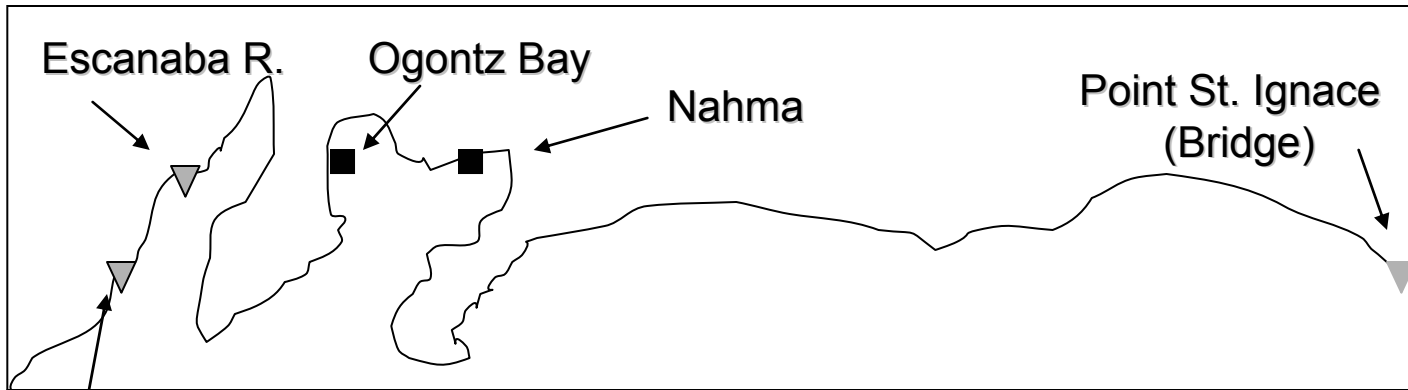
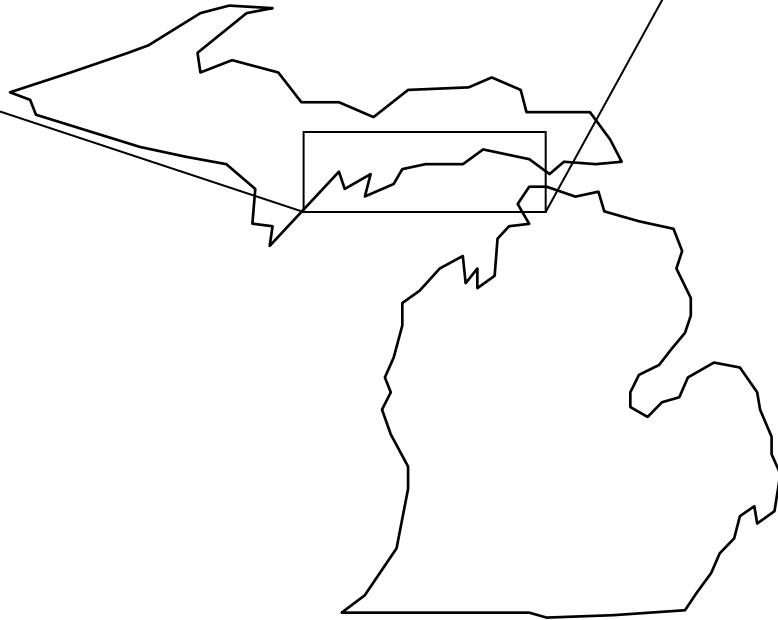


Low Disturbance Site ■  
 Intermediate Disturbance Site ▼  
 High Disturbance Site ●

