2010: The International Year of Biodiversity

United Nations Convention of Biological Diversity

Tracking Extinction Risks:

International Union for
Conservation of Nature
(IUCN)

Red List of Threatened Species

47,677 species at risk

including

35% of conifers and cycads

Biodiversity loss has grim consequences for humanity

J. Marton-Lefevre, IUCN Director General

Science, 5 March 2010

- Wild harvest
- Crop pollination
- Disaster mitigation
- Clean water
- Traditional cultures
- Unknown future benefits

Population Ecology, Dynamics and Conservation of Rare Plants in New York State

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College of Environmental Science and Forestry
Syracuse, NY

With contributions from

Matt Buff, Tony Eallonardo, Joe Gawronski-Salerno, Sean Robinson, Sara Scanga

= Critically imperiled in New York State because of extreme rarity (5 or fe
s or very few remaining individuals) or extremely vulnerable to extirpatio
v York State due to biological or human factors.

= Imperiled in New York State because of rarity (6 - 20 sites or few remai
viduals) or highly vulnerable to extirpation.

= Rare in New York State (usually 21 - 35 extant sites).

= Apparently secure in New York State.

= Demonstrably secure in New York State.

= Historical. No existing sites known in New York State in the last 20-30 y
it may be rediscovered.

= Apparently extirpated from New York State, very low probability of
scovery.

Endangered Species are those with:

1) 5 or fewer extant sites, or

2) fewer than 1,000 individuals, or

3) restricted to fewer than 4 U.S.G.S. 7 1/2 minute topographical maps, or

4) species listed as endangered by the USDI

Threatened Species are those with:

1) 6 to fewer than 20 extant sites, or

2) 1,000 to fewer than 3,000 individuals, or

3) restricted to not less than 4 or more than 7 U.S.G.S. 7 1/2 minute topographical map

4) listed as threatened by the USDI

Rare Species have:

1) 20 to 35 extant sites, or

2) 3,000 to 5,000 individuals statewide.

Exploitably Vulnerable Species are likely to become threatened in the near

throughout all or a significant portion of their range within the state if causal factors continue unchecked

How Do We Know?

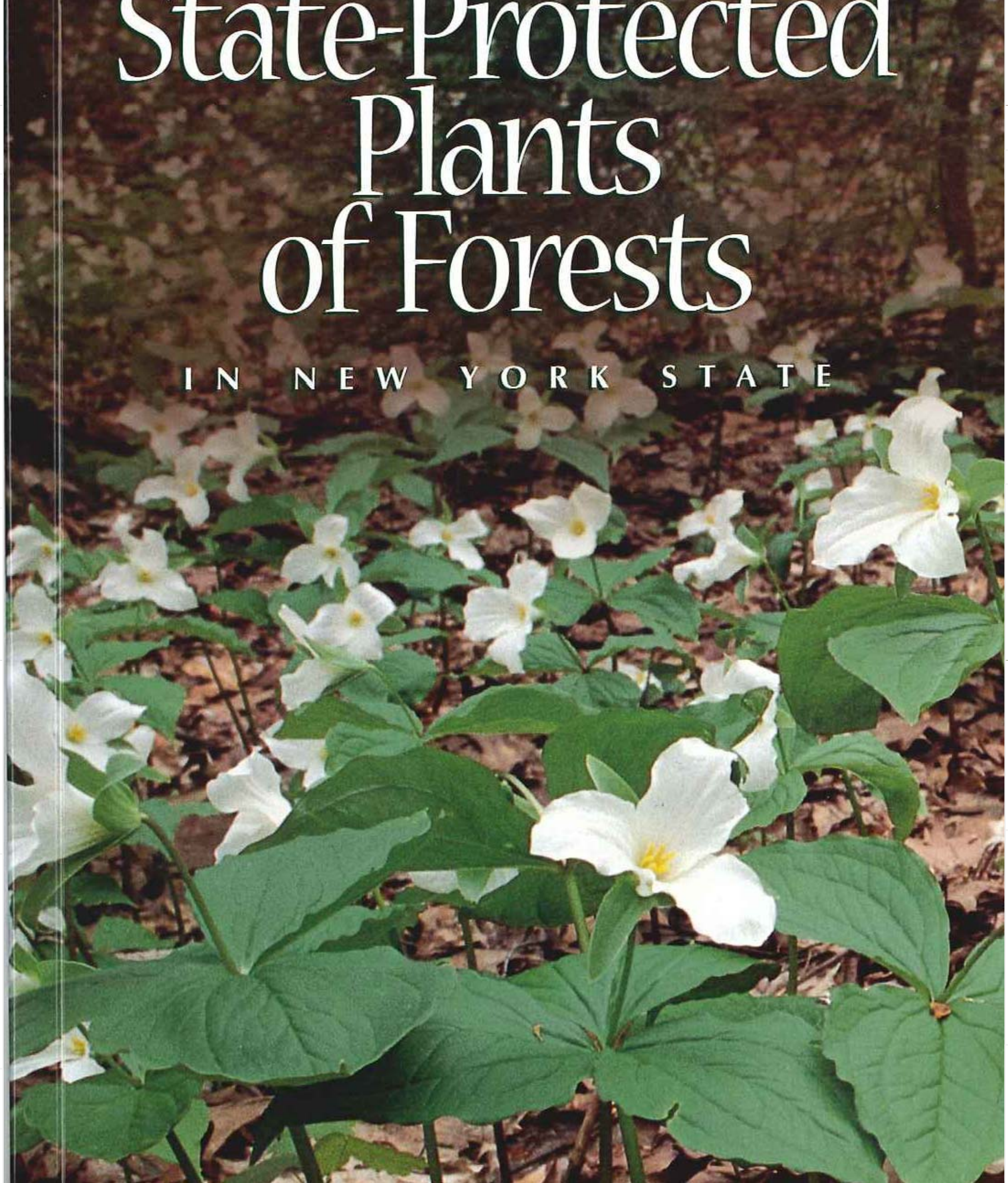
ung, Stephen M. 2008. New York Rare Pl
tatus Lists. New York Natural Heritage
rogram, Albany, NY. June 2008. 116 p.

This list is also published at the websites

www.nynhp.org

and

http://www.dec.ny.gov/regs/15522.html


State-Protected
Plants
of Forests
IN NEW YORK STATE

Critically imperiled throughout its range due to extreme rarity (5 or fewer
ry few remaining individuals) or extremely vulnerable to extinction due to
gical factors.

Imperiled throughout its range due to rarity (6 - 20 sites or few remaining
duals) or highly vulnerable to extinction due to biological factors.

Either very rare and local throughout its range (21 - 100 sites), with a
icted range (but possibly locally abundant), or vulnerable to extinction.

Apparently secure throughout its range (but possibly rare in parts).

Demonstrably secure throughout its range (but possibly rare in parts).

= No extant sites known but it may be rediscovered.

Species believed extinct.

T? = Status of the subspecies or variety unknown.

New York State Vascular Plant Taxa

	Native	Non-Native	Total
Families	155 (83%)	31 (17%)	186
Genera	575 (56%)	447 (44%)	1,022
Species	2,108 (59%)	1,465 (41%)	3,573
Taxa	2,267 (60%)	1,513 (40%)	3,780

New York State Vascular Plant Taxa Rarity Status

Endangered	91	2%
Threatened	79	2%
Rare	113	3%
Vulnerable	217	6%
Unprotected	285	8%
No Status	2,995	79%

Vascular Plant Taxa

Federal Legal Status

Endangered	4 (1 extant, 1 historical, 2 extirpated)
Threatened	7 (5 extant, 1 historical, 1 extirpated)

Causes of Rarity

Intrinsic factors

vs.

Extrinsic factors

Intrinsic Factors

Habitat specialization

Genetic factors

Symbioses

Extrinsic Factors

- Natural
- Human-induced

Natural Factors

- Interference, competition
- Natural disturbance, succession
- Pathogens and predators

Human-induced Factors

- Habitat degradation and fragmentation
- Invasive species
- Climate change


cetoxicum rossicum

Case Study 1

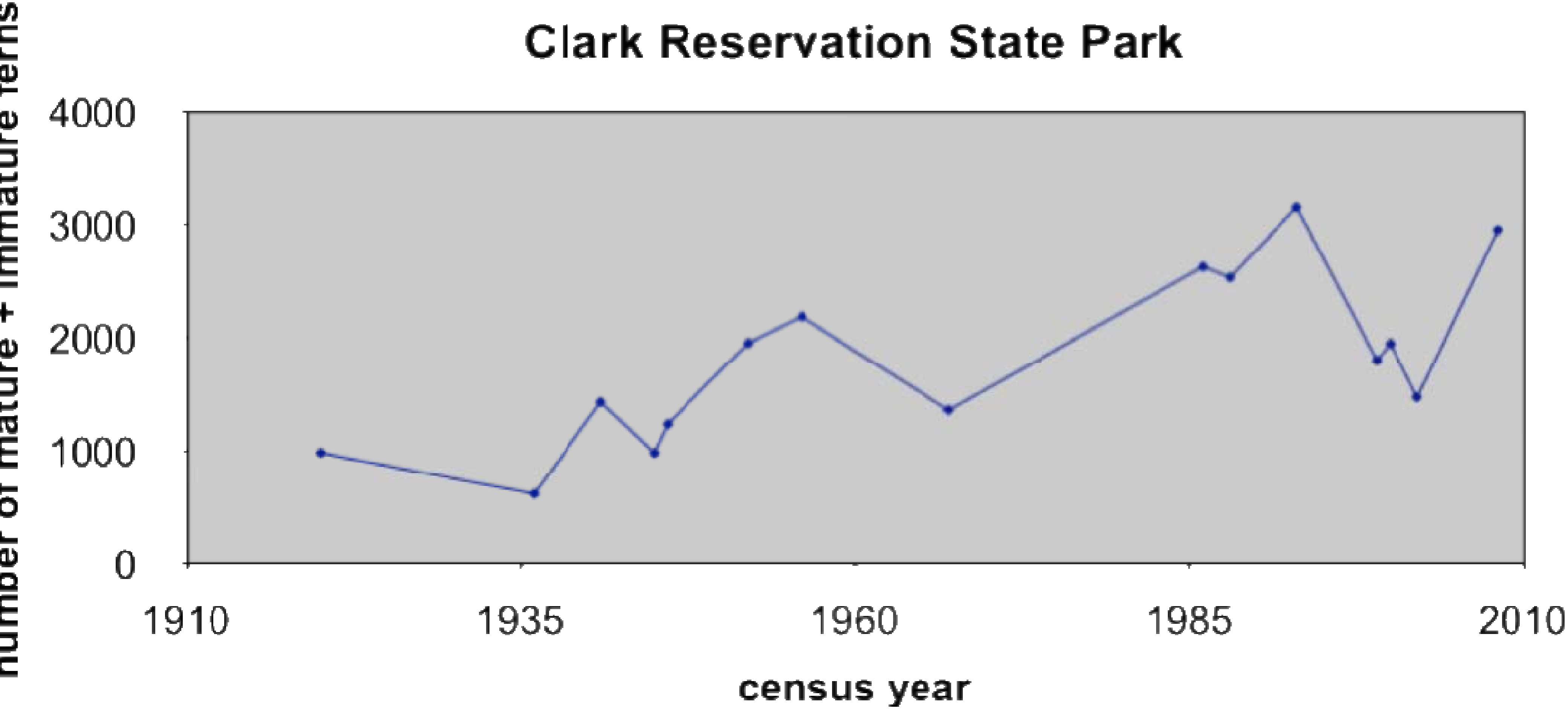
- *Asplenium scolopendrium* var. *americanum* American hart's tongue fern
- 2n=144 (tetraploid)
- Discovered in N. America in 1807 near Syracuse
- S2 in NY; S1 in rest of range (MI, AL, TN, ON); G4

