

# PRIORITIZING GOLDEN EAGLE LANDSCAPES WITH CONCEPTUAL MODELS AND ARCGIS (UC557)

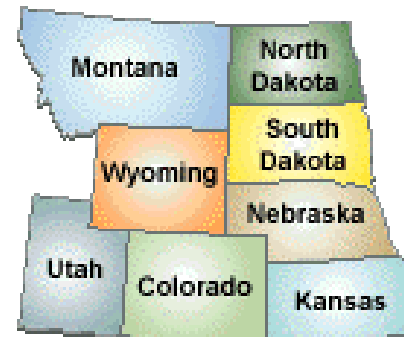
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**USFWS Region 6**



# Background

- Western golden eagle populations currently appear stable, but there is uncertainty in how populations will respond to increased mortality (Millsap et al. 2013)
- Development of energy resources within the Mountain-Prairie Region is expected to have both direct and indirect impacts on golden eagles

à Need to develop tools that can help avoid and minimize impacts to golden eagles, and identify opportunities for conservation



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# GOEA Project Objectives

1. Create spatially-explicit models that rank the relative value of the landscape for golden eagle habitat
  - à For use in preliminary evaluation or screening of potential sites for development or conservation



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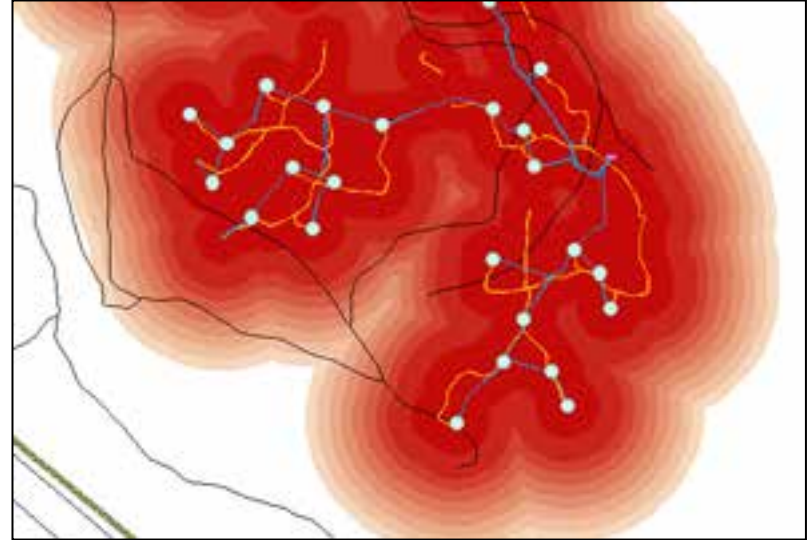
# GOEA Project Objectives

2. Pilot an approach for performing site-level, spatially-explicit assessments of project impacts on golden eagles and eagle resources

à Identify how and where project activities will impact eagles; design conservation measures to reduce impact

Project completed by R6  
LEAP (Landscape-scale  
Energy Action Plan) Team  
and the Redlands Institute

Today's presentation will  
focus on objective #1



# Golden Eagle (*Aquila chrysaetos*)

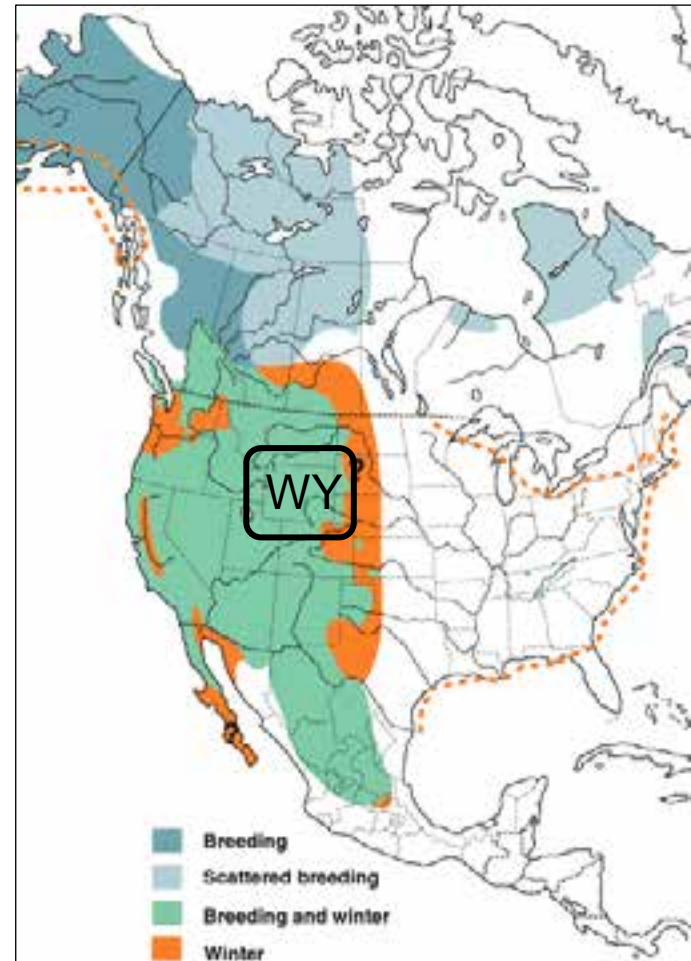
- Large, golden-brown raptor
- Western US/NA
- Preys on small-medium mammals
- Prefer open landscapes that support efficient hunting
- Nest in cliffs or large trees
- Partial migrant



