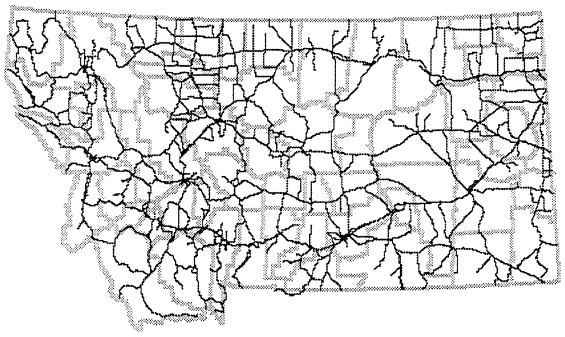
Potential Wildlife-Highway Interactions at Select Mile-Markers Along Montana Department of Transportation Routes: An ArcView GIS Analysis



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(February 2001)

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Combining MDT Roads Information with GAP Predicted Species Distributions

A potentially useful tool for MDT biologists and planners is a database table indicating where highways throughout the state show the potential for conflict with various vertebrate species. Given a list of potential species at a specified location, MDT biologists can be alert to the possibility of conflicts and/or mitigation. To develop a potential conflict database, areas around mile markers first defined various Montana road sections. Around each mile marker, we created a 10-mile radius buffer. 10-mile buffers have 2 major benefits: 1) they extend completely to the furthest neighboring mile marker, allowing for more complete coverage of roads between mile markers; 2) they are conservative in predicting potential species occurrences by indicating when mile markers fall within species' general distributions (i.e., they are less likely to miss rarer species). These buffered mile markers were then merged with GAP predicted species distributions via GIS.

GAP data provided the series of predicted species distributions based on habitat availability throughout the state. The National GAP Program supplied Montana GAP data layers for terrestrial vertebrates. GAP data will likely be the most widespread and available database of predicted species distributions available to the greatest number of groups and organizations and managers, especially for little studied species.

Predicted species distributions intersected with MDT mile marker layers were constructed for Montana Natural Heritage Program species of special concern or watch list species. Similarly, predicted species distributions intersected with MDT mile marker layers were constructed for all mammalian species. Output in the form of a MS Excel spreadsheet, an ASCII text file table, and an interactive ArcView data layer were constructed for species of special concern and watch list species. An interactive ArcView data layer was also constructed for all mammalian species.

It should be noted that the resulting conflict databases only provide a list of **potential** species that could occur at or near various locations. Like the GAP data from which they are produced, mile markers that indicate a species do not absolutely confirm the presence or absence of that species, they simply indicated that the species might occur near the point based on availability of appropriate habitat. MDT biologists should closely examine identified sites for all indicated species to determine if specific local habitats could indeed support those species.

Acknowledgements

We thank the following individuals and organizations for providing GIS layers for GAP analysis: Ree Bannon and Melissa Hart with the National GAP Program, and John O'Mara with Montana Department of Transportation. We also thank Shannon Podruzny, Edward Olexa, and Peter Gogan with the USGS Northern Rocky Mountain Science Center for GIS assistance and facilities.

GIS Process

To perform the following GIS processes in ArcView, the following extensions must first be installed: Animal Movement SA v 2.04 beta; Buffer Theme Builder Extension; Database Access; Geoprocessing; Getgrid Value Extension v2; Graticules and Measured Grids; Model Builder; and Spatial Analyst

