Cameras and other non-invasive wildlife research techniques

ASU SCHOOL OF Life Sciences
ARIZONA STATE UNIVERSITY

Jan Schipper, PhD
Conservation Research Postdoctoral Fellow
ASU SOLS and the Phoenix Zoo,
Arizona Center for Nature Conservation

phoenixzoo
ARIZONA CENTER for NATURE CONSERVATION

A picture is worth a thousand words…

What can we learn by looking at a photograph?

Species
Behavioral inference
Unique markings (ind)
Sex (male/female)
Animal condition
Reproductive cond.
Topical parasites
Habitat type
Time (activity patterns)
Date (moon phase)

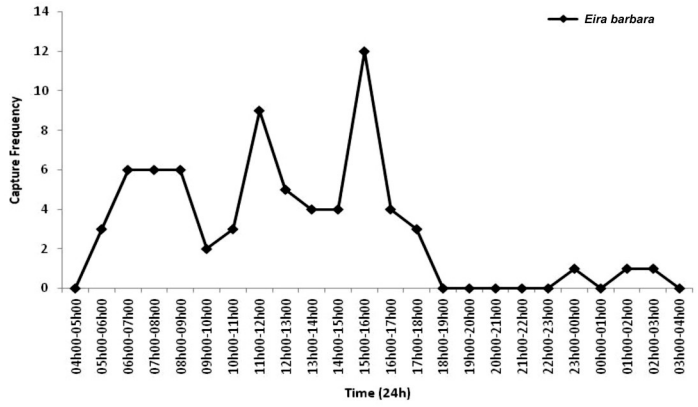
Sometimes:
Fruiting cycles
Prey species
Weather
Water volume

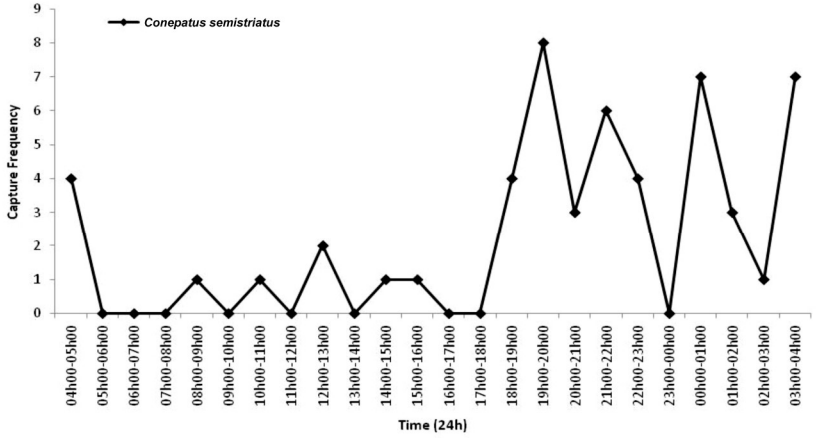
What can we do with all this information?

Unique marking: some species have unique patterns or markings which allow us to identify and track individual in the dataset.

What can we do with all this information?

Time and date: we can analyze animal activity patterns to look at their use of time (diurnal, nocturnal…) individuals and among species. Which is nocturnal?





What can we do with all this information?

Species composition, richness and diversity.

What species are most common (rel. abund)?

How many species are there (richness)?

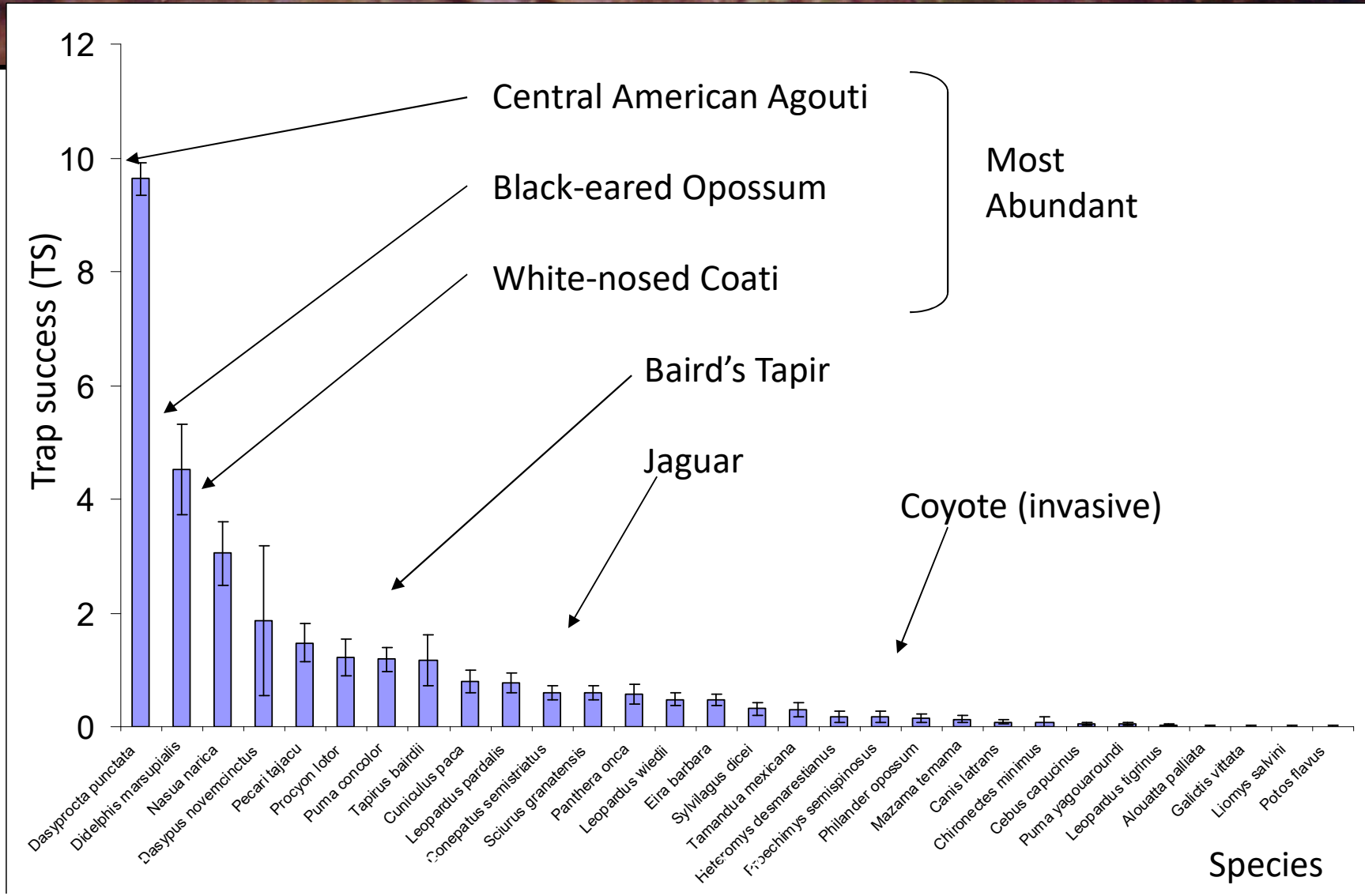
Which species are most abundant (evenness)?

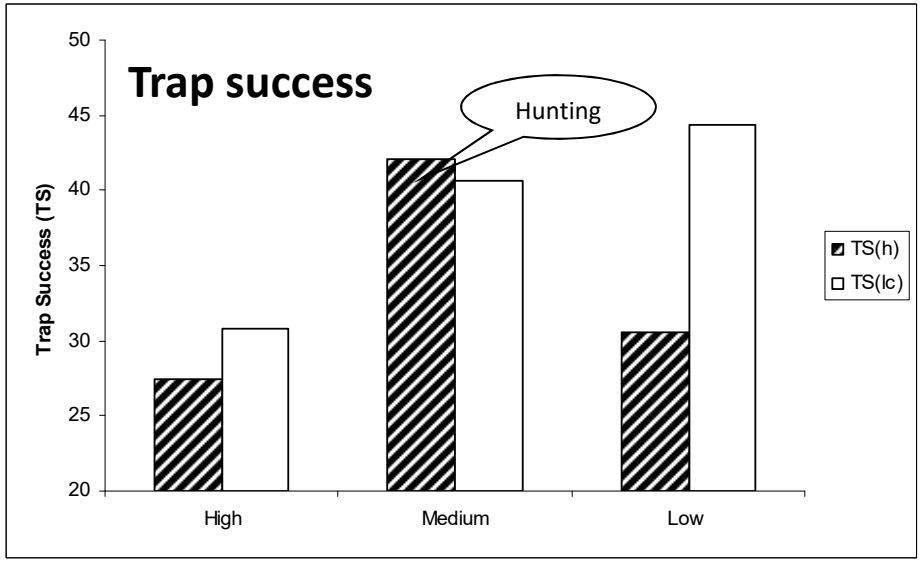
Does species diversity or abundance vary between sites? (hunting, tolerant sp) WHY?

