



U.S. Department of the Interior
Bureau of Land Management

Panel: Drought, Wild Horses and Burros

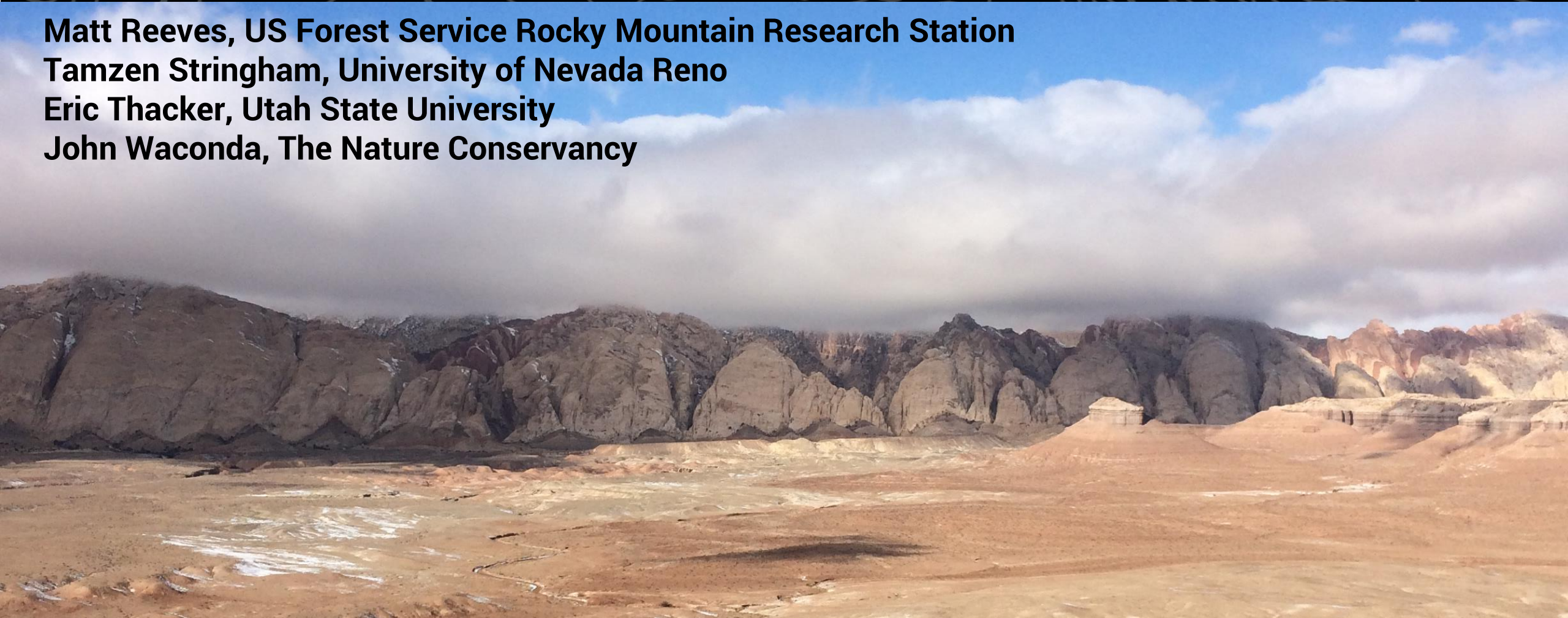
2023 National Wild Horse and Burro Advisory Board Meeting – Reno, Nevada

Matt Reeves, US Forest Service Rocky Mountain Research Station

Tamzen Stringham, University of Nevada Reno

Eric Thacker, Utah State University

John Waconda, The Nature Conservancy





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WH&B Program Population Modeling

2023 National Wild Horse and Burro Advisory Board Meeting – Reno, Nevada

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Wild Horse and Burro Program





Modeling concepts

Model Structure

- Which independent variables are included, to make predictions about dependent variables?

