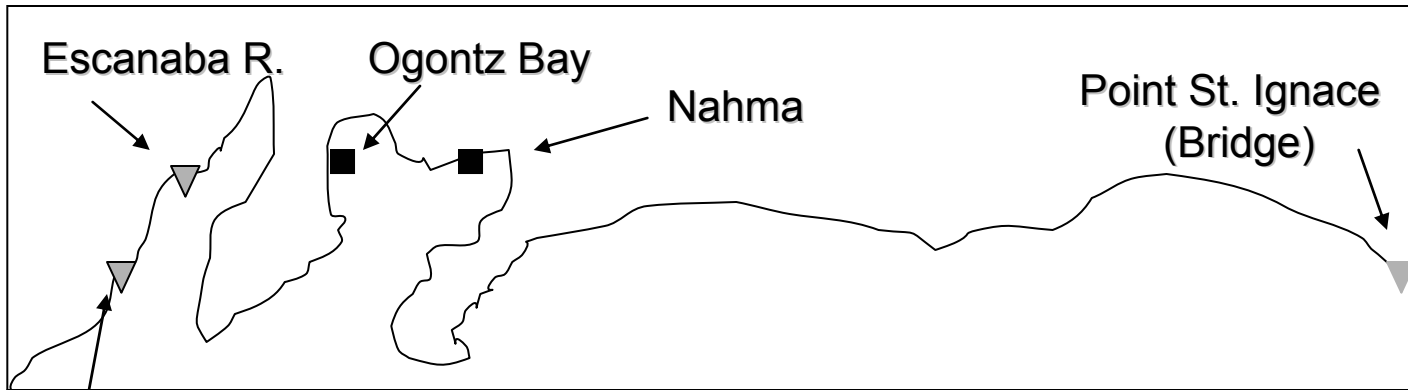
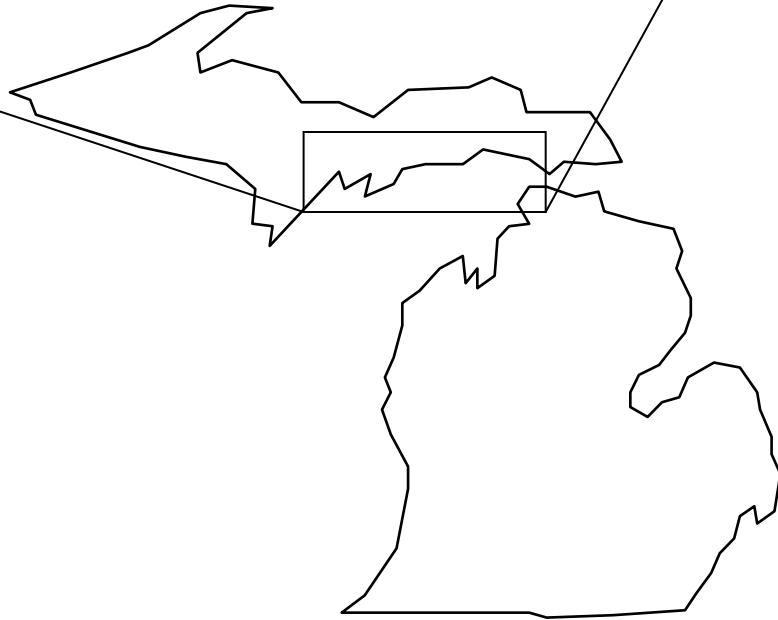