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# Project Area – Wyoming, US

- Used year-round by resident and non-resident eagles
- Extensive energy resources – oil, gas, wind, hydro
- High potential for conflict with GOEA and development



GOEA Distribution Map from Birds of North America Online



forested mountains



high-elevation prairie and agriculture



sagebrush-steppe

Photos by MONGO, Famartin, and Wusel007 (CC BY-SA 2.5 & 3.0)

# Methods

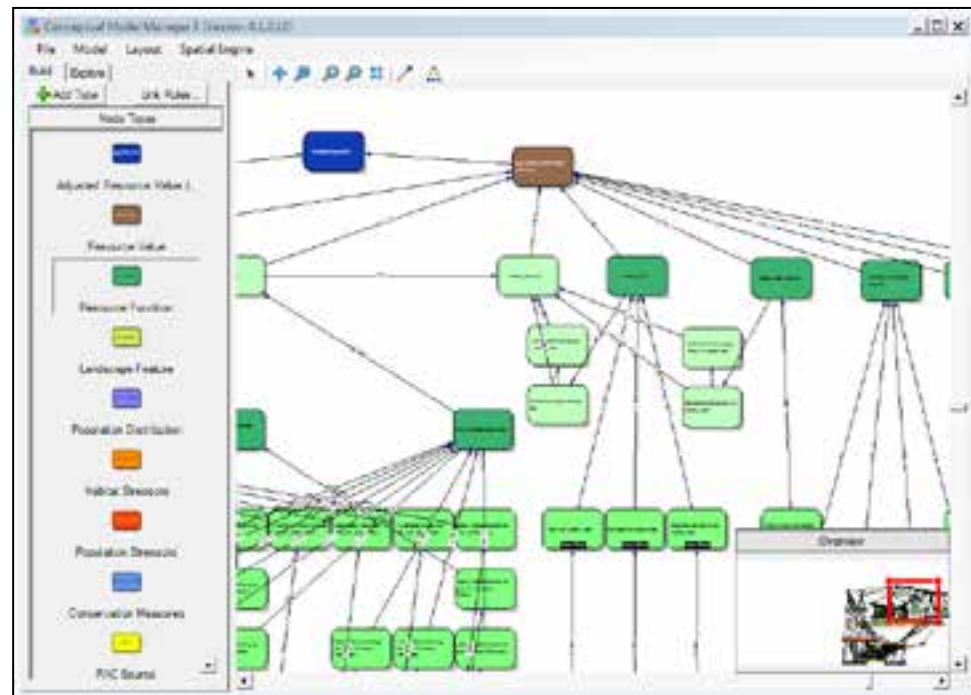
- Reviewed literature and consulted with eagle experts to identify landscape features and conditions associated with GOEA habitats (resources)
- Created conceptual models to document resource relationships with different functional types of habitat (nesting, foraging, winter foraging)
- Derived data layers representing each resource
- Aggregated weighted resource layers into composites representing each habitat type
- Revised models based on expert review and validation



# Software

- Conceptual models were built in the Conceptual Model Manager 3 application (Redlands Institute)
- Input data was prepared in ESRI ArcGIS/Modelbuilder

