THE INFLUENCE OF LANDSCAPE ON URBAN BUMBLE BEE FORAGING

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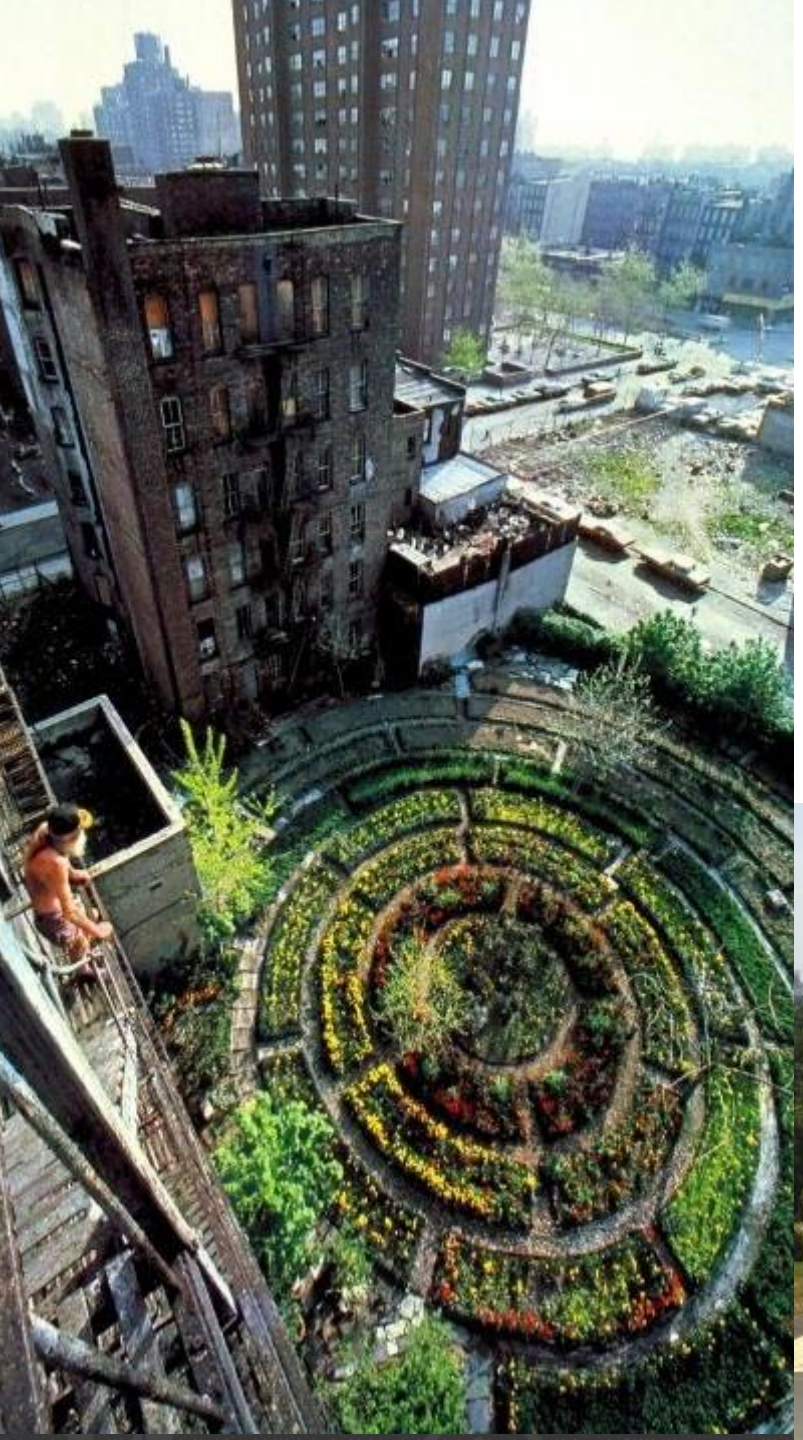
TWO URBAN BEE DISSERTATION CHAPTERS

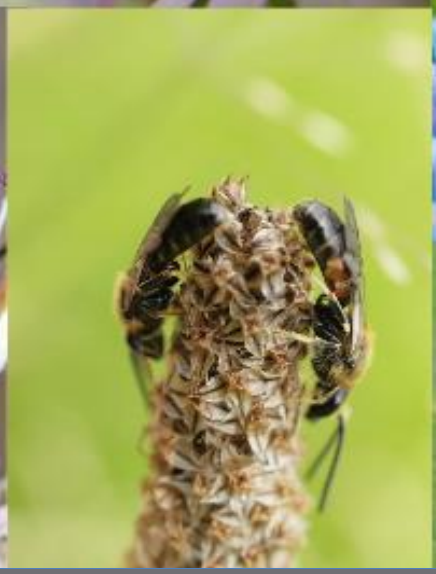
Influence of land cover and land use history on urban bee communities (Madison, WI)

The buzz in the city: the influence of urban floral resources on the distribution of foraging bumble bees



