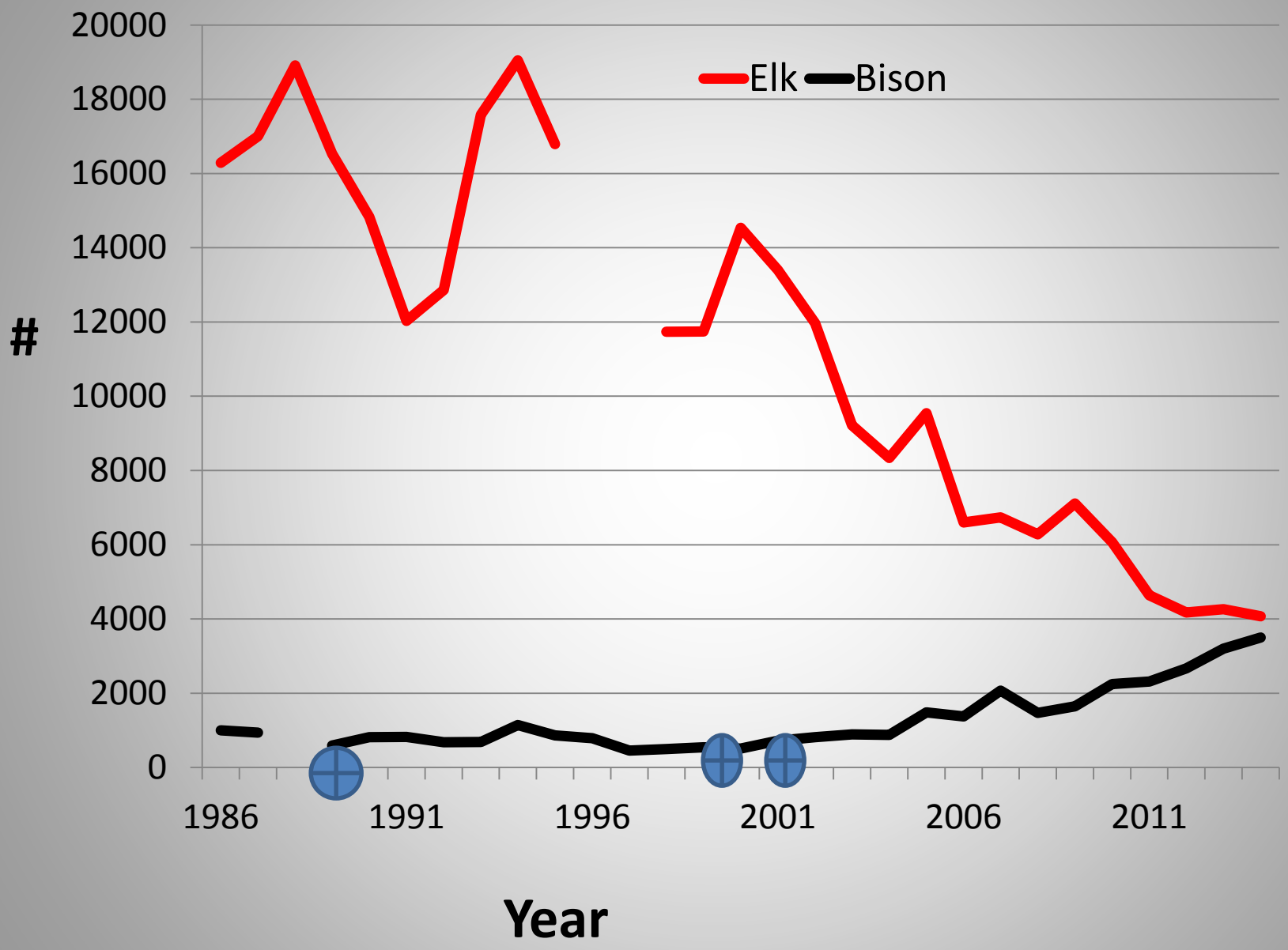
The Role Bison Play in Shaping Plant Communities

