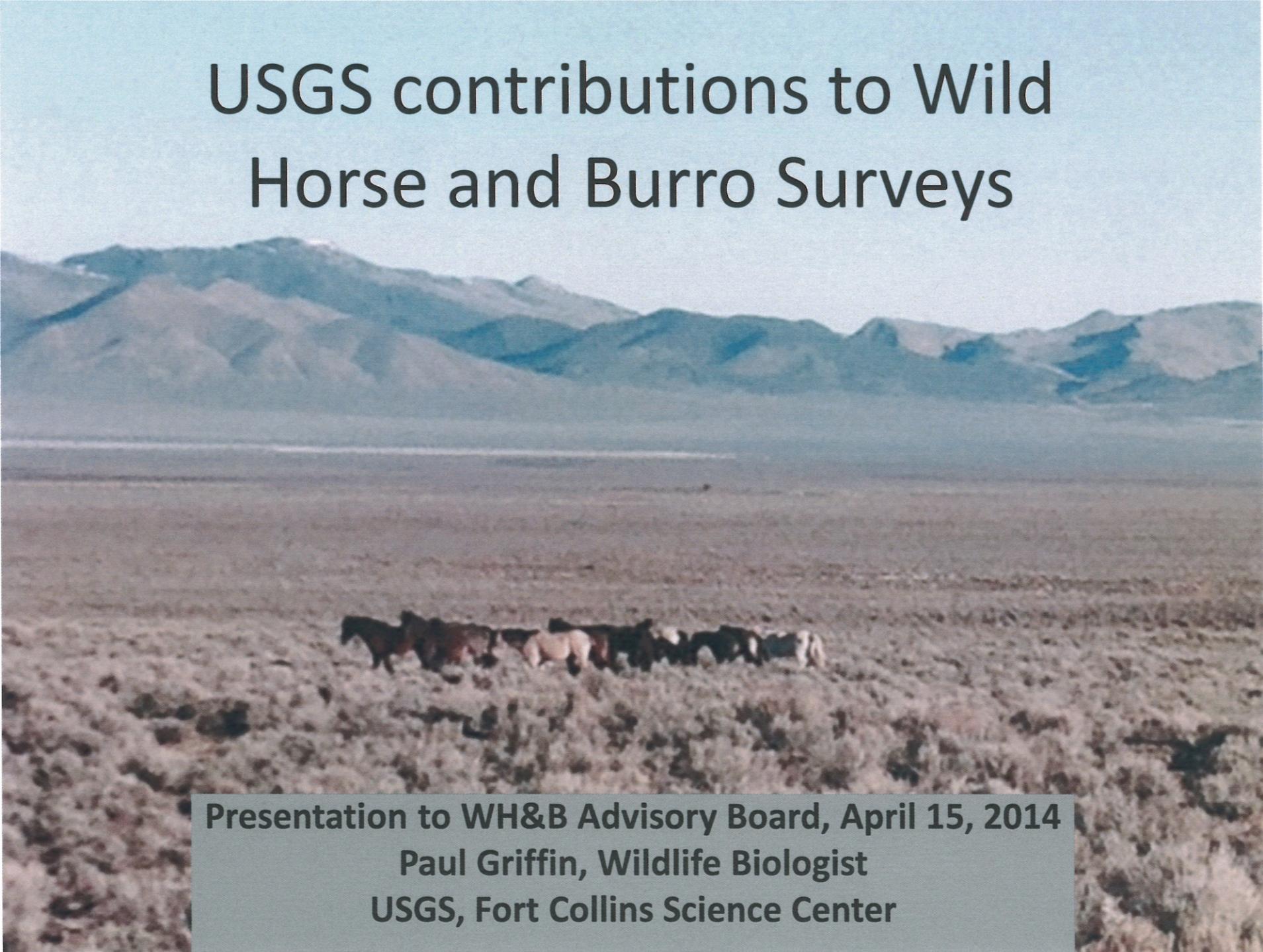


# USGS contributions to Wild Horse and Burro Surveys

A photograph of a herd of wild horses and burros grazing in a vast, open, arid landscape. The animals are in the foreground, scattered across a field of dry, scrubby vegetation. In the background, there are rolling hills and mountains under a clear blue sky. The overall scene is a typical representation of a wild horse and burro habitat.

