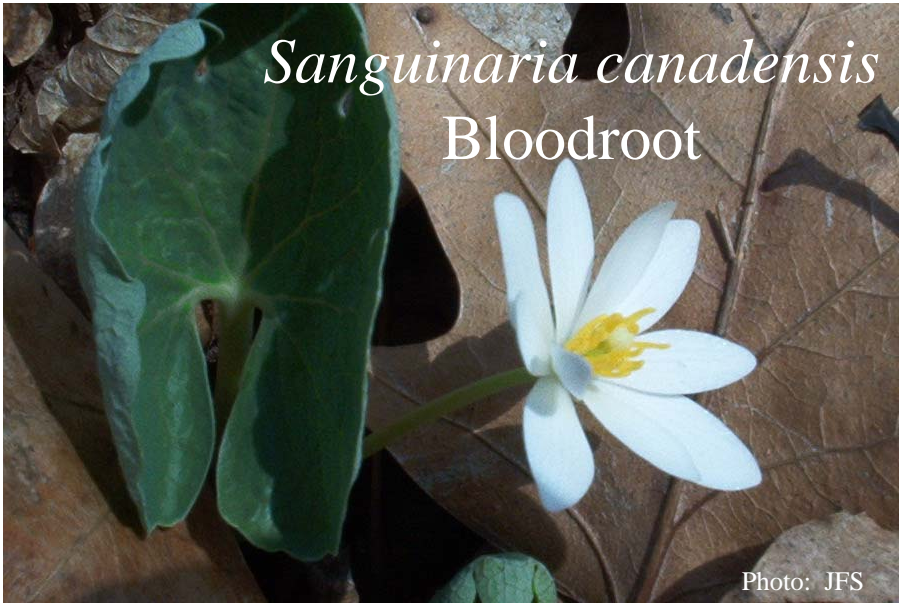
## Forest Park Gapmaker Death Dates



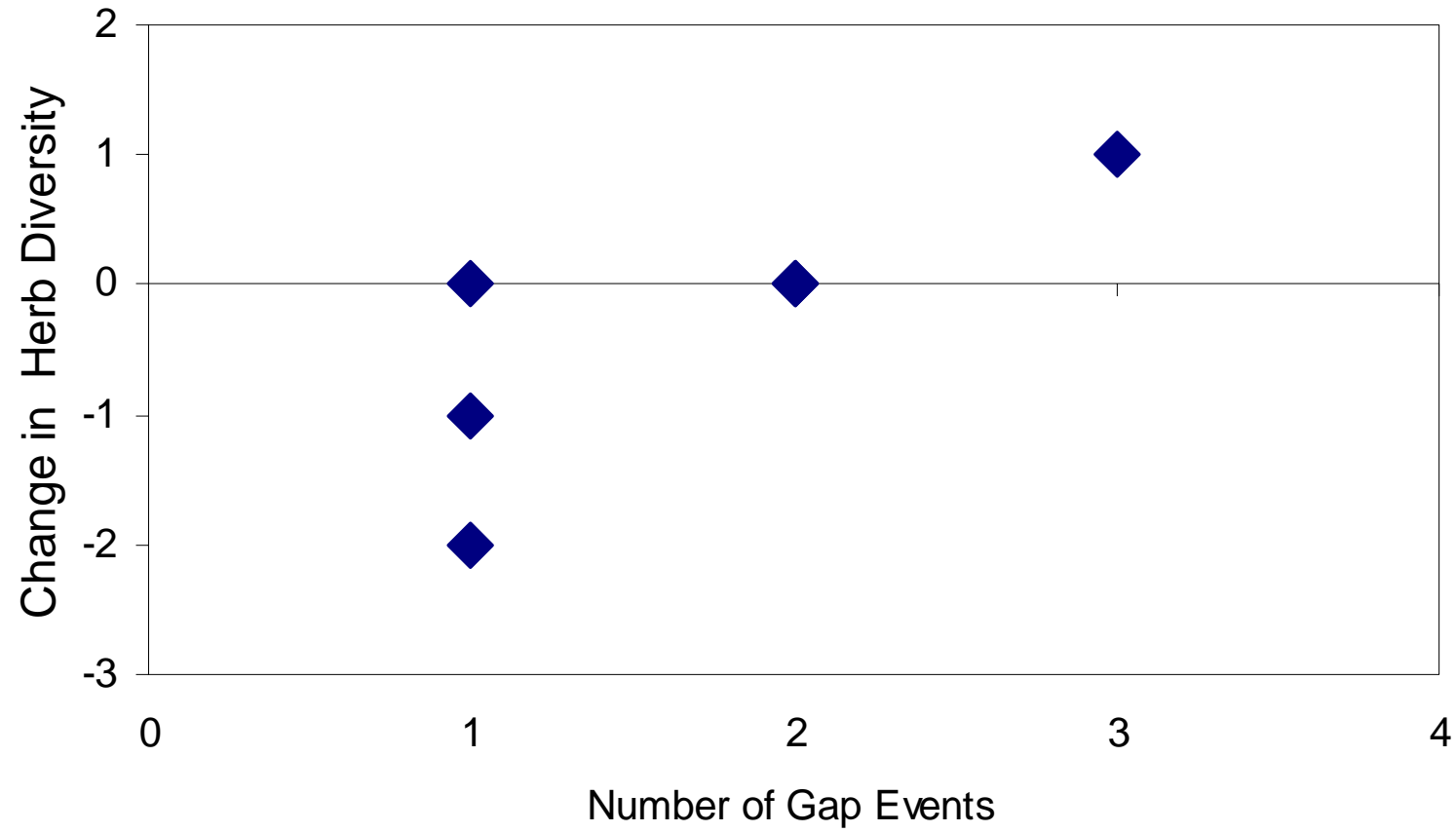
# PRELIMINARY HERBACEOUS DATA

<b>Forest Park, Kieweg</b>	<b>1981-2004</b>
Total # of Families	69
Total # of Genera	118
Total # of Species	180





## Herb Diversity versus Gap Events





# CONCLUSIONS

- ❖ Shade intolerant genera (*i.e. Quercus*) do not record gap dynamics as well as shade tolerant genera (*i.e. Fagus*)
- ❖ All plots record suppressions and releases in the mid to late 20th century
- ❖ Nine out of eleven gaps were caused by a single treefall or senescent tree
- ❖ Majority (Four out of eleven) of gaps are 100-199 m<sup>2</sup>
- ❖ Eight t-storms likely caused damage (83, 97, 99, 2000s)
- ❖ Slight decrease in herb plant diversity through time from old collections to new collections
- ❖ Increase in gaps does increase spring ephemeral diversity



# ACKNOWLEDGEMENTS

- ❖ Field Assistants: Rob Jean, Chris Ritzi, Jim Hayes, Brenda Farrell, Dale Sparks, Graham Bishop, Plant Taxonomy class, Dendrochronology Class, Vijay Lulla, Chris Gentry, Hua Li, Paleoclimate Class, and Dr. Marion Jackson
- ❖ Funding: ISU Graduate School, and Indiana Academy of Science-Winona Welch Award