

# Greater Yellowstone Area Elk Movements: Brucellosis and Hunter Access



Photo by Steve Ard



Ken Hamlin and Julie Cunningham  
Montana Fish, Wildlife and Parks



# Brucellosis & Hunter Access

This presentation began as a study involving elk movements and brucellosis risk

It became apparent that hunter accessibility was an important part of the equation

*Access has contributed to change in elk movement patterns which has brucellosis risk implications*

# Risk Analysis

**RISK = CONSEQUENCE x PROBABILITY**

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CONSEQUENCE = cost of vaccination, market value of cattle,  
loss to cattle industry and state economy

# Risk Analysis

**RISK = CONSEQUENCE x PROBABILITY**

Components of PROBABILITY related to cattle

- Cattle density
- Timing of cattle use in pastures/allotments
- Cattle movements and concentrations (feed lines)
- Cattle herd composition

# Risk Analysis

**RISK = CONSEQUENCE x PROBABILITY**

Components of PROBABILITY related to elk

- Elk density – we have estimated in most areas
- Elk seroprevalence – MFWP Wildlife Lab, Neil Anderson
- Timing of elk use (last trimester = “risky” period)
- Elk movements, distribution and concentrations

# Risk Analysis

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# Risk Analysis

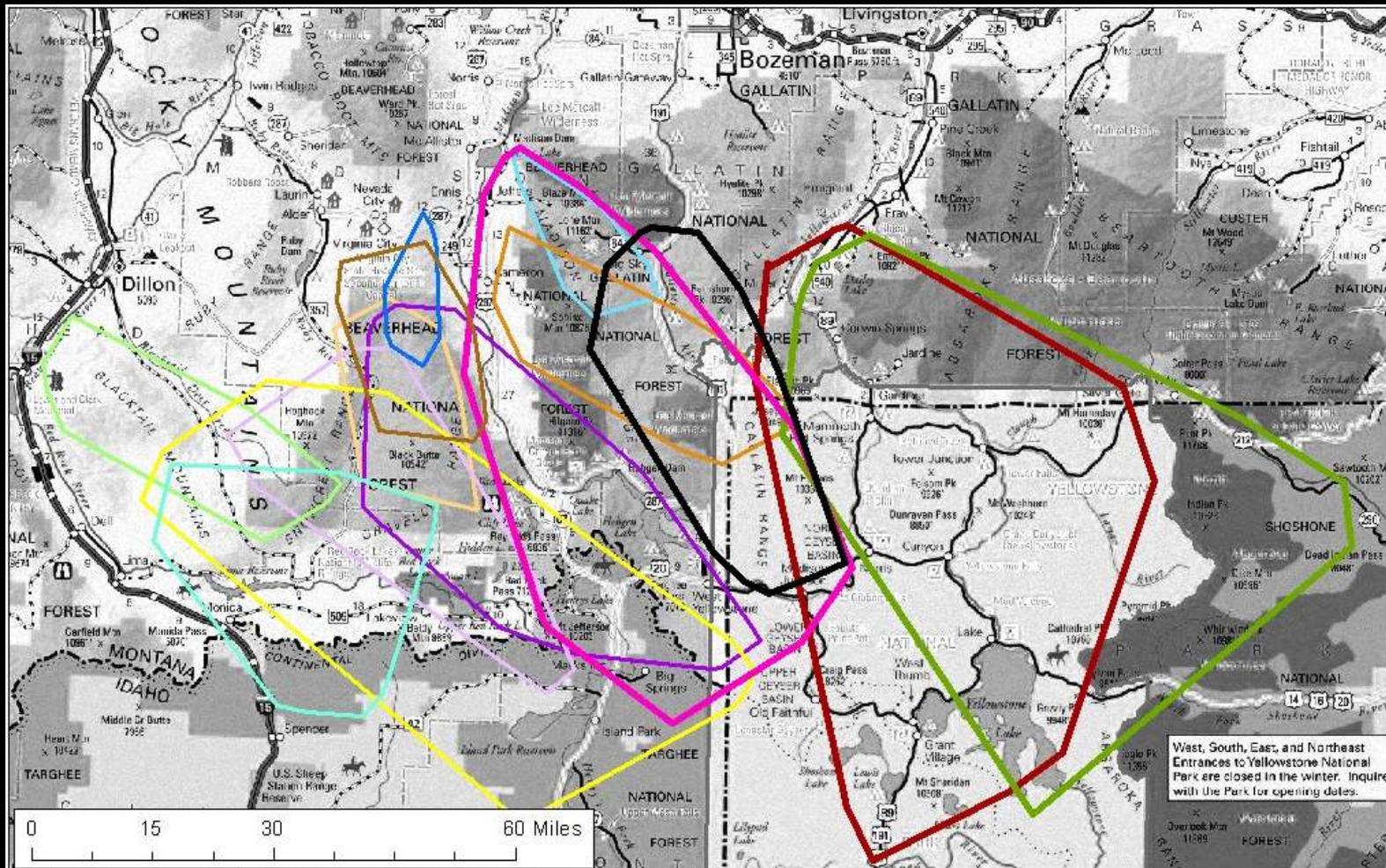
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- Elk density – we have estimated in most areas
- Elk seroprevalence – MFWP Wildlife Lab, Neil Anderson
- **Timing of elk use (last trimester = “risky” period)**
- **Elk movements, distribution and concentrations**

*We are making these data available to DOL to assist with livestock management plans to reduce risk*

# General Herd Range – GYA, MT

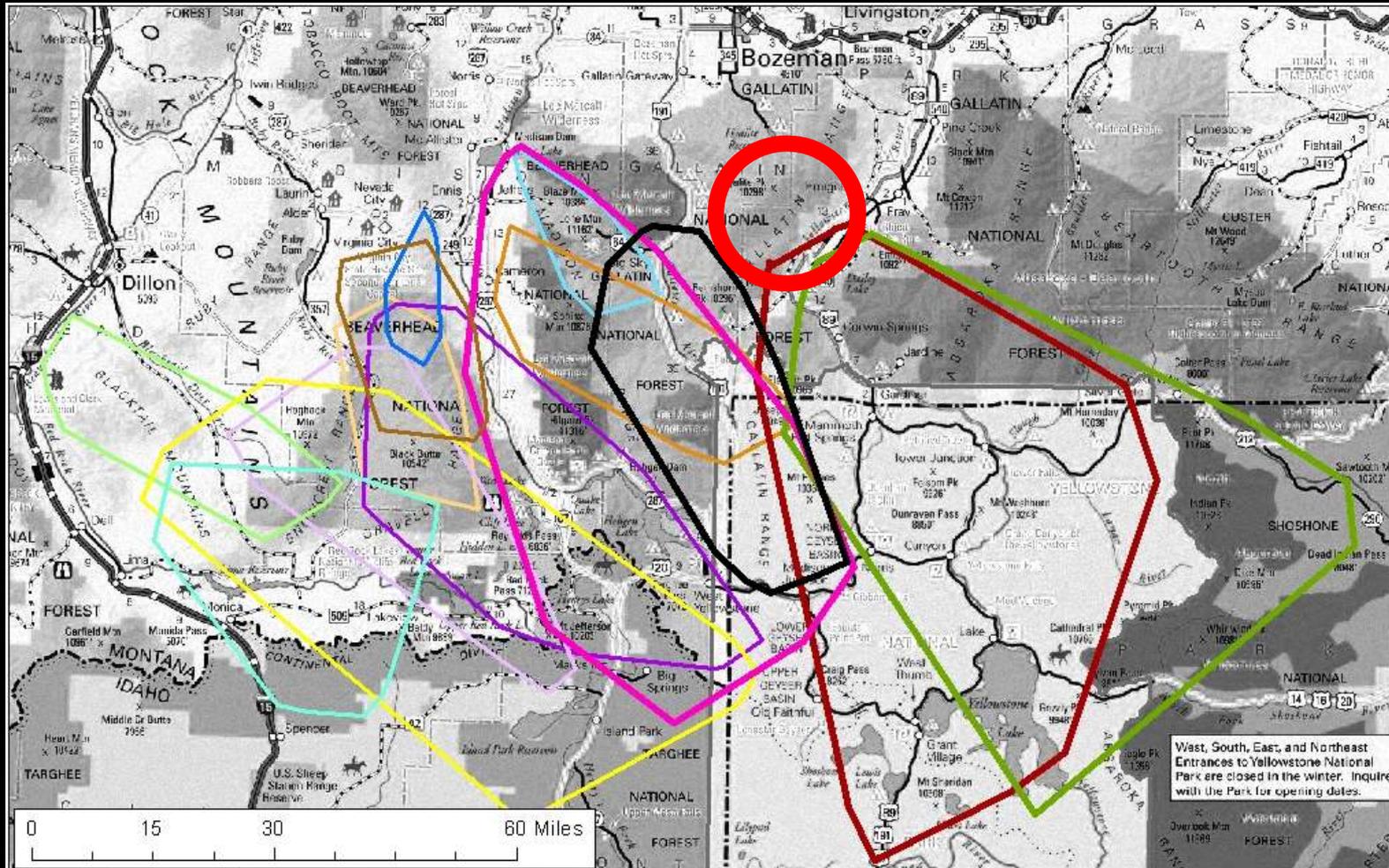


## MINIMUM CONVEX POLYGONS FROM FEMALE ELK

n = 8	Blacktail Ridge	n = 3	Axolotol Lake	n = 33	Robb Ledford	n = 201	Wall Creek	n = 28	HD 313 1984-87
n = 11	Basin-Sage Cr	n = 23	Cherry-Morgan Cr.	n = 8	Jumping Horse	n = 43	HD 362	n = 43	HD 313 2007-08
n = 184	Blacktail	n = 11	Warm Springs Cr	n = 5	Bear Creek	n = 51	Gallatin		



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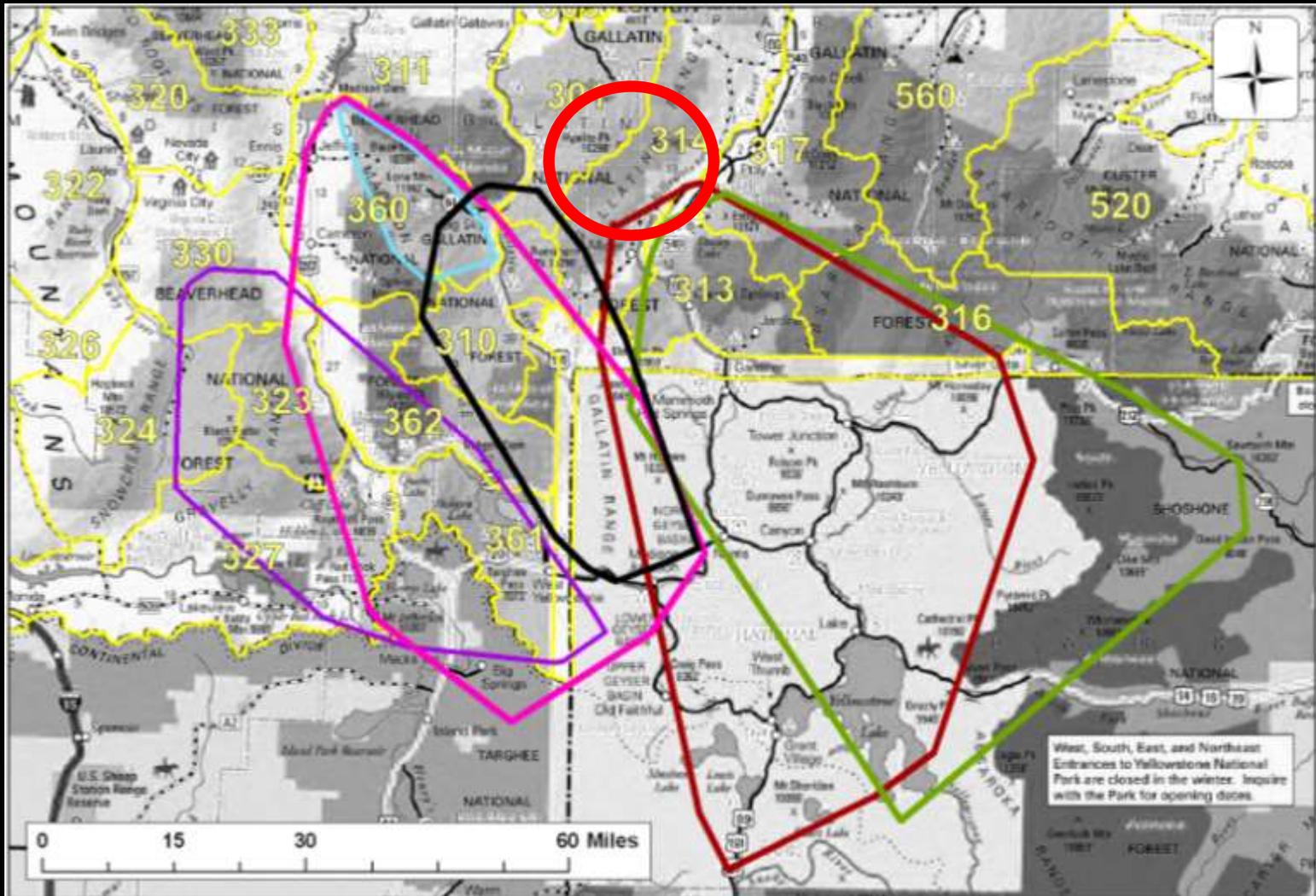


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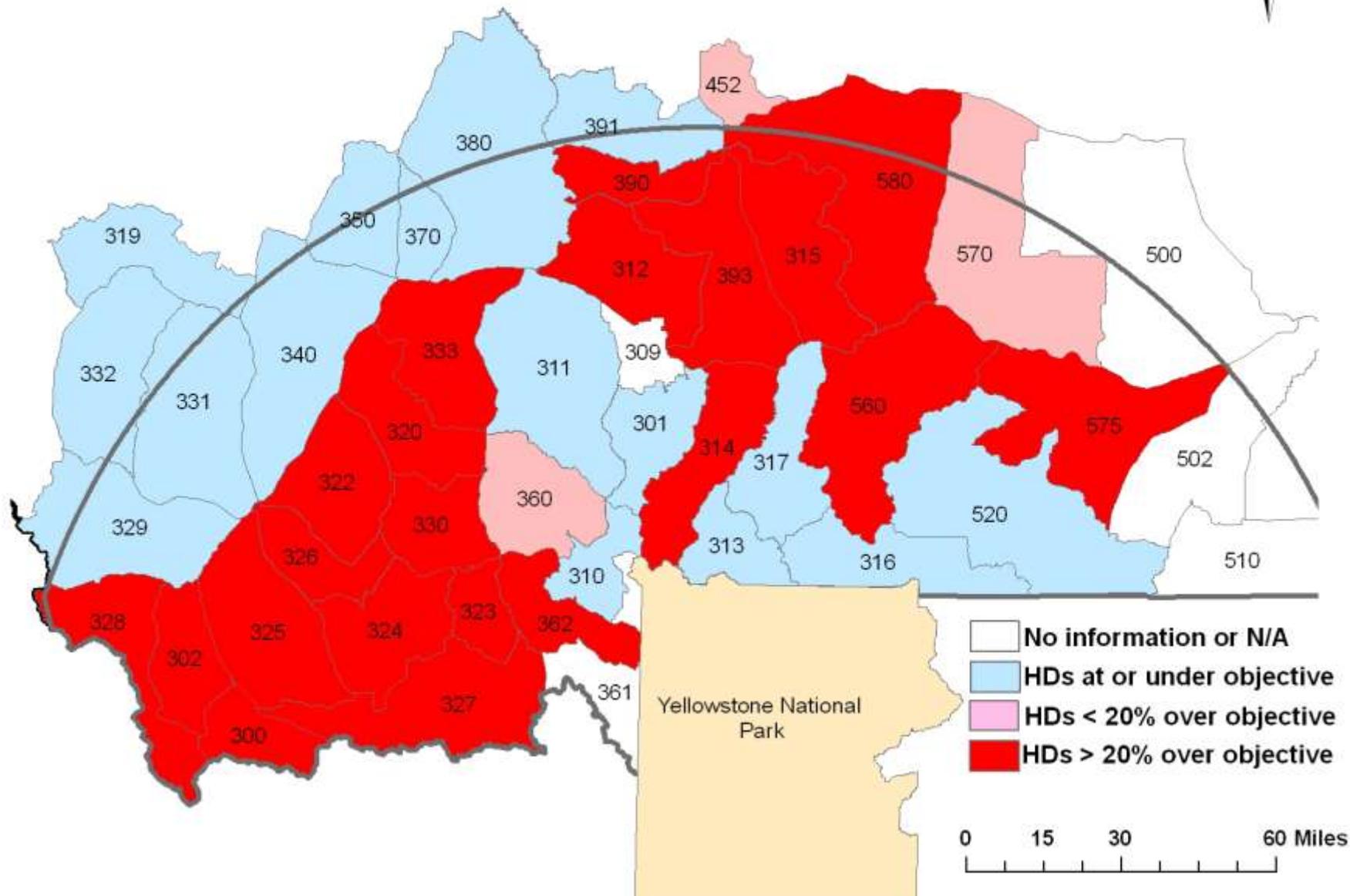
# Herd Range – Endemic Area, MT



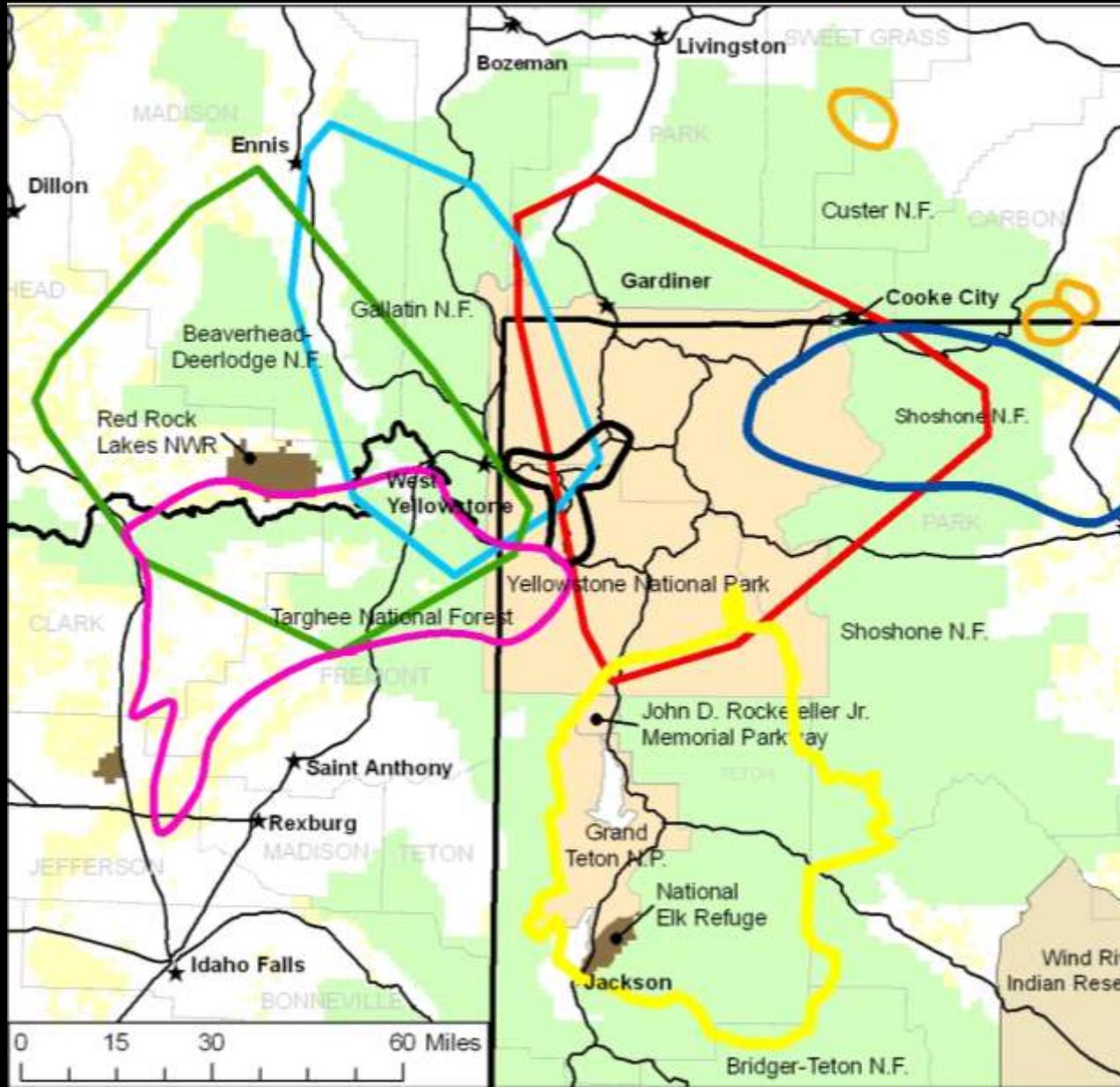
MINIMUM CONVEX POLYGONS FROM FEMALE ELK - Brucellosis endemic area

n = 201 Wall Creek 
 n = 43 HD362 
 n = 8 Jumping Horse 
 n = 51 Gallatin 
 n = 43 HD313 1984-87 
 n = 28 HD313 2007-08 
 Hunt Districts

# HDs over Elk Plan Objective - 2007 and 2008 count data



# Herd Ranges – WY, MT, ID



# Areas of Interest, MT

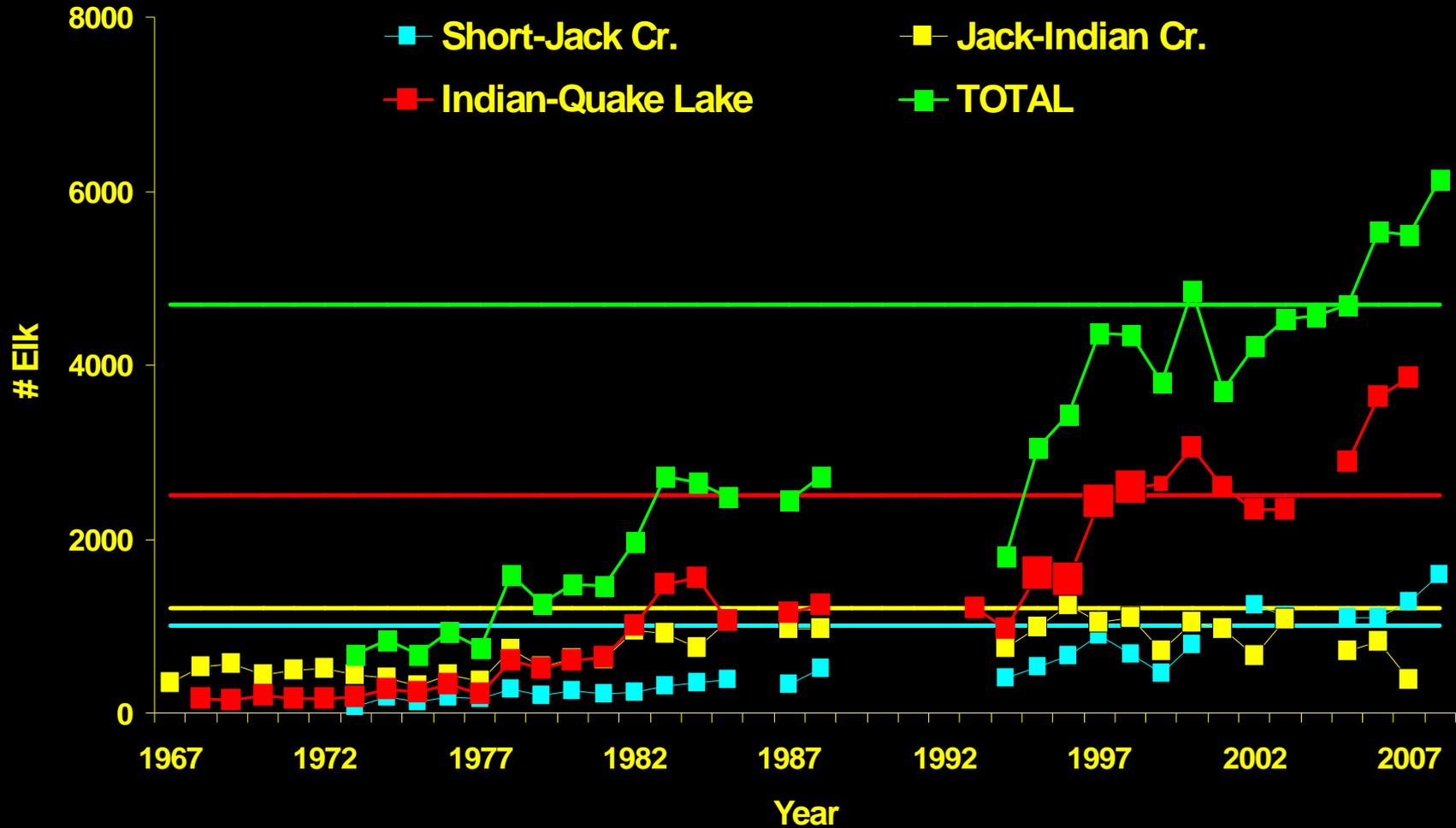
- **Madison Valley – HD's 360 and 362 (seroprevalence 3-5%)**  
43 cow elk marked with GPS collars 2005-2006, project completed 2007.
- **Paradise Valley – HD 313 (East side; seroprevalence 3-5%)**  
43 cow elk marked with GPS collars 2007 and 2008, project completed summer 2009.
- **Paradise Valley – HD 314 (West side; seroprevalence?)**  
45 cow elk marked in 2009, to be completed 2011.

# East Madison Valley



Photo by Craig Jourdonnais

# Spring Elk Counts – East Madison



# East Madison Valley

43 cow elk were captured and GPS-collared 2005-2006

- All were captured south of Indian Creek
- Collars recorded locations each half hour
- Collars kept out for 1 full year
- In total, we received more than 720,000 locations.