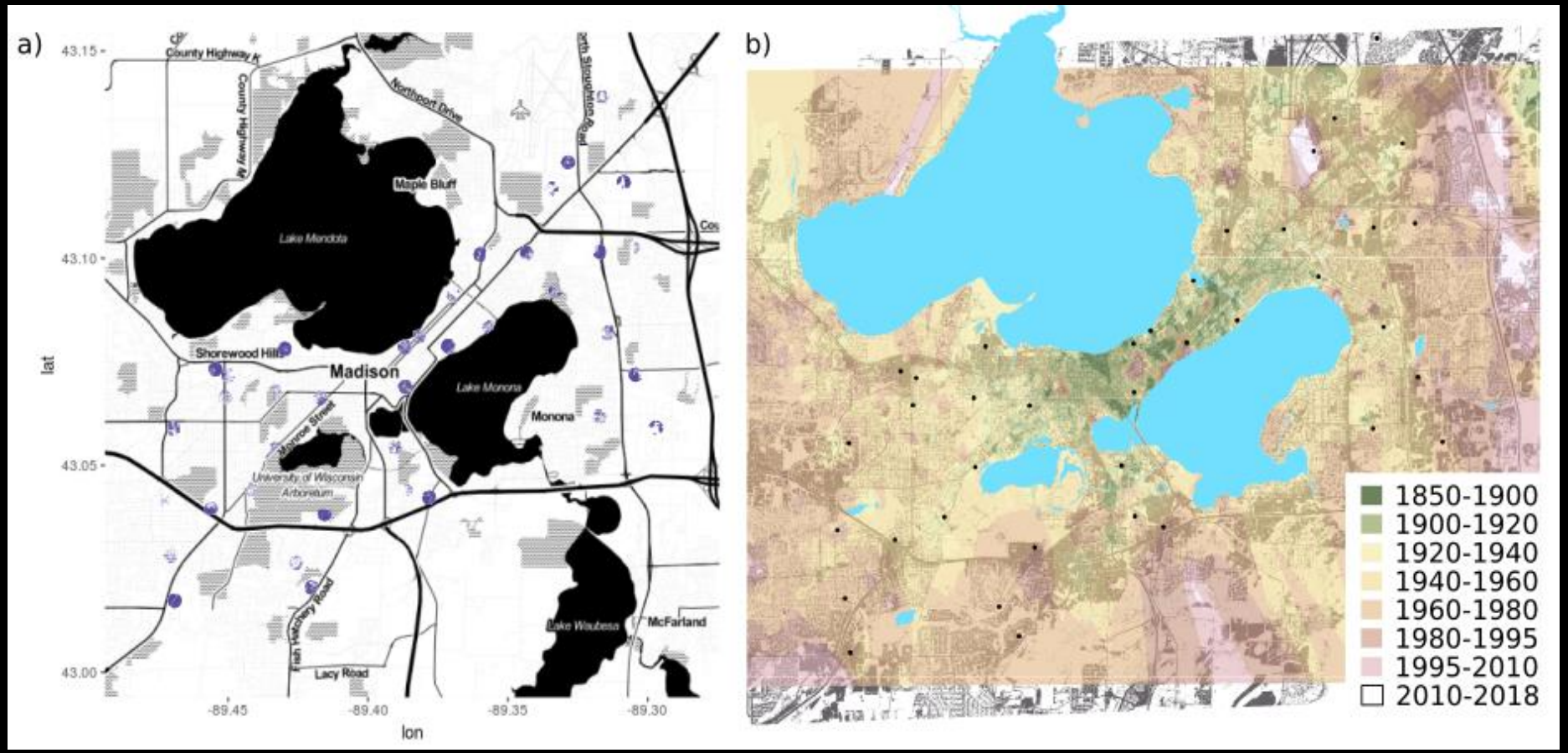
LAND COVER AND LAND USE HISTORY INFLUENCE URBAN BEE COMMUNITIES

URBAN BEE DIVERSITY



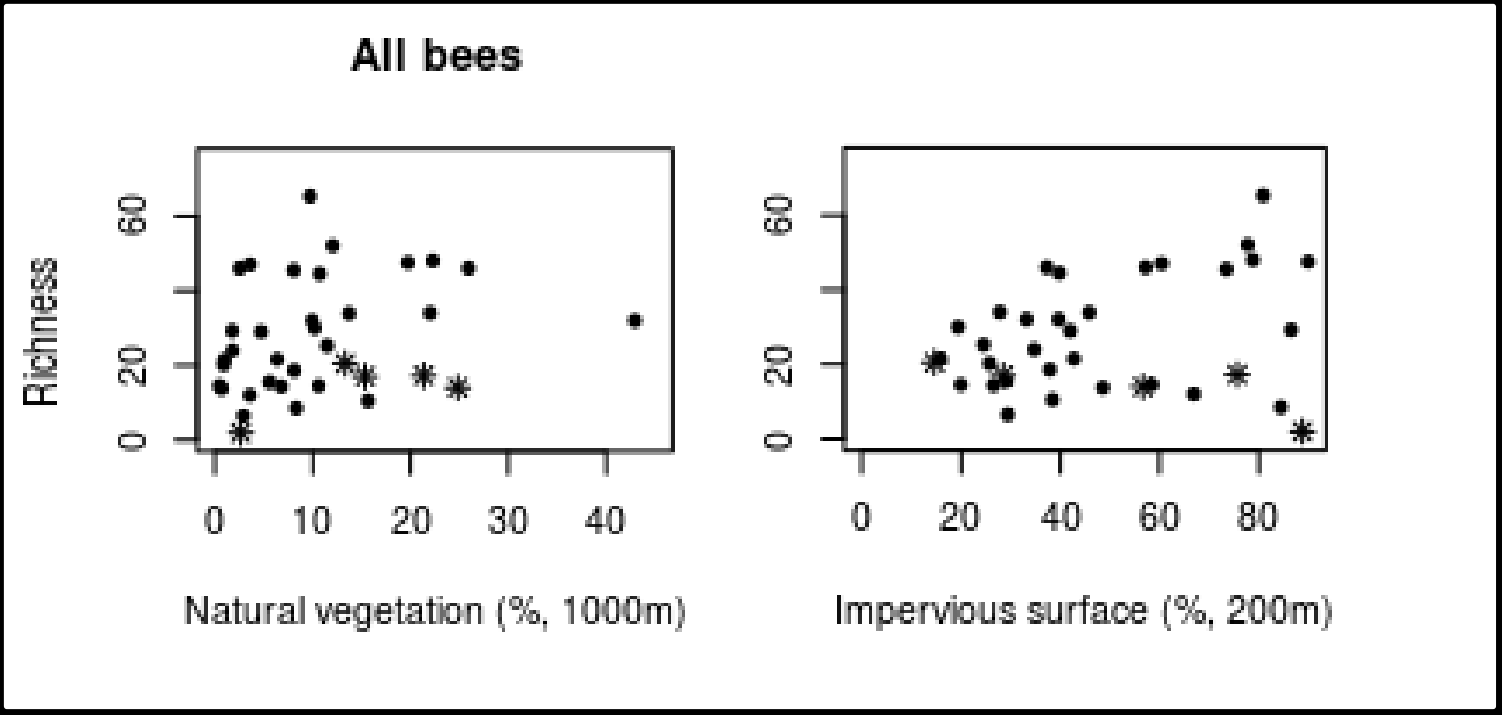
URBAN BEES BUMBLE BEE SURVEY METHODS RESULTS

URBAN BEE COMMUNITIES

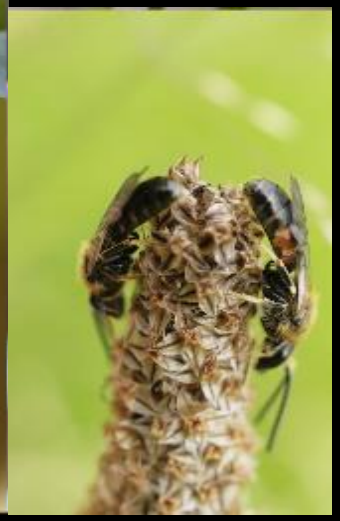


BEE RICHNESS

Model summary		
F-stat: 2.73	Rsqu: 0.14	p: 0.08
Factors	Estimate	p-value
Intercept	27.05	0.00 ***
Natural Veg (1000m)	3.71	0.14
Impervious (%, 200m)	4.29	0.09 .