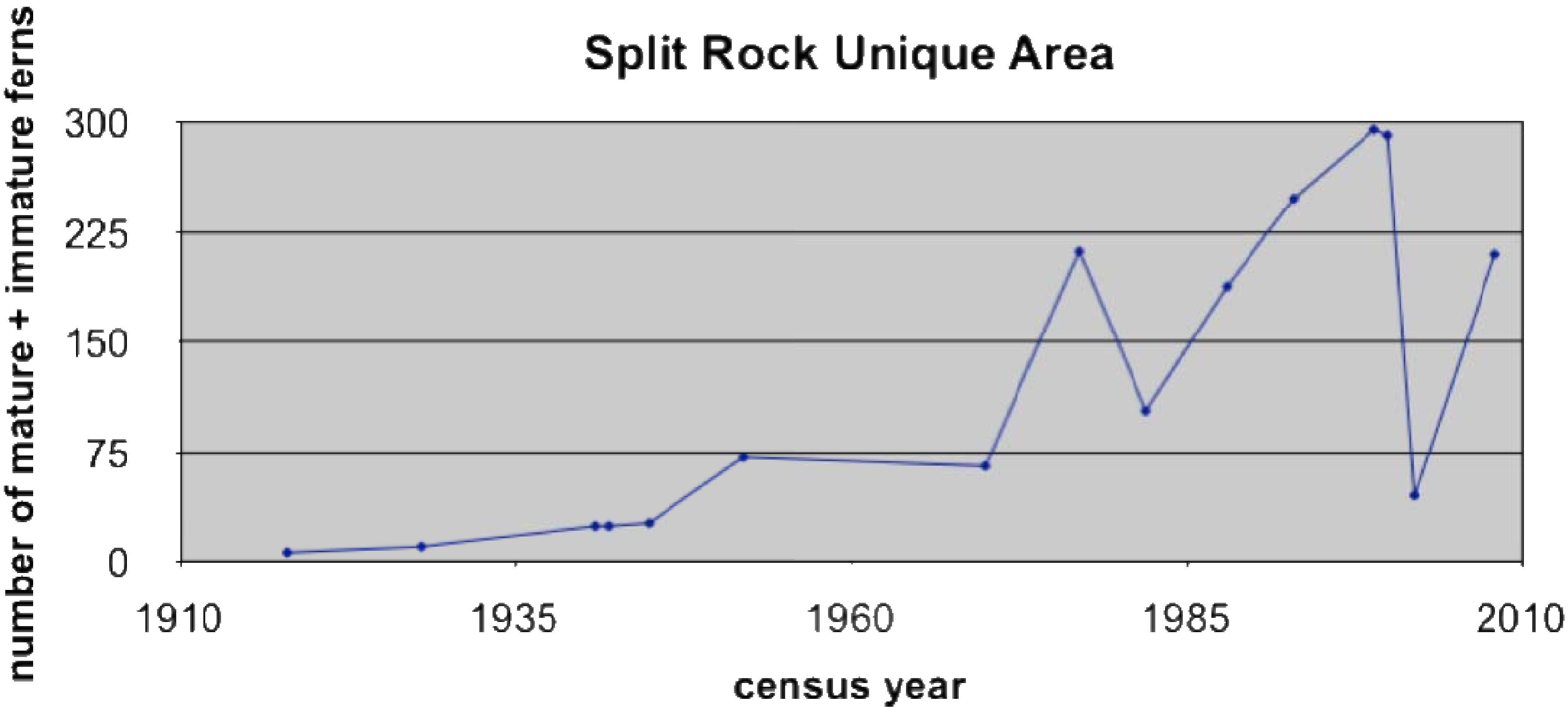

LIBERTY

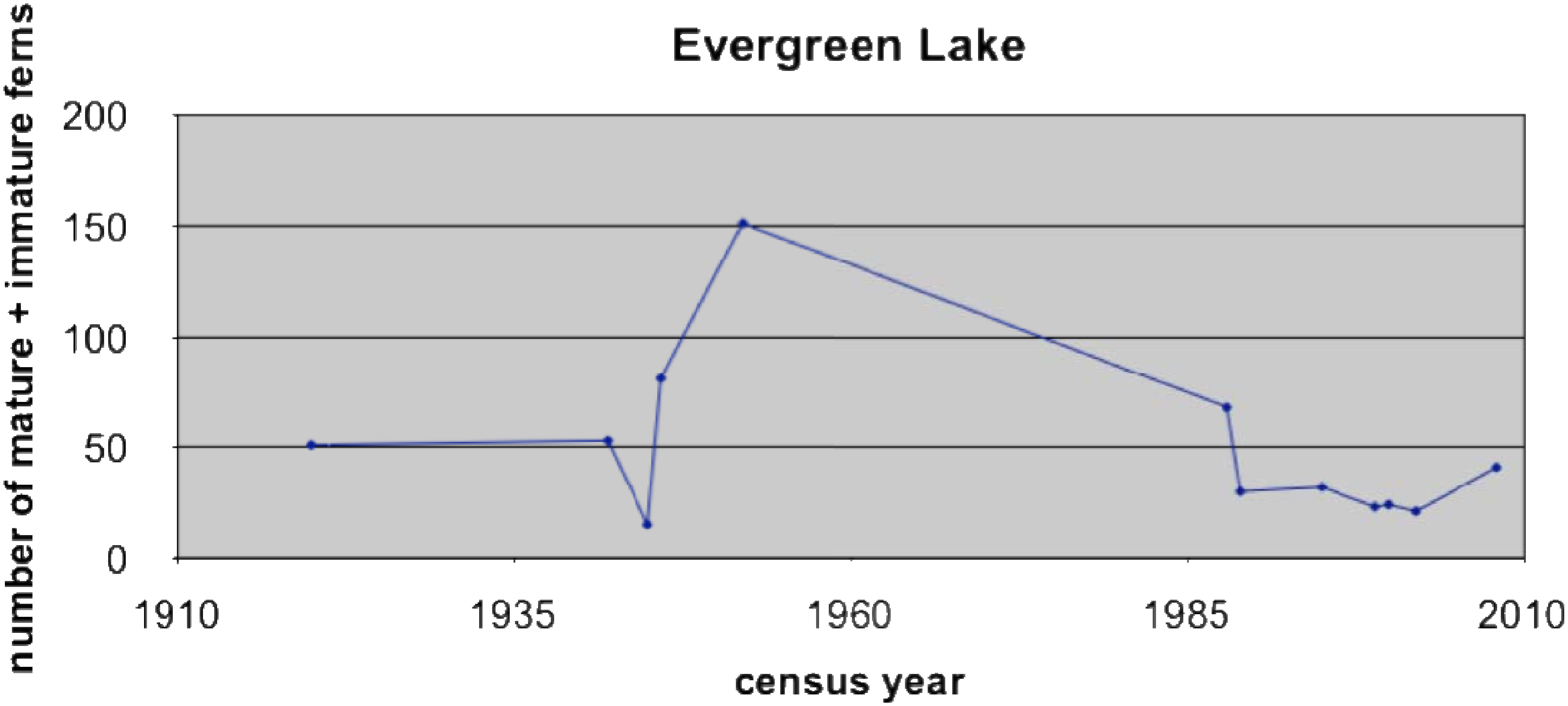
le 1. Topo-edaphic features of Asplenium scolopendrium sites in central New Yo

Feature	Mean (std. dev.)
% slope	59 (±13)
aspect	42º (±51º)
pH	7.0 (±0.5)
% nitrogen	1.7 (±6.7)
ppm magnesium	435.9 (±127.5)
ppm calcium	7227.1 (±2236.3)
ppm potassium	124.0 (±43.3)
ppm phosphorus	51 (±20)
% organic matter	55.7 (±23.2)

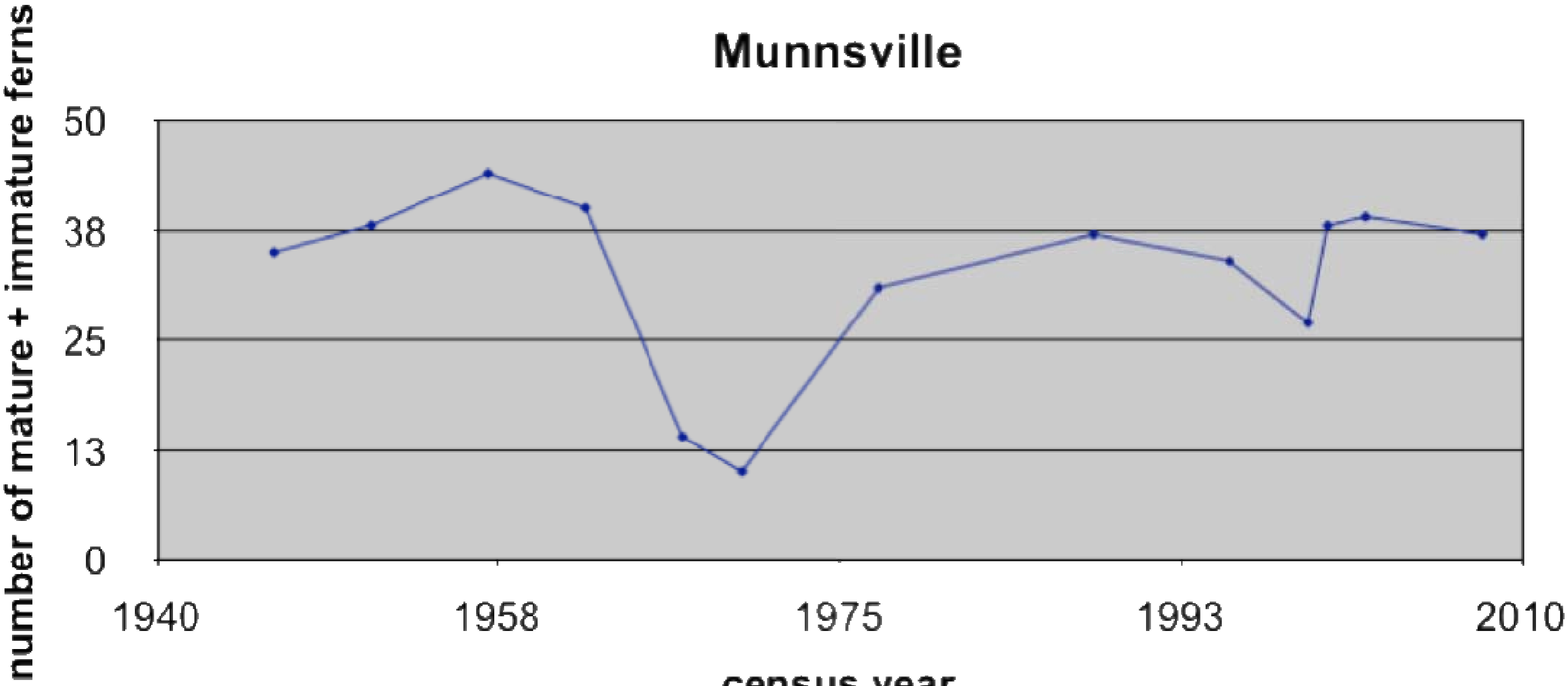
mani Kuehn, D. M., and D. J. Leopold. 1993. Habitat characteristics associated with *Phyllitis scolopendriur*
ewm. var. *americana* Fern. (Aspleniaceae) in central New York. Bulletin of the Torrey Botanical Club 120:31


Clark Reservation State Park
number of mature + immature ferns
4000
3000
2000
1000
0
1910
1935
1960
1985
2010
census year

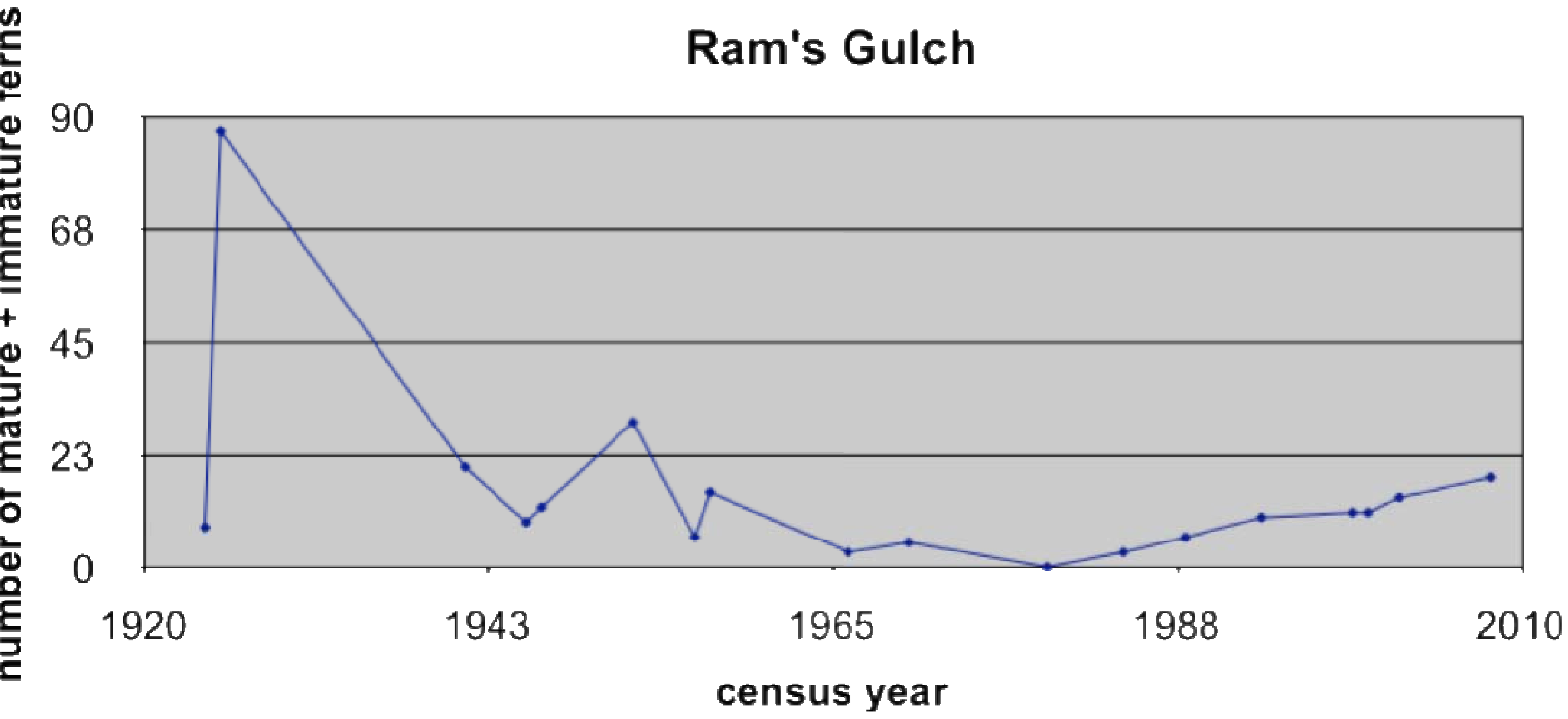

Split Rock Unique Area
number of mature + immature ferns
300
225
150
75
0
1910
1935
1960
1985
2010
census year