Accuracy

- Estimated values – i.e., for current conditions
- Expected values – i.e., for future conditions

Precision

- What is the range of likely values? (i.e., confidence intervals)



Herd size estimation: Aerial surveys

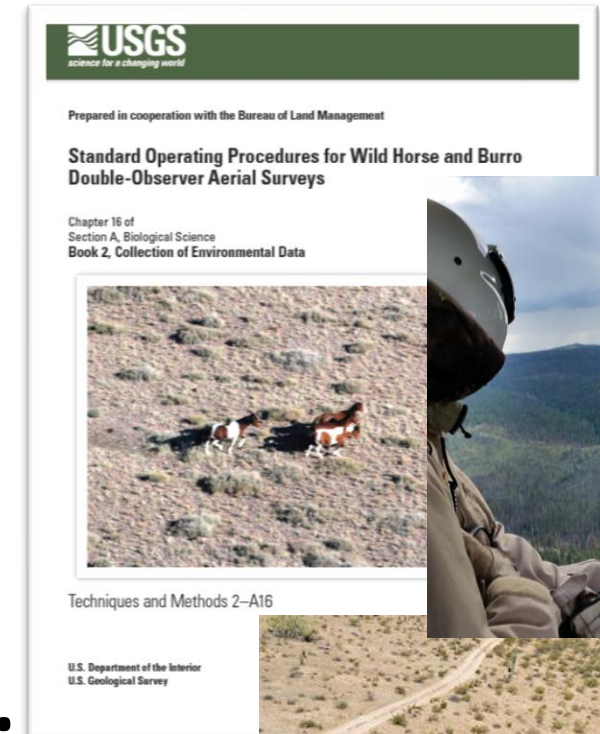
Simultaneous double-observer surveys

Model structure is determined from:

- Which observers detect each group
- Covariates for each group
(group size, distance from helicopter, % cover, etc.)

The total population estimate comes from:

- All the animals detected (seen) on the survey
- *PLUS* the unseen animals they represent,
based on a group specific correction factor

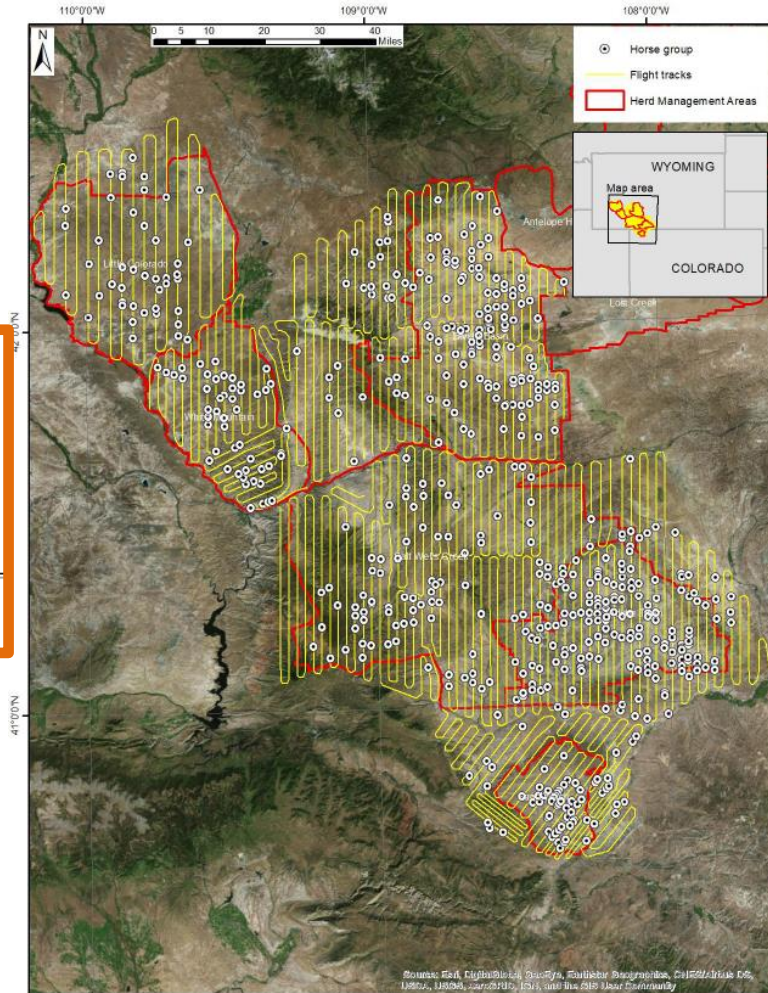




Herd size estimation: Aerial surveys (2)