URBAN BEE GUILDS



Soil nesters:
Sweat bees
Mining bees

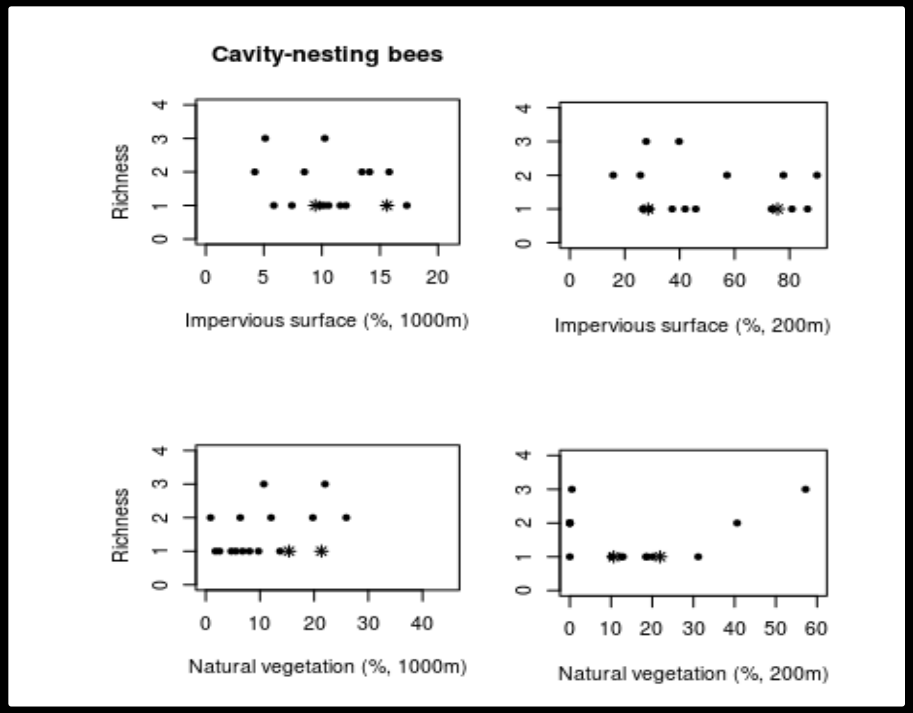
Underground cavity nesters:
Bumble bees

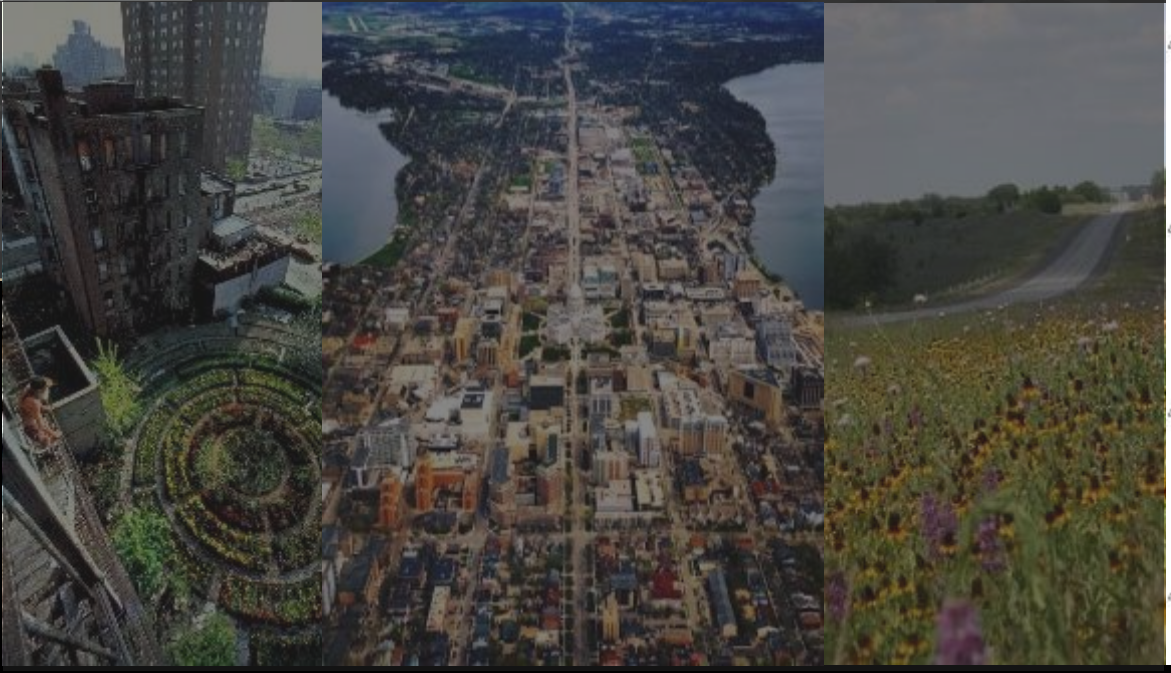
Above ground nesters:
Mason bees
Leaf cutting bees

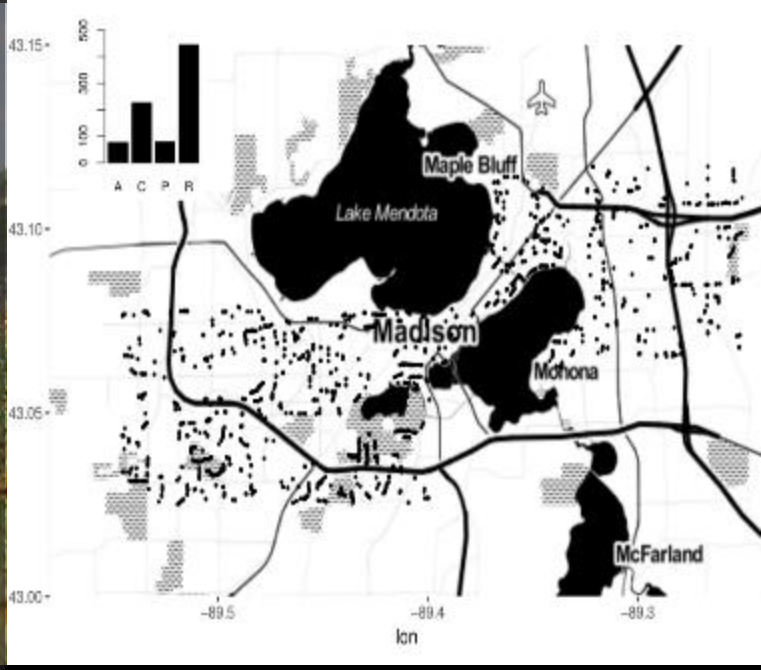
BUMBLE BEES

UNDERGROUND CAVITY NESTER BEE RICHNESS

Model summary		
F-stat: 3.04	Rsqu: 0.50	p: 0.06
Factors	Estimate	p-value
Intercept	1.53	0.00
Natural Veg (1000m)	0.63	0.01 *
Impervious (1000m)	-0.28	0.12
Natural Veg (200m)	-0.44	0.06
Mean Year Built (200m)	-0.39	0.05 .