Objectives

Consumption rates on the summer range

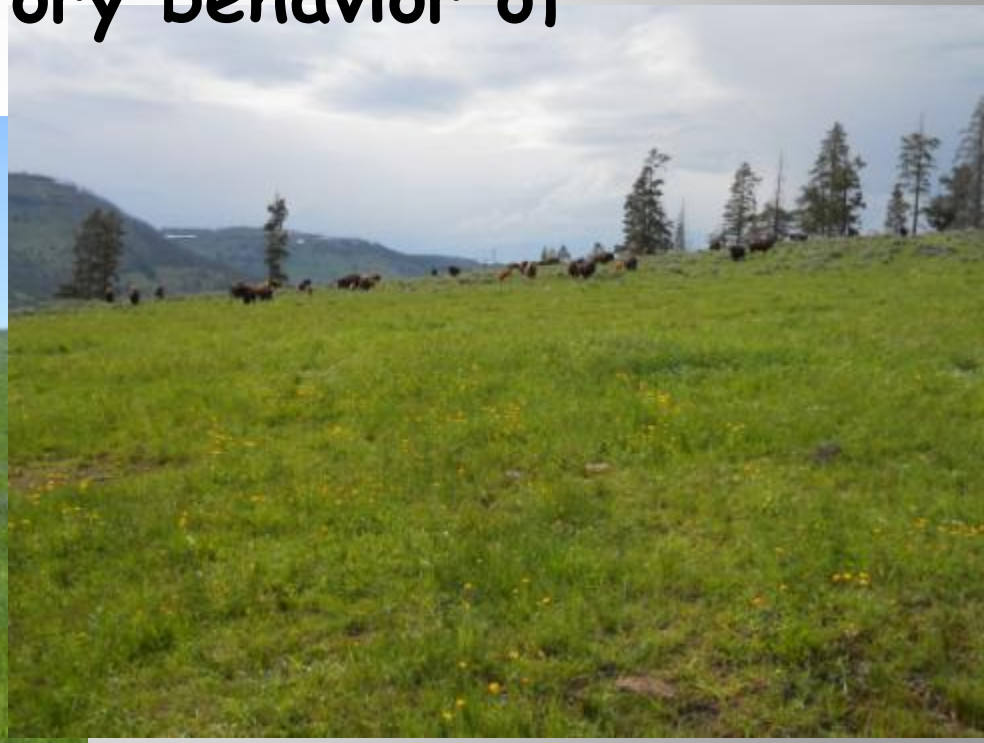
Response in Forage quality at grazed areas

The system has changed from elk being the dominant grazer to a system with bison now being the dominant grazer


20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
#
Elk
Bison
1986
1991
1996
2001
2006
2011
Year

Above ground productivity was 47% greater on grazed plots compared to ungrazed plots

Stimulation of above ground production is likely due to the migratory behavior of the ungulate grazers



