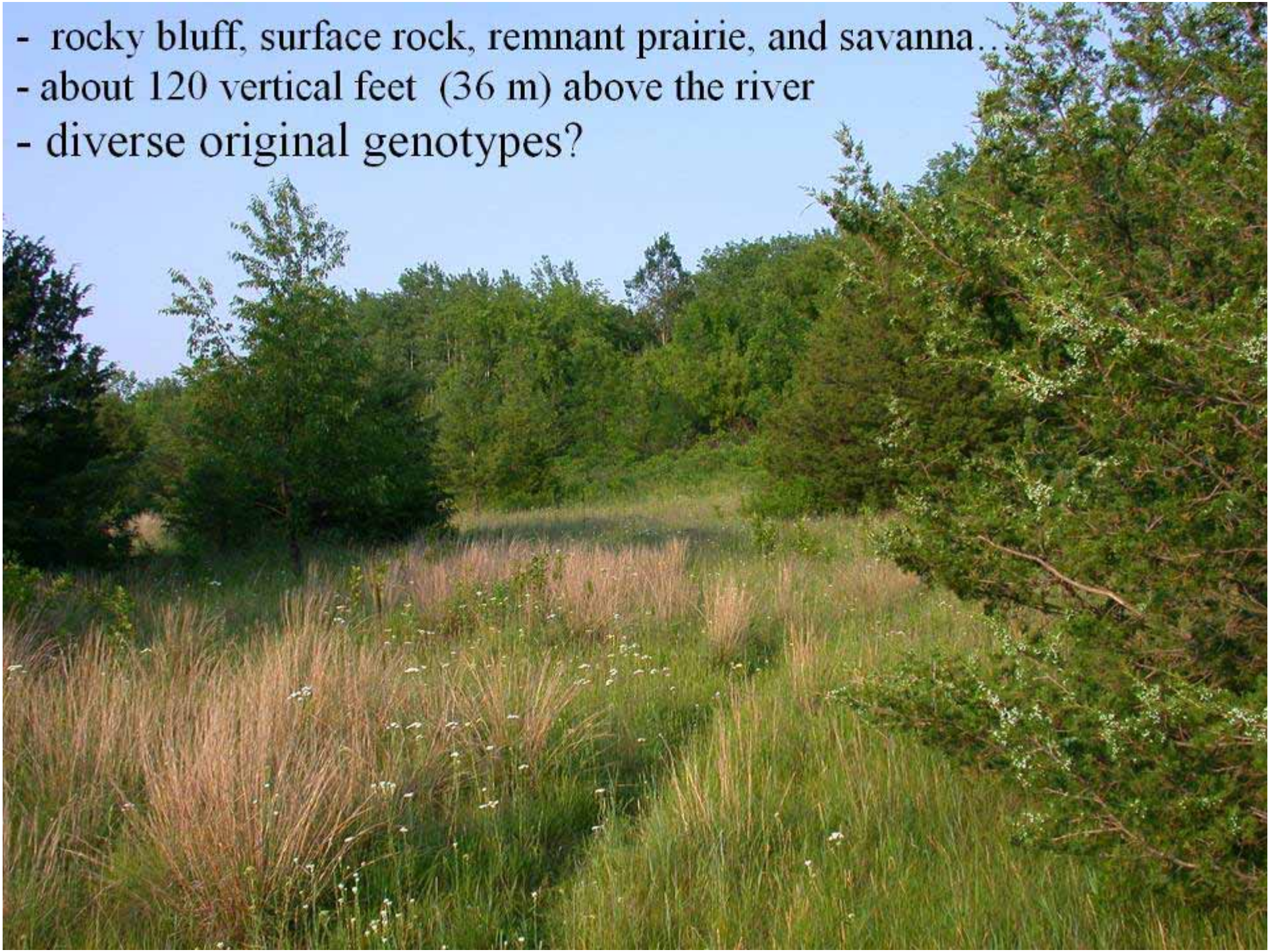
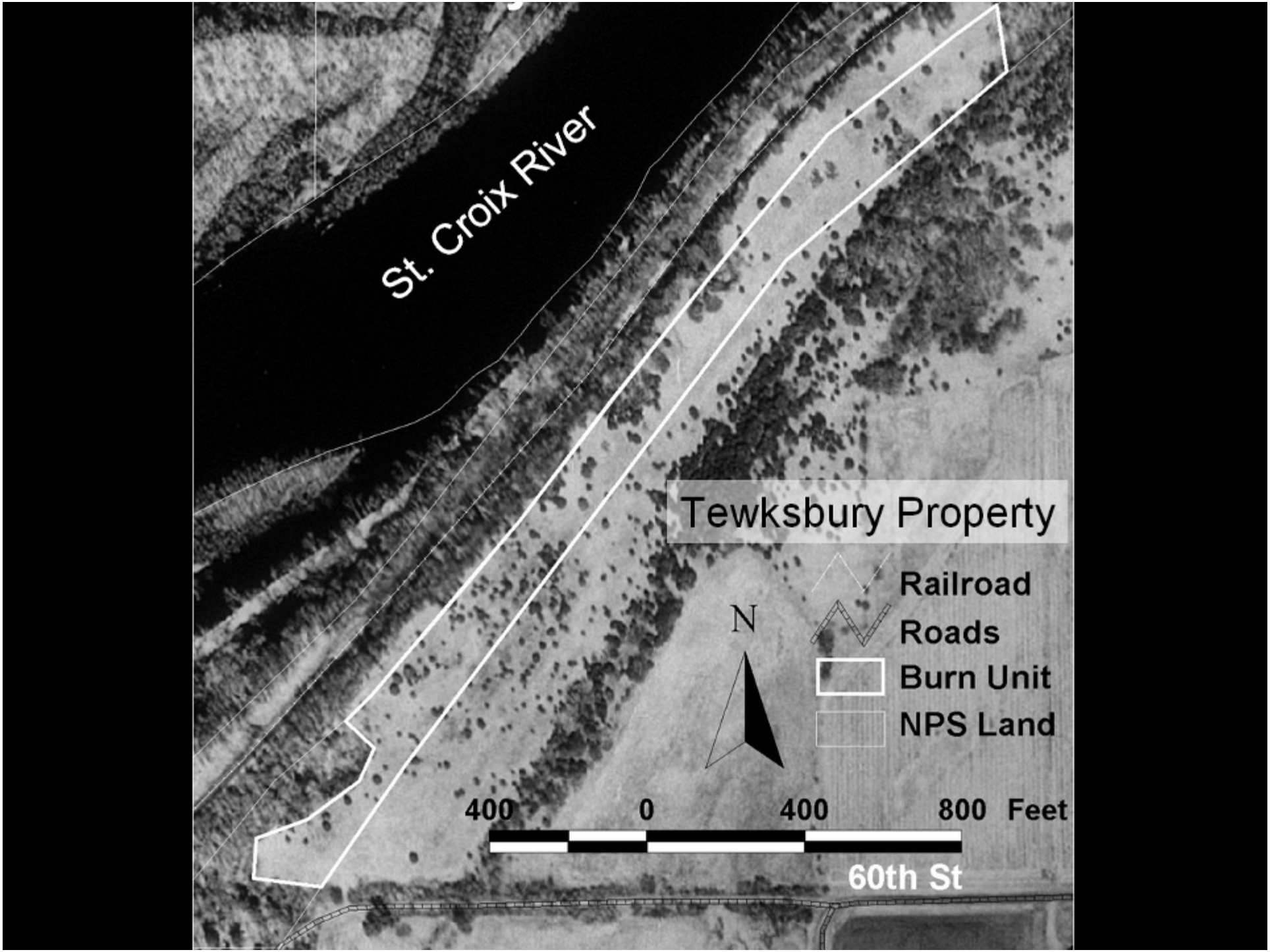
Pre-burn baseline inventory of epigeic invertebrates at the Tewksbury Unit of the St. Croix National Scenic Riverway

John Wheeler, Chelsie Harder, and Steven Wagner

Photo by Crystal Mathistrud


- rocky bluff, surface rock, remnant prairie, and savanna…
- about 120 vertical feet (36 m) above the river
- diverse original genotypes?


St. Croix River
Tewksbury Property
Railroad
Roads
Burn Unit
NPS Land
N
400 0 400 800 Feet
60th St

City of River Falls Biomonitoring, Site NM (North Main St.), rep. 1, 30 May 2006

State of Wisconsin
Department of Natural Resources

Guidelines for Collecting Macroinvertebrate Samples from Wadable Streams

SORTING PROCEDURES FOR SEMI-QUANTITATIVE HILSENHOFF BIOTIC INDEX (HBI) SAMPLES

INTRODUCTION

Aquatic organisms are sorted from Hilsenhoff Biotic Index (HBI) samples by water rinsing the sample, placing the sample in a sorting tray and removing the organisms, using forceps, from the sample debris with the aid of a 2X magnifying sorting lamp. The sample is grid sub-sorted according to procedures outlined by Hilsenhoff (1987) and modified as presented below. All non-plant organisms visible with the aid of the sorting lamp are removed from the sub-sort and preserved with 80% isopropyl alcohol in secure receiving containers for subsequent identification. Any unsorted sample remnant will be re-preserved in the original sample container and retained until sample report has been accepted by agency providing sample.

EQUIPMENT LIST

- Protective laboratory gear (Protective goggles, vinyl gloves, laboratory apron)
- Waste preservative container
- Nitex® washing net, #30 mesh
- Nitex® mesh, #30, 8" x 8"

How about biotic indexing with terrestrial invertebrates?

