

The Impact of Energy Sprawl on Biodiversity and Ecosystem Services



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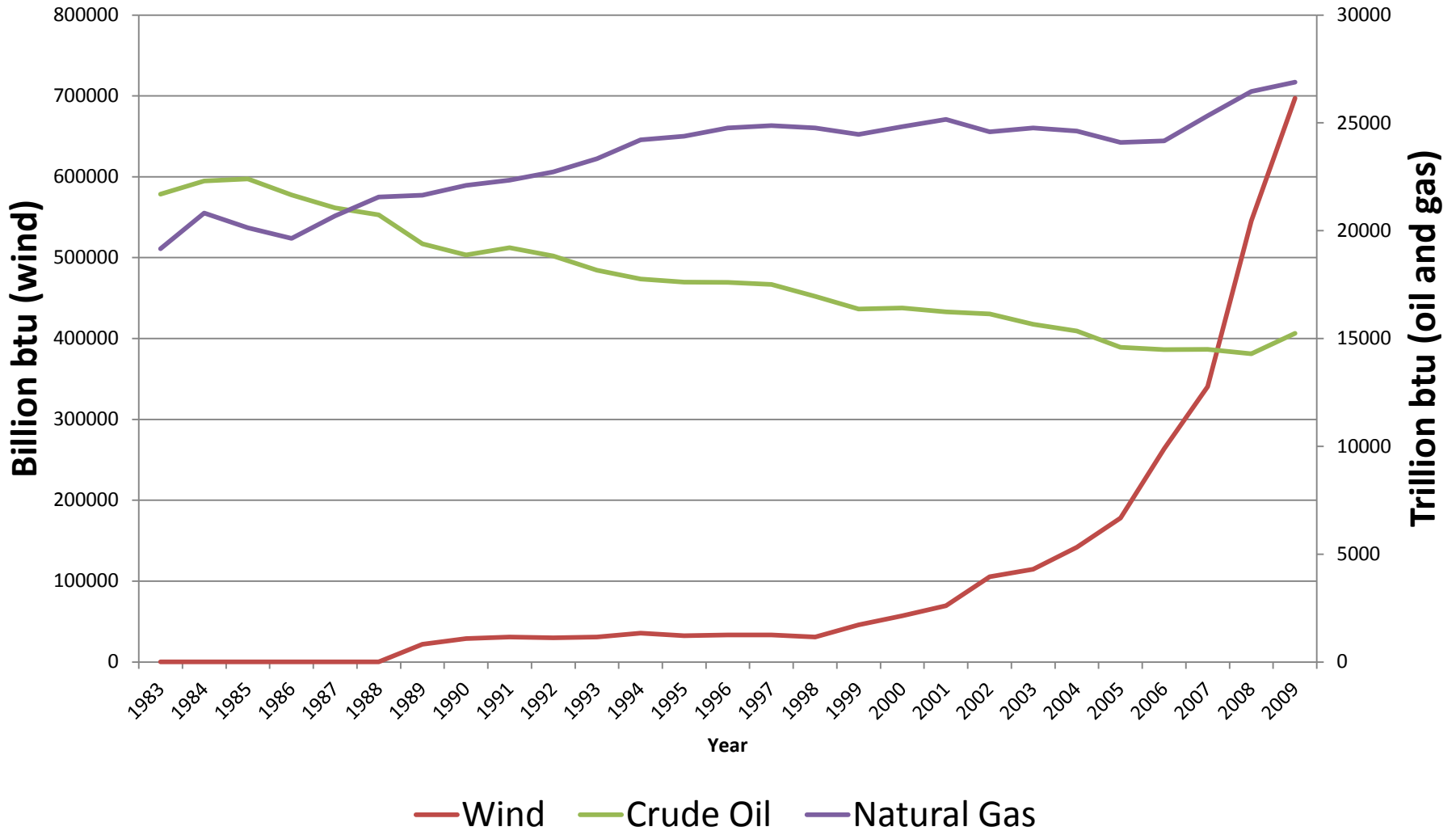


Outline

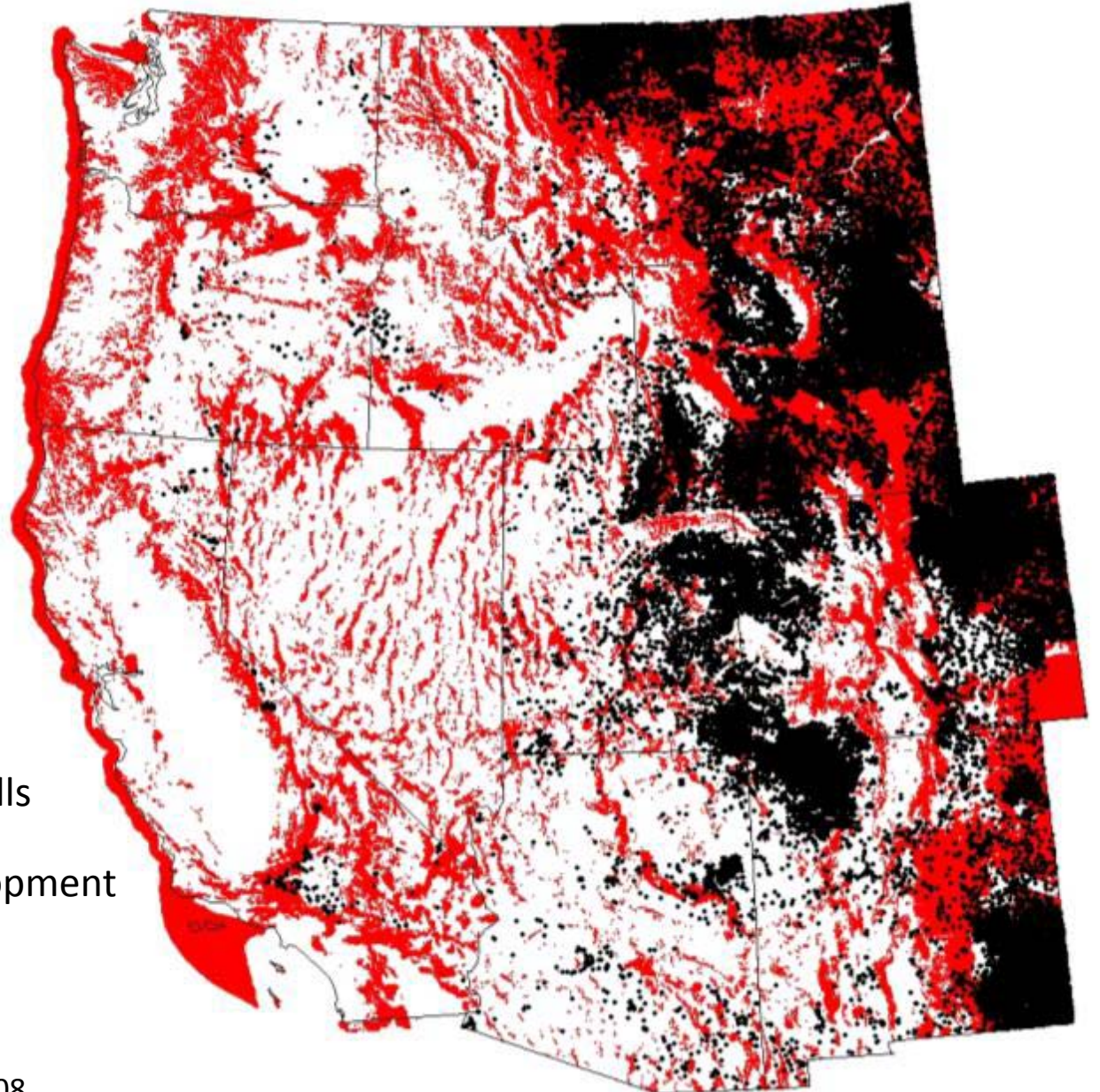
- Introduction, Background and Motivations
- Research Questions
- Study Design
- Data Collection
- Anticipated Applications
- Timeline
- Questions



