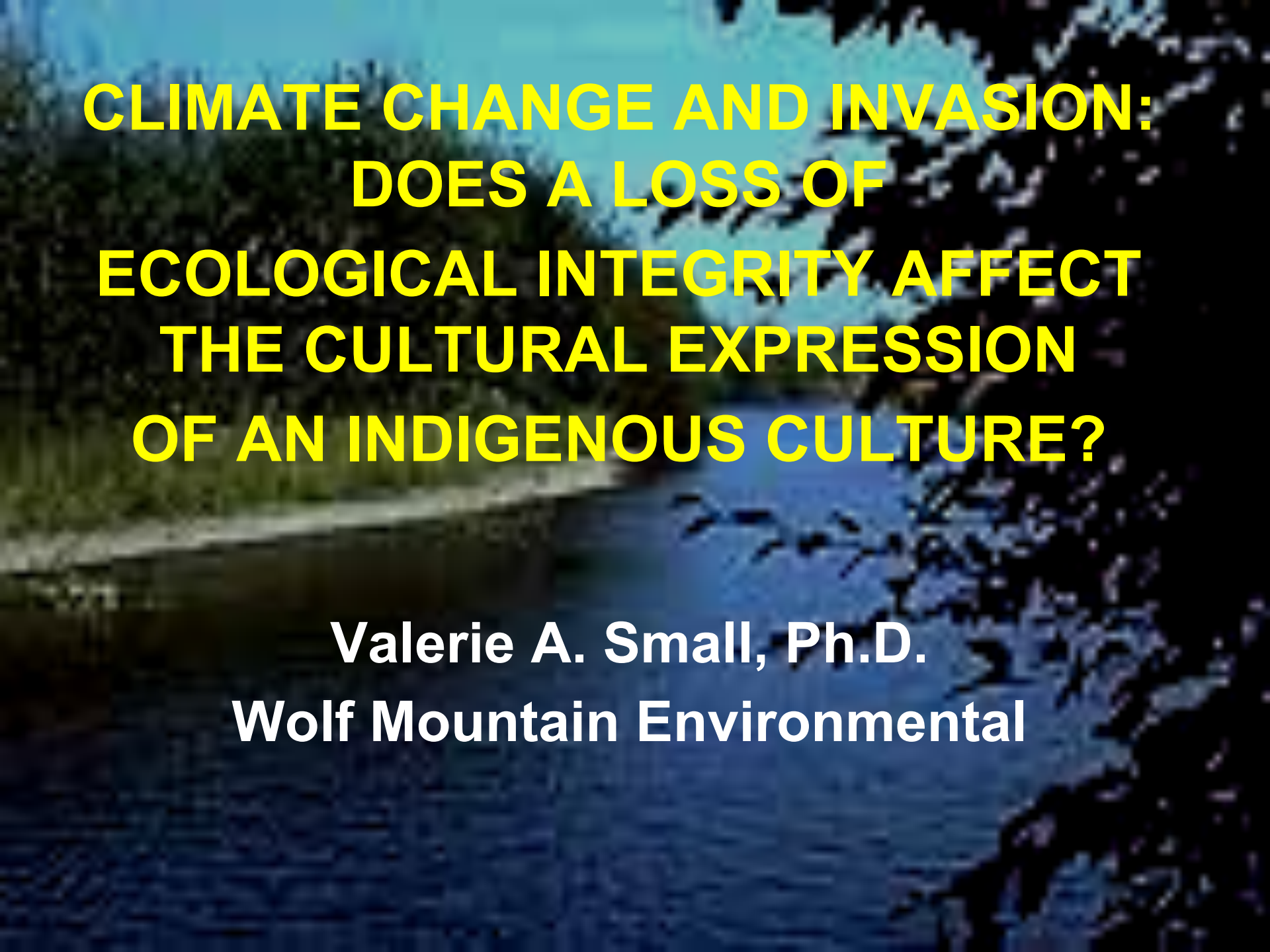


CLIMATE CHANGE AND INVASION: DOES A LOSS OF ECOLOGICAL INTEGRITY AFFECT THE CULTURAL EXPRESSION OF AN INDIGENOUS CULTURE?