*How well can 43 elk represent movement patterns of  
>4,000?*

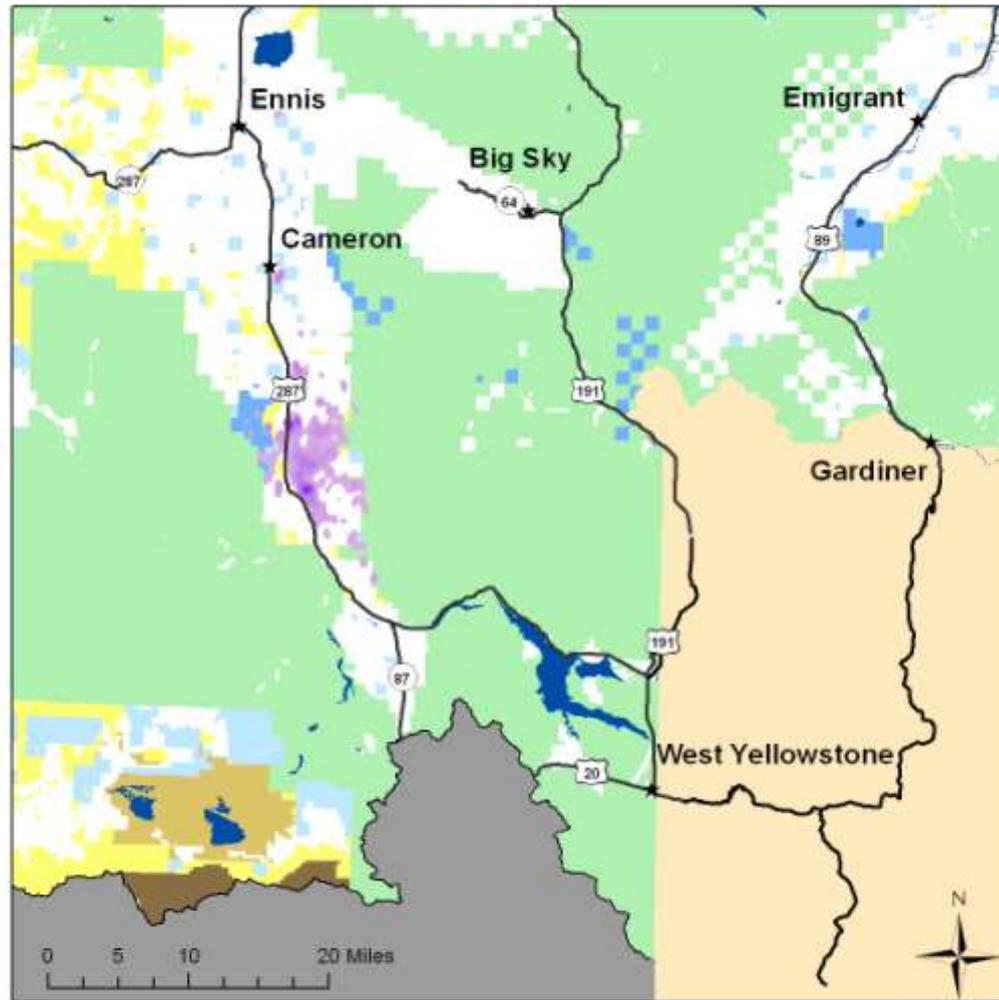


Photo by Craig Jourdonnais

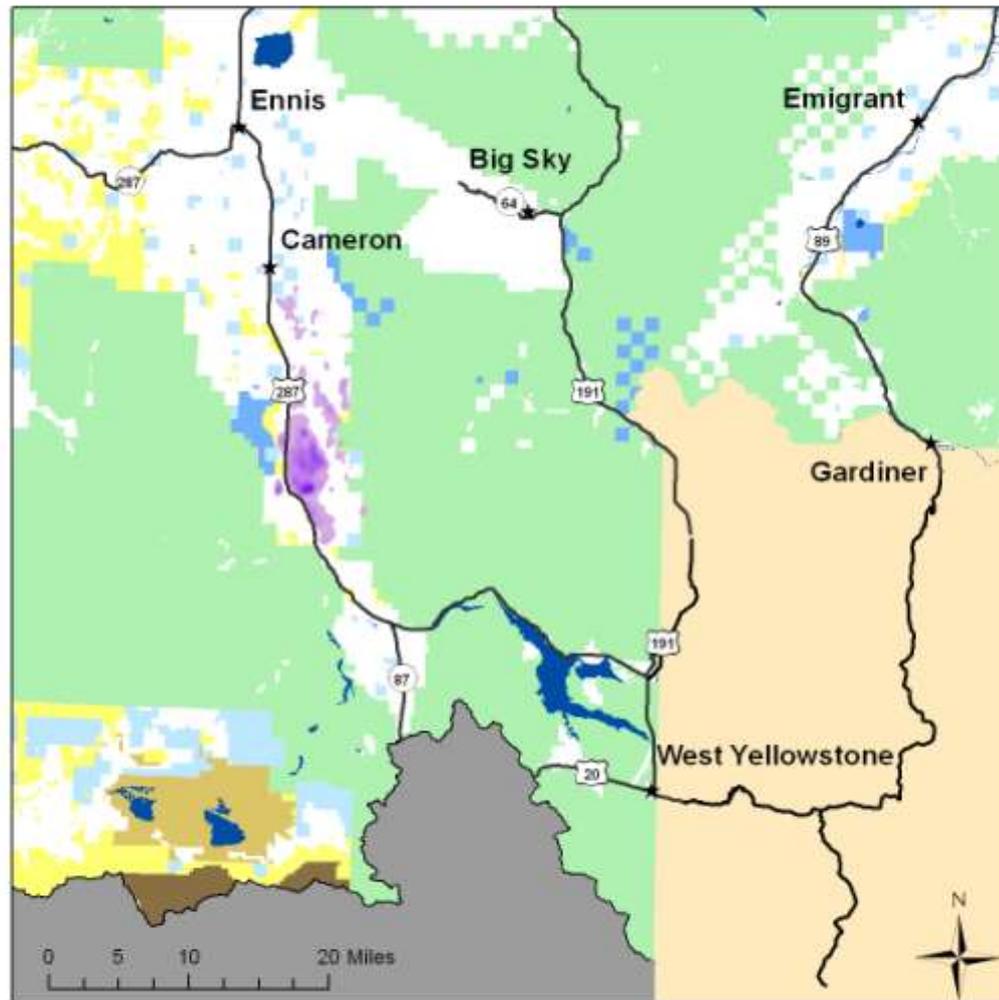


**Photo by Craig Jourdonnais**

# Madison Valley - 43 cow elk GPS collars (2005-2006) Kernel Density Estimator - February

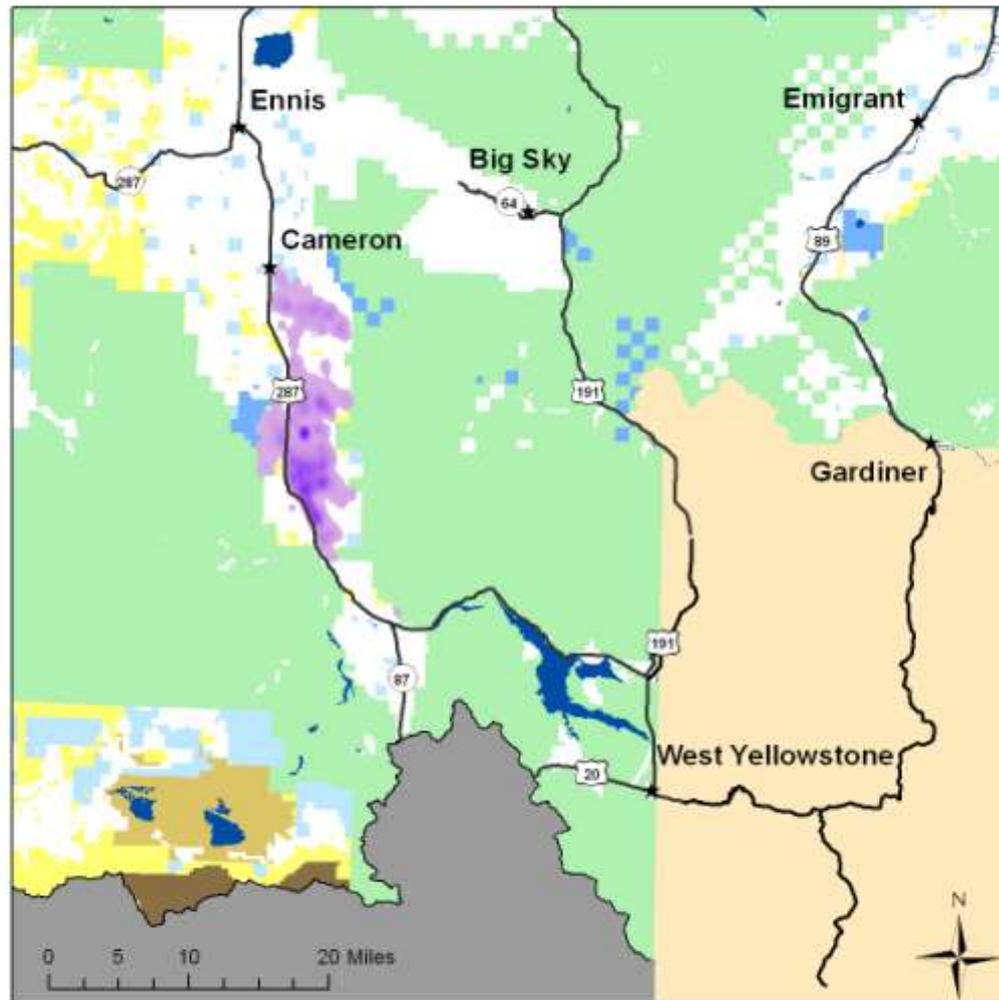


# Madison Valley - 43 cow elk GPS collars (2005-2006) Kernel Density Estimator - March

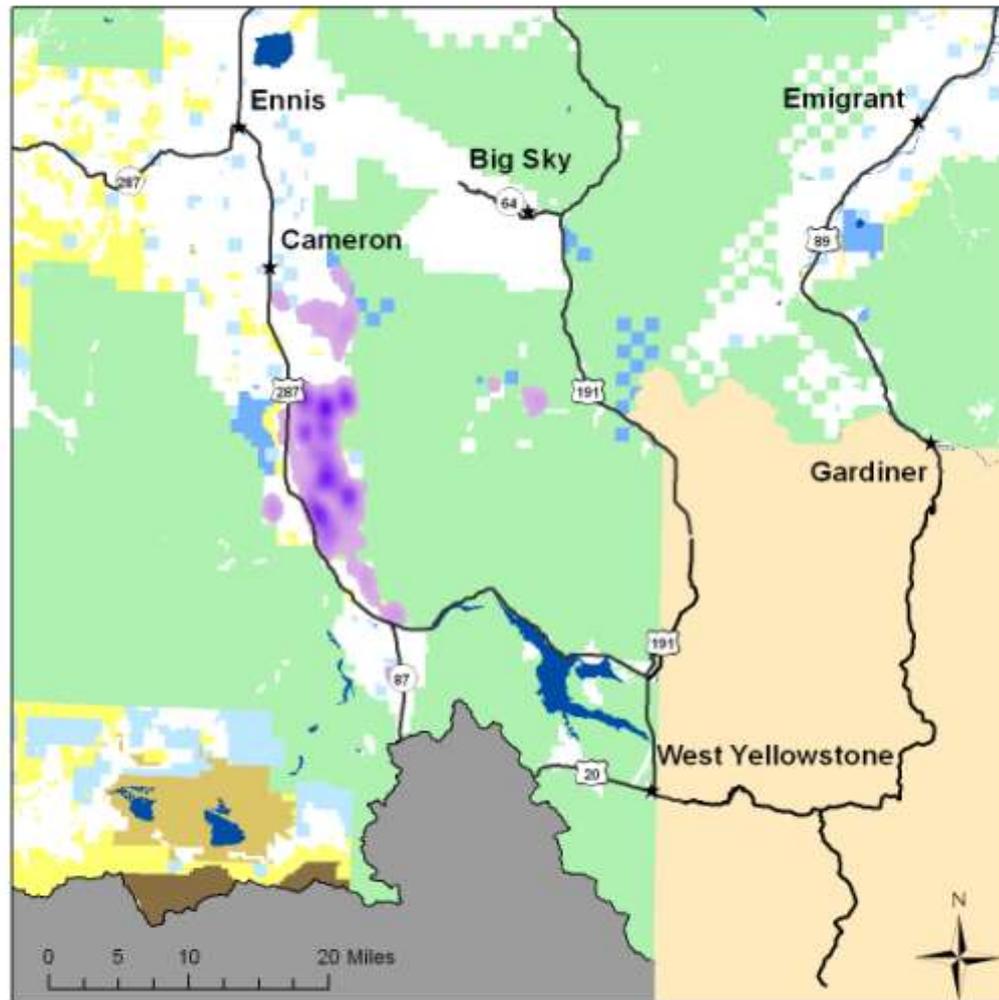


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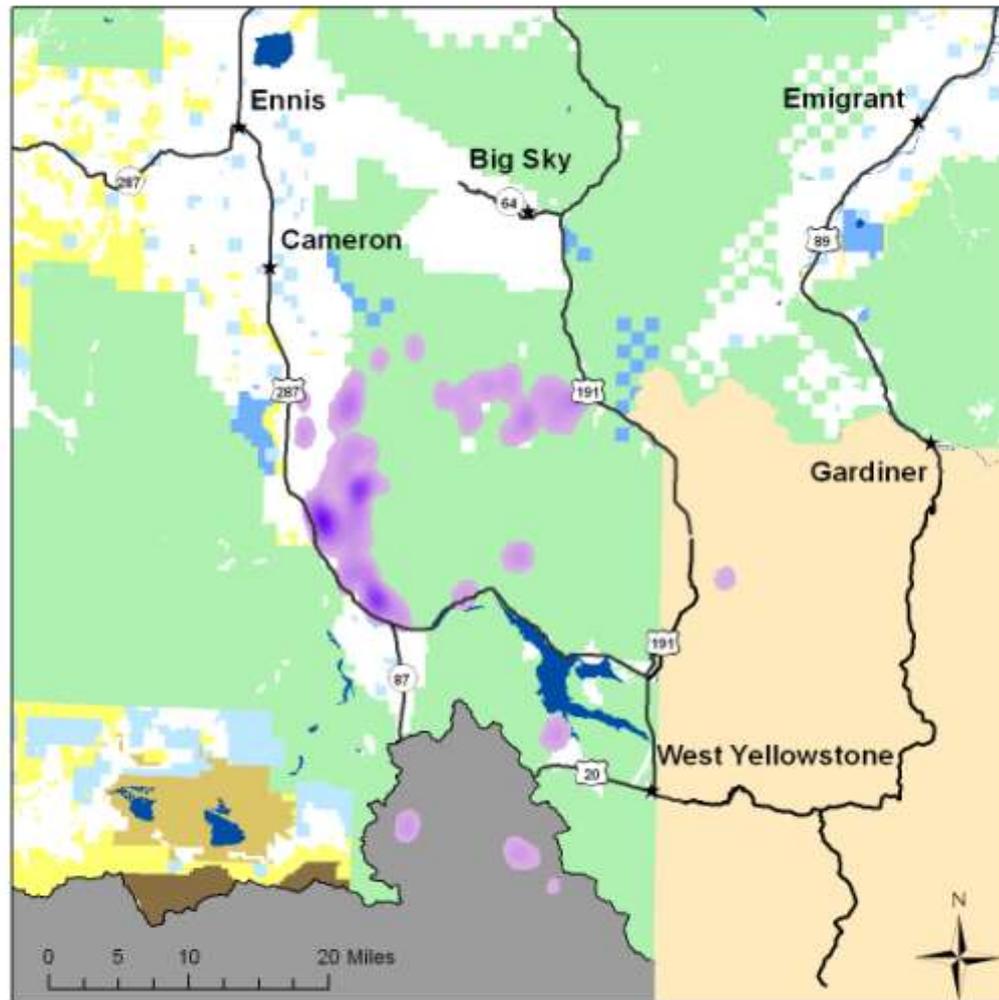
## Kernel Density Estimator - April



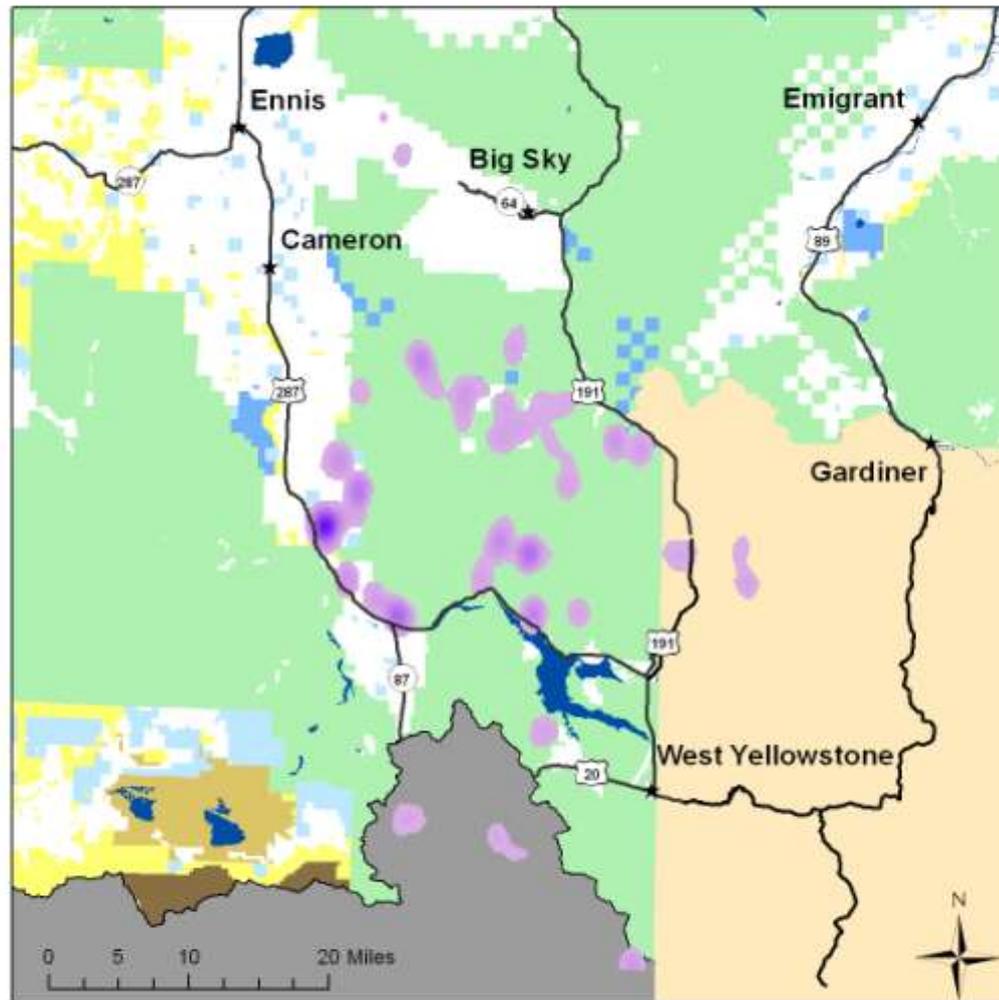
# Madison Valley - 43 cow elk GPS collars (2005-2006) Kernel Density Estimator - May 1-15



# Madison Valley - 43 cow elk GPS collars (2005-2006) Kernel Density Estimator - May 16-31

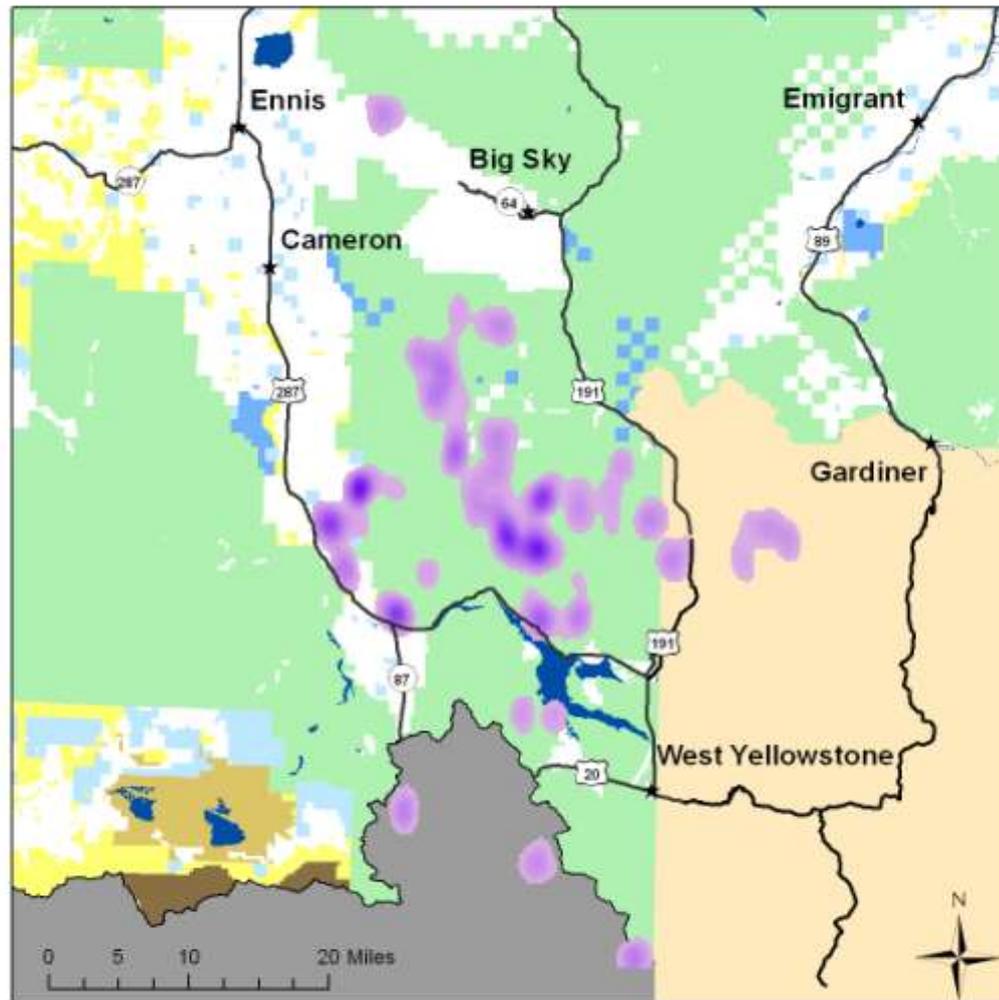


# Madison Valley - 43 cow elk GPS collars (2005-2006) Kernel Density Estimator - June 1-15

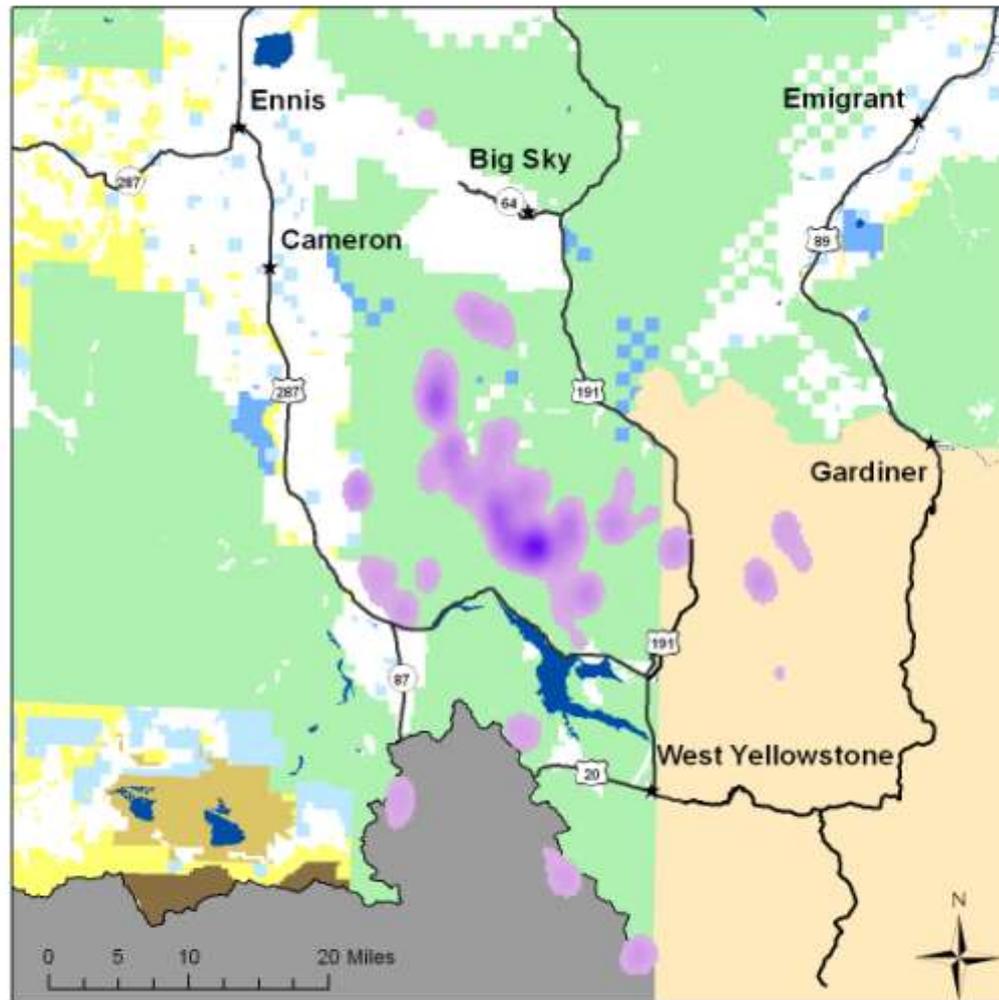


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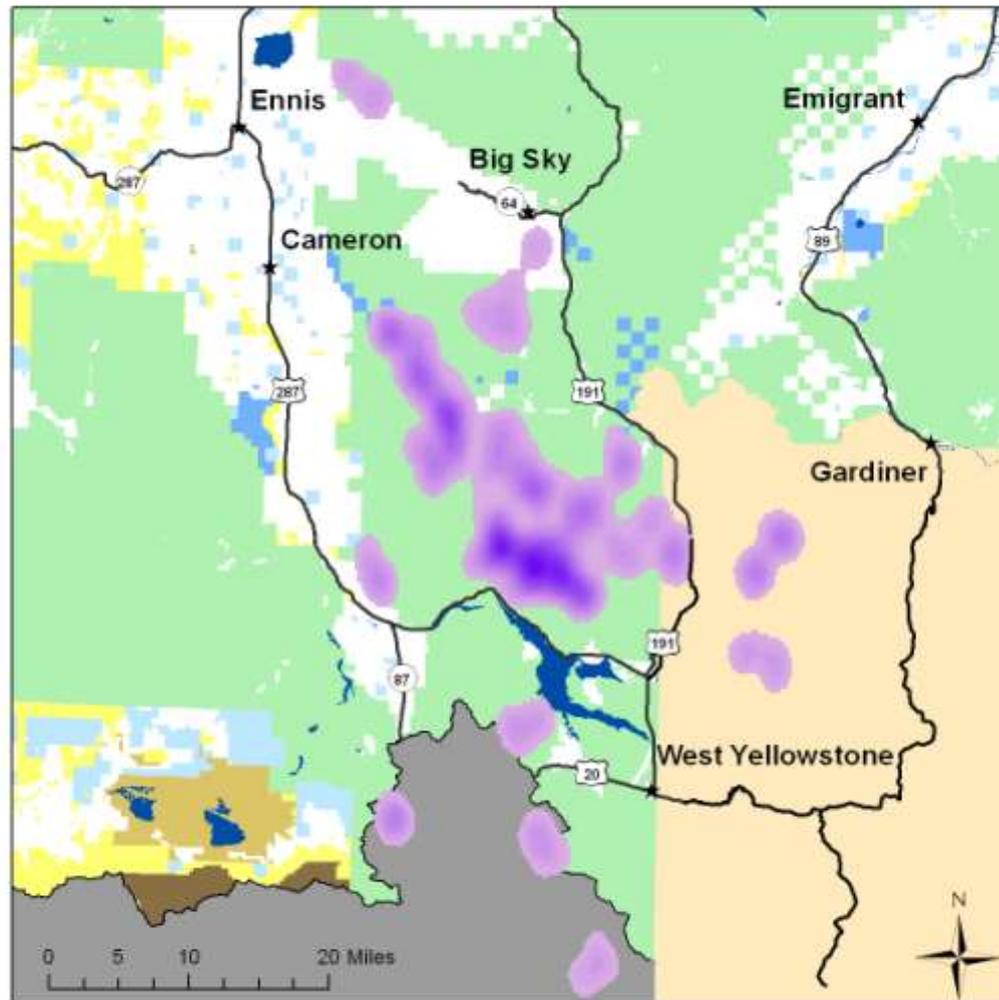
## Kernel Density Estimator - June 16-30