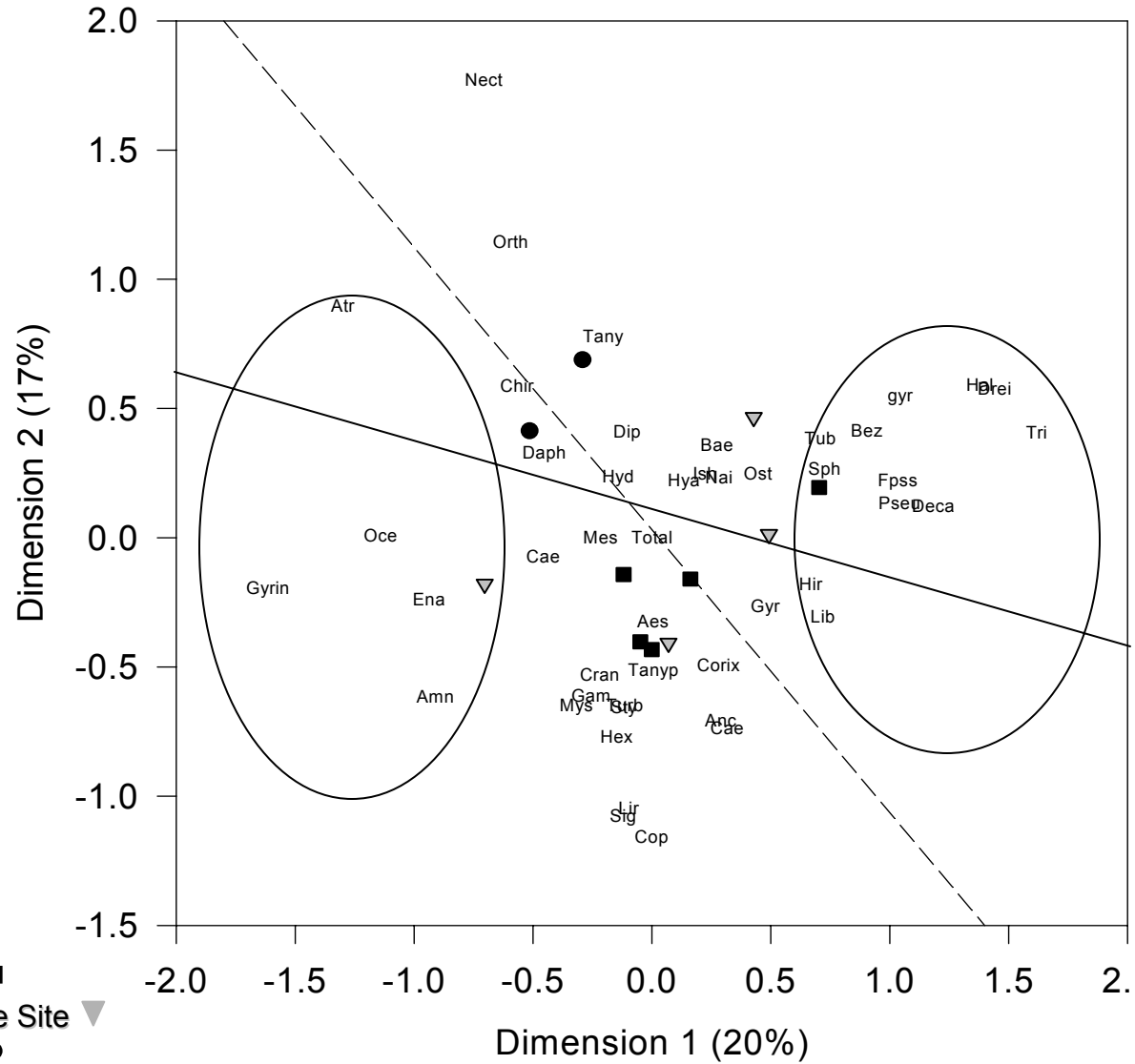


Ludington Park

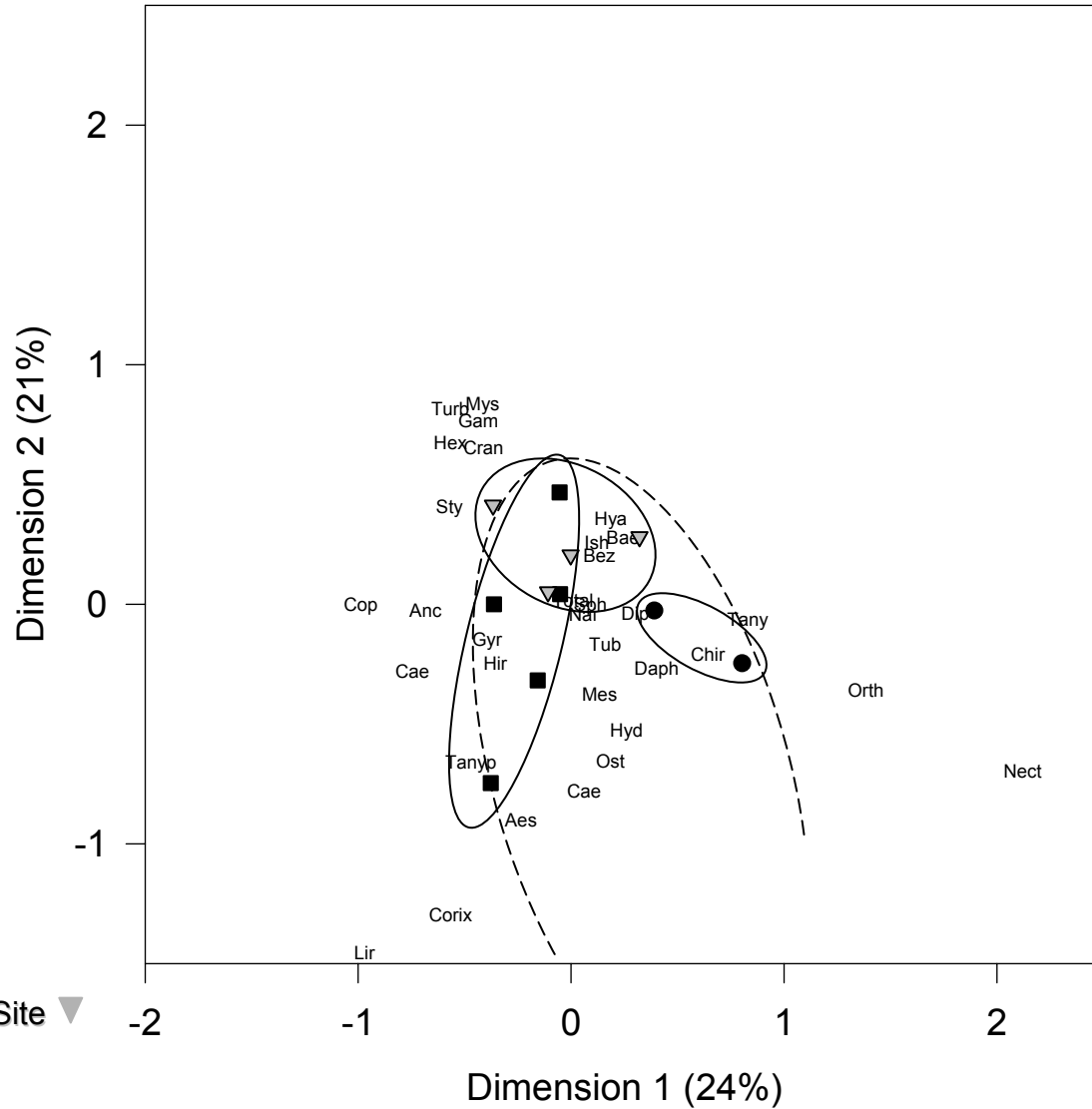


- Low Disturbance Site ■
- Intermediate Disturbance Site ▼
- High Disturbance Site ●