à CMM streamlines development and computation of complex conceptual models

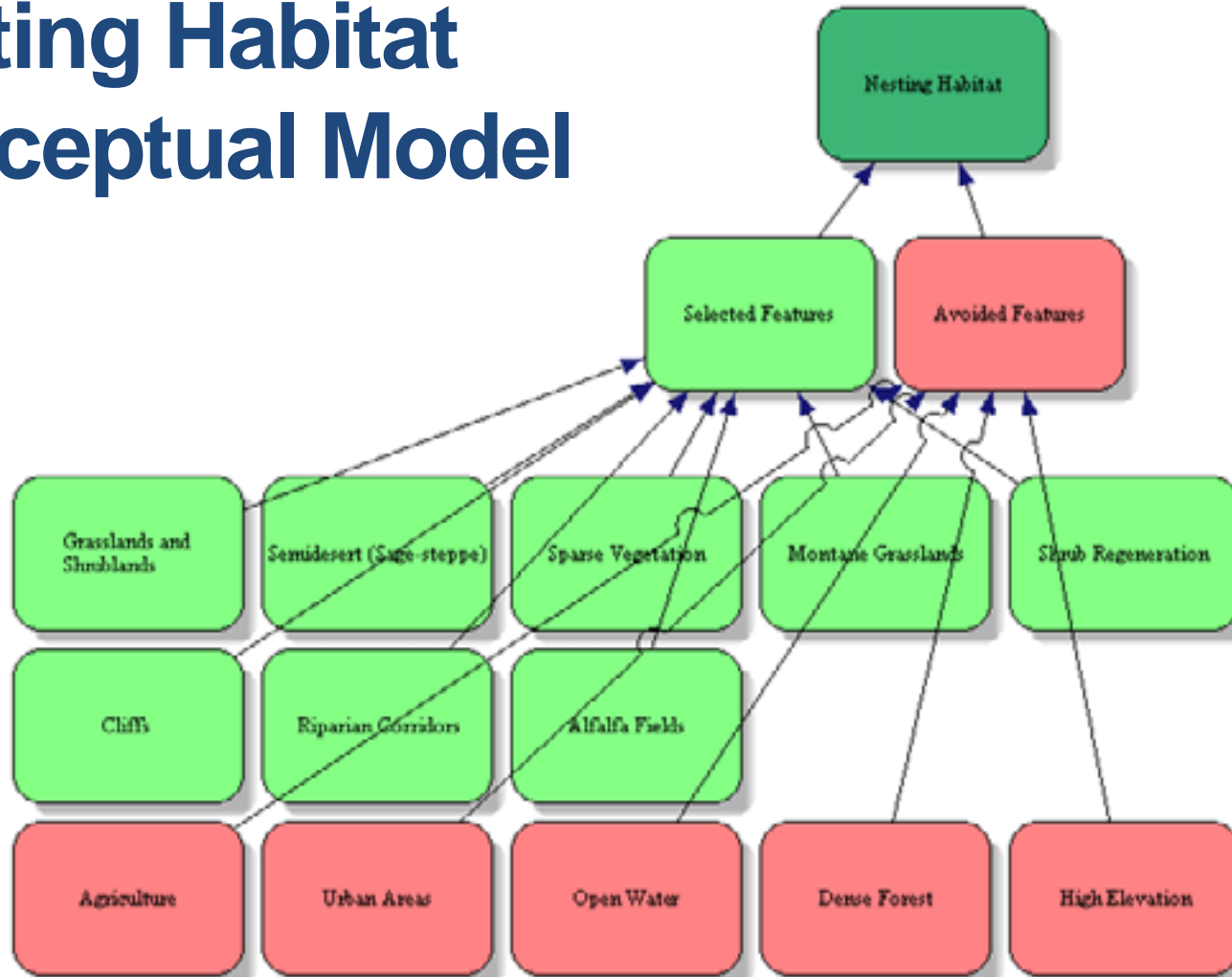


# Landscape Features

<u>Feature</u>	<u>Nesting</u>	<u>Foraging</u>	<u>Overwinter</u>
Grasslands and Shrublands	+	+	+
Semidesert (Sage-steppe)	+	+	+
Sparse Vegetation	+	+	+
Montane Grasslands	+	+	+
Shrub Regeneration	+	+	+
Open Water	-	-	-
Dense Forest	-	-	-
Alfalfa Fields	+	+	
Agriculture	-	-	-
Urban Areas	-	-	-
High Elevation	-		-
Cliffs (Roughness)	+		
Riparian Corridors	+		
Big Game Crucial Habitat			+

Feature selected for (+) or avoided (-)