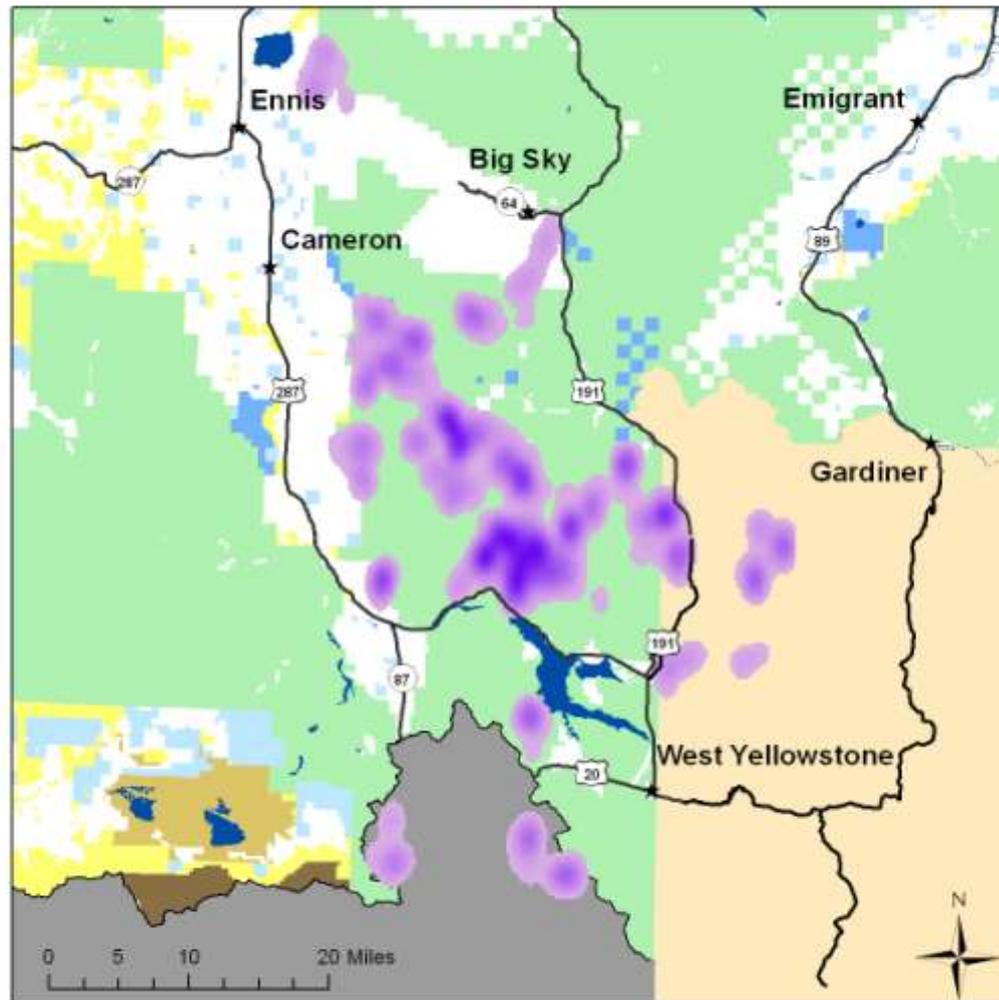
# Madison Valley - 43 cow elk GPS collars (2005-2006) Kernel Density Estimator - July



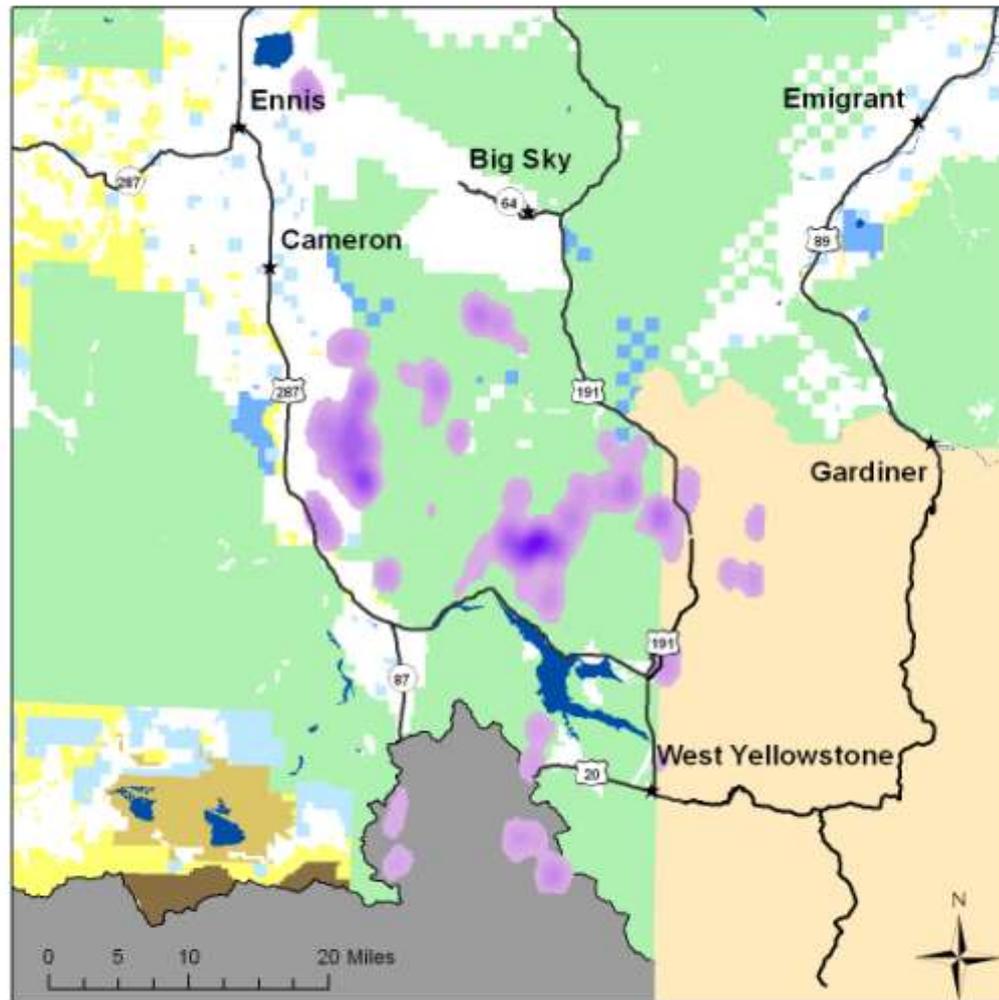
# Madison Valley - 43 cow elk GPS collars (2005-2006) Kernel Density Estimator - August



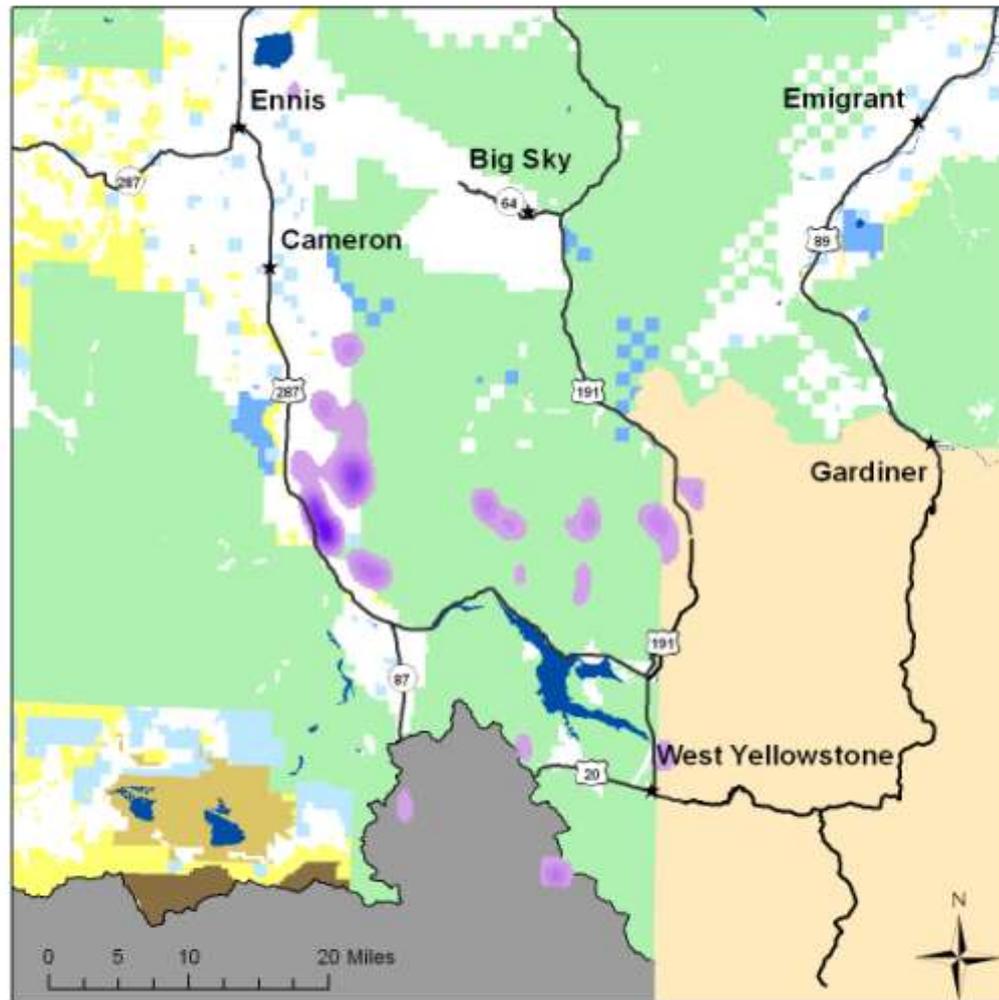
# Madison Valley - 43 cow elk GPS collars (2005-2006) Kernel Density Estimator - September



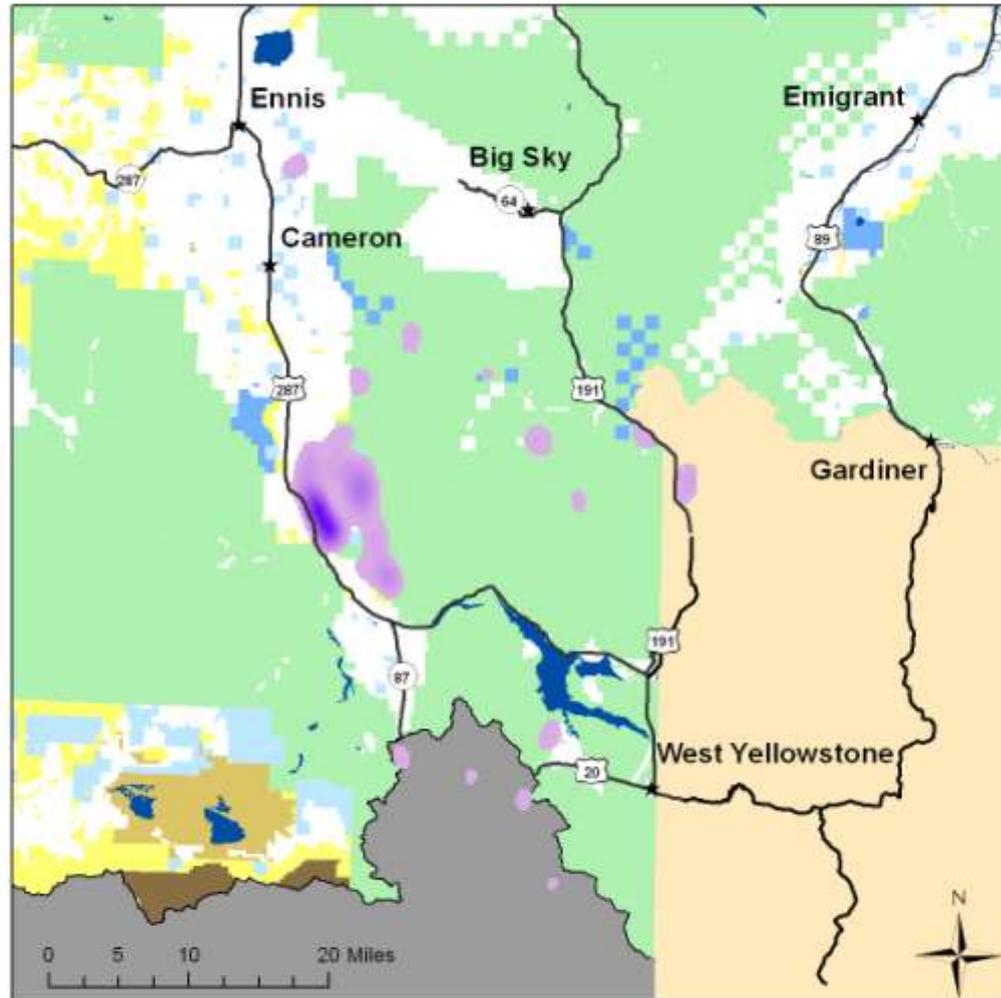
# Madison Valley - 43 cow elk GPS collars (2005-2006) Kernel Density Estimator - October 1-20



# Madison Valley - 43 cow elk GPS collars (2005-2006) Kernel Density Estimator - October 21-31

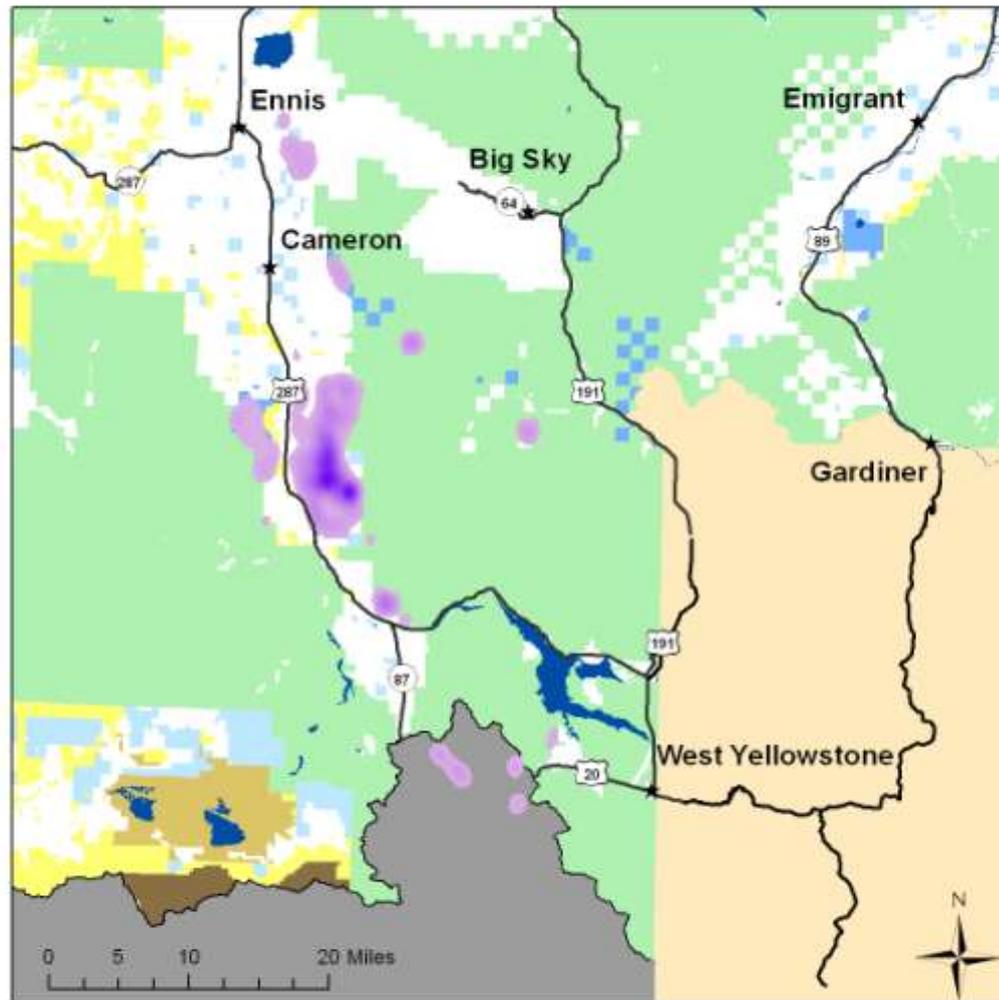


# Madison Valley - 43 cow elk GPS collars (2005-2006) Kernel Density Estimator - November

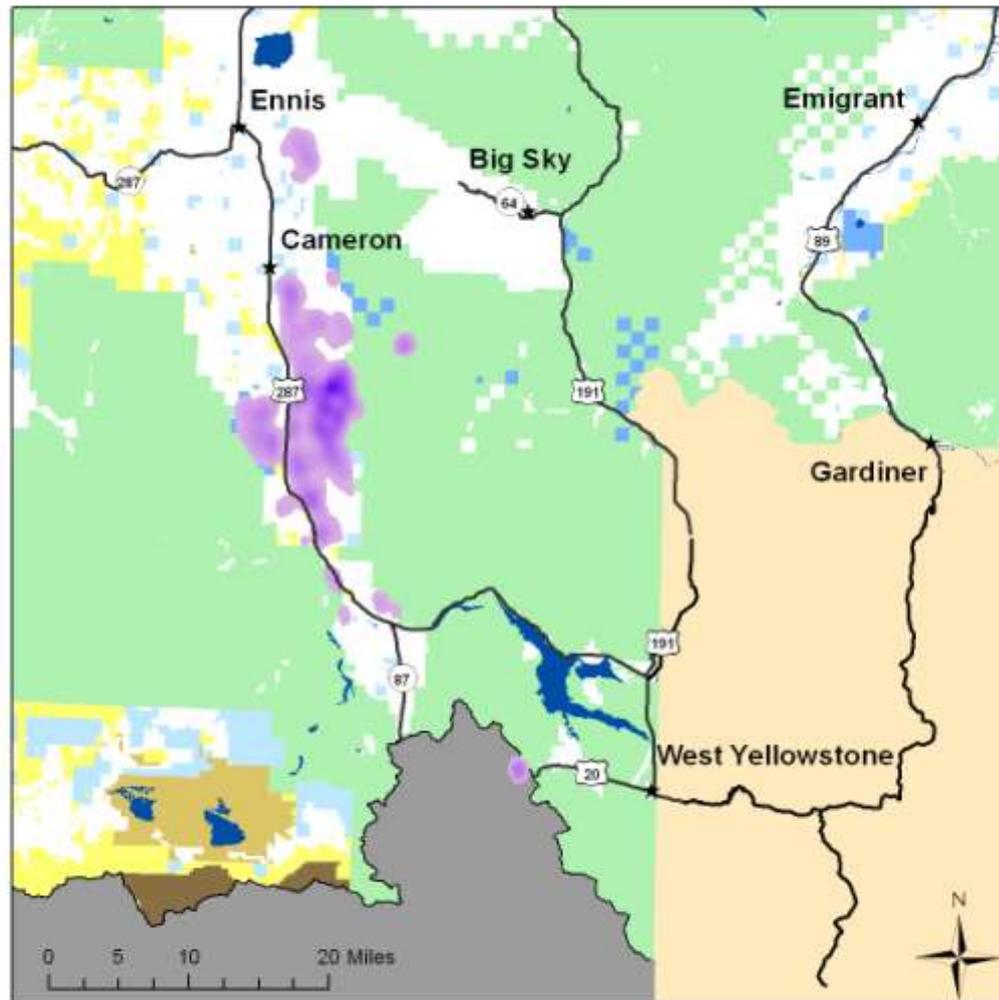


# Madison Valley - 43 cow elk GPS collars (2005-2006)

## Kernel Density Estimator - December



# Madison Valley - 43 cow elk GPS collars (2005-2006) Kernel Density Estimator - January



# East Madison Valley

14 elk remained on the private lands in HD 362 June 1-15.

*Of these:*

- 1 never left!
- 3 arrived in September
- 6 arrived in October
- 2 arrived the first 2 weeks in November
- 2 arrived late November – early December

*The elk calving on private lands were largely the same elk that migrated early into the wintering range.*

# East Madison Valley

19 elk had not migrated to the Madison by October. Of these, 21% (4) calved on the private lands in June

24 elk migrated to the Madison before or during October. Of these, 42% (10) calved on private lands in June.

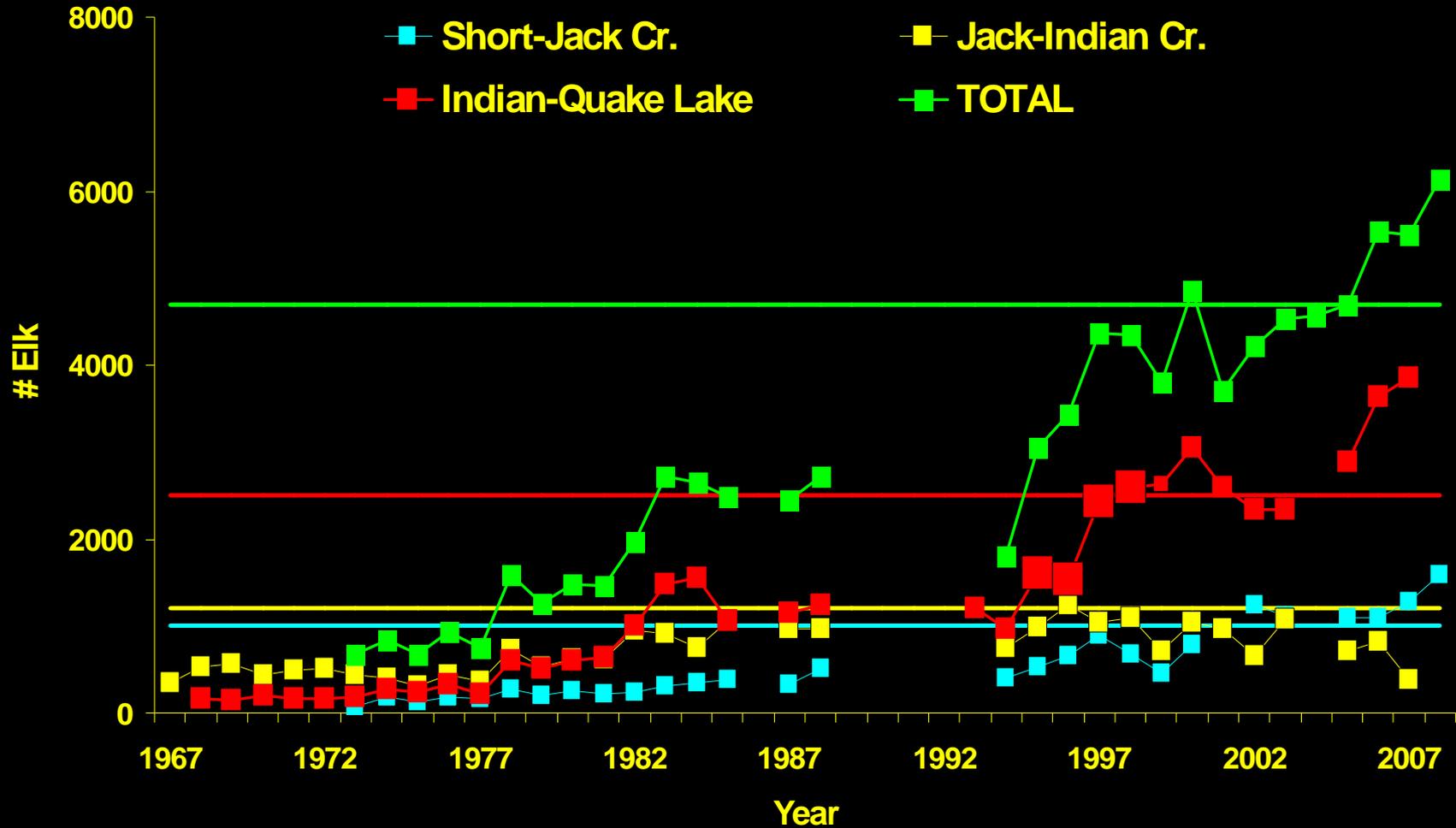
*The early migrants are twice as likely to stay late and calve than the late migrants. We may be developing a “year-round” herd.*

# Past Data - Madison Valley

27 cow elk were captured and radio-tracked 1976-1986

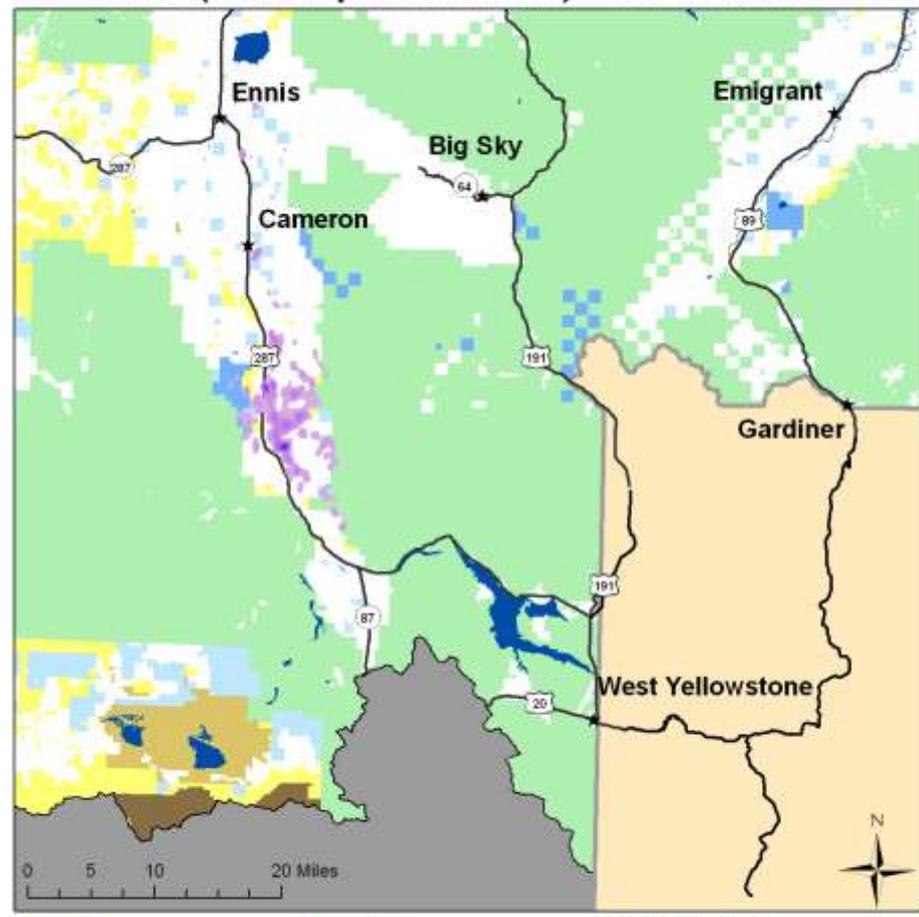
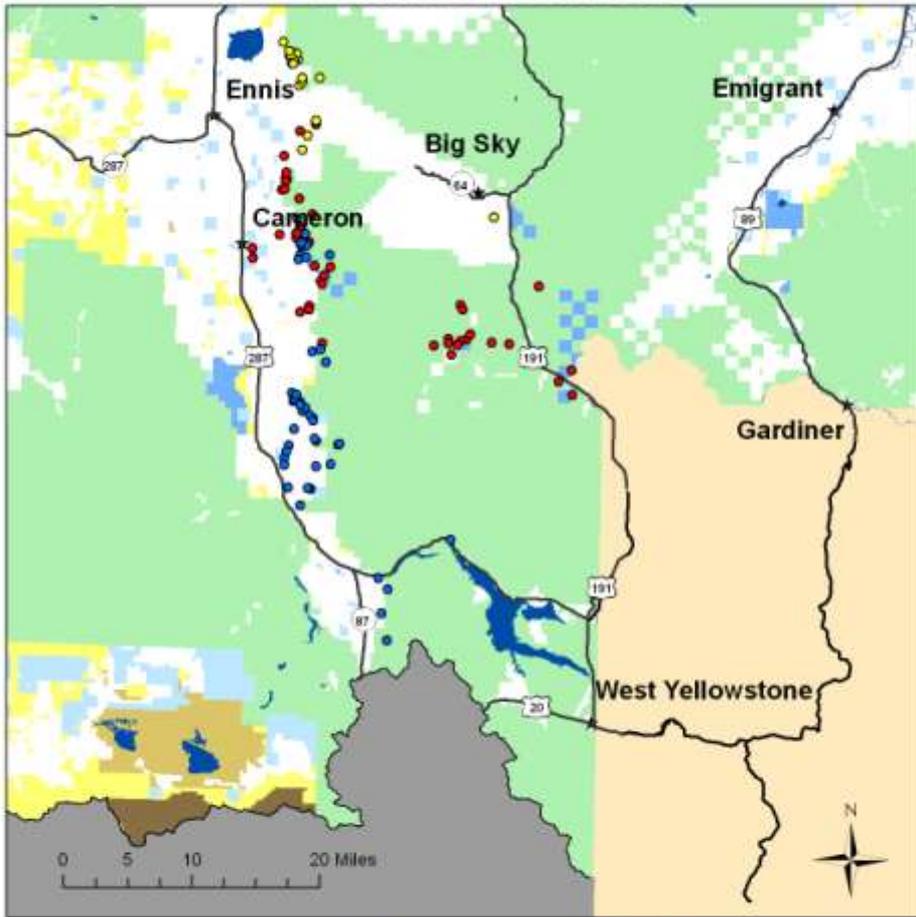
- 10 from Jumping Horse
- 9 from Bear Creek
- 8 from Sun Ranch