THE BUZZ IN THE CITY: THE INFLUENCE OF FLORAL RESOURCES ON BUMBLE BEE FORAGING

FLORAL RESOURCE HETEROGENEITY

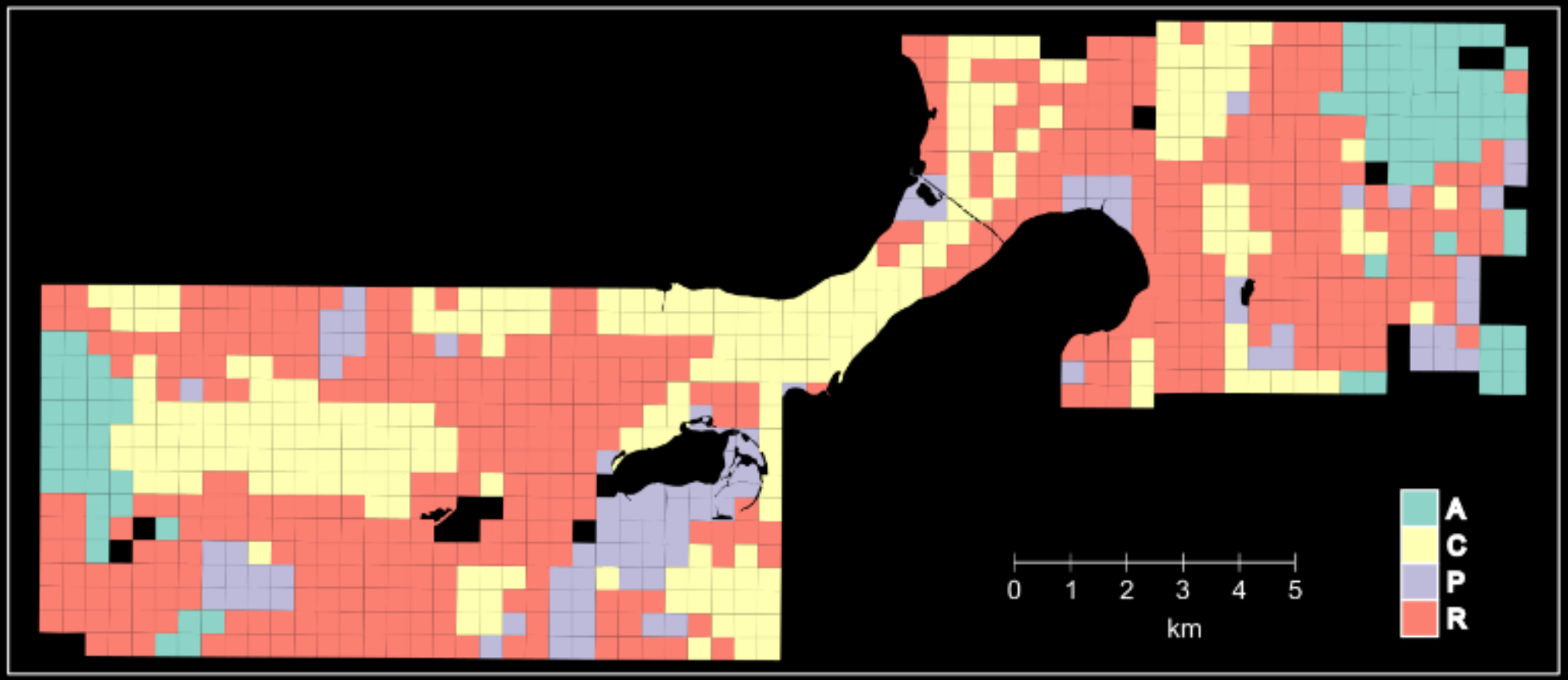
RESEARCH HYPOTHESES

H1) Increased *flower cover* and *density* as well as *species richness* and especially *prairie/lawn species richness* increase the number of foraging bumble bees

H2) The *influence of floral resource variables exhibit non-stationarity,* differing across the study extent due to local floral resource diversity and distribution