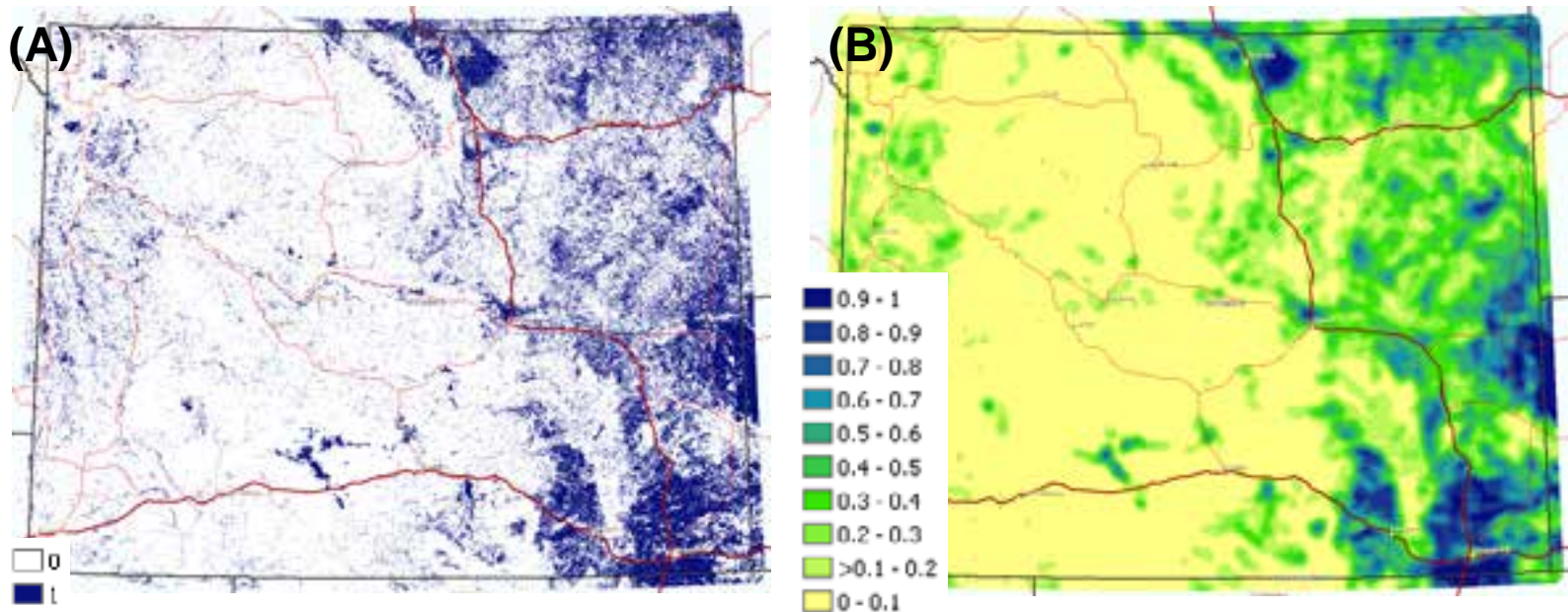
# Nesting Habitat Conceptual Model



from Conceptual Model Manager

# Deriving Data Layers

- Each resource layer was scored 0-1 (A)