1) Create/Open ArcView Project (wildlife.apr in folder Irby_MDT).
2) Re-project MDT routes, mile-markers, counties, cities, and streams themes to conform with GAP data layer specifications (See Data Projection Conversion Section below). This step has been performed and does not need to be repeated.
3) Add above re-projected themes to Project wildlife.apr.
4) Construct 10-mile radius buffers around mile-markers (Figure 1). This layer has been created (Buffered Mile Markers theme in wildlife.apr) and will not need to be duplicated unless a buffer of a different radius is desired.
5) Add Theme (data source=GRID data source) for desired species from CD or hard drive.
6) Convert GAP predicted species distributions from GRID format to Shapefile format (Figure 1). Activate species GRID layer created in step 5. Click Theme menu – Convert to Shapefile. Enter filename in an appropriate directory. Click <OK>. (This step can be time consuming ... wait).. At prompt "Add Shapefile as Theme to View?", click <Yes>.
7) Intersect Shapefiles of buffered mile markers and predicted species distributions (Figure 1). Activate GRID theme for desired species. Click <Theme Properties>. Click <Theme Query Builder>. Enter "Gridcode=1". Click <OK> and then click <OK> again to run Query and exit Theme Properties. Activate "Buffered Mile Markers" theme. Click Theme menu – Select by Theme. Then choose "Select Features that Intersect the selected features of (Shapefile of species distribution)" and click <New Set>.
8) Develop database table of potential species occurrence for each mile marker. Click <Open Theme Table> of activated "Buffered Mile Markers" theme. Click Table menu – Start Editing. Click Edit Menu – Add Field. Enter Field Name (Species ID etc. up to 8 characters) and Field Width. Click <OK> to exit Field Definitions. Highlight Field Name. Click <Calculate>. Enter "fieldname" = 1. Click <Switch Selection>. Click <Calculate>. Enter "fieldname" = 0. Click <Clear Selected Features>. Click Table menu – Stop Editing. Click <Yes> to Save Edits. Close table. Delete Grid and Shapefiles for species distribution from view. Click <Save>. Repeat steps for additional species. To make "Buffered Mile Markers" theme table available to use in various database managing software environments (e.g., Access, Oracle, dBase) - open the table and choose File menu – Export and save as a dBase file (with a new name).
9) Import database table as Shapefile to allow for interactive onscreen query of mile markers (Figure 2). Go to "Tables" in wildlife.apr, click <Add> and choose the new dBase file exported in step 8. Go to View window, Choose

View menu – Add Event Theme. Select the new dBase file from the list of tables and use the UTM fields for the X and Y coordinates. Long species names can be added to field names in the new theme's attribute table. With the table open, choose Table menu – Properties to enter aliases. In the View window with the new theme activated, use the <Identity> tool to view attributes of a particular mile marker.

Data Projection Conversion for MDT Data Layers

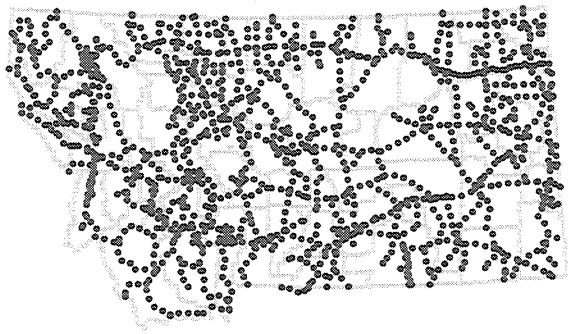
Input Coordinate System:
Name: NAD_1983_Montana
POSC: 32100
Unit: Meter
Geographic CSYS: GCS_North_American_1983
Datum: D_North_American_1983
Prime Meridian: Greenwich
False Easting: 600000
False Northing: 0
Base Projection: Lambert_Conformal_Conic
Central_Meridian: -109.5
Central_Parallel: 44.25
Standard_Parallel_1: 45.0
Standard_Parallel_2: 49.0

Input Geographic Transformation:
none

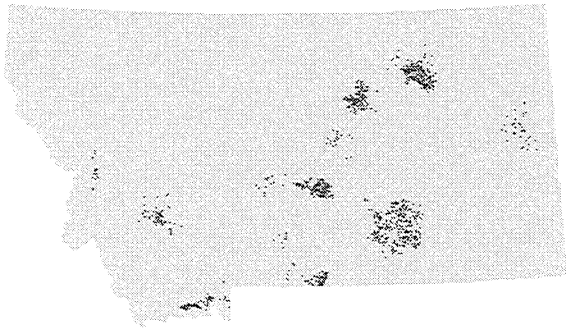
Output Geographic Transformation:
WGS_1984_4_To_NAD_1927 [8073]

Output Coordinate System:
Name: Custom
POSC: -1
Unit: Meter
Geographic CSYS: GCS_North_American_1927
Datum: D_North_American_1927
Prime Meridian: Greenwich
False Easting: 600000
False Northing: 0
Base Projection: Albers
Central_Meridian: -109.5
Central_Parallel: 44.25
Standard_Parallel_1: 46.0
Standard_Parallel_2: 48.0