**Presentation to WH&B Advisory Board, April 15, 2014**  
**Paul Griffin, Wildlife Biologist**  
**USGS, Fort Collins Science Center**

# Repeatable Methods and Accurate Estimates

1. Why the USGS is involved
2. National Academy report guidelines
3. The two approved methods for aerial survey
4. FY2014 surveys: What is the process now?
5. Upcoming USGS survey-related research

# 1. Why the US Geological Survey?

- Conducted WH&B research since 1993
- History of testing aerial survey methods
- Impartial, peer-reviewed process



# USGS & Wild Horses

Late 1990's - Expert committees convened

2000 - Dr. Francis Singer drafted the first Strategic Research Plan for wild horse work

2001 – PZP Field Trial Plan

2004 – Aerial Survey Work Plan

All USGS research to date was conducted using appropriated USGS funds (except the new SpayVac study and my position)



# Specific Tasks of BLM-USGS Agreement

- Train BLM in proper survey methods
- Develop survey training manual and work flow
- Help select method for each HMA or complex
- Work with the BLM-contracted statistician
- Help to develop other new methods for survey
- Help to develop database for survey data

\$ 450,000 for 2013-2016 technical assistance

\$263K Salary, \$65K Travel, \$122K Overhead

There is also a US Forest Service – USGS agreement



## 2014 Plans

### Training:

- Trained staff in OR, NV, UT, WY so far

### Surveys:

- 20 HMAs or HAs surveyed so far
- 86 HMAs or HAs planned for this year (5 ground count)

## 2. NAS Guidelines for Surveys

- Use methods that account for unseen animals  
(Estimate the true number of animals)
- Manage survey data for repeatable analysis and long-term access

also...

- Survey HMAs completely; go beyond if needed
- Survey HMAs in 'complexes' together
- Be consistent about survey timing

# Detection Bias: A Thorny Issue

#  
Horses

**DETECTION BIAS**

Horses Present

Horses Counted

Time



# Detection Bias: A Thorny Issue



# Accounting for Unseen Animals

Key ideas:

- Observe horse groups
- Estimate each 'seen' horse group's probability of detection, if the survey were repeated
- Correct for the estimated number of horse groups *like the ones observed* that did not get detected



## 3a. Simultaneous Double-Count

- Most useful where visibility is *fairly* good
- Best when there is a large number of observations that can be used in analysis
  - Observation data can be combined from many HMAs, and many years
- Method was validated for horses based on studies in CO, NV, UT, WY, and for burros based on studies in AZ

# 'Double-observer' data = Who Detected

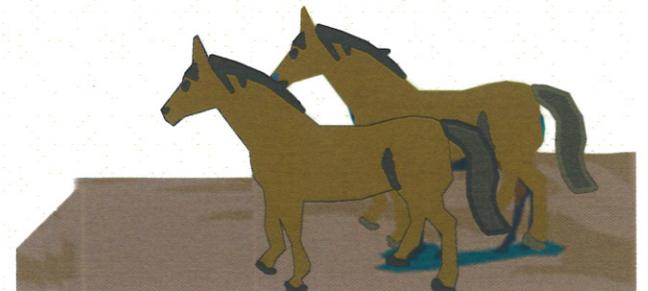
- Front = pilot and / or front seat observer
- Back = either back seat observer
- Front and Back search independently