Low Disturbance Site ■
 Intermediate Disturbance Site ▼
 High Disturbance Site ●

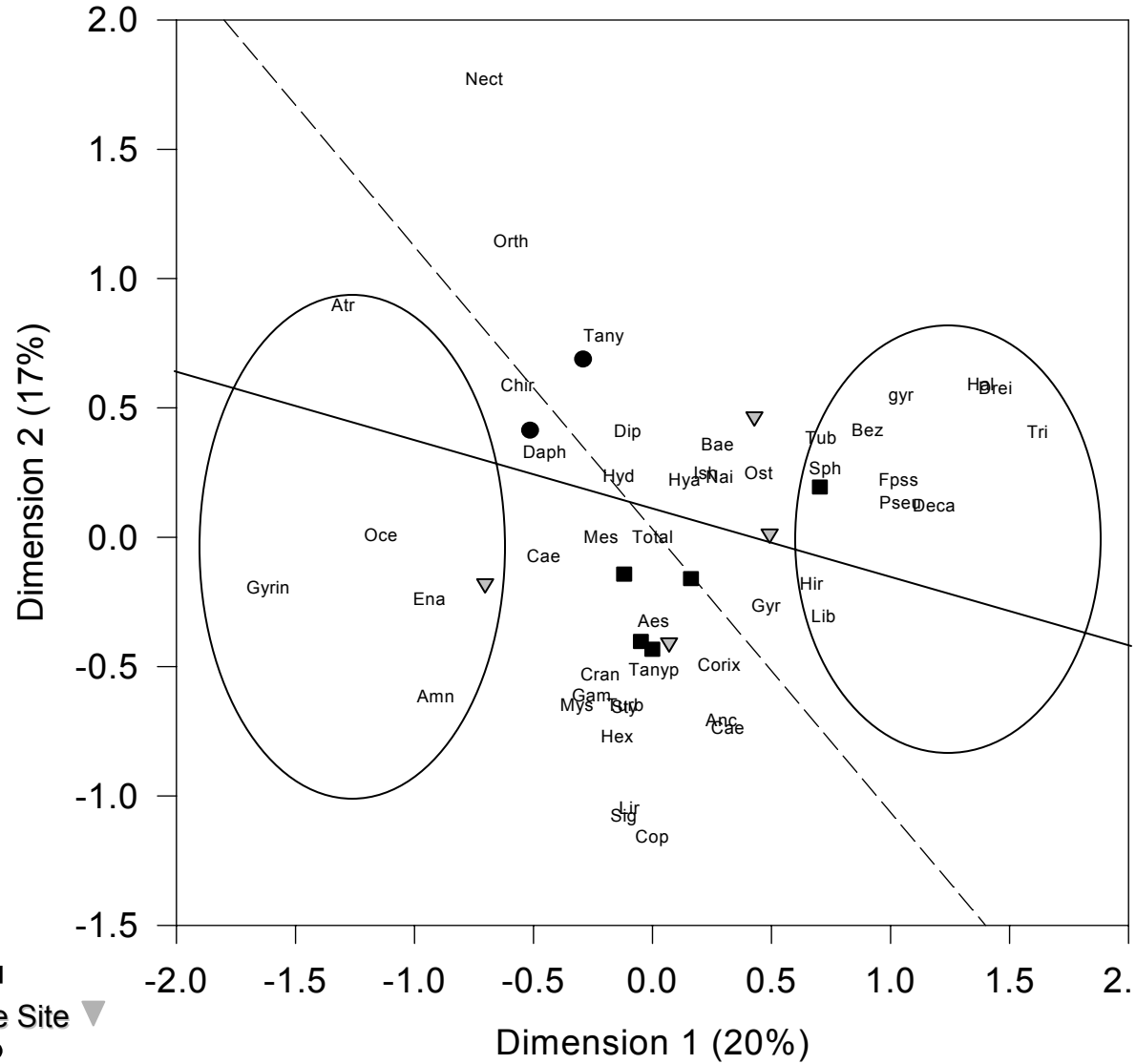


Ludington Park

