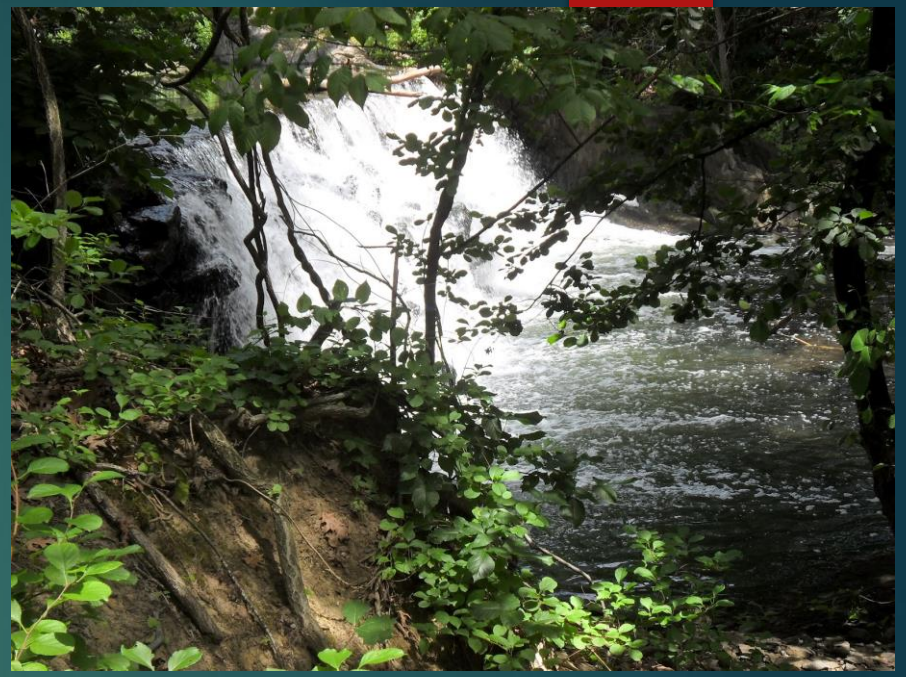
Using count-based models to examine urban coyote activity

Habitat Models

- We would like to know where the animals are
- We would also like to know why?
- Habitat
  - Food?
  - Water?
  - Shelter?

- Habitat models analyze the correlation between animal distribution and potential explanatory variables (environment, climate, habitat).