# Spring Elk Counts – East Madison



**Madison Valley - 27 cow elk VHF collars (1976-1986)  
FEBRUARY LOCATIONS**

**Madison Valley - 43 cow elk GPS collars (2005-06)  
KDE (7am-12pm locations) - FEBRUARY**



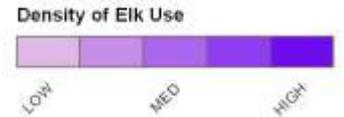
**POPULATION**

- Bear Creek
- Jumping Horse
- Sun Ranch

- BLM
- NPS
- Other Federal
- USFWS

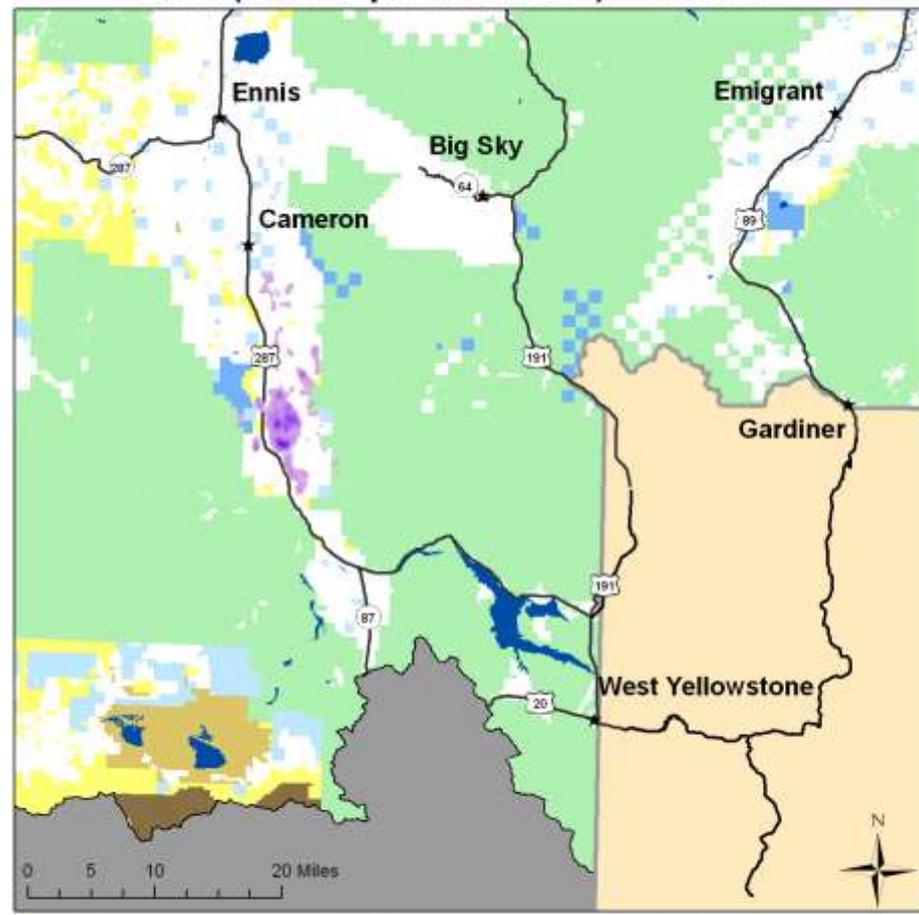
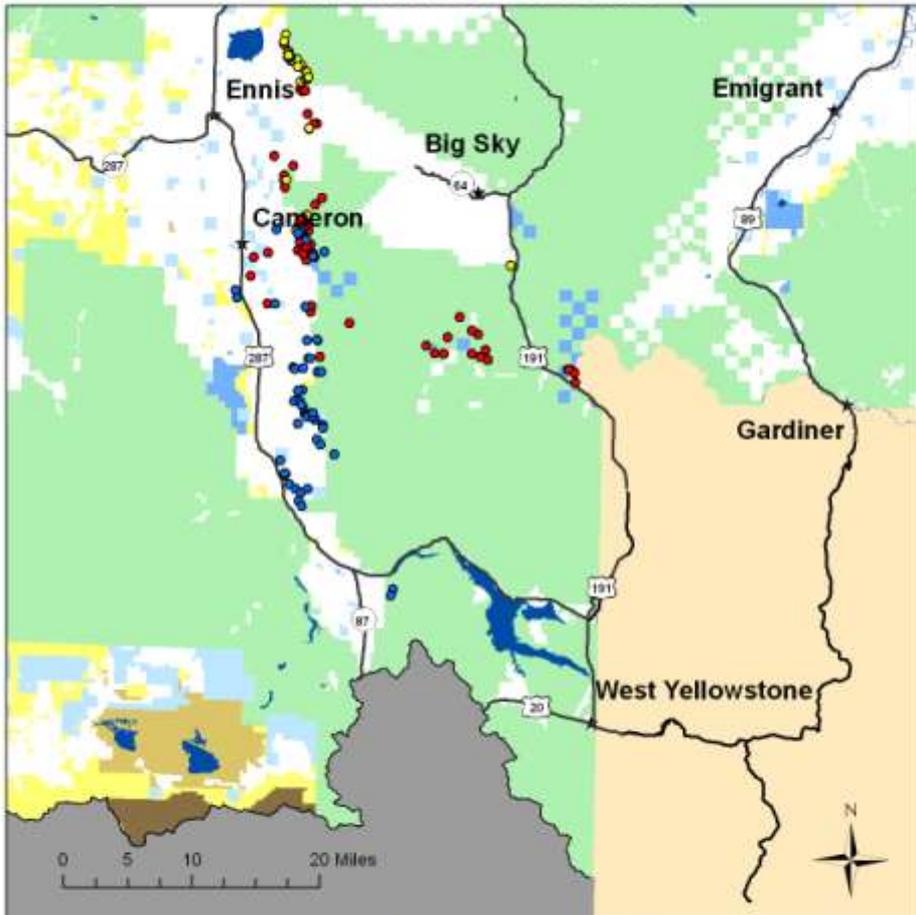
- USFS
- MFWP
- MT State Trust
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**Madison Valley - 27 cow elk VHF collars (1976-1986)**  
**MARCH LOCATIONS**

**Madison Valley - 43 cow elk GPS collars (2005-06)**  
**KDE (7am-12pm locations) - MARCH**



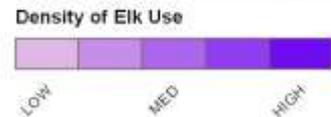
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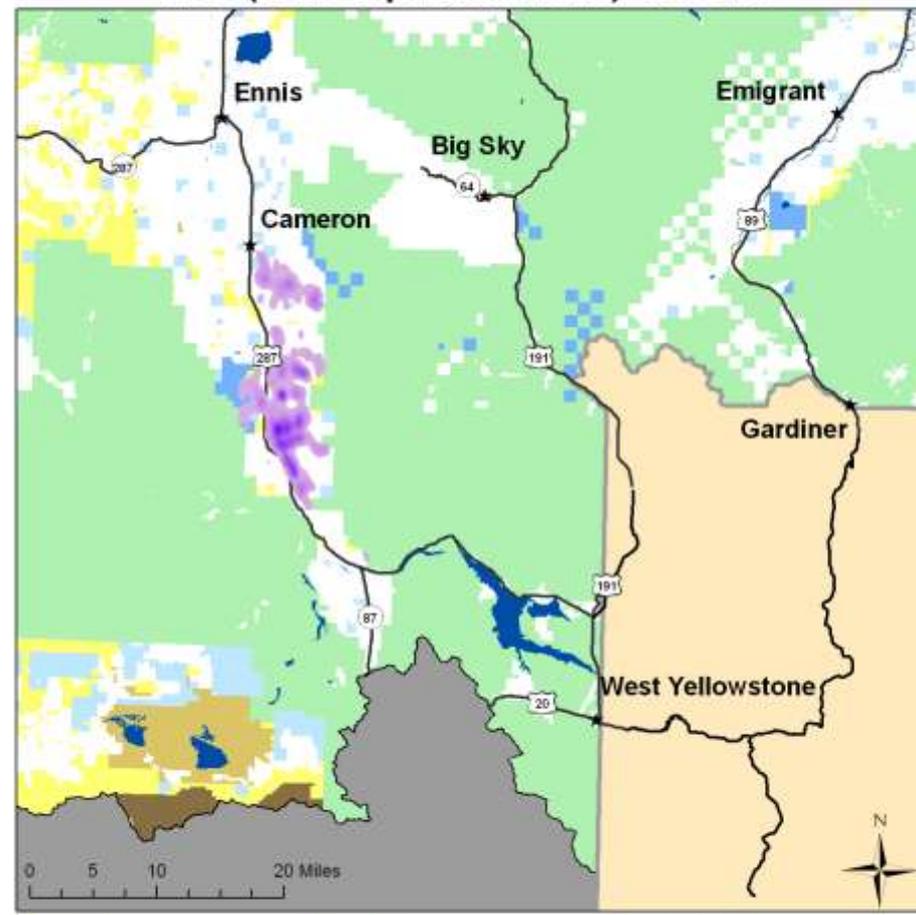
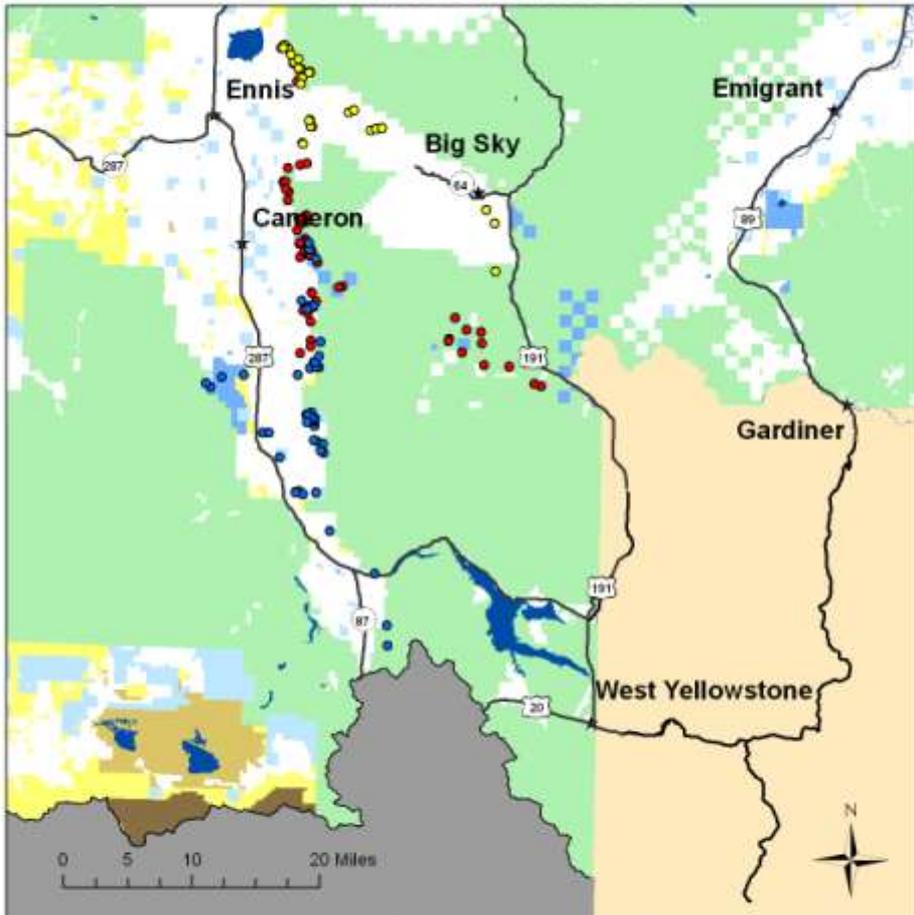
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**Madison Valley - 27 cow elk VHF collars (1976-1986)  
APRIL LOCATIONS**

**Madison Valley - 43 cow elk GPS collars (2005-06)  
KDE (7am-12pm locations) - APRIL**



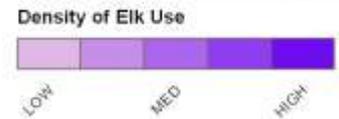
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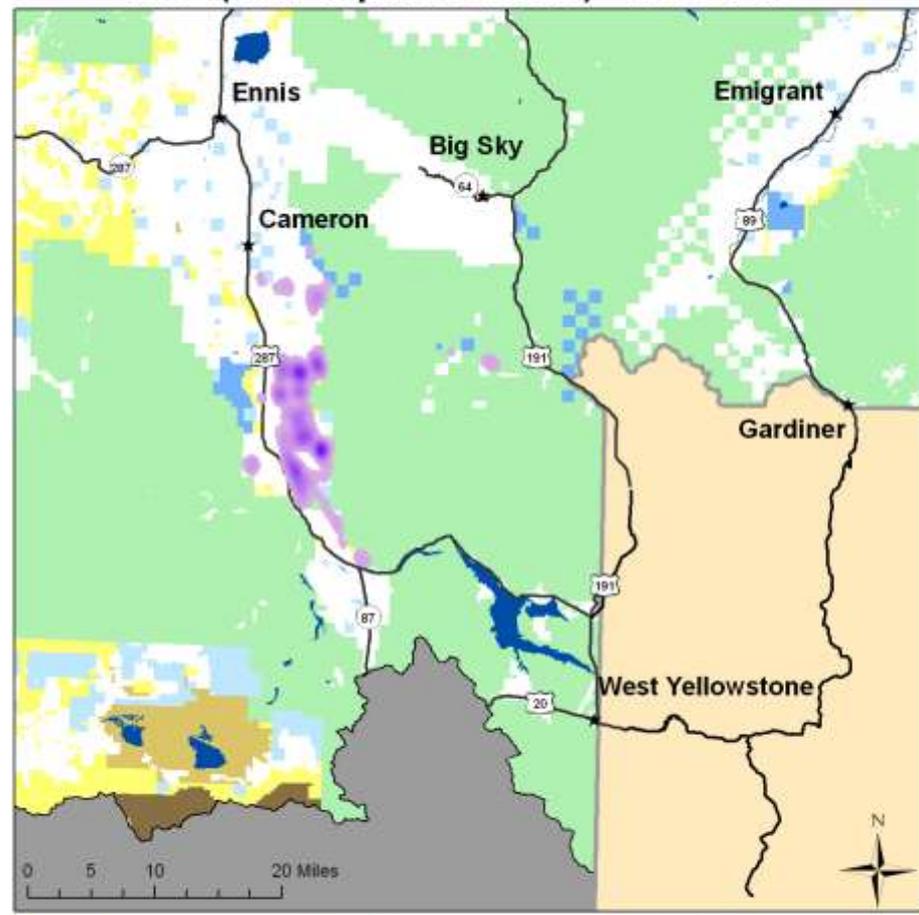
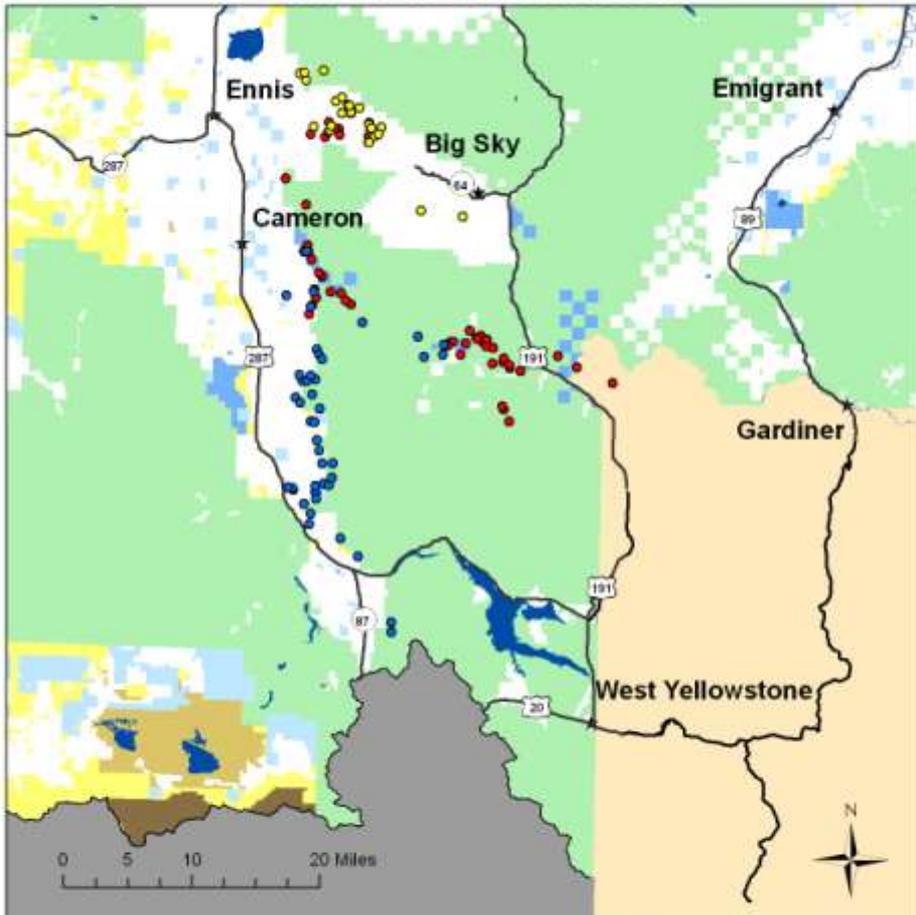
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**Madison Valley - 27 cow elk VHF collars (1976-1986)**  
**MAY 1-15 LOCATIONS**

**Madison Valley - 43 cow elk GPS collars (2005-06)**  
**KDE (7am-12pm locations) - MAY 1-15**



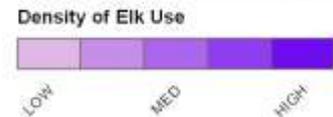
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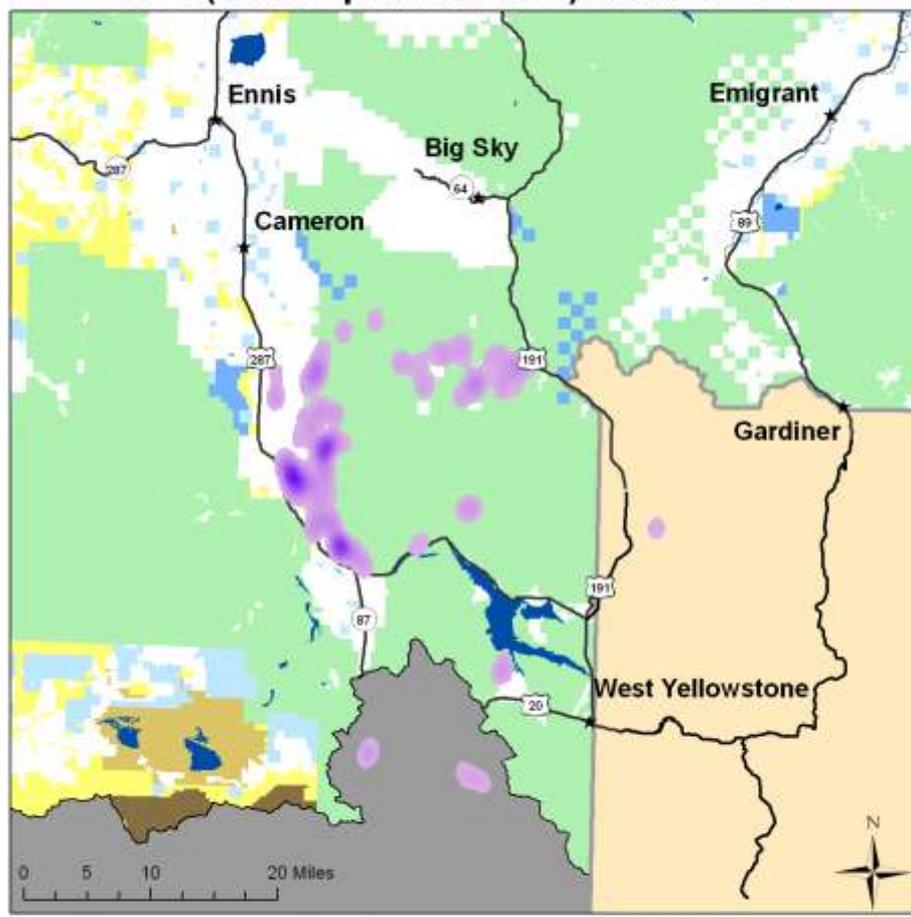
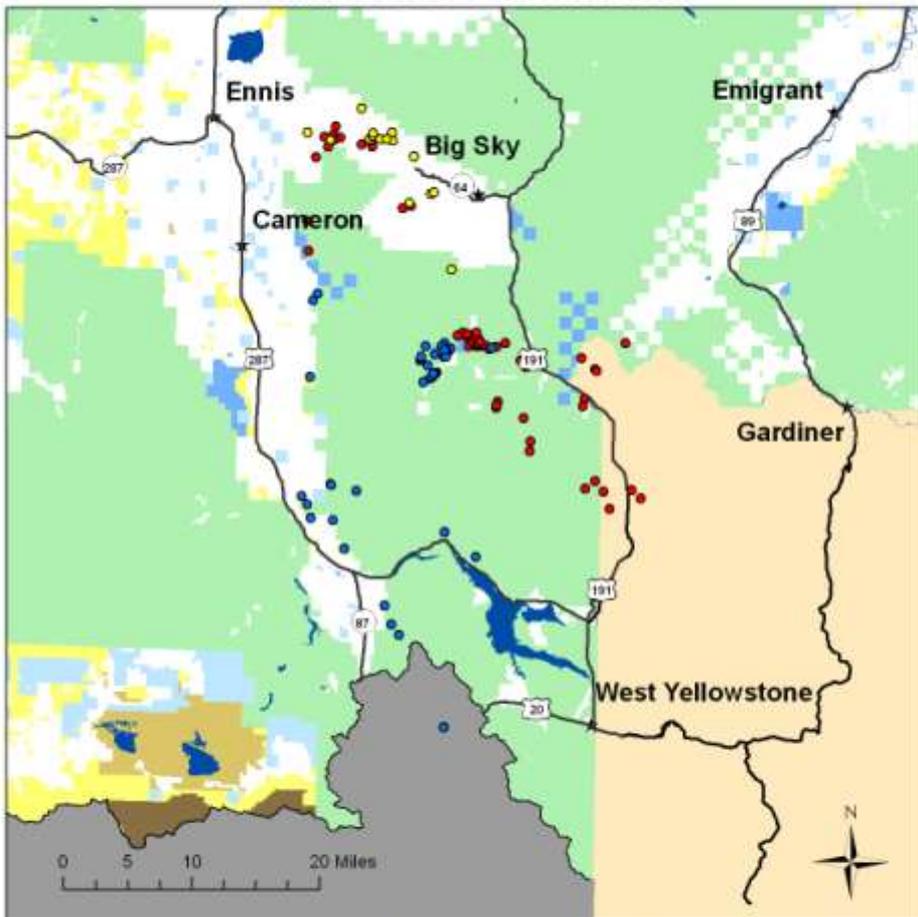
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**Madison Valley - 27 cow elk VHF collars (1976-1986)**  
**MAY 16-31 LOCATIONS**