STUDY EXTENT

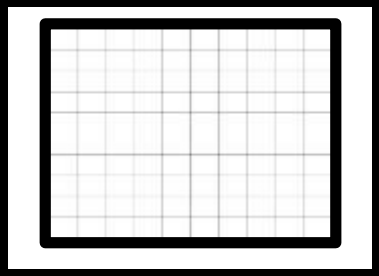
Madison, WI, USA



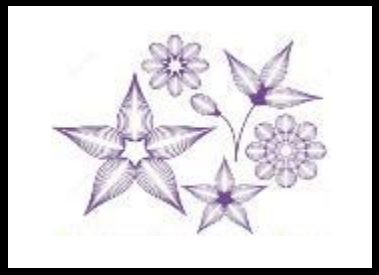
400m x 400m blocks

TRANSECT FLORAL DATA

Flower Cover



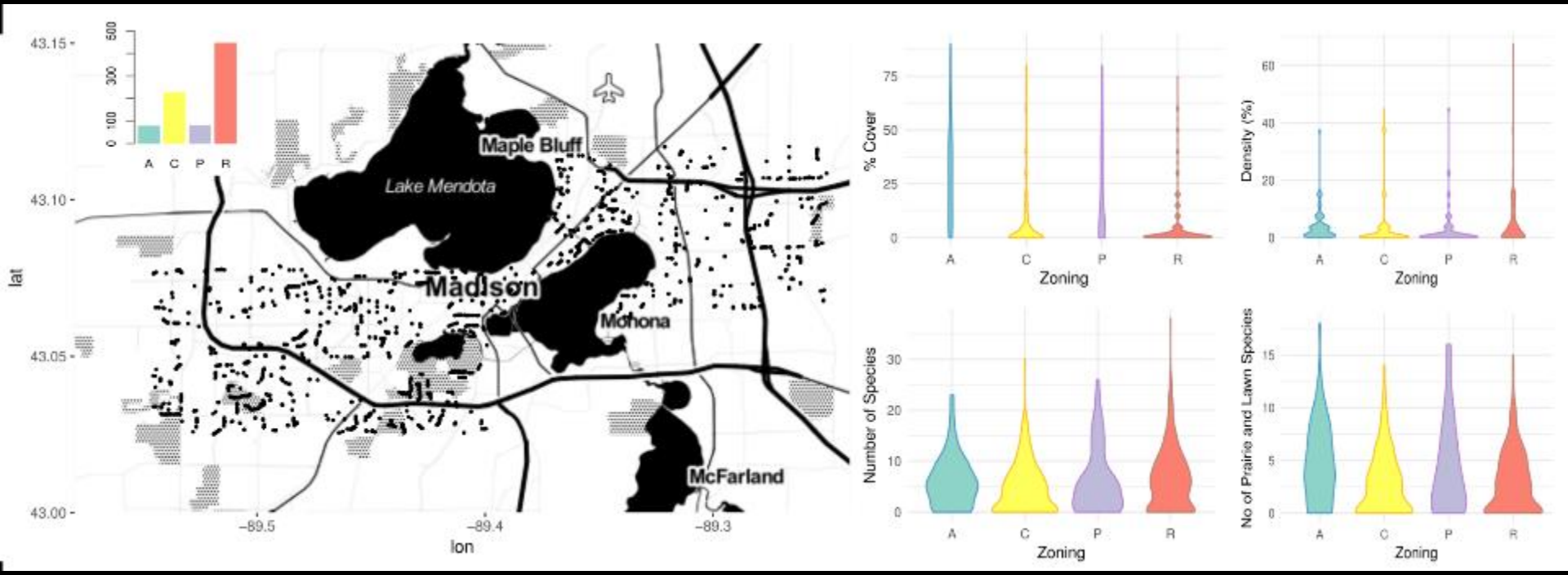
Flower Density



Flowering plant morphospecies richness

Prairie, lawn, garden species type

FLORAL VARIABLES

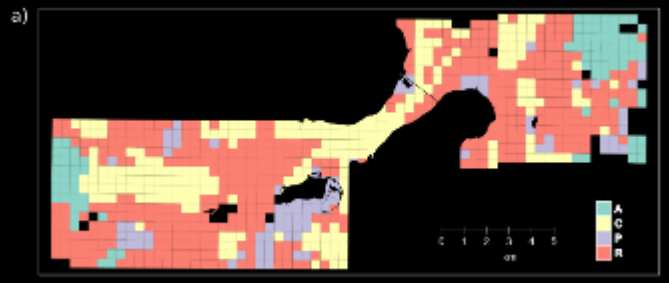


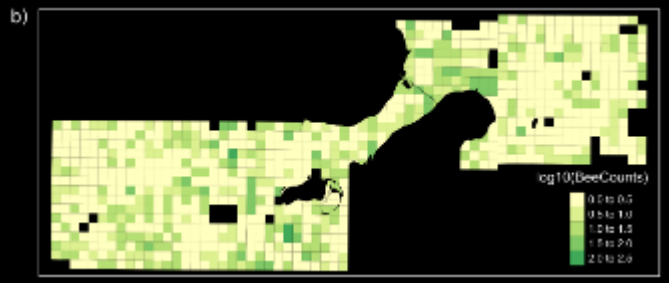
GLOBAL MODEL

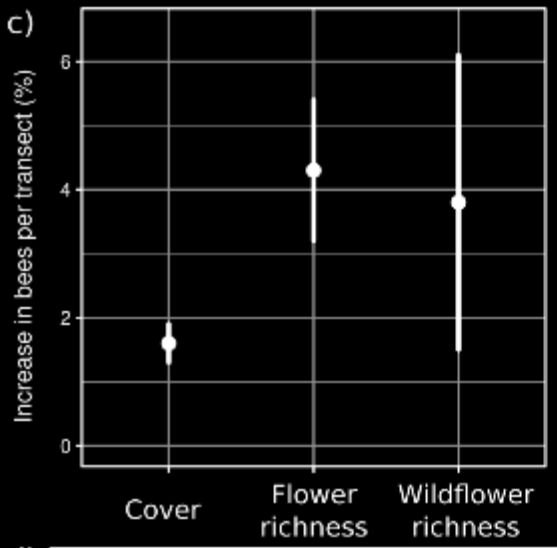
Quasipoisson GLM model
Model summary

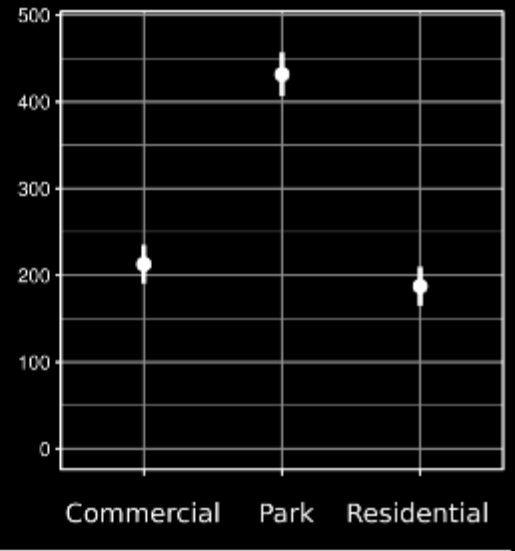
Factors	Estimate	Robust error	p-value
Intercept	0.330	0.225	0.194
Cover	0.016	0.003	0.000 ***
Species	0.042	0.011	0.000 ***
Wildflowers	0.037	0.023	0.073 .
Commercial	0.755	0.222	0.004 **
Park	1.463	0.251	0.000 ***
Residential	0.628	0.223	0.015 *