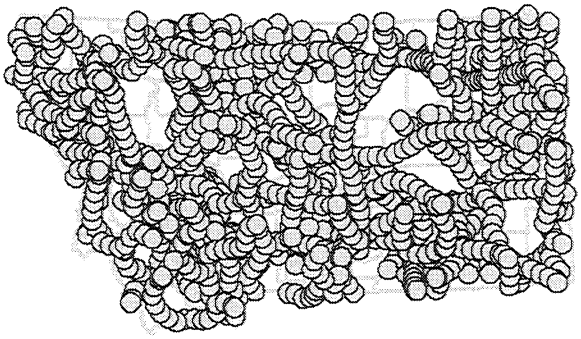
Figures



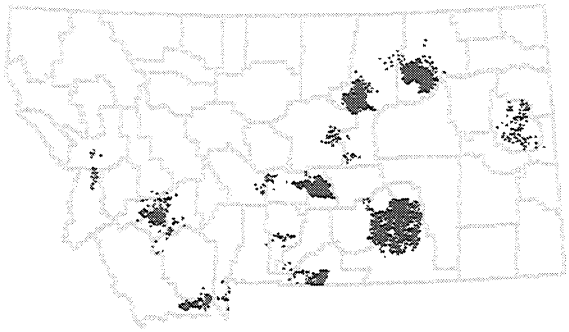
ArcView Shape File of Mile Markers along MDT Routes



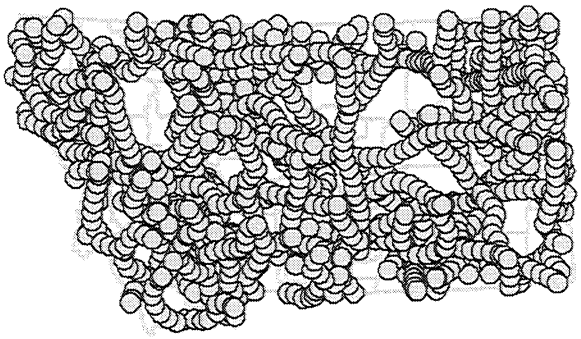
ArcView Grid File of Predicted Species Distribution



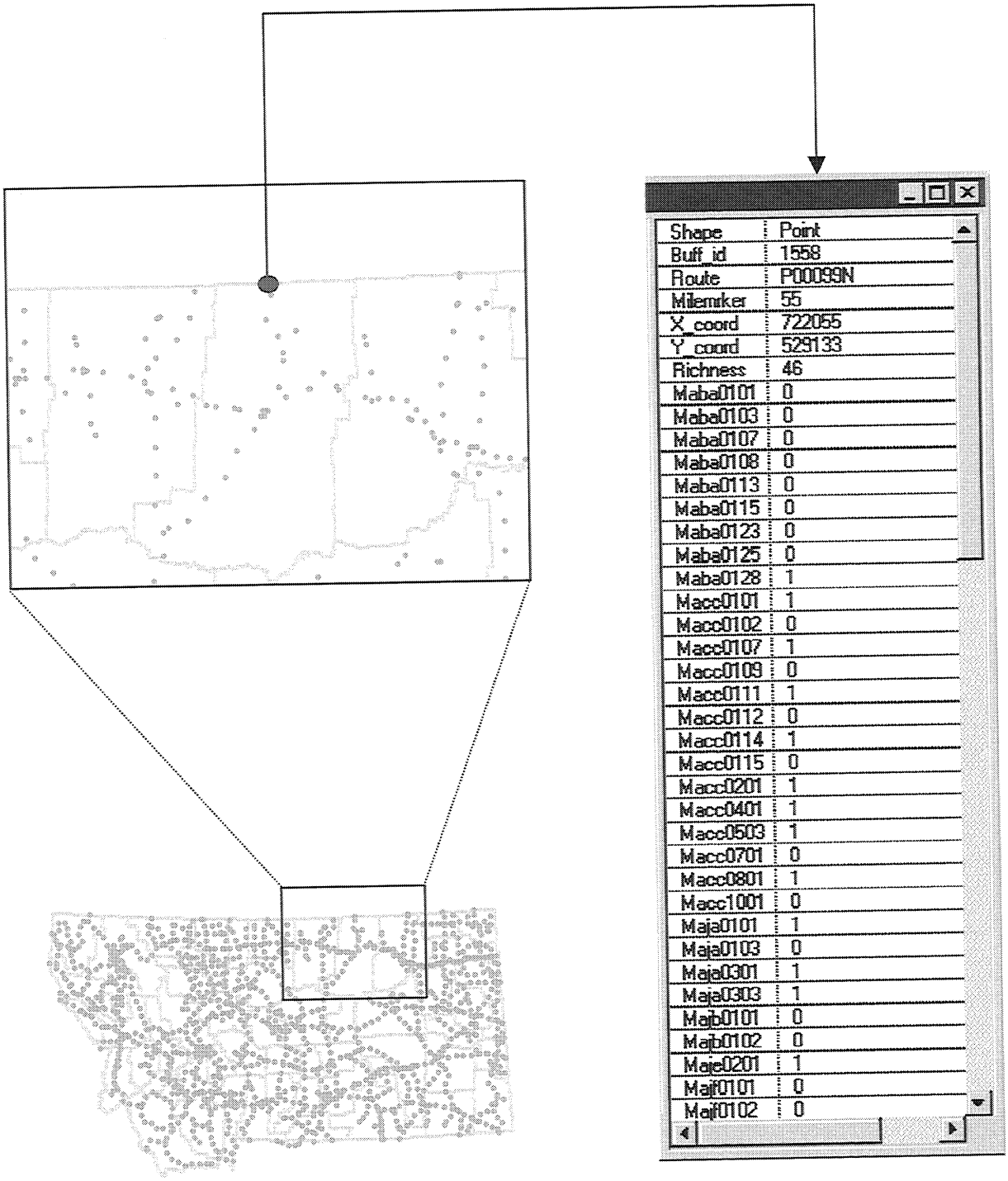
ArcView Shape File of Mile Markers with 10 mi Buffers