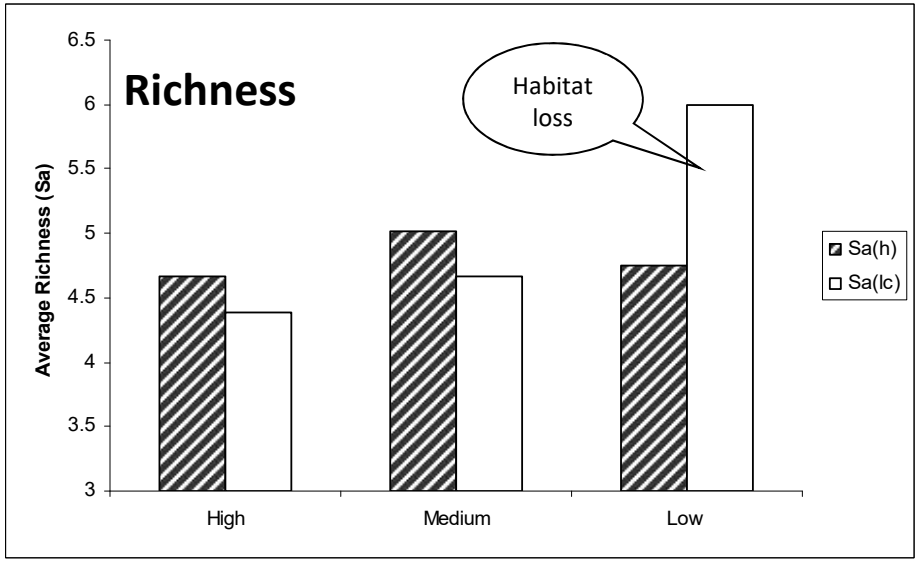
Does community structure change over time based on resource availability (trophic scaling)?

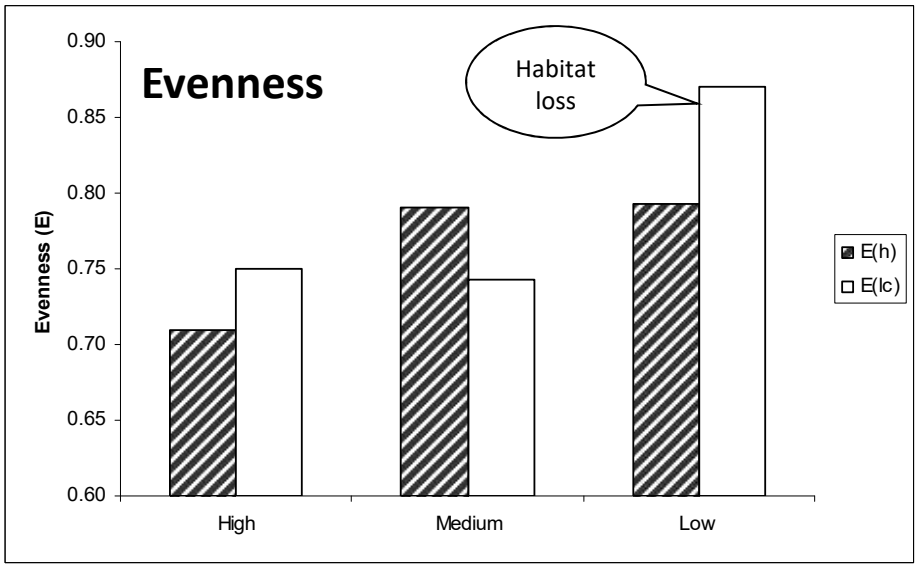
Which species are most abundant?

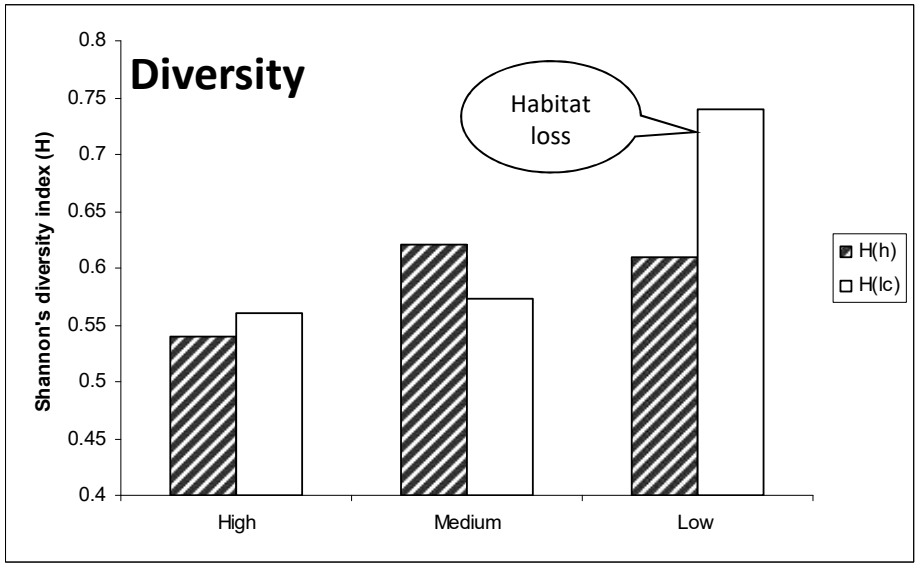
TS=trap events/trap nights*100

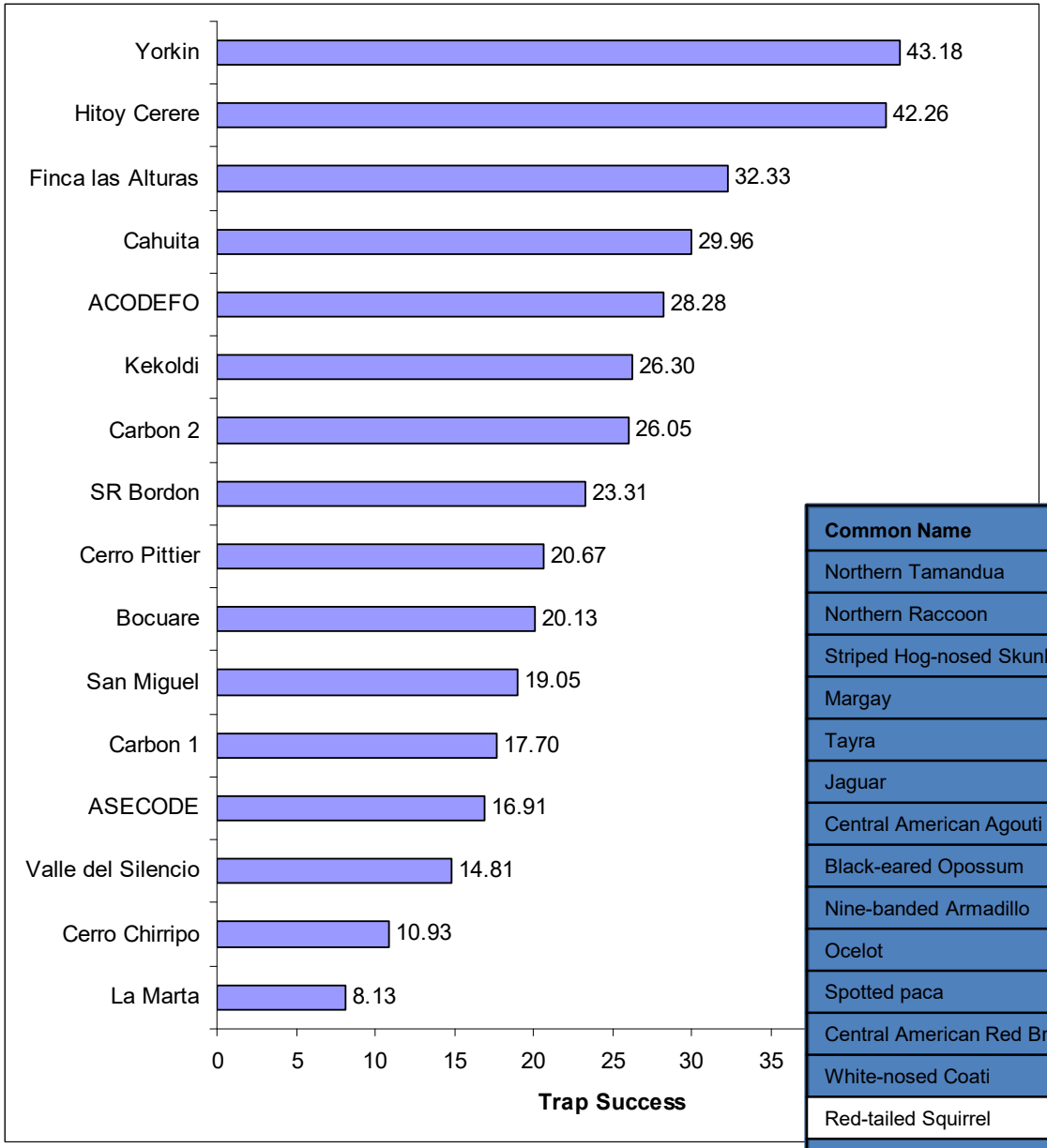



Trap success
Hunting
Trap Success (TS)
50
45
40
35
30
25
20
High
Medium
Low
TS(h)
TS(lc)