Valerie A. Small, Ph.D.
Wolf Mountain Environmental

INTRODUCTION

- Biological diversity—manifestation of ecosystem health
- Invasive plant species threatens ecosystem function
- Riparian zones—vulnerable
- River regulation/diversions (dams)
  - Invasive plants may threaten indigenous rituals/ceremonies due to:
    - Outcompete native plant species
    - Reducing availability to harvest plants for cultural use

RIPARIAN ECOSYSTEMS

- **Plant survivorship—complex riparian**

  Historical native vegetation

  ***Salicacaeae Populus deltoides* L. Plains cottonwood**

  (Salix sp.) Willow

  Natural flow of rivers—now regulated

  Divergent Dams—irrigation

  Removing flood pulse = lack of recruitment sites

  Milk and Marias River

  decline in native woody vegetation

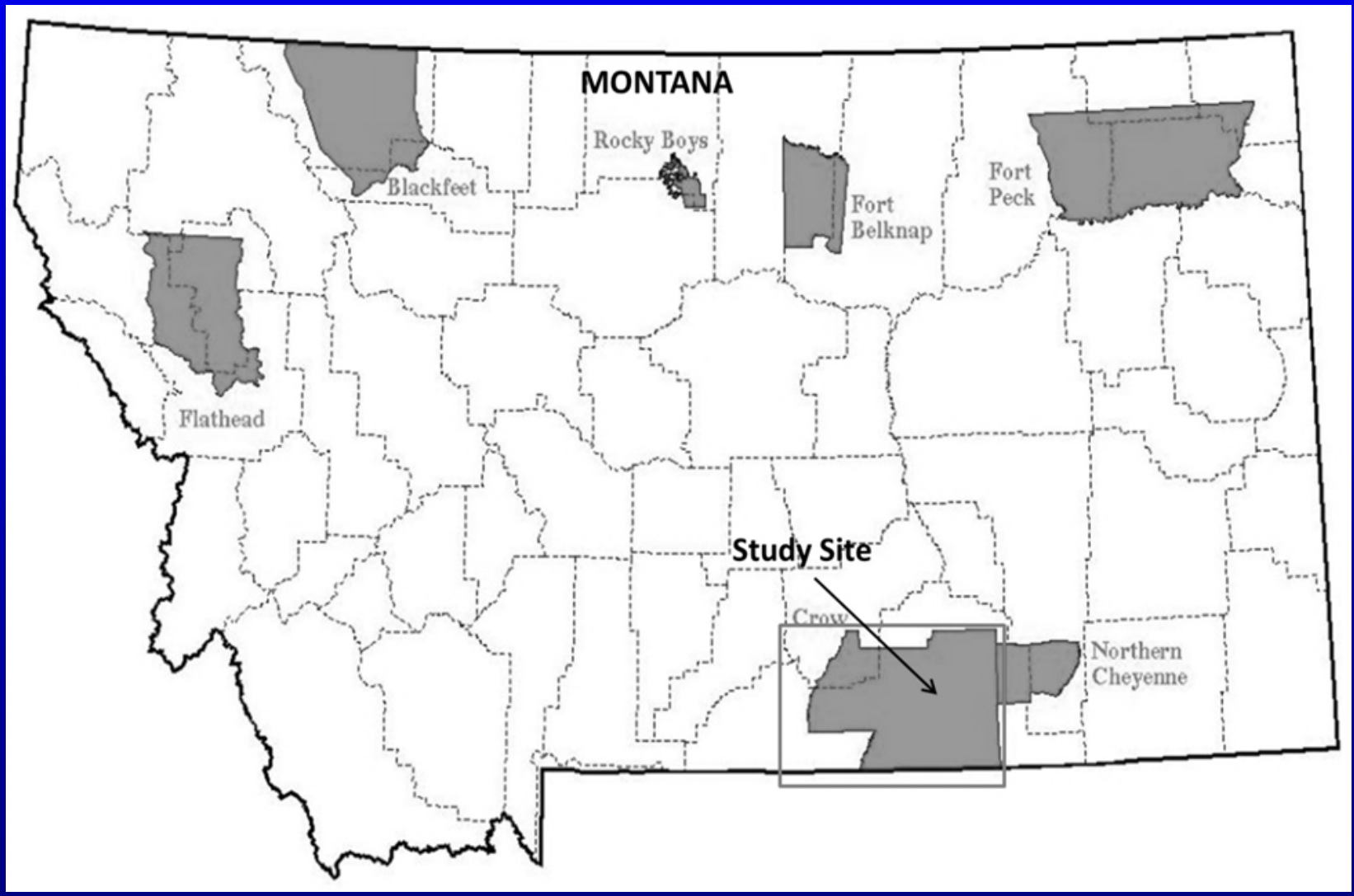
Populus deltoides subsp. *monilifera* (plains cottonwood)

