From feces to families:
Genotyping beavers in the Reed Canyon

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May 2016

The North American Beaver

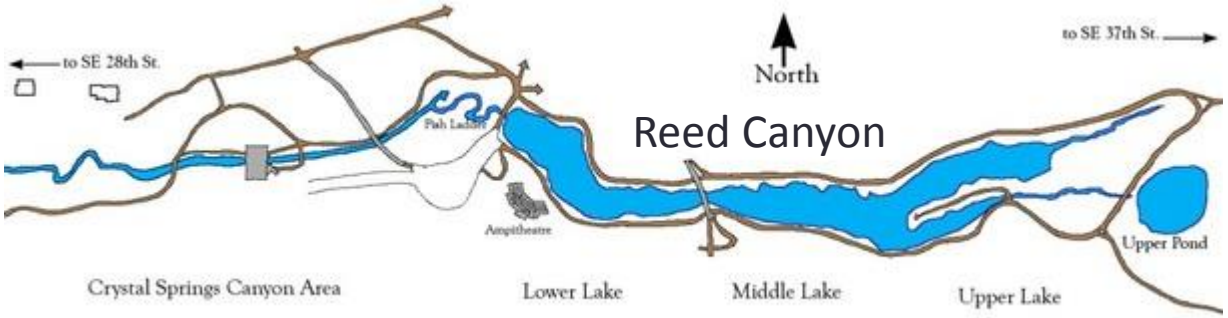
Castor canadensis

Lincoln's hat

The Reed Canyon

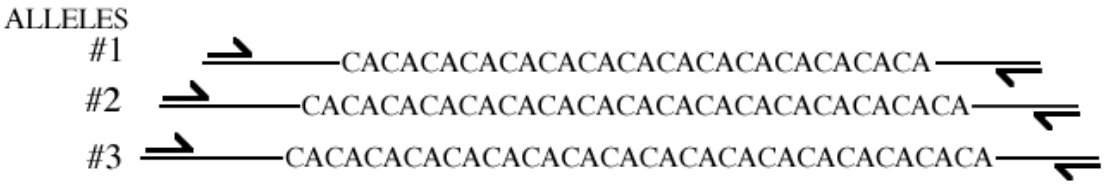
The mysterious beavers

- How many beavers live in Reed Canyon?
- What are their nightly activities?
- Can I detect genetic diversity among them?



The approach

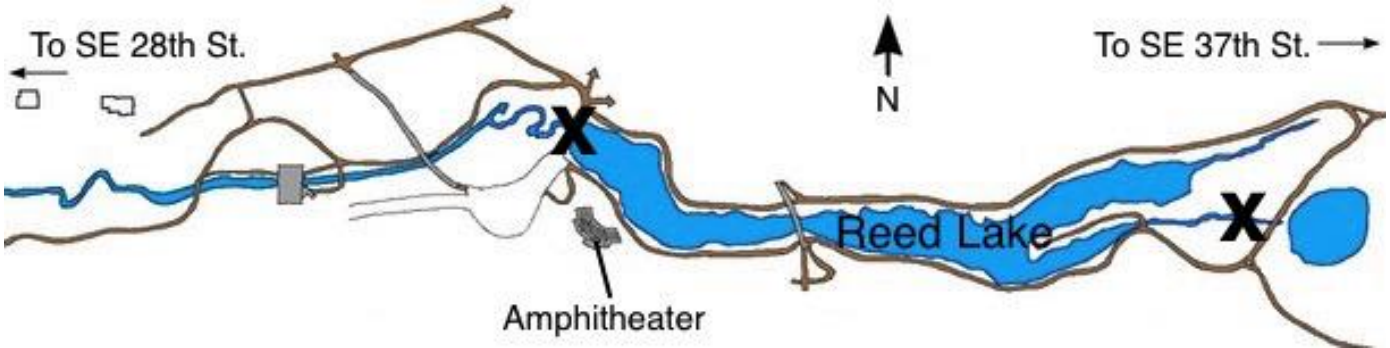
- Part 1: Molecular ecology
  - Collect DNA
  - Amplify at known microsatellite loci
  - Construct family tree using genotypes