Why not?

What are the hallmarks of a good sentinel group?

Estimating the density of ground-dwelling arthropods with pitfall traps using a nested-cross array

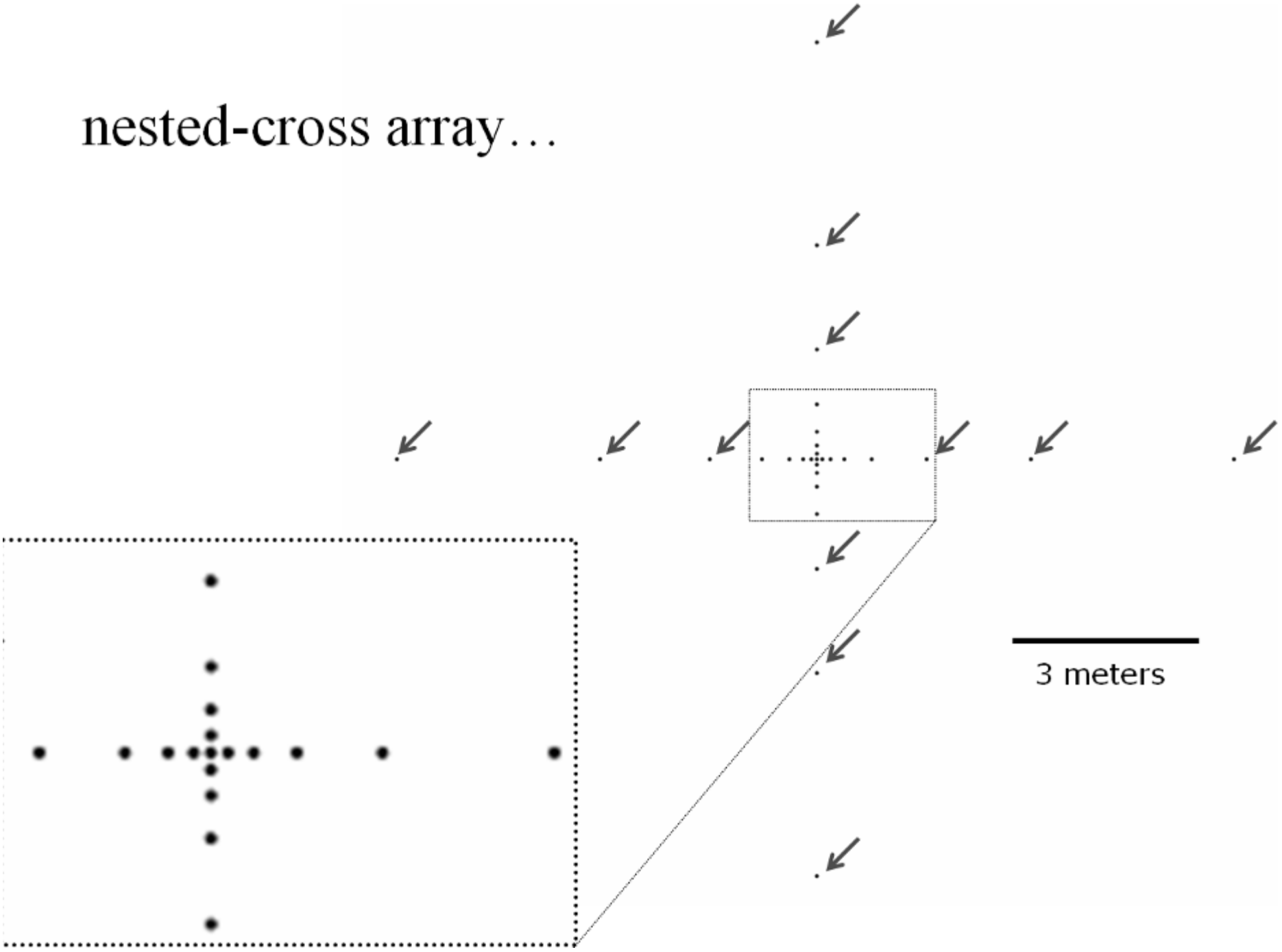
JÖRG PERNER and SILVIO SCHUELER*

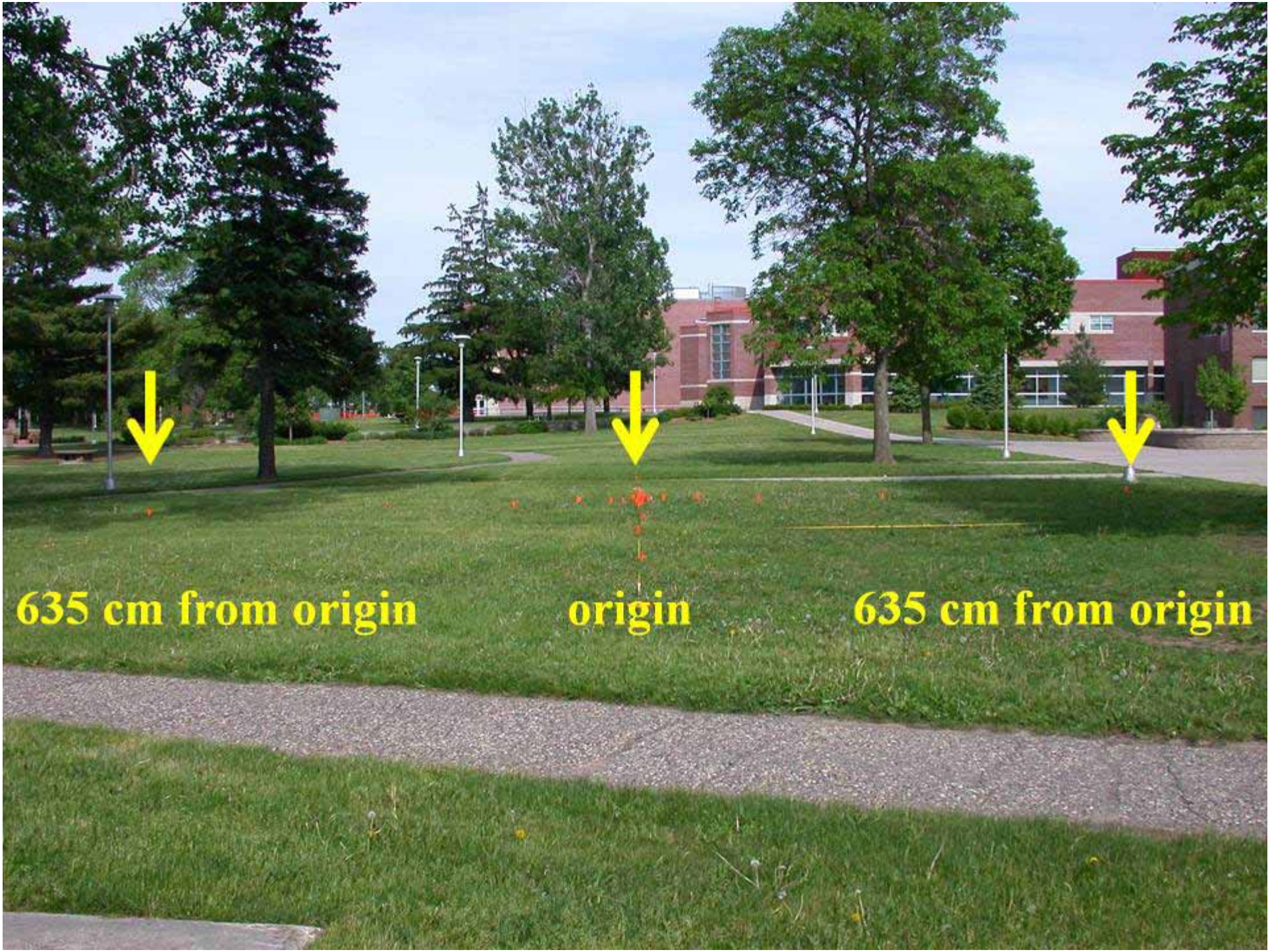
Institute of Ecology, Friedrich Schiller University Jena, Dornburger Straße 159, D-07743 Jena, Germany