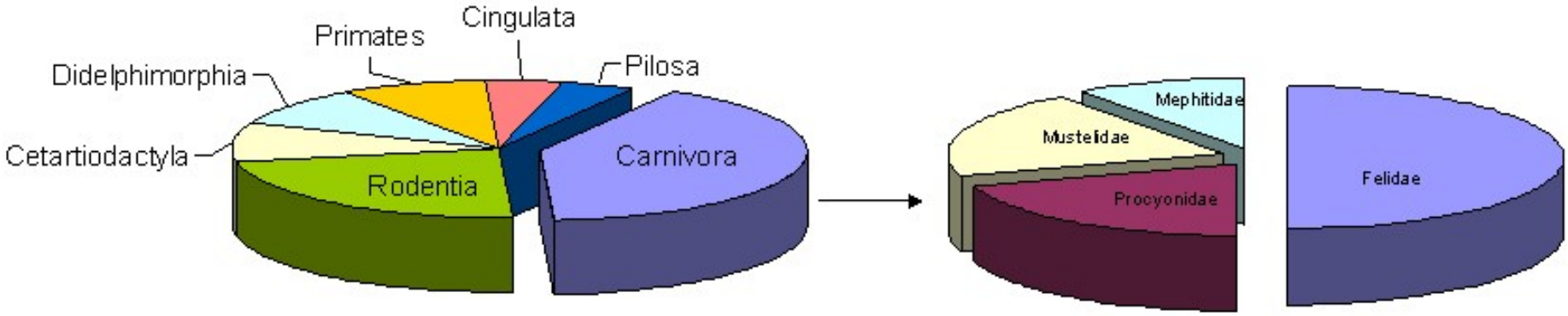

Richness
Habitat loss
Average Richness (Sa)
6.5
6
5.5
5
4.5
4
3.5
3
High
Medium
Low
Sa(h)
Sa(lc)


Evenness
Habitat loss
Evenness (E)
0.90
0.85
0.80
0.75
0.70
0.65
0.60
High
Medium
Low
E(h)
E(lc)


Diversity
Habitat loss
Shannon's diversity index (H)
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
High
Medium
Low
H(h)
H(lc)



Common Name	0-1000m	1000-2000m	2000-3000m	3000m+
Northern Tamandua				
Northern Raccoon				
Striped Hog-nosed Skunk				
Margay				
Tayra				
Jaguar				
Central American Agouti				
Black-eared Opossum				
Nine-banded Armadillo				
Ocelot				
Spotted paca				
Central American Red Brocket				
White-nosed Coati				
Red-tailed Squirrel				
Collared Peccary				
Puma				
Dice's Cottontail				
Baird's Tapir				

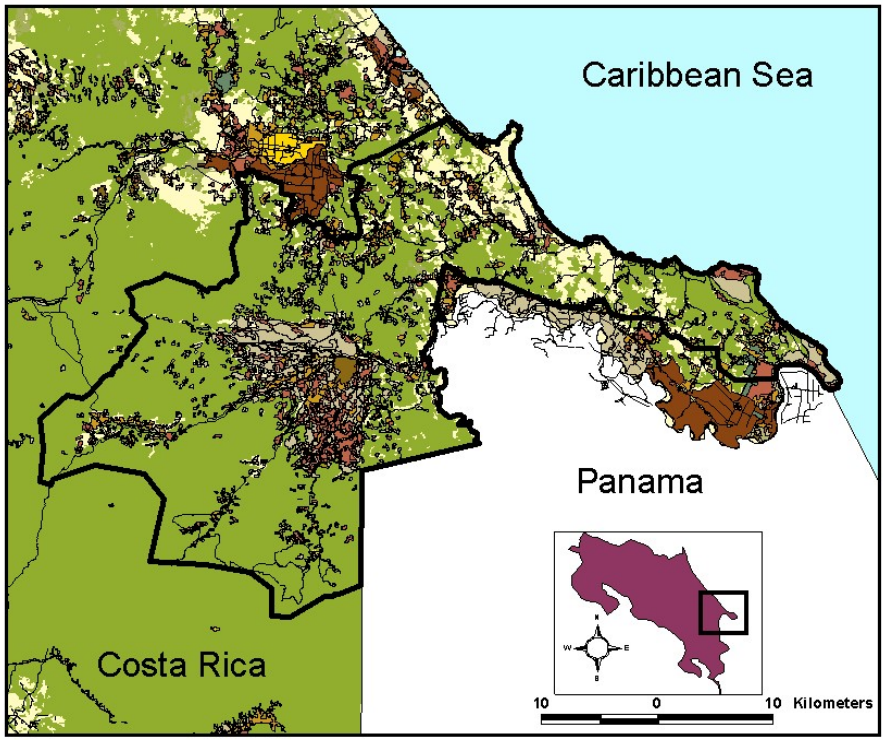


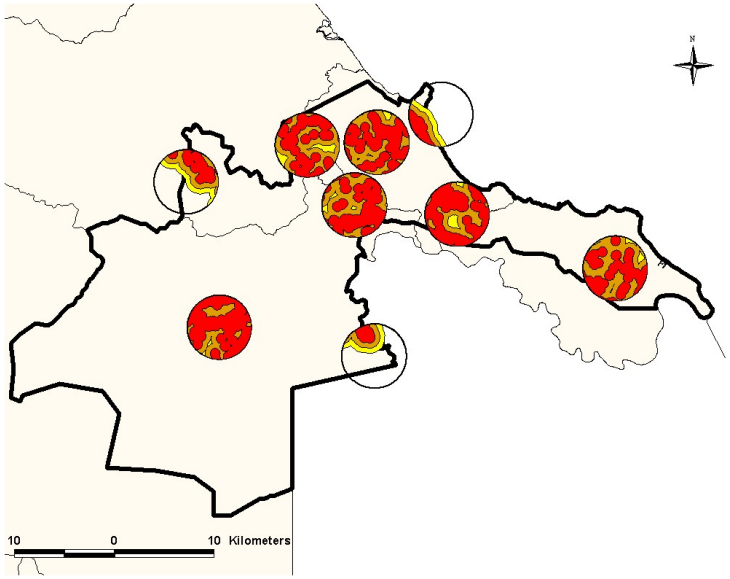
All species

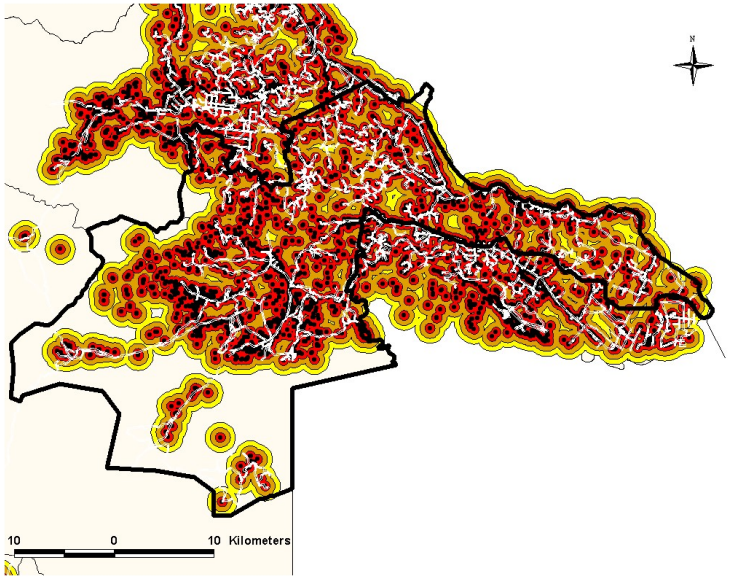
Carnivores

What can we do with all this information?