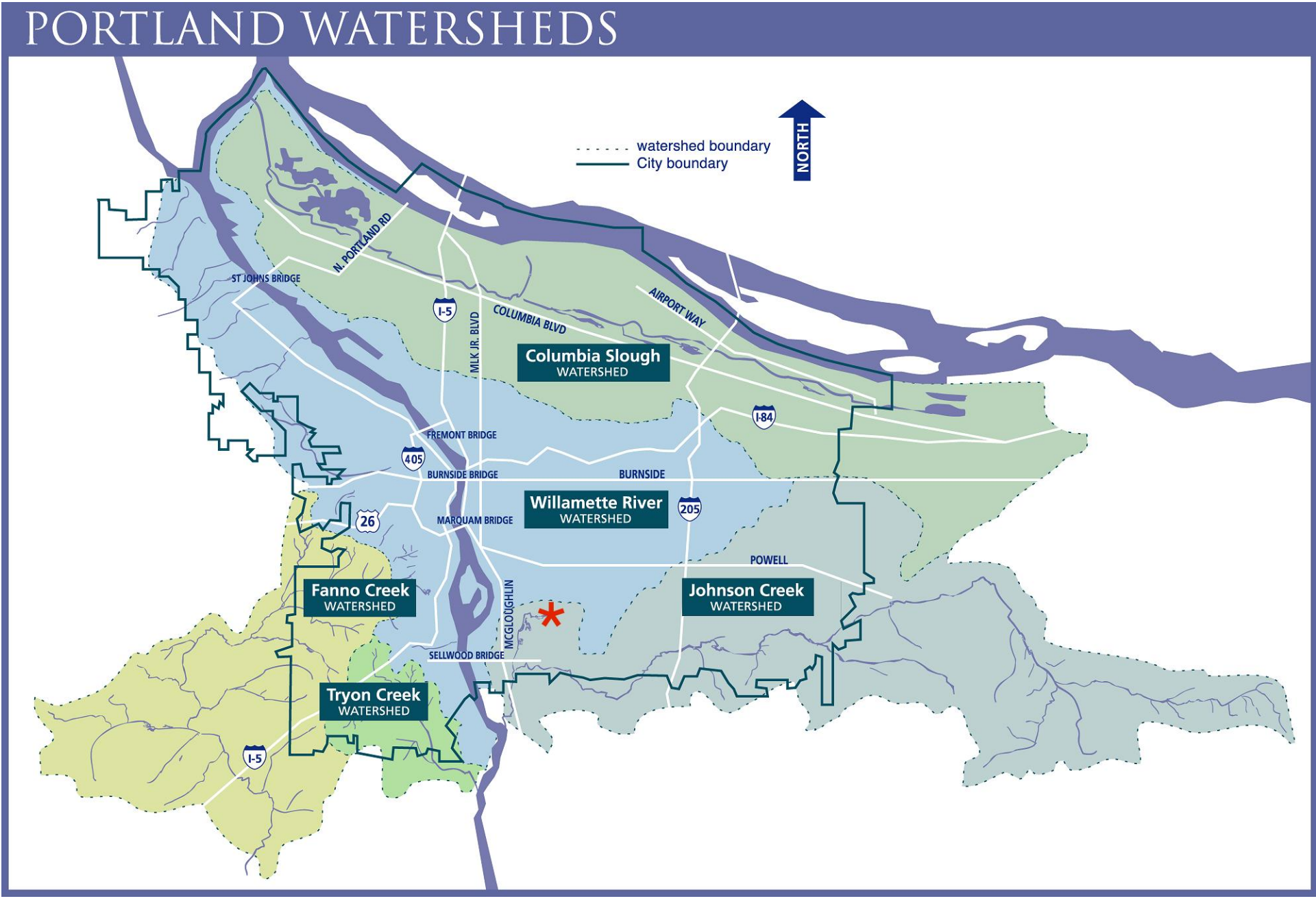
- Part 2: Camera trapping
  - Set video cameras in known areas of activity
  - Gain insight into activities
  - Get minimum count?