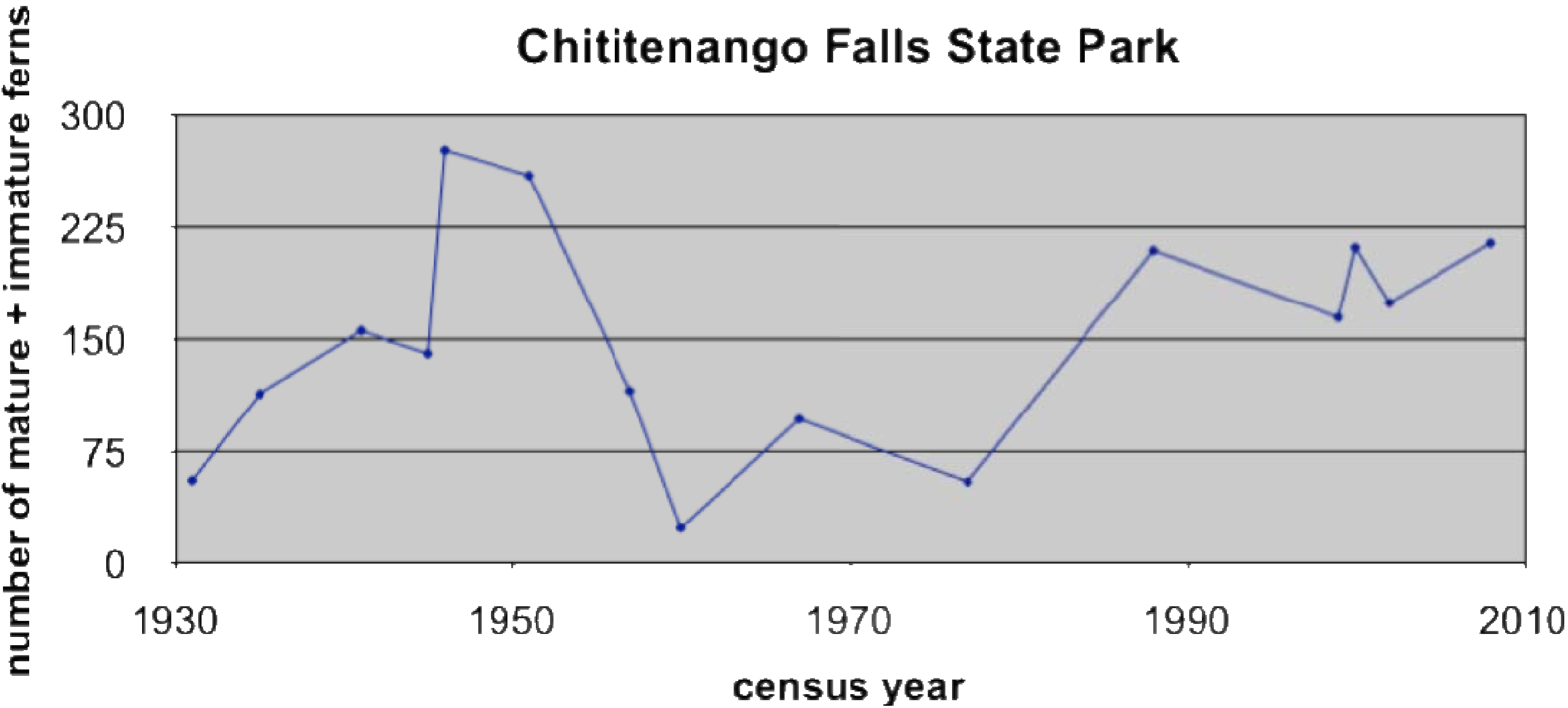


Evergreen Lake
number of mature + immature ferns
200
150
100
50
0
1910
1935
1960
1985
2010
census year



Munnsville
number of mature + immature ferns
50
38
25
13
0
1940
1958
1975
1993
2010
census year


Ram's Gulch
number of mature + immature ferns
90
68
45
23
0
1920
1943
1965
1988
2010
census year



Chititenango Falls State Park
number of mature + immature ferns
300
225
150
75
0
1930
1950
1970
1990
2010
census year

Future Directions in Genetic Analysis

Microsatellite characterization of Asplenium scolopendrium.

Measure heterozygosity between and within element occurrences to determine genetic metapopulation structure.

- For all of NYS occurrences and possibly for the rest of the North American occurrences.
- Addresses the target of 15 self-sustaining populations indicated in the 1993 USFWS Recovery Plan.

Measure of isolation by distance, if present.

Measure presence (if any) of drift and/or inbreeding effects.

Determine number of genetically distinct populations of AHTF and to what degree they are connected.

Case Study 2

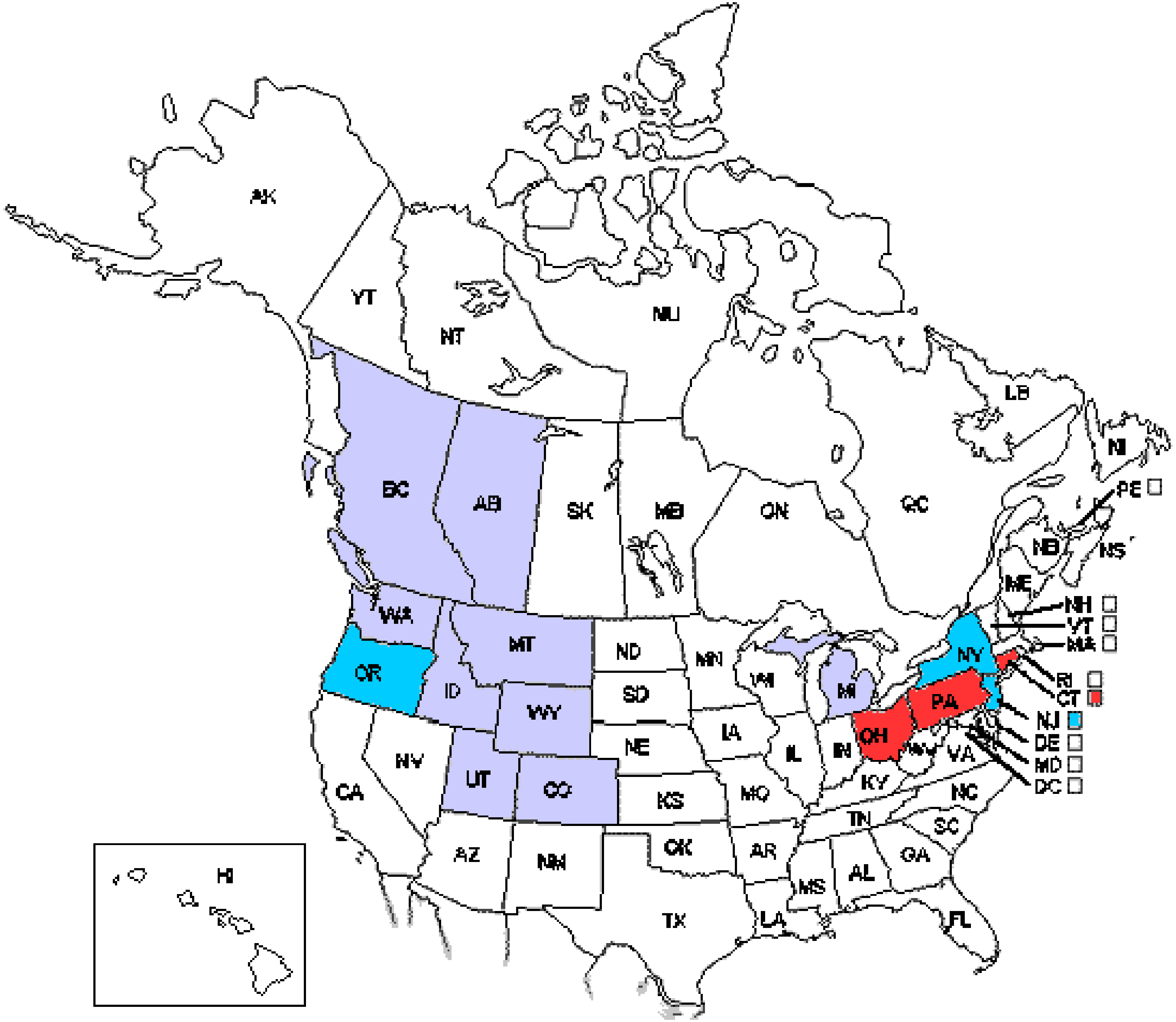
Trollius laxus (spreading globe flower)