Frank and McNaughton 1993

1980's to mid 1990's…Grazers increase plant productivity and nitrogen availability and reduce nitrogen loss from the soil

Late 1990's in to early 2000's…The enhanced effects from grazers wane

Today … Now what is happening

Frank and Evans 1997
Frank, Groffman, Evans and Tracy 1999
Frank, Kuns and Guido 2002

Methods

Measure Plant Production within and outside of grazing exclosures

Methods

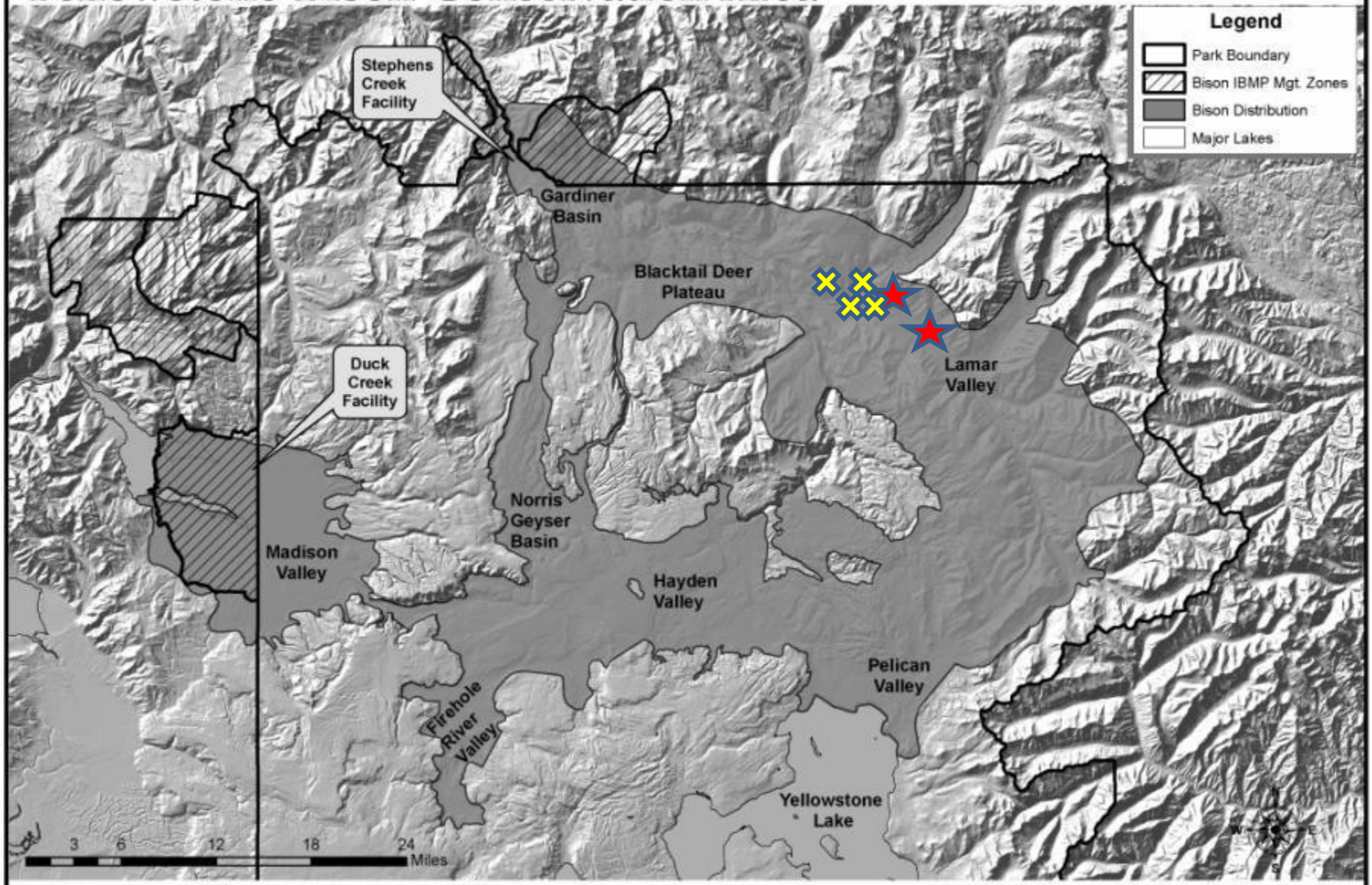
Ungrazed areas
Grazed one month
Grazed two months
Grazed all season