Horse groups in the data were seen by

Front, or

Back, or

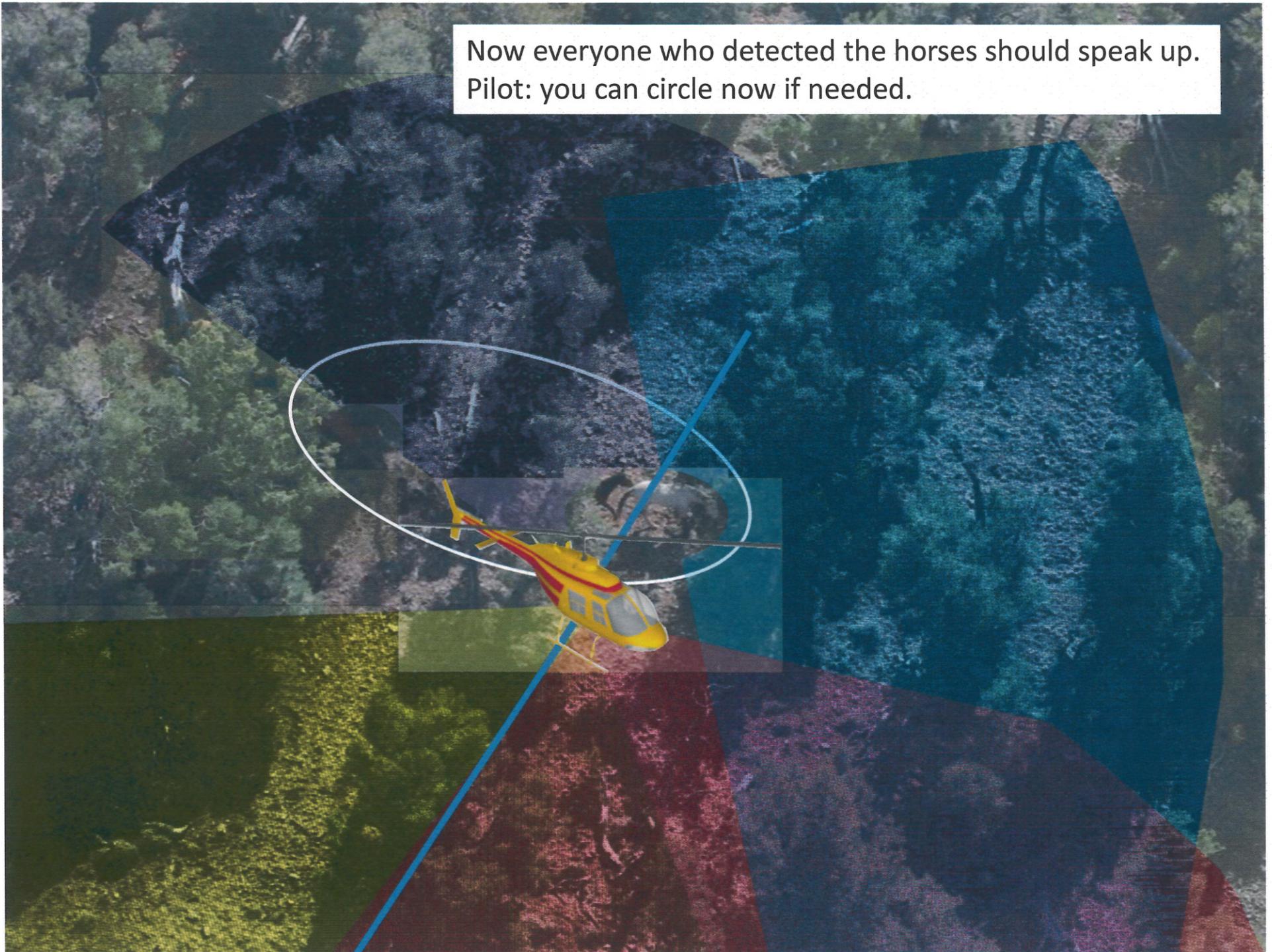
Front and Back



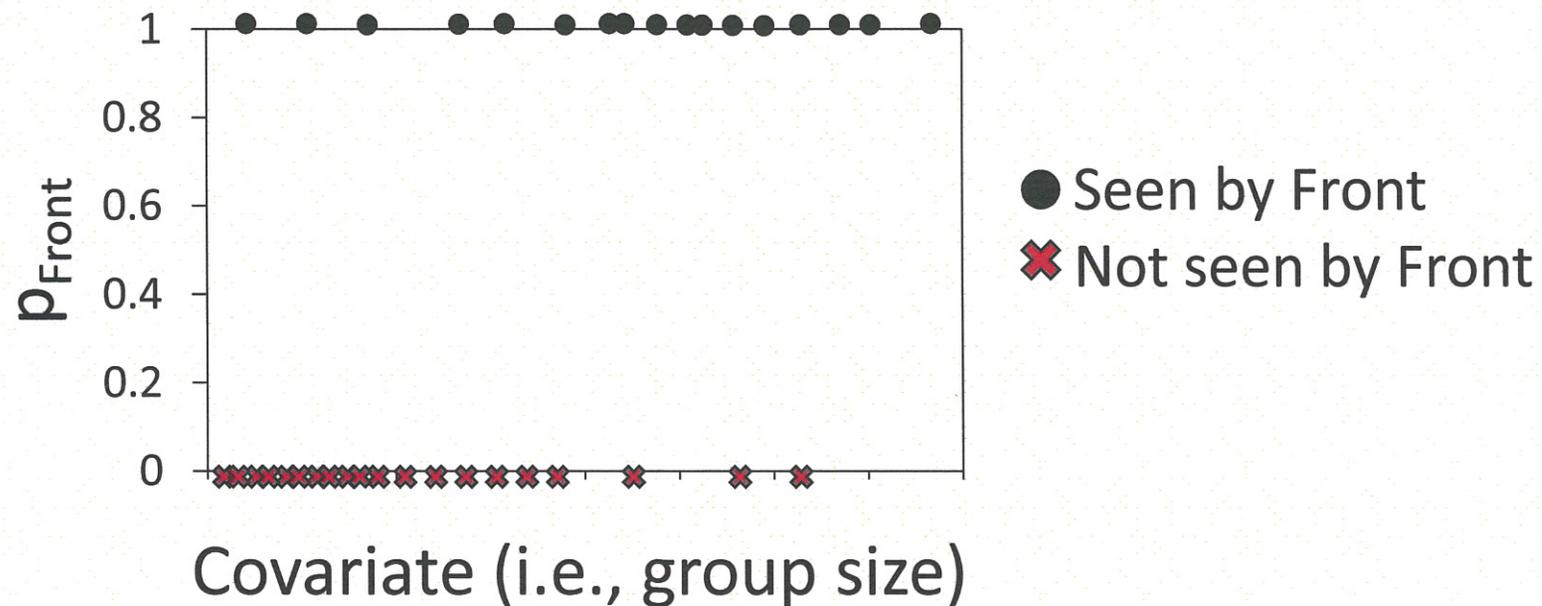
Too early for anyone to say anything.  
Pilot: keep flying straight.