Background



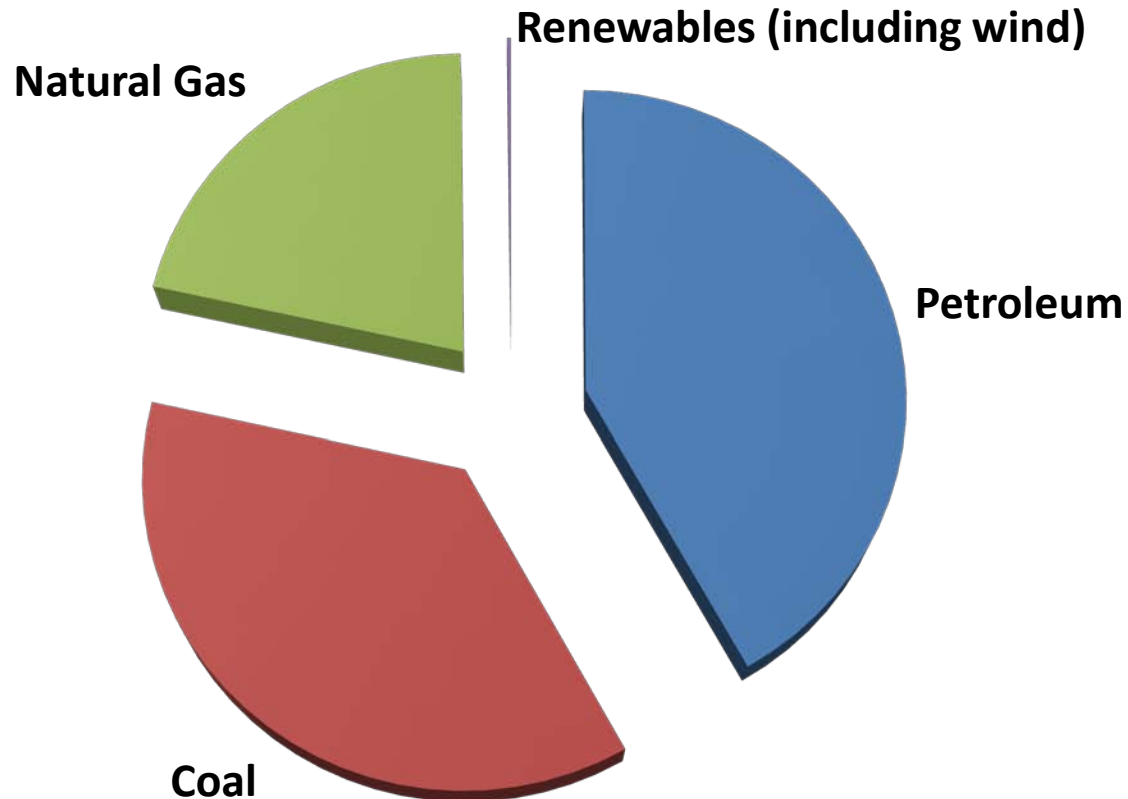
Background



- Existing Oil or Gas Wells
- Potential Wind Development

Background

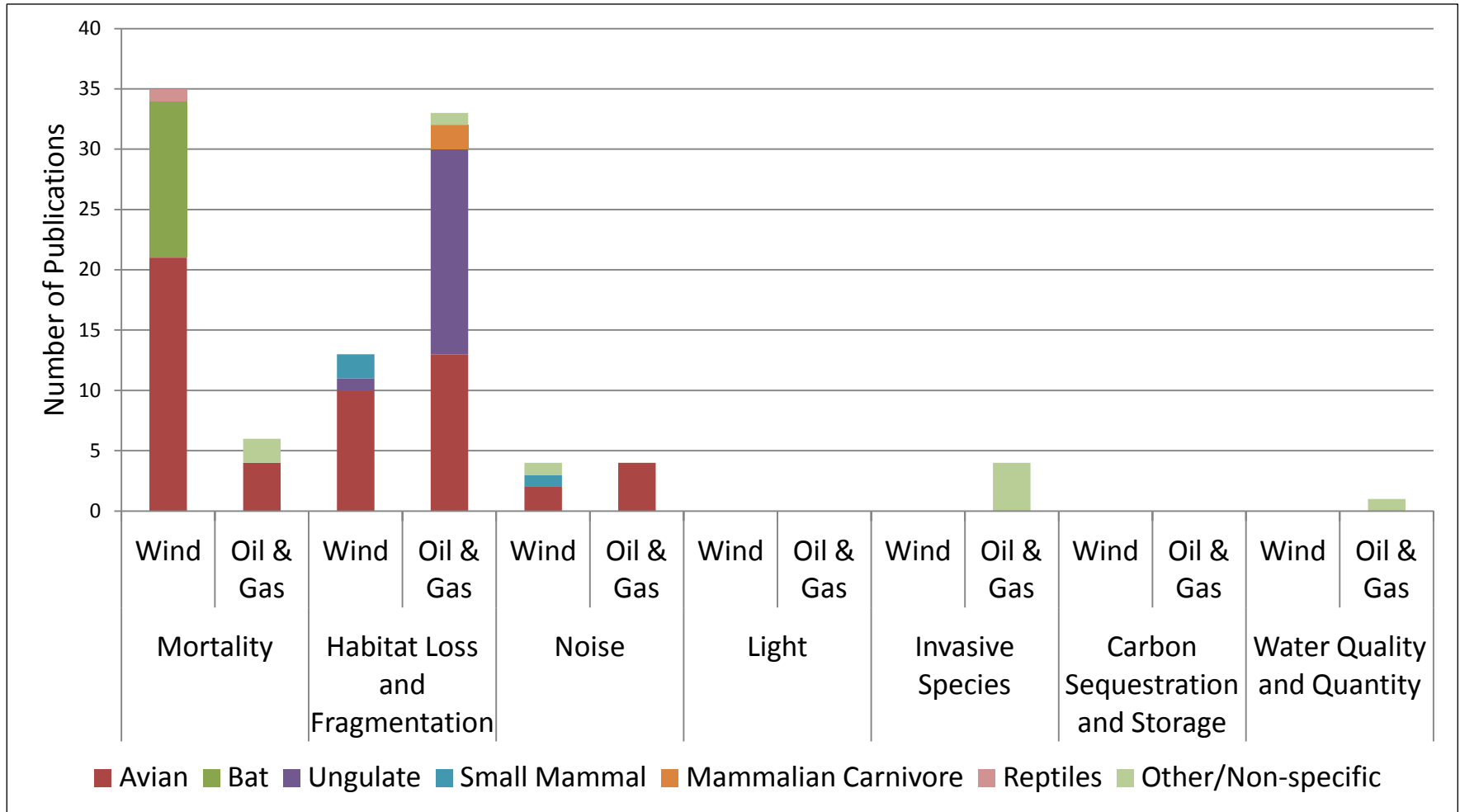
US CO₂ Emissions by Energy Type



Research Questions

1. How does wind energy development compare to oil and gas development in impacts to biodiversity and ecosystem services?
2. How does energy development compare to other land uses in impacts to biodiversity and ecosystem services?
3. How do characteristics of the landscape affect the level and intensity of these impacts?

New Approach



The number of published studies of wind, oil and natural gas development impacts on seven indicators of biodiversity and ecological services. Only papers with primary data on the impacts of onshore wind, oil or gas development were included.