**Madison Valley - 43 cow elk GPS collars (2005-06)**  
**KDE (7am-12pm locations) - MAY 16-31**



**POPULATION**

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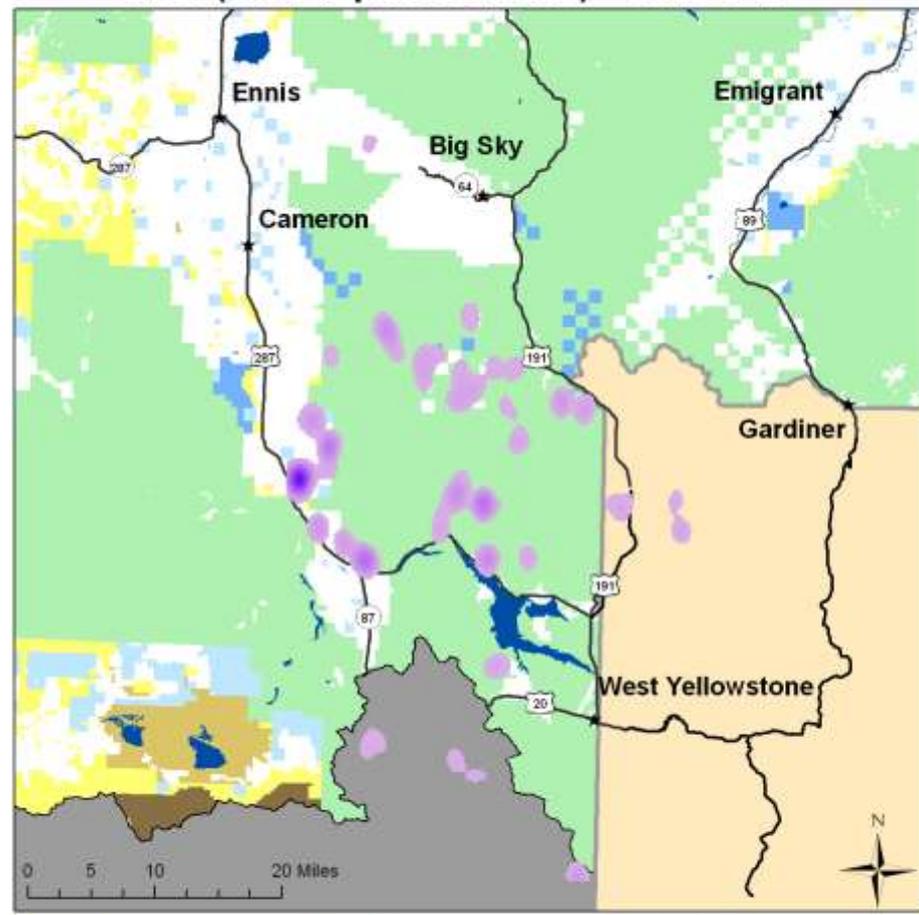
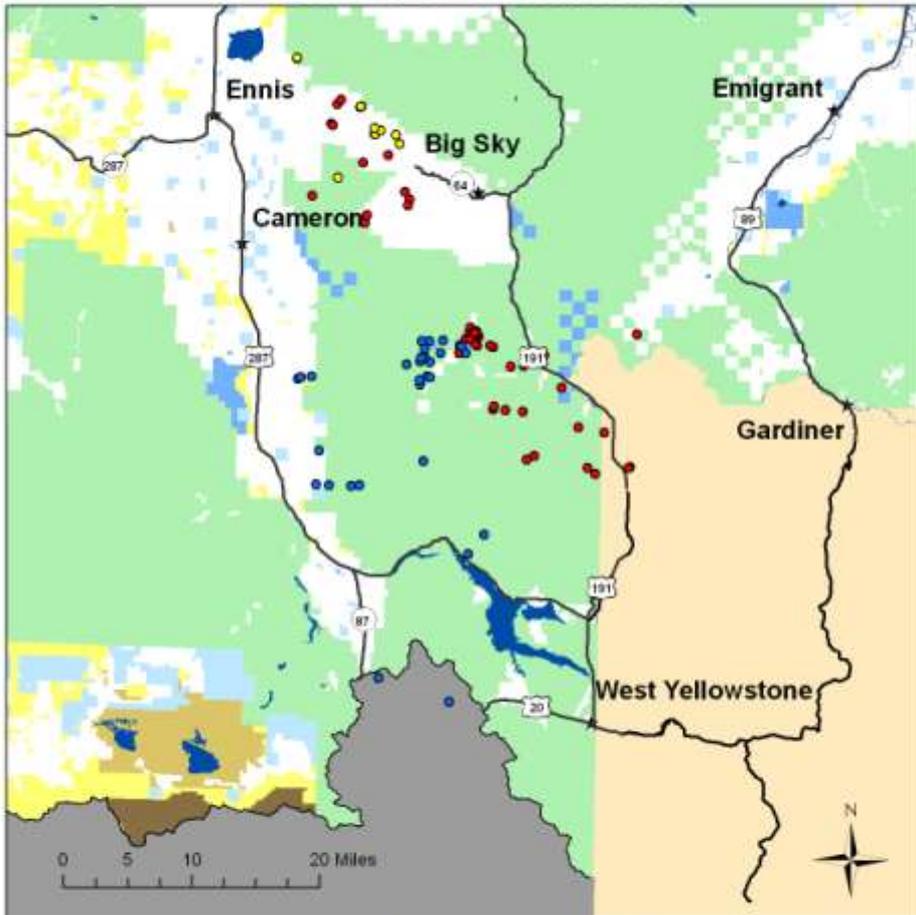
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**Density of Elk Use**



**Madison Valley - 27 cow elk VHF collars (1976-1986)  
JUNE 1-15 LOCATIONS**

**Madison Valley - 43 cow elk GPS collars (2005-06)  
KDE (7am-12pm locations) - June 1-15**



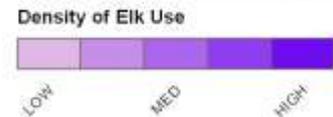
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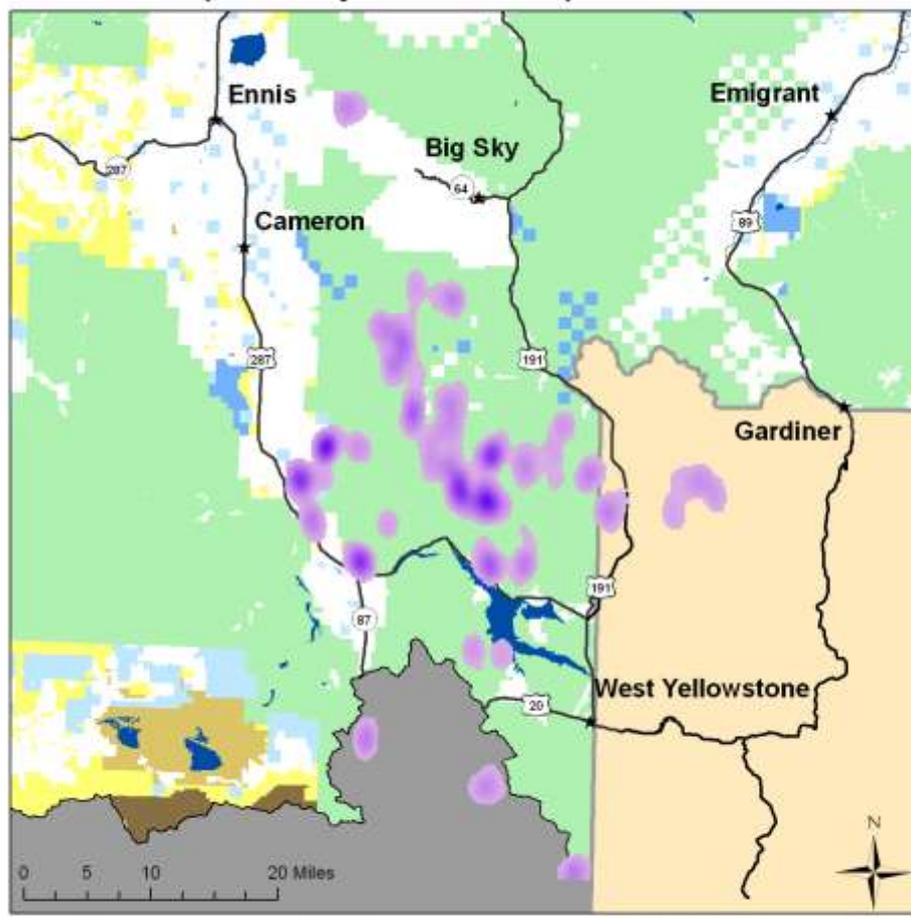
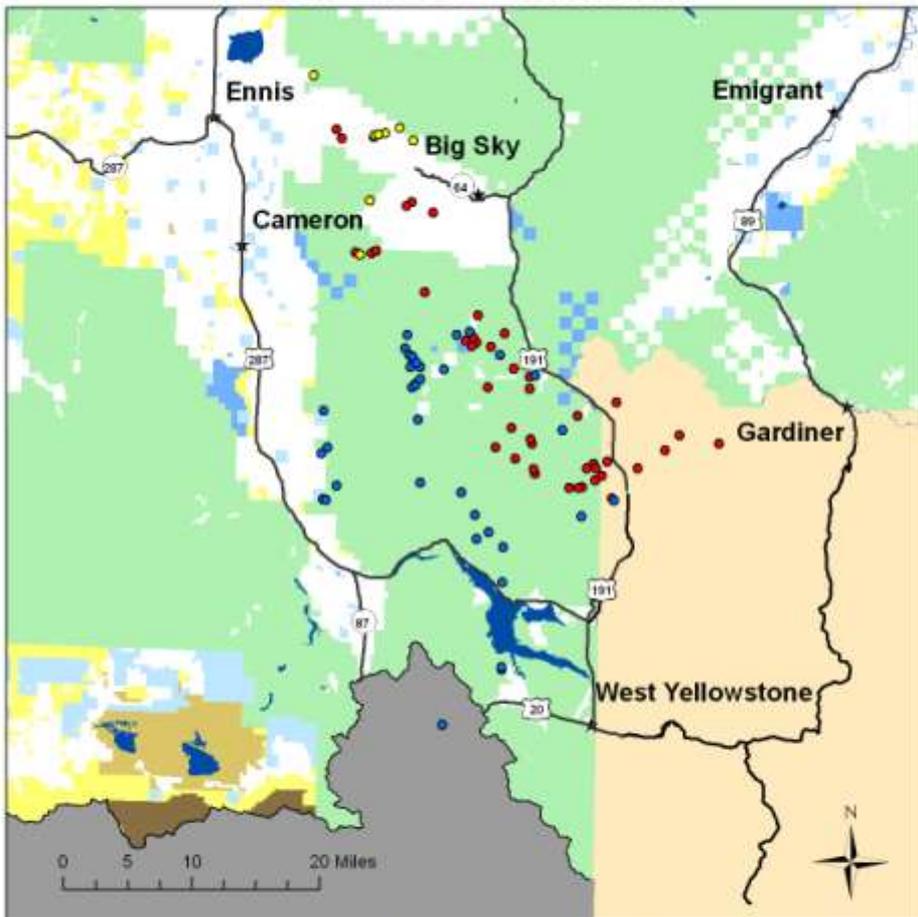
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**Madison Valley - 27 cow elk VHF collars (1976-1986)  
JUNE 16-30 LOCATIONS**

**Madison Valley - 43 cow elk GPS collars (2005-06)  
KDE (7am-12pm locations) - June 16-30**



**POPULATION**

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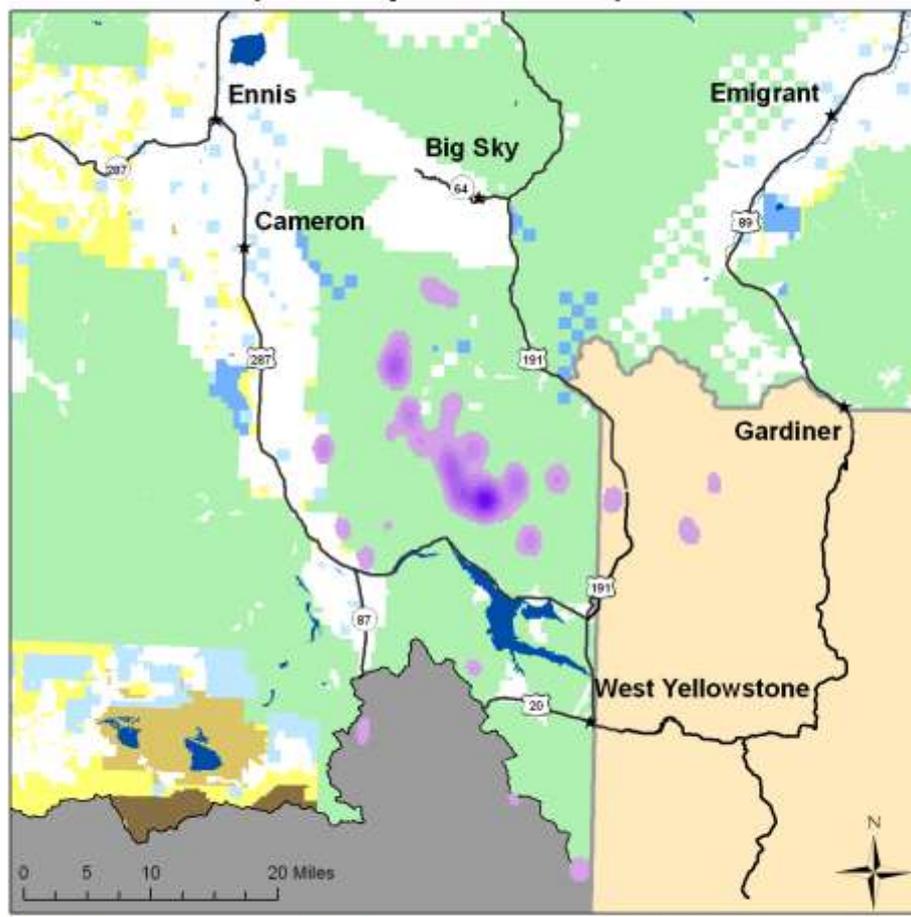
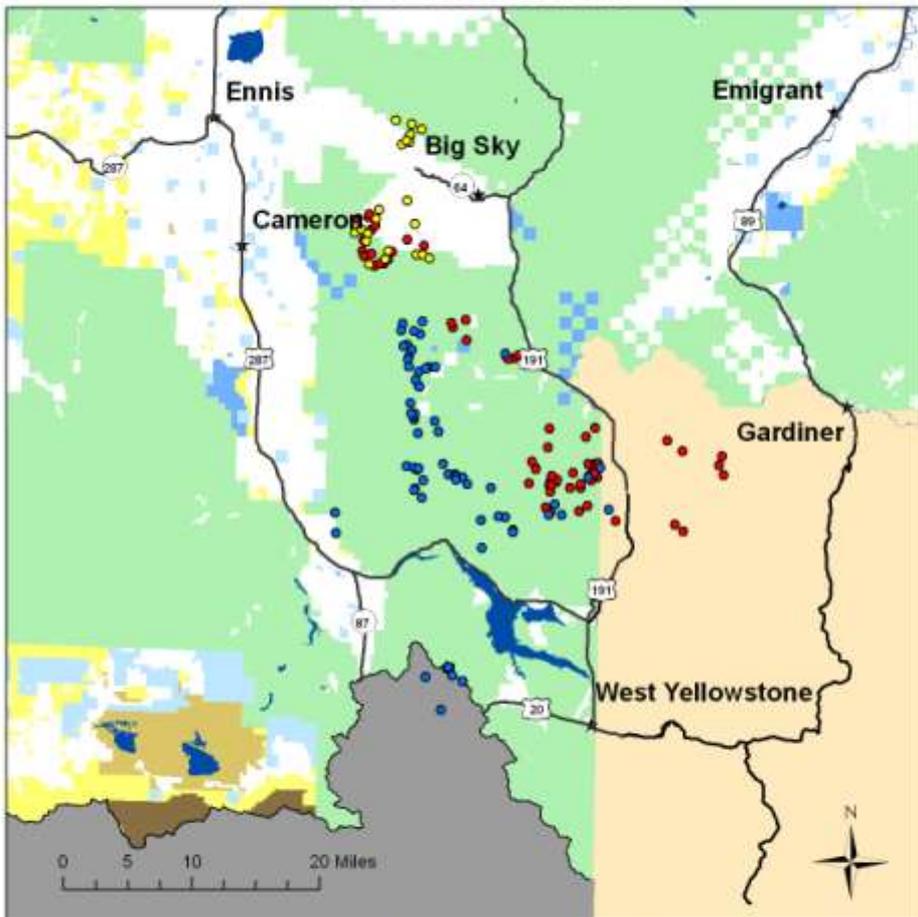
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**Density of Elk Use**



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JULY LOCATIONS**

**Madison Valley - 43 cow elk GPS collars (2005-06)  
KDE (7am-12pm locations) - JULY**



**POPULATION**

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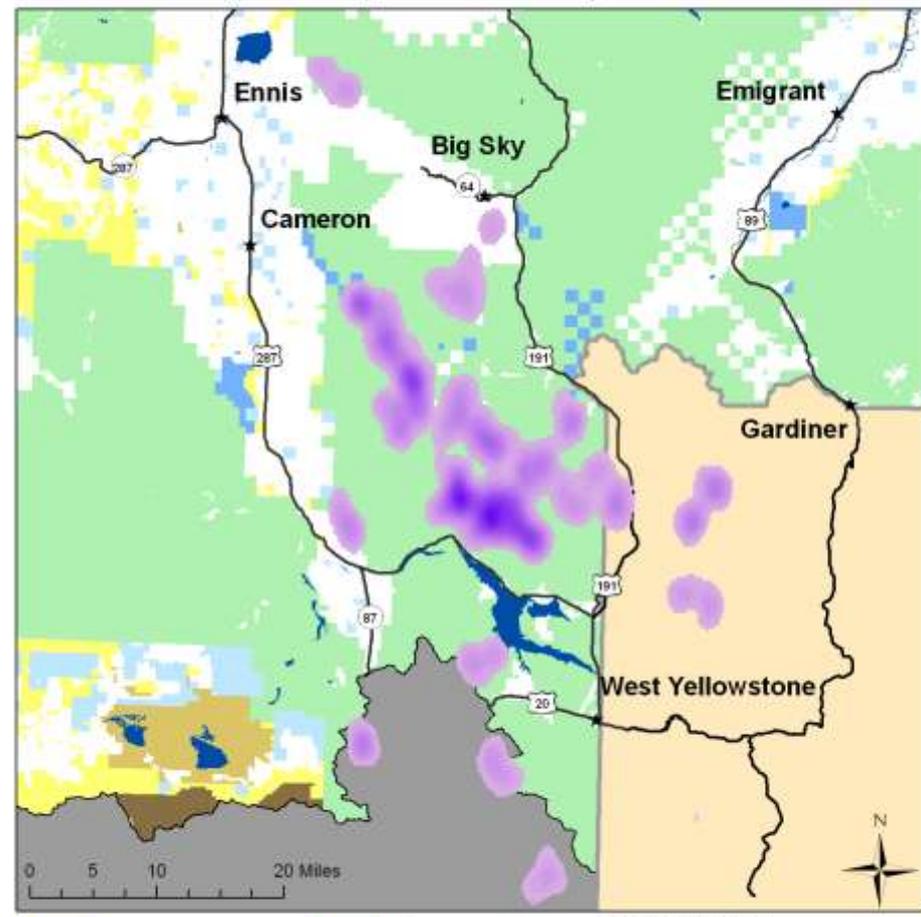
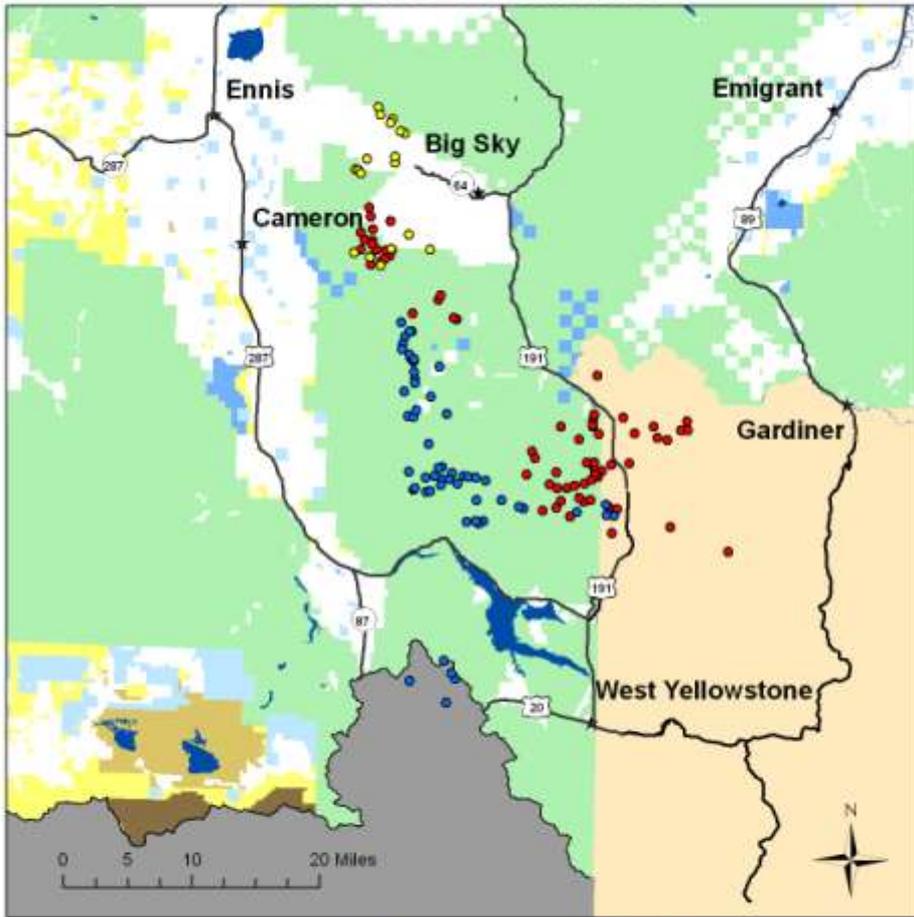
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**Density of Elk Use**



**Madison Valley - 27 cow elk VHF collars (1976-1986)  
AUGUST LOCATIONS**

**Madison Valley - 43 cow elk GPS collars (2005-06)  
KDE (7am-12pm locations) - AUGUST**



**POPULATION**

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- Jumping Horse
- Sun Ranch

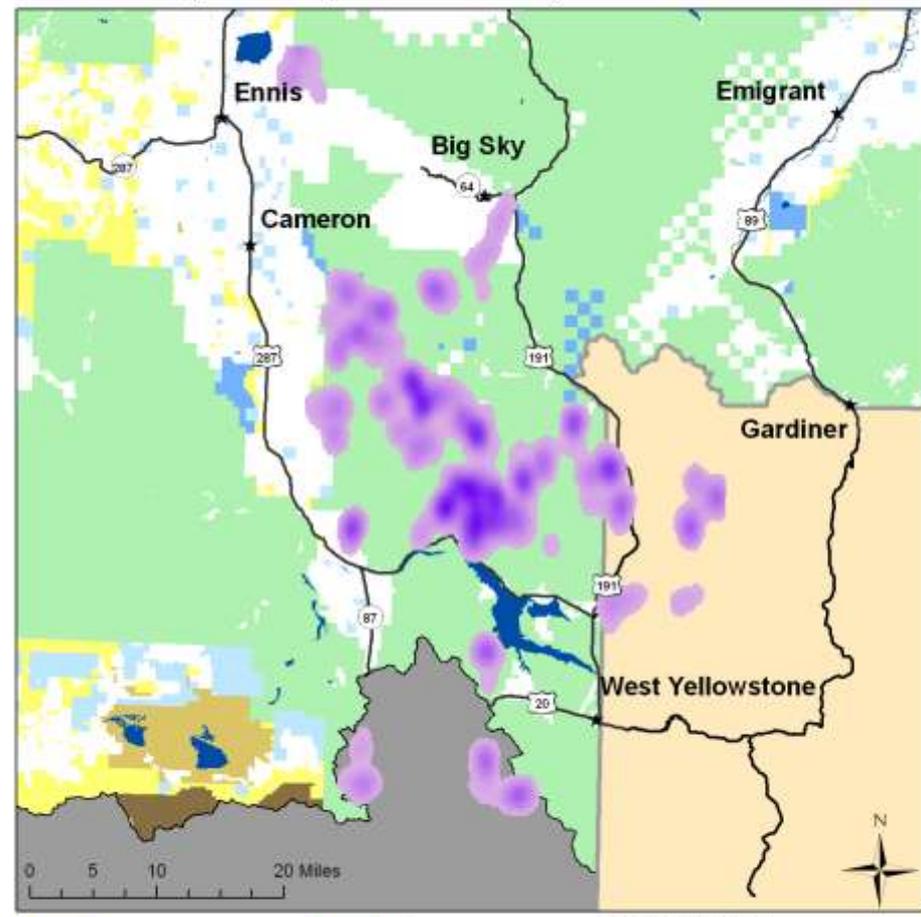
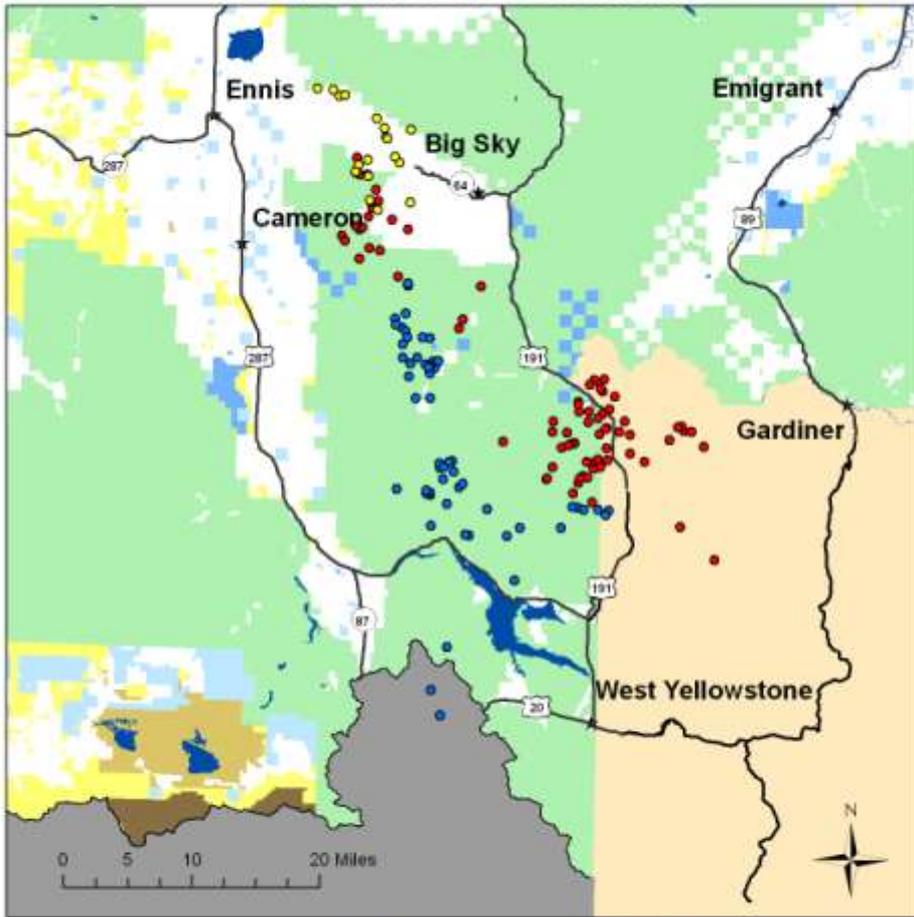
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**Madison Valley - 27 cow elk VHF collars (1976-1986)  
SEPTEMBER LOCATIONS**