Hand clipped study plots within a large exclosure to simulate the influence of grazing

Yellowstone National Park
Wyoming - Montana - Idaho

National Park Service
U.S. Department of the Interior

Yellowstone Bison Conservation Area



Produced by the Yellowstone Spatial Analysis Center 307-344-2246

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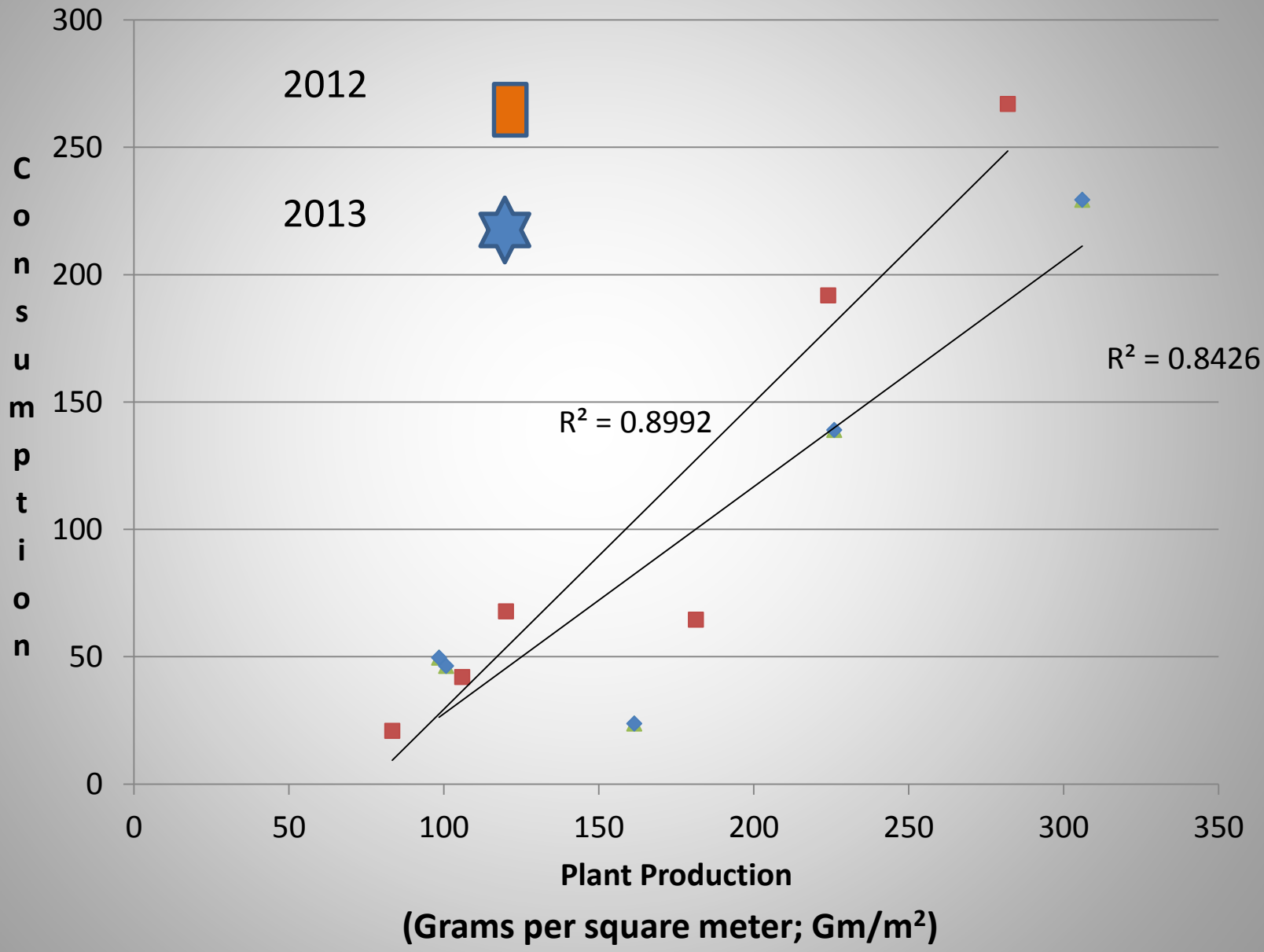