ArcView Shape File of Predicted Species Distribution



Intersection of Buffered Mile Markers and Predicted Species Distribution



Shape	Point
Buff_id	1558
Route	P00099N
Milemrker	55
X_coord	722055
Y_coord	529133
Richness	46
Maba0101	0
Maba0103	0
Maba0107	0
Maba0108	0
Maba0113	0
Maba0115	0
Maba0123	0
Maba0125	0
Maba0128	1
Macc0101	1
Macc0102	0
Macc0107	1
Macc0109	0
Macc0111	1
Macc0112	0
Macc0114	1
Macc0115	0
Macc0201	1
Macc0401	1
Macc0503	1
Macc0701	0
Macc0801	1
Macc1001	0
Maja0101	1
Maja0103	0
Maja0301	1
Maja0303	1
Majb0101	0
Majb0102	0
Maje0201	1
Majf0101	0
Majf0102	0

Montana Natural Heritage Program Species of Special Concern

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Animal Species of Special Concern

September, 1999

Introduction

The Montana Natural Heritage Program (MTNHP) maintains an inventory of the elements of biological diversity in Montana. The inventory focuses on plant species, animal species, plant communities, and biological features that are rare, endemic, disjunct, threatened, or endangered throughout their range or in Montana, vulnerable to extirpation from Montana, or in need of further research.

The attached list of animal species of special concern in Montana is used to direct data acquisition by MTNHP, and to provide information to others on the current status of these species. It has been developed largely from information in the scientific literature, unpublished reports, agency databases, field research, and field inventories. This information comes from a variety of cooperating local, state and federal agencies, private organizations and businesses, academic researchers, and interested individuals.

Background information was obtained from sources such as *Vertebrate Species of Special Interest or Concern* (Flath 1984, 1995), *P. D. Skaar's Montana Bird Distribution* (Montana Bird Distribution Committee 1996), *Fishes of Montana* (Brown 1971), the USFWS's *Animal Candidate Review for Listing as Endangered or Threatened Species* (61 FR 7596, Feb. 28, 1996), and from scientific literature, personal contacts, museum specimens, and MTNHP staff research.

This list is dynamic and is periodically revised as new data becomes available. Changes to the list since the previous edition (Reichel 1997) are highlighted for quick reference. Printed revisions are produced annually, while regularly-updated versions are available from our office or via our home page at www.nris.state.mt.gov/mtnhp. Comments and suggestions are continually needed on this list, particularly regarding recommended additions or deletions. We also welcome new or updated location information for any of these taxa.