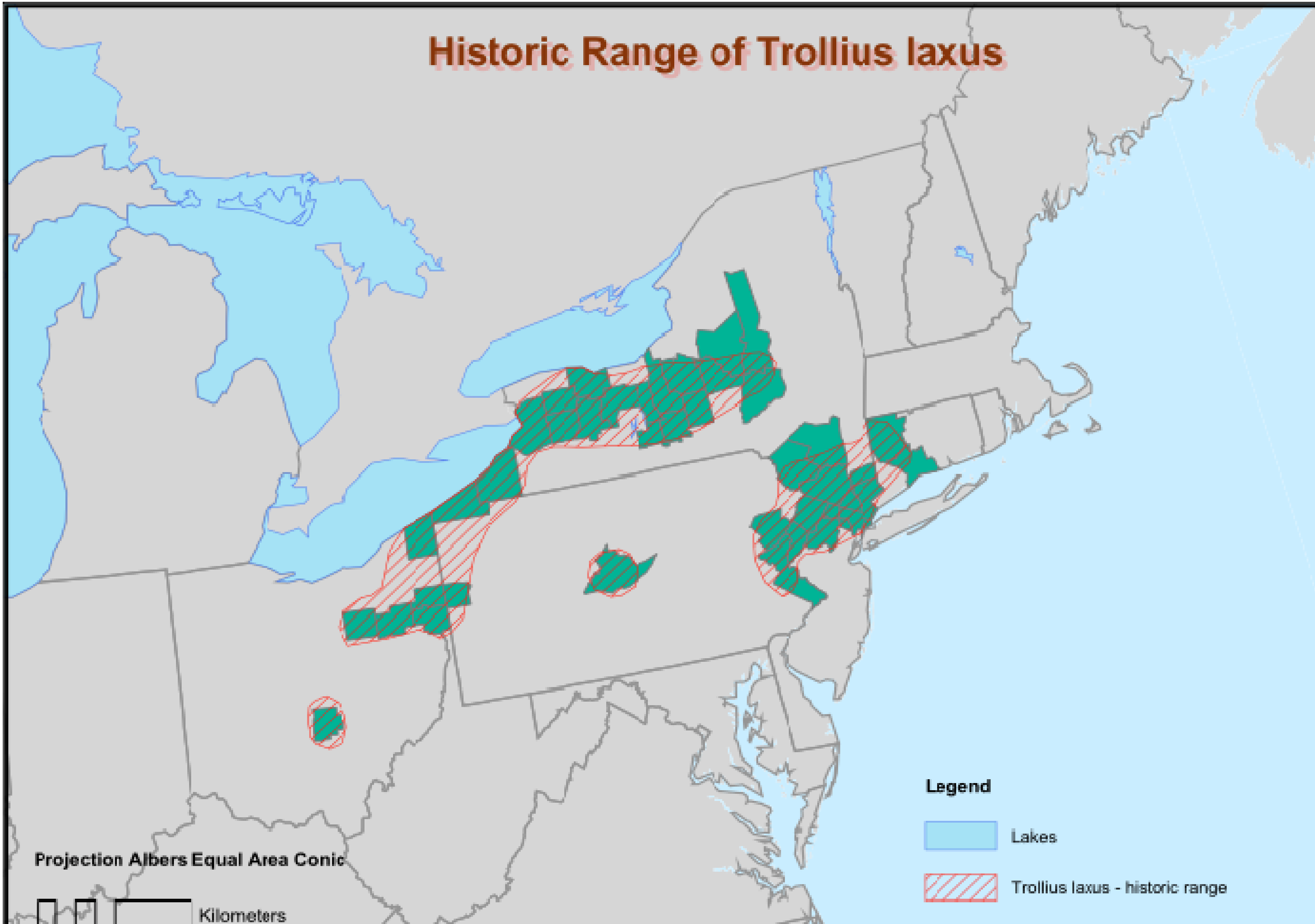
2n = 32

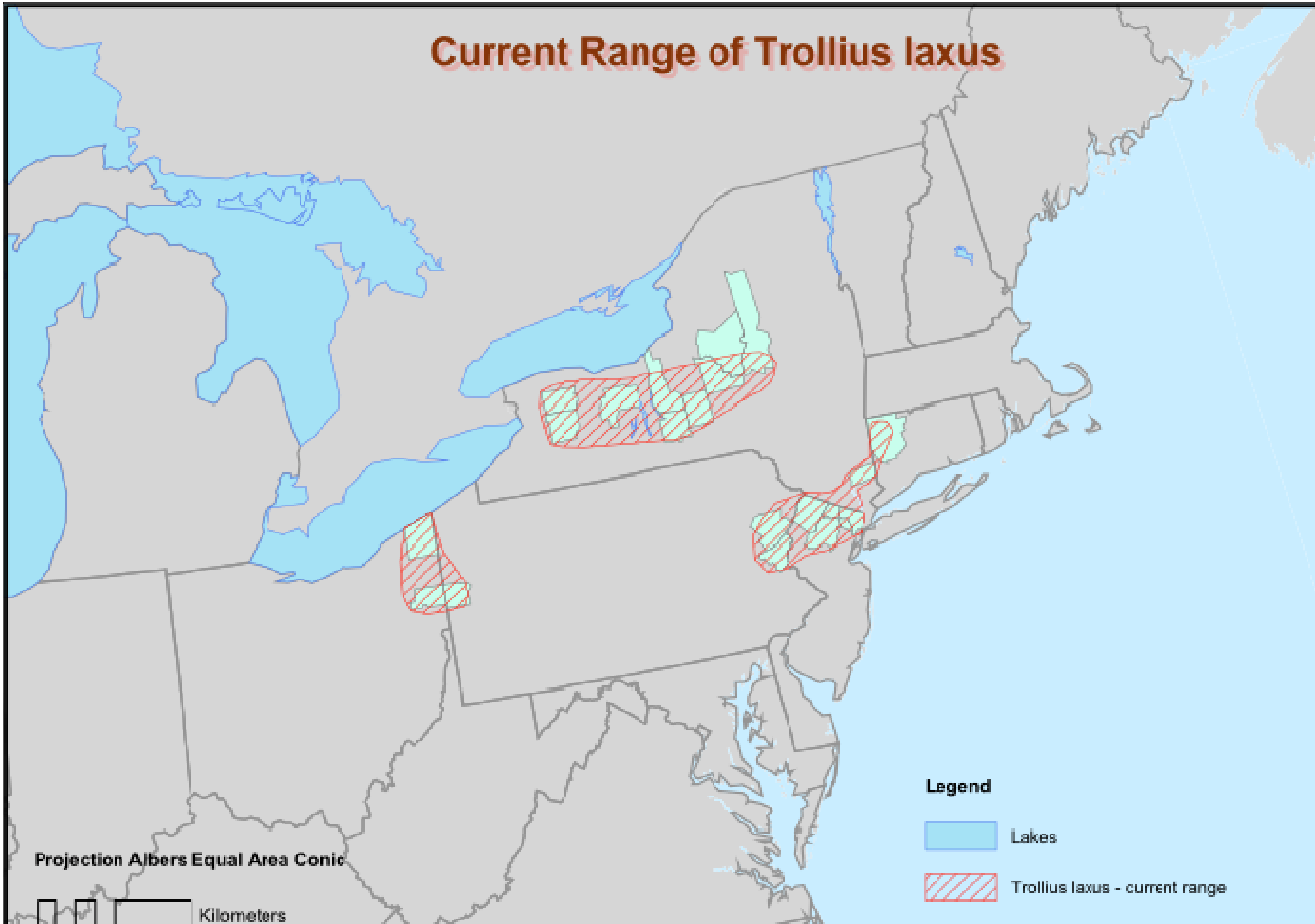
S3, G3

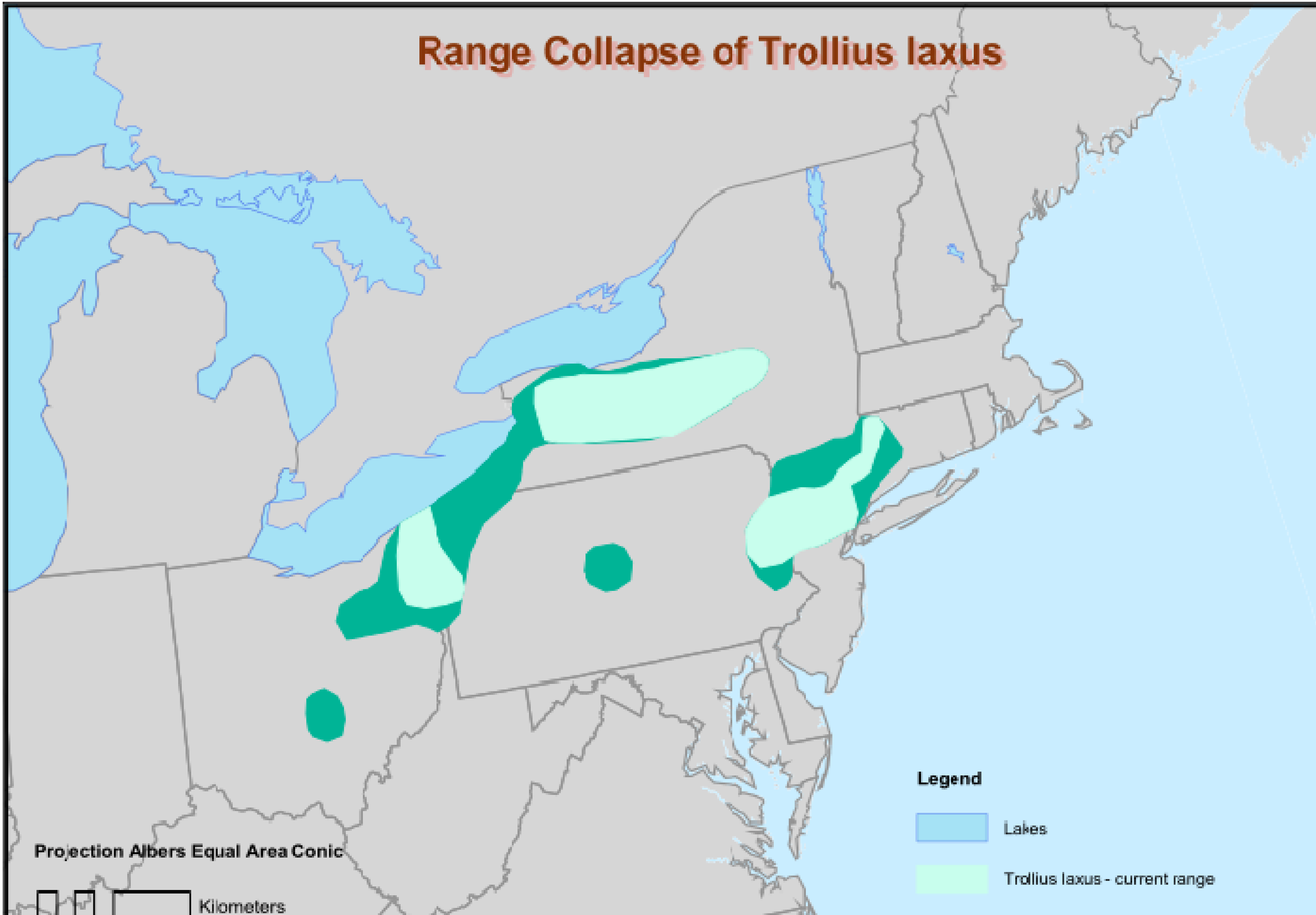
State	NHP Rank	State Legal Status	# of Counties	
			Historic	Extant
NY*	S3	Rare	25	10
NJ	S1	Endangered	?	5
OH	S1	Endangered	6	2
PA**	S1	Endangered	5	3
CT***	S1	Endangered	2	1

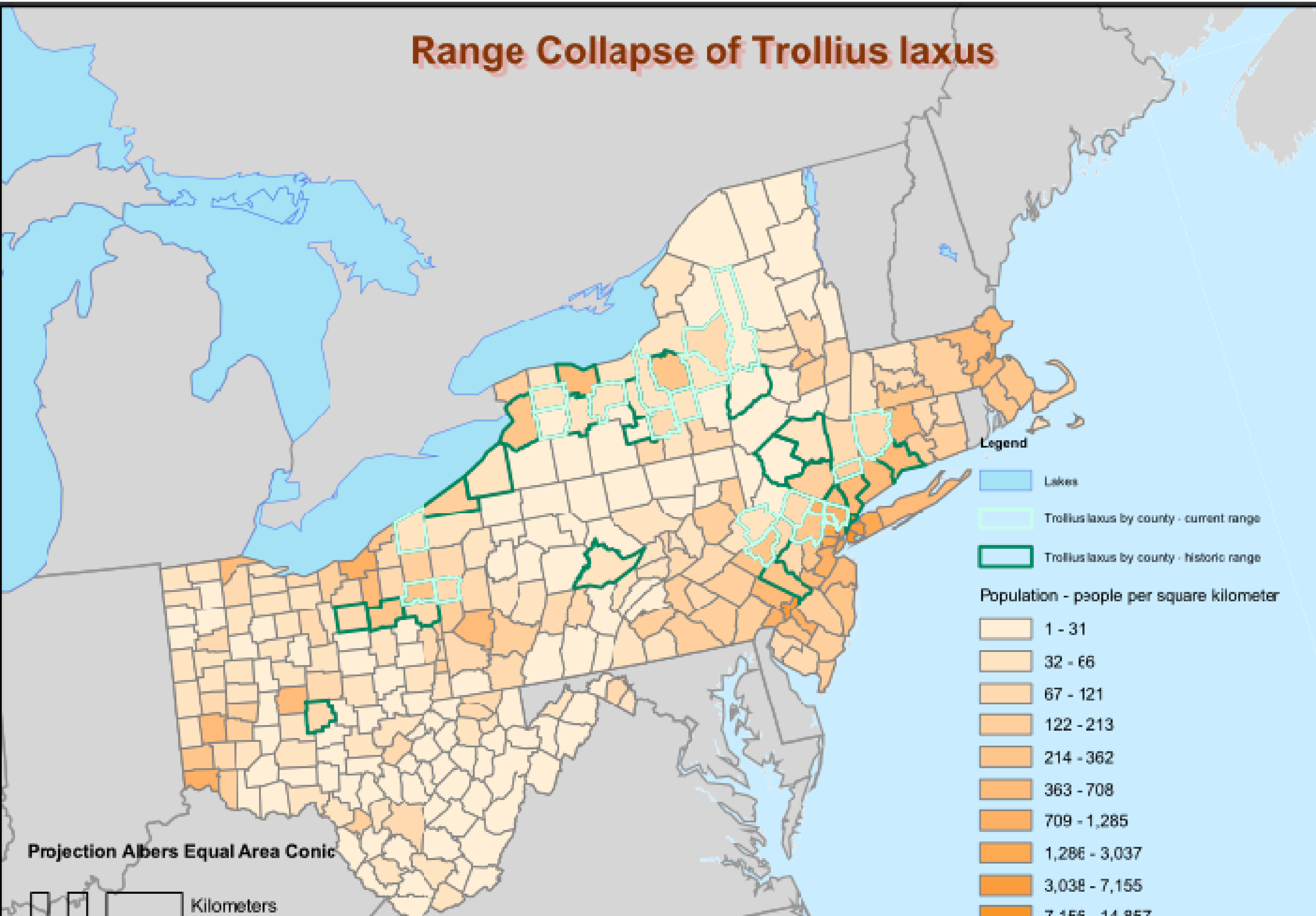
*31 extant sites, 26 historic sites
**8 of 15 sites destroyed
***6 extant sites, 3 historic sites


AK
YT
NT
NU
LB
NF
PE
NS
NB
QC
ON
MB
SK
AB
BC
WA
OR
ID
MT
WY
ND
SD
NE
MN
WI
MI
IA
IL
IN
OH
PA
NY
ME
NH
VT
MA
RI
CT
NJ
DE
MD
DC
WV
VA
KY
NC
TN
SC
GA
AL
MS
LA
FL
AR
MO
KS
OK
TX
NM
AZ
UT
CO
NV
CA
HI


Historic Range of Trollius laxus
Legend
Lakes
Trollius laxus - historic range
Projection Albers Equal Area Conic
Kilometers

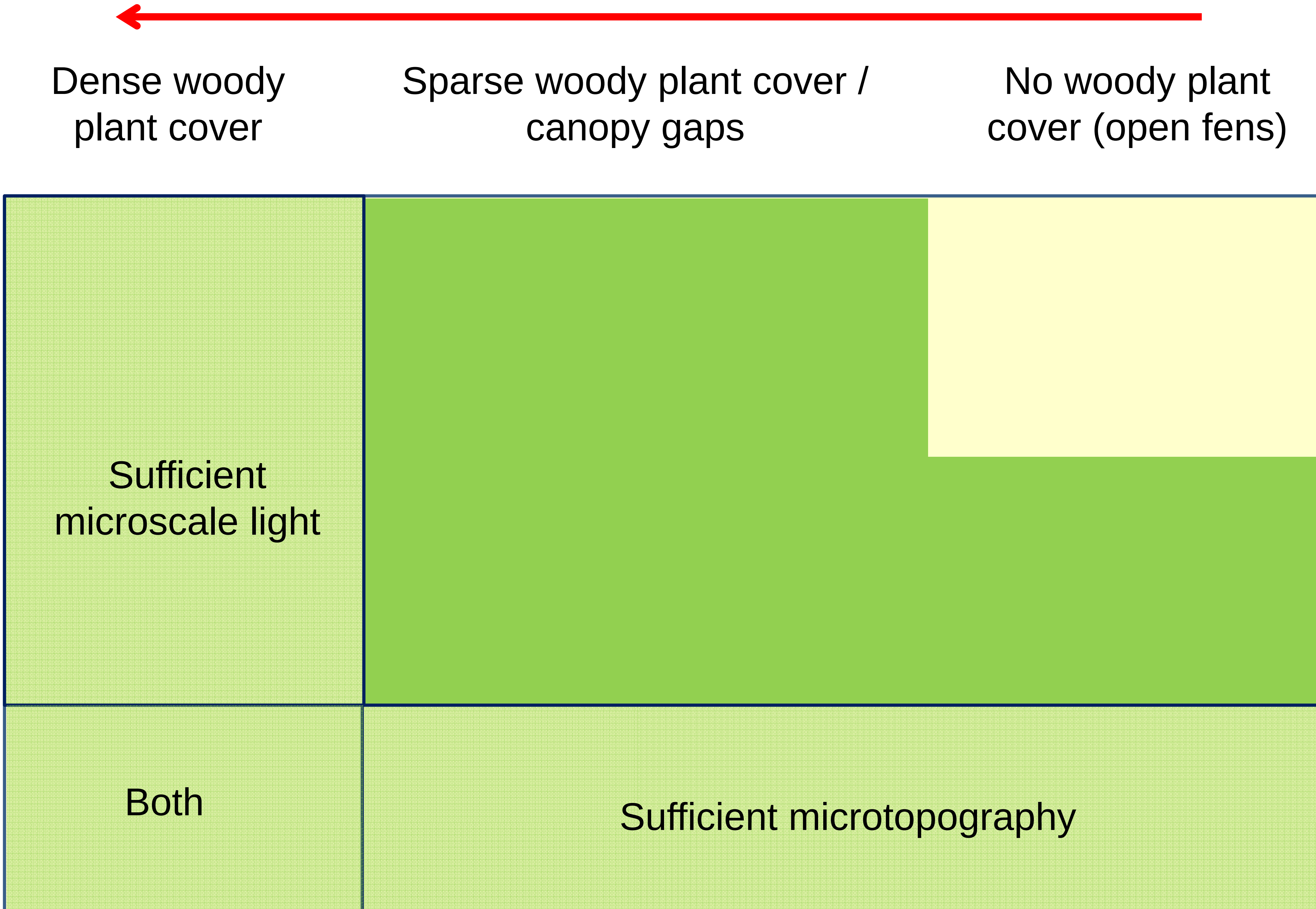

Current Range of Trollius laxus
Legend
Lakes
Trollius laxus - current range
Projection Albers Equal Area Conic
Kilometers