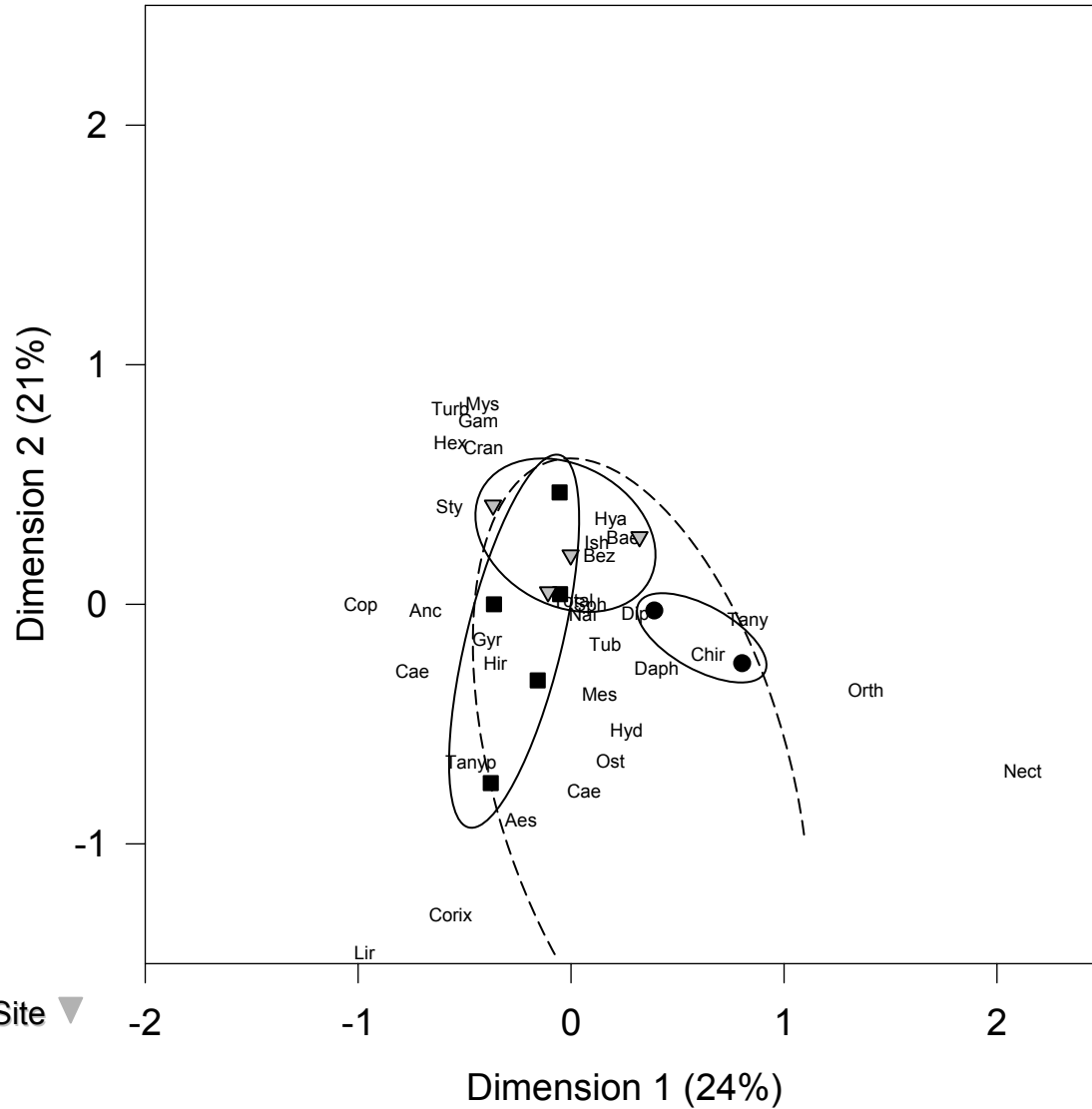


- Low Disturbance Site ■
- Intermediate Disturbance Site ▼
- High Disturbance Site ●