Heritage Program Ranks

Taxa are evaluated and ranked by the Heritage Program on the basis of their global (range-wide) status, and their state-wide status. These ranks are used to determine protection and data collection priorities, and are revised as new information becomes available.

A scale of 1 (critically imperiled) to 5 (demonstrably secure) is used for these ranks. Each species is assigned the appropriate combination of global (G) and state (S) ranks.

Example: Merriam's shrew = G5 / S3 (i.e., species is demonstrably secure globally; in Montana is found within a restricted range).

Global and state ranks are assigned according to a standardized procedure used by all Natural Heritage Programs (The Nature Conservancy 1992), and are briefly defined below.

Rank	Definition
G1 S1	Critically imperiled because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction.
G2 S2	Imperiled because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extinction throughout its range.
G3 S3	Either very rare and local throughout its range, or found locally (even abundantly at some of its locations) in a restricted range, or vulnerable to extinction throughout its range because of other factors; in the range of 21 to 100 occurrences.
G4 S4	Apparently secure, though it may be quite rare in parts of its range, especially at the periphery.
G5 S5	Demonstrably secure, though it may be quite rare in parts of its range, especially at the periphery.
GU SU	Possibly in peril, but status uncertain; more information needed.
GH SH	Historically known; may be rediscovered.
GX SX	Believed to be extinct; historical records only, continue search.

Other Heritage Codes

A	Accidental in the state; including species (usually birds or butterflies) recorded very infrequently, hundreds or thousands of miles outside their usual range.
B	A state rank modifier indicating breeding status for a migratory species. Example: S1B,SZN – breeding occurrences for the species are ranked S1 (critically imperiled) in the state, nonbreeding occurrences are not ranked in the state.
E	An exotic established in the state; may be native in nearby regions.
HYB	Element represents a hybrid of species
N	A state rank modifier indicating non-breeding status for a migratory species. Example: S1B,SZN — breeding occurrences for the species are ranked S1 (critically imperiled) in the state, nonbreeding occurrences are not ranked in the state.
P	Indicates the element may potentially occur in the state.
Q	Taxonomic questions or problems involved, more information needed; appended to the global rank.
R	Reported in the state; but lacking documentation which would provide a basis for either accepting or rejecting the report.
T	Rank for subspecific taxon (subspecies, variety, or population); appended to the global rank for the full species.
Z	Ranking not applicable.
C	Captive or Cultivated: extant only in captivity or cultivation, or as a reintroduced population not yet established.

Fish and Wildlife Service Status

The abbreviations in this column denote the categories defined in the U.S. Fish and Wildlife Service Notice of Review (1980, 1983, 1985, 1990, 1993, 1996) and indicate the status of a taxon in Montana under the federal Endangered Species Act of 1973 (16 U.S.C.A. § 1531-1543 (Supp. 1996)). Categories are listed below:

LE	listed endangered
LT	listed threatened
PE	proposed endangered
PT	proposed threatened
C	candidate--substantial information exists in U.S. Fish and Wildlife Service files on biological vulnerability to support proposals to list as endangered or threatened.
XN	non-essential experimental population

Forest Service Status

This column indicates the status of species on Forest Service lands as defined by the U.S. Forest Service manual (2670.22). These taxa are listed as such by the Regional Forester (Northern Region) on National Forests in Montana. The Forest Service lists species as either:

E	edangered: federally listed as endangered
T	threatened: federally listed as threatened
PT	proposed threatened: federally-proposed as threatened
S	sensitive: animal species identified by the Regional Forester for which population viability is a concern as evidenced by significant downward trend in population or a significant downward trend in habitat capacity.

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Bureau of Land Management Status

This column indicates the status of species on Bureau of Land Management lands as defined by the BLM 6840 Manual.

SS Special Status: federally-listed Endangered, Threatened, or Candidate species or other rare or endemic species that occur on BLM lands.

Changes from the June, 1997 List

The Eastern Red Bat has been added to the Species of Special Concern List after first-time observations were reported for Montana. The Boreal Toad and Northern Leopard Frog have been moved from the Watch List to the Species of Special Concern List following recent marked declines in numbers reported. And the Wood Frog has been moved from the Species of Special Concern list to the Watch List due to a lack of confirmed observations of the species in Montana.