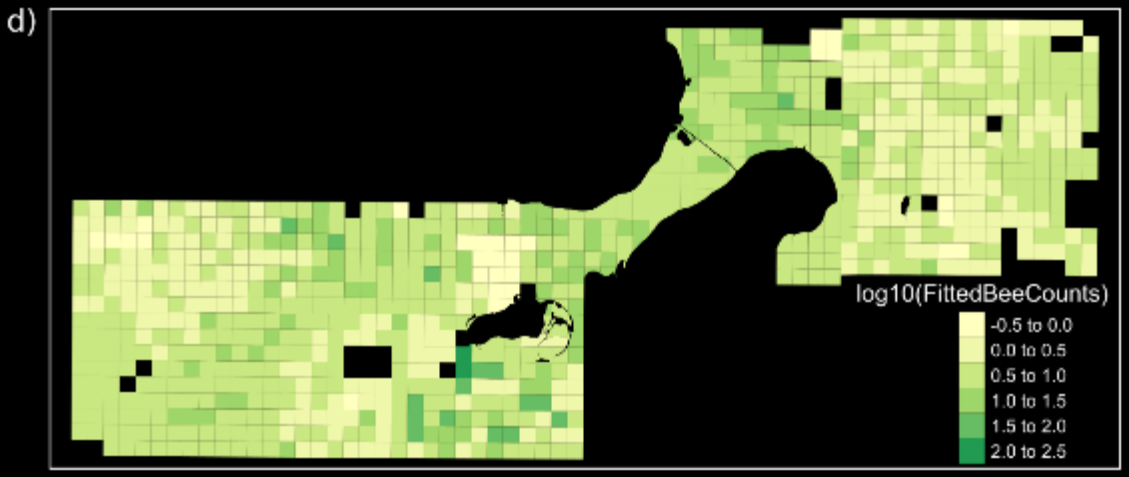
Null deviance: 12821.6 on 783 degrees of freedom
Residual deviance: 9085.1 on 777 degrees of freedom