Landscape Context: Anthropogenic impacts on wildlife





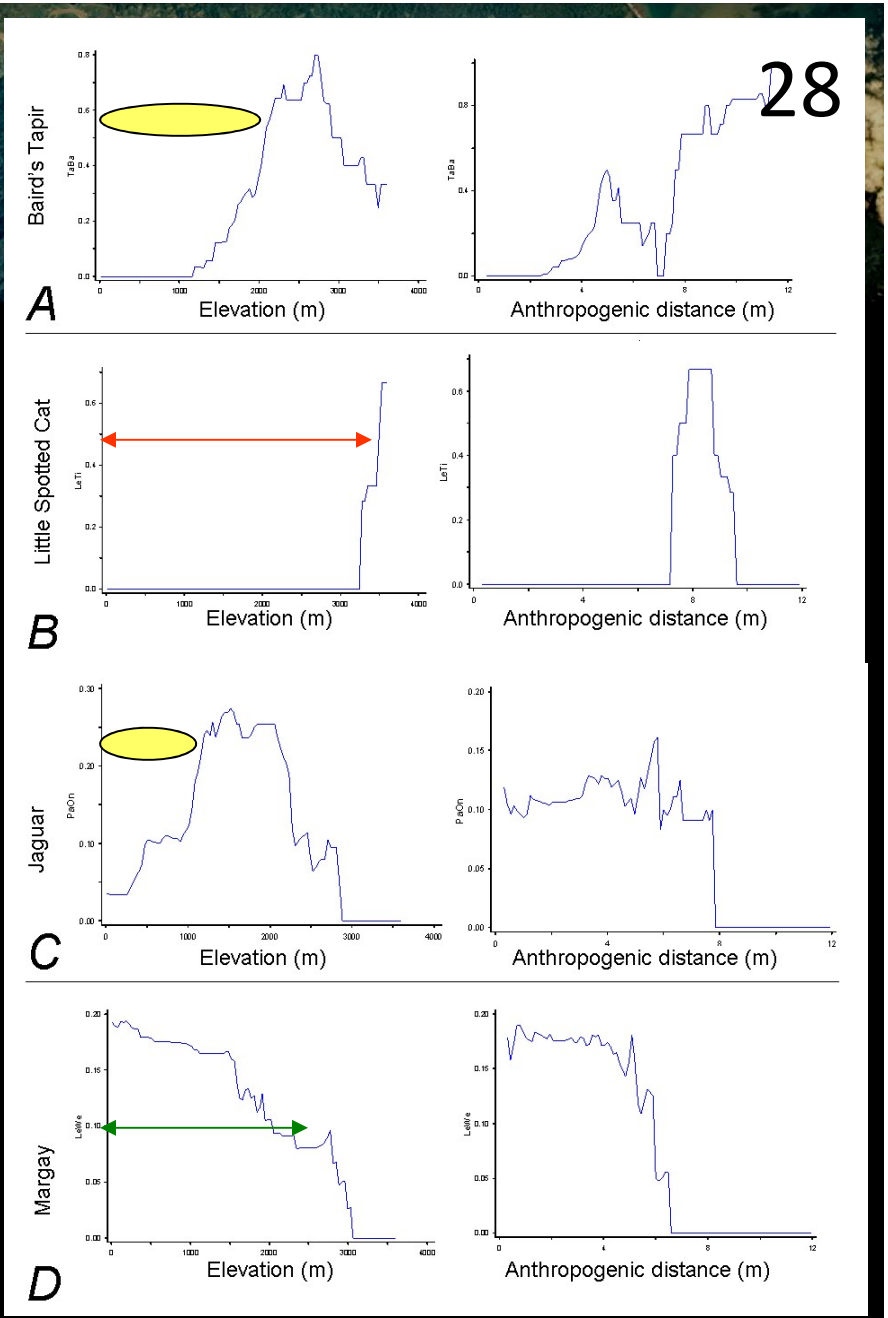


How are species distributed?

Baird's Tapir and Jaguar, both predominantly lowland species, are today only found only at higher elevations due to overhunting and loss of forest habitat in lowlands. Much of the native range of these species is unoccupied.

Little Spotted Cat are only found at the highest elevations, however in South America the species occurs in lowlands.

The Margay, which is not hunted and is tolerant of habitat fragmentation, is still common in its native range



Relative abundance per species across elevations and human disturbance regimes.

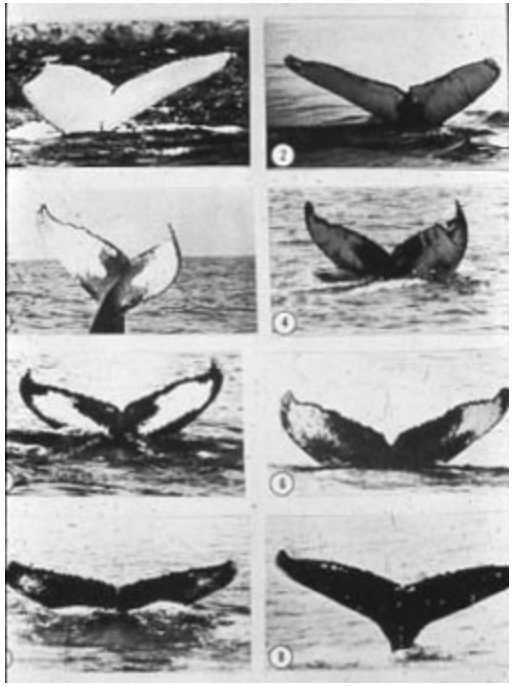
How effective are Protected Areas?

Status	Stewardship	Camera Locations	Trap Nights	Total Captures	Trap Success
Not protected	Private Conservation	50	2305	710	30.8
Not protected	Indigenous Territory	29	1233	354	28.7
Not protected	Private Non-Conservation	27	1280	286	22.3
Not protected Sum		**107**	**4818**	**1350**	**28.0**
Protected	National Park	35	1711	332	19.4
Protected	Wildlife Refuge	4	128	7	5.5
Protected	Biological Reserve	23	904	382	42.3
Protected	Protected Zone	29	1585	368	23.2
Protected Sum		**90**	**4228**	**1089**	**25.8**

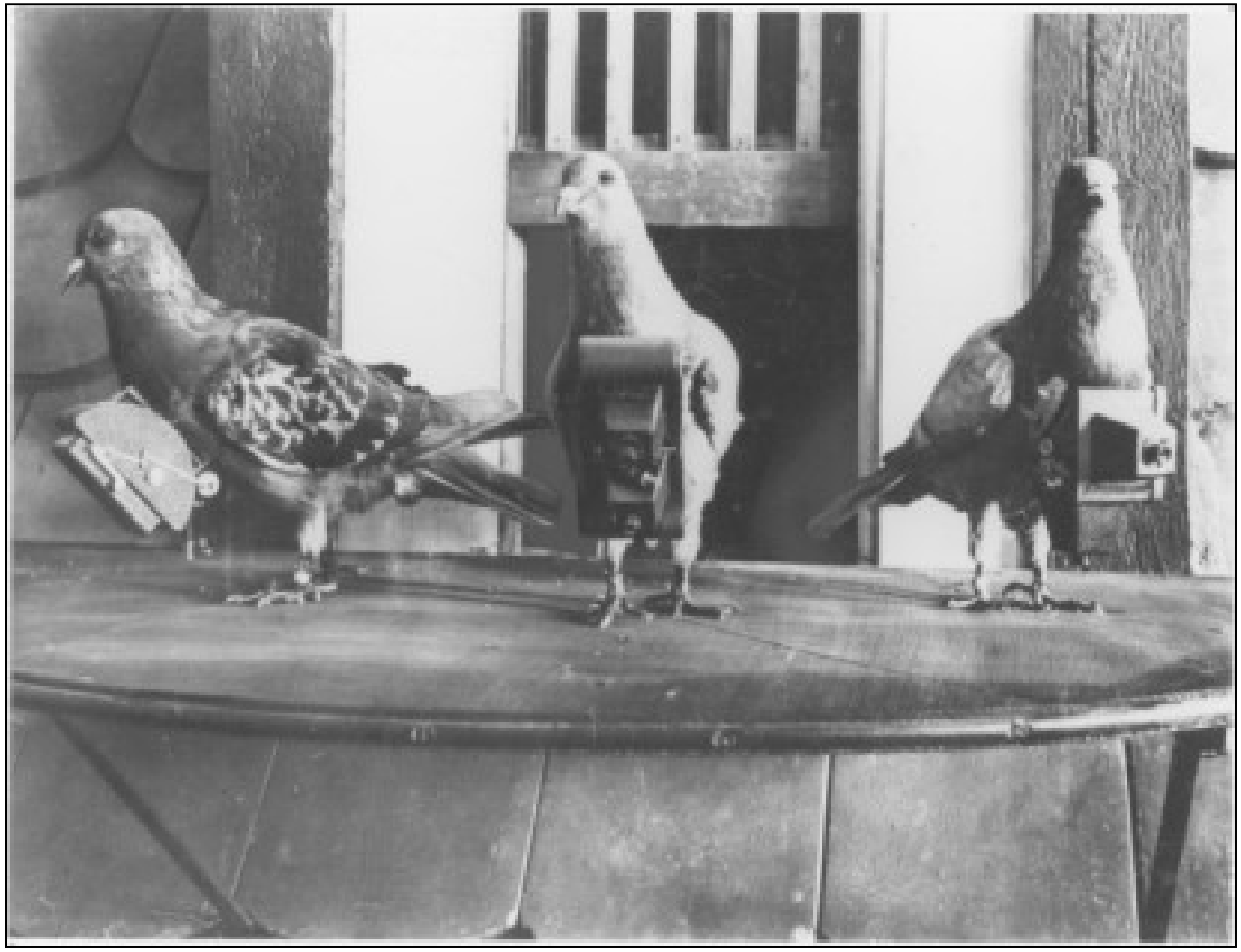
Distribution of camera trap locations and resulting capture summaries among land management types (stewardship) across the study area.

Camera trapping

The camera was invented in the 19th Century, and since then people have tried to photograph wildlife. Gradually images were seen as a new type of data – and new analytical tools were developed. Increasingly it has become a way to measure animal populations, especially in very remote areas or over long time periods.

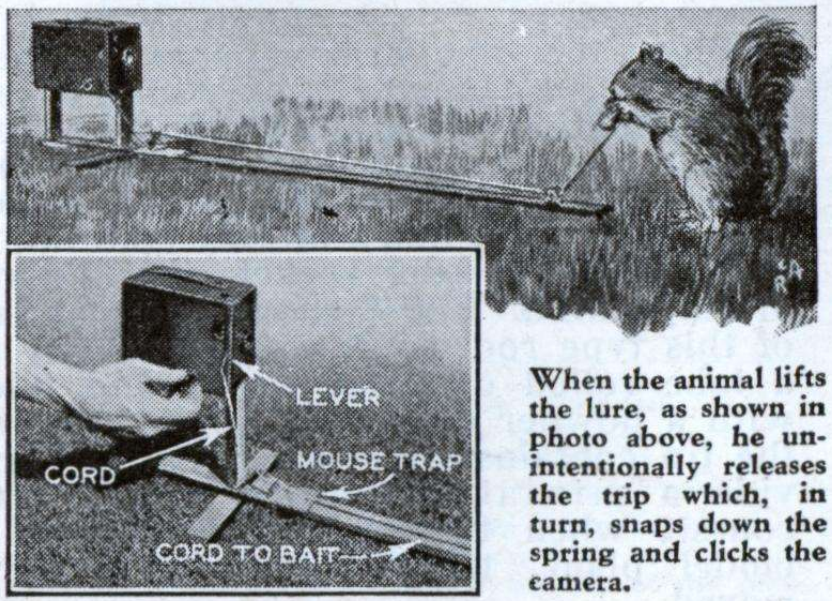


History of “trapping” animals in photographs….remote sensing



Camera Trap Catches Unusual Poses of Smaller Forms of Wild Life (Jan, 1933)

Camera Trap Catches Unusual Poses of Smaller Forms of Wild Life



When the animal lifts the lure, as shown in photo above, he unintentionally releases the trip which, in turn, snaps down the spring and clicks the camera.