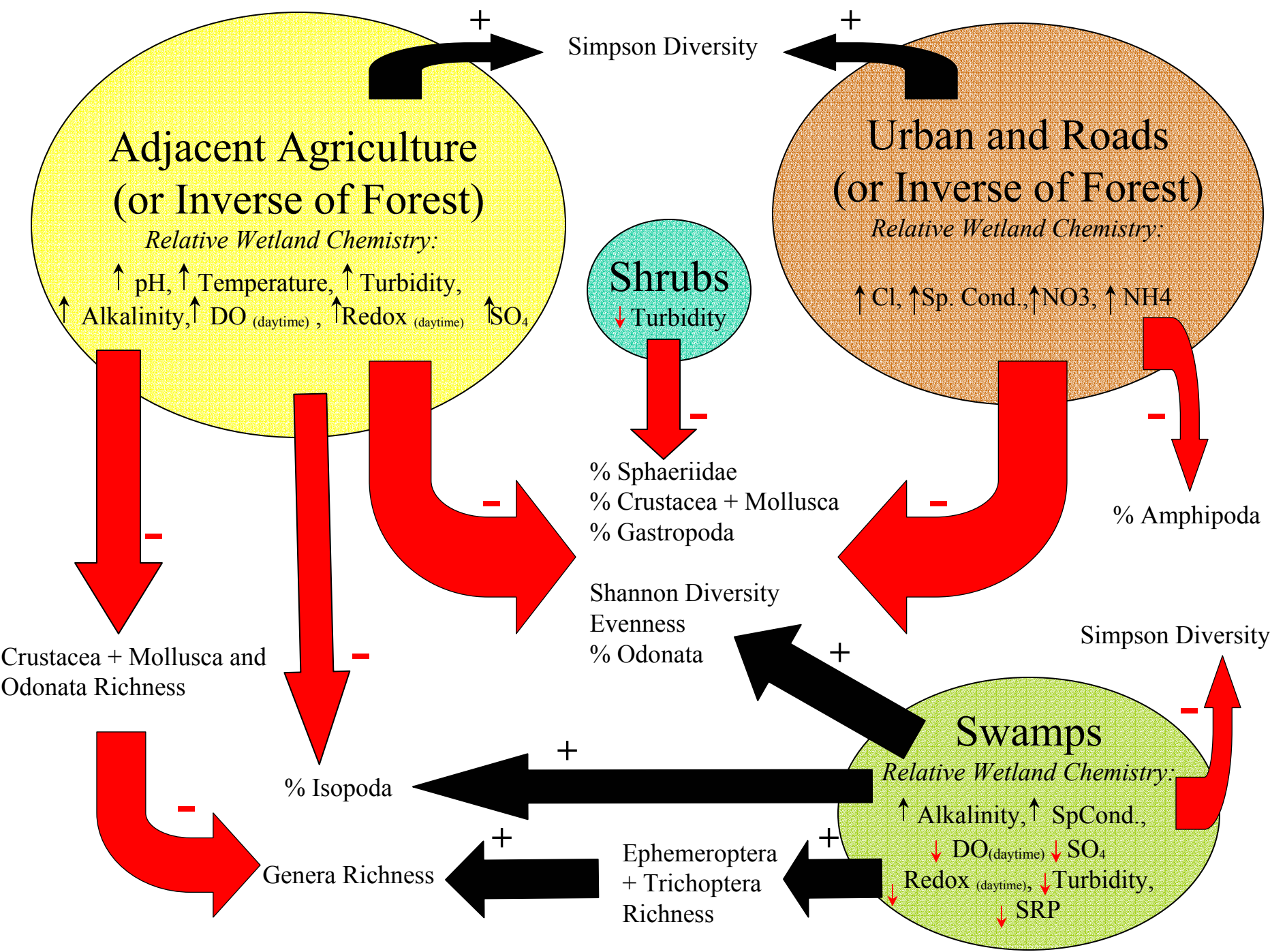
# Correspondence Analysis Using 1999 Taxa Inner *Scirpus*