**Madison Valley - 43 cow elk GPS collars (2005-06)  
KDE (7am-12pm locations) - SEPTEMBER**



**POPULATION**

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- Sun Ranch

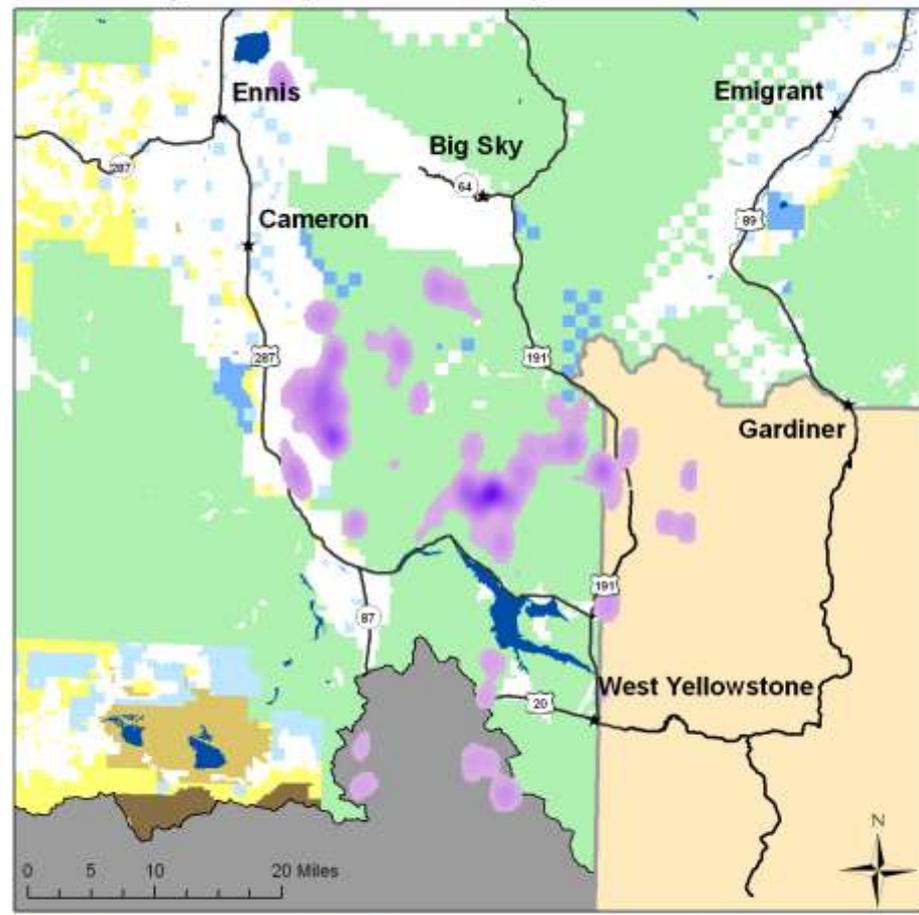
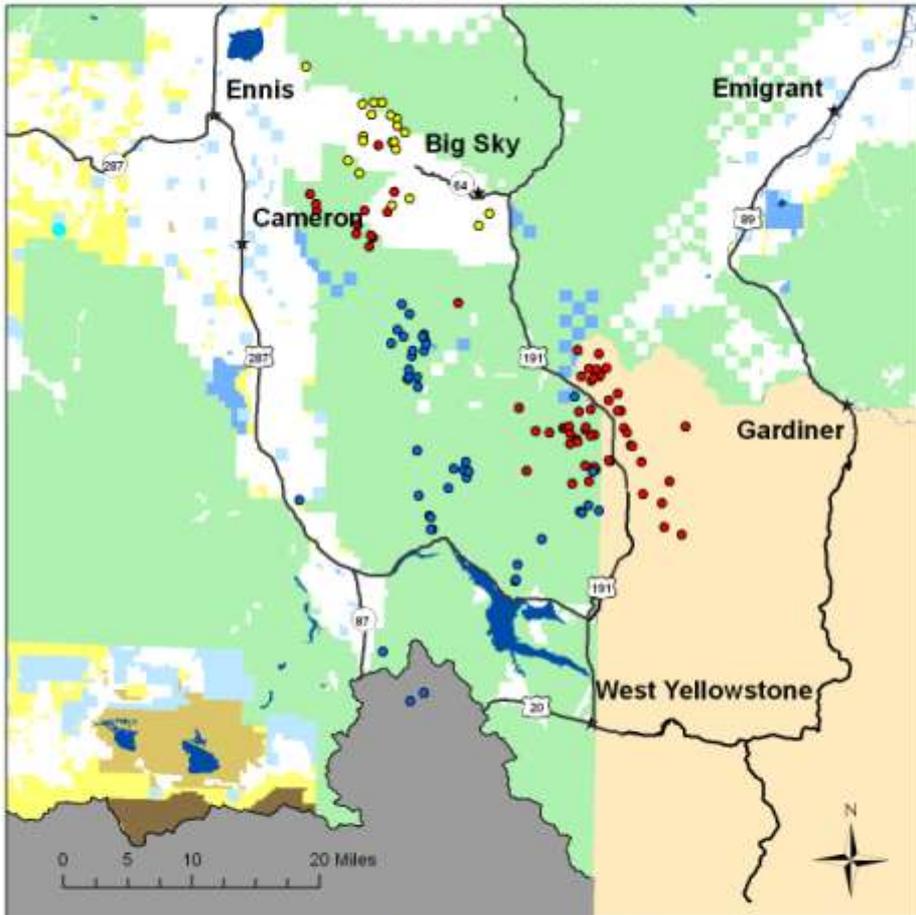
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**Madison Valley - 27 cow elk VHF collars (1976-1986)  
OCTOBER 1-21 LOCATIONS**

**Madison Valley - 43 cow elk GPS collars (2005-06)  
KDE (7am-12pm locations) - OCTOBER 1-20**



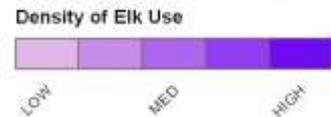
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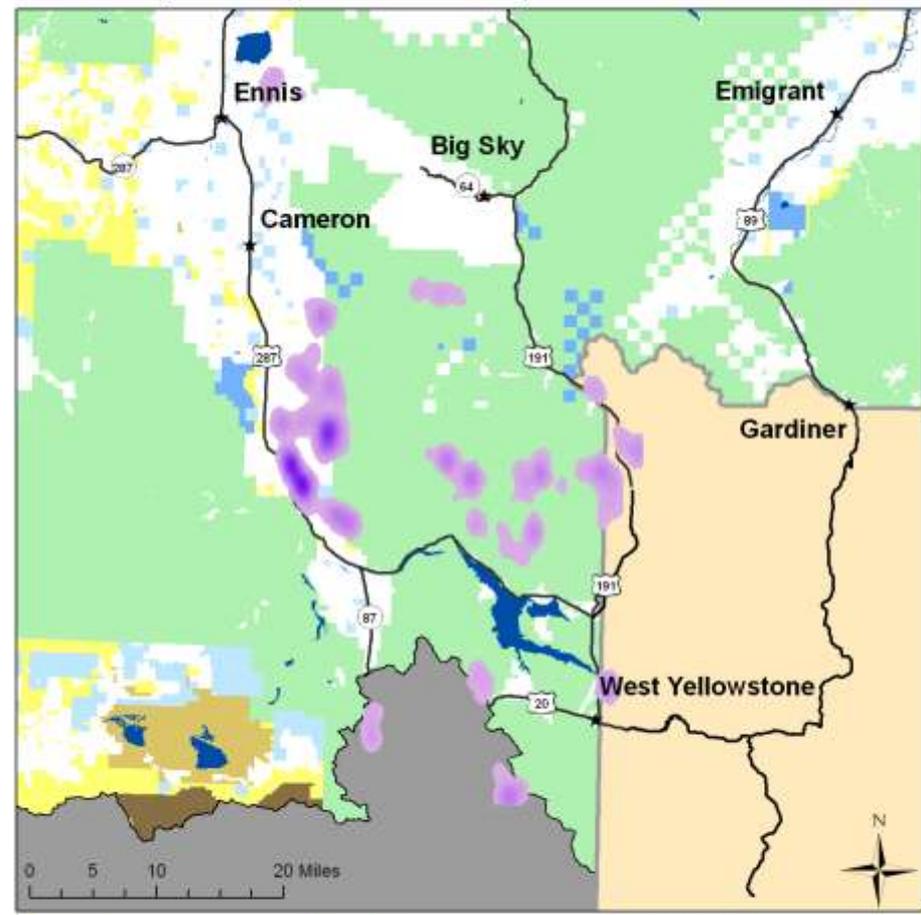
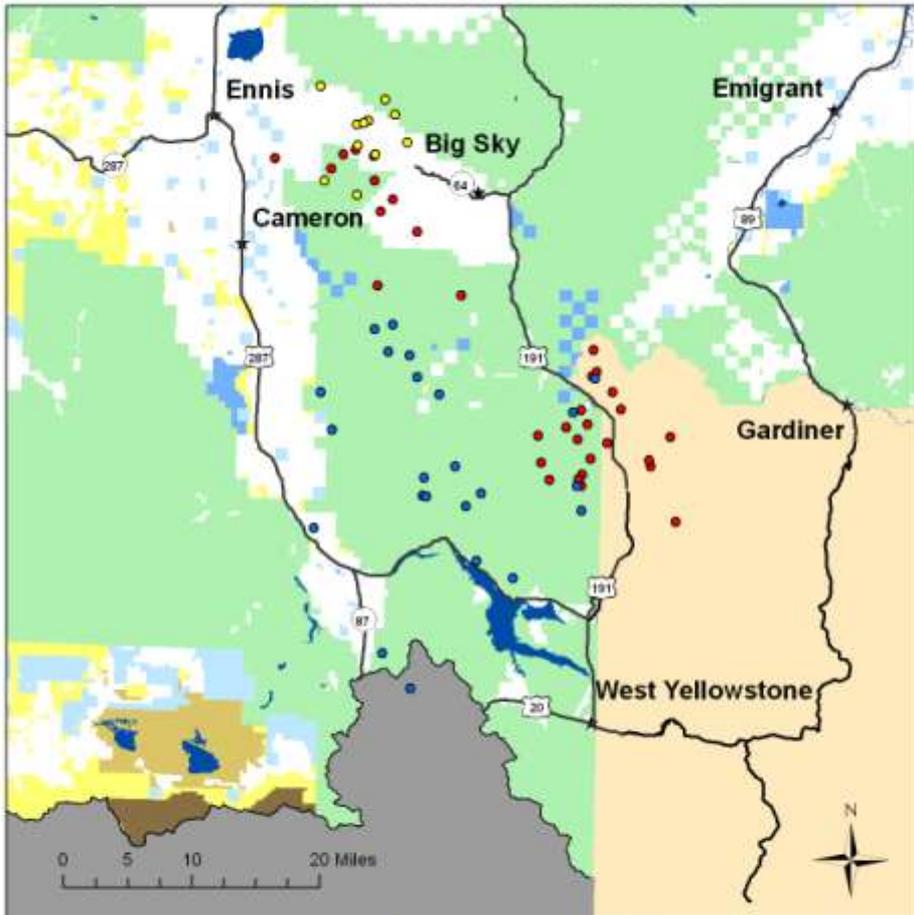
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- MFWP
- MT State Trust
- Private Land



**Madison Valley - 27 cow elk VHF collars (1976-1986)  
OCTOBER 22-31 LOCATIONS**

**Madison Valley - 43 cow elk GPS collars (2005-06)  
KDE (7am-12pm locations) - OCTOBER 21-31**



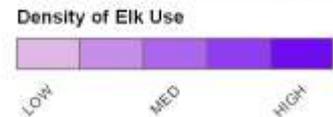
**POPULATION**

- Bear Creek
- Jumping Horse
- Sun Ranch

- BLM
- NPS
- Other Federal
- USFWS

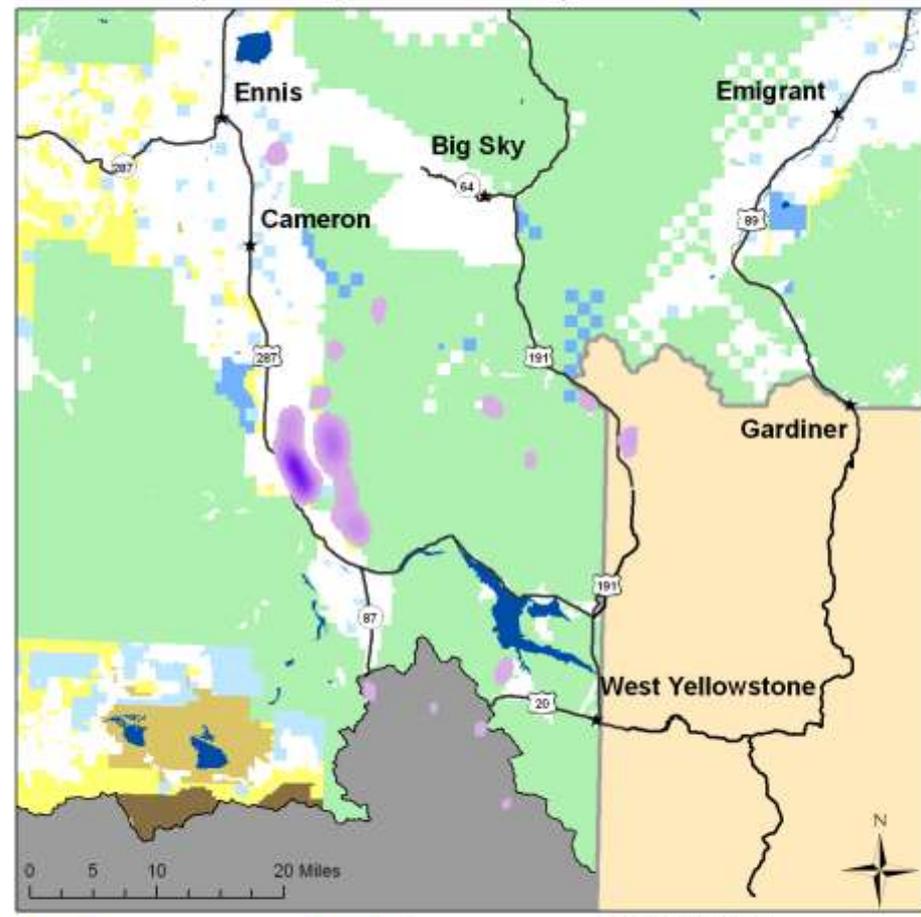
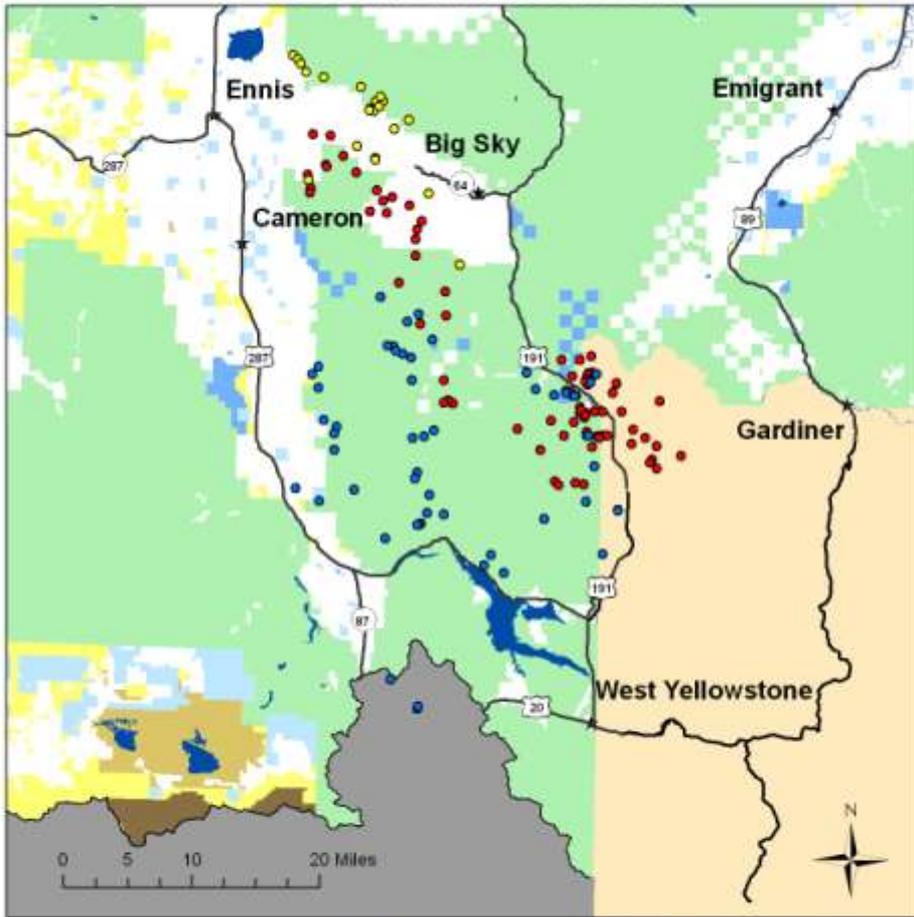
- USFS
- MFWP
- MT State Trust
- Private Land

- BLM
- NPS
- Other Federal
- USFWS
- USFS
- MFWP
- MT State Trust
- Private Land



**Madison Valley - 27 cow elk VHF collars (1976-1986)  
NOVEMBER LOCATIONS**

**Madison Valley - 43 cow elk GPS collars (2005-06)  
KDE (7am-12pm locations) - NOVEMBER**



**POPULATION**

- Bear Creek
- Jumping Horse
- Sun Ranch

- BLM
- NPS
- Other Federal
- USFWS

- USFS
- MFWP
- MT State Trust
- Private Land

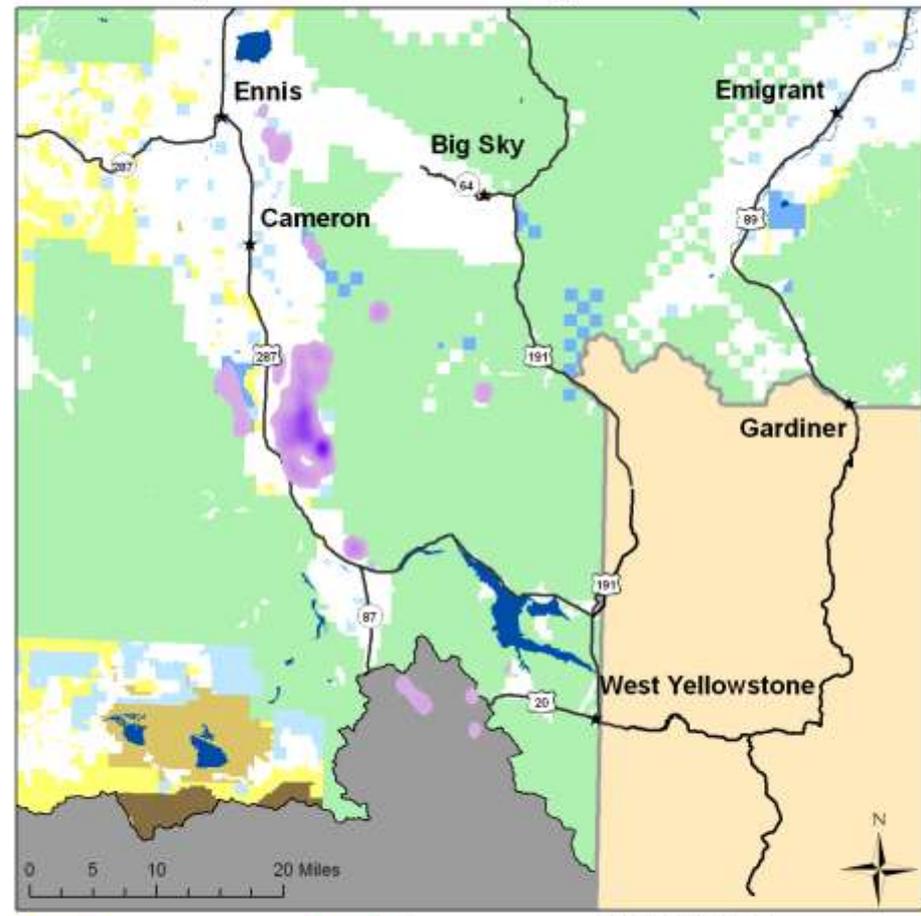
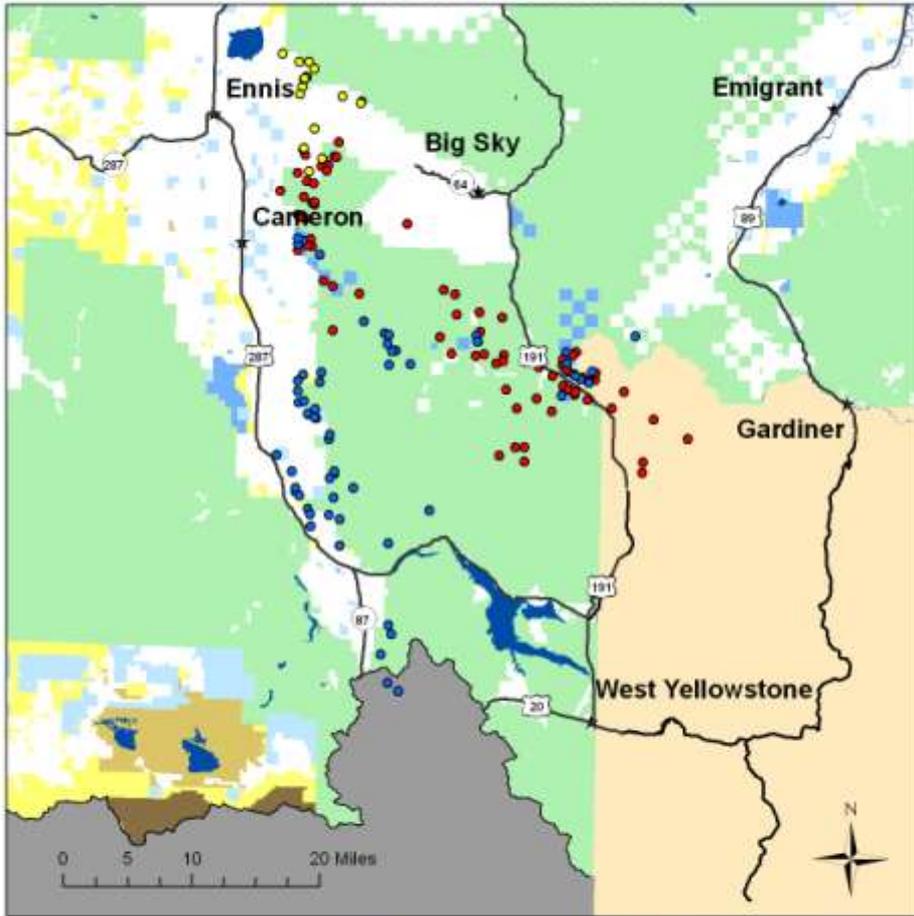
- BLM
- NPS
- Other Federal
- USFWS
- USFS
- MFWP
- MT State Trust
- Private Land

**Density of Elk Use**



**Madison Valley - 27 cow elk VHF collars (1976-1986)  
DECEMBER LOCATIONS**

**Madison Valley - 43 cow elk GPS collars (2005-06)  
KDE (7am-12pm locations) - DECEMBER**



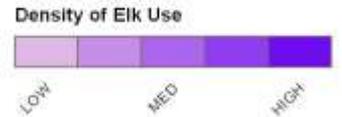
**POPULATION**

- Bear Creek
- Jumping Horse
- Sun Ranch

- BLM
- NPS
- Other Federal
- USFWS

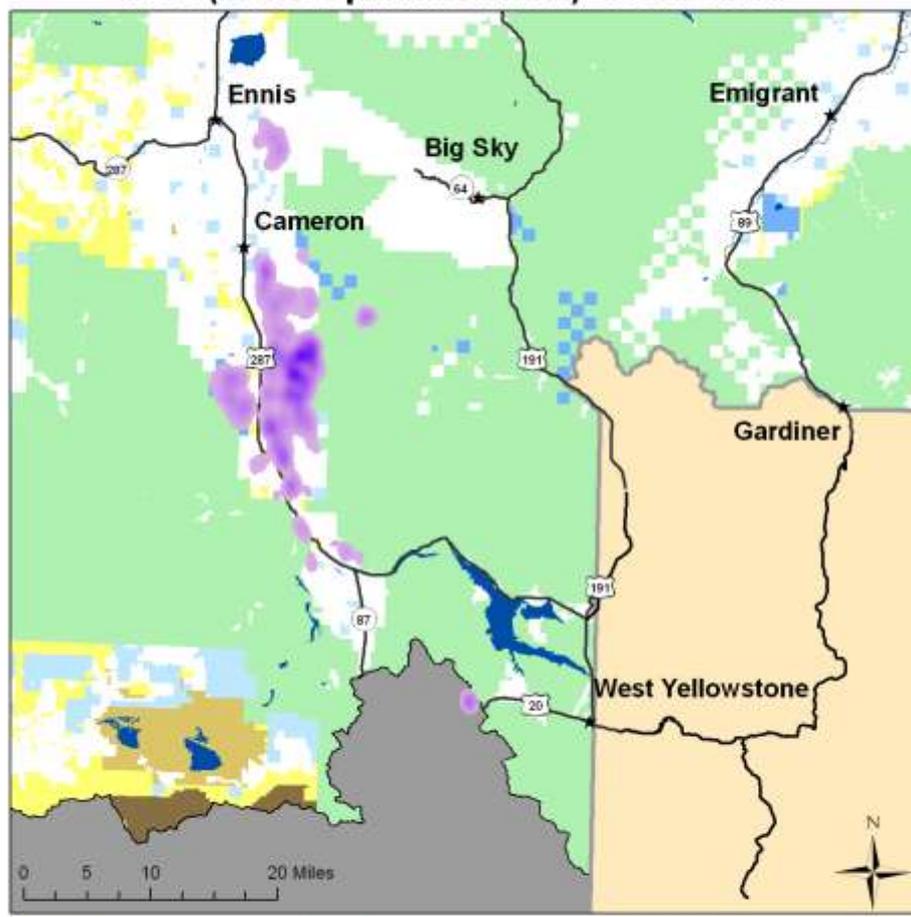
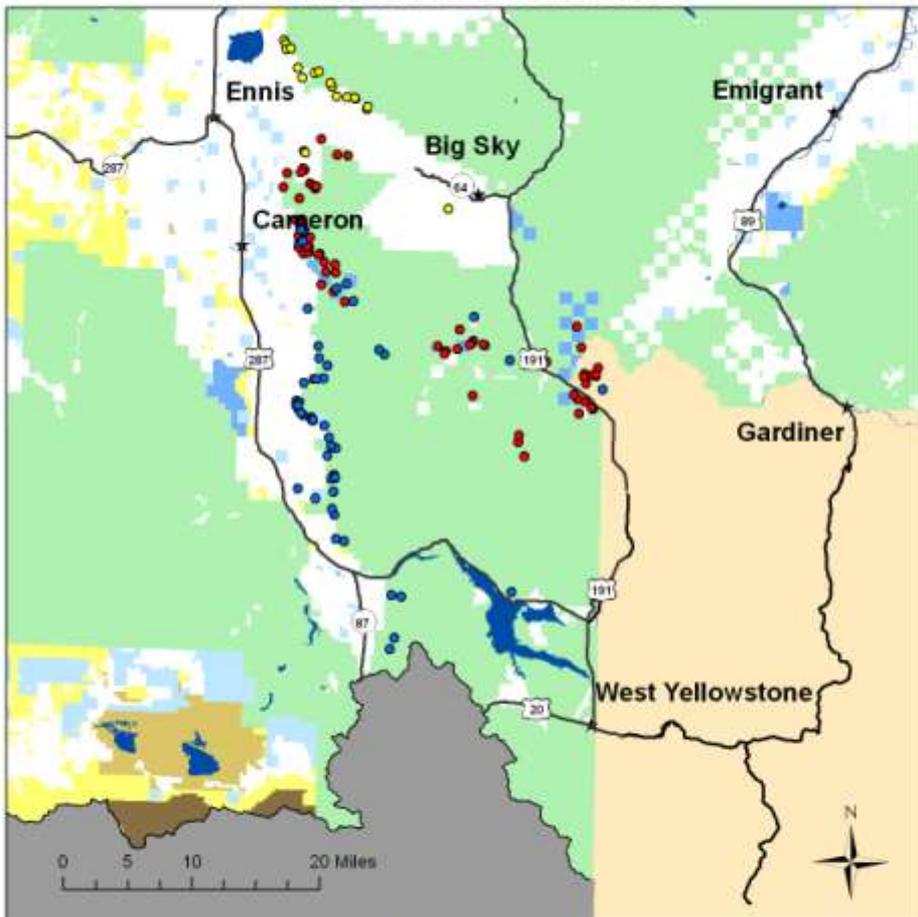
- USFS
- MFWP
- MT State Trust
- Private Land

- BLM
- NPS
- Other Federal
- USFWS
- USFS
- MFWP
- MT State Trust
- Private Land



**Madison Valley - 27 cow elk VHF collars (1976-1986)  
JANUARY LOCATIONS**

**Madison Valley - 43 cow elk GPS collars (2005-06)  
KDE (7am-12pm locations) - JANUARY**



**POPULATION**

- Bear Creek
- Jumping Horse
- Sun Ranch

- BLM
- NPS
- Other Federal
- USFWS

- USFS
- MFWP
- MT State Trust
- Private Land

- BLM
- NPS
- Other Federal
- USFWS
- USFS
- MFWP
- MT State Trust
- Private Land

**Density of Elk Use**



# General Rifle Season Locations

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<b>Land Type</b>	<b>1976-1986</b>	<b>2005-2006*</b>
<b>Yellowstone National Park</b>	<b>20.5%</b>	<b>6.5%</b>
<b>Forest (public &amp; private)</b>	<b>74.6%</b>	<b>43.7%</b>
<b>Private Ag. (valley bottom)</b>	<b>3.3%</b>	<b>41.7%</b>

---

\* 2005-2006 are 7:00am to 12:00pm locations to be compatible with the 1976-1986 flight data

# Madison Valley – Comparison

- In 2005-06, 12.6 times more elk locations were on private land than 1976-86 during the general hunt.
- In 1976-86, elk did not move to winter ranges until winter conditions set in (December through February)
- In 2005-06, elk moved to private lands as early as September.