Indicators of Biodiversity and Ecosystem Services

Wildlife Mortality

Habitat Loss

Fragmentation/Edge Effect

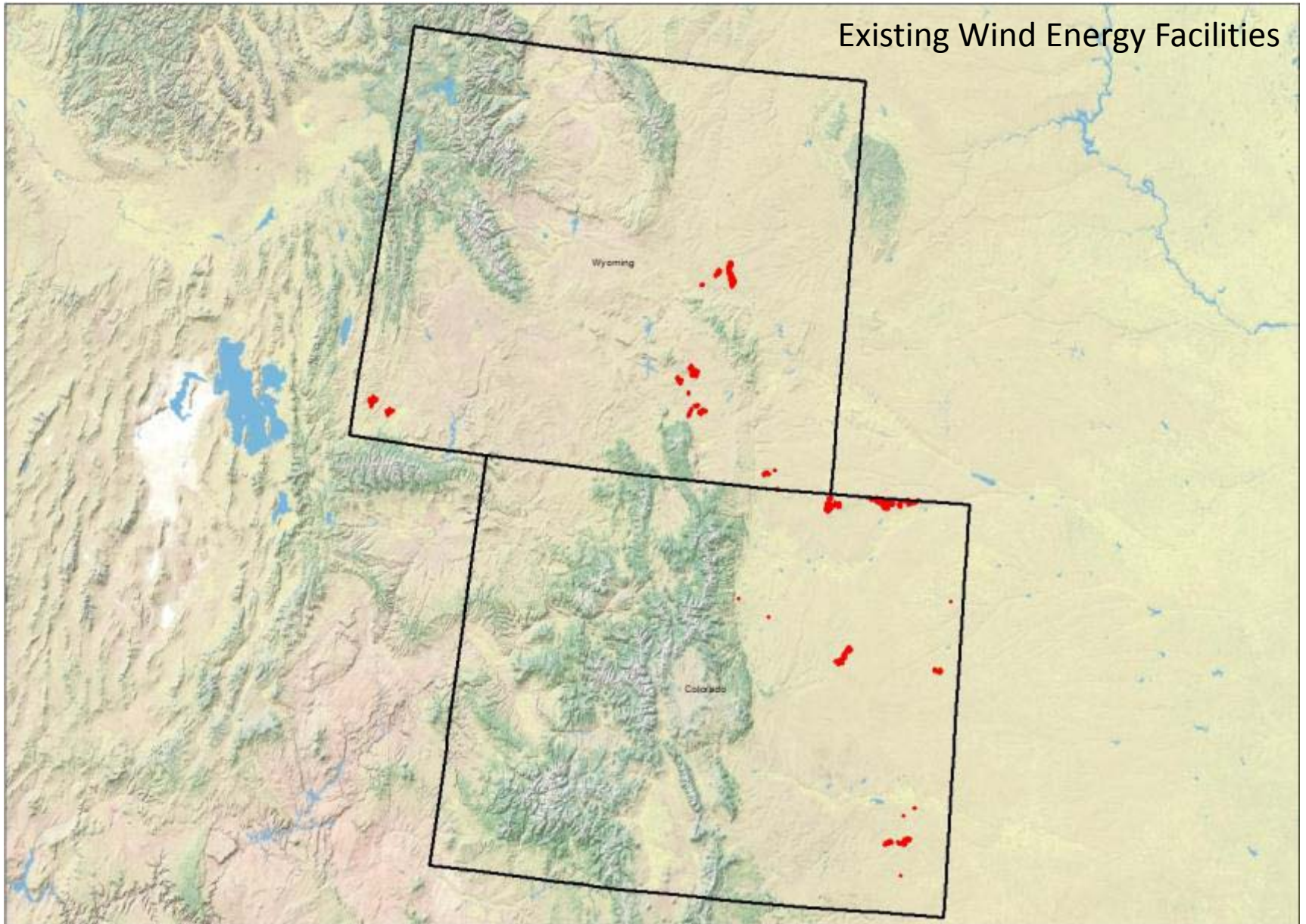
Noise and Light Pollution

Invasive Species

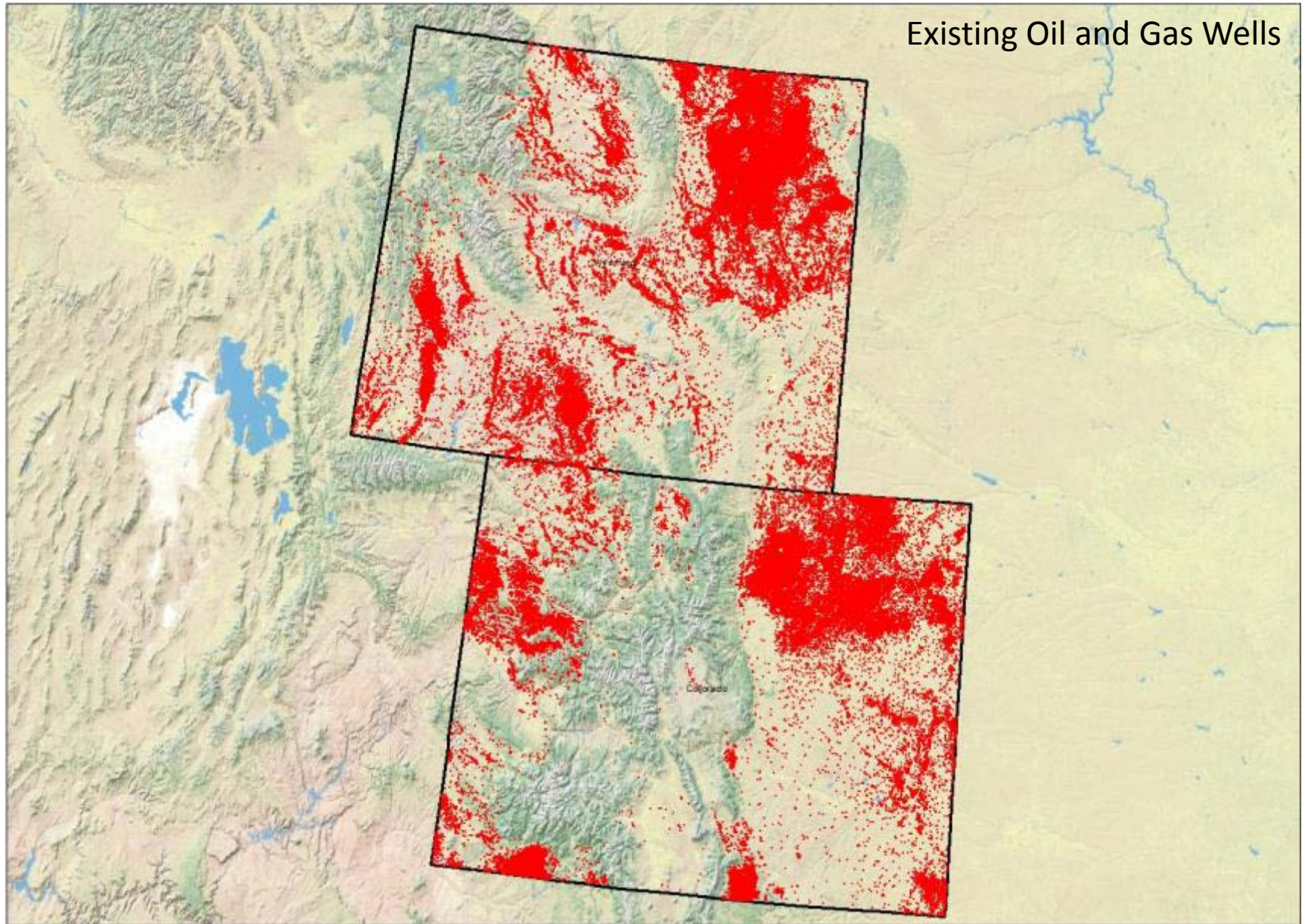
Carbon Storage and Sequestration

Water Resources

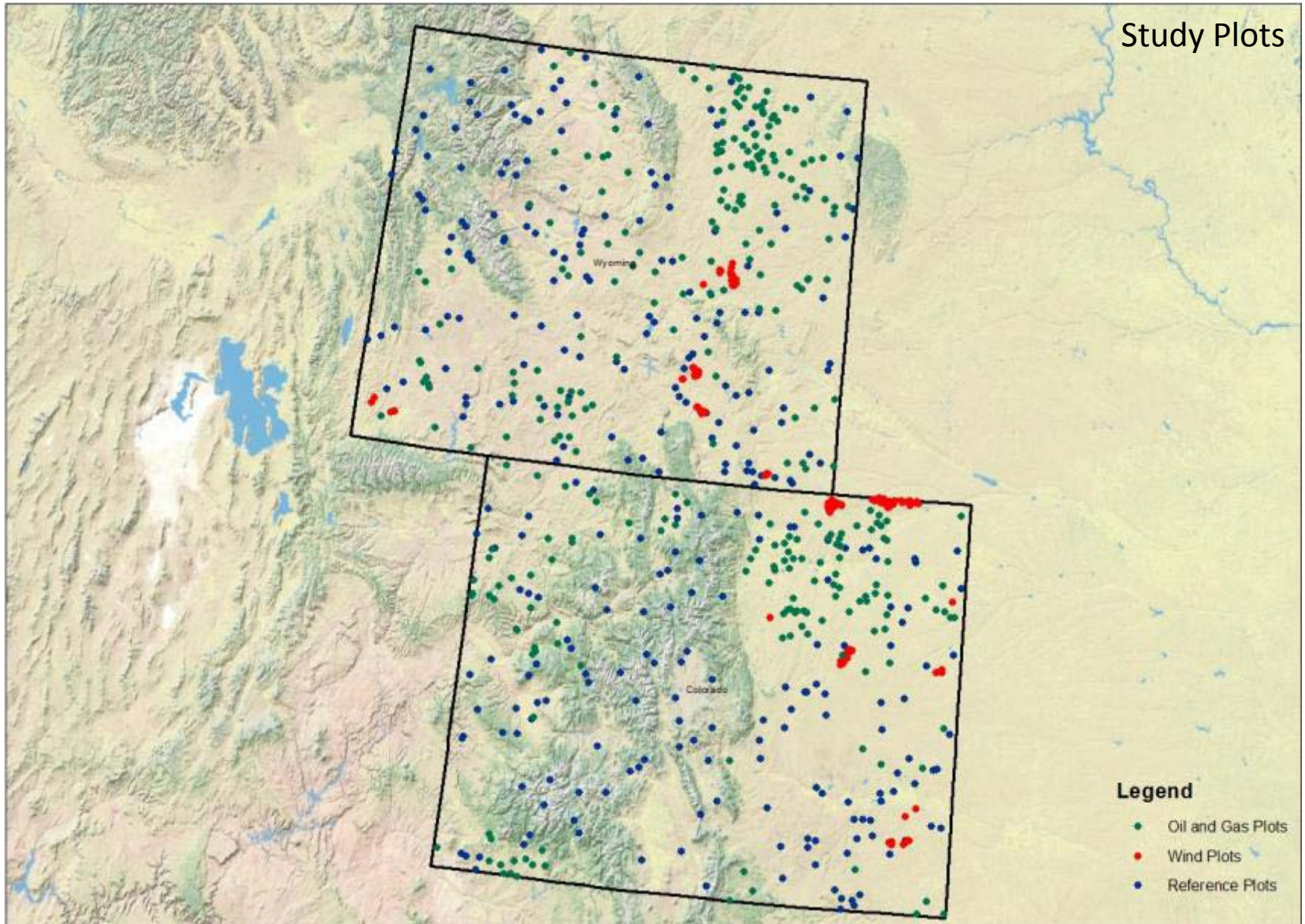
Study Design



Study Design



Study Design



Example Plots