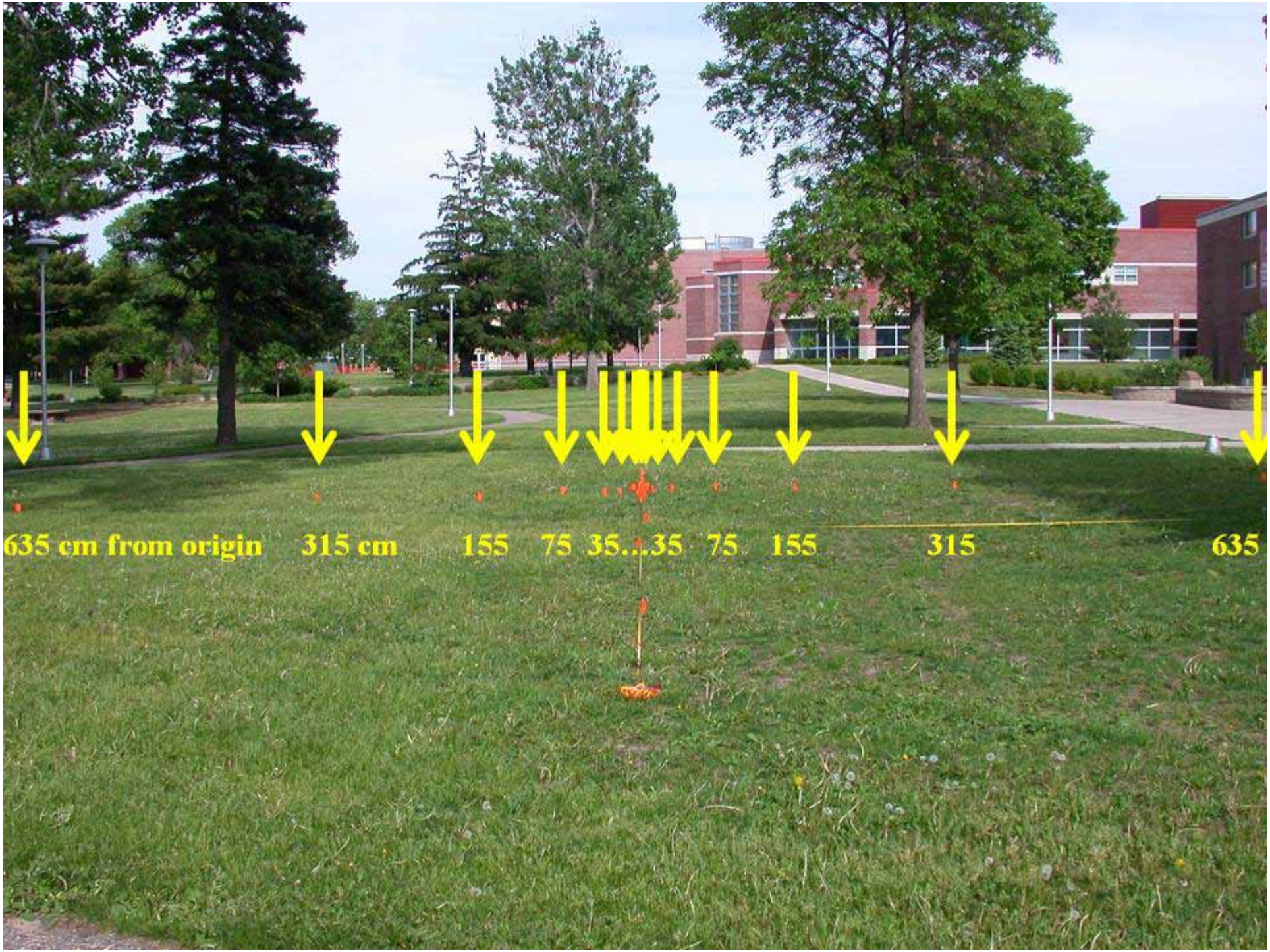
Summary

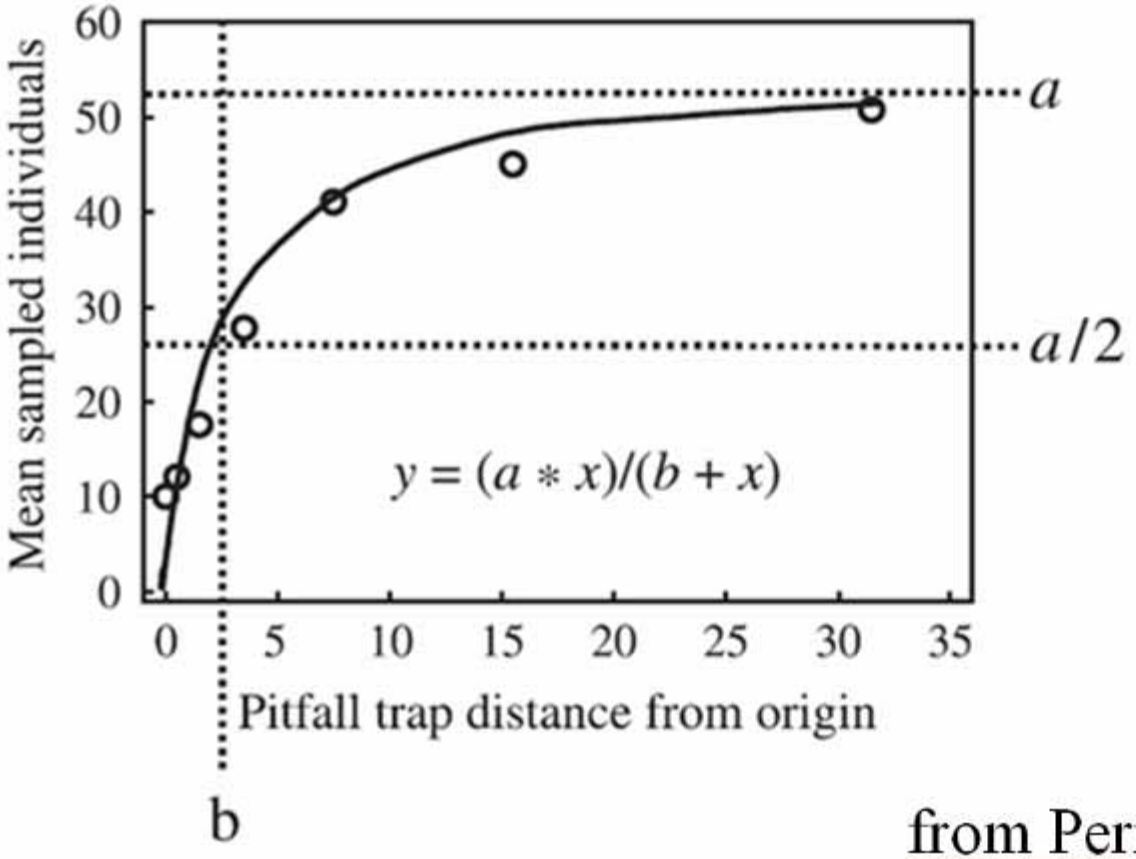
1. A new procedure for estimating the population densities of ground-dwelling arthropods with pitfall trapping is described. It couples the fitting of single hyperbolic functions to trap data with the use of a 'nested-cross array', a cross-shaped trap arrangement with distances between traps doubling with increasing distance from the central trap.
2. We used individual-based simulation modelling to test the method's reliability given

nested-cross array…




635 cm from origin
origin
635 cm from origin


635 cm from origin
315 cm
155
75
35
35
75
155
315
635



from Perner and Schueler 2004

Estimating the density of ground-dwelling arthropods with pitfall traps using a nested-cross array

JÖRG PERNER and SILVIO SCHUELER*

$$\hat{D} = \frac{(a/2)}{\pi \times b^2} = \frac{a}{2\pi \times b^2}$$

(formula for estimated density)

Study site 1: higher plant diversity, more native plant species.

Study site 2: smooth brome!

Study site 3: smooth brome and cypress spurge.


Cypress Spurge! *Euphorbia cyparissias* L.