- Dominant component of riparian ecosystems
- Riparian ecosystems (only native forested environments)
- Essential habitat (82 % avian species)
- Cultural significance not addressed
- Harvested for ceremonial purposes
  - Crow Tribal members

Populus deltoides (contd.)

- Seed dispersal-wind
- Germination success (small)
- Declined (Pearce & Smith 2009)
  - seed/seedling mortality
  - Lack of recruitment sites
  - agriculture--draining floodplains

STUDY LOCATION



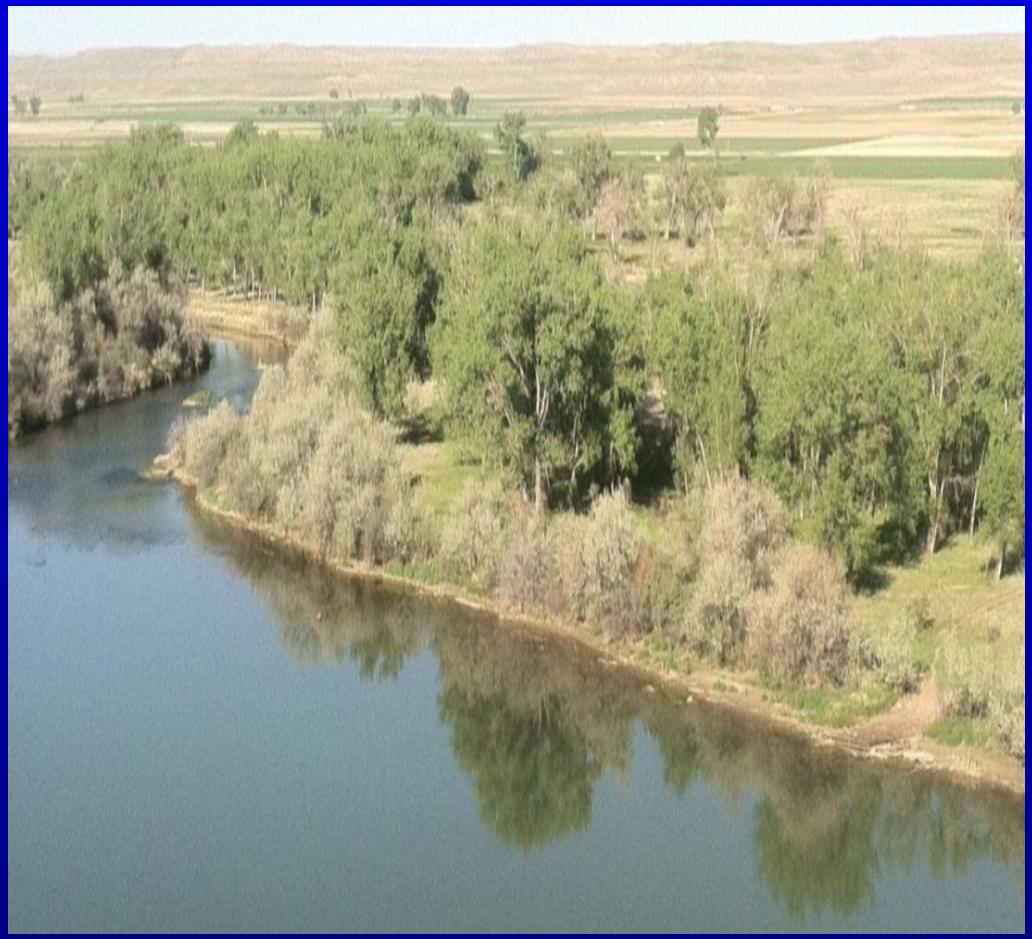
Cultural Significance Plains Cottonwoods