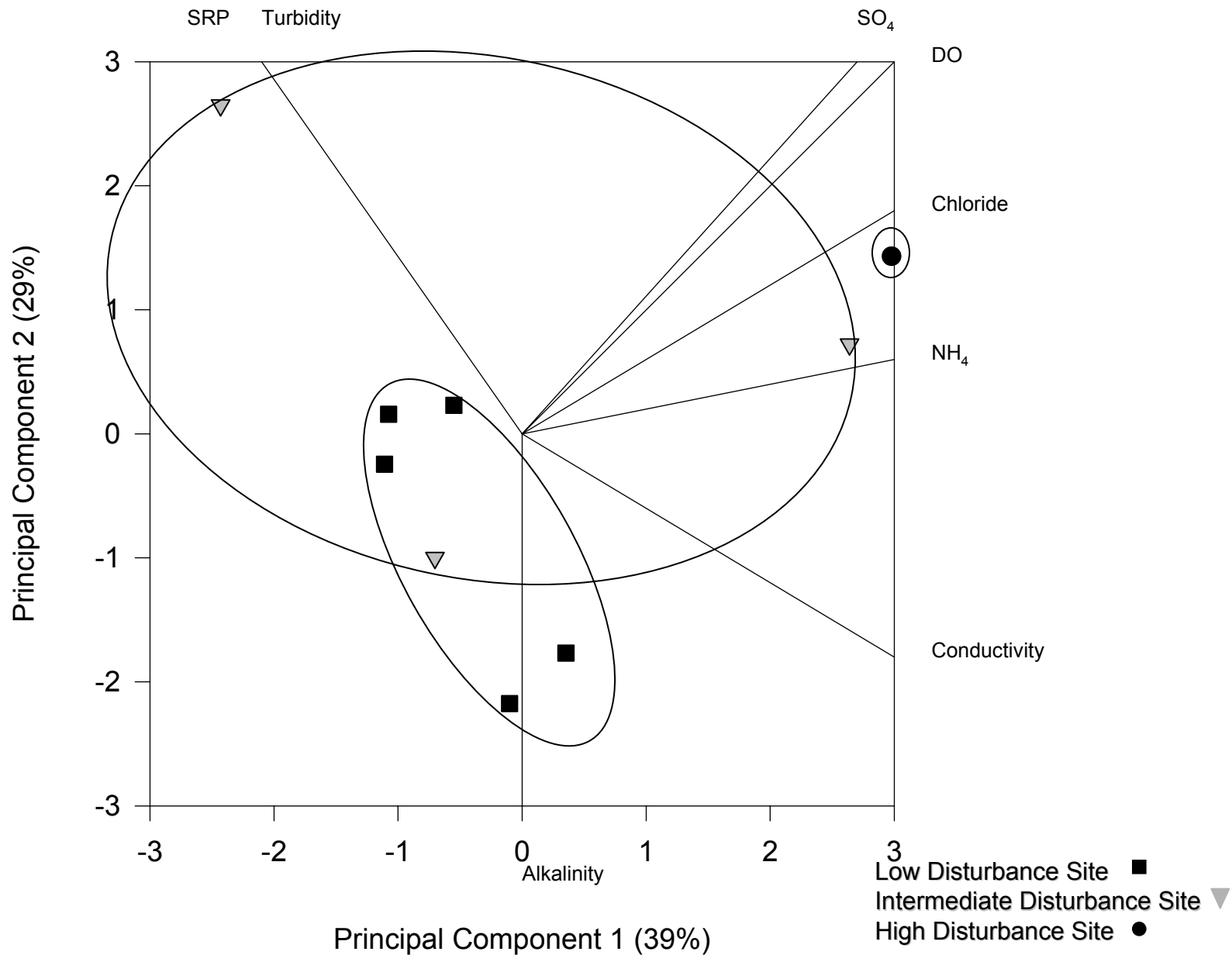
# Correspondence Analysis Using 1999 Taxa Inner *Scirpus* (2nd Run)