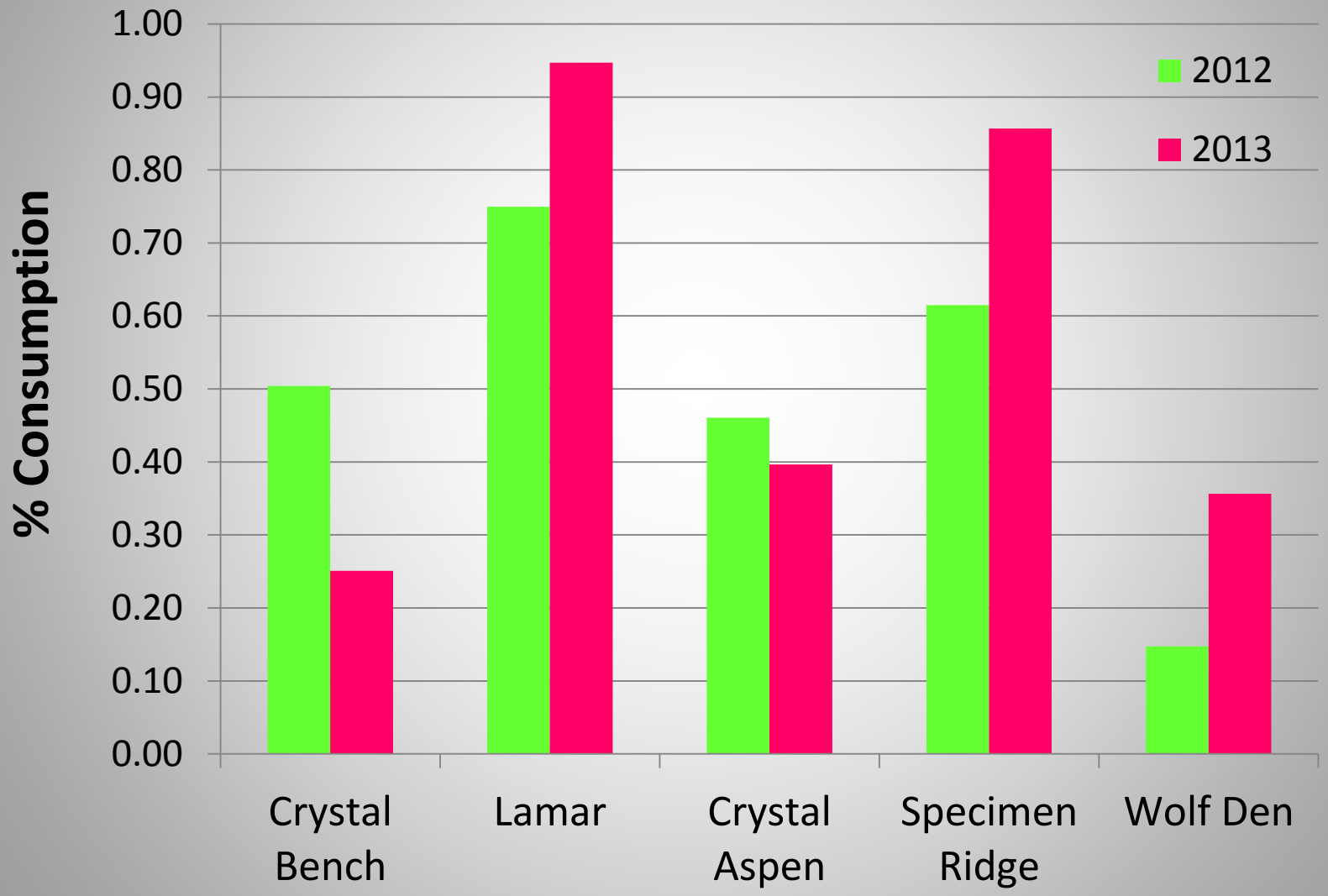
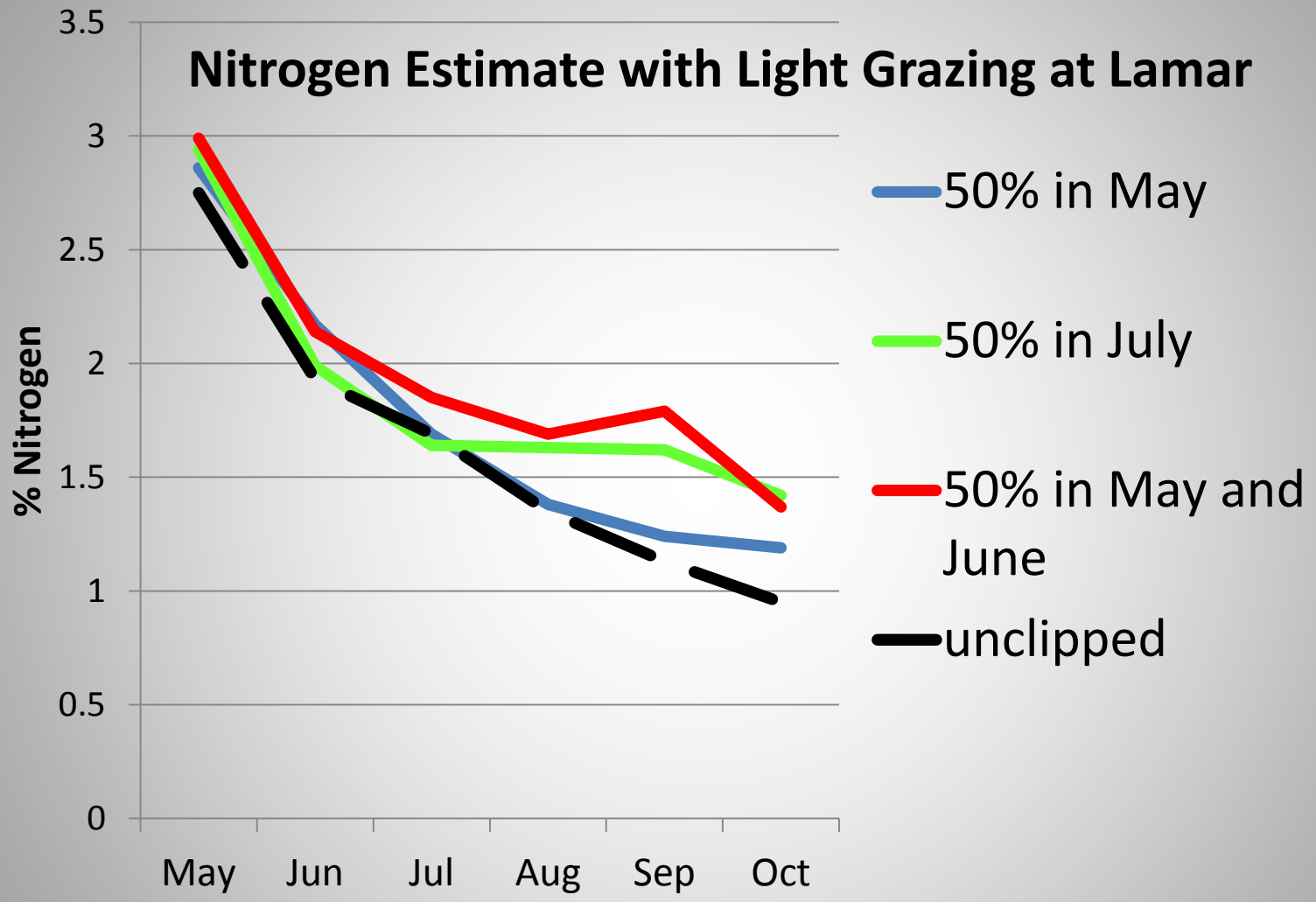
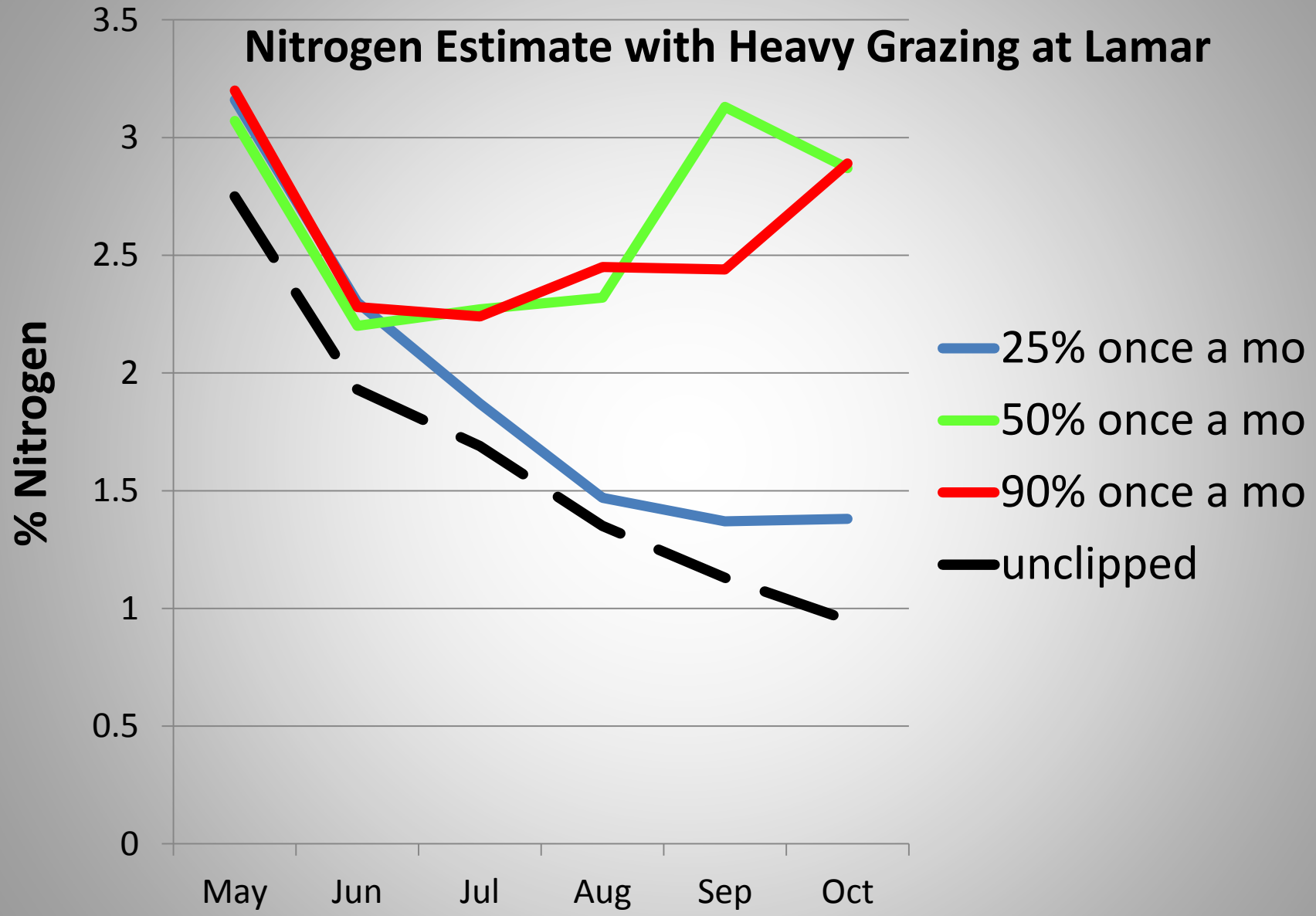
FILE: S:/smiller/Projects_2008/Rick_Wallen/ArcMap_Projects/Yell_bison_conservation_area_landscape.mxd