- Historical
  - Battle of Little Big Horn
- Contemporary practices
  - Sweatlodge
  - Sacred Sundance Ceremony
  - Annual Crow Fair
  - Traditional gathering of native plants

PLAINS COTTONWOOD CULTURAL USE

RUSSIAN OLIVE INVASION IN PASTURES

STUDY SPECIES
RUSSIAN OLIVE (*ELAEAGNUS ANGUSTIFOLIA* L.)



- Invasive woody shrub/small tree
- Agriculture development post-Dawes Act 1887
- Planted within floodplains
- Crow-IECCC

Elaeagnus angustifolia L.
Russian Olive

- Shade tolerant
- Flood/drought tolerant
- Fixes Nitrogen
- Asexual/sexual reproduction
- Seed longevity (drupes)
- Dispersal – bird/mammal/water
- Pathogens/herbivores absent
- Difficult to control/eradicate

RESEARCH QUESTIONS/ METHODOLOGY

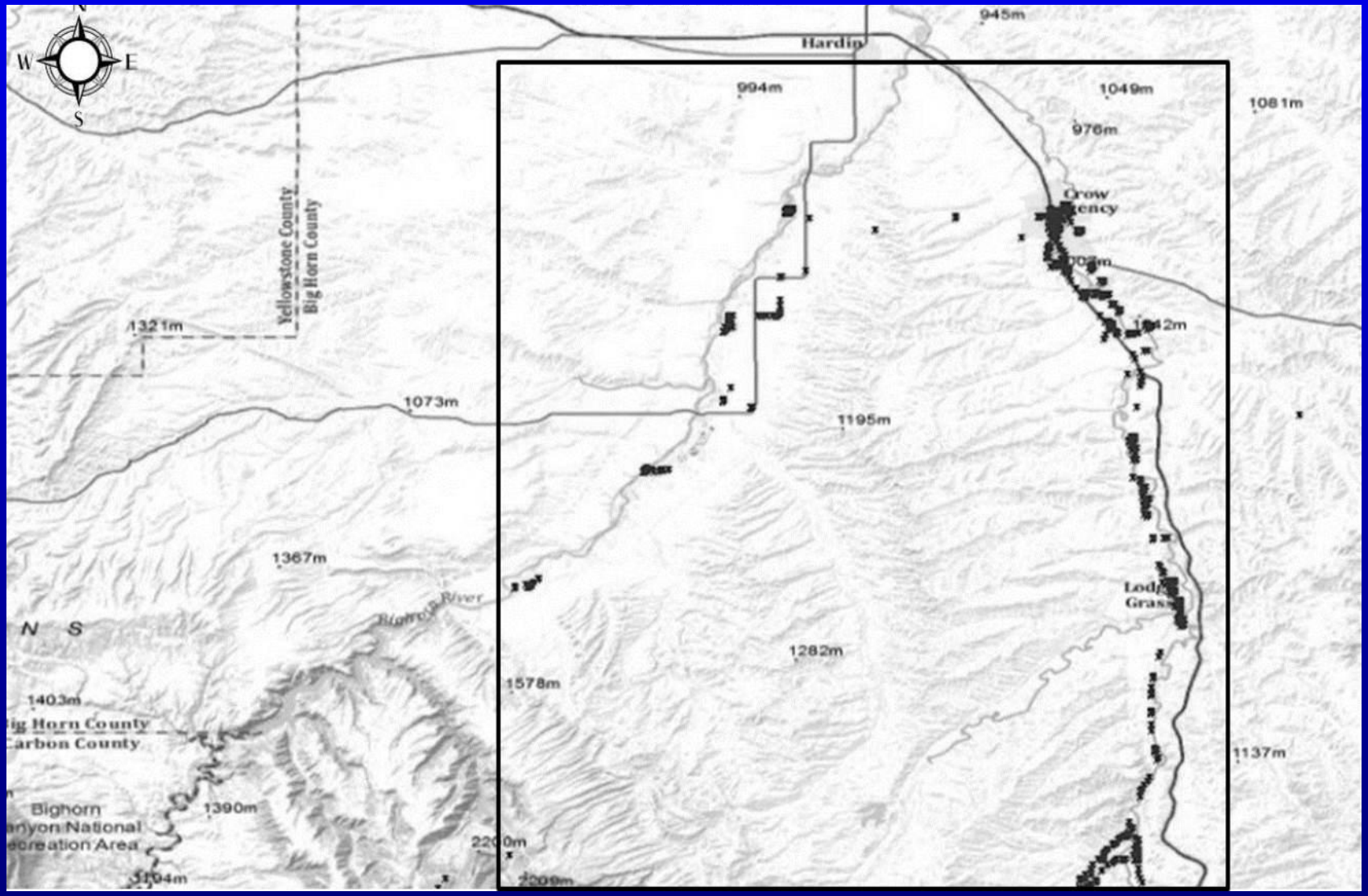
QUESTIONS

- What is the current distribution of Russian olive along Little Bighorn/Bighorn Rivers and floodplains?
- Will near-term climate change influence the spread of Russian olive?
- What is the current estimated size structure of cottonwood?

METHODS

- Mapped presence points
- Maximum Entropy Model (MaxEnt)
- NIISS
- 7.32m circular plots (n = 10)
- Near/far ceremonial sites
- Interviews with Elders
  - Distance to travel
  - Availability perceptions

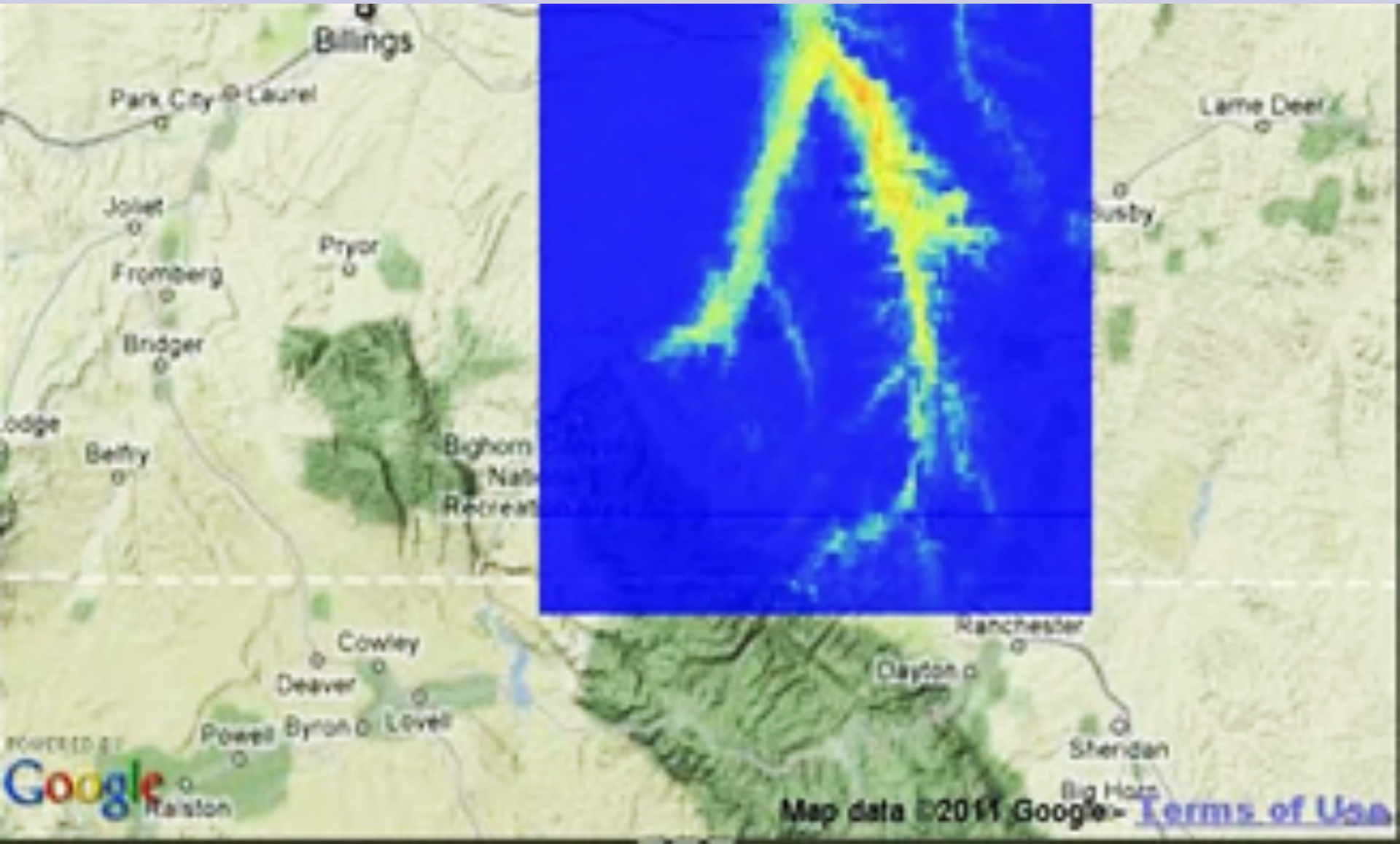
Mapped Russian olive (*Elaeagnus angustifolia* L.)