# Madison Valley – Other Factors

Have changes in agriculture affected elk movements?

*Note that the Sun Ranch has actually removed pivots and donated their water rights to Trout Unlimited*

*(no irrigation)*



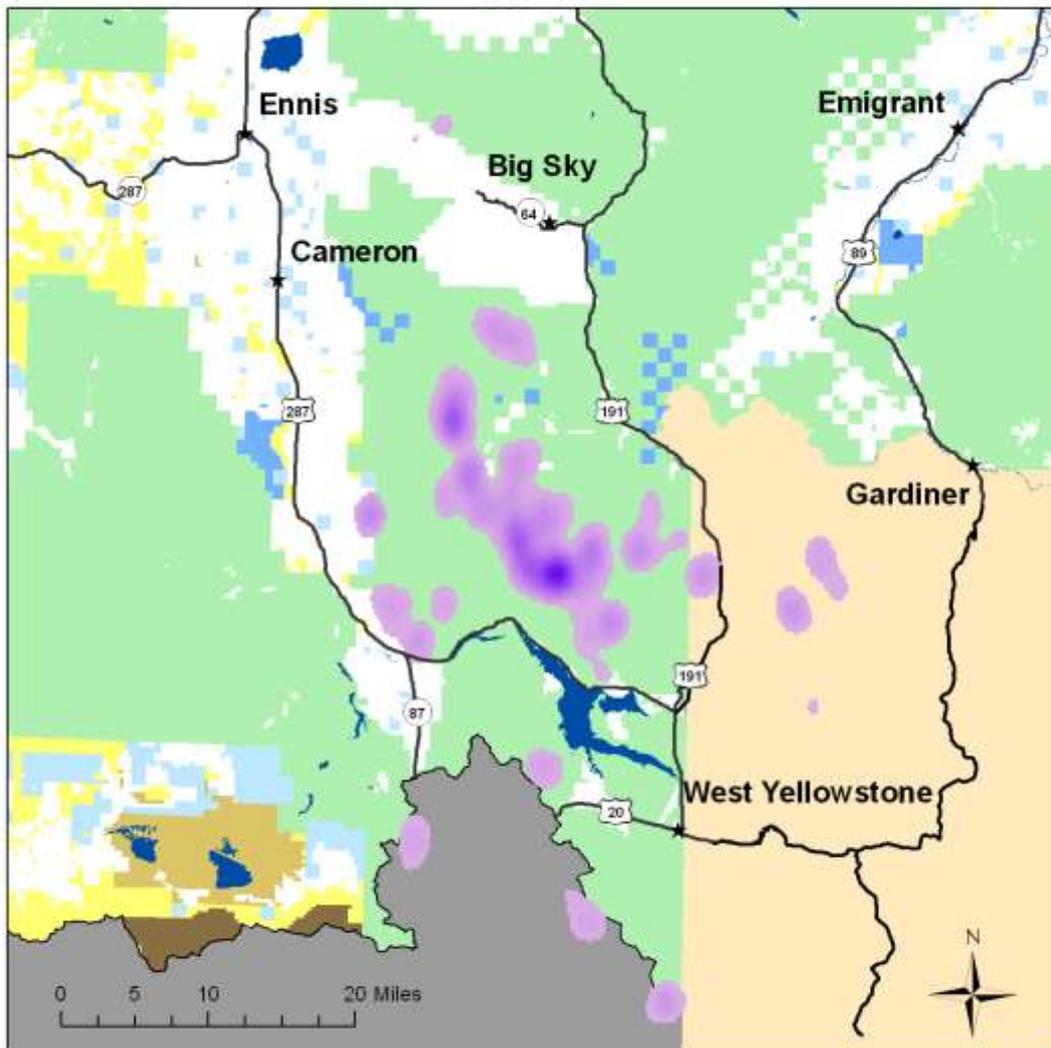
# Madison Valley – Other Factors

Do wolves affect elk movements?