AN ORDINARY mouse trap and a few feet of ½"x1¼" stock are all the parts required to make this automatic shutter release for your box camera. The device, which should be painted green, is unique in catching unusual poses of small forms of wild life.

At one end of the 51-in. base, construct a mount for the camera. The rear of the mount is 5¾" and the front is 5½" to allow the lens to point down into the camera field. Screw the trap to the base of the device directly below the lens. A short length of wire connects the camera lever to the trap spring. Another length runs from the trigger through wire screw-eyes in the base to the opposite end where a nut or morsel of food is fastened as bait.

Research

Photography

WILD TIGERS. DECEMBER 2011

Camera-trapping

- **Background** – a collision of research and management needs and appropriate advances in technology
- **Current Use** – camera-trap development is now split between several markets – recreation (hunting), management and science. Although numerous models are available, most of the features now available are driven by recreation needs. But as prices drop, scientific studies are getting bigger and bigger.
- **Continued evolution** – cameras are getting faster, can stay in the field longer (Lithium), panoramic being developed, detection limits increase, larger format images, hyperfire, images sent to phone/laptop, satellite uplink…etc.

Lab

In the lab today we will be using camera traps, and thus a more complete discussion of using camera trap data will follow.

But first lets look at how we are currently using cameras in the field to answer conservation and wildlife management questions….

ASU-Phoenix Zoo Partnership

What are we working on?

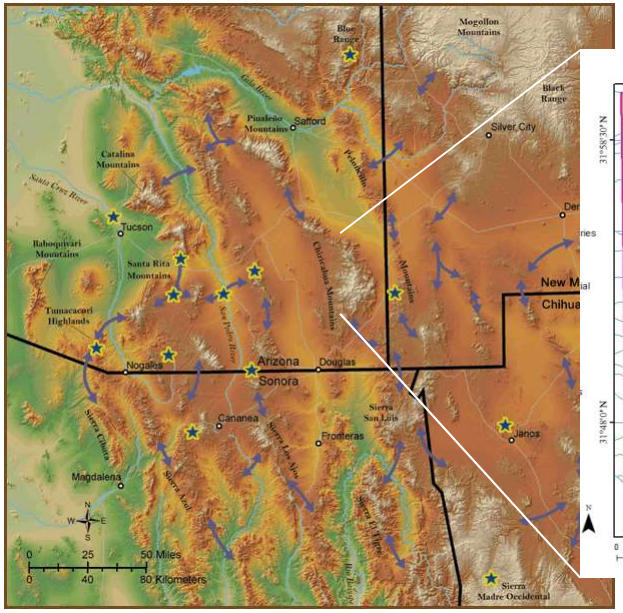
The partnership is involved in many projects – but has four specific lines of research that transcend them all (IRIE)

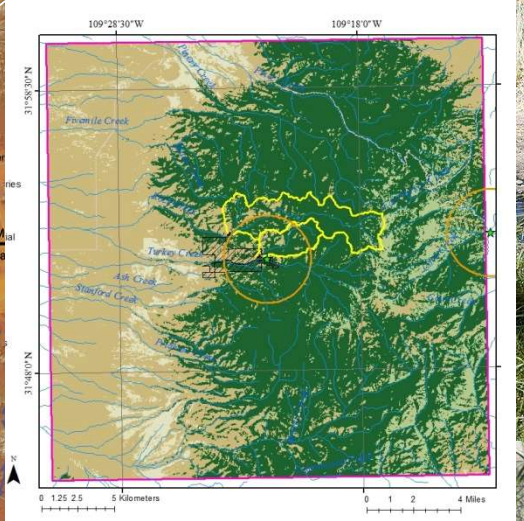
1. **Identification** of threats (responding to a management issue)
2. **Research** to provide the best science to quantify threats and possible solutions
3. **Implementation** of conservation research into local/national rules and policy
4. **Education** and outreach tools

Three regions of focus (currently)

- **Chiricahua's, Arizona** – many issues surrounding surface water, habitat connectivity and US-Mex border
- **Zona Sur, Costa Rica** – the southern zone and human dominated landscape between La Amistad and Corcovado National Parks.
- **Verde River, Arizona** – confluence of human and wildlife needs on this Wild and Scenic River.

Chiricahua Mountains: water, restoration, ranching and wildlife corridor design





Threats

- Infrastructure: international barrier wall and numerous highways divide wildlife movement routes
- Water is increasingly a limiting resource
  - Groundwater depletion

Study design

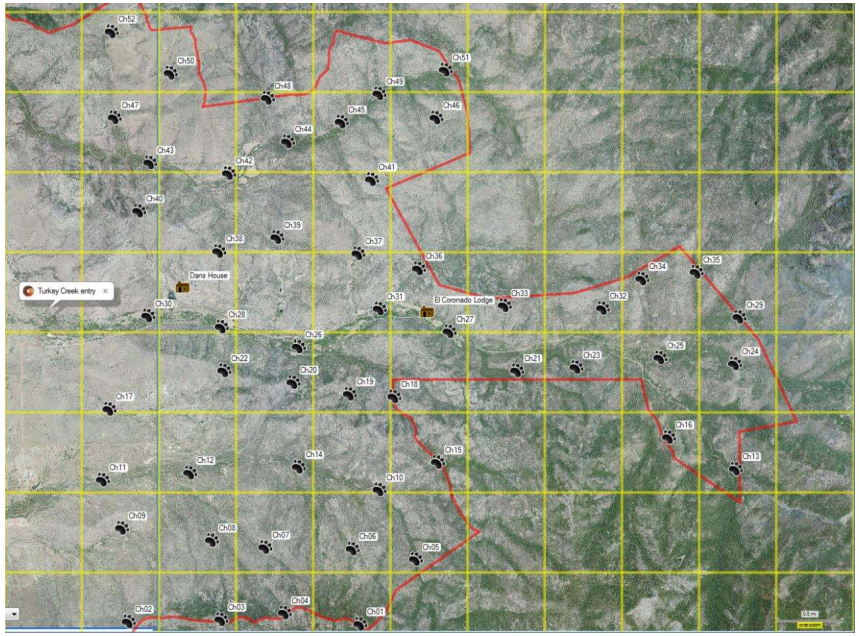
We are using a GRID design, stratified across a number of landscape features to ensure we have a representative network.

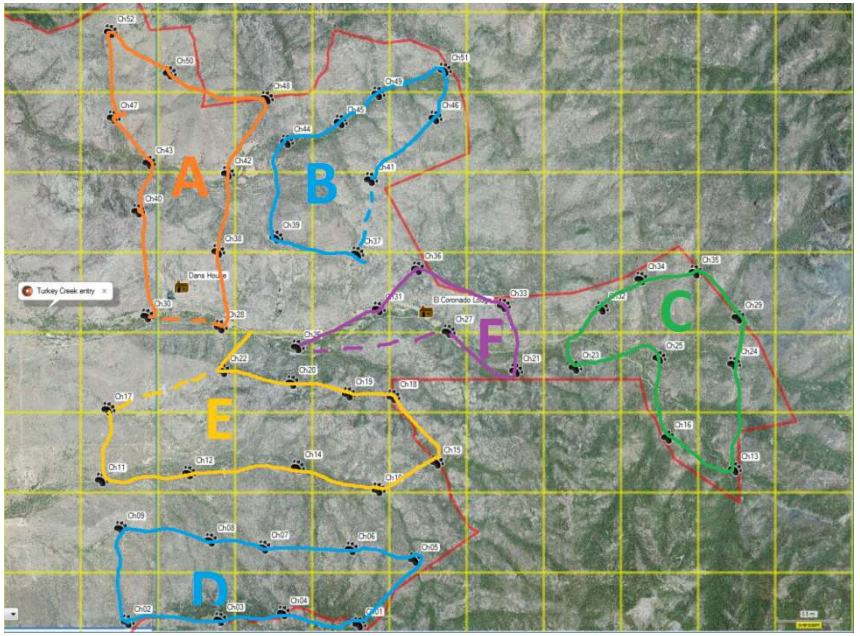
One question we are asking is:

Does stream restoration have an impact on wildlife communities?

How would we go about designing this study?

Study design





Progress to date

We began working with a ranching family who own significant acreage in the region, and who have been in the process of water restoration for over 30 years across several small watersheds. This gives us an excellent opportunity for a study design looking at water abundance and wildlife diversity and occupancy patterns.