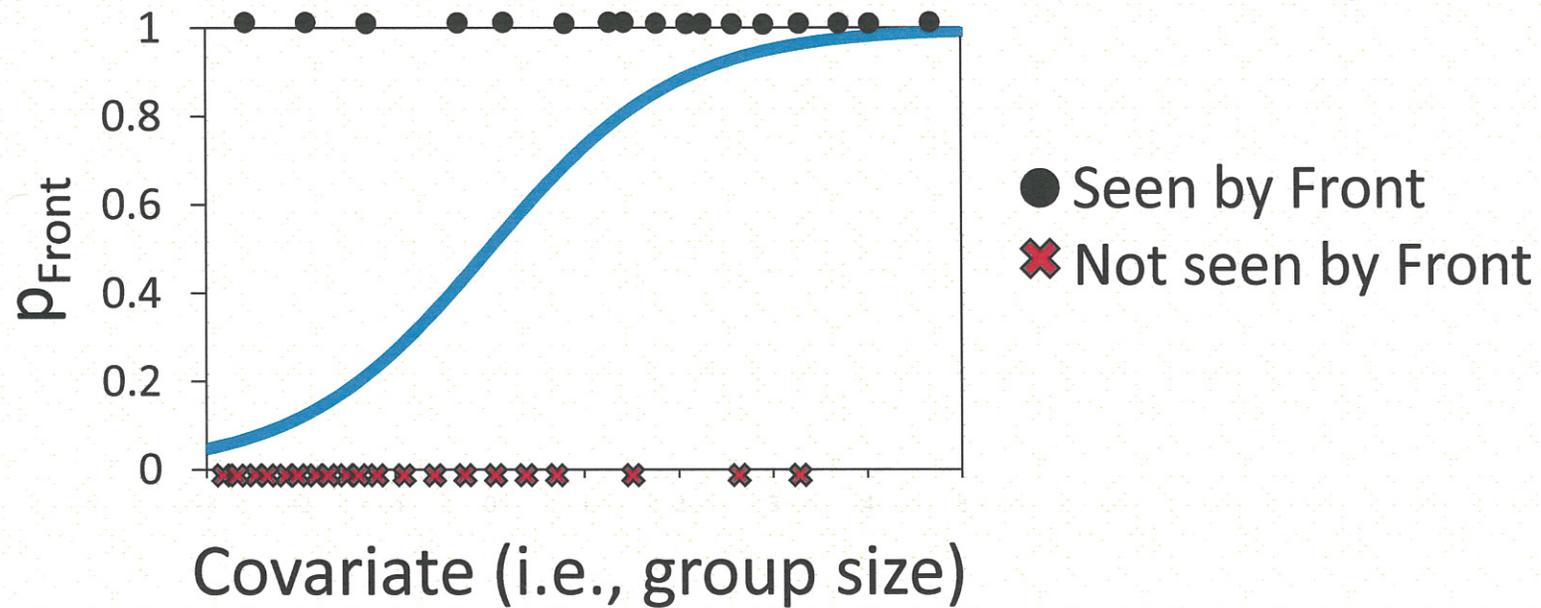
Now everyone who detected the horses should speak up.  
Pilot: you can circle now if needed.