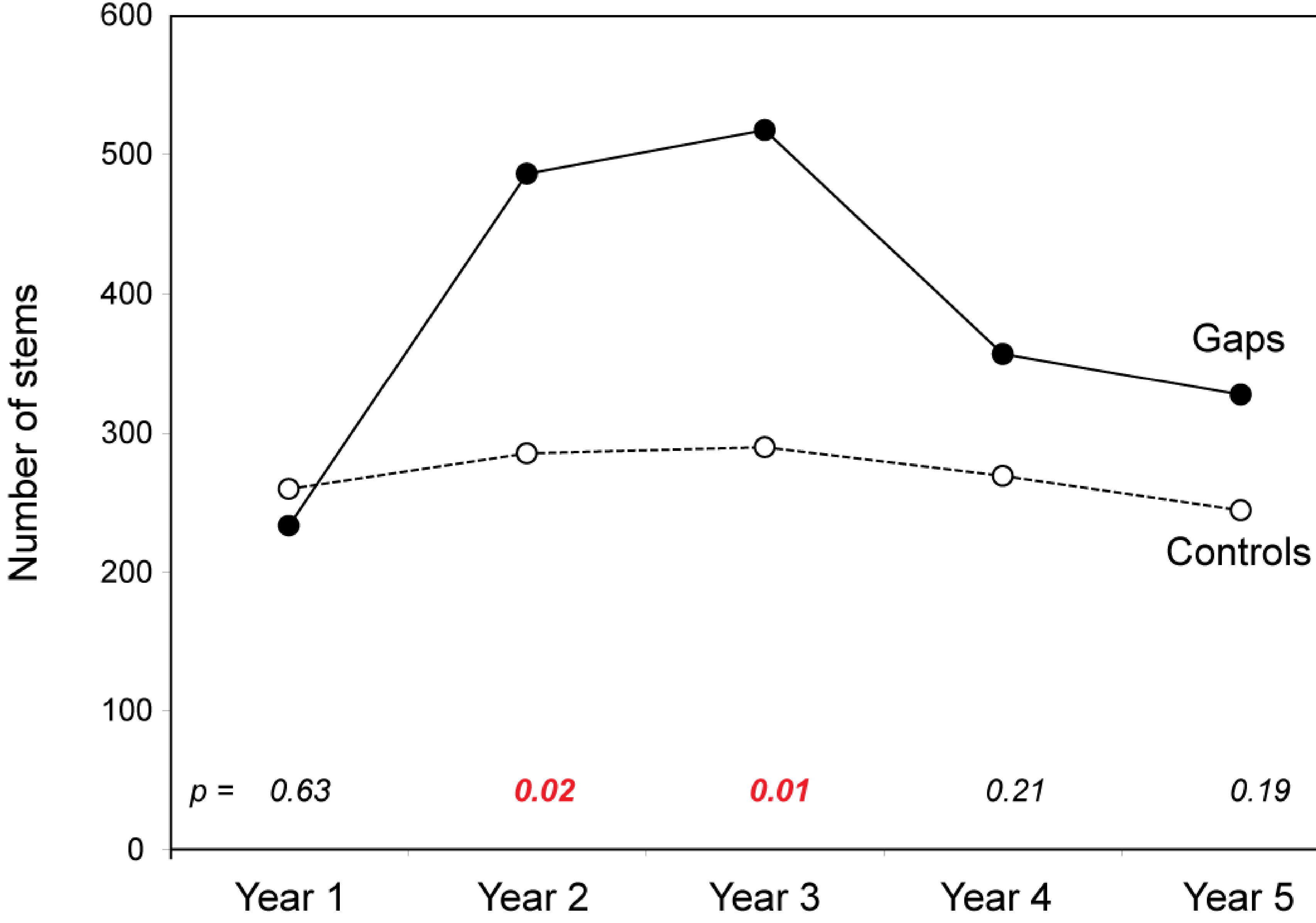

Range Collapse of Trollius laxus
Legend
Lakes
Trollius laxus - current range
Projection Albers Equal Area Conic
Kilometers


Range Collapse of Trollius laxus
Legend
Lakes
Trollius laxus by county - current range
Trollius laxus by county - historic range
Population - people per square kilometer
1 - 31
32 - 66
67 - 121
122 - 213
214 - 362
363 - 708
709 - 1,285
1,286 - 3,037
3,038 - 7,155
Projection Albers Equal Area Conic
Kilometers

ccurrence in fens

Succession

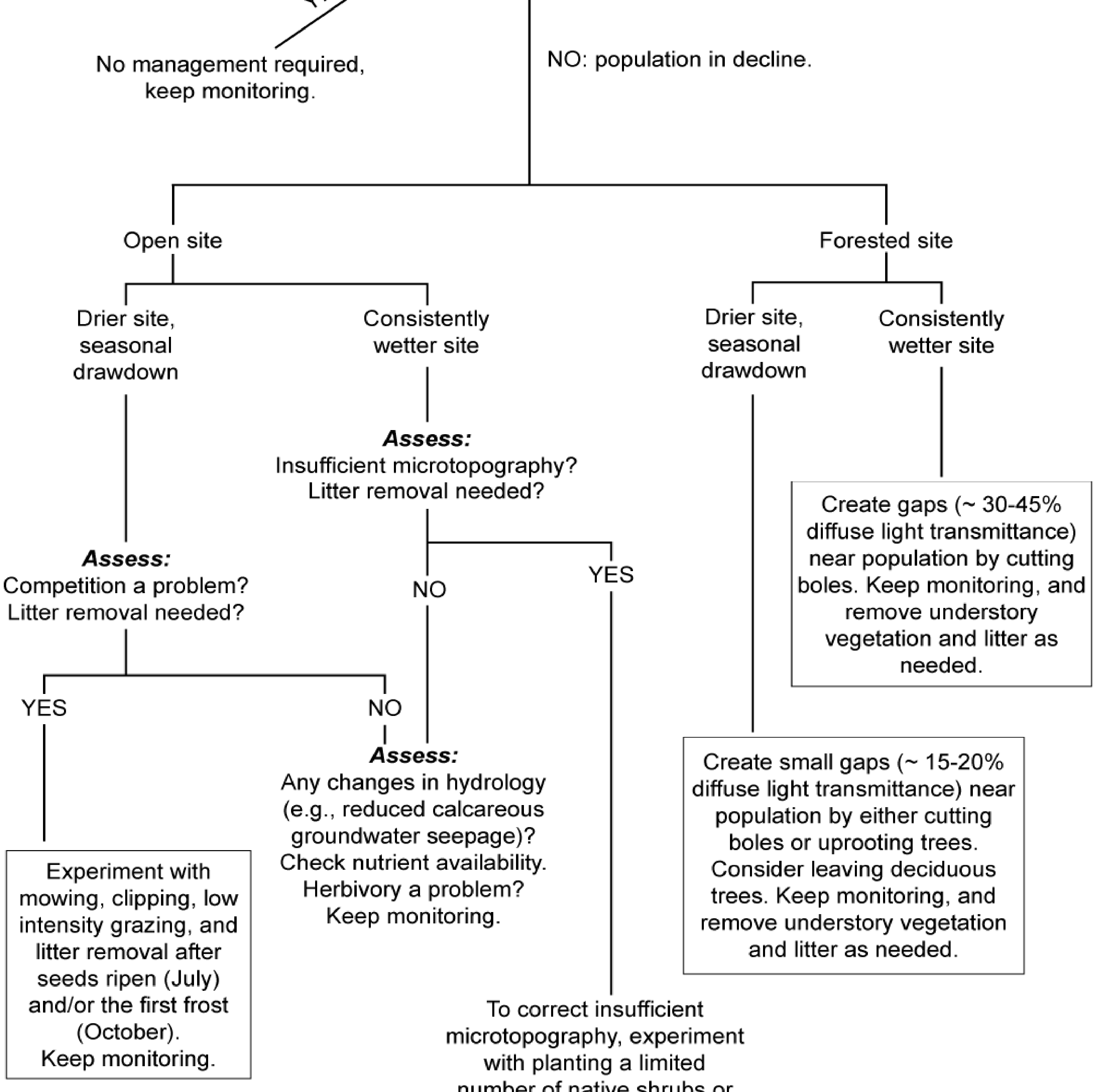




600
500
400
300
200
100
0
Number of stems
Gaps
Controls
p = 0.63
0.02
0.01
0.21
0.19
Year 1
Year 2
Year 3
Year 4
Year 5

Conclusions

- mportance of succession and disturbance to *T. axus* conservation.
  - –Light and hydrology
  - –Canopy gaps
- How to manage succession and disturbance for *axus* conservation.
  - –Low to intermediate light levels optimal
  - –Management framework
- mplications for management of North American ens.

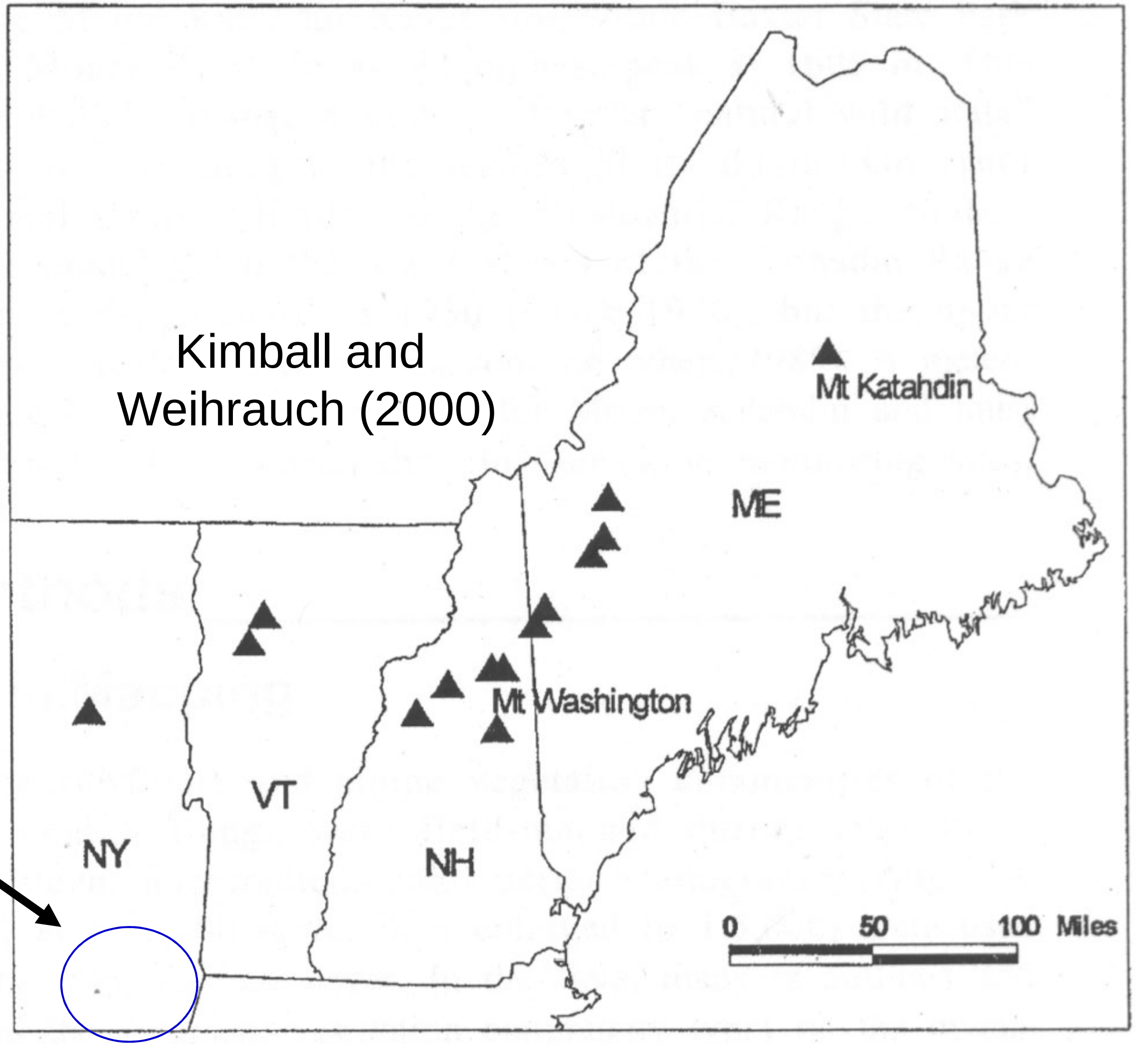

No management required, keep monitoring.
NO: population in decline.
Open site
Forested site
Drier site, seasonal drawdown
Consistently wetter site
Drier site, seasonal drawdown
Consistently wetter site
Assess: Insufficient microtopography? Litter removal needed?
Create gaps (~ 30-45% diffuse light transmittance) near population by cutting boles. Keep monitoring, and remove understory vegetation and litter as needed.
Assess: Competition a problem? Litter removal needed?
NO
YES
YES
NO
Assess: Any changes in hydrology (e.g., reduced calcareous groundwater seepage)? Check nutrient availability. Herbivory a problem? Keep monitoring.
Create small gaps (~ 15-20% diffuse light transmittance) near population by either cutting boles or uprooting trees. Consider leaving deciduous trees. Keep monitoring, and remove understory vegetation and litter as needed.
Experiment with mowing, clipping, low intensity grazing, and litter removal after seeds ripen (July) and/or the first frost (October). Keep monitoring.
To correct insufficient microtopography, experiment with planting a limited