Climate Predictor Variables Used As Environmental Layers In MaxEnt Model

Temperature	Annual Precipitation
Maximum Temperature: Warmest Month	Precipitation: Wettest Month
Enhanced Vegetation Index	Mean Temperature: Coldest Quarter
Precipitation: Driest Month	Frequency of Precipitation
Precipitation: Wettest Quarter	Annual Mean Temperature
Isothermality	Mean Temperature: Driest Quarter
Mean Temperature: Wettest Quarter	Precipitation: Warmest Quarter
Mean Temperature: Coldest Quarter	Enhanced Vegetation Index/ Mean
Precipitation: Coldest Quarter	Precipitation Seasonality
Mean Diurnal Range	Precipitation: Driest Quarter
Annual Grow Days	Minimum Temperature: Coldest Month

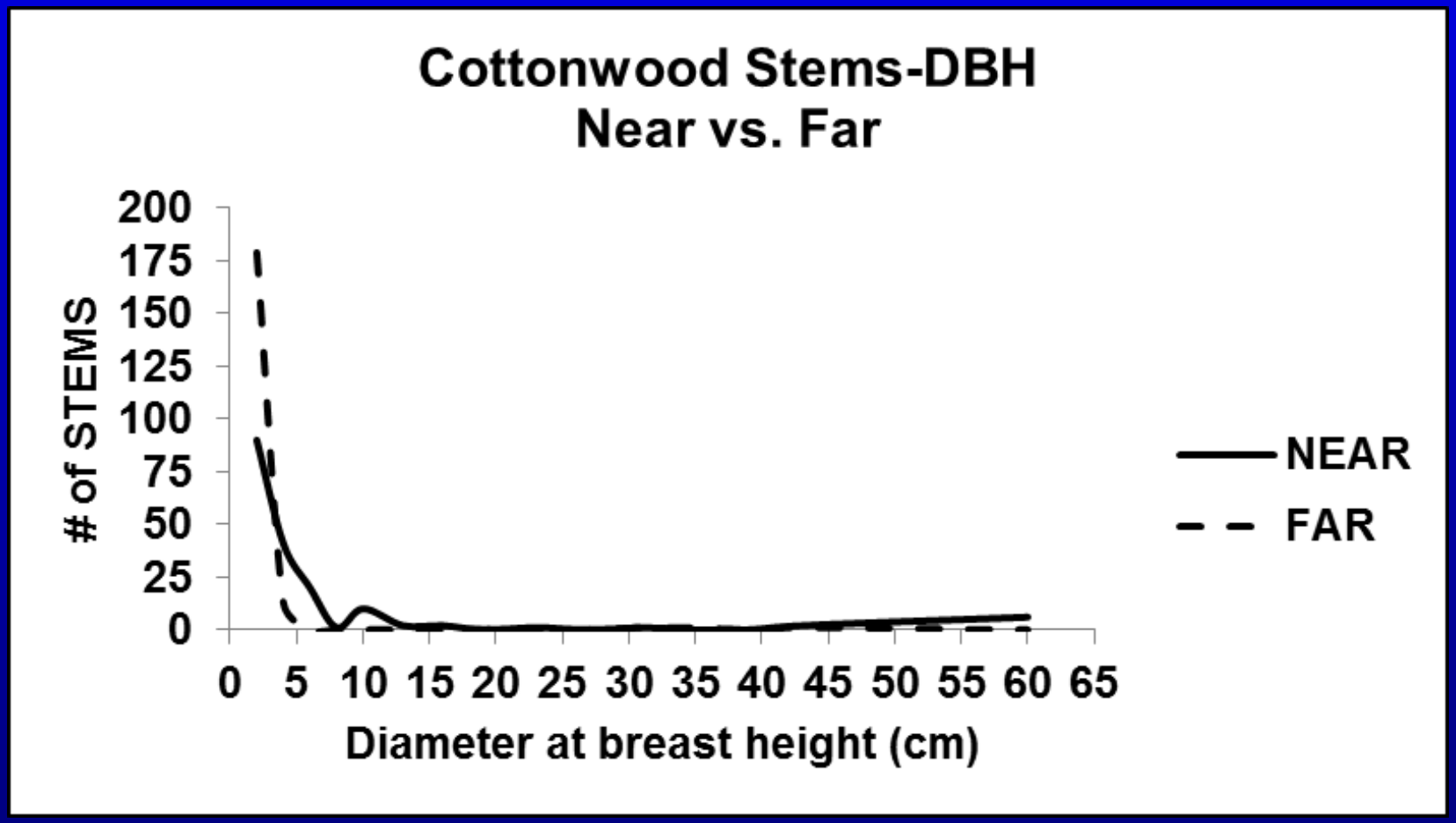
Results
MaxEnt Model



Plot Results
Cottonwood Height
Near/Far Ceremonial Sites

Plot Variables	Near Plots	Far Plots
Mean	1.41	0.77
Variance	7.24	6.34
Df	355	P (T<=t) two-tail 0.01 P (T<=t) one-tail 0. 001

RESTULS (CONTD.)
PLOT DATA--DBH



INTERVIEW RESULTS

- The maximum distance harvest >
- 80 km to 8.0 km for all size classes 25 ybp
- Present-day mean maximum ~ 98 km, greatest = 193 km
- 82% travel to harvest sapling size (3.6-4.5m) class stems > within 25 years
- Support plot data
- All size classes affected

CONCLUSIONS

- Russian olive continued spread
- Cottonwood (other species) continue to decline
- Climate change—hasten effects (increased precip/temps)
- Threatens cultural integrity and ecological biodiversity
- Management plans
  - mitigation of *E. angustifolia*
  - Planting of cottonwoods/willows in buffer zones

RESEARCH

DISSERTATION TITLE

- **LINKING CULTURE, ECOLOGY AND POLICY: THE INVASION OF RUSSIAN-OLIVE (*ELAEAGNUS ANGUSTIFOLIA* L.) ON THE CROW INDIAN RESERVATION, SOUTH-CENTRAL MONTANA, USA**

CHAPTER TITLES

American Indian Land Policy: Land Use, Ownership Status and the Density of The Invasive Russian Olive (*Elaeagnus Angustifolia* L.) On The Crow Indian Reservation, Montana, USA

Chapter 3: Losing Tradition: The Biocultural Effects of Russian Olive (*Elaeagnus Angustifolia* L.) On The Crow Indian Reservation, Montana, USA