Cypress Spurge colonizes new surface by means of a clonal front…

- 50 cc centrifuge tubes

- propylene glycol

- top flush with surface

- 4 June-18 June 2007

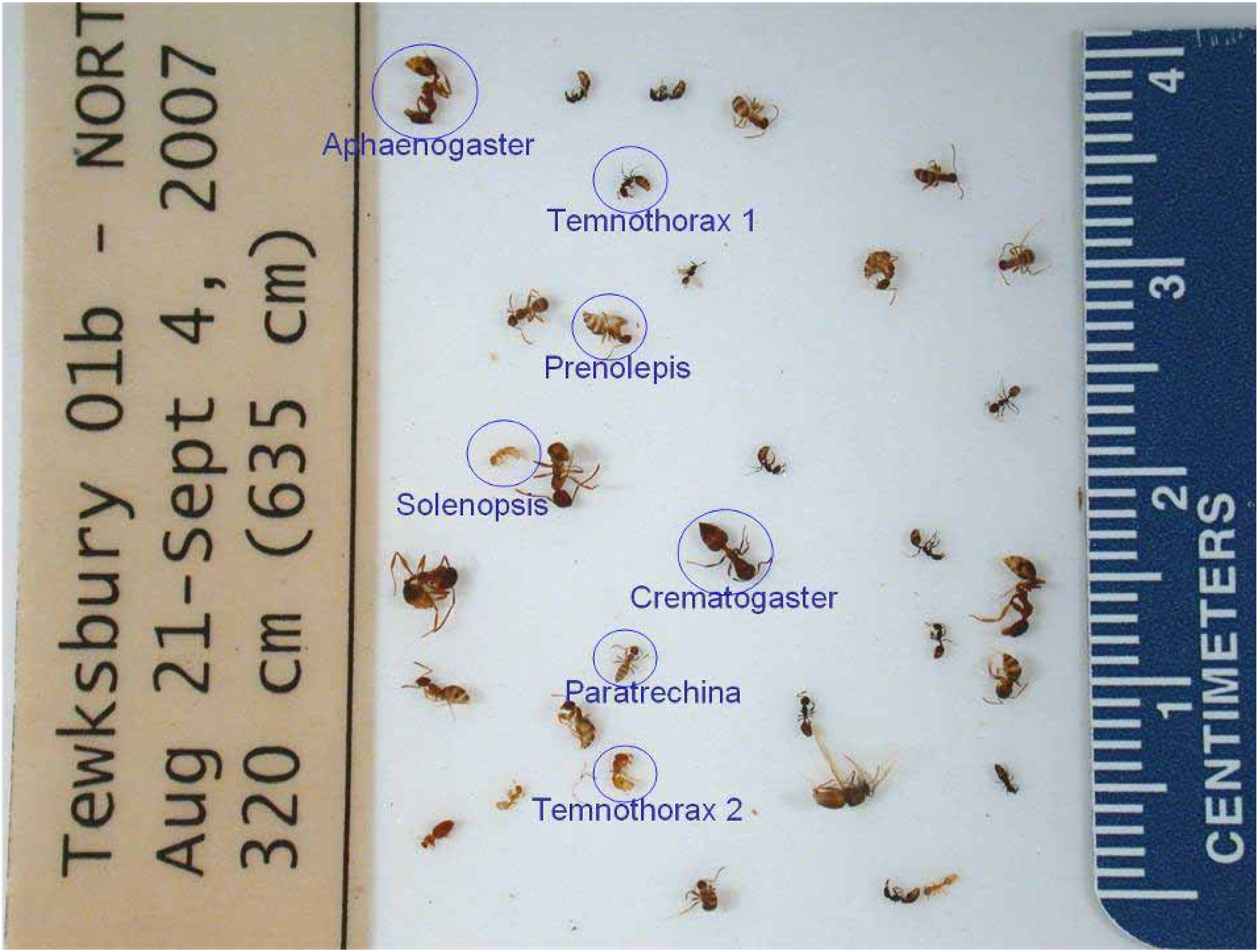
- 21 Aug- 4 Sept 2007

of course it rained…

nonetheless, it worked; here is a typical pitfall trap sample.

Then comes the sorting and morphotyping…

Photo by Jens Gunelson


Tewksbury 01b - NORT
Aug 21-Sept 4, 2007
320 cm (635 cm)
Aphaenogaster
Temnothorax 1
Prenolepis
Solenopsis
Crematogaster
Paratrechina
Temnothorax 2
CENTIMETERS
1
2
3
4

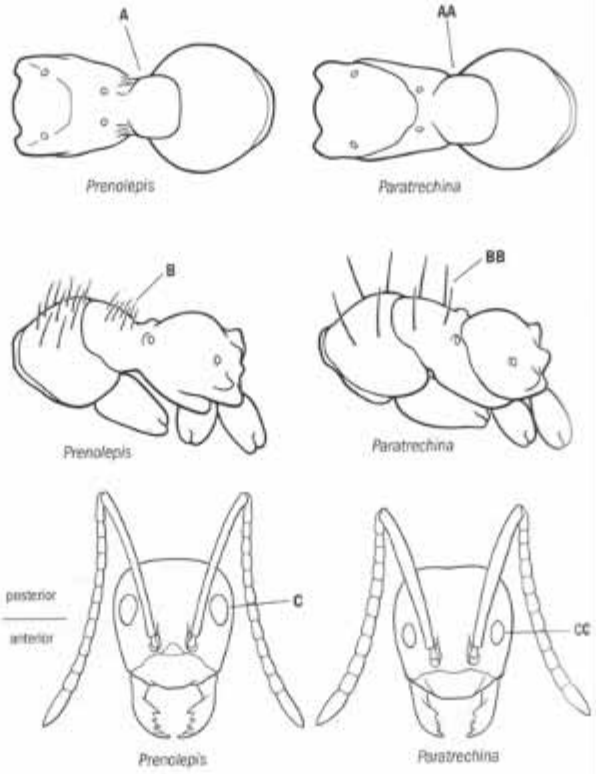
An important thing happened in September 2007... a new guide to ant genera!

ANTS
OF NORTH AMERICA
A Guide to the Genera

Brian L. Fisher
and Stefan P. Cover

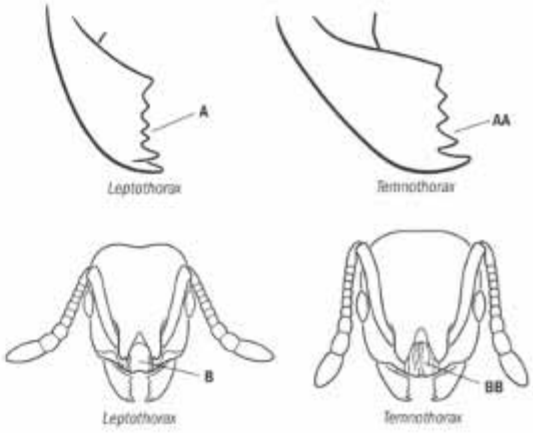
Illustrated by Ginny Kirsch and Jennifer Kane
Color images created by April Nobile

UNIVERSITY OF CALIFORNIA PRESS
Berkeley Los Angeles London



13 (5) Propodeum (lateral view) strongly hollowed out behind, forming a shelf that overhangs the petiole, the node of which fits snugly into this concavity. Propodeum rounded at juncture of dorsal and declivitous face, often strongly sculptured, with large, shallow punctures **(A)** ..... ***Dolichoderus***
Note: Eastern and midwestern North America.

54 (53) Mandible with six teeth **(A)**. Usually, median portion of clypeus smooth and longitudinally excavate, lacking carinae centrally; several carinae usually present on lateral portions **(B)** ..... ***Leptothorax***
— Mandible with five teeth **(AA)**. Median portion of clypeus more or less flat, not smooth and longitudinally excavate, and with one or more carinae centrally, sometimes weakly developed or very rarely absent; carinae on lateral portions often present **(BB)** ..... ***Temnothorax*** (in part)



AntWeb

Monomorium minimum

Specimen Code:
CASENT0173040

Locality:
U.S.A.: Colorado: Chaffee; 6.6mi S. Jct. Rt. 306 on Co. Rd. 321; 38°44'32"N 106° 09'43"W 2621 m

Collection Information:

Collection codes:	SPC6704	Date:	9 Jul 2004
Collected by:	SPCover & L.Davis Jr.	Method:	1 diam. faint crater in bare, sandy soil.
Habitat:	Open grassy-herb. slope w/scattered Pinyon and Ponderosa Pine to 30' tall.	Transect Type:	Sparse groundcover.
		Transect Sample #:	

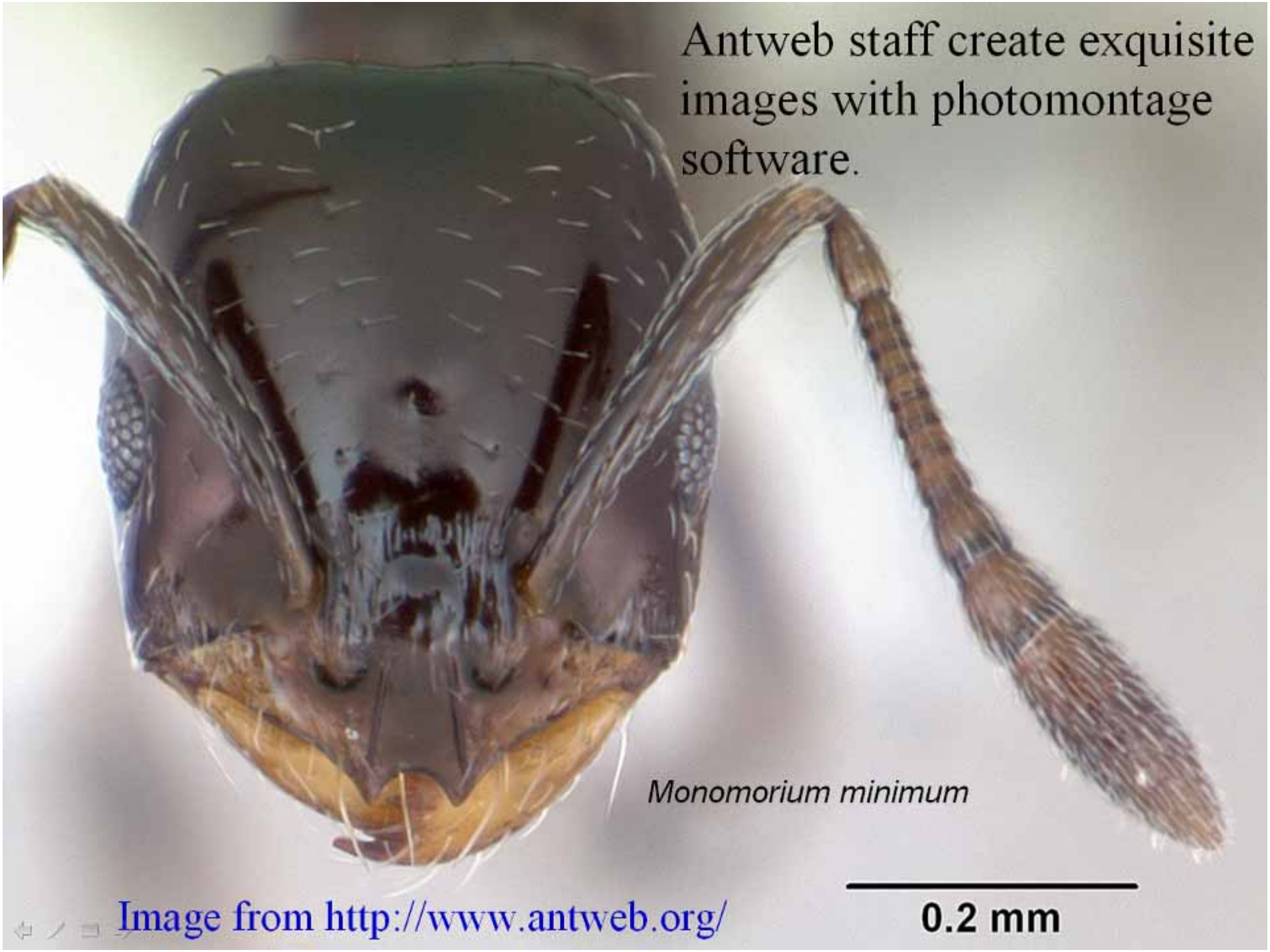
Specimen Information:

Life Stage:	1aQ, 1w	Owned by:	MCZC
Located at:	MCZC	Type Status:	

Specimen Images:

Enlarge Map

screenshot http://www.antweb.org/


Antweb staff create exquisite images with photomontage software.
Monomorium minimum
0.2 mm
Image from http://www.antweb.org/

AntWeb

Myrmica fracticornis

Specimen Code:
CASENT0104832

Locality:
U.S.A.: Minnesota: St. Louis; 2km W Warrior Hill, Bdy Waters Wilderness; 48° 16'00"N 092°02'00"W 360 m

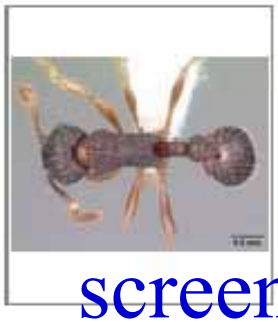
Collection Information:

Collection codes:	PSW12086	Date:	15 Aug 1993
Collected by:	P.S.Ward	Method:	under stone
Habitat:	pine-fir-spruce forest	Transect Type:	
		Transect Sample #:	

Specimen Information:

Life Stage:	1dQ, 2w	Owned by:	UCDC
Located at:	UCDC	Type Status:	

Specimen Images:



Enlarge Map

screenshot http://www.antweb.org/


Myrmica fracticornis
Image from http://www.antweb.org/
0.2 mm

Ant species and unidentified ant morphospecies detected in the June 2007 samples.

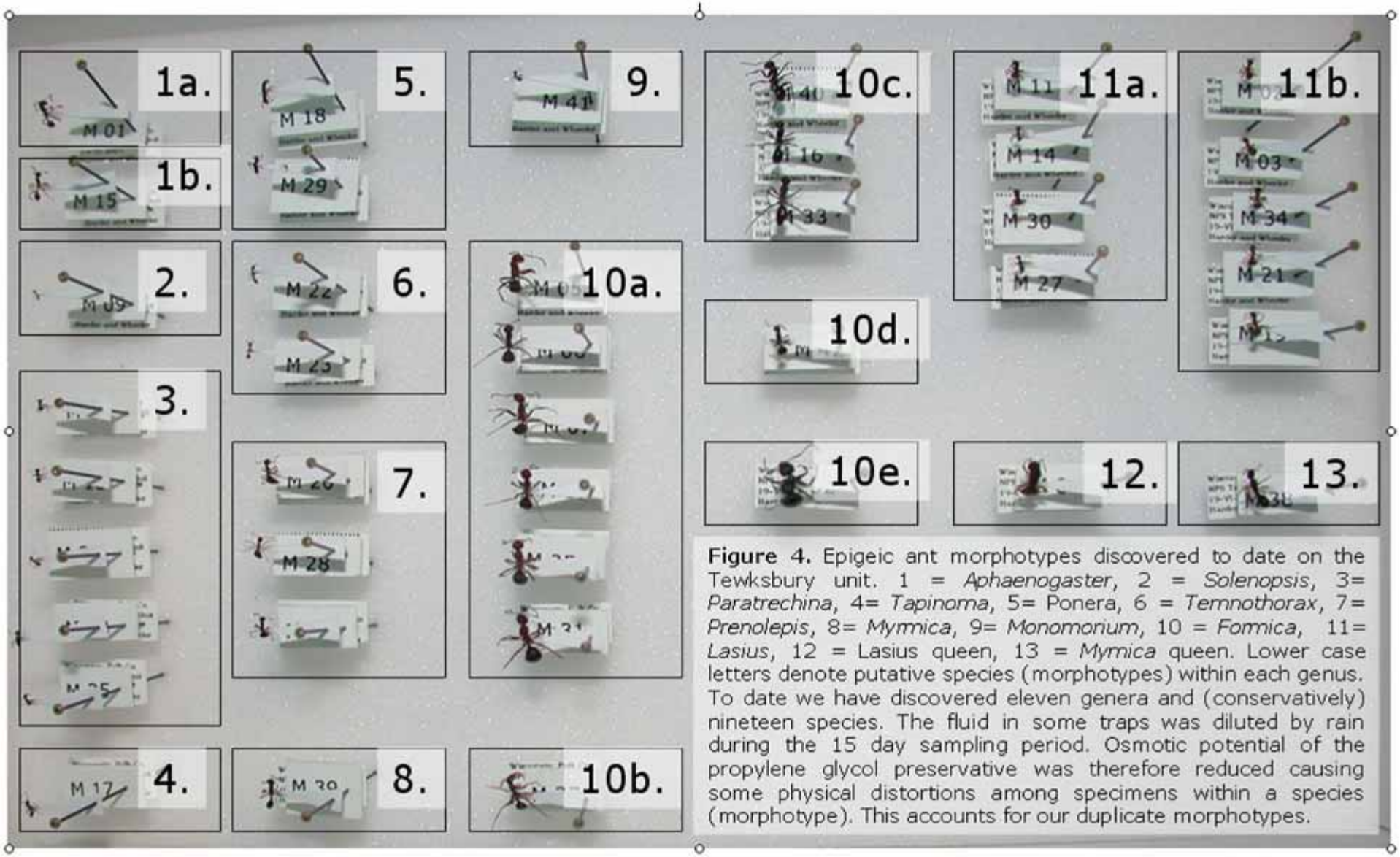


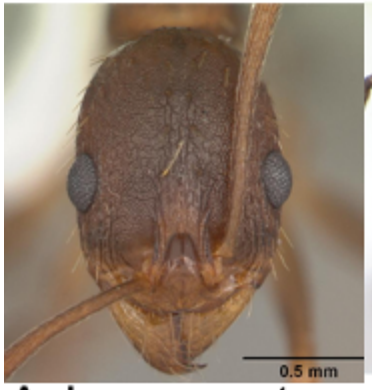
Figure 4. Epigeic ant morphotypes discovered to date on the Tewksbury unit. 1 = *Aphaenogaster*, 2 = *Solenopsis*, 3= *Paratrechina*, 4= *Tapinoma*, 5= Ponera, 6 = *Temnothorax*, 7= *Prenolepis*, 8= *Myrmica*, 9= *Monomorium*, 10 = *Formica*, 11= *Lasius*, 12 = Lasius queen, 13 = *Myrmica* queen. Lower case letters denote putative species (morphotypes) within each genus. To date we have discovered eleven genera and (conservatively) nineteen species. The fluid in some traps was diluted by rain during the 15 day sampling period. Osmotic potential of the propylene glycol preservative was therefore reduced causing some physical distortions among specimens within a species (morphotype). This accounts for our duplicate morphotypes.

Three additional genera (so far) in the late summer samples…


Pyramica!
only one individual so far…
This entire scale bar extends 2 mm.

The ants of Tewksbury (so far…)

Images downloaded from Antweb.



Aphaenogaster

Monomorium

Lasius

Chrematogaster

Formica

Solenopsis

Camponotus

Prenolepis

Myrmica

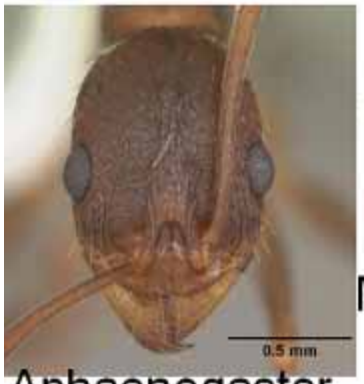
Ponera

Themnothorax

Pyramica

Paratrechina

Tapinoma



Aphaenogaster

Monomorium

Lasius

Chrematogaster

Formica

Myrmica

Camponotus

images downloaded from Antweb.