Wind

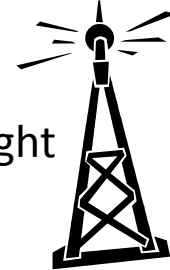
Oil & Gas



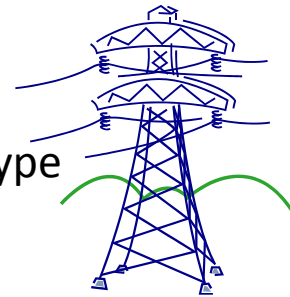
Wildlife Mortality



of turbines and RD



of met towers and height



meters of power line and type



meters of road, road type and vegetation



of flare stacks



of waste pits

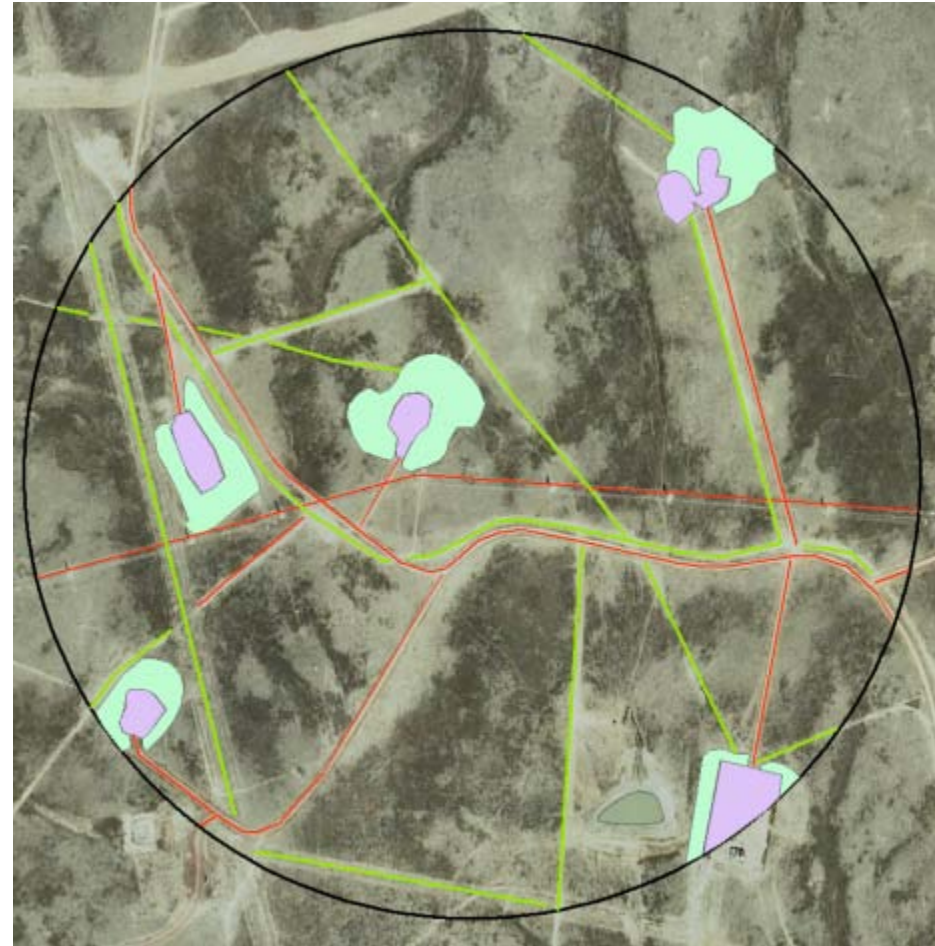


of gas compressors

Mortality Data Collection



6 Turbines, 77 m RD