Case Study 3

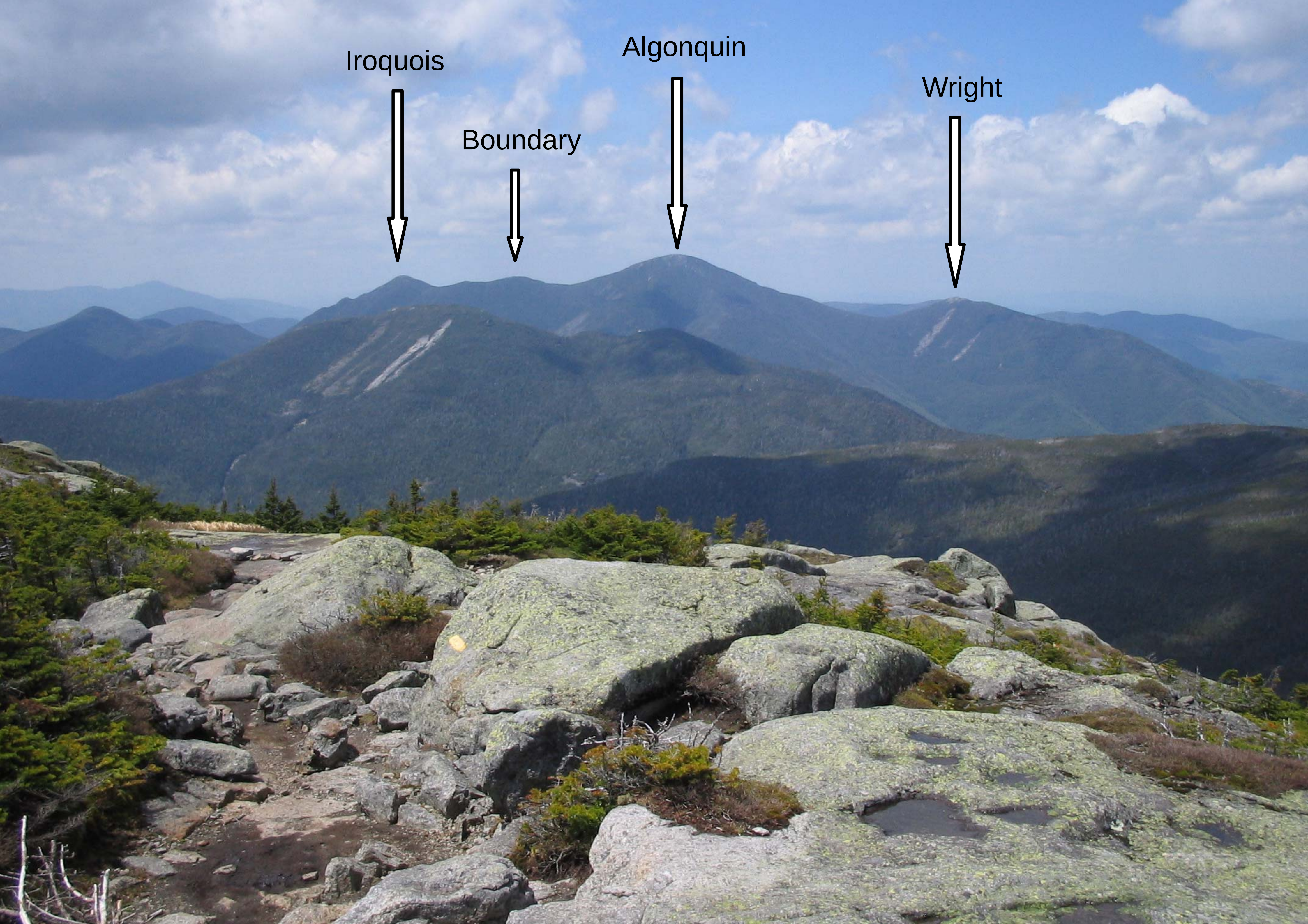
Conservation of Alpine Flora

Southernmost communities of alpine vegetatio in the eastern United States

ndack High Peaks



Alpine areas in the northeastern United States


Iroquois
Boundary
Algonquin
Wright

Substratum

- Bare rock (~ 40% of alpine)
- Fine-to-medium mineral soil
- Black humus layer
- Layer of decomposed material
- pH: 3.8 to 4.0

Microclimate

- Overall harsh conditions
- Solar radiation
- High winds
- Thin soils
- Cold temperatures
- Water availability
- Microtopography

Undesignated trail

Soil islands resulting from erosive impac

A 25-Year Assessment of Vegetation Change

Objective: Document vegetation change

Hypotheses:

- Little or no overall change in vegetation (nu
- Measurable changes in species compositio and presence/absence

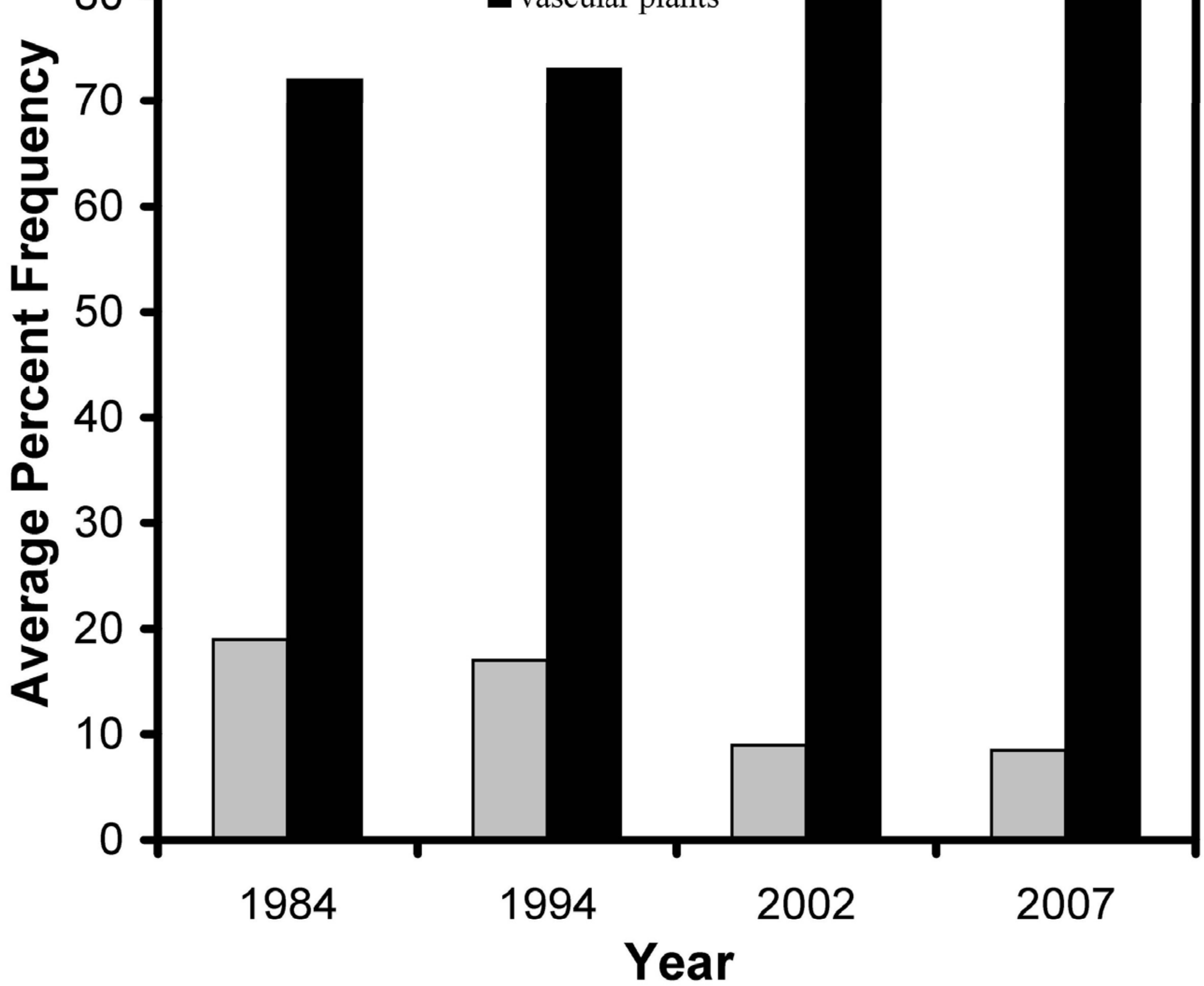
Methods

- 11 transects (30 m) established in 1984
- Sampled in 1984, 1994, 2002, 2007
- Point-intercept method – every 5 cm

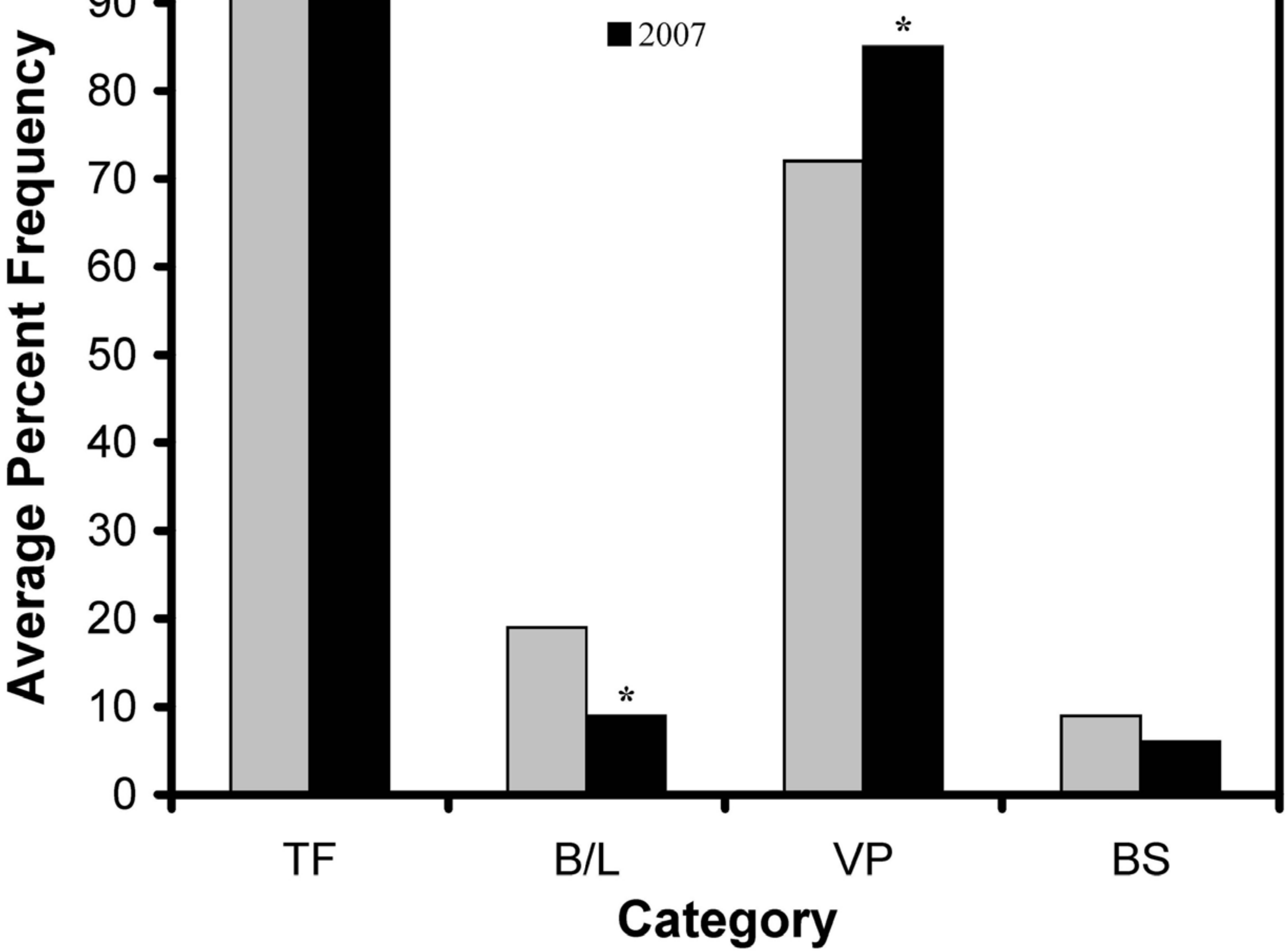
Transect 3 on Wright Pea

Encountered

- 58 species (29 families)
- 6 substratum types



gure 1. Change in mean frequency of bryophytes/lichens versus
vascular plants across all four sampling years



e 2. Comparison of overall change in mean percent frequency between 1984 and 2007 for four different categories (paired t-test) (* = $p < 0.05$) (TF = total plant and lichen frequency; BL = bryophytes/lichens; VP = vascular plants; BS = bare substratum