Paratrechina

Prenolepis

Ponera

Themnothorax

Pyramica

Solenopsis

Tapinoma

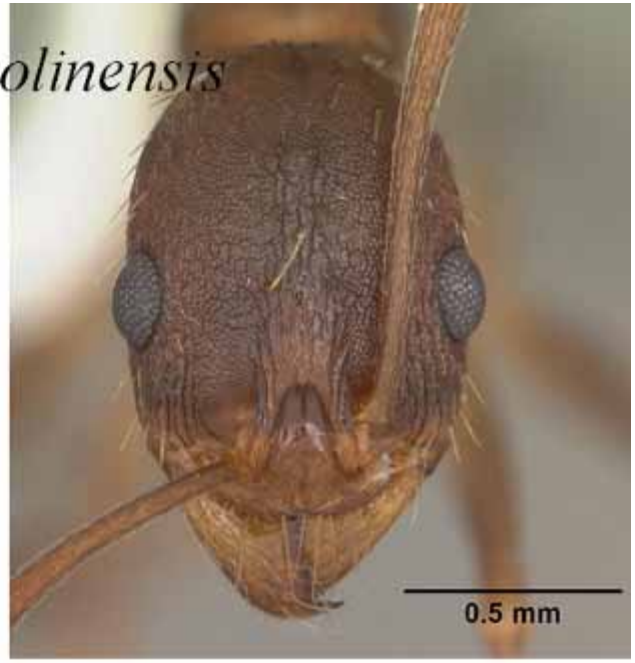
adjusted to relative scale

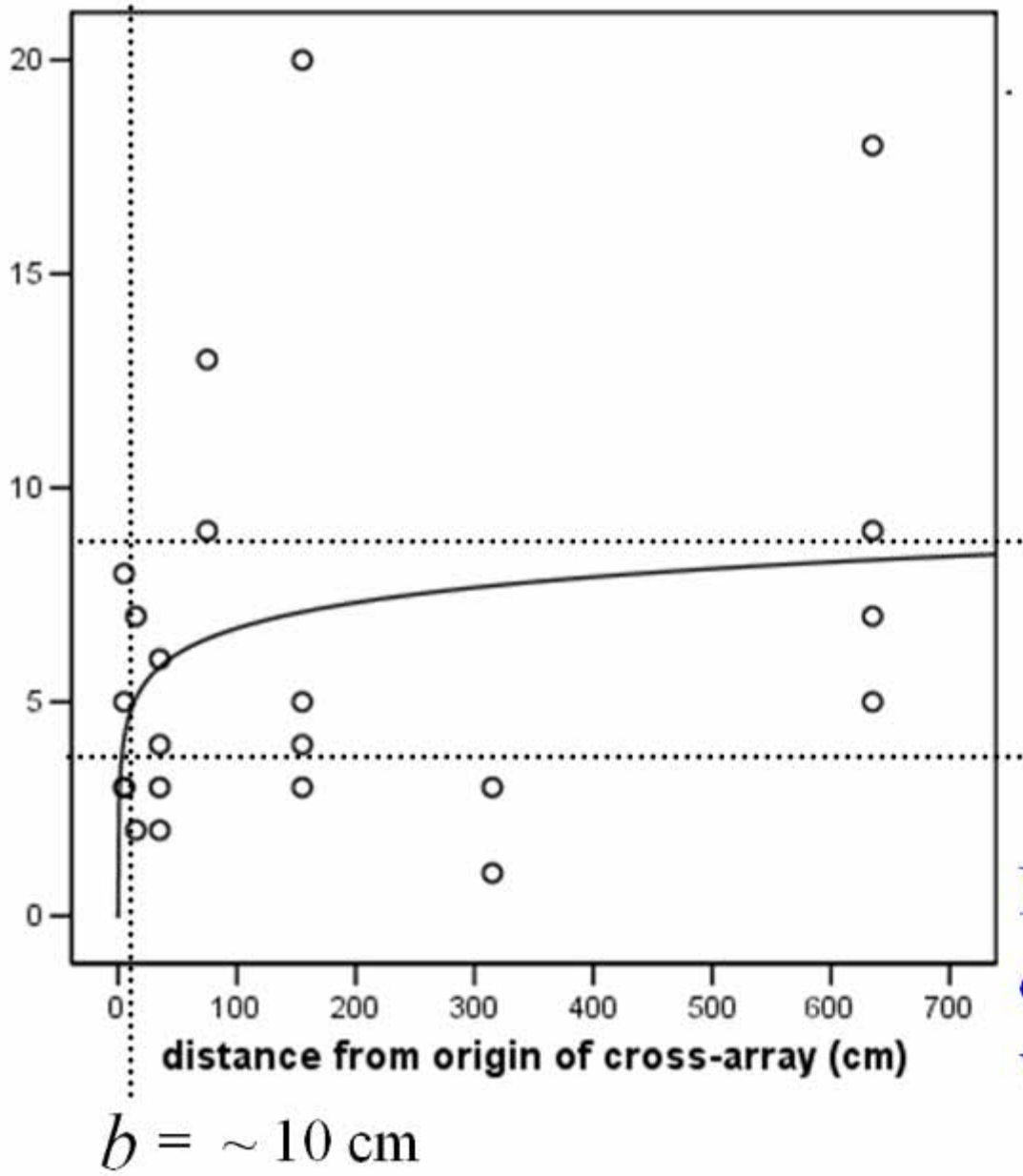
Were our efforts with the nested-cross arrays worth all the trouble?

Were our efforts with the nested-cross arrays worth all the trouble?

Not really.

SITE 1- pitfall trap counts for *Aphaenogaster carolinensis*



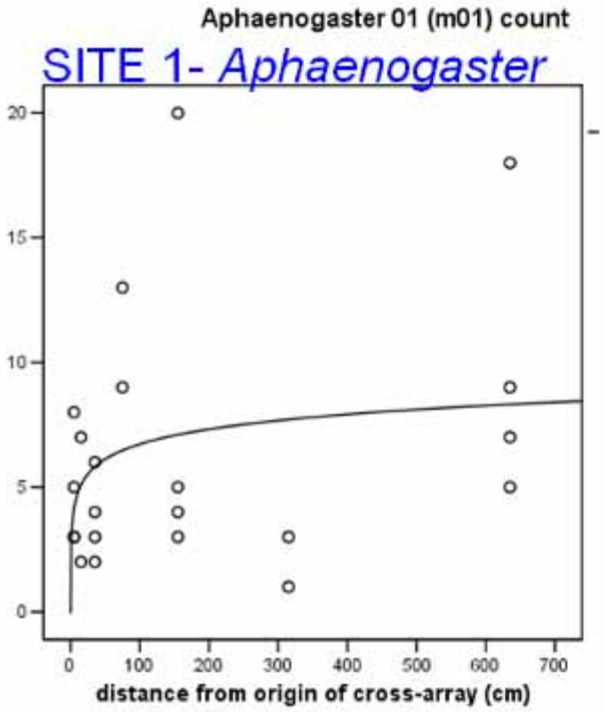


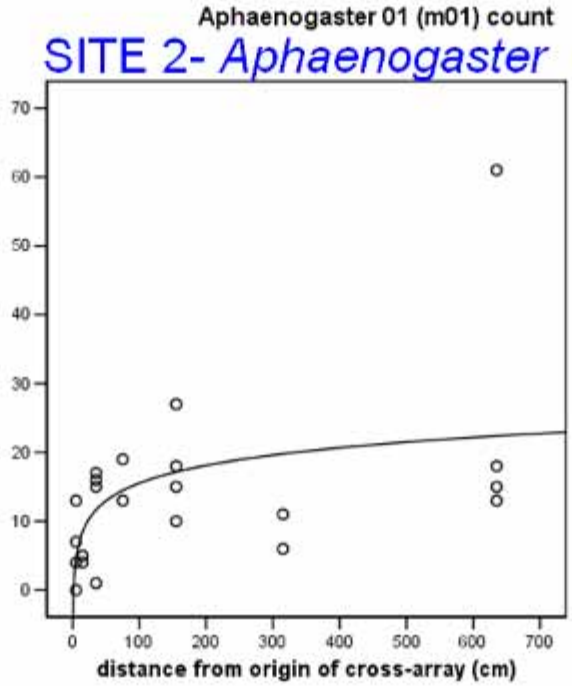
a (~ 8 indiv.)

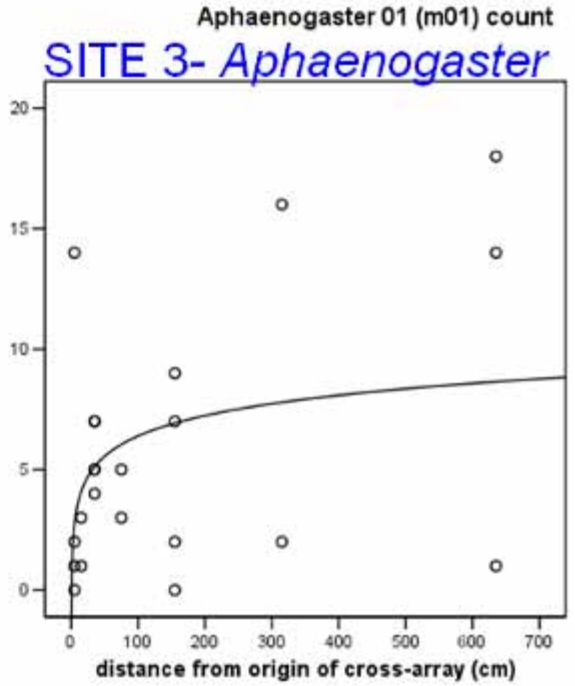
$a/2$ (4 indiv.)

b = ~ 10 cm

Notice the scatter, one *could* estimate density but would anyone believe it?

