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
WH&B Program Population Modeling
2023 National Wild Horse and Burro Advisory Board Meeting – Reno, Nevada

Paul Griffin, Research Coordinator
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

Estimates include measures of precision

<table>
<thead>
<tr>
<th>Area</th>
<th>Age Class</th>
<th>Estimate (No. Horses)</th>
<th>LCL</th>
<th>UCL</th>
<th>Std Err</th>
<th>CV</th>
<th>No. Horses Seen</th>
<th>% Missed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand Wash Basin HMA</td>
<td>Total</td>
<td>441</td>
<td>393</td>
<td>494</td>
<td>31.1</td>
<td>7</td>
<td>393</td>
<td>10.9</td>
</tr>
<tr>
<td></td>
<td>Foals</td>
<td>8</td>
<td>7</td>
<td>11</td>
<td>1.8</td>
<td>22.9</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adults</td>
<td>433</td>
<td>386</td>
<td>483</td>
<td>30.2</td>
<td>7</td>
<td>386</td>
<td></td>
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</table>
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 (\(\lambda\))

\[
\hat{\lambda} = \sqrt[2]{\frac{\hat{N}_{t+x}}{\hat{N}_t}}
\]

\(\hat{\lambda}\) is the annual growth rate estimate, \(\hat{N}\) is an estimate of abundance, and \(t\) is the year.
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*
<table>
<thead>
<tr>
<th>Alternative</th>
<th># Gathered</th>
<th># Removed</th>
<th># Treated</th>
<th>On-range cost ($M)</th>
<th>Off-range cost ($M)</th>
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</thead>
<tbody>
<tr>
<td>Removals</td>
<td>1181</td>
<td>834</td>
<td>0</td>
<td>1.0</td>
<td>5.95</td>
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<td>Removals + GonaCon</td>
<td>1148</td>
<td>596</td>
<td>290</td>
<td>1.04</td>
<td>4.33</td>
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<tr>
<td>GonaCon (darting)</td>
<td>0</td>
<td>0</td>
<td>2967</td>
<td>0.89</td>
<td>0</td>
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<tr>
<td>ZonaStat-H (darting)</td>
<td>0</td>
<td>0</td>
<td>2821</td>
<td>0.92</td>
<td>0</td>
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</tbody>
</table>
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