1.5 km of Access Road, Grassland Habitat



6 Waste Pits
2.6 km of Access Road, Grassland Habitat
1 km of Three Phase Power Line

Habitat Loss

: Square Meters of Anthropogenic Disturbance

Noise Pollution

: Number of Noise Sources

Light Pollution

: Number of Light Sources

Invasive Species

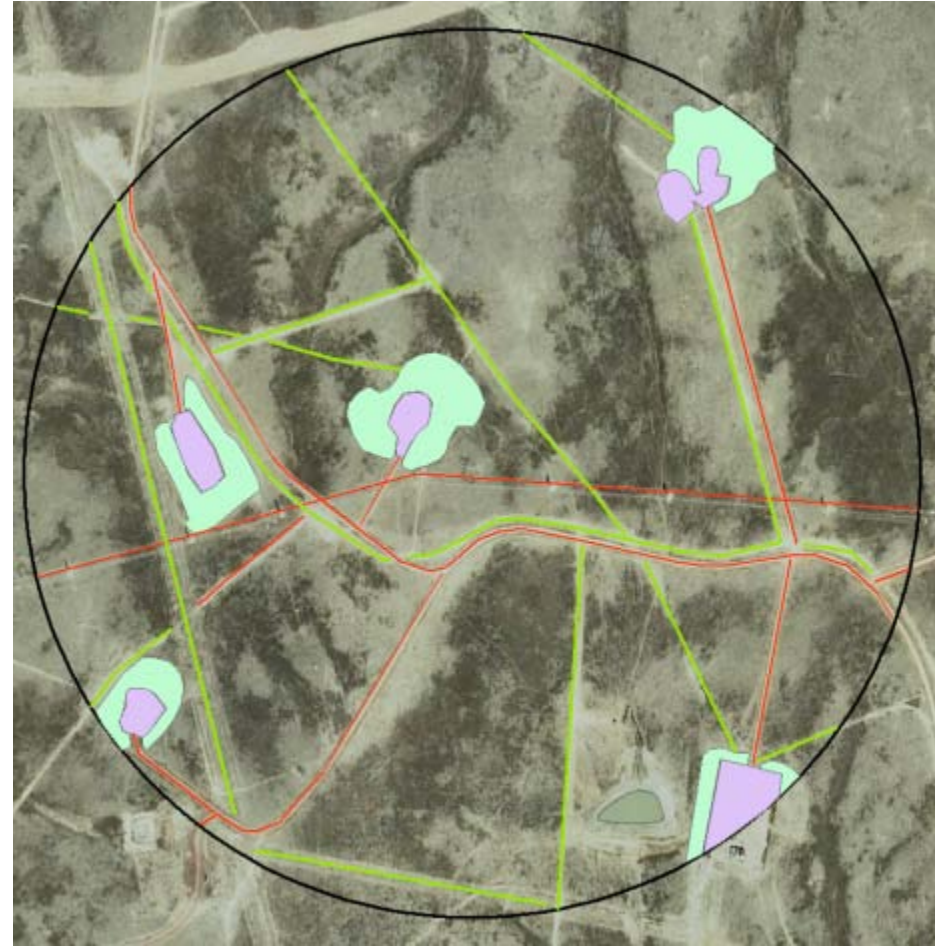
: Meters of Roads and Other Linear Features