- Calculated focal mean using 1-5km circular window (B)  
à proportion of neighborhood classified as resource

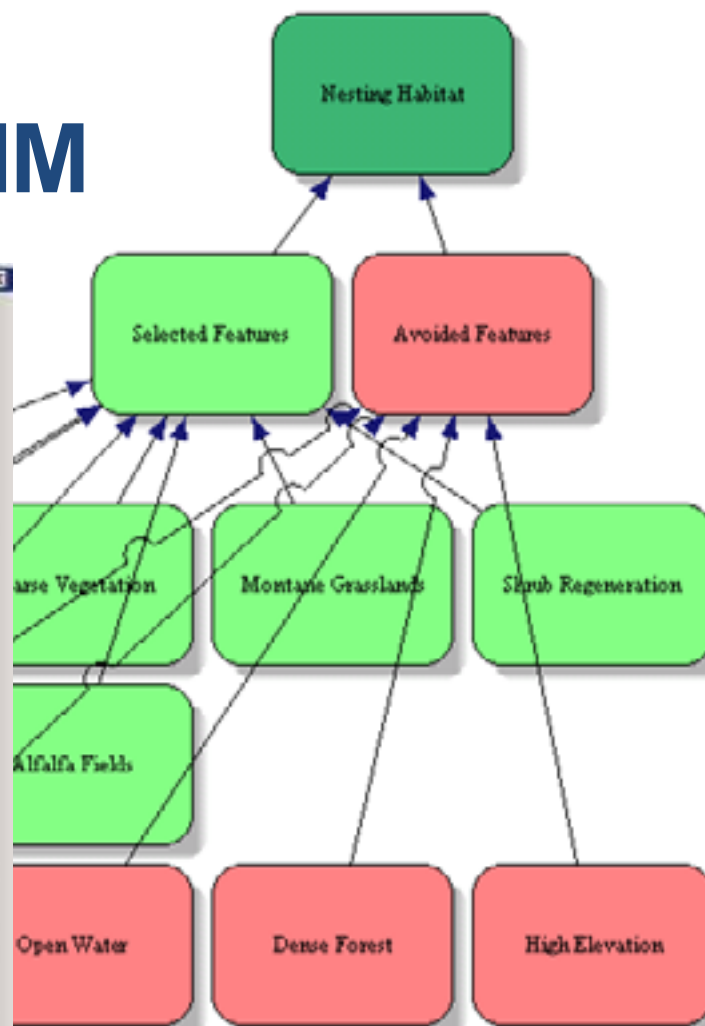
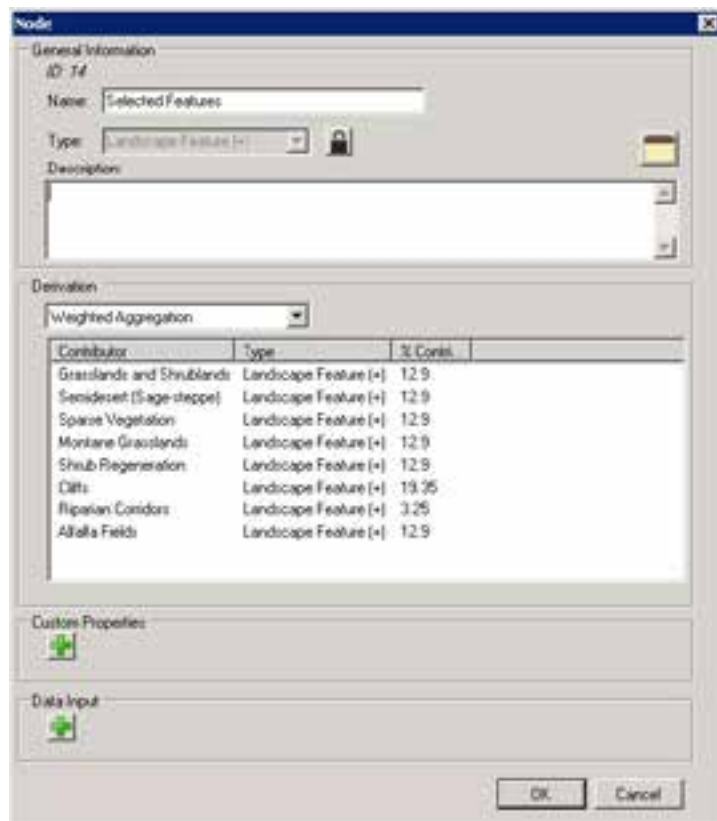