300
250
200
150
100
50
0
Consumption
2012
2013
R² = 0.8992
R² = 0.8426
0
50
100
150
200
250
300
350
Plant Production
(Grams per square meter; Gm/m²)

Consumption rates at study sites

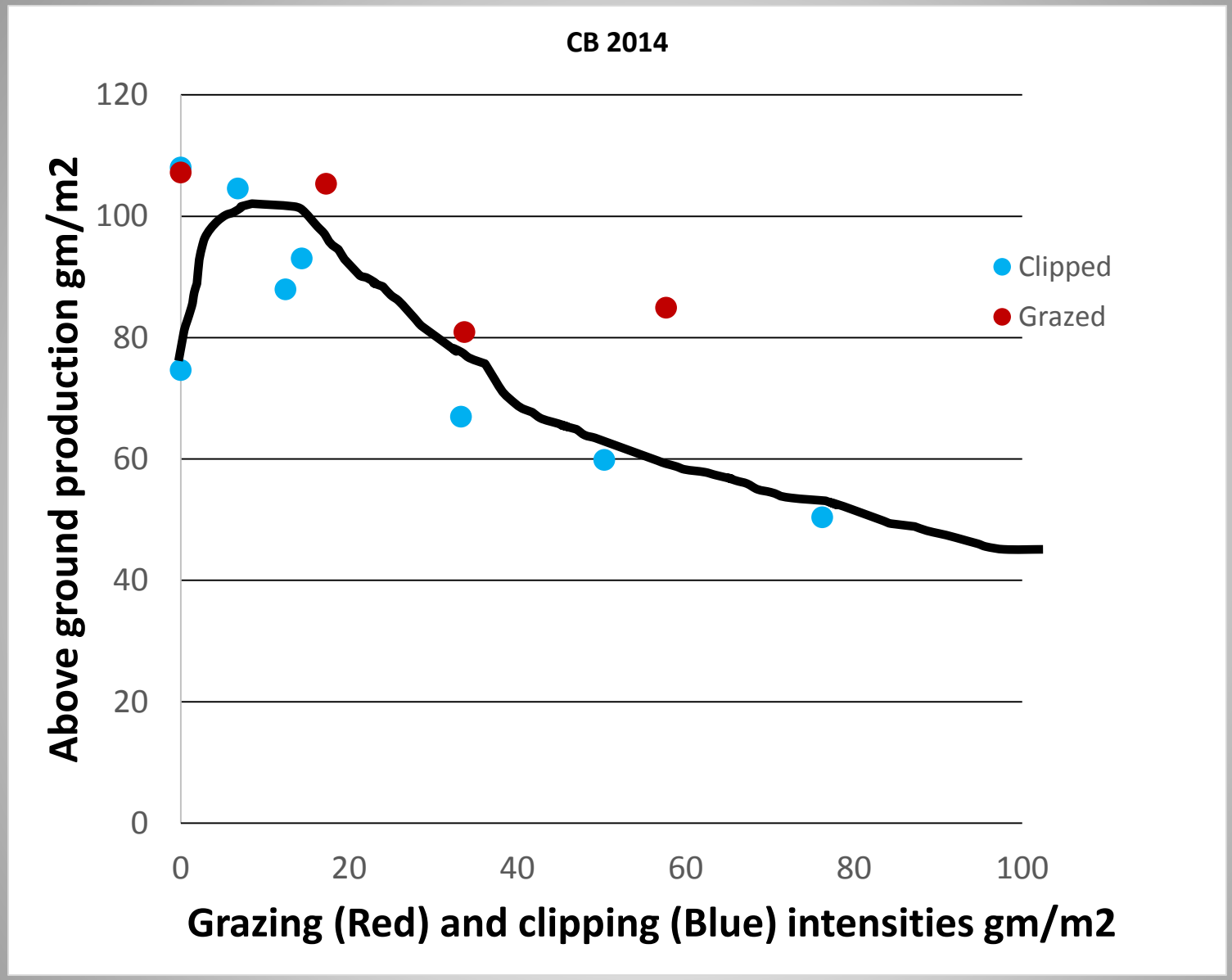



Nitrogen Estimate with Light Grazing at Lamar
% Nitrogen
3.5
3
2.5
2
1.5
1
0.5
0
May
Jun
Jul
Aug
Sep
Oct
50% in May
50% in July
50% in May and June
unclipped


Nitrogen Estimate with Heavy Grazing at Lamar
% Nitrogen
3.5
3
2.5
2
1.5
1
0.5
0
May
Jun
Jul
Aug
Sep
Oct
25% once a mo
50% once a mo
90% once a mo
unclipped

While high rates consumption may result in reduced biomass production,

grazing stimulates large amounts of soil nitrogen for plants leading to higher nitrogen availability in the food available for bison.