Statistical models are used to estimate each observer's detection probability



Statistical models are used to estimate each observer's detection probability



Each group gets its own correction factor,  $\theta$ , based on its  $p^*$  overall detection probability

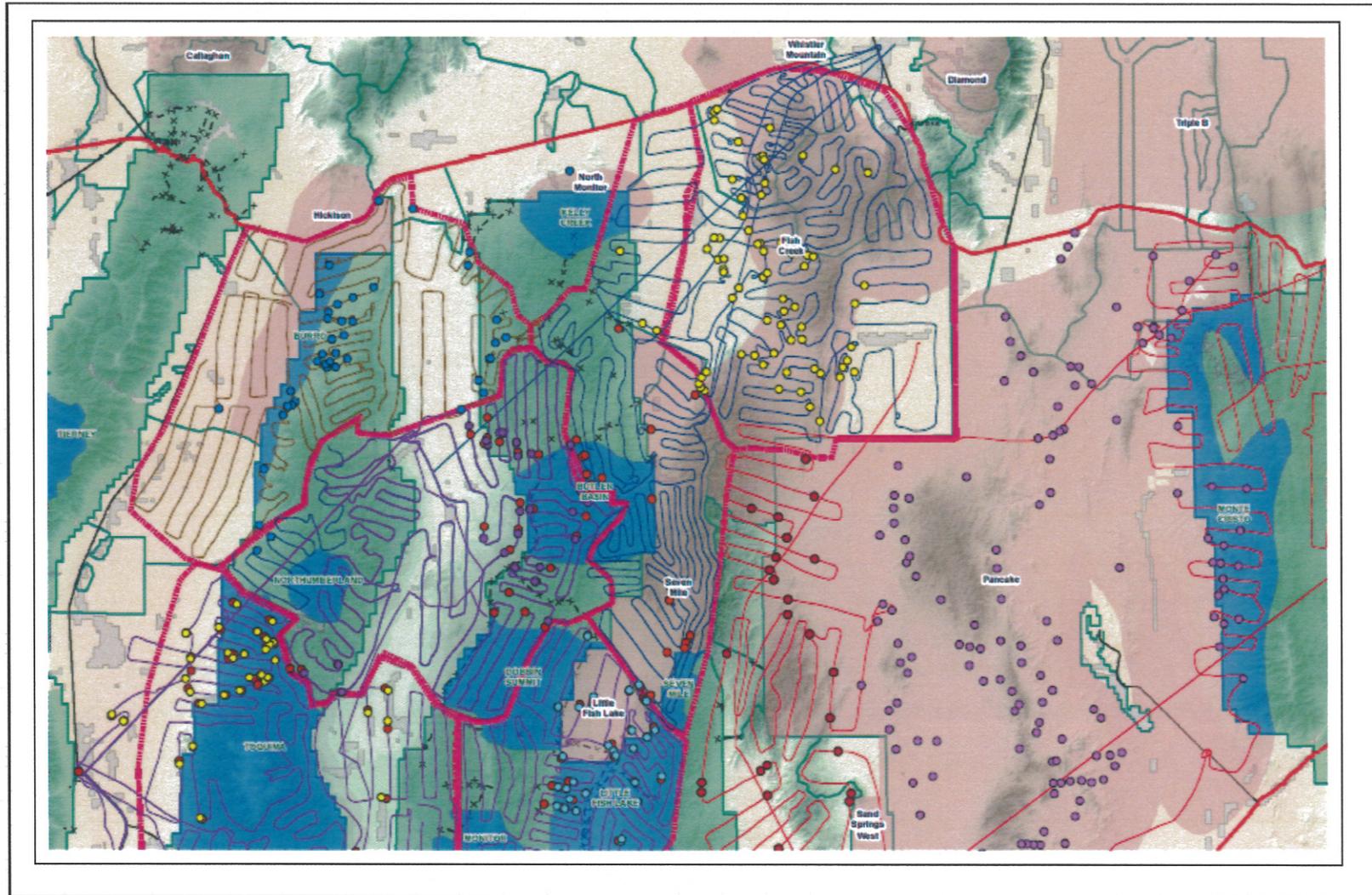
- Every group seen with probability  $p^*$  represents a total of  $(1 / p^*)$  animals
  - i.e., if there's a  $1/3$  chance of detecting a horse group, we conclude there were 3 such groups

$$p^* = 1/3 \quad (1/p^*) = 3$$

$$\left( \text{🐎🐎} \right) * 3 = \text{🐎🐎} + \text{🐎🐎} + \text{🐎🐎}$$

- The total population estimate comes from: all the animals detected, plus the unseen animals they represent