GAP Grasslands and Shrublands

# Deriving Data Layers

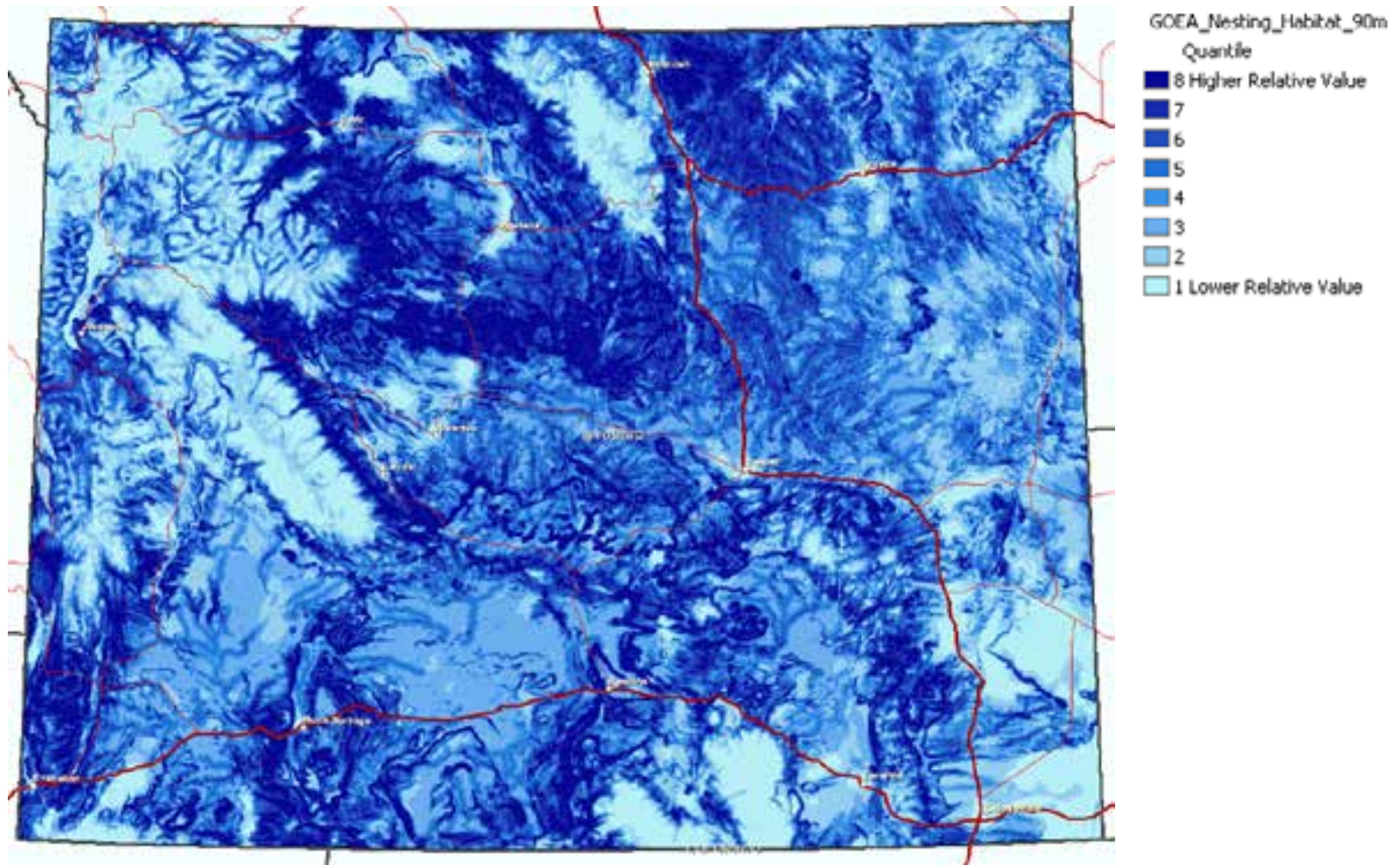
<u>Feature</u>	<u>Data Source</u>	<u>Scale</u>
Grasslands and Shrublands	GAP – Grassland and Shrubland	5km
Semidesert (Sage-steppe)	GAP – Semidesert	5km
Sparse Vegetation	GAP – Sparse Vegetation	5km
Montane Grasslands	GAP Montane Vegetation	5km
Shrub Regeneration	GAP – Forest Harvest Shrub Regen	5km
Open Water	GAP – Open Water	3km
Dense Forest	Landfire EVC/GAP – % Tree Cover	3km
Alfalfa Fields	NASS – Alfalfa (2010-2013)	3km
Agriculture	NASS – Agriculture (2010-2013)	3km
Urban Areas	US Census – Urban Areas	3km
High Elevation	NED 30m – Value scaled by elevation	1km
Cliffs (Roughness)	NED 30m – Value scale by SD of elevation	1km
Riparian Corridors	NOAA – Distance to River	3km
Big Game Crucial Habitat	WGFD – Big Game Crucial Habitat	5km