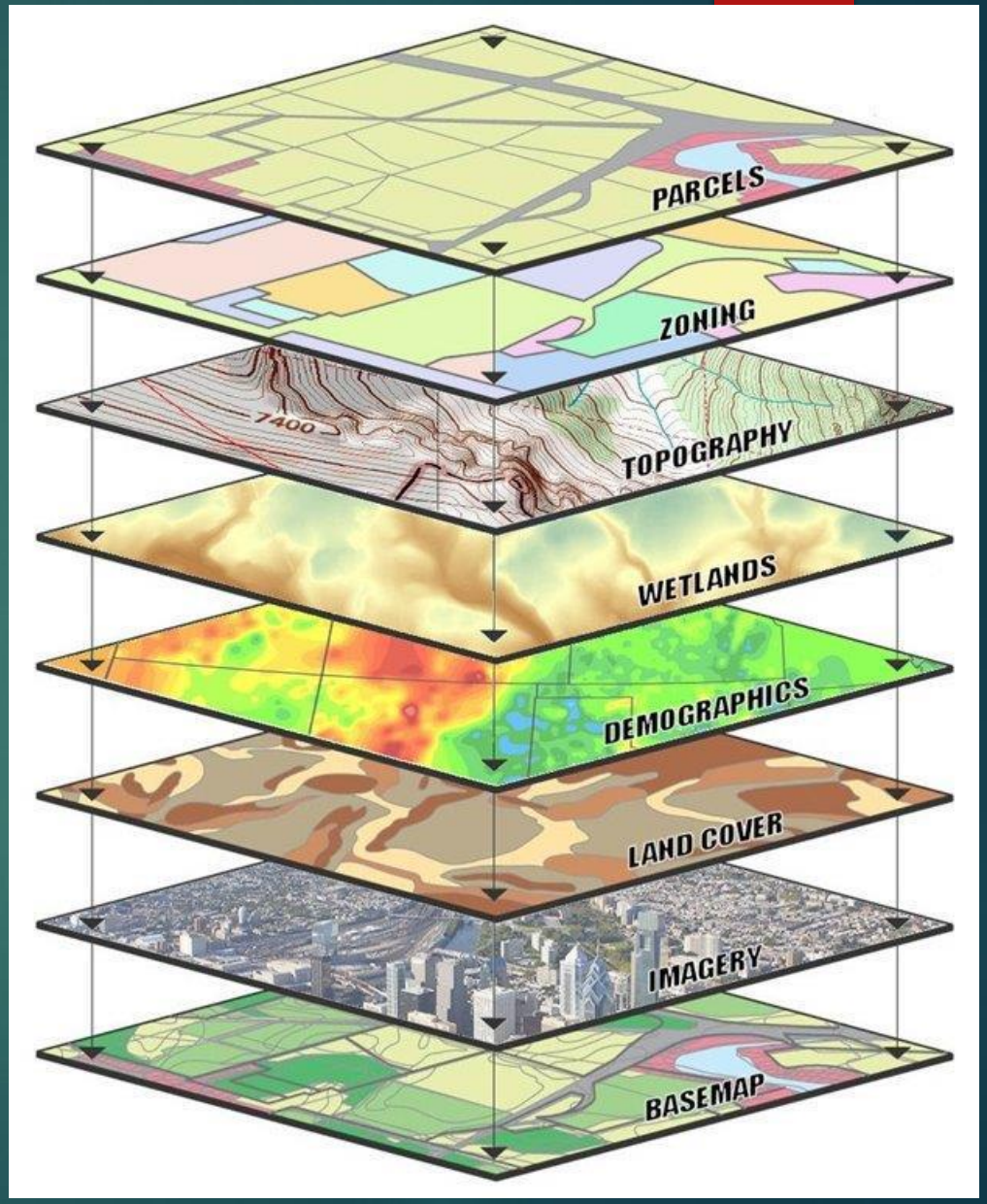


Measuring Distribution

- Used motion-activated cameras spread out across NYC parks (Manhattan, Queens, Bronx)
- January – October 2016
- Presence / Absence models
- Occupancy models
- **Count models (N-mixture)**
  - **Number of detections => index of 'intensity of use'**

Measuring Habitat

- 1 km buffer zone around each camera
- Used GIS to calculate variables:
  - Canopy Cover
  - Forest
  - Patch Size
  - Total Habitat
- Included socioeconomic variables (census):
  - Vacancy
  - Population density
  - Housing density
  - Mean income
- Two categorical variables:
  - Season
  - Bronx