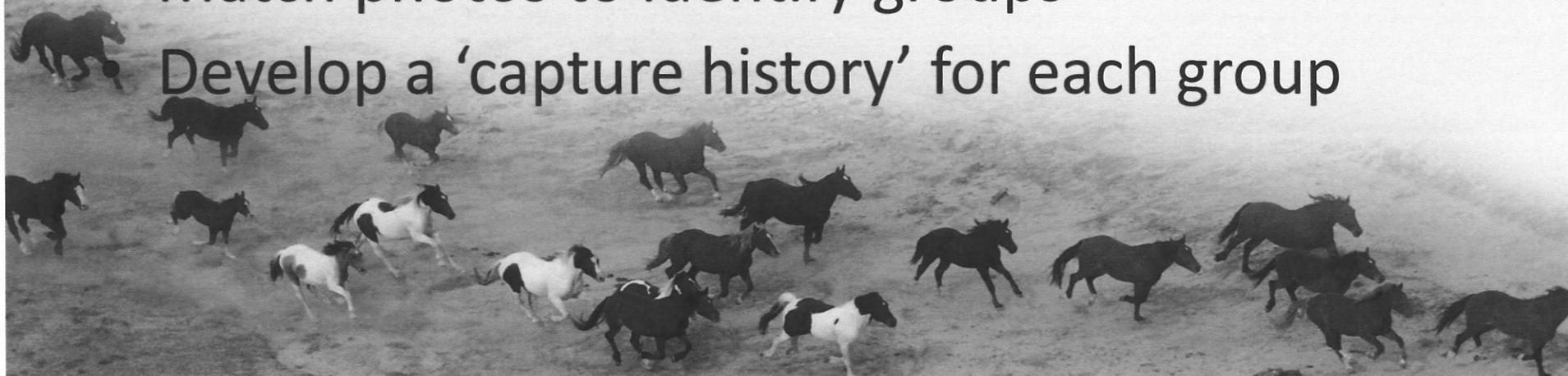
# Example flight lines; Battle Mountain 2014