The Deepwater Sculpin has been added to the Watch List as potentially occurring in Montana following a report of the species being collected in Waterton Lake on the Canadian side. The Short-horned Lizard and Common Garter Snake have been added to the watch list due to the few numbers reported.

Global and state ranks have changed for a number of species since the 1997 list. These changes are highlighted in the following pages.

Selected References

Brown, C. J. D. 1971. Fishes of Montana. Montana State University, Bozeman. 207 pp.

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Thompson, L. S. 1982. Distribution of Montana amphibians, reptiles, and mammals. Montana Audubon Council, Helena. 24 pp.

U.S. Fish and Wildlife Service. 1996. Animal Candidate Review for Listing as Endangered and Threatened Species. 61 FR 7596, February 28, 1996.

U.S. Fish and Wildlife Service. 1993. Endangered and threatened wildlife and plants. 50 CFR 17.11 & 17.12, August 23, 1993. U. S. Govt. Printing Office: 1993-342-477/94033. 40 pp.

More Information

Extensive additional information, including location data, is available on all species listed here. MTNHP serves as an information clearinghouse, and each year responds to hundreds of data requests regarding plants, animals, and biological communities of special concern.

To place a data request, contact us via phone (406-444-3009), email (mtnhp@state.mt.us), or use our on-line request form (www.nris.state.mt.us/mtnhp).

MTNHP's website provides direct access to species data, photographs, search tools, and links to related sites. Visit us at **www.nris.state.mt.us/mtnhp**.

The preferred citation for this document is:

Roedel, M.D. 1999. Montana animal species of special concern. [Unpublished list.] Montana Natural Heritage Program, Helena. 8 pp.

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Watch List Species

These species are not currently known to meet the criteria of the Species of Special Concern. They are on the Watch List for one or more of the following reasons:
(1) there are indications that they may be less common than currently thought;
(2) they are currently declining in Montana or across much of their range;
(3) there is so little information available that we cannot adequately rank them; and
(4) they are not known to have established breeding populations in Montana, but are known from states or provinces near their border with Montana and if they occur in Montana they would be Species of Special Concern.

While not actively soliciting information for these species, we are accumulating data as it is received for possible re-ranking of these species. Modifications to global and state ranks are the result of changes in either our knowledge of the species or actual changes in population status.

Fish

Myoxocephalus thompsoni
Deepwater Sculpin
Hybognathus argyritis
Western Silvery Minnow
Hybognathus placitus
Plains Minnow
Hybopsis gracilis
Flathead Chub

Amphibians

Ascaphus truei
Tailed Frog
Bufo cognatus
Great Plains Toad
Spea bombifrons
Plains Spadefoot
Spea intermontana
Great Basin Spadefoot
Rana sylvatica
Wood Frog

Reptiles

Phrynosoma hernandesi
Short-horned Lizard
Sceloporus graciosus
Sagebrush Lizard
Eumeces skiltonianus
Western Skink
Thamnophis sirtalis
Common Garter Snake

Birds

Ardea herodias
Great Blue Heron
Lagopus leucurus
White-tailed Ptarmigan
Centrocercus urophasianus
Sage Grouse
Tyto alba
Barn Owl
Otus asio
Eastern Screech-owl
Otus kennicottii
Western Screech-owl
Surnia ulula
Northern Hawk Owl
Selasphorus platycercus
Broad-tailed Hummingbird
Lanius ludovicianus
Loggerhead Shrike
Vermivora peregrina
Tennessee Warbler
Mniotilta varia
Black-and-white Warbler
Amphispiza belli
Sage Sparrow

Mammals

Myotis yumanensis
Yuma Myotis
Sylvilagus floridanus
Eastern Cottontail
Spilogale putorius
Eastern Spotted Skunk
Spilogale gracilis
Western Spotted Skunk