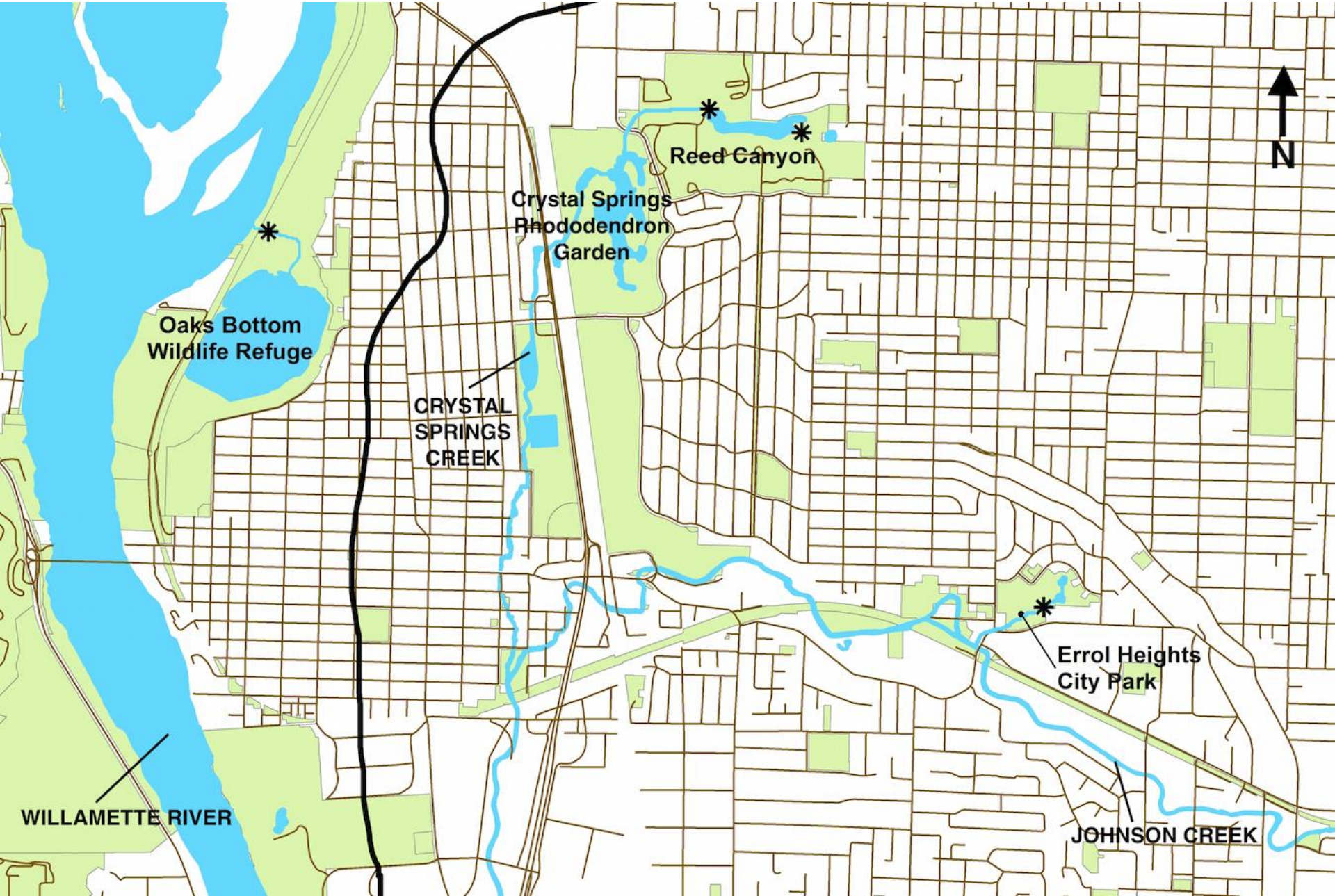
Methods pt. 1: Molecular ecology

- Extract DNA
  - Confirm at COI locus
    - Amplify at 14 microsatellite loci
      - Compare repeat number