# Data Layers Aggregated in CMM



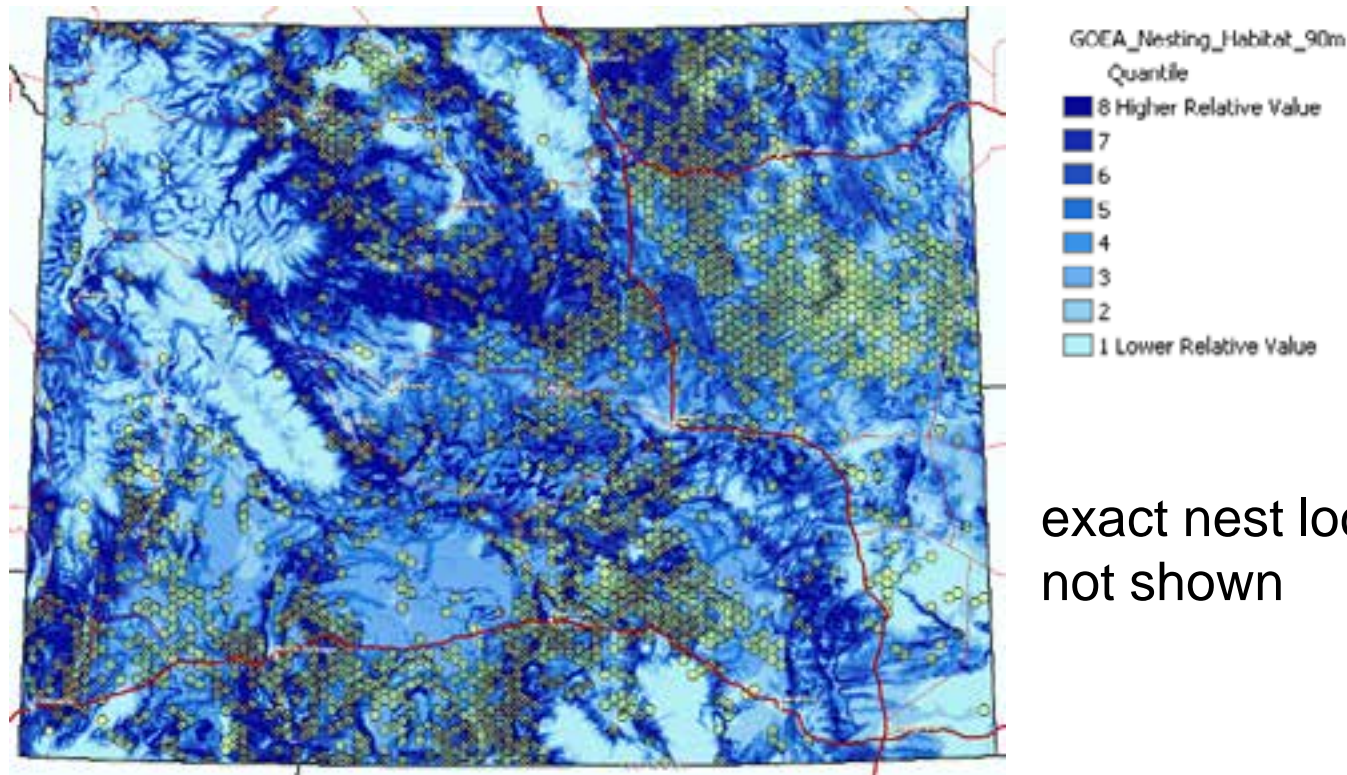
from Conceptual Model Manager

# Nesting Habitat Model Results



# Nesting Habitat Validation

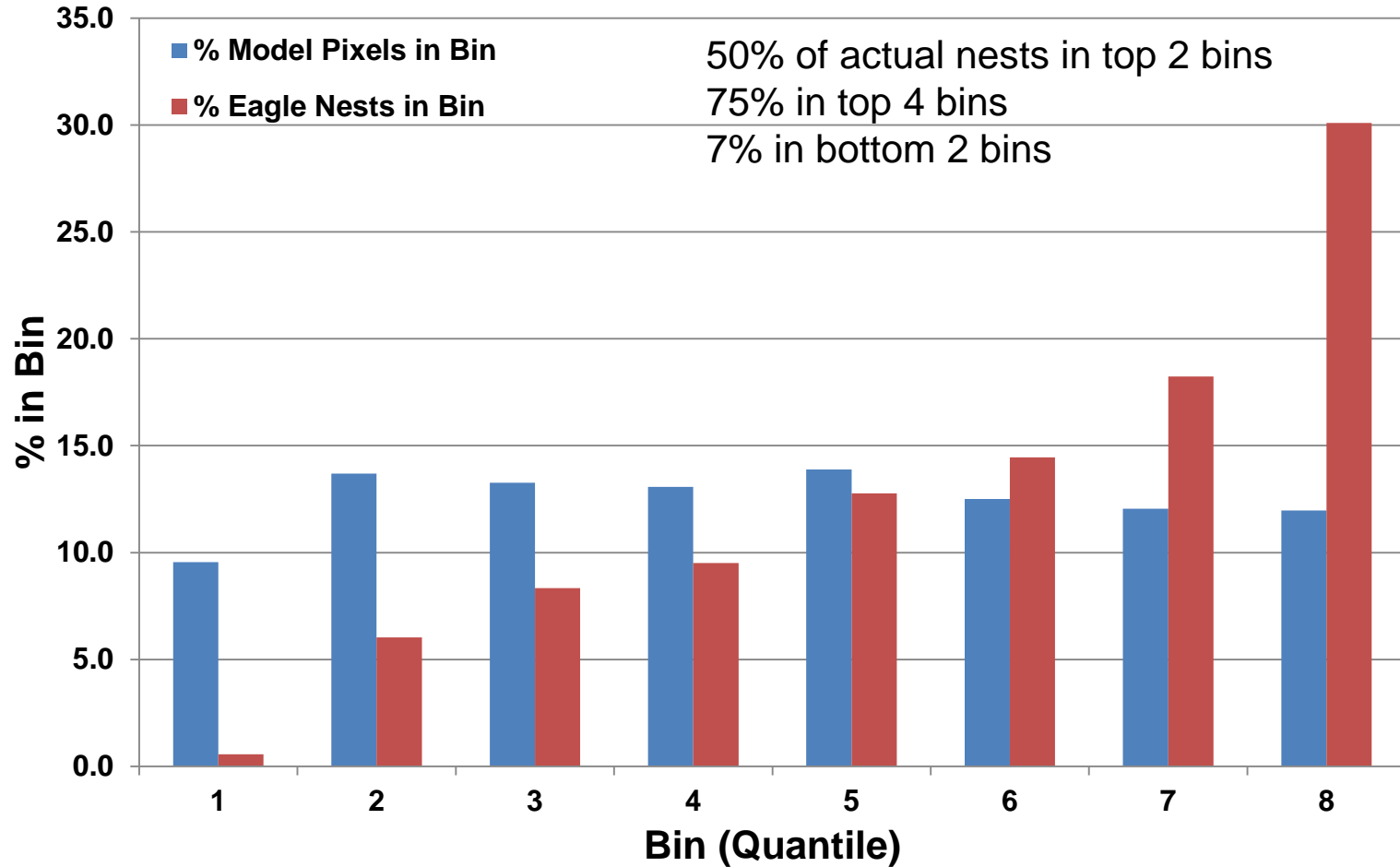
- Tested Nesting Habitat model against known GOEA nest locations (n=3563)