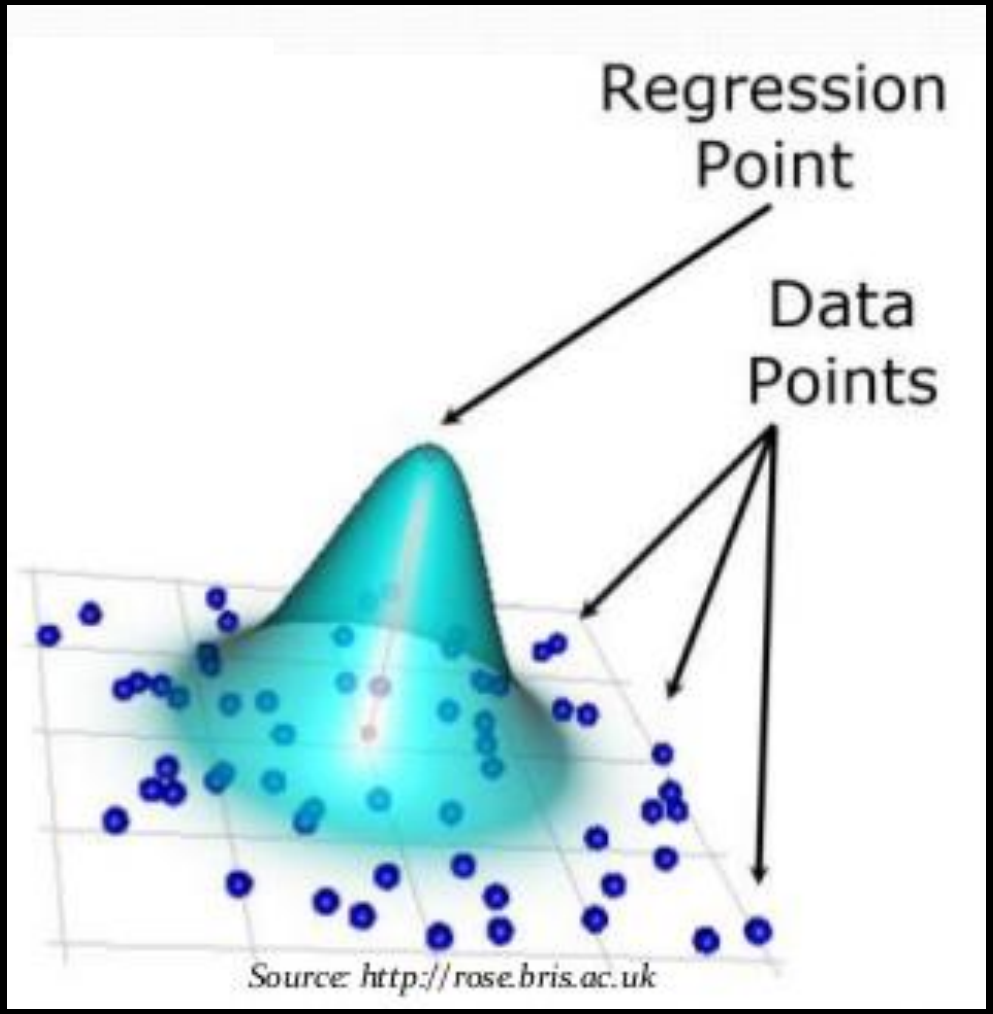






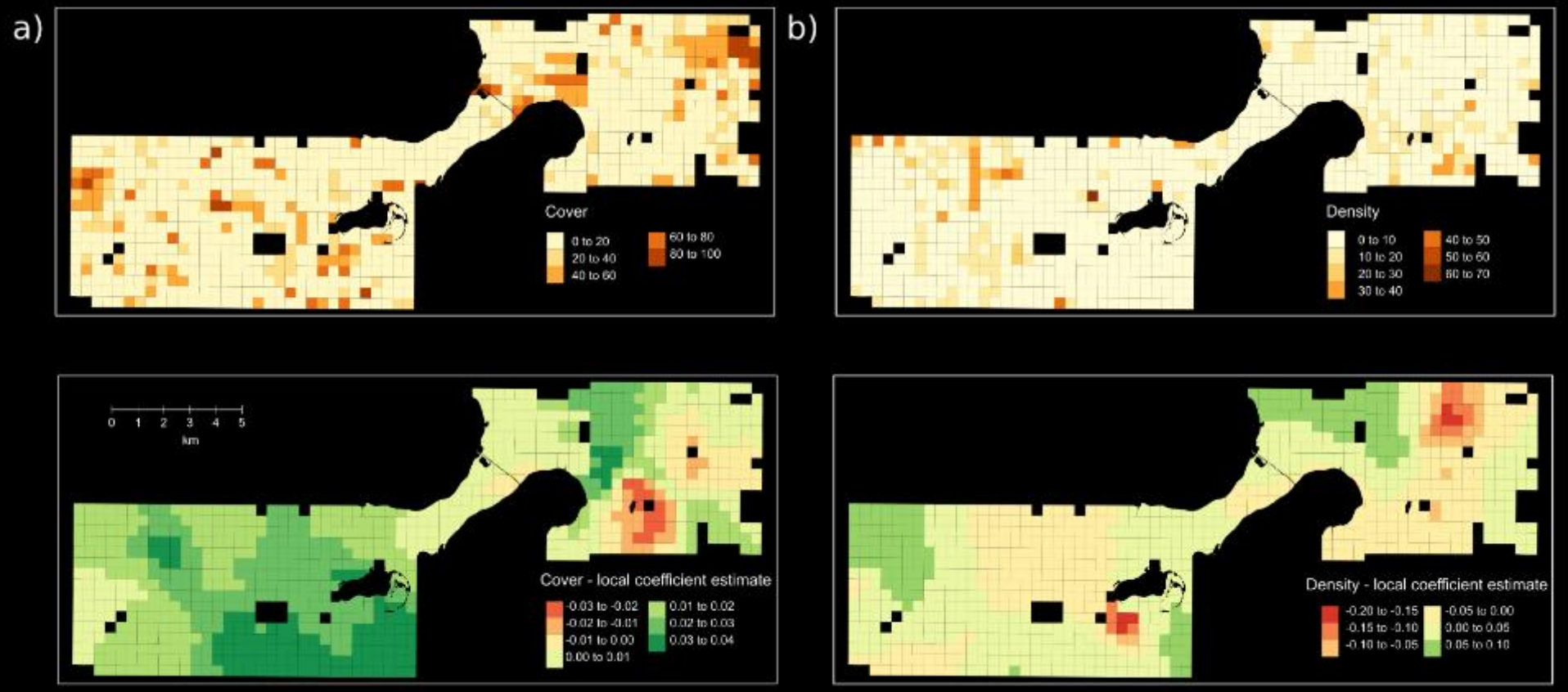


GEOGRAPHICALLY WEIGHTED REGRESSION

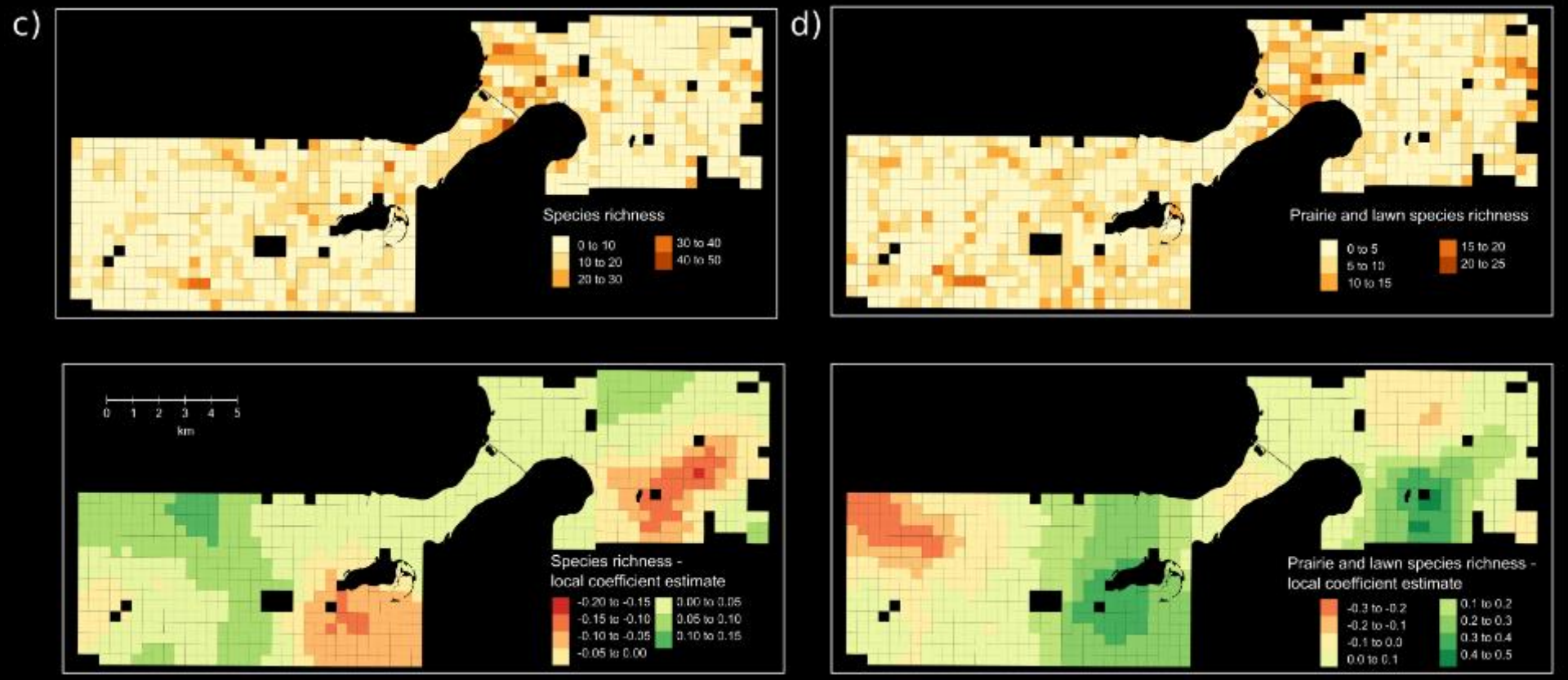


- Type of local regression
- Exploratory method to investigate non-stationarity in fixed effects