Photo by Craig Jourdonnais

# 43 Cow Elk and Alpha Male Wolf (2005-2006) JULY



Density of Elk Use



LOW

MED

HIGH

Density of Wolf Use

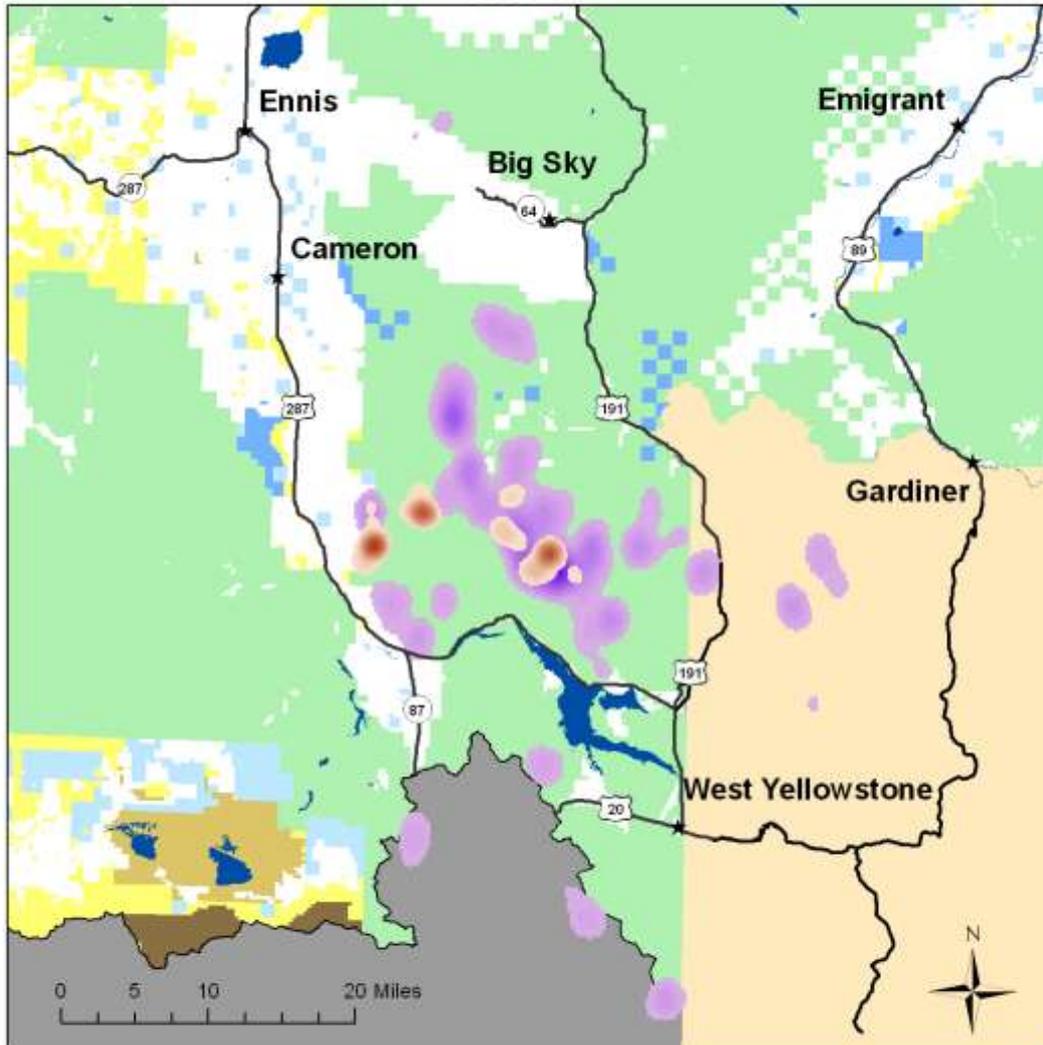


LOW

MED

HIGH

# 43 Cow Elk and Alpha Male Wolf (2005-2006) JULY



Density of Elk Use



LOW

MED

HIGH

Density of Wolf Use

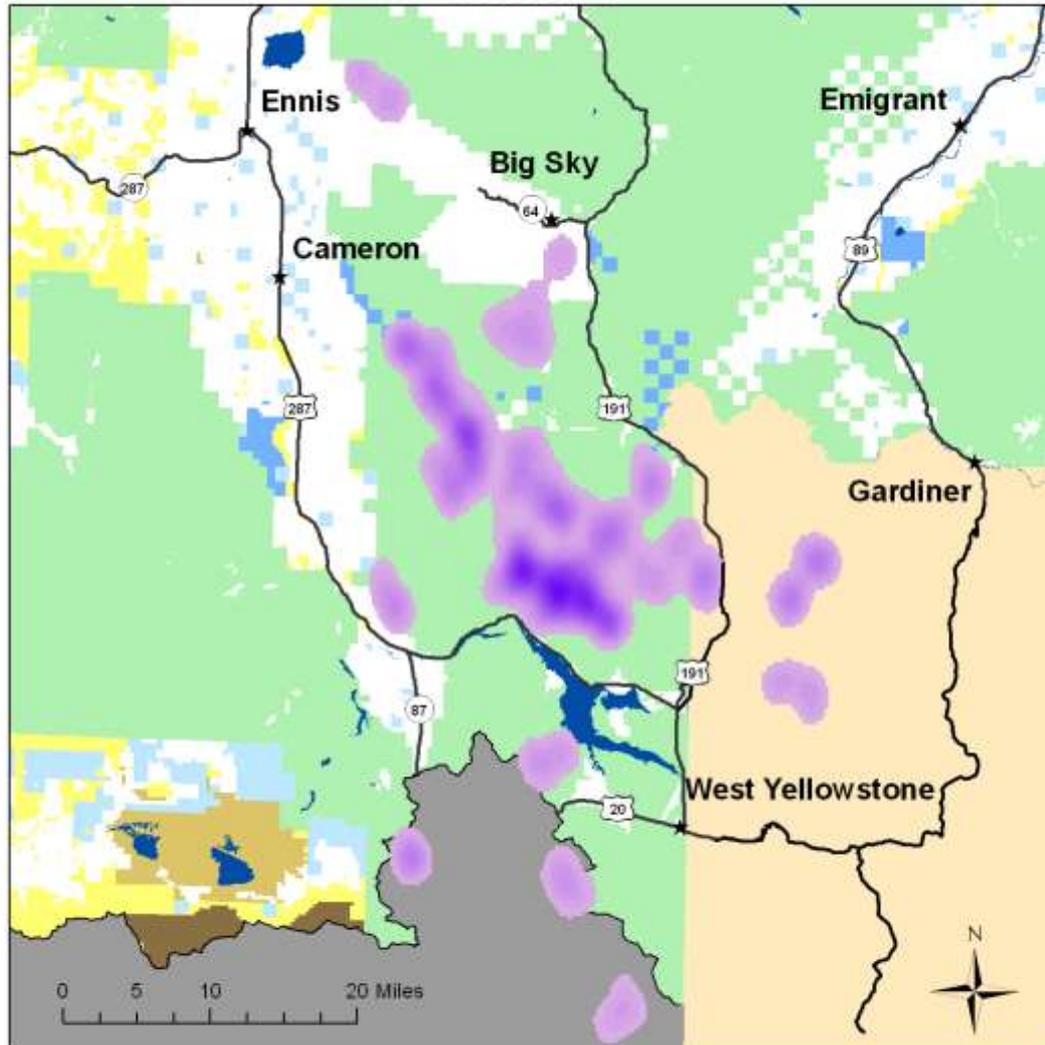


LOW

MED

HIGH

# 43 Cow Elk and Alpha Male Wolf (2005-2006) AUGUST



Density of Elk Use



LOW

MED

HIGH

Density of Wolf Use

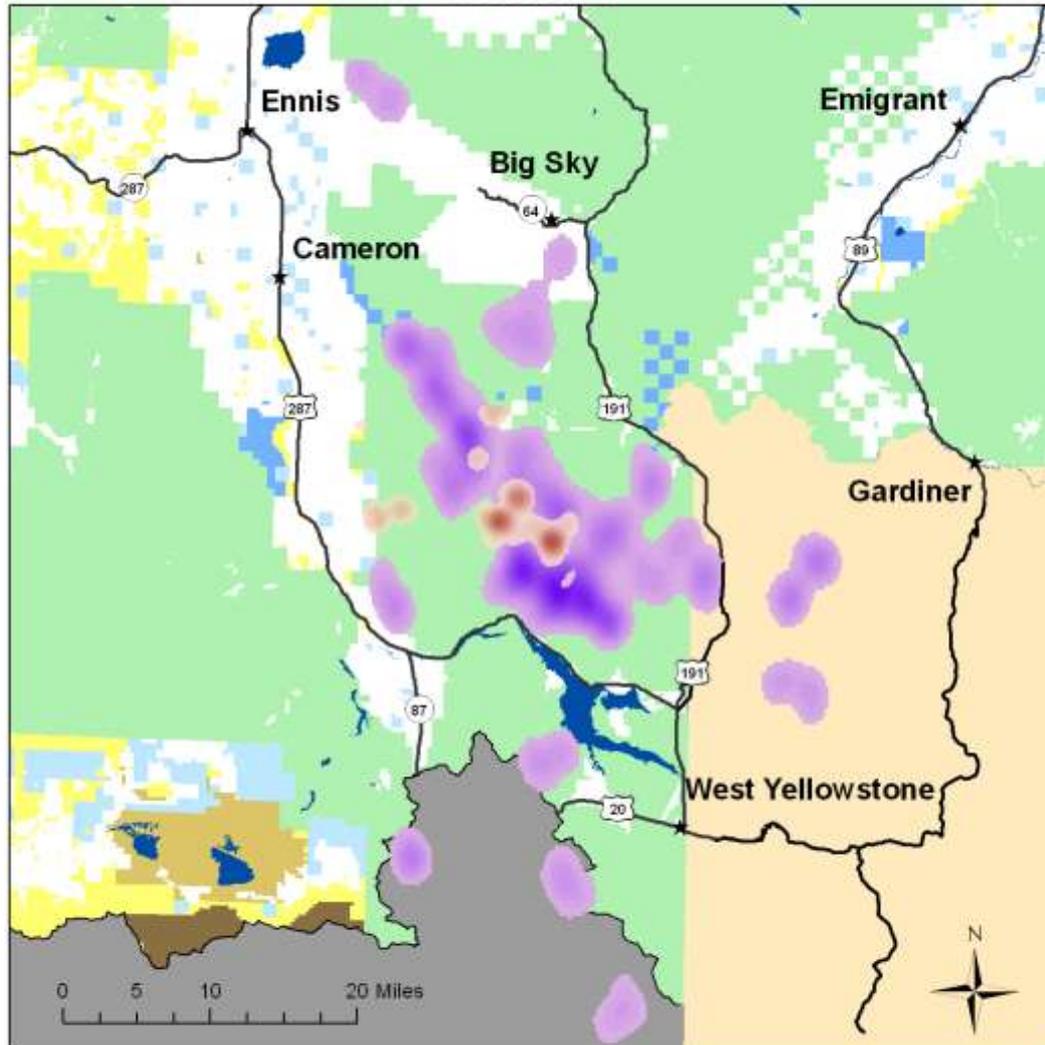


LOW

MED

HIGH

# 43 Cow Elk and Alpha Male Wolf (2005-2006) AUGUST



Density of Elk Use



LOW

MED

HIGH

Density of Wolf Use

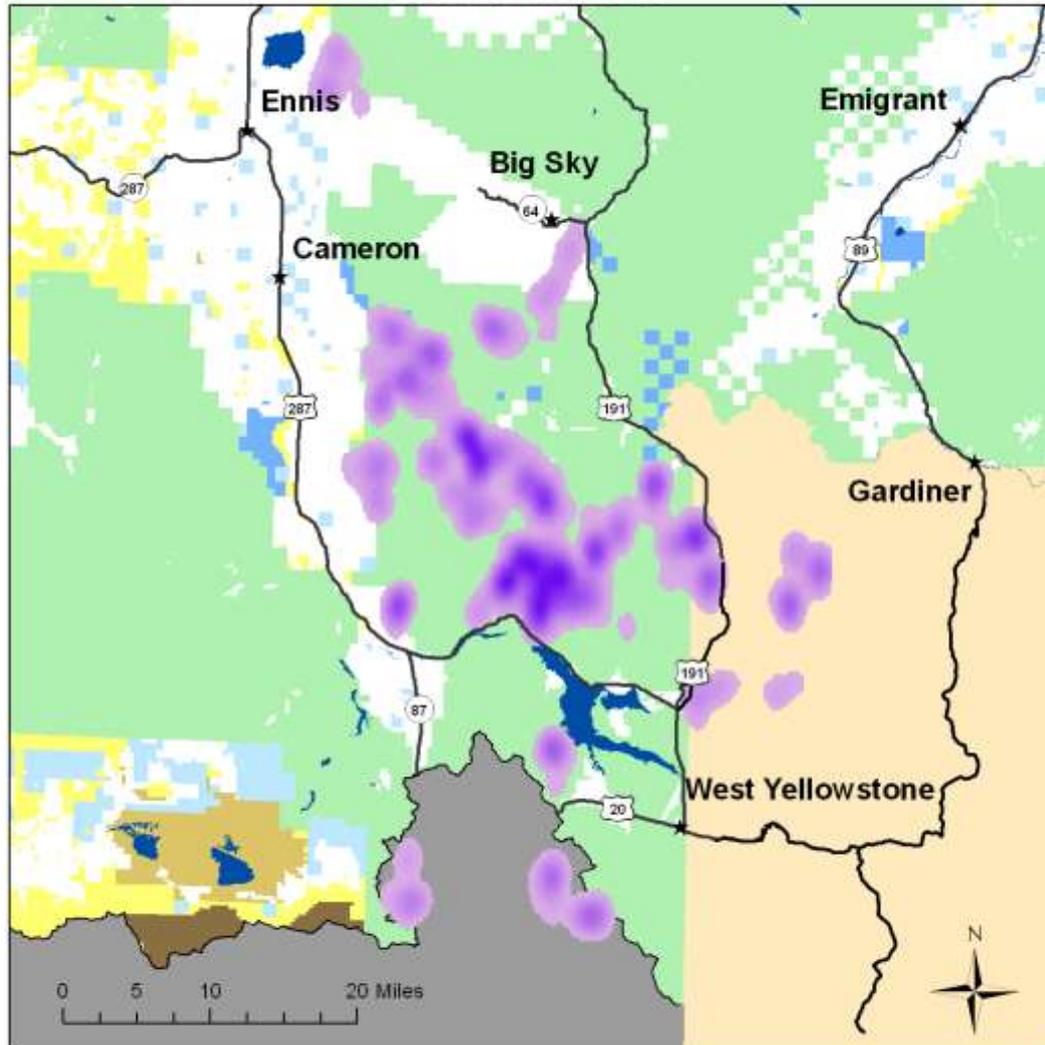


LOW

MED

HIGH

# 43 Cow Elk and Alpha Male Wolf (2005-2006) SEPTEMBER



Density of Elk Use



LOW

MED

HIGH

Density of Wolf Use

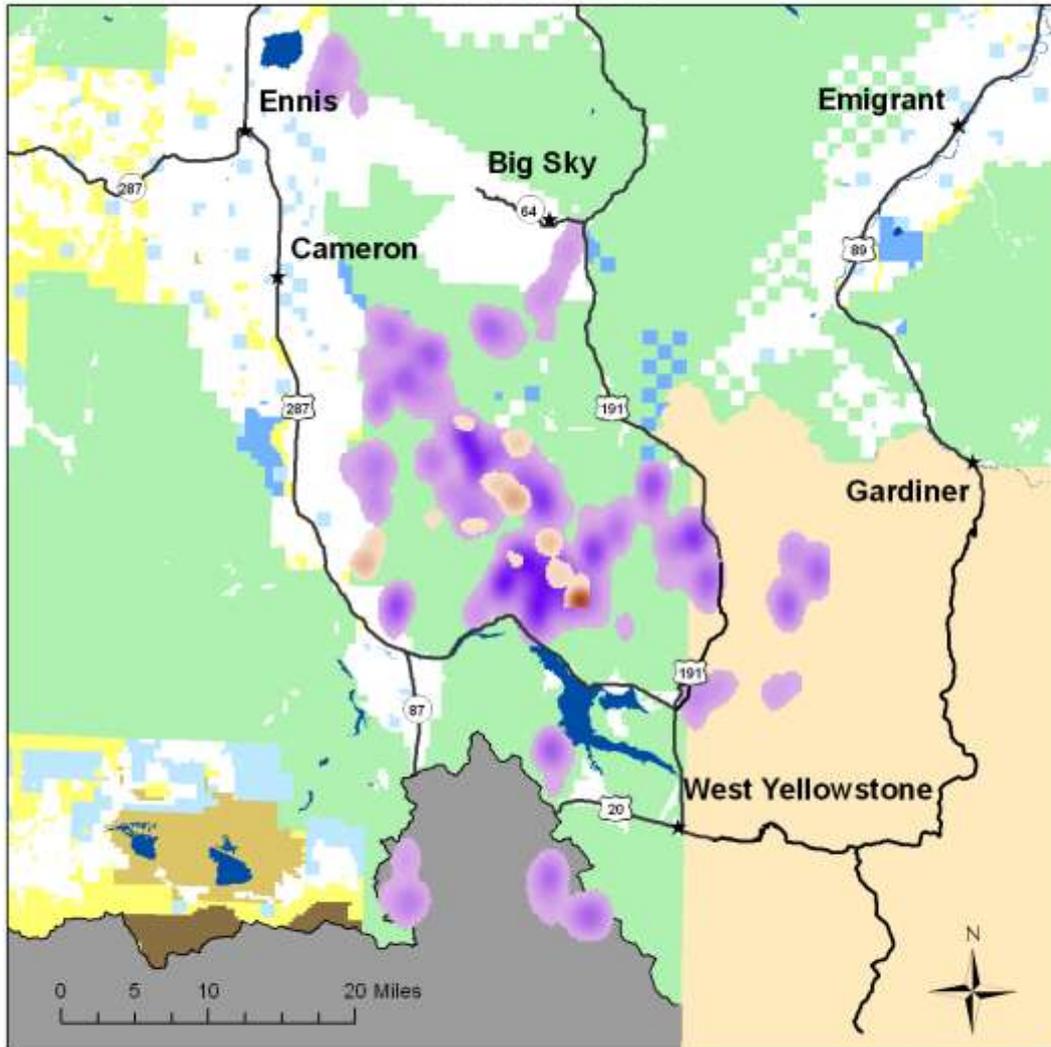


LOW

MED

HIGH

# 43 Cow Elk and Alpha Male Wolf (2005-2006) SEPTEMBER



Density of Elk Use



LOW

MED

HIGH

Density of Wolf Use

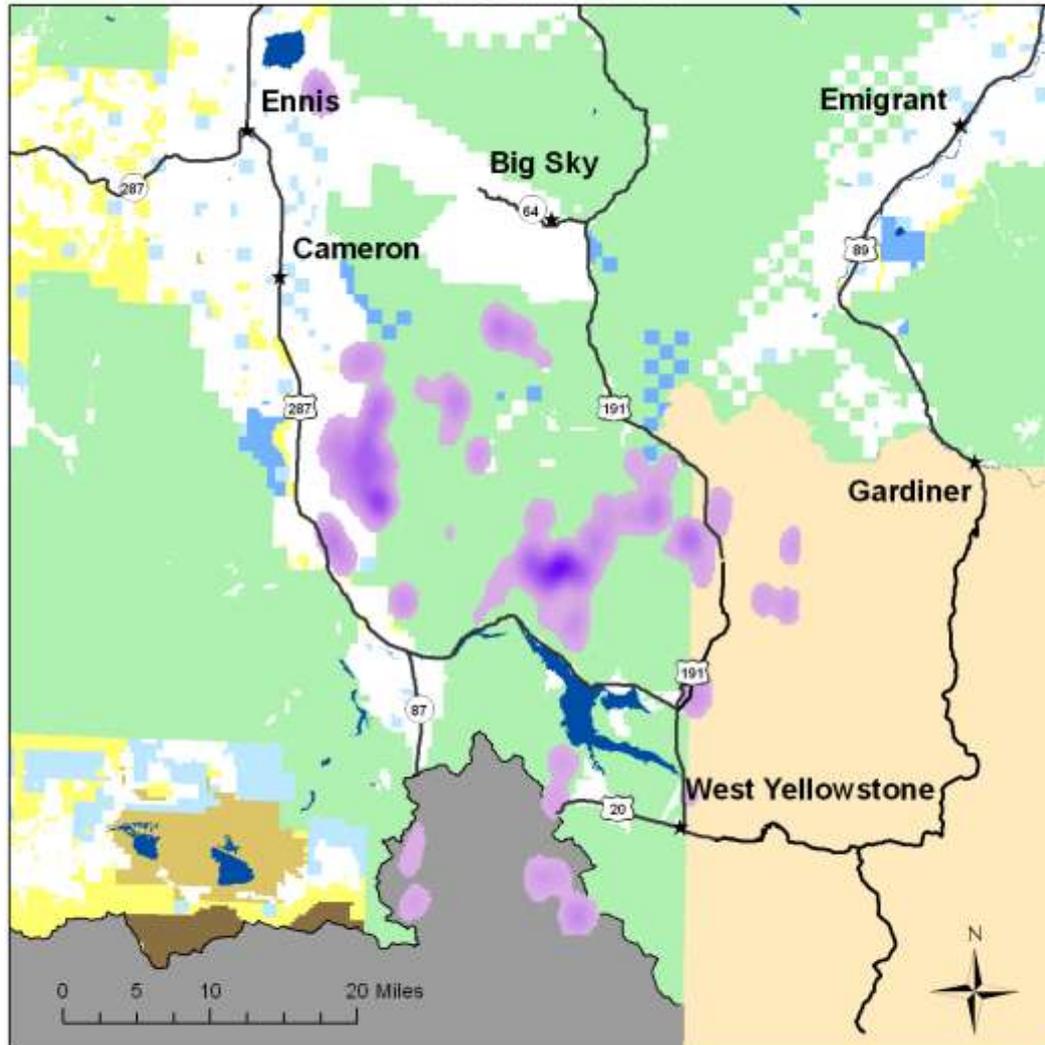


LOW

MED

HIGH

# 43 Cow Elk and Alpha Male Wolf (2005-2006) OCTOBER 1-20



Density of Elk Use



LOW

MED

HIGH

Density of Wolf Use

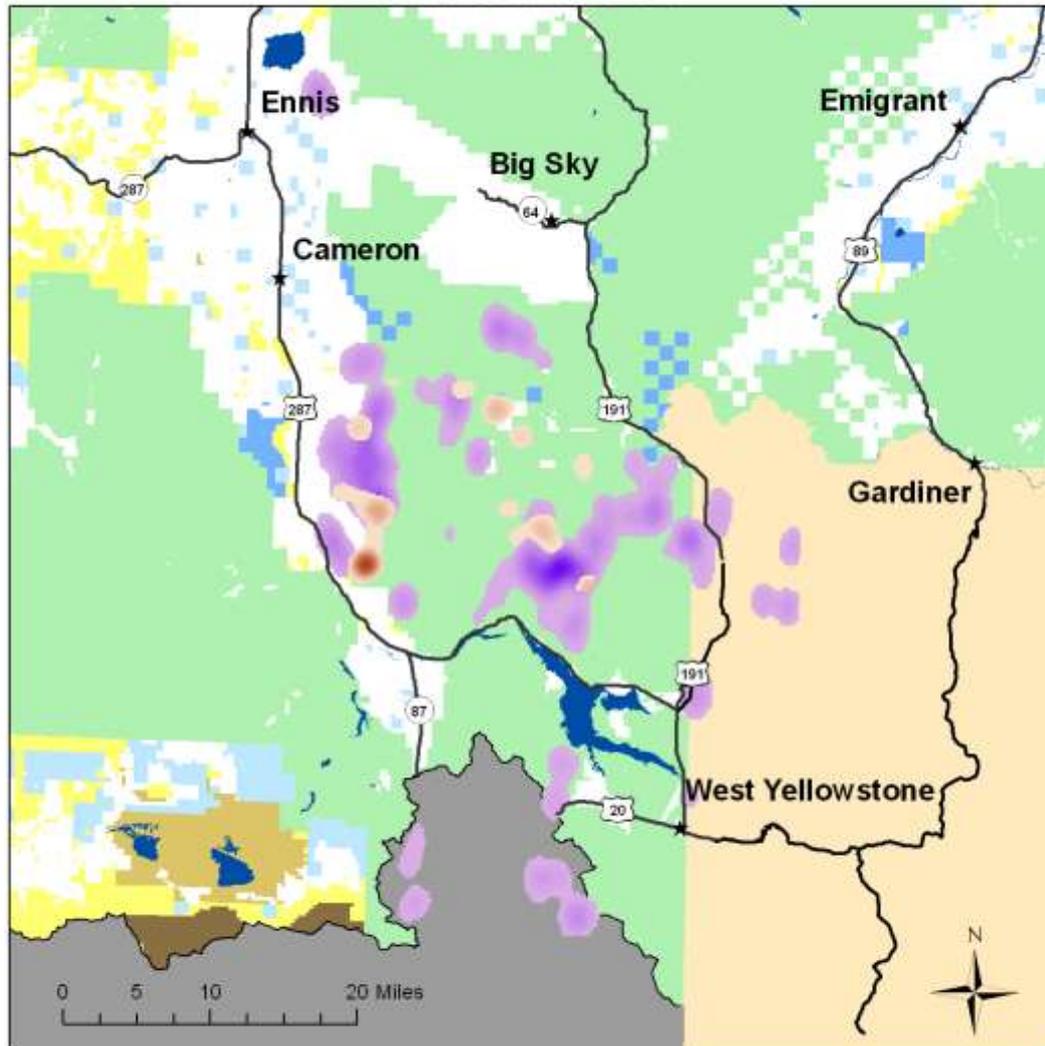


LOW

MED

HIGH

# 43 Cow Elk and Alpha Male Wolf (2005-2006) OCTOBER 1-20



Density of Elk Use



LOW

MED

HIGH

Density of Wolf Use

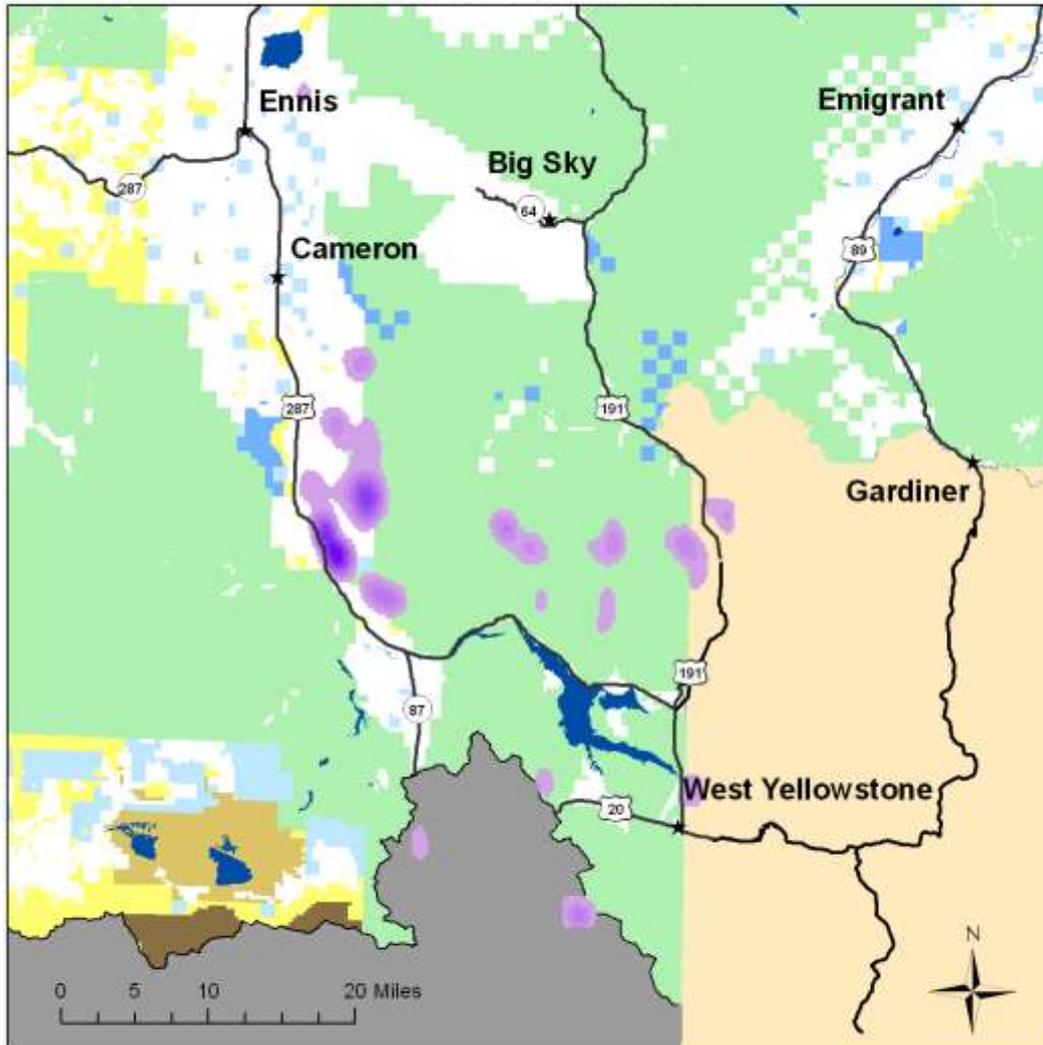


LOW

MED

HIGH

# 43 Cow Elk and Alpha Male Wolf (2005-2006) OCTOBER 21-31



Density of Elk Use



LOW

MED

HIGH

Density of Wolf Use

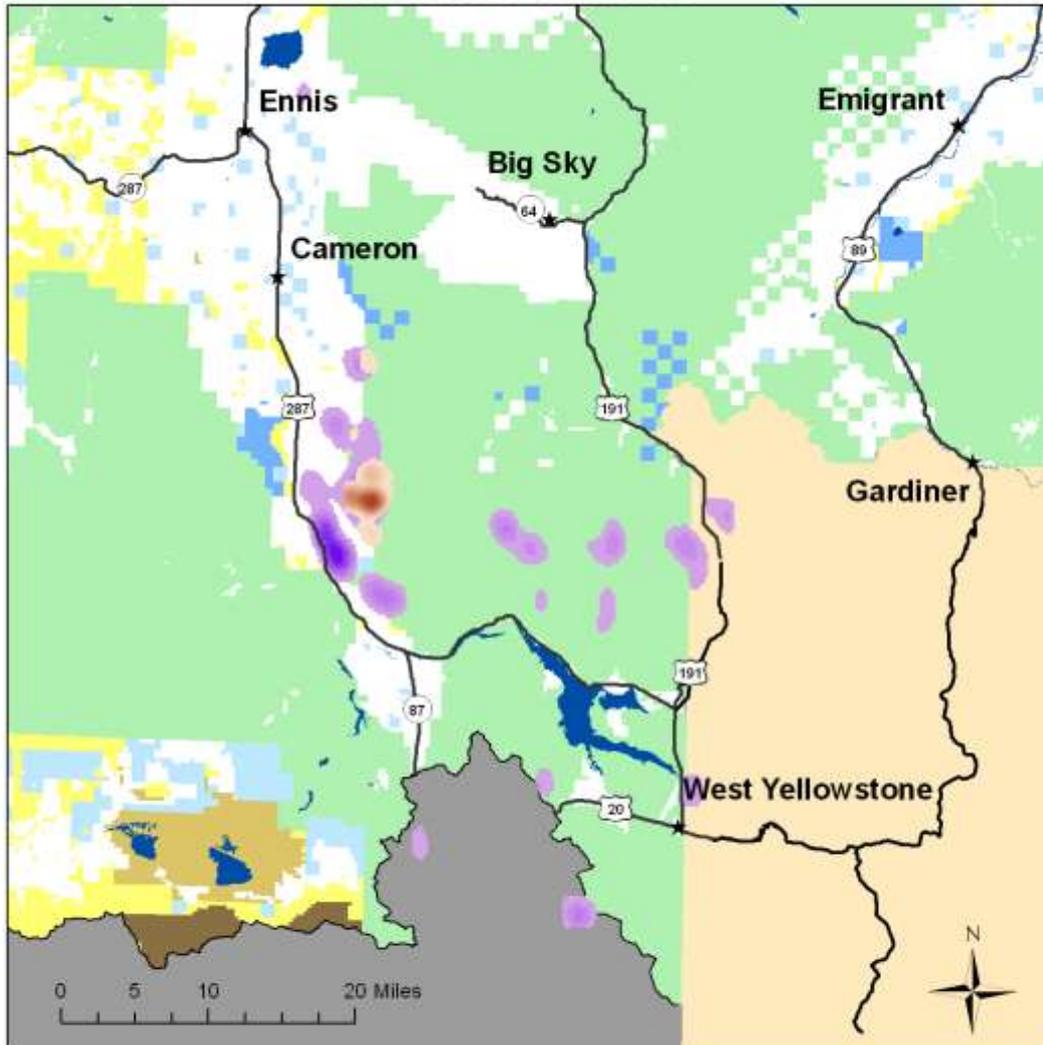


LOW

MED

HIGH

# 43 Cow Elk and Alpha Male Wolf (2005-2006) OCTOBER 21-31



Density of Elk Use



LOW

MED

HIGH

Density of Wolf Use

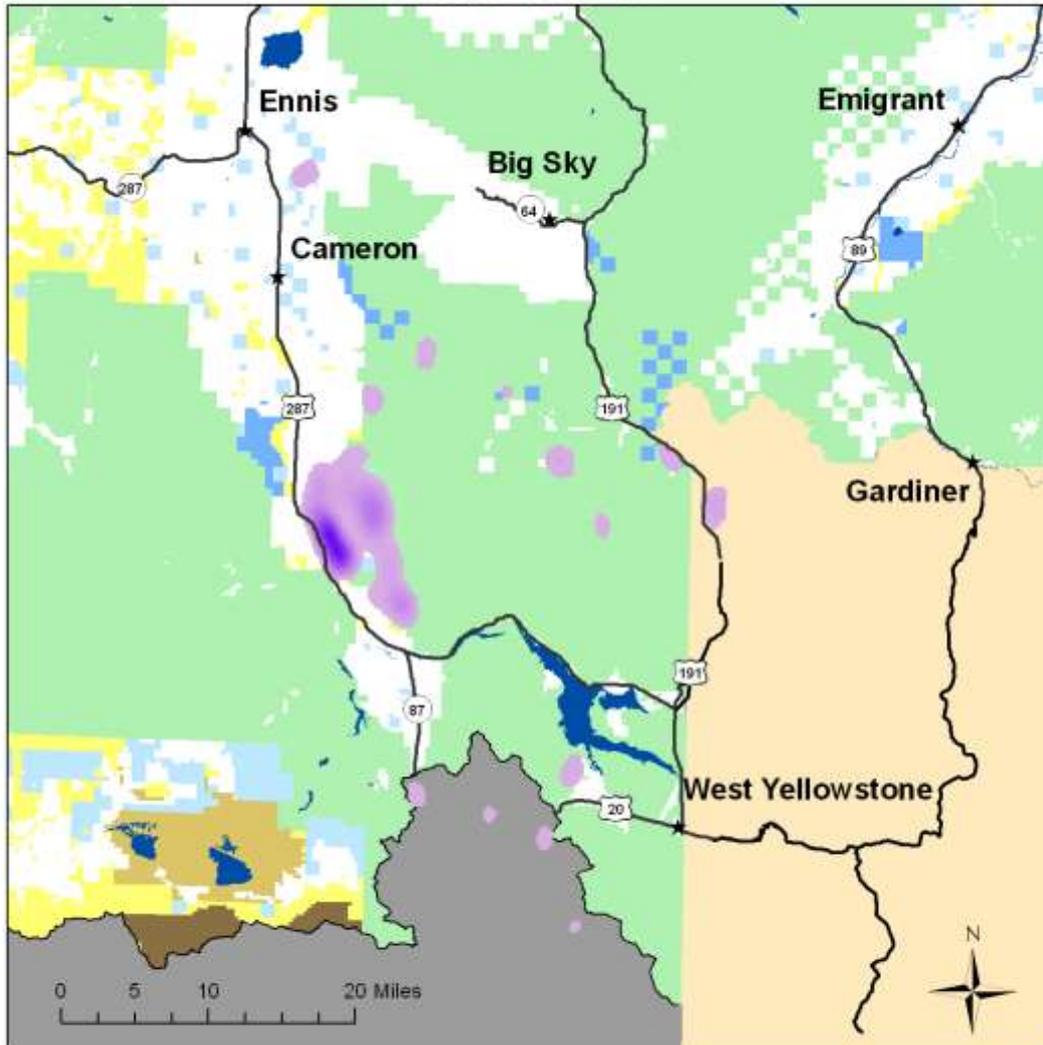


LOW

MED

HIGH

# 43 Cow Elk and Alpha Male Wolf (2005-2006) NOVEMBER



Density of Elk Use



LOW

MED

HIGH

Density of Wolf Use

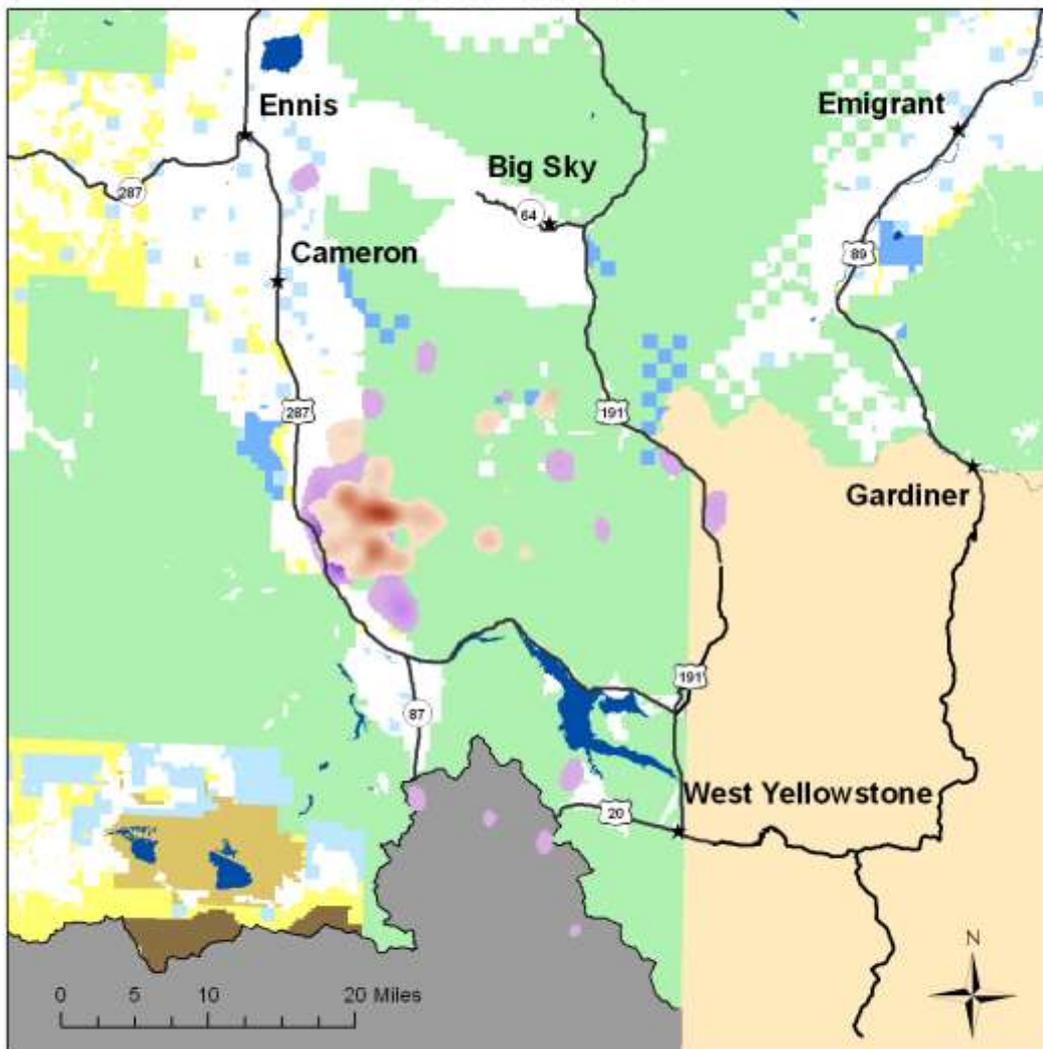


LOW

MED

HIGH

# 43 Cow Elk and Alpha Male Wolf (2005-2006) NOVEMBER



Density of Elk Use



LOW

MED

HIGH

Density of Wolf Use

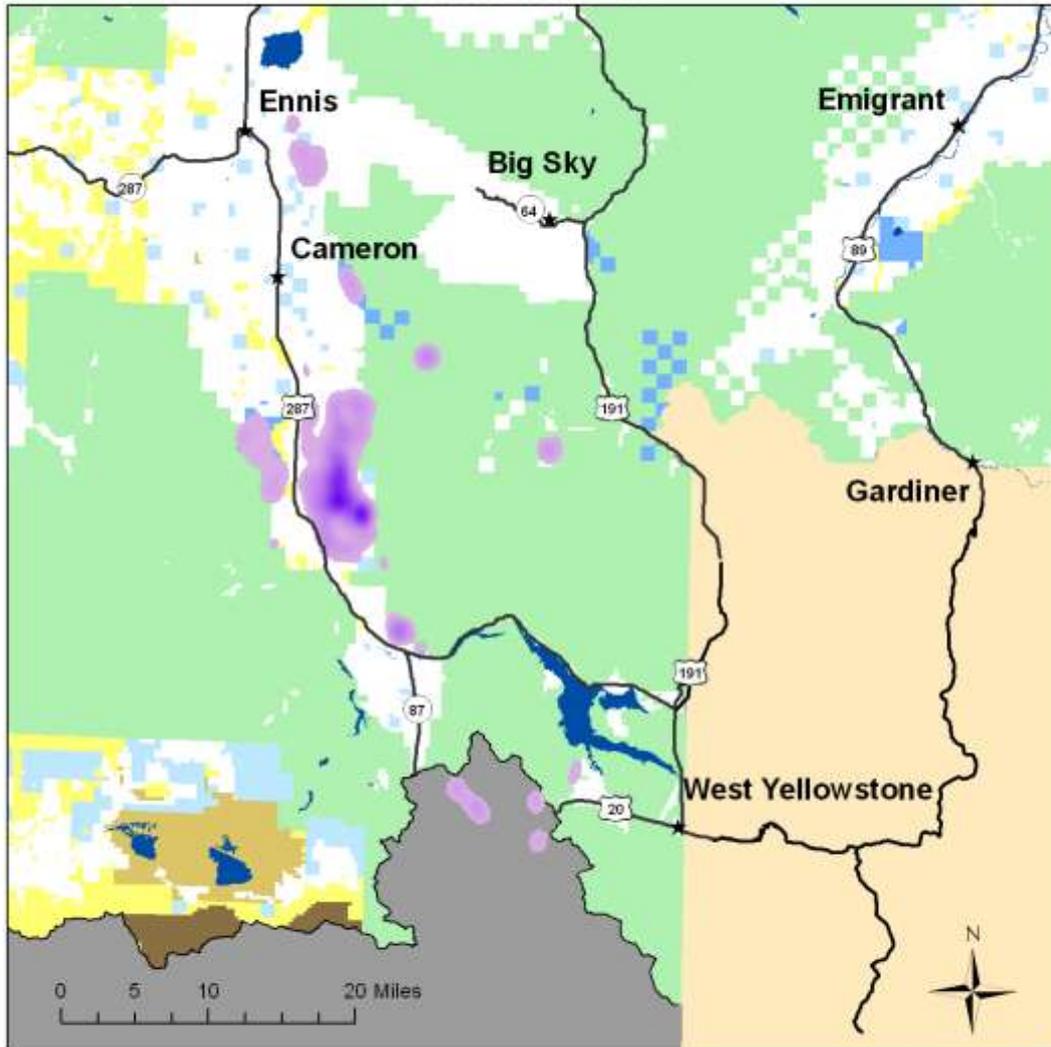


LOW

MED

HIGH

# 43 Cow Elk and Alpha Male Wolf (2005-2006) DECEMBER



Density of Elk Use



LOW

MED

HIGH

Density of Wolf Use

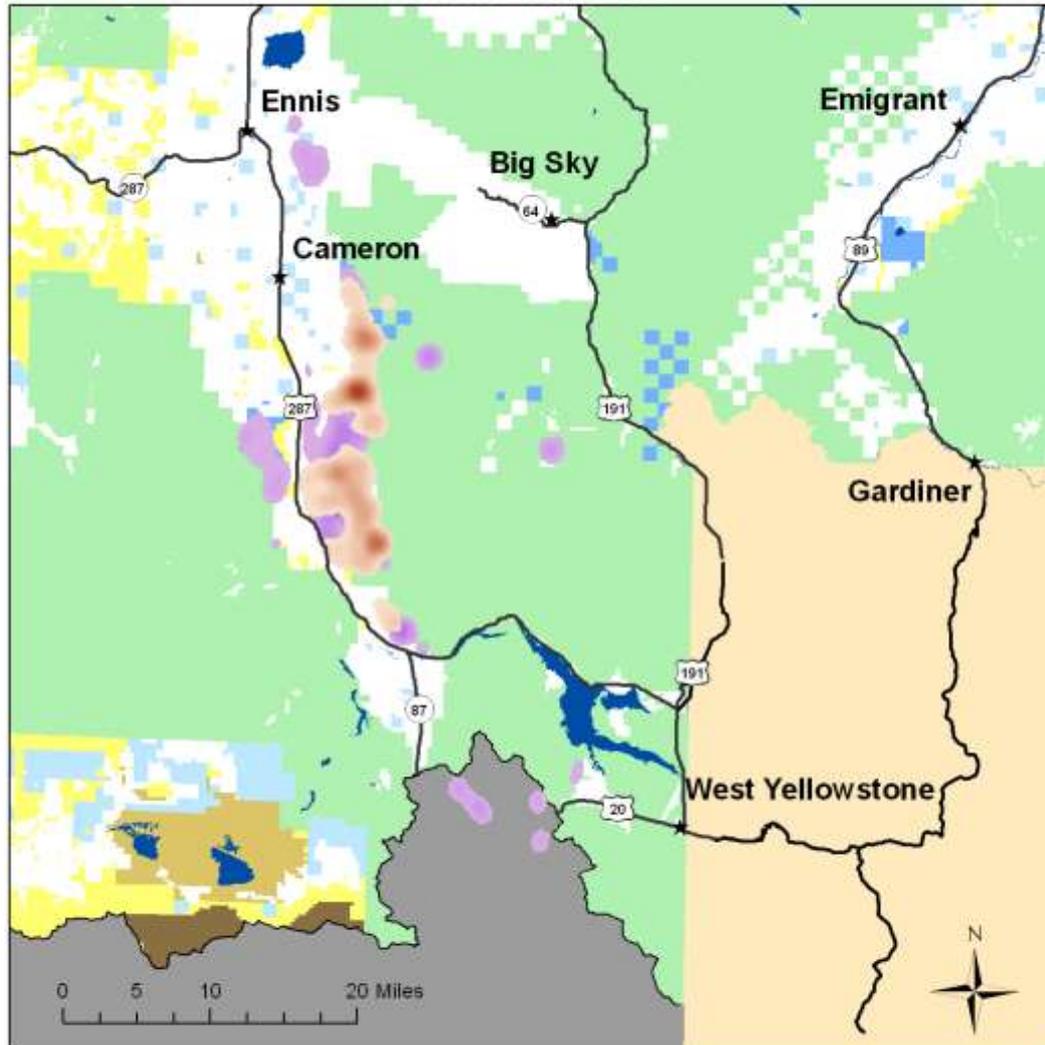


LOW

MED

HIGH

# 43 Cow Elk and Alpha Male Wolf (2005-2006) DECEMBER



Density of Elk Use



LOW

MED

HIGH

Density of Wolf Use



LOW

MED

HIGH

# Conclusions

- Compared to 2005-06 elk, 1976-1986 elk spent LESS time than on private, agricultural lands during the Feb 15- June 15 “risk period”.
- Increased hunting on public lands + decreased access on private lands = change in elk behavior/distribution

*Hunting and hunting access affect elk movements on large scales, influencing elk distributions during brucellosis risk periods.*

# Future Needs

*In addition to the required sampling, movement data are essential to understand risk of brucellosis transmission.*

# Future Needs

*In addition to the required sampling, movement data are essential to understand risk of brucellosis transmission.*

Research in HD 314 will identify calving areas, extent of movements, overlap with private land, and hunting season availability.

*HD 317? HD 520? Gravelly Mountains?*

# Acknowledgements

*This presentation would not have been possible without the assistance and efforts of the following individuals:*

**MFWP personnel:** Kurt Alt, Mark Atkinson, Neil Anderson, Keith Aune, John Cada, Justin Gude, Craig Jourdonnais, Fred King, Tom Lemke, Terry Lonner, Mike Ross, Graham Taylor, John Vore, Harry Whitney

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**Montana State University:** Dr. Bob Garrott and Jamin Grigg

**Private landowners:** in the Madison who have allowed MFWP access for capture and collar retrieval