: Square Meters of Temporary Disturbance

Habitat Loss/Invasives Data Collection



5.6 Hectares Habitat Lost
3.3 Hectares of Temporary Disturbance

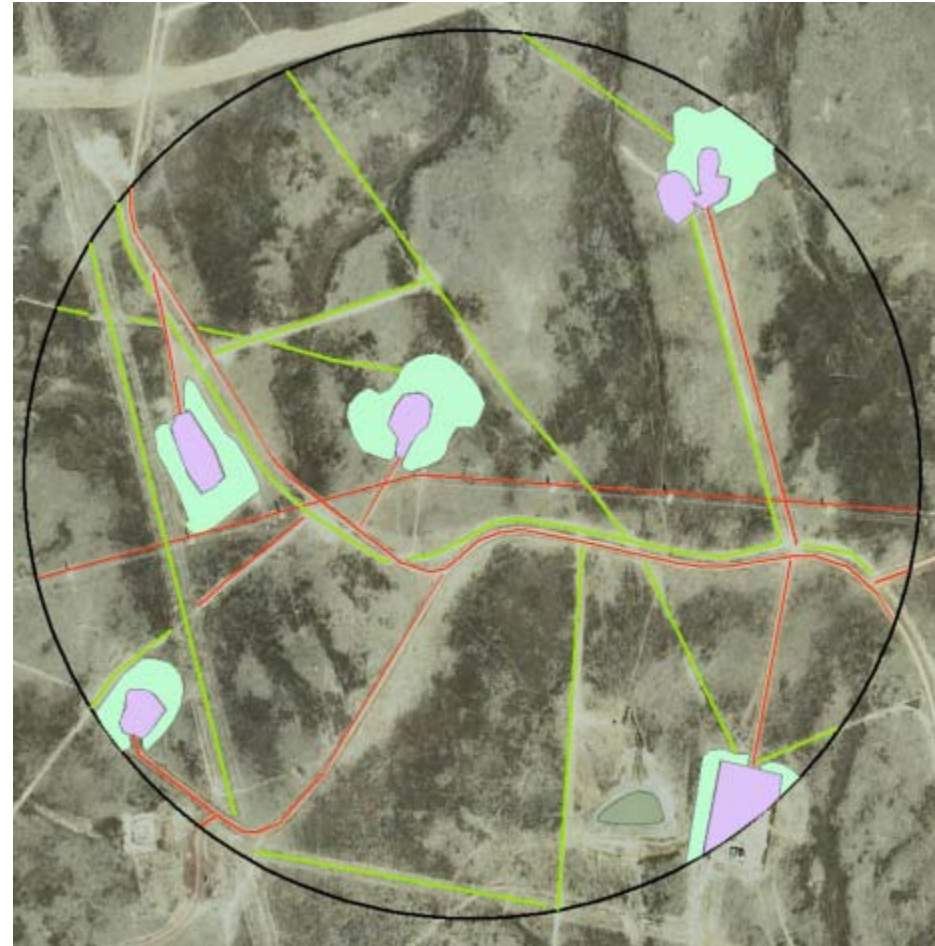


10.8 Hectares Habitat Lost
6.7 Hectares of Temporary Disturbance

Noise and Light Data Collection



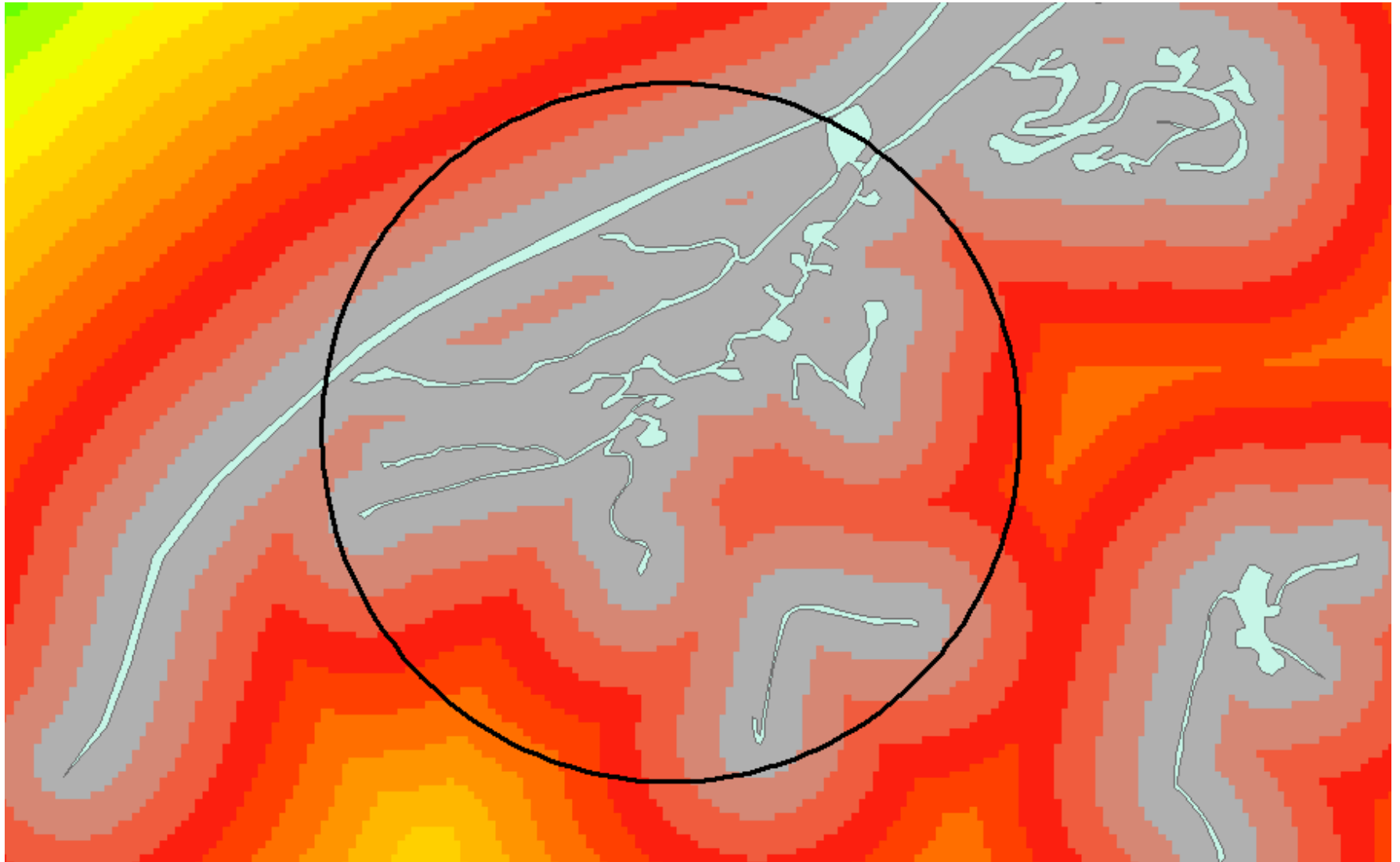
6 Noise Sources
6 Light Sources



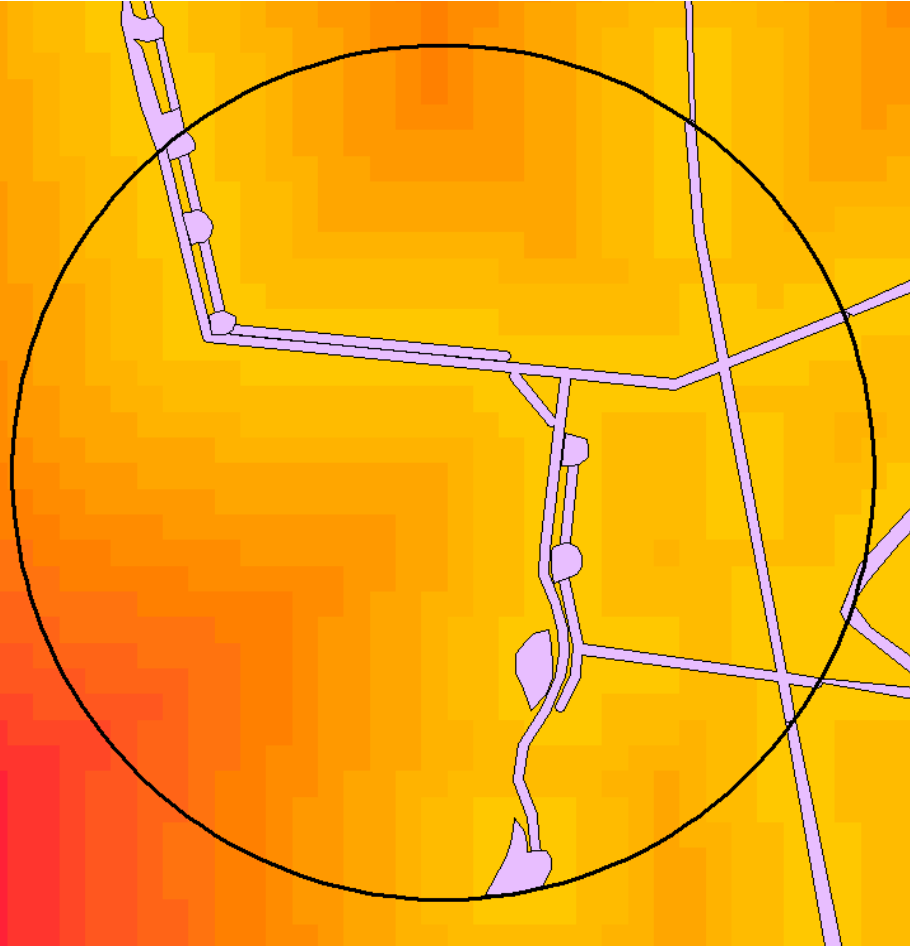
6 Noise Sources
0 Light Sources

Habitat Fragmentation/Edge Effect

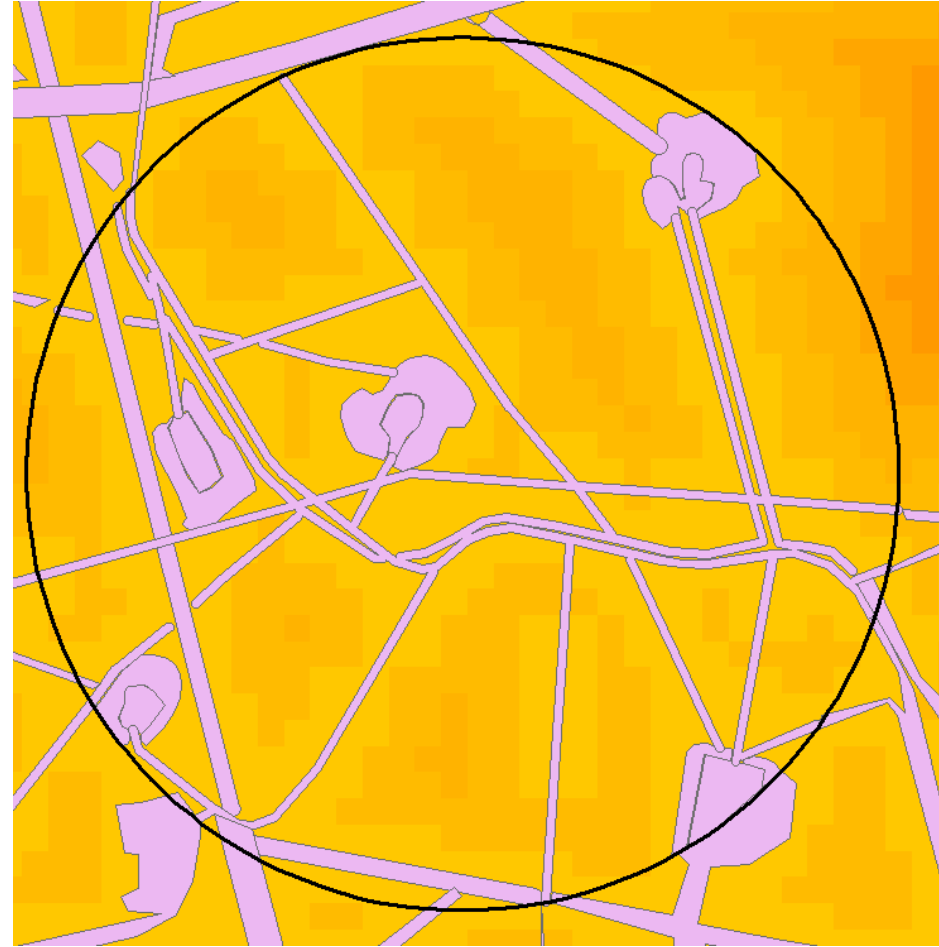
:GIS Frag, mean distance to nearest human footprint



Fragmentation Data Collection



GIS Frag = 127.11



GIS Frag = 45.12

Carbon Storage and Sequestration

: Carbon Storage Potential of Land Cover and Soil in Plot minus
Potential of Area Covered by Impervious Surface

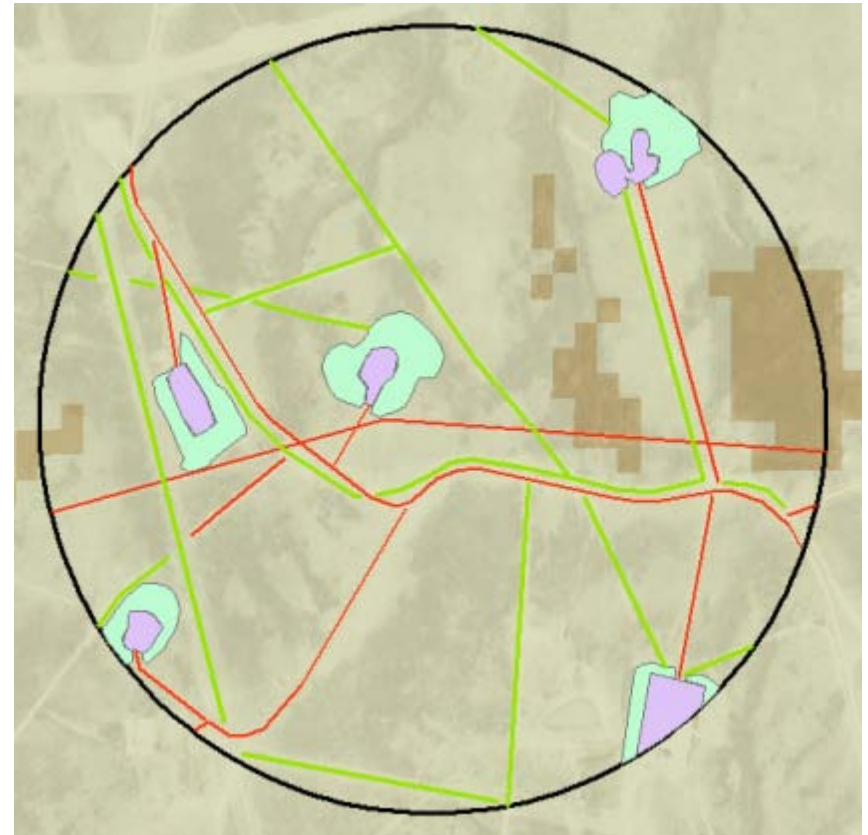
Water Resources

: Water Used for Construction and Operation of Facilities
: Square Meters of Impervious Surface