June 2014 we initiated a camera-trap surveys across three ranches

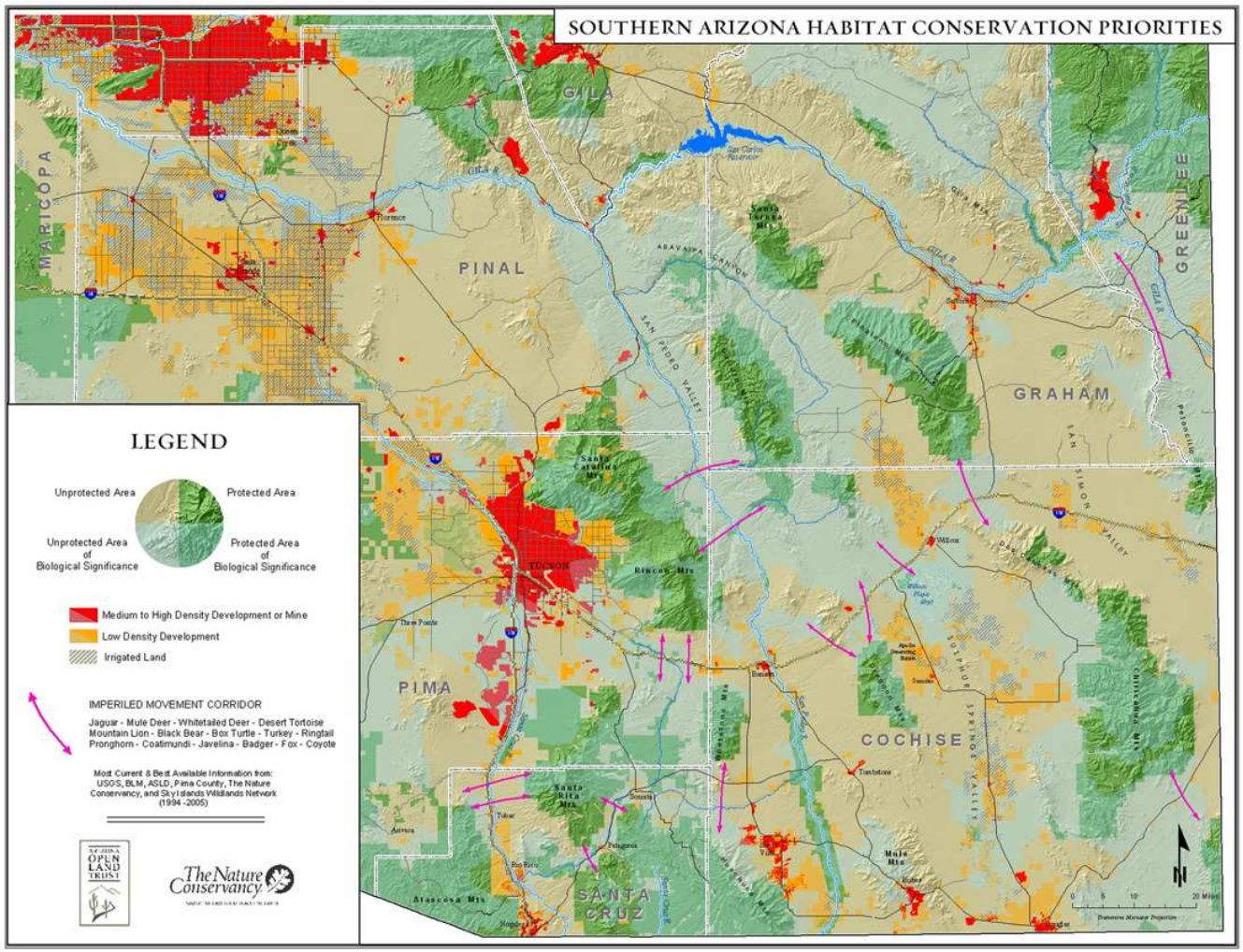
- we installed 40 cameras across a variety of land uses (ranch-forest)
- resulted in over 500,000 images (many blanks due to grass)
- Survey concluded in October 2014

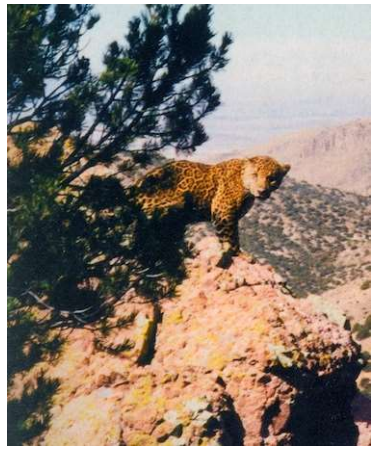
December 2014 we initiated a larger study area to include surrounding forest service

- we installed over 50 cameras across 3 paired watersheds
- Incorporate weedwacker into study design
- Survey will run for one year, with several trips to change batteries, etc.