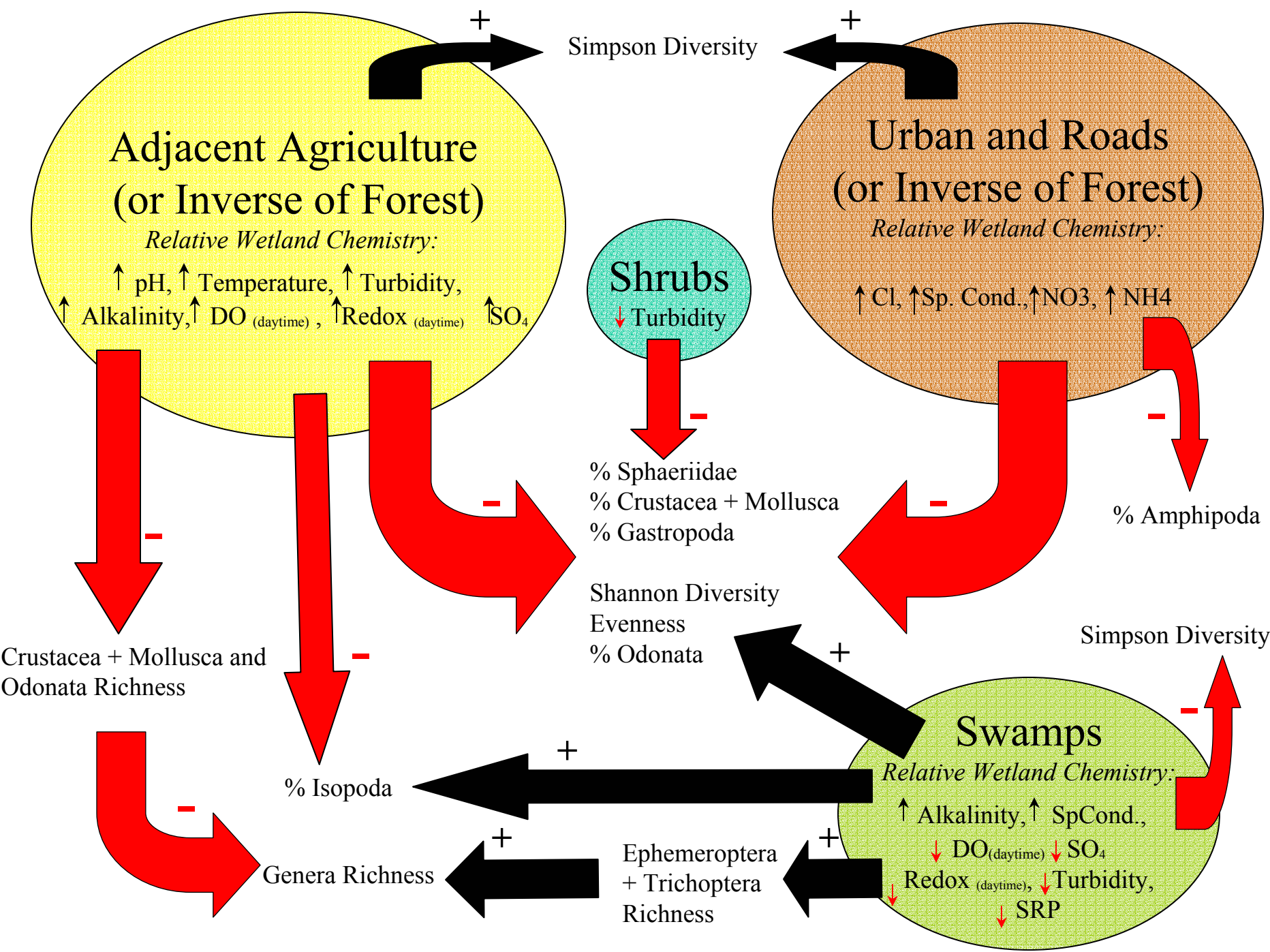
Correspondence Analysis Using 1999 Taxa Inner *Scirpus*