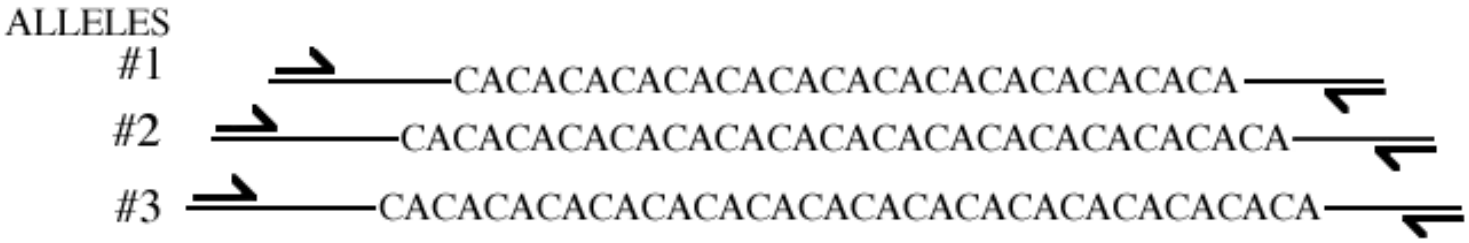
PORTLAND WATERSHEDS



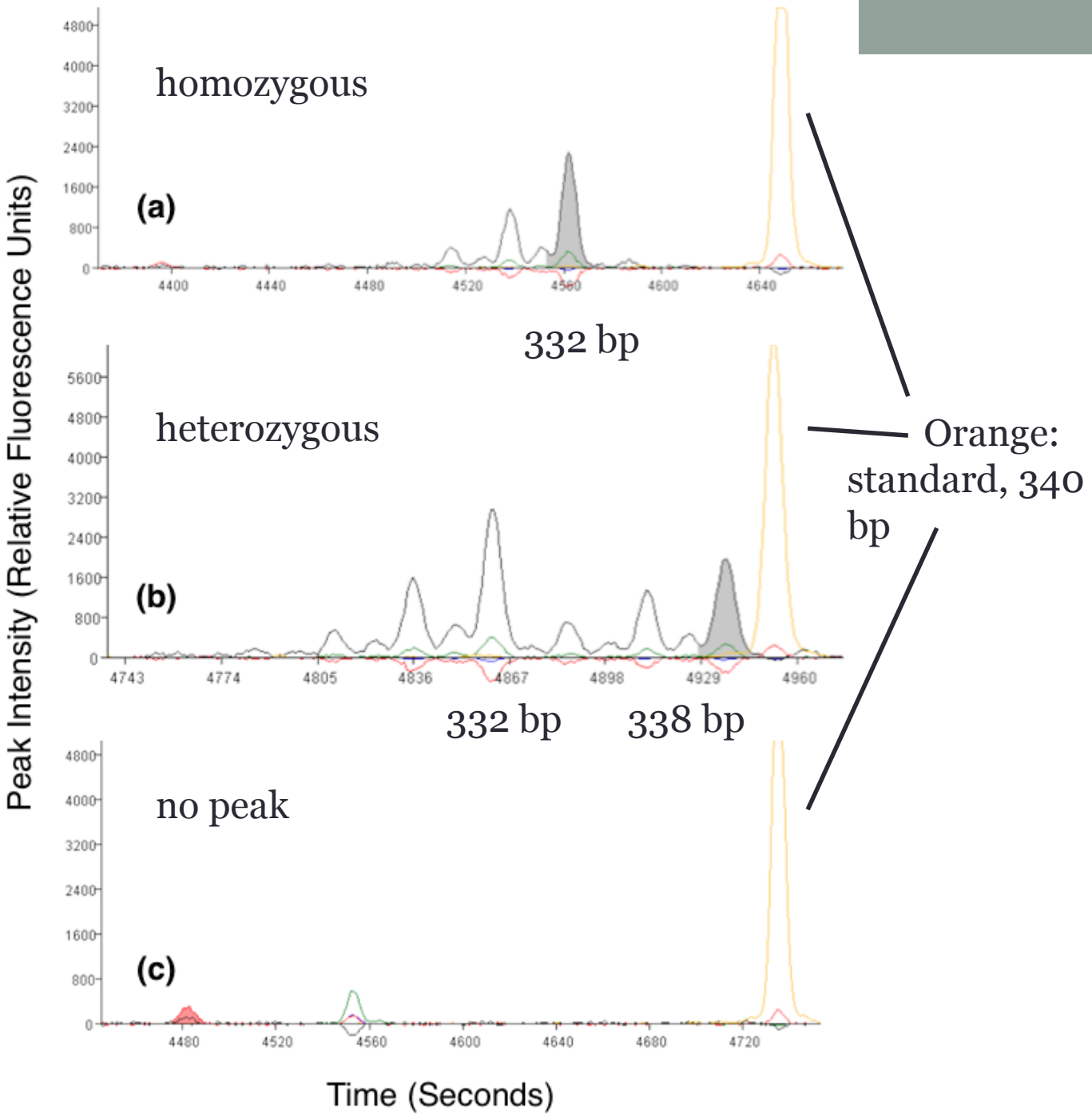

Reed Canyon
Crystal Springs
Rhododendron
Garden
Oaks Bottom
Wildlife Refuge
CRYSTAL
SPRINGS
CREEK
N
Errol Heights
City Park
WILLAMETTE RIVER
JOHNSON CREEK