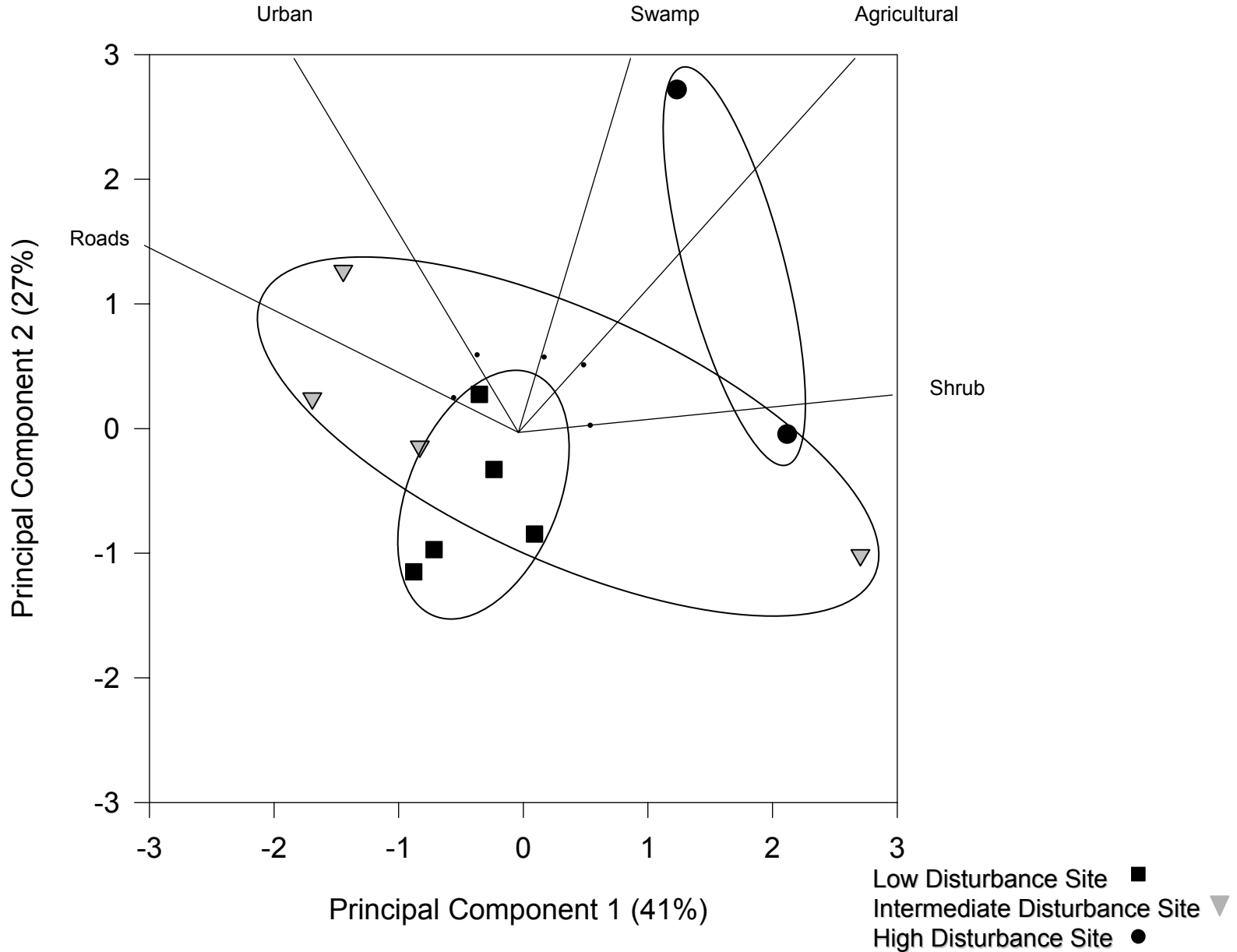
Low Disturbance Site ■  
 Intermediate Disturbance Site ▼  
 High Disturbance Site ●



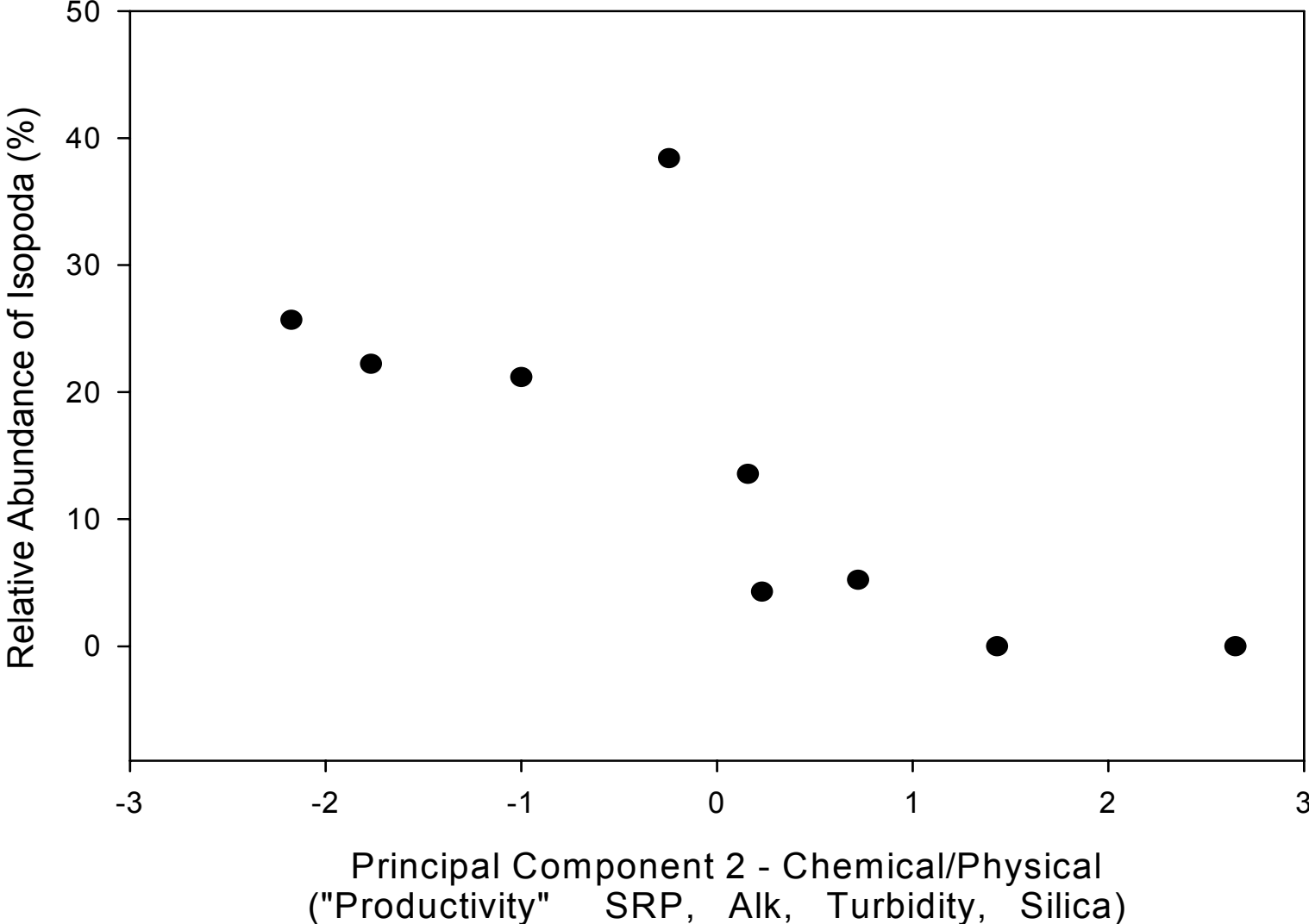
# Inner Scirpus Principal Component Analysis Using 1999 Chemical/Physical data