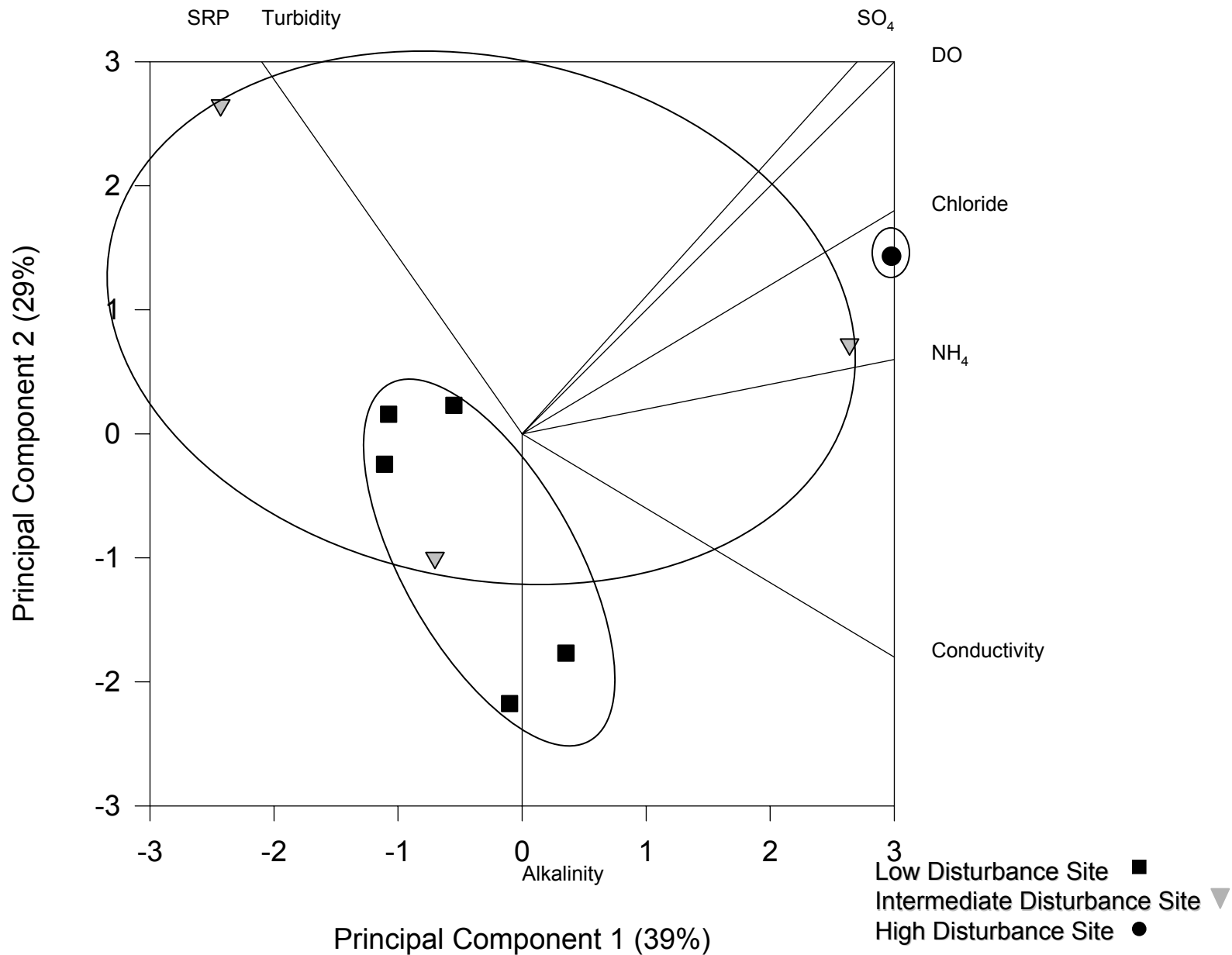
Correspondence Analysis Using 1999 Taxa Inner *Scirpus* (2nd Run)