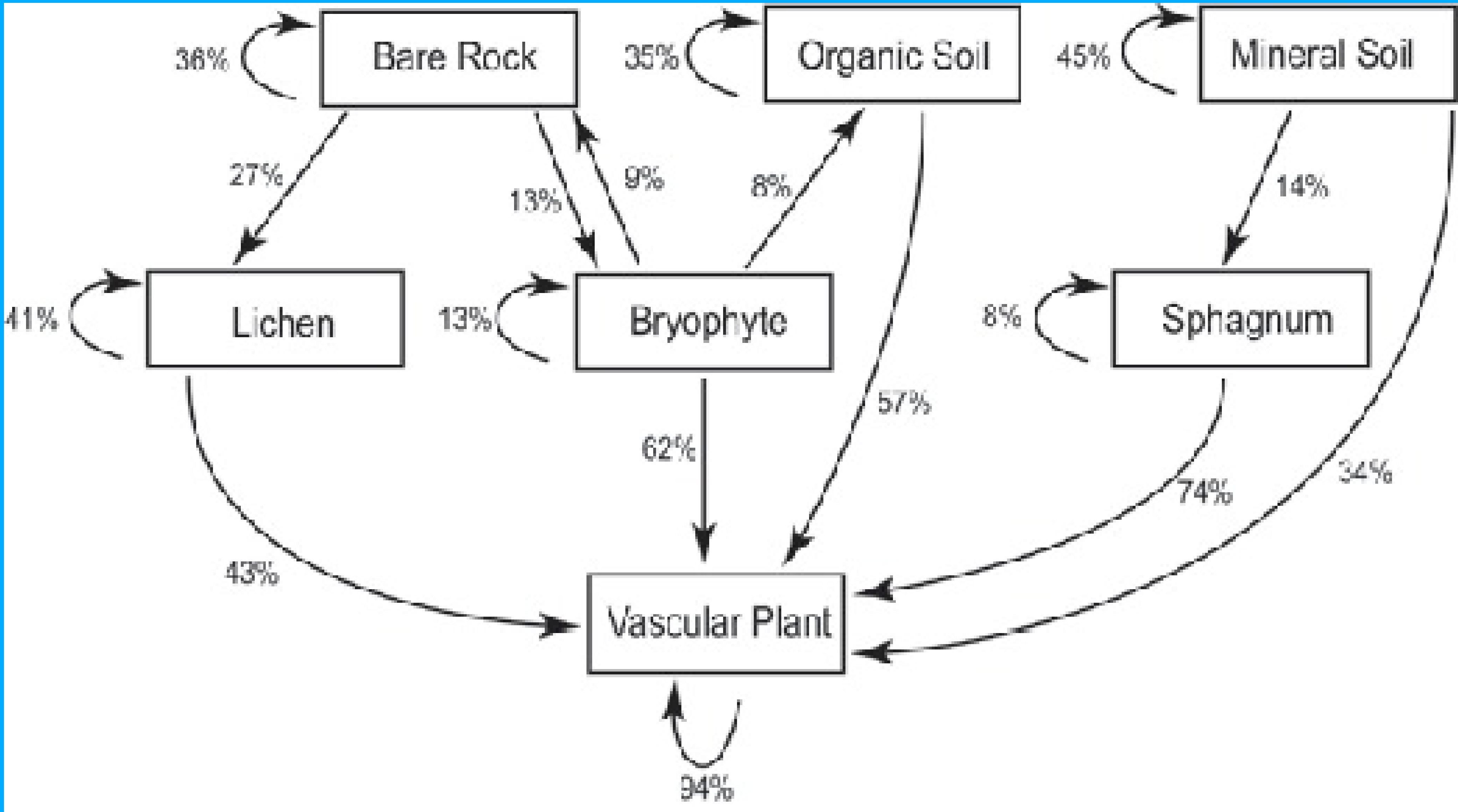
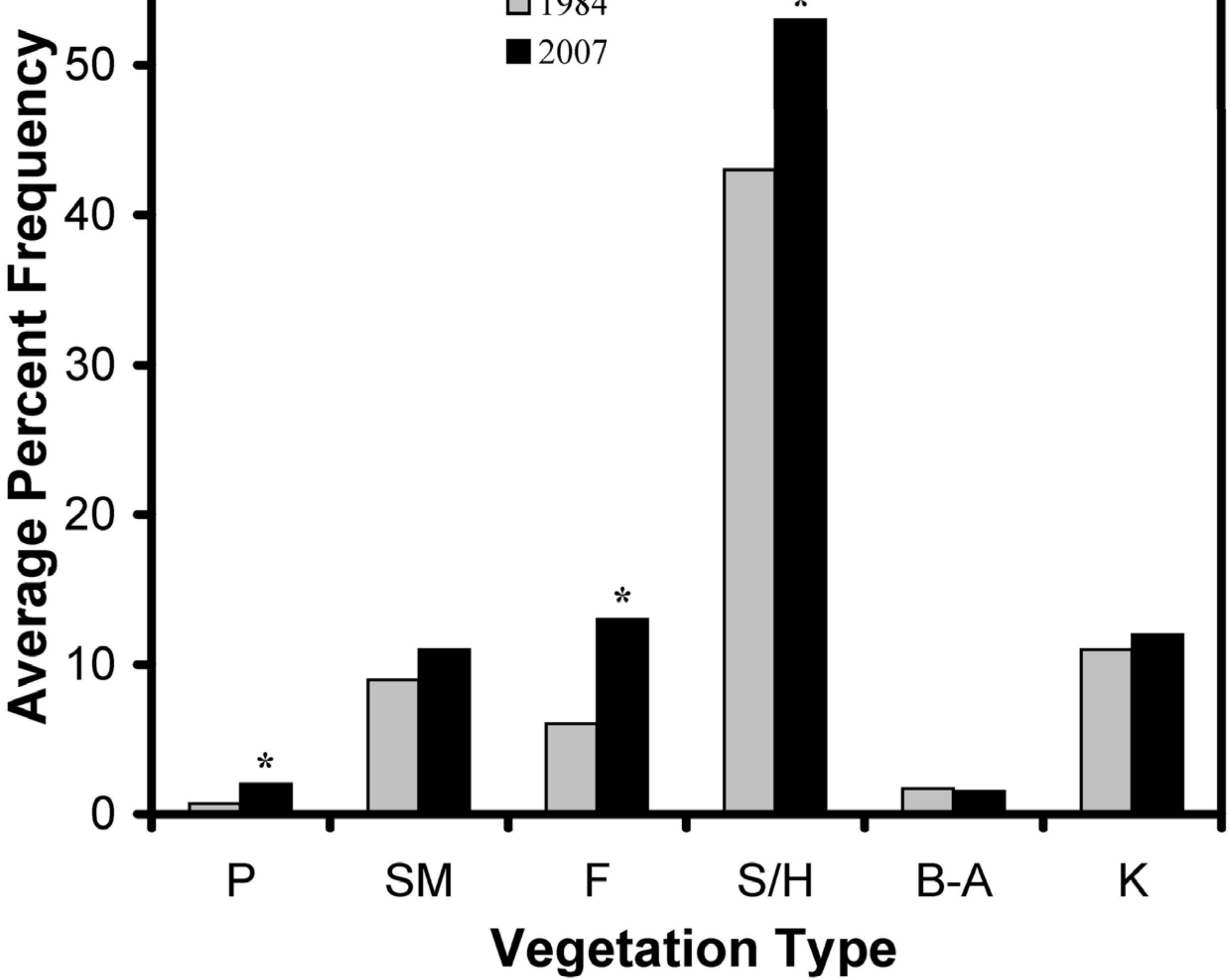


Figure 3. Transition diagram constructed through a point-by-point comparison of all data points across all 11 transects for data collected in 1994, 2002, and 2007.

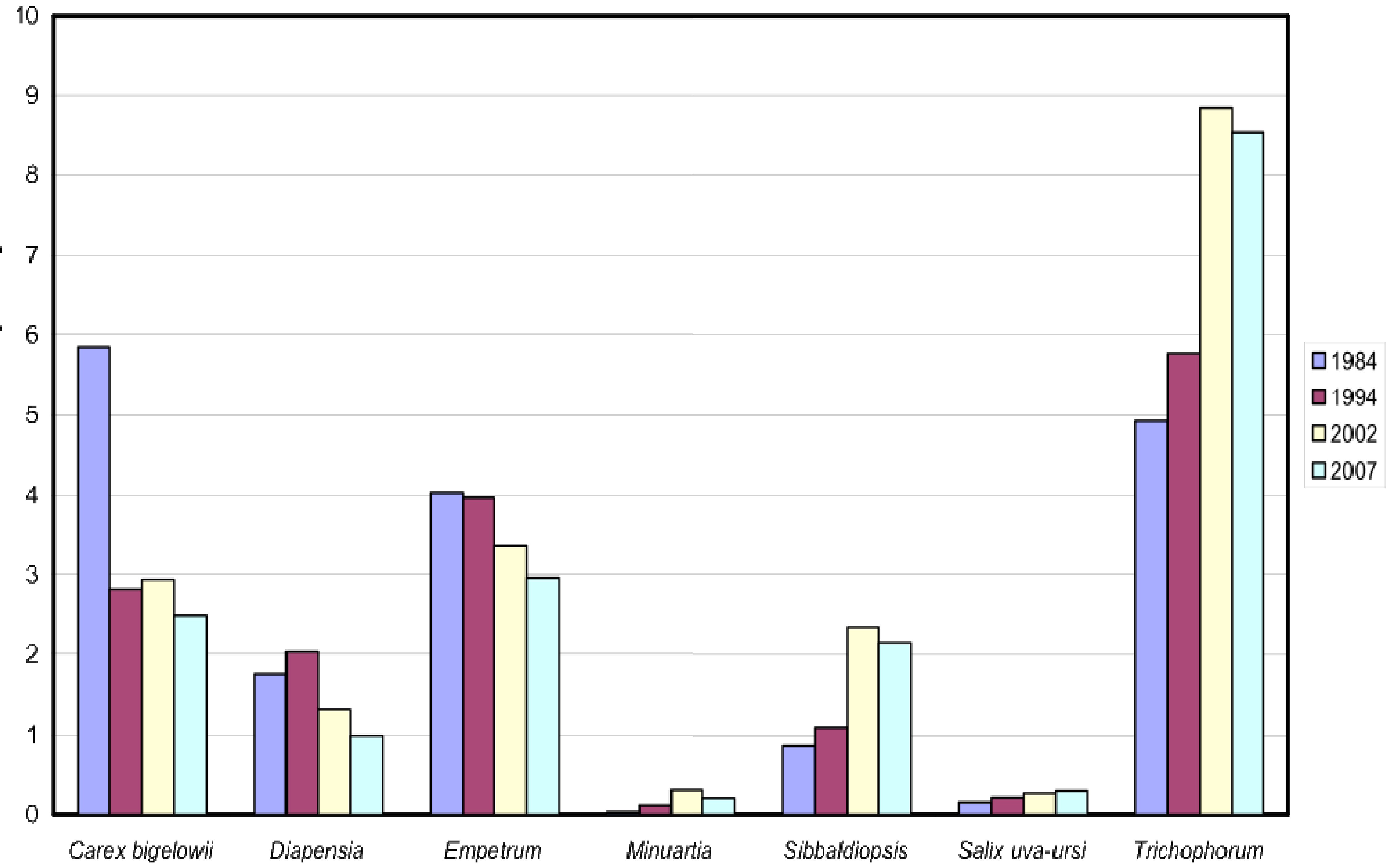


re 6. Comparison of overall change in mean percent frequency
een 1984 and 2007 for six different vegetation types (paired t-te
p < 0.05) (P = pioneer; SM = sedge meadow; F = fen; S/H =