Results pt. 1: Molecular ecology

- N = 14 fecal samples from Canyon
- N = 4 fecal samples from Oaks Bottom, Errol Heights
- 10/14 microsatellite primer pairs successful
- Obtained data for 10 microsatellite loci in 18 samples



Sample Data


homozygous
(a)
332 bp
heterozygous
(b)
332 bp
338 bp
no peak
(c)
Orange: standard, 340 bp
Peak Intensity (Relative Fluorescence Units)
Time (Seconds)

Microsatellite Lengths

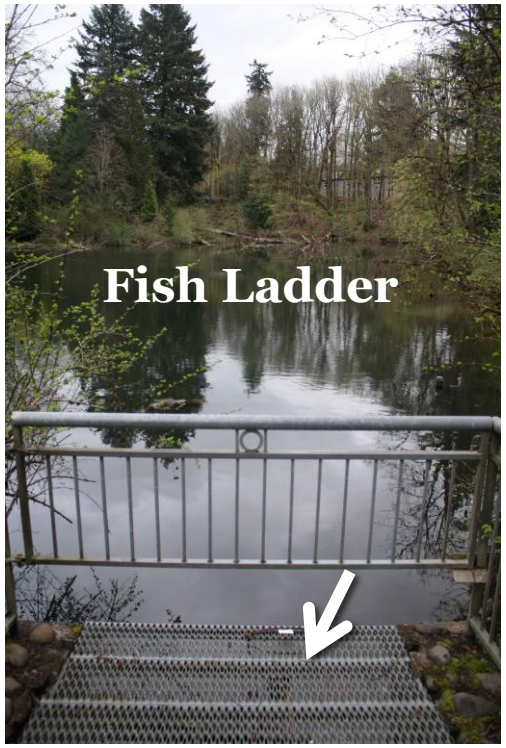
ID	Sample	Cca56	Cca20	Cca18	Cca62	Cca76	Cca122	Cca19	Cca92	Cca8	Cca112
RC1	2	no peak	278, 284	217	329, 332	no peak	no peak	no peak	254	382	178, 190
RC2	3	208, 240	no peak	215, 217	332	195	232	no peak	254, 258	382, 390	178, 186
RC3	4	208, 240	284, 290	215, 217	332	195	233	no peak	254, 258	382, 390	178, 186
RC4	5	208, 240	284, 294	215, 217	332	195	232	no peak	254	no peak	178, 186
RC5	6	208, 240	284, 294	215, 217	332	195	232	no peak	254	382, 390	178, 186
RC6	7	208, 240	284, 294	215, 217	332	195	233	no peak	254	no peak	178, 186
RC7	1	208, 240	284, 294	215, 217	332	195	232	no peak	254	382, 390	178, 186
RC8	12	no peak	284, 294	215, 217	no peak	195	no peak	no peak	254	382, 409	182, 198
RC9	13	208, 240	284, 294	215, 217	no peak	195	232	230	252, 254	390	186, 198
RC10	14	no peak	278, 284	215, 217	332	195	232	no peak	254	390, 409	186, 190
RC11	15	240	278, 284	215, 217	332	195	232	no peak	254	390, 409	186, 190
RC12	16	208, 240	278, 284	215, 217	332	195	232	no peak	254	390, 409	186, 190
RC13	17	208, 240	294	217	332, 336	no peak	no peak	no peak	254	382, 409	186, 190
RC14	18	208, 240	294	217	332	195	232	no peak	254	382, 409	186, 190
EH1	10	208	276, 288	215, 217	332, 336	195	232, 237	224, 241	254, 263	no peak	186, 190
EH2	11	208	276	217	332, 336	no peak	232, 237	224, 241	254, 263	382, 409	186, 190
OB1	8	208, 240	258	no peak	332, 338	195	no peak	no peak	no peak	401, 409	183
OB2	9	262	276, 292	215	332, 338	195	232, 239	no peak	256	401, 409	186, 190