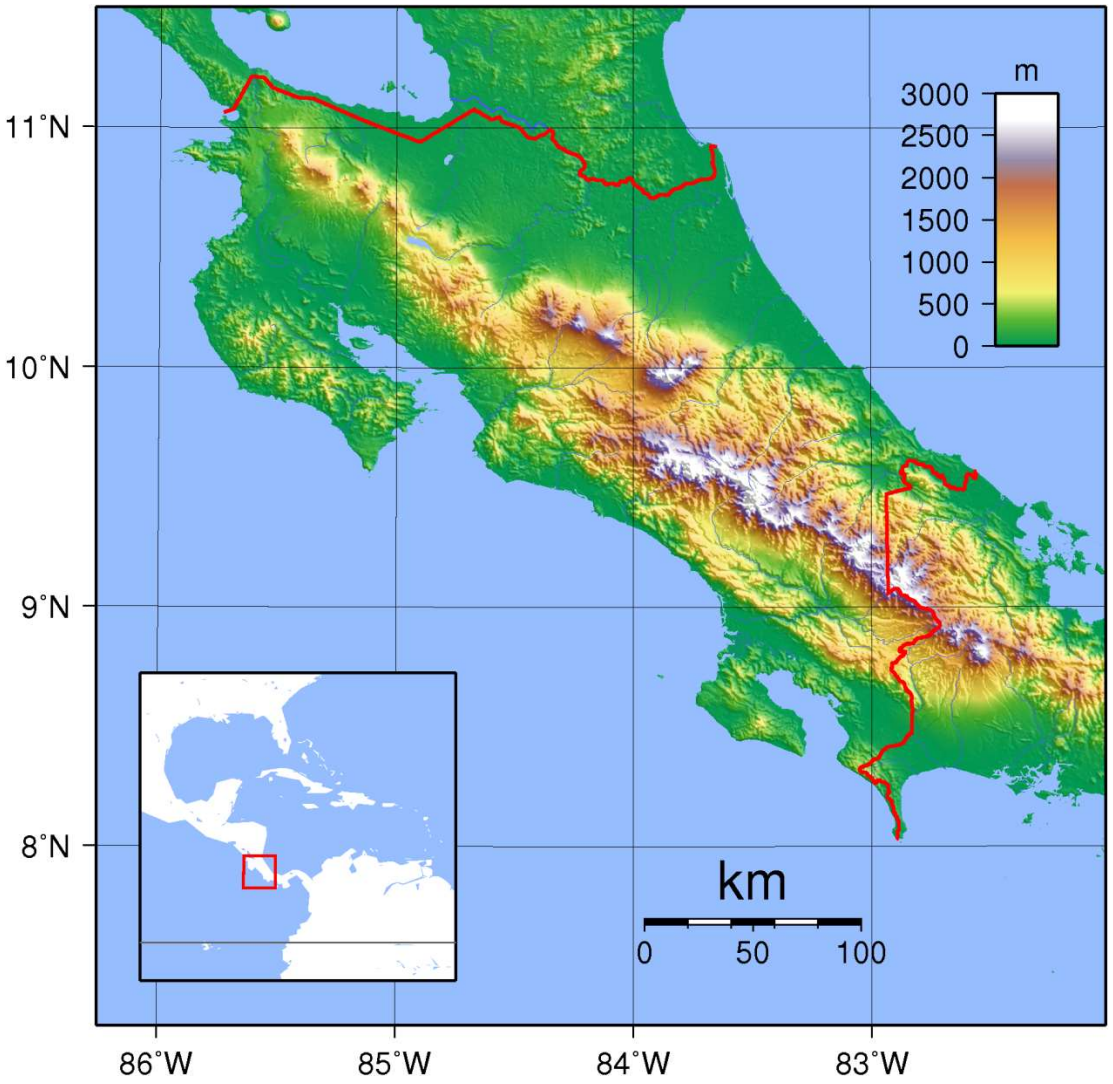

Bushnell
Camera Name 82℉27℃
07-13-2014 16:10:02

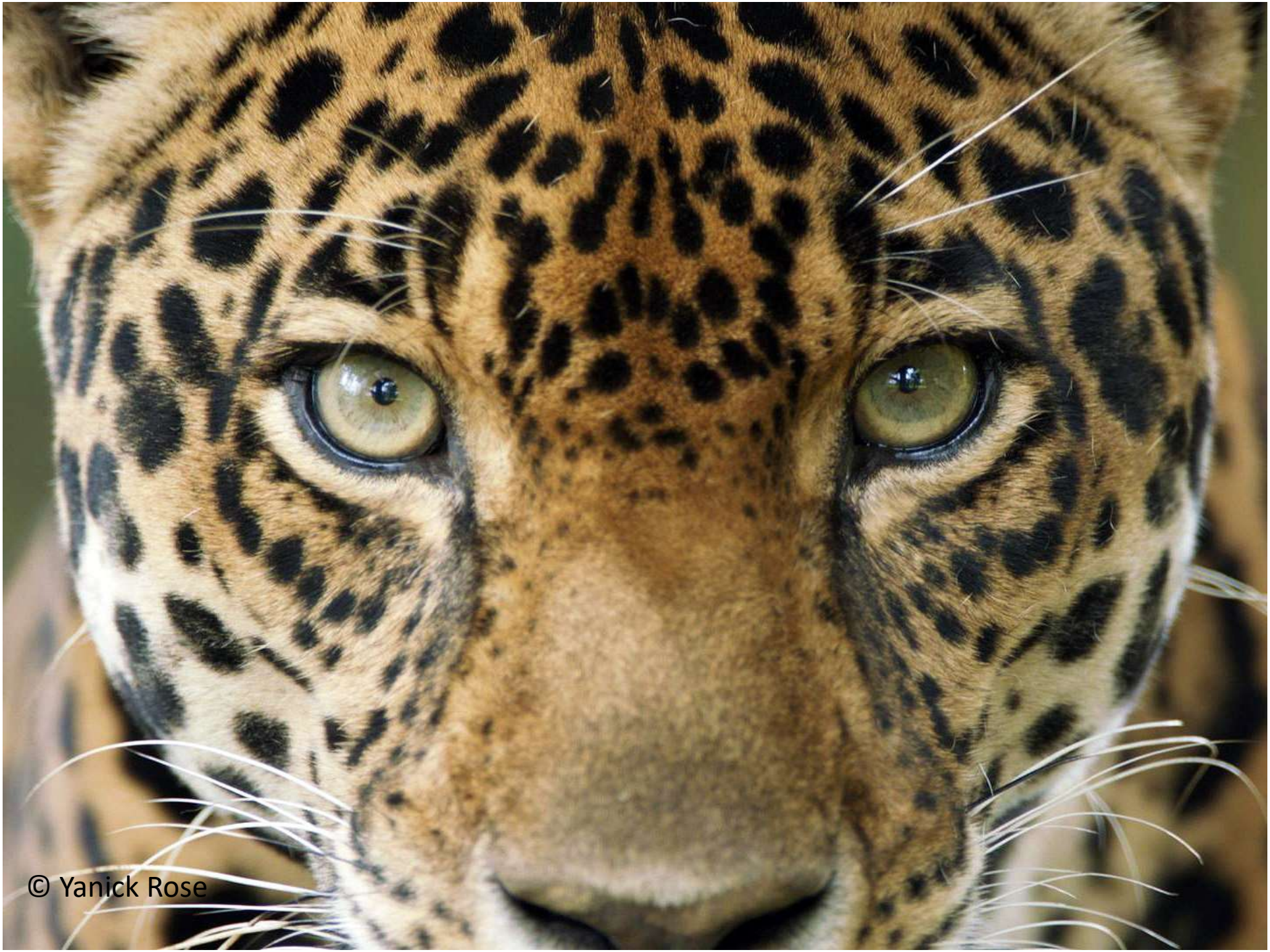
Jaguar and Mexican wolves in the SW: an example of corridors and barriers



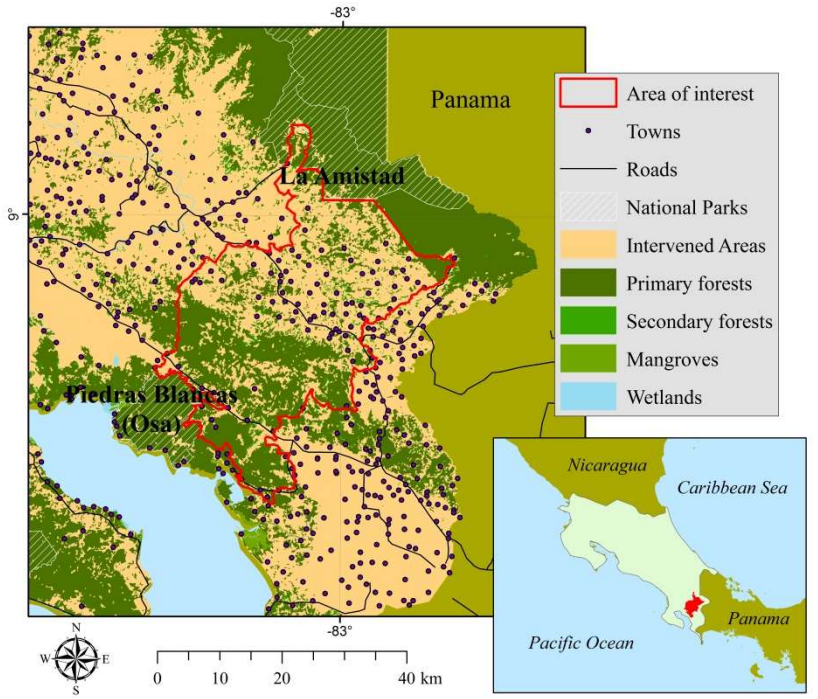


Costa Rica: reconnecting the mountains to the coastline




© Yanick Rose

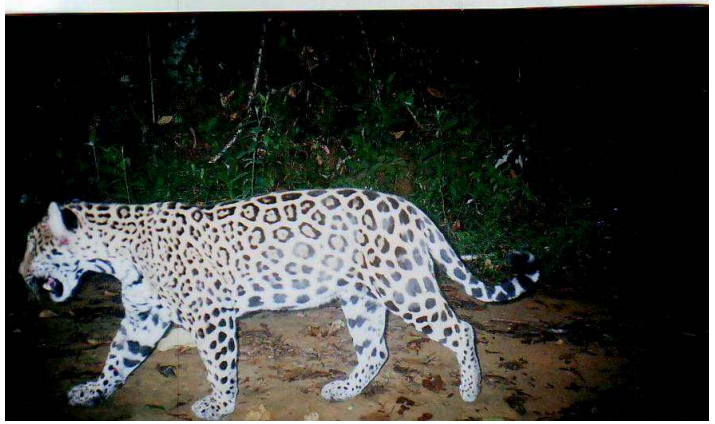
Jaguar corridor – working to study and implement the possibility of a jaguar corridor reconnecting the Talamanca Mts. with the Osa Peninsula



Tapir corridor – here we are implementing basic research and studying canopy connectivity across highways.

Jaguar Corridor

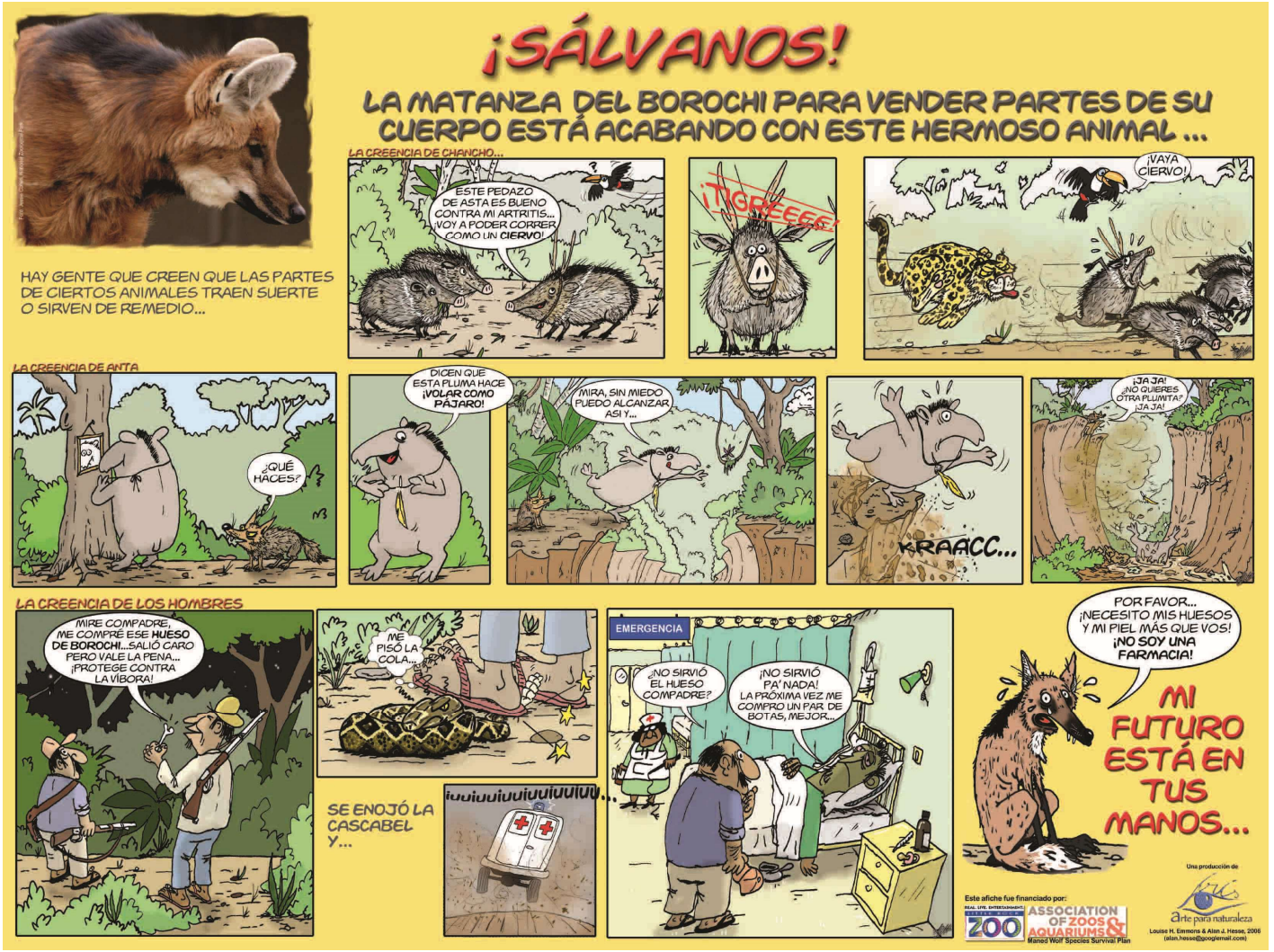
- 10 years of research now begin to inform a long term strategy for a corridor



Corridor: a human space

Environmental outreach and education is the future

Rebranding jaguar to remove negative associations



Canopy connectivity

- A major barrier to the dispersal of arboreal mammals is the connectivity of rainforest canopy trees. Most vulnerable are slow mammals such as sloth and tamadua, as well as reptiles, etc.