Insects

Tanypteryx hageni
Black Petaltail
Cordulegaster dorsalis
Pacific Spiketail
Gomphus externus
Plains Clubtail
Ophiogomphus occidentis
Sinuous Snaketail
Aeshna canadensis
Canada Darner
Aeshna constricta
Lance-tipped Darner
Aeshna multicolor
Blue-eyed Darner
Aeshna sitchensis
Zigzag Darner
Aeshna tuberculifera
Black-tipped Darner
Macromia illinoiensis
Illinois River Cruiser
Somatochlora minor
Ocellated Emerald
Libellula composita
Bleached Skimmer
Libellula nodisticta
Hoary Skimmer
Pantala flavescens
Wandering Glider
Sympetrum madidum
Red-veined Meadowhawk
Lestes forcipatus
Sweetflag Spreadwing
Argia fumipennis violacea
Variable Dancer
Argia alberta
Paiute Dancer
Coenagrion angulatum
Prairie Bluet
Enallagma civile
Familiar Bluet
Enallagma clausum
Alkali Bluet
Arigomphus cornutus
Horned Clubtail

Mollusks

Radiodiscus abietum
Fir Pinwheel
Polygyrella polygyrella
Humped Coin
Udosarx lyrata lyrata
Lyre Mantleslug
Promenetus exacuous megas
Prairie Sprite

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Species of Special Concern

Fish

Scientific Name	Common Name	Global Rank	State Rank	ESA	USFS	BLM
Cottus confusus	Shorthead Sculpin	G5	S3			
Cottus rhotheus	Torrent Sculpin	G5	S2		S	
Cottus ricei	Spoonhead Sculpin	G5	S1			
Acipenser transmontanus pop 1	White Sturgeon (Kootenai River Population)	G4T1Q	S1	LE	E	
Scaphirhynchus albus	Pallid Sturgeon	G1G2	S1	LE		SS
Polyodon spathula	Paddlefish	G4	S1S2			SS
Lepisosteus platostomus	Shortnose Gar	G5	S1			SS
Oncorhynchus clarki bouvieri	Yellowstone Cutthroat Trout	G4T2	S2		S	SS
Oncorhynchus clarki lewisi	Westslope Cutthroat Trout	G4T3	S3		S	SS
Oncorhynchus mykiss gairdneri	Interior Redband Trout	G5T4?	S2		S	
Salvelinus confluentus	Bull Trout	G3	S3	LT	T	SS
Thymallus arcticus montanus	Montana Arctic Grayling	G5T2Q	S1	C	S	SS
Phoxinus eos x phoxinus neogaeus	Northern Redbelly X Finescale Dace	HYB	S3			SS
Hybopsis gelida	Sturgeon Chub	G2	S2	C		SS
Hybopsis meeki	Sicklefin Chub	G3	S1	C		SS
Semotilus margarita	Pearl Dace	G5	S2			SS
Cycleptus elongatus	Blue Sucker	G4	S3?			SS
Percopsis omiscomaycus	Trout-perch	G5	S1			

Amphibians

Scientific Name	Common Name	Global Rank	State Rank	ESA	USFS	BLM
Plethodon idahoensis	Coeur d'Alene Salamander	G3	S2		S	SS
Dicamptodon aterrimus	Idaho Giant Salamander	G3	SH			
Bufo boreas	Boreal Toad	G4	S3S4		S	
Bufo hemiophrys	Canadian Toad	G4	S1			SS
Rana pipiens	Northern Leopard Frog	G5	S3S4		S	

Reptiles

Scientific Name	Common Name	Global Rank	State Rank	ESA	USFS	BLM
Chelydra serpentina	Snapping Turtle	G5	S3			SS
Trionyx spiniferus	Spiny Softshell	G5	S3			SS
Heterodon nasicus	Western Hognose Snake	G5	S3			
Lampropeltis triangulum	Milk Snake	G5	S2			
Liochlorophis vernalis	Smooth Green Snake	G5	S2S3			

Birds

Scientific Name	Common Name	Global Rank	State Rank	ESA	USFS	BLM
Gavia immer	Common Loon	G5	S2B,SZN		S	SS
Aechmophorus clarkii	Clark's Grebe	G5	S2S4B,SZN			

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Birds (continued)