Carbon and Water Data Collection



Total Potential Carbon Storage in Plot:
3.1 million kilograms
Total Carbon Storage Potential Removed:
233,000 kilograms
Water Loss: 15,000 gallons
2.3 Hectares of Impervious Surface



Total Potential Carbon Storage in Plot:
4.3 million kilograms
Total Carbon Storage Potential Removed:
594,000 kilograms
Water Loss: 416,000 gallons
4.1 Hectares of Impervious Surface

Covariates

Land Use

Land Cover

Land Ownership

Date of Development

State

County

Mean Slope

Mean Elevation

Median Income

Housing Density

Political Affiliations

Anticipated Applications

1. Direct comparison of wind, oil & gas and other land uses on various indicators.
 - Per unit land area
 - Per unit energy produced
2. Determine which landscape characteristics affect the impacts of energy sprawl.
3. Improve the capabilities of predicting future impacts based on alternative land use scenarios.
4. Provide a research model to improve management and policy decisions.

Limitations

- Global Climate Change
- Temporal Aspects
- No Direct Competition

Additional Research

- No Substitute for Quality Field Research
- Increase Amount, Quality, and Transparency
- Expand Focus to Indirect Impacts

Timeline

- Data Collection Currently Underway
- Data Analysis Anticipated Spring 2012
- Results Available May 2012
- Manuscript Submission Summer 2012



Acknowledgements

Committee

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Guidance

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Geospatial Data

Duke Energy, USGS, COMap, COGCC, WOGCC, NREL

- Currently Seeking Funding for Student Work Study Position
- For More Information visit:
<http://warnercnr.colostate.edu/~nfjones/>
- Contact Information: nathan.jones@colostate.edu

References

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Image Sources

Images (in order of appearance)

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