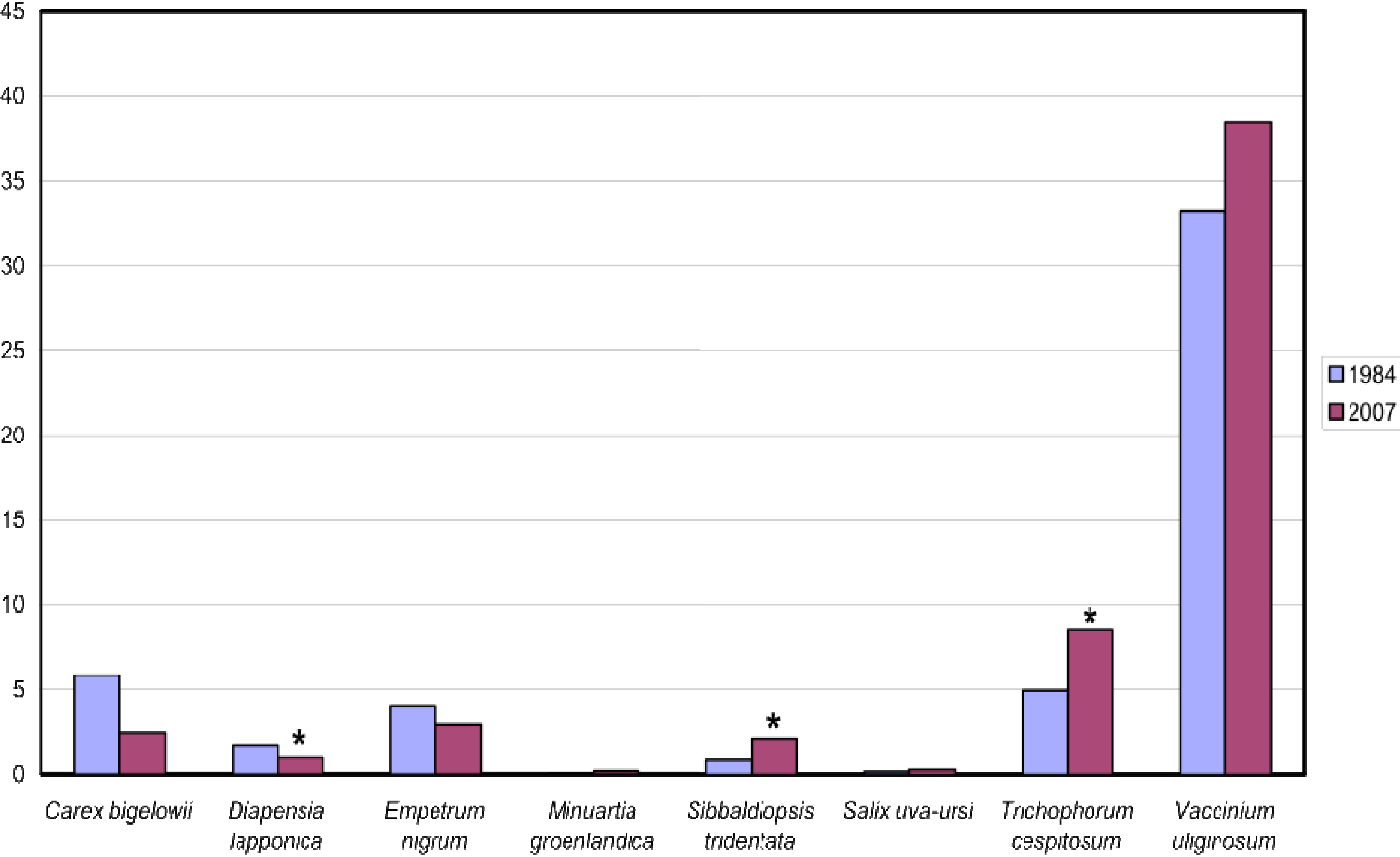
lpine species frequency changes

Species	1984	1994	2002	2007
Carex bigelowii	5.85	2.82	2.94	2.5
Diapensia lapponica	1.75	2.03	1.32	0.99
Empetrum nigrum	4.03	3.97	3.36	2.96
Minuartia groenlandica	0.03	0.11	0.3	0.2
Sibbaldiopsis tridentata	0.85	1.09	2.33	2.14
Salix uva-ursi	0.15	0.21	0.26	0.29
Trichophorum cespitosum	4.92	5.77	8.84	8.54
Vaccinium uliginosum	33.14	34.24	34.56	38.39

Figure 2. Change in Mean Frequency of Individual Alpine Species Across All Four Sampling Years (Excluding *Vaccinium uliginosum*)



for Individual Alpine Species, MacIntyre Range, Adirondack High Peaks Region (paired t-test)
(* = p < 0.05)



Very little change in total plant and licher frequency

Definite changes in composition

- Transects differed in respect to compositio change

- Successional shift from bryophyte/lichen to vascular plant domination

Climate Change?

Future Tasks

ontinue to sample transects every 5 years

ermanent plots have been established along transects

- Representing different microclimates at different successional stages

ompare successional process between differe microclimates

etter assess causes of change

Case Study 4

Restoration of Rare Plants and Plant Communities on Brownfields

(Onondaga County, NY)

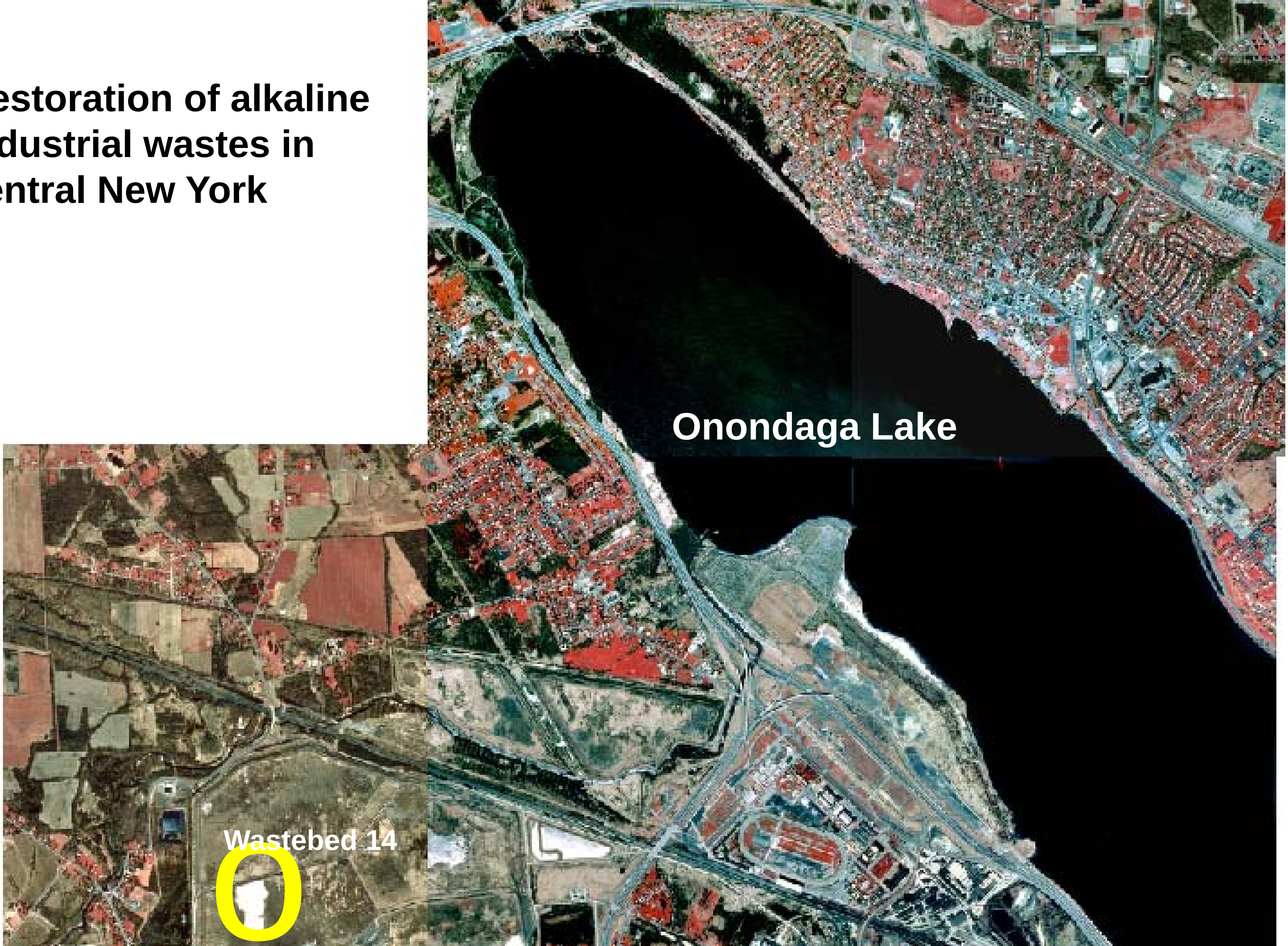
Context

nland salt marsh

photo taken in 1936 near downtown Syracus


one of three inland salt marshes remaining in NYS
(and only 1 in Michigan for 4 total in eastern US)

Restoration of alkaline industrial wastes in central New York




Wastebed 14


CAT


2.0 ha site planted, most of
which is inland salt marsh
community

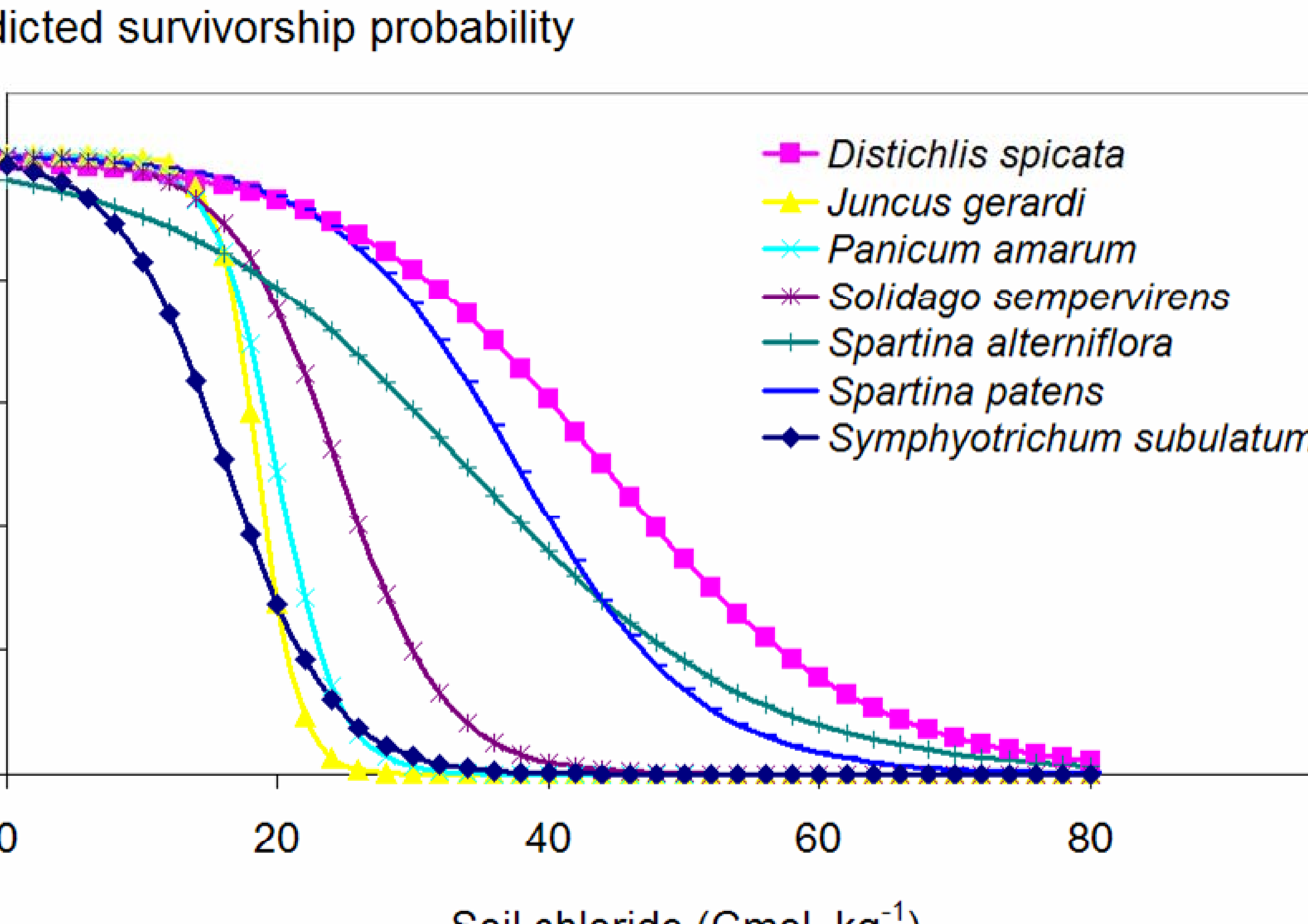

next growing season

le goldenrod – *Solidago sempervirens*

discovered in upstate NY along expressway near Syracuse)

planted on wastebed


Aster subulatus – saltmarsh aster
(rare in NYS) on restored site



dicted survivorship probability
Distichlis spicata
Juncus gerardi
Panicum amarum
Solidago sempervirens
Spartina alterniflora
Spartina patens
Symphyotrichum subulatum
0
20
40
60
80


Trollius laxus spp. *laxus*
in created rich fen

Long-term monitoring is essential to assess the demographic and reproductive dynamics of rare species

Knowledge of substrate characteristics is key to understanding population dynamics of rare species: especially hydrology, microtopography, chemistry

The role of light intensity and quality provides a basis for evaluation of population change

Conclusions

- Linking habitat disturbance and resultant successional trajectories is critical for understanding rare plant demography

- Invasive species threaten populations of rare species

- Unproductive sites provide refuges for uncommon species and offer locations for successful restoration