# 1999 Inner Scirpus Sites Principal Component Analysis Using 1978 Landuse Data



**Relative abundance of Isopoda vs. Principal Component 2  
(Pearson correlation  $r = -0.734$ ,  $p = 0.024$ )**





# Northern Lake Huron Site Descriptions

<u>Site</u>	<u>Major Disturbance</u>
Duck, Peck & Voight Bays	Some dwellings adjacent to the bay (Marquette Island)
Mackinac, Mismar, & Prentiss Bays	Some dwellings, highway across upper wet meadow zone
St. Martin's Bay	Limited sediment from the Pine R.
Pine River	Substantial sediment from Pine R. (St. Martin's Bay)
Golf Course	Adjacent golf course (Mackinac Bay)
Port Dolomite	Dolomite [(Ca,Mg)CO <sub>3</sub> ] mining
Cedarville Bay	Sewage effluent, urban runoff, marine traffic

## Saginaw Bay Site Descriptions

Wildfowl Bay	Near intense agriculture and small town of Sebewaing (Island near outer bay)
Wigwam Bay	North Branch of the Pine R. draining agricultural land (40% Forested, outer bay)
Vanderbilt Park	Near Quanicassee River draining intensely farmed region
Almeda	Adjacent to intense agriculture
Cotter Road	Adjacent to intense agriculture; Near Saginaw R.

# Northern Lake Huron Sites

Duck Bay  
Peck Bay  
Voight Bay  
Mackinac Bay  
Mismer Bay  
Prentiss Bay  
St. Martin's Bay

Low Impact

Pine River  
Golf Course  
Port Dolomite  
Cedarville Bay

Intermediate Impact

# Saginaw Bay Sites

Wildfowl Bay  
Wigwam Bay  
Vanderbilt Park  
Almeda  
Cotter Road

Intense Impact

# Northern Lake Michigan Site Descriptions

<u>Site</u>	<u>Major Disturbance</u>
Ogontz	Some dwellings adjacent to the site with an adjacent boat launch.
Nahma	A golf course and some dwellings adjacent to the site with an adjacent rural road.
Pt. St. Ignace 'Bridge'	Adjacent to a major highway and urbanization.
Escanaba	Near urban and industrial area of Escanaba MI.
Ludington Park	Near urban and industrial area of Escanaba MI. with heavy boat traffic.