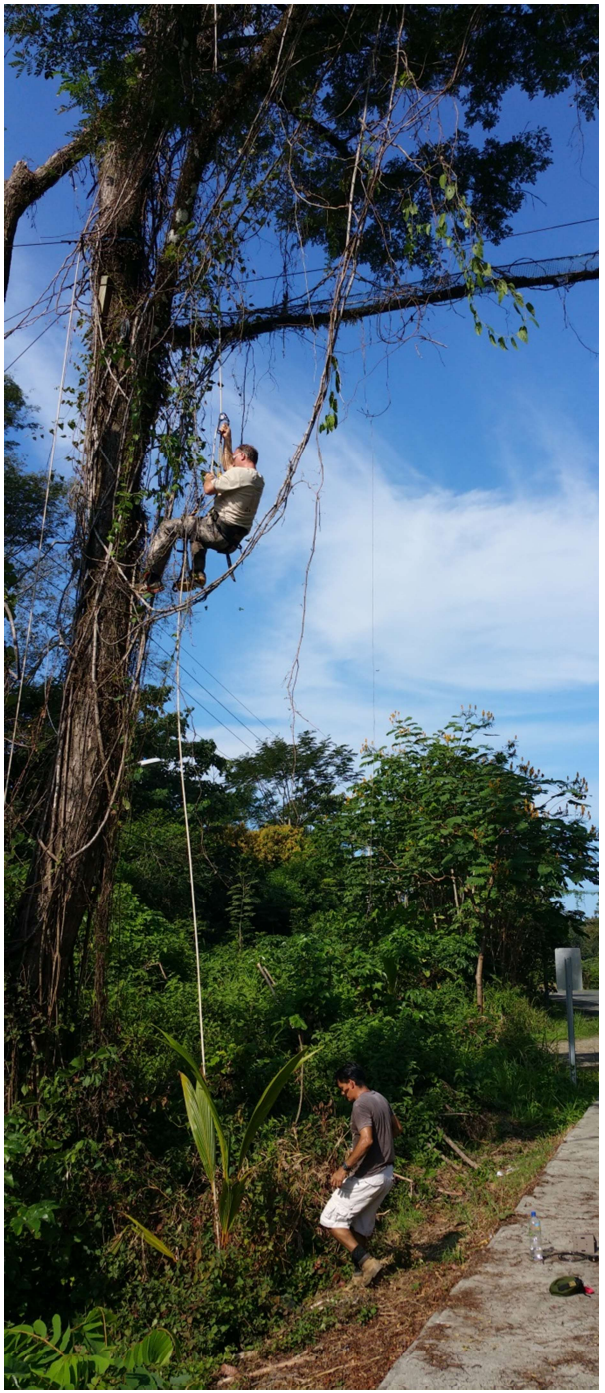
Canopy cables

- In June 2014 we initiated a wildlife survey of animals using canopy cables – as an opportunistic site to demonstrate proof of concept of arboreal camera-trapping.

Canopy walkways

- In January 2015 we used the techniques developed from the previous study to begin a project evaluating the use of man-made canopy walkways across the Pan-American highway (recently paved)

Opportunities to cross knowledge gaps and bridge opportunities

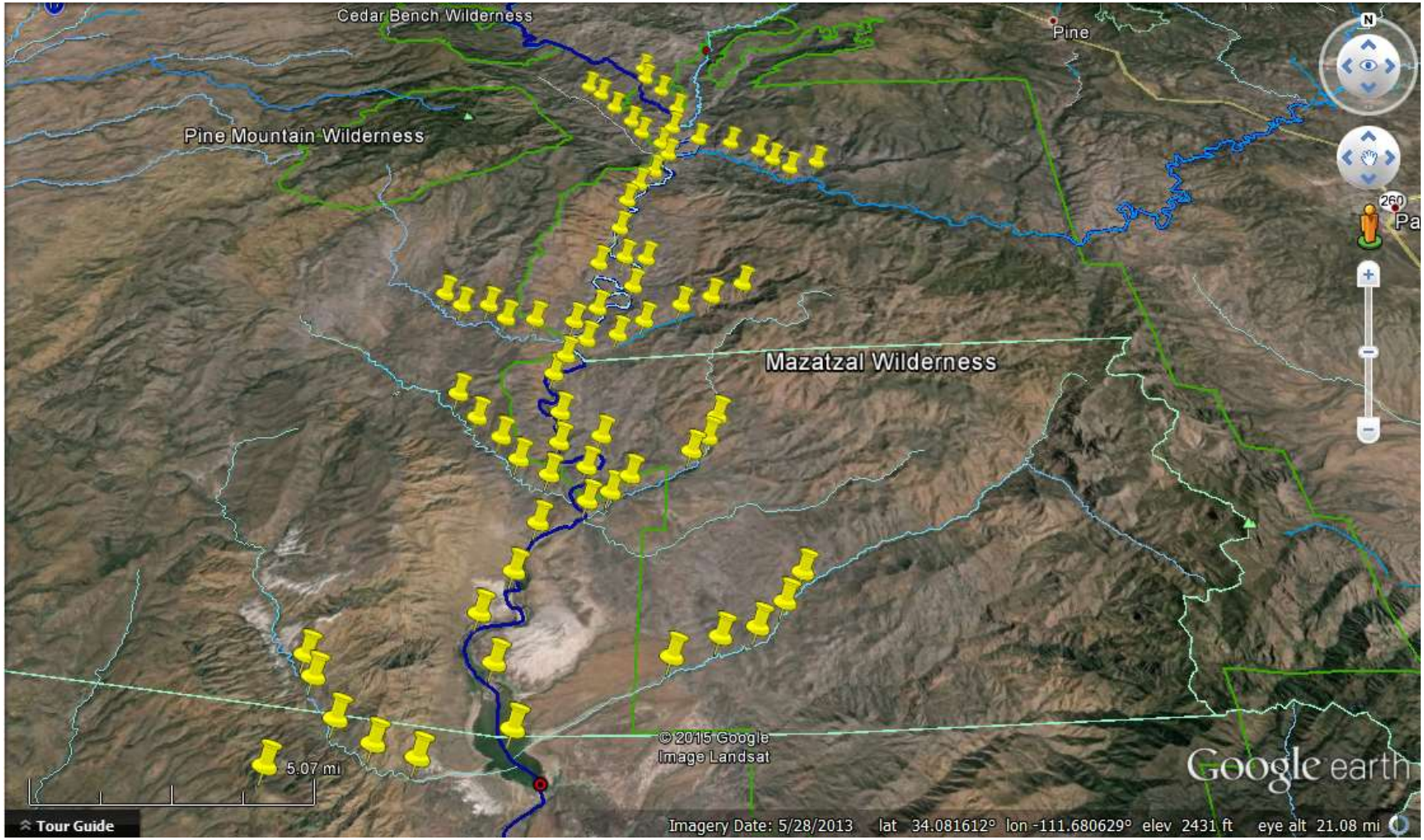


Verde Project: Wild water

Increasingly the decline of surface water is impacting species ability to occupy certain areas – especially during the dry season.

We are now initiating a project to evaluate how the presence and quality of water impacts species site occupancy – and use this to predict future impacts on populations and connectivity.

Preliminary study design (70 cameras across 3 stream system types)



Progress to date

We are currently in the process of implementing the Wild Water project – about half the cameras are out and in 2 weeks it will be up and running.

Verde River

Remote access strategies and extensive logistics are necessary to work in an area as large and difficult to access as Tonto National Forest.

How can YOU get more involved?

VOLUNTEER!

Volunteer

- The simplest way would be as a project volunteer, either come out in the “field” with us to experience field research or help with image sorting and analysis from the comfort of your home (with over a million images taken so far we always welcome help looking for animals).
- As volunteers get more training they will have more opportunities and given more responsibilities.

ASU Credit

- ASU students are able to get research credits to work within the partnership

20015-2016 Plans

- Verde River – trying to develop a longer term monitoring project and also looking across different lengths of the river.
- Blue Mountains – partnering with wolf reintroduction team to look at restoration of mammal communities following the return of the top predator.
- Chiricahua Corridor Project
- Costa Rica Jaguar Corridor

Come join us!!!

Thanks to all our students and volunteers!!!!