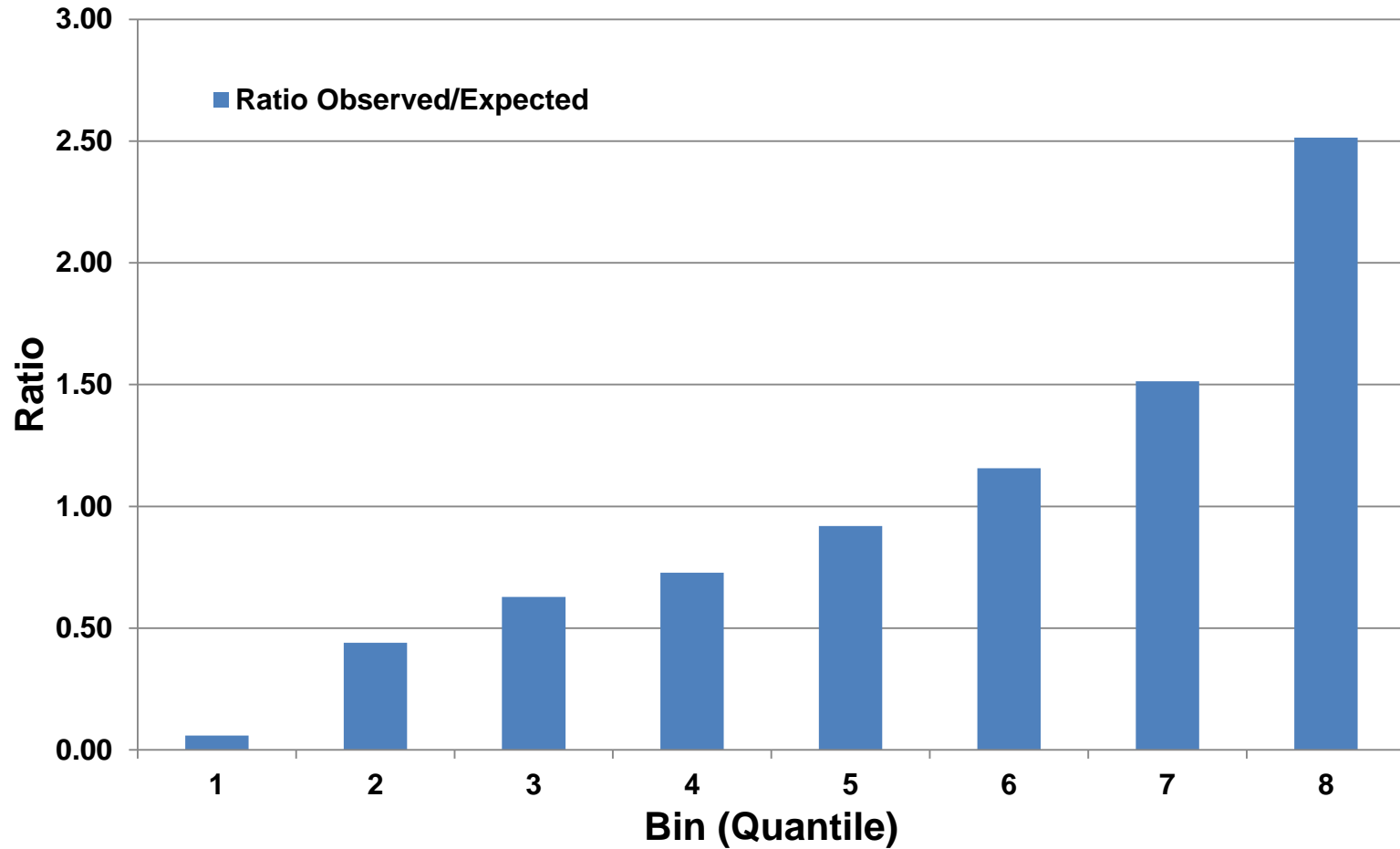
exact nest locations  
not shown



# Nesting Habitat Validation Results



# Nesting Habitat Validation Results



# Conclusions

- GOEA models useful for initial screening of sites at broad spatial scales, but do not eliminate the need for on-the-ground surveys
- Deductive modeling approach can be useful when data is too limited for inductive models
- General modeling framework illustrated with GOEA model and developed with the Conceptual Model Manager and ESRI ArcGIS could be applied to other Trust Resources

# Acknowledgements



Jordan Henk  
Naicong Li  
Philip Murphy  
Serene Ong  
Nathan Strout



Photo by Rocky-Flickr (CC BY 2.0)

## Useful Websites:

USFWS Mountain-Prairie Region  
<http://www.fws.gov/mountain-prairie/>

Initial Project Scoping Tool  
<http://ecos.fws.gov/ipac/>

ScienceBase  
<https://www.sciencebase.gov/catalog/?community=LEAP>