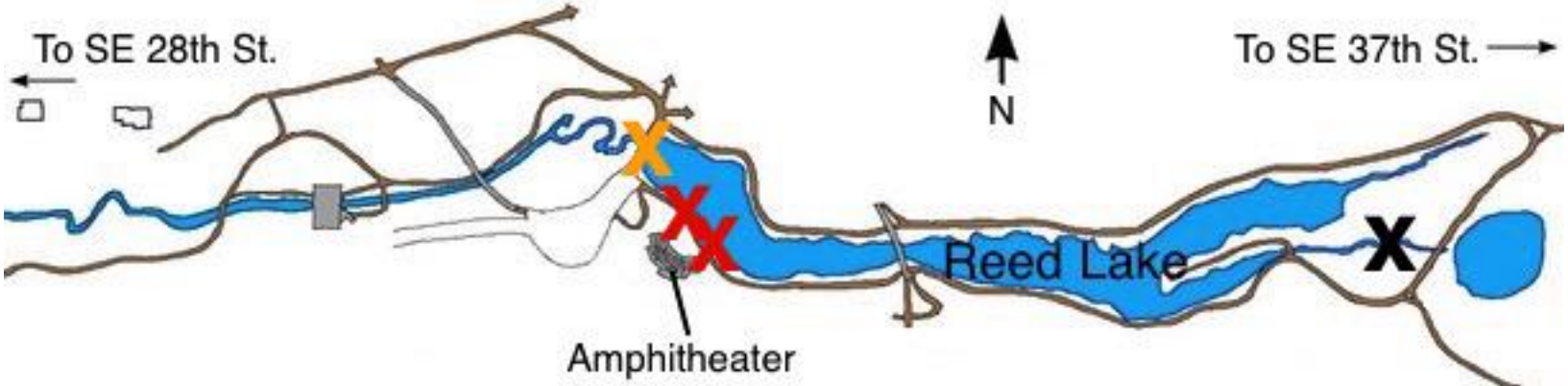
RC1 – RC12 = Reed Canyon: 5 distinct patterns

EH1 – EH 2 = Errol Heights: 1 pattern (more similar to Reed)

OB1 – OB2 = Oaks Bottom: 1 pattern (less similar to Reed)