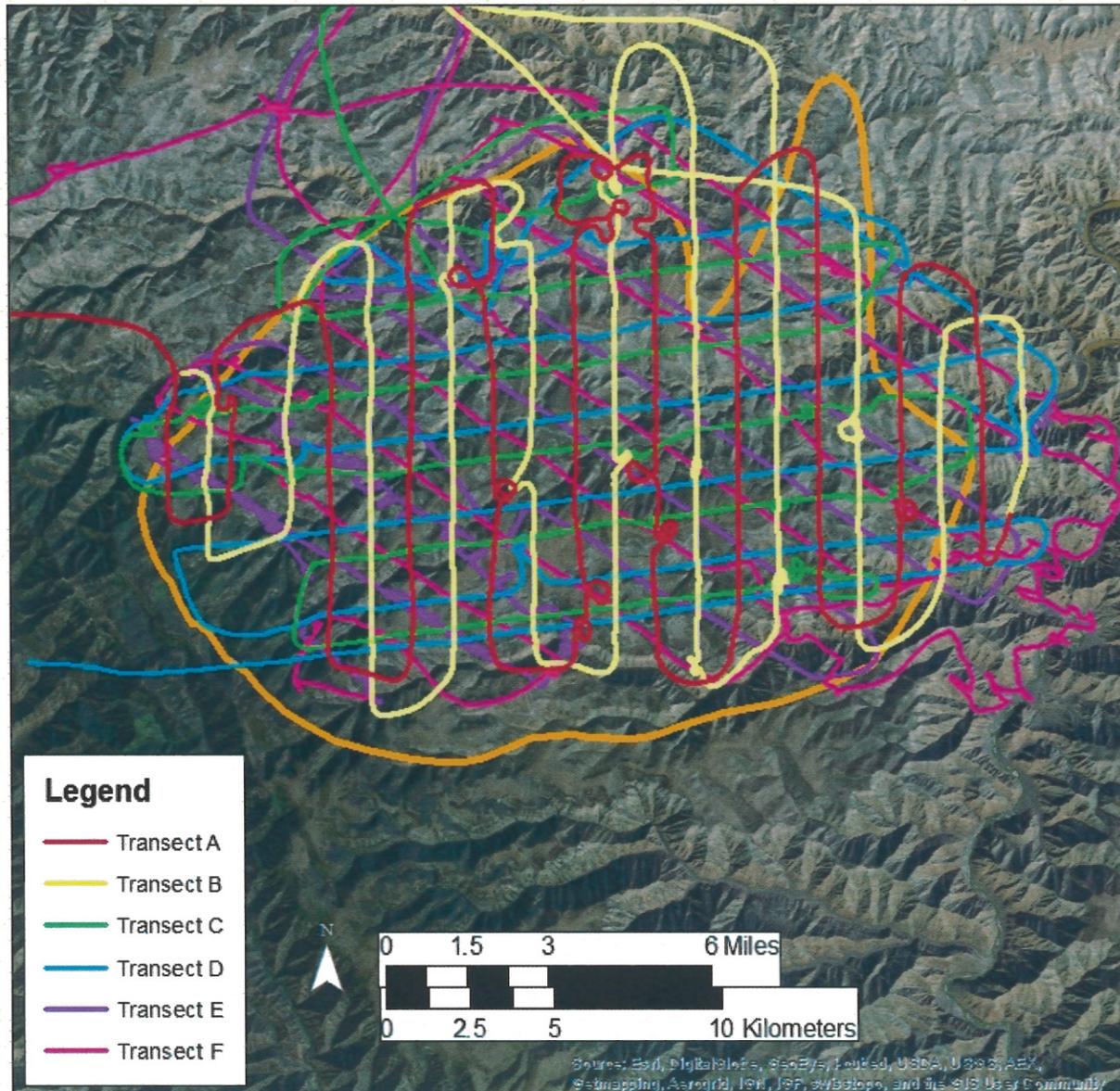
## 3b. Photo Mark-Resight

- Useful in *small* HMAs with lots of color variation
- More appropriate where visibility is low
- More costly than simultaneous double-count
- Survey the area 6 times in sets of transects
- Photograph each group seen
- Match photos to identify groups

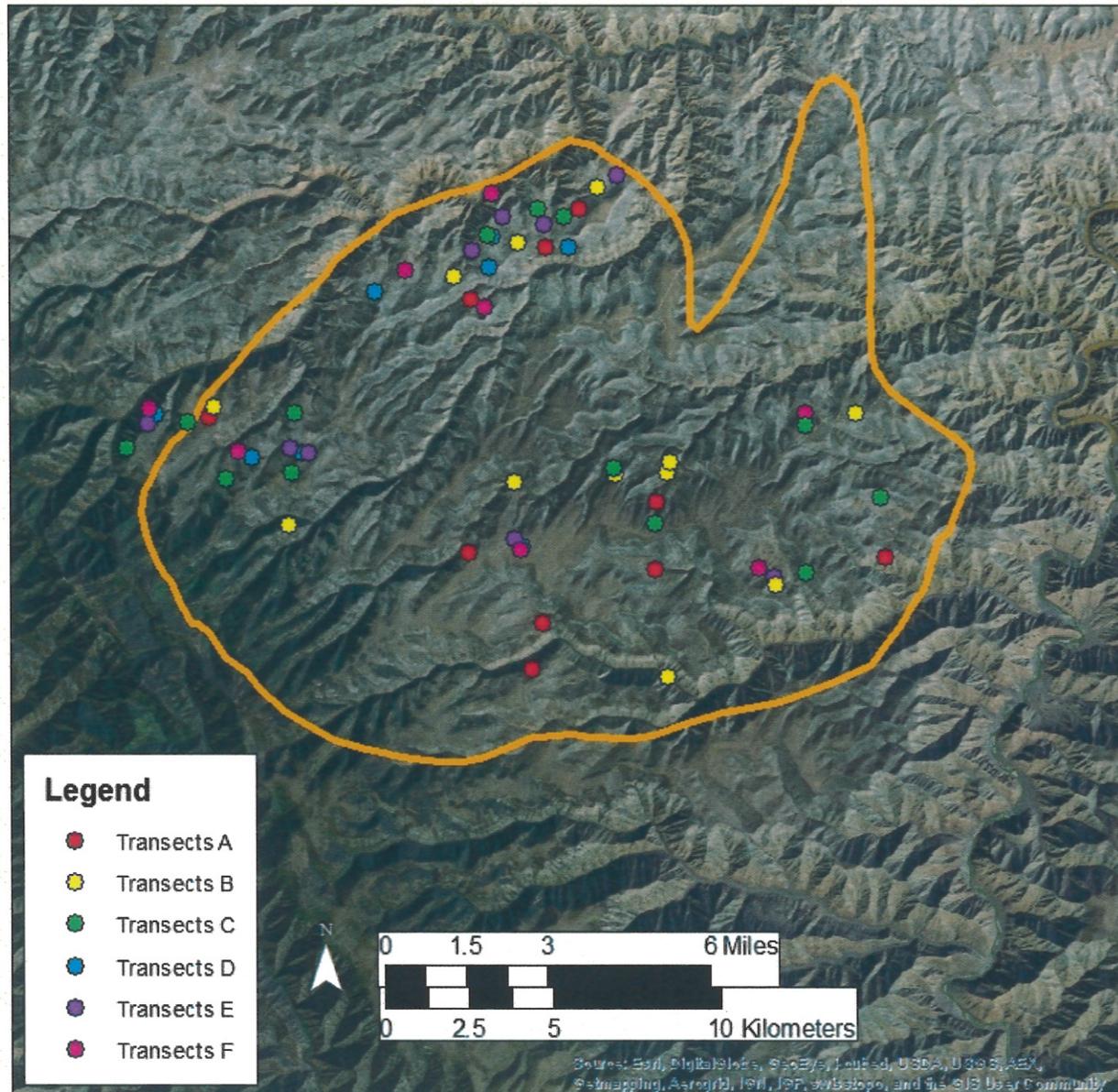
Develop a 'capture history' for each group