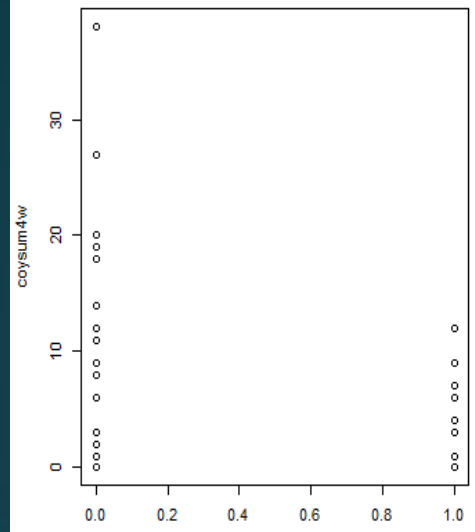



2016-02-11 2:45:39 AM M 5/5 -1°C
A5

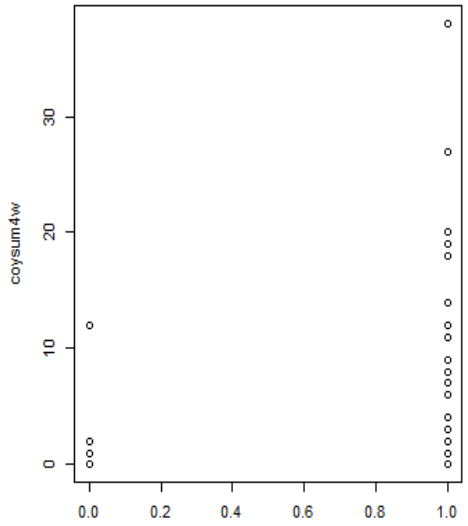

2016-02-11 2:45:36 AM M 1/5 -1°C
RECONYX


2012-03-04 9:07:01 PM M 2/5 1°C
G14
RECONYX

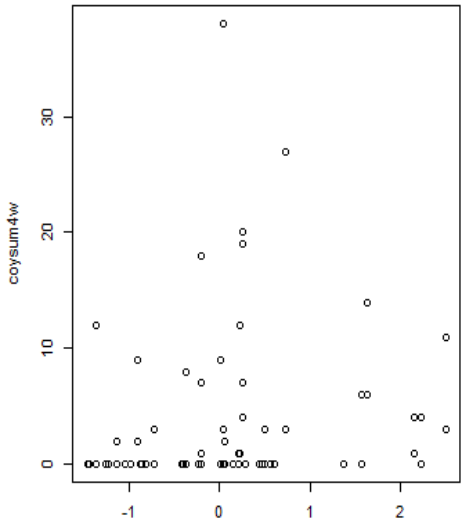

2012-08-01 3:51:04 AM M 3/5 20°C
RECONYX
HC500 HYPERFIRE
RECONYX



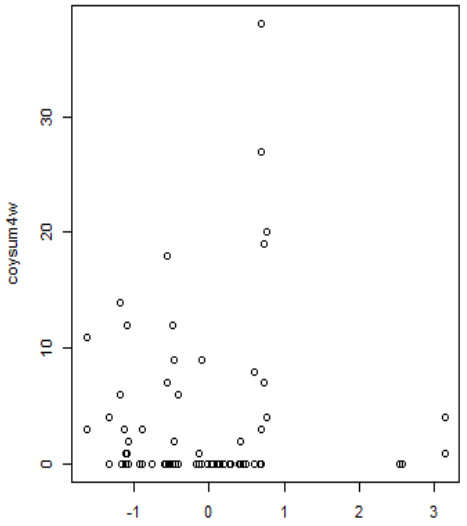
Season



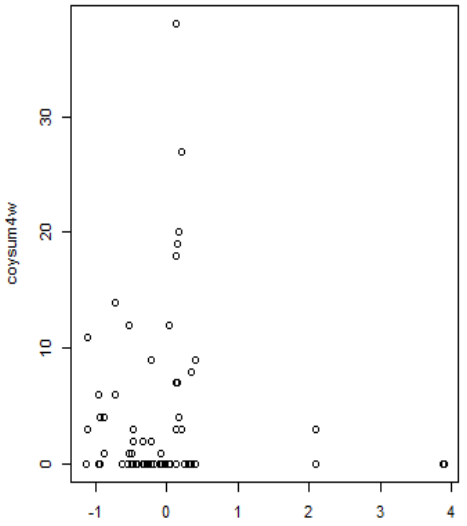
Bronx



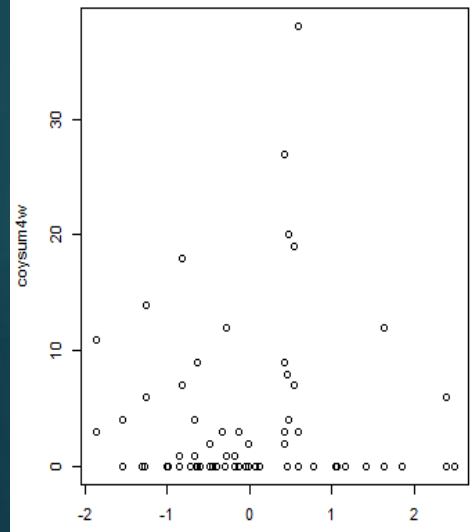
Total Hab



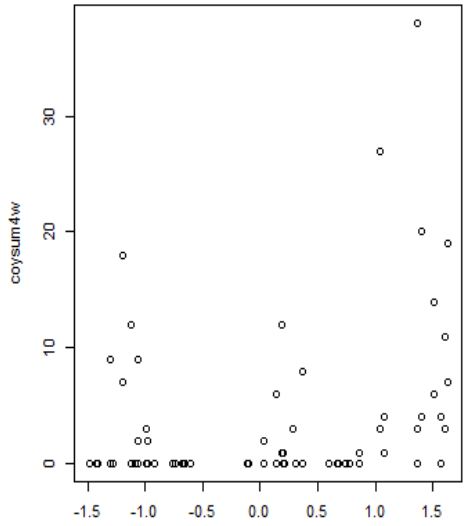
Mean Inc



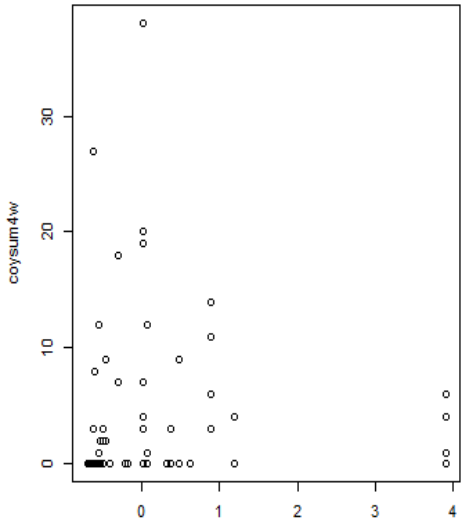
Vacancy



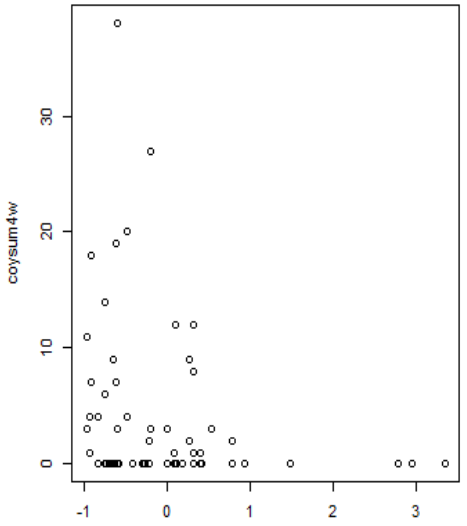
Housing Den



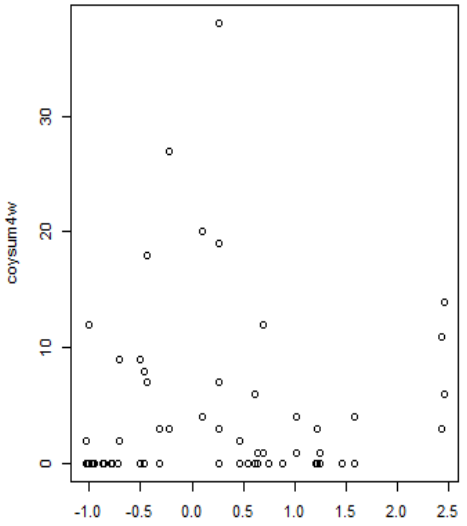
Canopy Cover



Patch Size



Pop Density



Forest

Lamda Models	K	QAICc	Delta_QAICc	**QAICcWt**	Cum.Wt	Quasi.LL
~ Bronx + season	11	373.73	0	**0.08**	0.08	-174.11
~ Bronx + season + Vacancy	12	375.42	1.69	**0.04**	0.12	-173.6