CB 2014
120
100
80
60
40
20
0
0
20
40
60
80
100
Above ground production gm/m2
Grazing (Red) and clipping (Blue) intensities gm/m2
Clipped
Grazed

Bison are selecting areas with high quality food value (grasses with higher nitrogen content)

Grazing and deposition of urine and fecal material are enhancing grass quality

The area that is being grazed at very high consumption rates is quite small compared to total available grassland habitat in the park

Shifting patterns of use is likely to be an ongoing process with Yellowstone bison

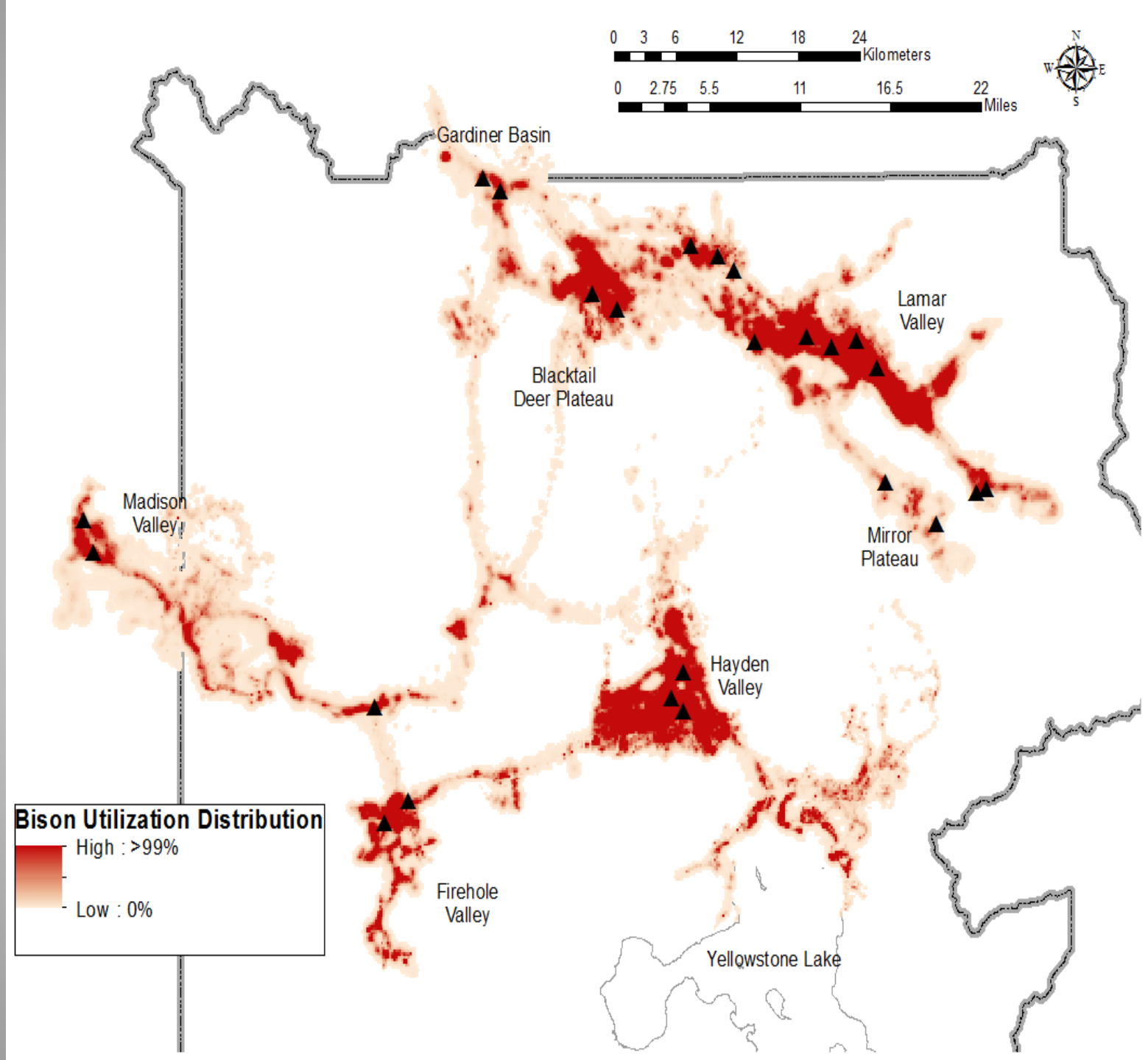
What next?

Estimate grazing effects on above-ground production in wintering, transitional, and summering areas used by bison.

Link vegetation condition with the timing of bison foraging in seasonal use areas. Are bison tracking food quality and/or quantity during spring and summer migrations?

Since bison repeatedly return to the same areas during summer. Does re-grazing engineer food quality and quantity (Creating the buffalo candy store?).

How does the grazing lawn in the lower elevation compared to higher elevation areas above the Lamar Valley?


0 3 6 12 18 24
Kilometers
0 2.75 5.5 11 16.5 22
Miles
N
W
E
S
Gardiner Basin
Blacktail
Deer Plateau
Lamar
Valley
Madison
Valley
Mirror
Plateau
Hayden
Valley
Firehole
Valley
Yellowstone Lake
Bison Utilization Distribution
High : >99%
Low : 0%


Questions?