Estimates include measures of precision

Area	Age Class	Estimate (No. Horses)	LCL ^a	UCL	Std Err	CV	No. Horses Seen	% Missed
Sand Wash Basin HMA	Total	441	393	494	31.1	7	393	10.9
	Foals	8	7	11	1.8	22.9	7	
	Adults	433	386	483	30.2	7	386	





Annual Herd size estimates

Based on recent surveys,
and growth rate estimates

Standard Operating Procedure 7

Principles for Projecting Population Size

Approximating the Annual Growth Rate, lambda (λ)

$$\hat{\lambda} = \sqrt[x]{\frac{\hat{N}_{t+x}}{\hat{N}_t}}$$

$\hat{\lambda}$ is the annual growth rate estimate,
 \hat{N} is an estimate of abundance, and
 t is the year.

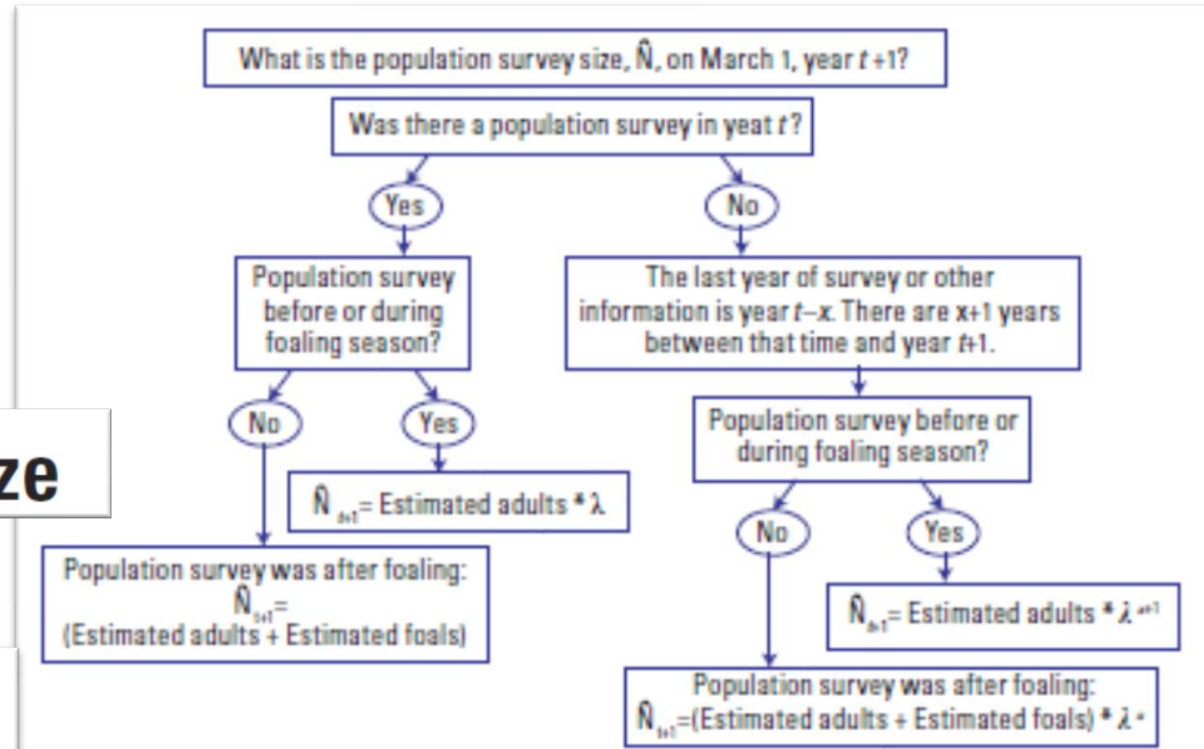


Figure 21. Projecting population size for wild horses and burros using a flow chart that diagrams the choices made in to determine the estimated abundance, \hat{N} , on March 1, of year $t+1$, for herds with no recent gather. Choices about whether to multiply an abundance estimate from year t by the annual growth rate, λ , depend on whether the survey or other information source was at a time of year after the great majority of foaling was expected to have already taken place (that is, after August 31). (\hat{N} , estimate of abundance; λ , annual growth rate; t , year)



Simple demographic rates: insights

Annual herd growth of 15% - 25%

- **Consistent with observations, and demographic models**
 - ~60+% of mares foal every year
 - Foal survival is often 80+%
 - Mare survival is usually 90+%

To have no net growth: foaling rates must be *about* %15.
That means, about 75% of mares infertile every year.