~ Bronx + season + forest	12	375.68	1.95	**0.03**	0.15	-173.73
~ PopDen	10	375.76	2.03	**0.03**	0.18	-176.43
~ Bronx + season + Hdens	12	375.86	2.13	**0.03**	0.21	-173.82
~ 1	9	382.87	9.14	**0**	0.97	-181.26

	p (detection)				Lambda (use)			
	beta	se	lo ci	high ci	beta	se	lo ci	high ci
Int	-1.4	1.51	-4.36	1.56				
Bronx	-2.65	3.11	-8.75	3.45				
season	1.83	2.48	-3.03	6.7				
Hdens	0.31	0.3	-0.28	0.9				
Patchsize	-0.3	0.55	-1.38	0.78				
PopDen	0.41	2.42	-4.33	5.16				
Int					1.23	1.5	-1.71	4.16
Bronx					**5.23**	**1.73**	**1.84**	**8.62**
Season					**-3.63**	**1.5**	**-6.57**	**-0.69**
Vac					-0.21	0.27	-0.73	0.31
forest					0.1	0.14	-0.17	0.36
PopDen					-2.57	2	-6.48	1.35
Hdens					0.36	0.38	-0.38	1.11
CanCov					0.04	0.09	-0.13	0.21
Patchsize					-0.61	0.69	-1.96	0.73
MeanInc					-0.1	0.15	-0.41	0.2
TotHab					-0.01	0.16	-0.31	0.3