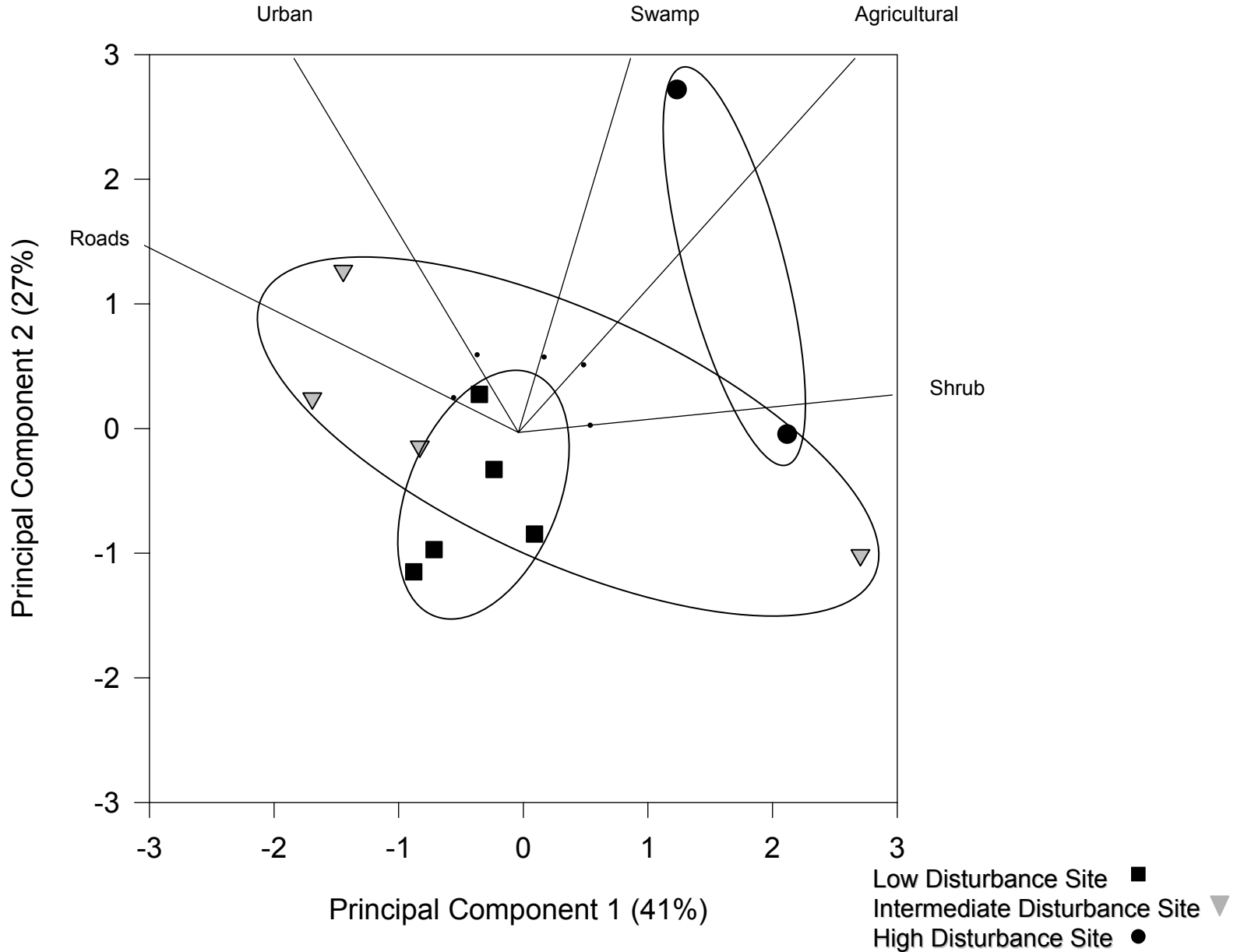
Low Disturbance Site ■
 Intermediate Disturbance Site ▼
 High Disturbance Site ●