Methods pt. 2: Camera trapping

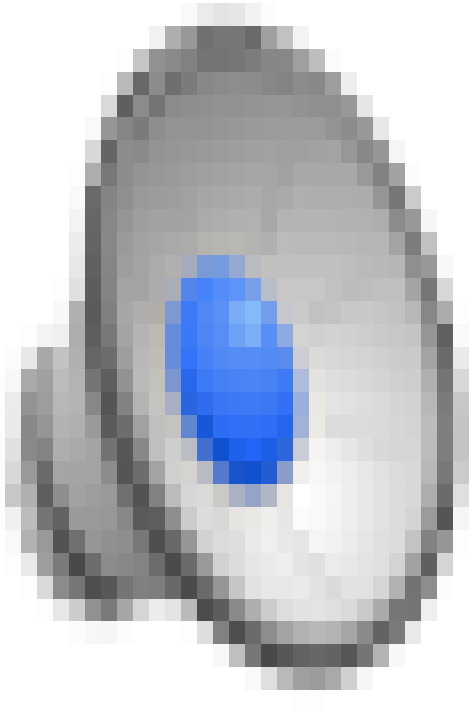




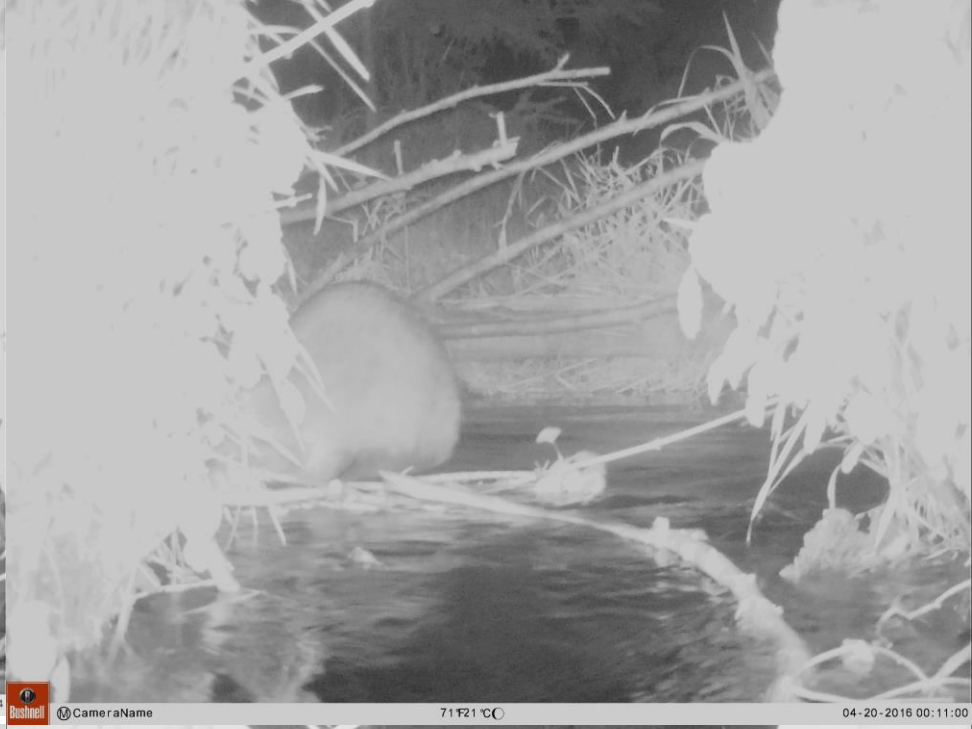
Results pt. 2: Camera trapping

- Beaver footage:
  - Jan 13 – 2:23 and 6:34
  - Jan 24 – 22:45
  - Apr 14 – 22:09
  - Apr 18 to 21 – various times

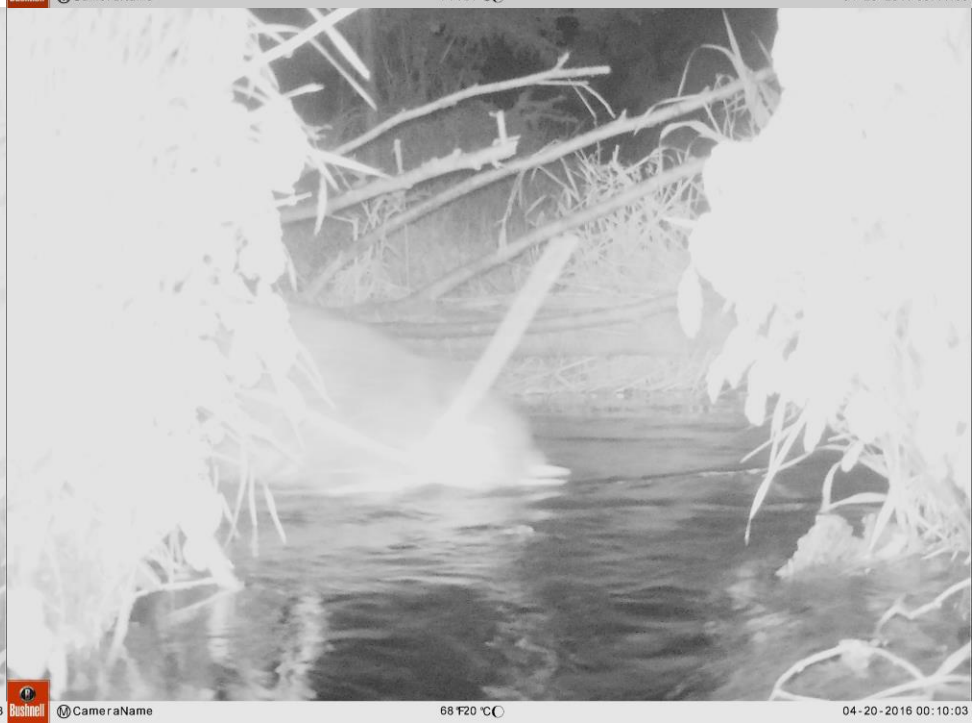
Camera location	Dates monitored	Beaver observed ?
Boardwalk	1/8 – 2/15; 3/7 – 4/25	Yes
Amphitheater	2/23 – 3/10; 4/7 – 4/16	No
Fish ladder	2/23 – 3/1; 4/7 – 4/16	No




Bushnell
CameraName
70°F21°C
04-20-2016 00:10:24


Bushnell
CameraName
71°F21°C
04-20-2016 00:11:00


Bushnell
CameraName
51°F10°C
04-20-2016 03:22:28


Bushnell
CameraName
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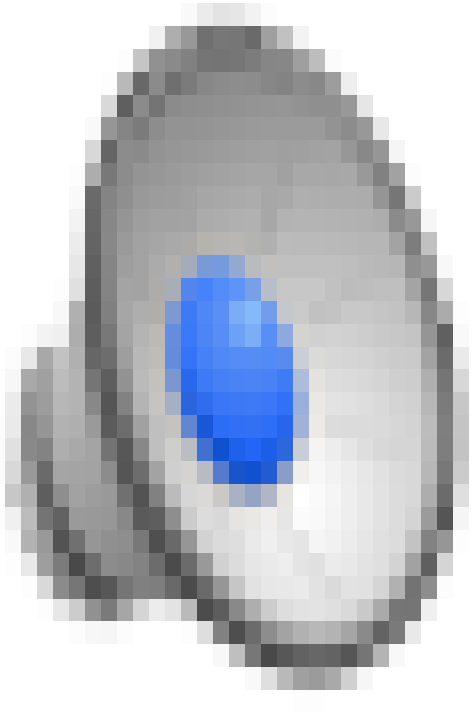
04-20-2016 00:10:03