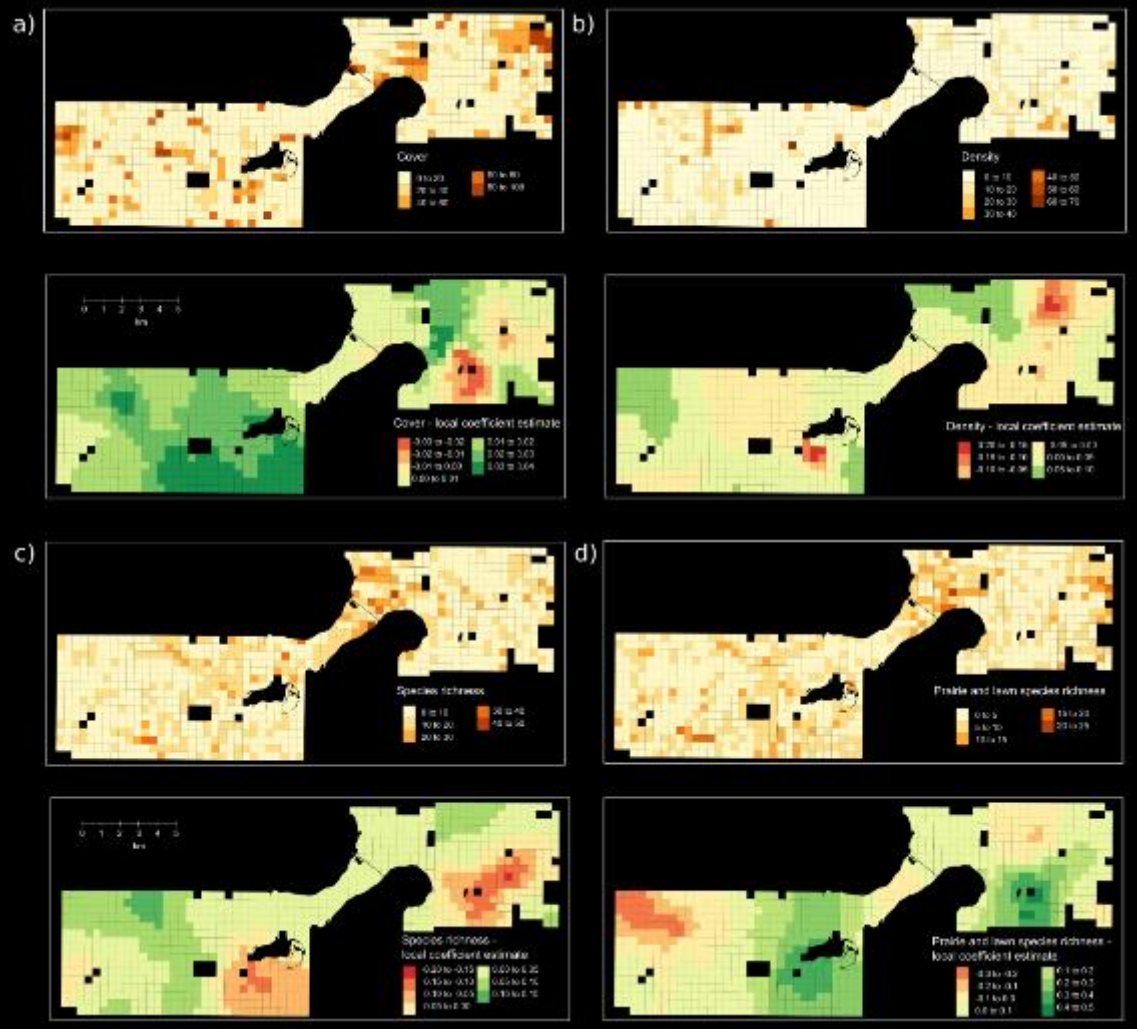
GEOGRAPHICALLY WEIGHTED REGRESSION



GEOGRAPHICALLY WEIGHTED REGRESSION



SUMMARY



H1) *Flower cover, species richness* and especially *prairie/lawn species richness* increased the number of foraging bumble bees

H2) The influence of floral resource variables differ across the extent. Floral cover is the most pervasively strong influence, but the influence of native species richness stands out in large restored prairies nested in residential zones

14 FAVORITE FLOWERS

ACHIEVING OVER 1% OF BEE VISITS (70% TOTAL)

goldenrod (12.4%)
Solidago spp.

white clover (12.2%)
Trifolium repens

thistle (11.2%)
Cirsium spp.

bee balm (10.4%)
Monarda spp.

garden mints (5.6%)
Mentha spp.

spirea (5.5%)
Spirea spp.

purple coneflower (4.0%)
Echinacea purpurea

silphiums (Silphium spp.), Russian sage (*Perovskia atriplicifolia*), Birds-foot trefoil *(Lotus corniculatus*), knapweed (*Centaurea spp.*), crown vetch (*Secuigera varia*), joe pye weed (*Eutrochium purpureum*), and red clover (*Trifolium pretense*), comprised between 1-3% of visits

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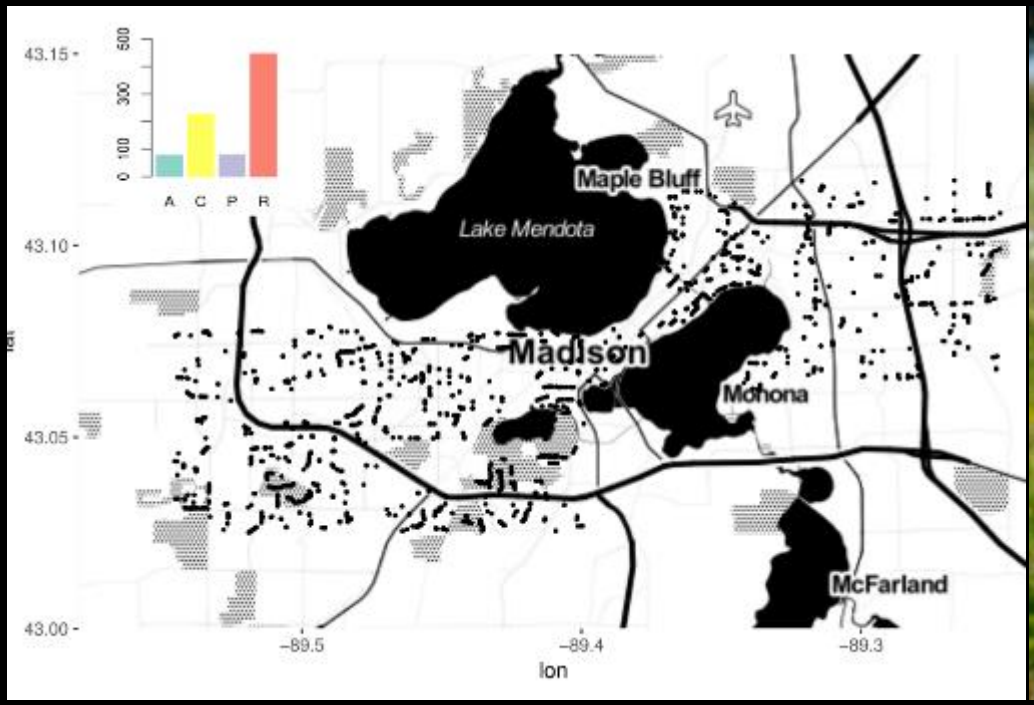
QUESTIONS?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43.10
43.05
43.00
0
100
300
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A C P R
Maple Bluff
Lake Mendota
Madison
Mohona
McFarland
−89.5
−89.4
−89.3
lon