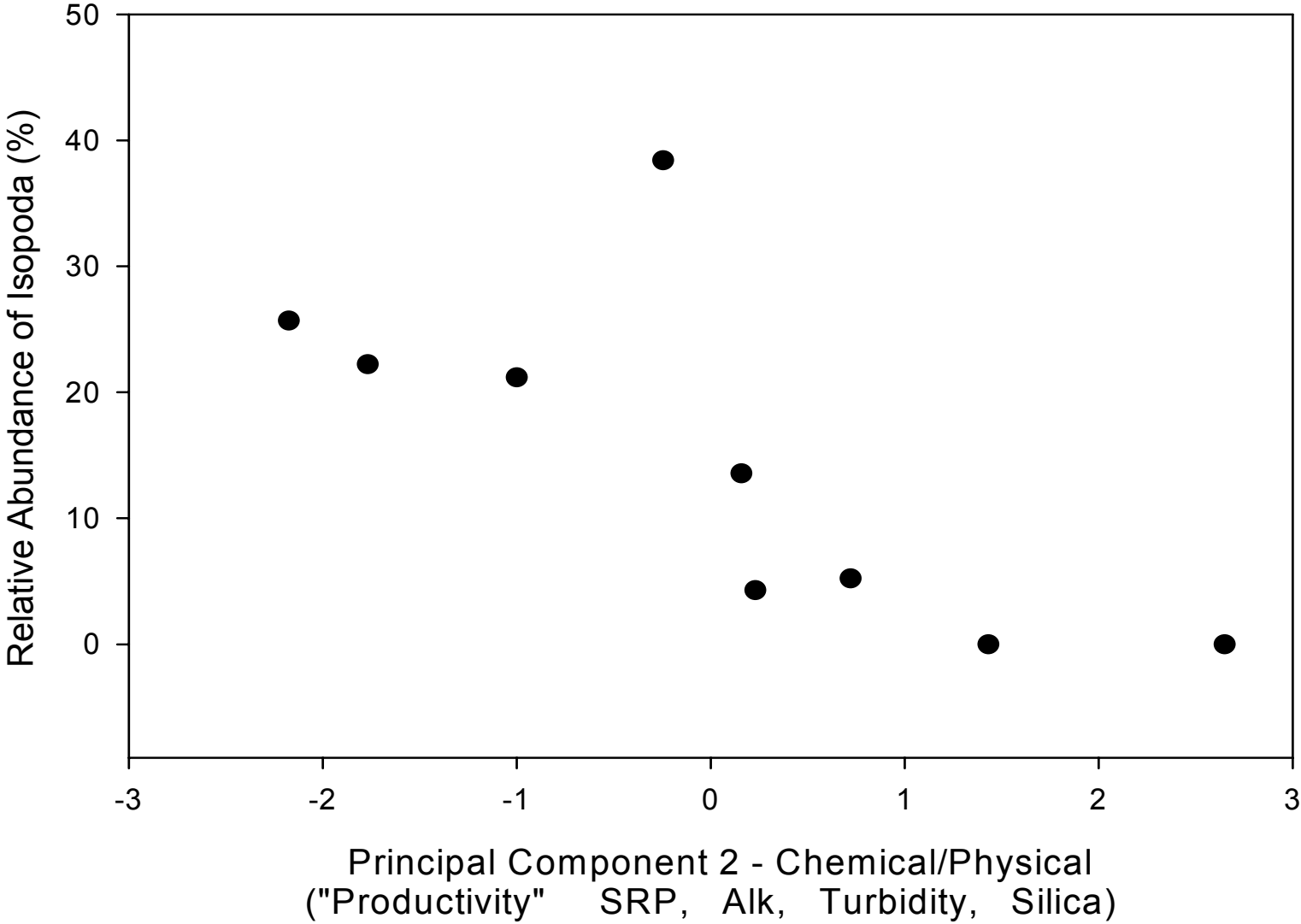
Inner Scirpus Principal Component Analysis Using 1999 Chemical/Physical data



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 ₃] 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

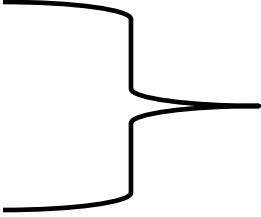
Ogontz

Nahma

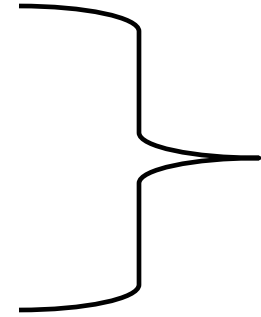
Pt. St. Ignace 'Bridge'

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
 Tricoptera Leptoceridae Mystacides
 Tricoptera 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		
1999	Wildfowl	x	x	x				x		
	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

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			