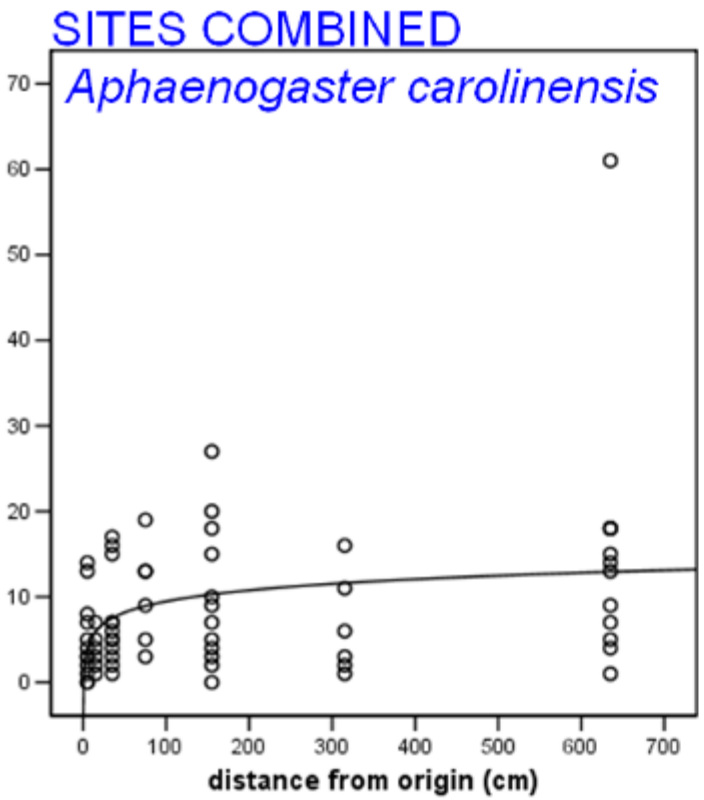




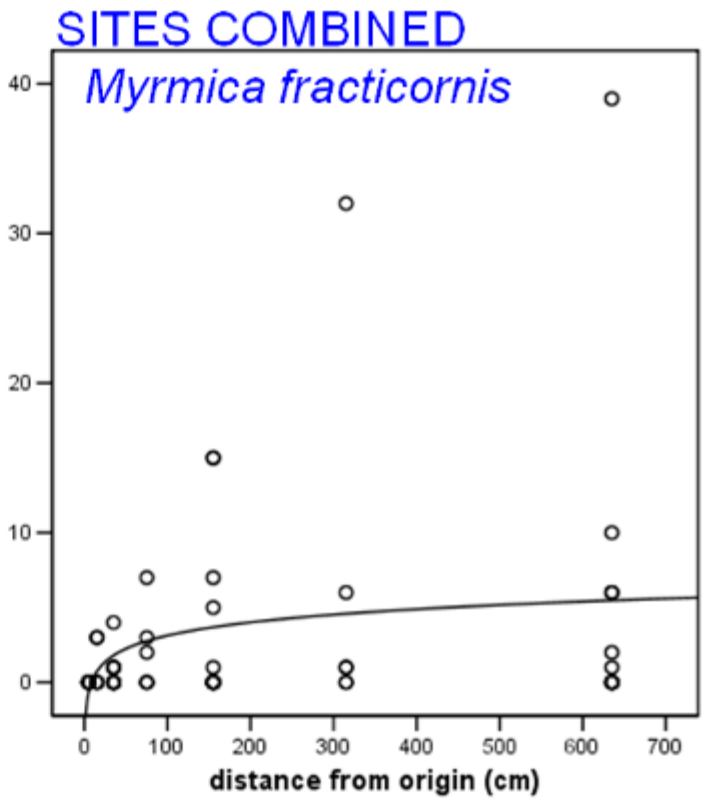


Not worth it in our opinion, too noisy!

M01 counts



M39 counts



species richness

Test Statistics[a,b]

	RICHNESS (all morphospecies)	RICHNESS (spider morphospecies)	RICHNESS (beetle morphospecies)	RICHNESS (parasitic microwasps)	RICHNESS (ants)
Chi-Square	4.405	.907	6.150	.819	1.003
df	2	2	2	2	2
Asymp. Sig.	.111	.636	.046	.664	.606

a. Kruskal Wallis Test

b. Grouping Variable: STUDY SITES

Note: the significant site effect for beetle species richness is due to a low richness at Site 3 relative to the other two sites.


parasitic (i.e. parasitoid) microwasp


parasitic (i.e. parasitoid) microwasp
wingless female; ant mimic
remember, most predators avoid ants

community diversity (reciprocal Berger-Parker Index)

Ranks

	STUDY SITES	N	Mean Rank
reciprocal D (BP) for ants	1	8	17.69
	2	8	8.31
	3	8	11.50
	Total	24	
reciprocal D (BP) for nonants	1	8	17.25
	2	8	8.25
	3	8	12.00
	Total	24	
reciprocal D (BP) for all species	1	8	16.50
	2	8	10.38
	3	8	10.63
	Total	24	

Note: Site 1 shows the highest diversity score for the

1) ant community*

2) nonant community* and

3) combined

Test Statistics[a,b]

	reciprocal D (BP) for ants	reciprocal D (BP) for nonants	reciprocal D (BP) for all species
Chi-Square	7.281	6.540	3.847
df	2	2	2
Asymp. Sig.	.026	.038	.146

a. Kruskal Wallis Test

b. Grouping Variable: STUDY SITES

* significant at the 5% level

What else did we learn?

What are the advantages/ disadvantages of…

Spiders?

Beetles?

Parasitic microwasps?

Ants?

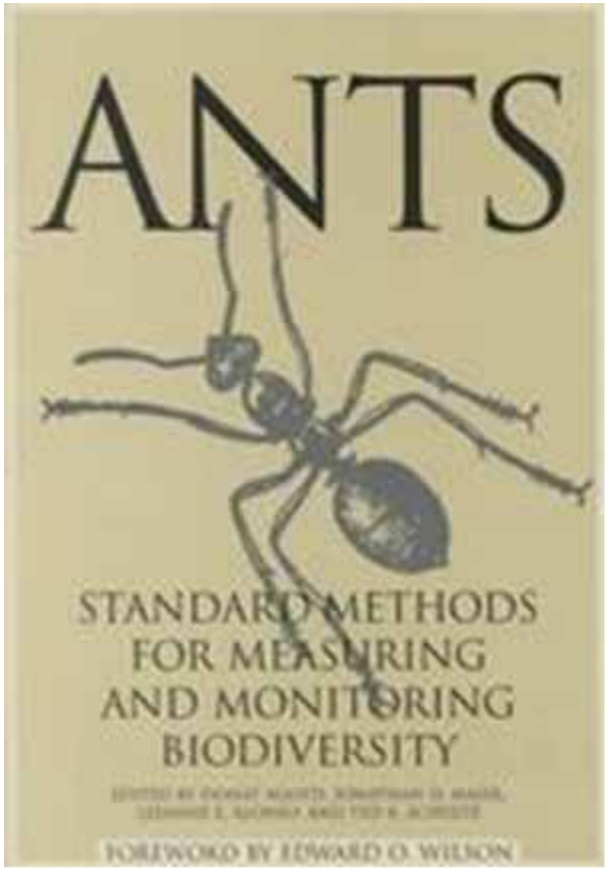


Table 10.1 Actual Number of Ant Species Sampled by the 17 Methods Described in the Text

Sampling Method	Number of Species	Rank[a]
Winkler extraction samples	63	1
Berlese funnel samples	48	2
Dead wood inspection	45	3
Small soil samples	42	4
Pitfall traps (7-day)	40	5
Pitfall traps (24-hour)	27	6
Large soil samples	26	7
Sardine bait (24-hour)	20	8.5
Orange peel bait (24-hour)	20	8.5
Sardine bait (4-hour)	19	10.5
Orange peel bait (4-hour)	19	10.5
Sugar bait (4-hour)	18	12
Dried cocoa pod inspection	17	13
Cassava flour bait (4-hour)	16	14
Meat bait (24-hour)	15	15
Cassava flour bait (24-hour)	14	16
Sugar bait (24-hour)	11	17

[a]Methods are ranked from 1 (most species sampled) through 17 (fewest species sampled).

Winkler Extraction Sampler (leaf litter)

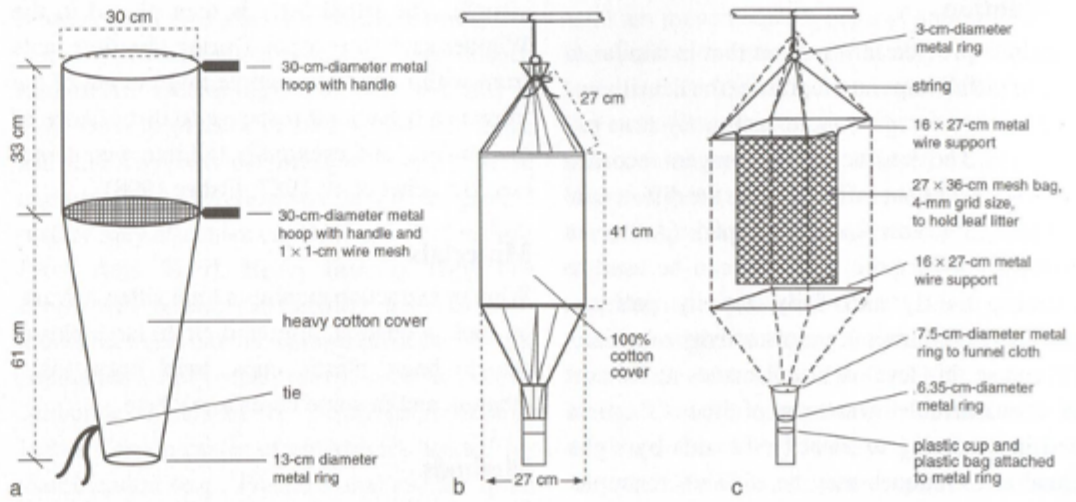
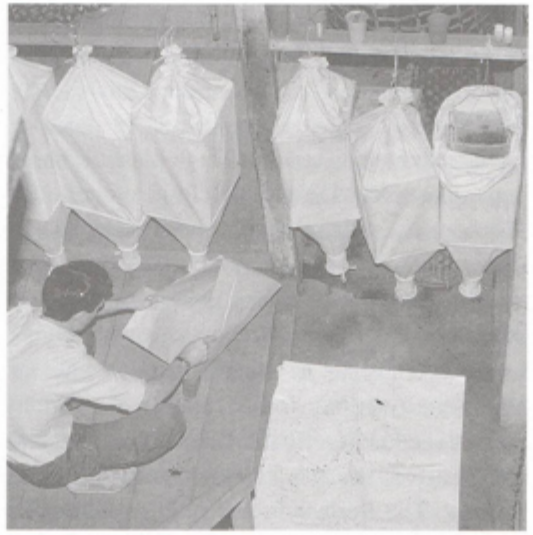


Figure 9.4. (a) Construction of the litter sifter. (b) External dimensions of the "mini-Winkler" sack. (c) Construction of the "mini-Winkler" sack (Fisher 1999a).