Percent infertile depends on:

- Number of mares treated, and the duration of effect



Horse herd & cost projections: **PopEquus**

Publicly available: rconnect.usgs.gov/popequus/

Age & stage-based matrix model

User can select management alternatives

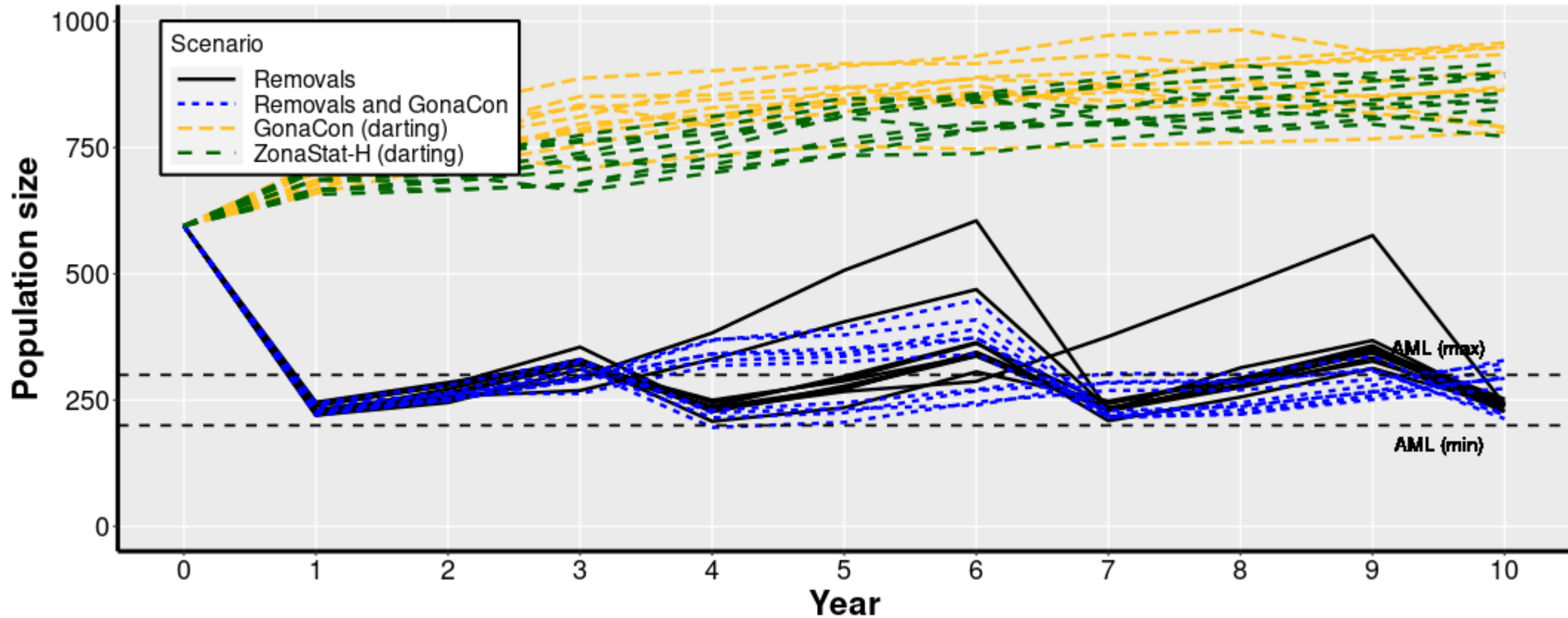
User can tailor inputs for specific herds

Model projects herd size, numbers removed, treated, and costs

Intended for single herds / complexes



Hypothetical HMA



Alternative	# Gathered	# Removed	# Treated	On-range cost (\$M)	Off-range cost (\$M)
Removals	1181	834	0	1.0	5.95
Removals + GonaCon	1148	596	290	1.04	4.33
GonaCon (darting) 0	0	0	2967	0.89	0
ZonaStat-H (darting)	0	0	2821	0.92	0



PopEquus projection model; insights

Longer-lasting fertility control methods → fewer handling occasions needed

What relative effort in fertility control vs. removals leads to reaching and staying at AML?

- Depends on your starting herd size, compared to AML

Ratio of Removals to Fertility control treatments, with respect to starting % of AML