Bushnell
CameraName
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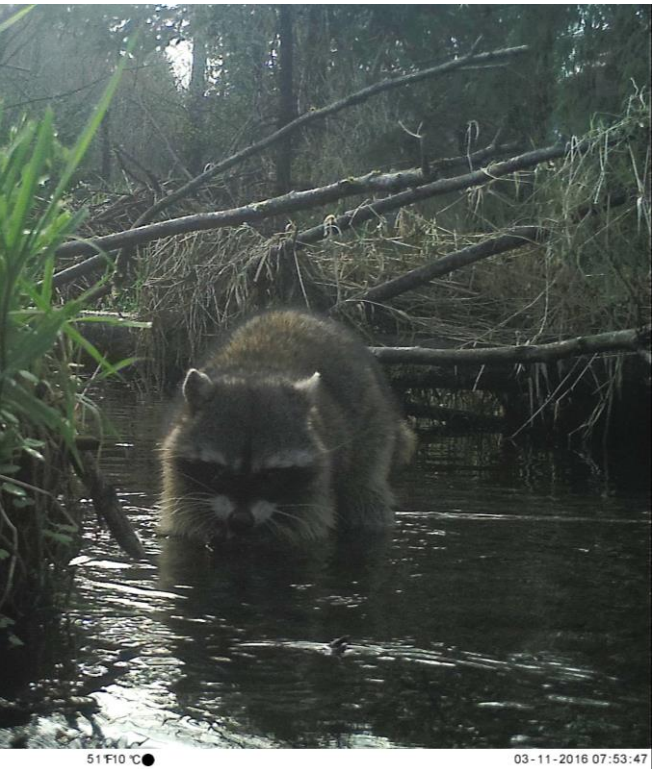
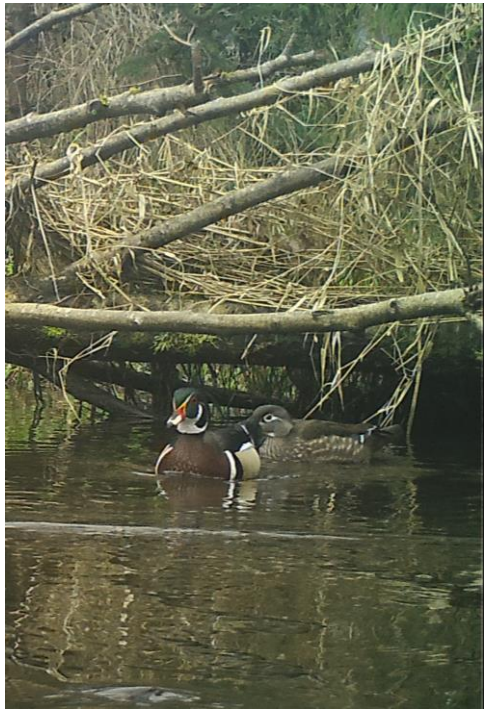
02-11-2016 14:41:29


51°F10°C
03-11-2016 07:53:47




50°F10°C
03

Conclusions

- At least one, probably 5 beavers live in the canyon
  - Reed samples more similar to Errol Heights than Oaks Bottom
- Feces are dropped at dam sites, but not outside of den
  - Always underwater
- It's possible to extract DNA from beaver feces!
  - This is a new technique in beavers!

Thank you to…

- Todd and the Schlenke Lab
- Zac Perry
- Funding from NSF and Bio Dept
- Kristin Bott
- Jay Ewing
- Bob Kaplan
- Parks & Rec ecologists Mart Hughes & Laura Guderyahn
- Uri Shanas & Susan Barnes
- Reed Bio Stockroom
- Melanie Culver & Joan Crawford
- Field assistants: Maia, Emma, Emily, Shelly, Indra, Heather
- Friends & family

Questions?