Figure 9.5. Leaf litter extraction using the Winkler extractor. (a) Sifting leaf litter. (b) Transferring sifted litter into a mesh inlet sack that will be placed inside the Winkler sack. (c) Winkler sacks hanging from support beams, with researcher collecting excess debris from sacks. Photo by Donat Agosti.



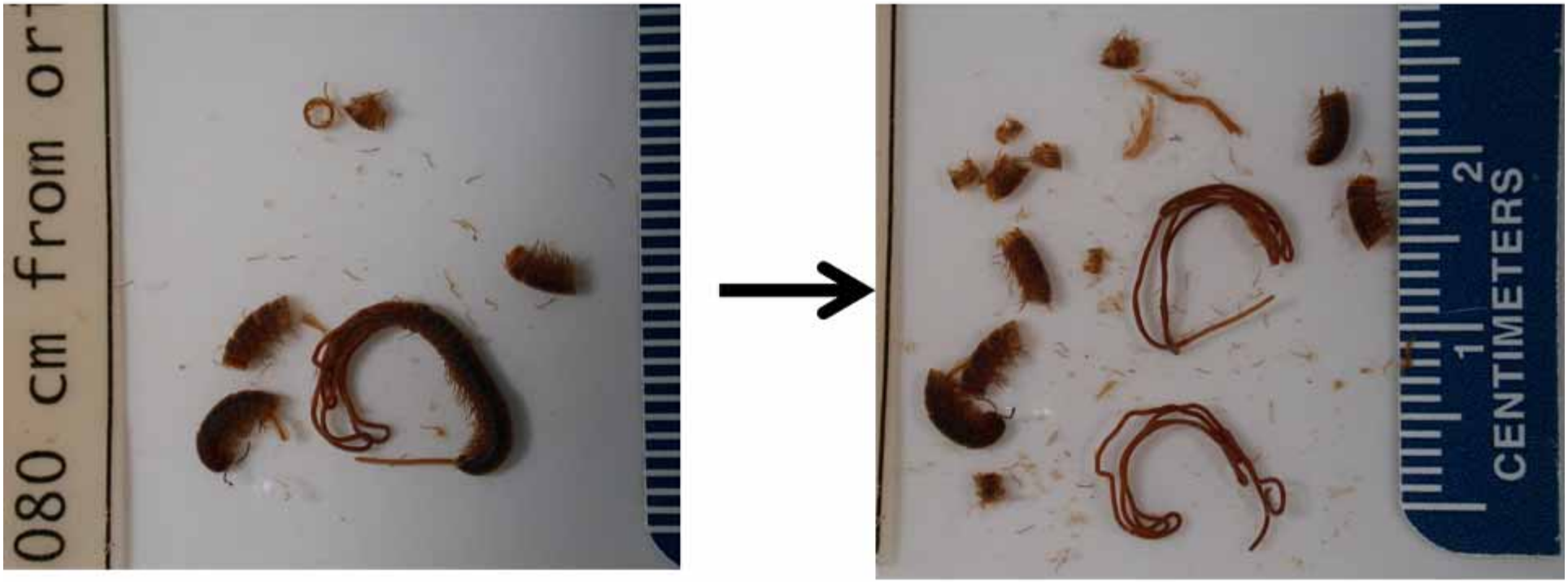

Tewksbury 02 - WEST
June 4-18, 2007
080 cm from origin
1
2
3
4
CENTIMETERS

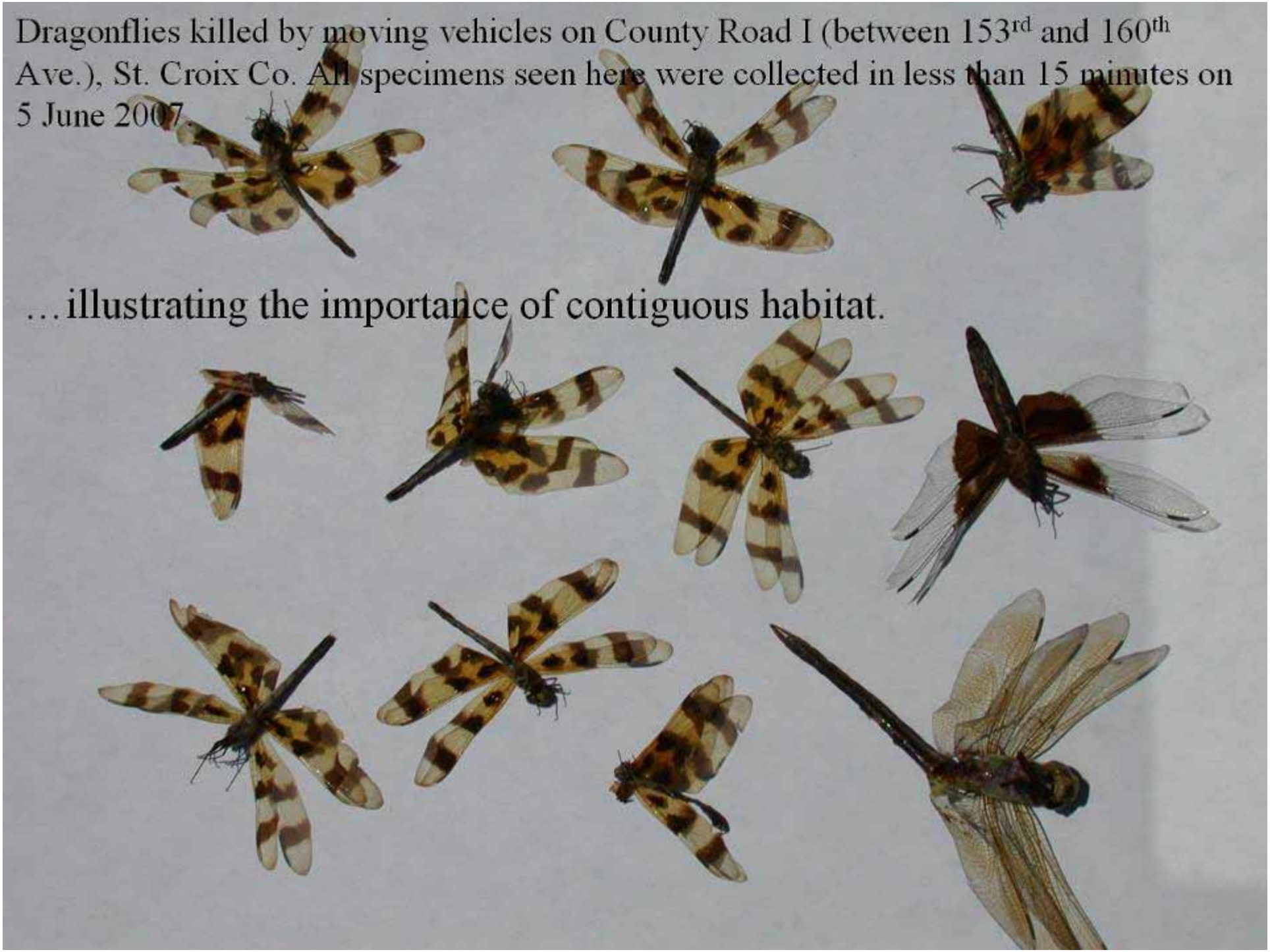

Tewksbury 02 - SOUTH
June 4-18, 2007
320 cm from origin
1
2
3
4


Tewksbury 02 - EAST
June 4-18, 2007
320 cm from origin
CENTIMETERS
1
2
3
4


The millipede: *Aniulus (Hakiulus) diversifrons diversifrons* . Identification courtesy of Rowland Shelley.
North Carolina State Museum of Natural Sciences
Dr. Shelley writes, "I know nematomorphs are known to emerge from millipedes, but I've never personally seen this nor do I think it's common."

a crude dissection reveals not one, but two endoparasitoids…




Dragonflies killed by moving vehicles on County Road I (between 153rd and 160th Ave.), St. Croix Co. All specimens seen here were collected in less than 15 minutes on 5 June 2007.
…illustrating the importance of contiguous habitat.


Halloween Pennant
(*Celithemis eponina*)
Tewksbury Unit


Common Baskettail
(*Epitheca cynosura*)


Dot-tailed Whiteface
(*Leucorrhinia intacta*)
Tewksbury Unit

We thank the National Park Service and Robin Maercklein (St. Croix National Scenic Riverway) for access to the Tewksbury Unit and for writing the grant that secured student internship funding for this project.


Dot-tailed Whiteface
(*Leucorrhinia intacta*)