# Range Creek HMA, UT, 2013: Transects



# Range Creek HMA, UT, 2013: Detections



# Photo Mark-Resight Analysis

Group #	1 <sup>st</sup> Transects	2 <sup>nd</sup> Transects	3 <sup>rd</sup> Transects	4 <sup>th</sup> Transects	5 <sup>th</sup> Transects	6 <sup>th</sup> Transects
1	1	1	0	1	0	1
2	1	0	1	1	0	0
3	0	1	1	0	1	1
4	0	1	0	1	1	0
5	0	0	0	1	1	0

...and so on...

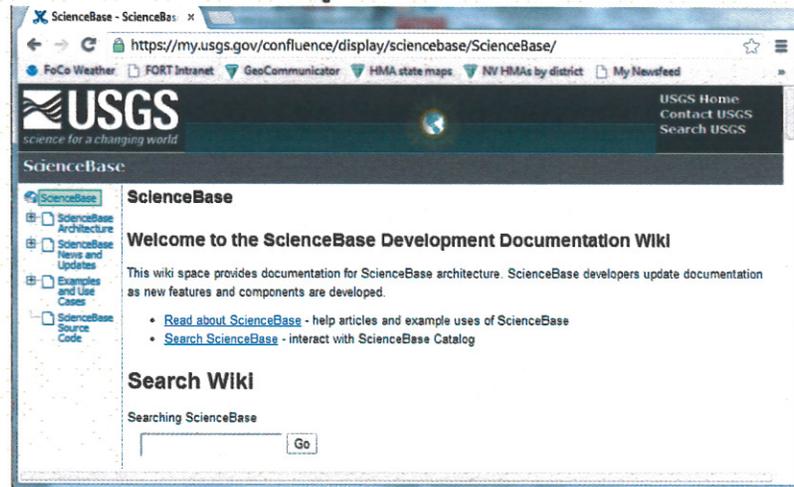
Based on the groups seen in each set of transects, we can estimate the detection rate per group. Then we can estimate the number of missed groups

## 4. The current work flow

- BLM contacts USGS about planning
- USGS trains observers for consistent methods
  - Checklists and SOPS for each survey
- BLM conducts surveys,
  - USGS helps with in-flight training, if needed
- BLM enters and verifies data
- USGS shepherds data to statistician
- Statistician estimates population size
- BLM and USGS store related files

# Data Management

- Supporting files are critical long-term records
  - GIS and GPS: Planned flight lines, Actual flight lines, Animal Locations
  - Observation file, Analysis files, Analysis Memo
- Storage in USGS ScienceBase, or eventually at the BLM National Operations Center



## 5. Developing more tools for population estimates

- Test GPS radio collar safety for horses
- Use 'stratified sampling' to reduce the area of unoccupied habitat that gets searched, to reduce costs
- Develop new survey techniques for burros
- Use DNA from dung to estimate population size, and potentially evaluate herd genetic structure
- Develop new method to measure distance from aircraft to observed group
- Re-examine Forward-Looking Infrared? Drones?