Discussion

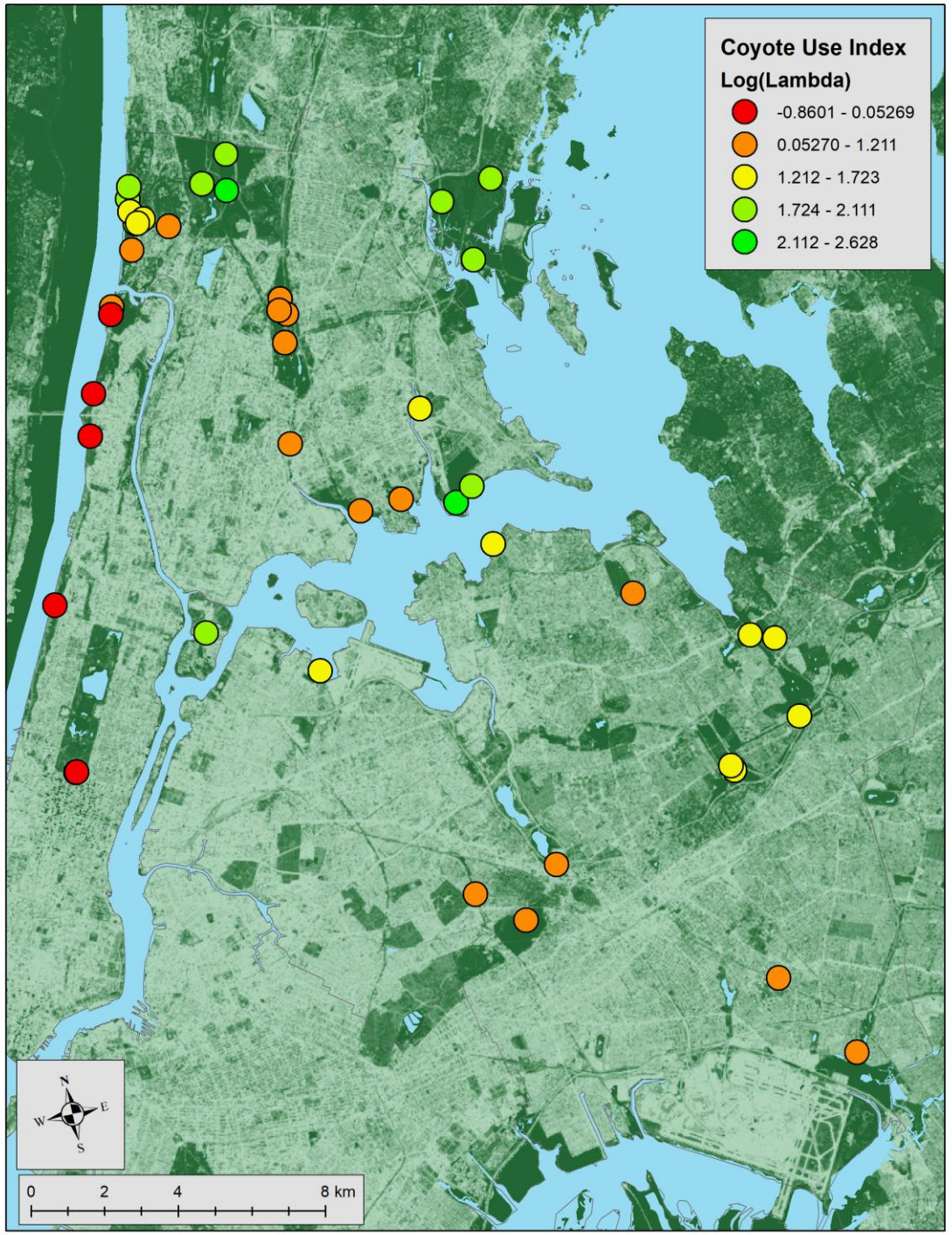
- Overall there was a substantial difference in the number of coyote detections in the Bronx vs. Manhattan and Queens
- Bronx sites – up to 400
- Non-Bronx sites – 0 to 10

- High SE due to high variability in detection histories
  - Still shows accurate correlation

- Coyote use depends on availability -- If they can reach a site
    - Bronx is most accessible
- Within-site habitat quality is less important – coyotes can live almost anywhere

Model-averaged predictions (ΔQAICc <4)

Coyote-present sites had predicted Log(Lambda) > 0



Many sites in Queens have suitable habitat for coyotes

(they just need to get there!)