# Northern Lake Michigan Sites

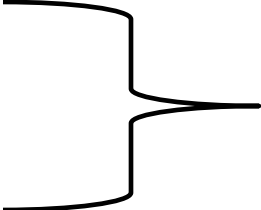
Ogontz

Nahma

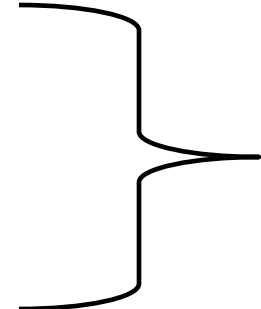
Pt. St. Ignace 'Bridge'

Escanaba

Ludington Park



Low Impact



Intermediate Impact

**Taxa from the Inner Scirpus zone  
responsible for ecoregional inertia**

**Taxa from the Outer Scirpus zone  
responsible for ecoregional inertia**

Crustacea Decapoda  
Mollusca Bivalvia Dreissena polymorpha  
Mollusca Gastropoda Lymnaeidae Fossaria  
Mollusca Gastropoda Lymnaeidae Pseudosuccinea columella  
Mollusca Gastropoda Physidae Physa gyrina  
Mollusca Gastropoda Hydrobiidae Amnicola  
Diptera Ceratopogonidae Atrichopogon  
Odonata Libellulidae Libellula  
Odonata Coenagrionidae Enallagma  
Hemiptera Corixidae Trichocorixa  
Coleoptera Halipidae Halipus  
Coleoptera Gyrinidae Gyrinus  
Trichoptera Leptoceridae Oecetis

Amphipoda Gammarid Gammarus  
Amphipoda Crangonctidae Crangonyx  
Gastropoda Lymnaeidae Fossaria  
Trichoptera Leptoceridae Mystacides  
Trichoptera Leptoceridae Nectopsyche  
Hemiptera Corixidae Sigara  
Hemiptera Corixidae Trichorixa  
Tubificidae

	Site	WM	OS	IS	Ex. Degraded	Degraded	Mod.Degraded	Mod. Impacted	Mild. Impacted	Reference
1997	Mackinac	x	x	x						x
	Duck	x	x	x					x	
	Mismer	x	x	x					x	
	WildFowl	x	x	x			x			
	Cotter Road	x					x			
	Vanderbilt	x	x	x			x			
1998	Peck			x						x
	Duck			x						x
	Mismer			x					x	
	Mackinac			x					x	
	St. Martins			x					x	
	Prentiss			x					x	
	Voight	x	x	x				x		
	Cedarville			x				x		
	Wildfowl	x	x	x				x		
1999	Duck Bay		x	x						x
	Mismer		x	x					x	
	Mackinac		x	x					x	
	Port Dolomite		x	x					x	
	Prentiss		x	x					x	
	St. Martins		x	x				x		
	Wigwam		x	x				x		
	Golf Course		x	x				x		
	Wildfowl		x					x		
	Vanderbilt		x	x				x		
	Almeda		x	x				x		
	Cedarville			x			x			
	2000	Mismer		x	x					x
Duck			x	x					x	
Mackinac			x	x				x		
Pine River			x					x		
Cedarville				x				x		

# Wilcoxon Signed Ranks Tests

## Inner *Scirpus* Metrics: 1998 vs. 1999

(Water Level was 46cm lower in 1999 than in 1998)

<u>Metric (Inner <i>Scirpus</i>)</u>	<u><i>p</i></u>
Odonata Richness	0.083
% Odonata	0.310
Crustacea + Mollusca Richness	0.999
Genera Richness	0.157
% Gastropoda	0.180
% Sphaeriidae	0.317
Ephem + Trichop Richness	0.157
% Isopoda	0.317
Evenness	0.414
Shannon Diversity	0.999
Simpson Index	0.564

Duck, Mackinac, Prentiss, Mismar, St. Martin's, and Cedarville (n = 6)

\*Note: Similar results for 97 – 00 using Duck, Mackinac, Mismar (n = 3)\*

2001

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Site	WM	OS	IS	Ex. Degraded	Degraded	Mod.Degraded	Mod. Impacted	Mild. Impacted	Reference
Mackinac		x	x					x	
Duck		x	x				x		
Nahma		x	x				x		
Ogontz		x	x				x		
Escanaba		x	x				x		
Bridge		x	x				x		
Cedarville			x				x		
Port Dolomite			x				x		
McKay			x			x			
Pine River		x				x			
Ludington Park		x			x	x			

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