Scientific Name	Common Name	Global Rank	State Rank	ESA	USFS	BLM
Pelecanus ery throrhynchos	American White Pelican	G3	S2B,SZN			
Nycticorax nycticorax	Black-crowned Night-heron	G5	S2S3B,SZN			
Cygnus buccinator	Trumpeter Swan	G4	S2B,S2N		S	SS
Histrionicus histrionicus	Harlequin Duck	G4	S2B,SZN		S	SS
Haliaeetus leucocephalus	Bald Eagle	G4	S3B,S3N	LT	T	SS
Accipiter gentilis	Northern Goshawk	G5	S3S4		S	SS
Buteo regalis	Ferruginous Hawk	G4	S3B,SZN			SS
Falco peregrinus	Peregrine Falcon	G4	S1S2B,SZN		pending	SS
Tympanuchus phasianellus columbianus	Columbian Sharp-tailed Grouse	G4T3	S1		S	SS
Coturnicops noveboracensis	Yellow Rail	G4	S1B,SZN			
Grus americana	Whooping Crane	G1	SZN	LE	E	SS
Charadrius melodus	Piping Plover	G3	S2B,SZN	LT		SS
Charadrius montanus	Mountain Plover	G2	S2B,SZN	PT	PT	SS
Himantopus mexicanus	Black-necked Stilt	G5	S2B,SZN			
Larus pipixcan	Franklin's Gull	G4G5	S3B,SZN			
Sterna caspia	Caspian Tern	G5	S2B,SZN			
Sterna hirundo	Common Tern	G5	S3B,SZN			
Sterna forsteri	Forster's Tern	G5	S2B,SZN			
Sterna antillarum athalassos	Interior Least Tern	G4T2Q	S1B,SZN	LE		SS
Chlidonias niger	Black Tern	G4	S3B,SZN			SS
Coccyzus americanus	Yellow-billed Cuckoo	G5	S3B,SZN			
Otus flammeolus	Flammulated Owl	G4	S3B,SZN		S	SS
Athene cunicularia	Burrowing Owl	G4	S3B,SZN		S	SS
Strix nebulosa	Great Gray Owl	G5	S3			SS
Aegolius funereus	Boreal Owl	G5	S4			SS
Cypseloides niger	Black Swift	G4	S3B,SZN			
Picoides arcticus	Black-backed Woodpecker	G5	S3		S	SS
Empidonax alnorum	Alder Flycatcher	G5	S1B,SZN			
Tyrannus vociferans	Cassin's Kingbird	G5	S1S3B,SZN			
Polioptila caerulea	Blue-gray Gnatcatcher	G5	S1B,SAN			
Spiza americana	Dickcissel	G5	S1S2B,SZN			SS
Ammodramus bairdii	Baird's Sparrow	G4	S3S4B,SZN		S	
Ammodramus leconteii	Le Conte's Sparrow	G4	S1S2B,SZN			SS
Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	G5	S1B,SZN			

Mammals

Scientific Name	Common Name	Global Rank	State Rank	ESA	USFS	BLM
Sorex nanus	Dwarf Shrew	G4	S3			
Sorex merriami	Merriam's Shrew	G5	S3			SS
Myotis thysanodes	Fringed Myotis	G5	S3			
Myotis septentrionalis	Northern Myotis	G4	S1			
Lasiurus borealis	Eastern Red Bat	G5	S1			

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Mammals (continued)

Scientific Name	Common Name	Global Rank	State Rank	ESA	USFS	BLM
Euderma maculatum	Spotted Bat	G4	S1		S	SS
Corynorhinus townsendii	Townsend's Big-eared Bat	G4	S2S3		S	SS
Lepus californicus	Black-tailed Jack Rabbit	G5	S2S3			
Brachylagus idahoensis	Pygmy Rabbit	G4	S2S3		S	SS
Tamias umbrinus	Uinta Chipmunk	G5	S3?			
Cynomys ludovicianus	Black-tailed Prairie Dog	G4	S3S4		S	SS
Cynomys leucurus	White-tailed Prairie Dog	G4	S1		S	SS
Perognathus parvus	Great Basin Pocket Mouse	G5	S2S4			
Chaetodipus hispidus	Hispid Pocket Mouse	G5	S1			
Synaptomys borealis	Northern Bog Lemming	G4	S2		S	SS
Zapus hudsonius	Meadow Jumping Mouse	G5	S2S3			SS
Canis lupus	Gray Wolf	G4	S1	LE	E	SS
Vulpes velox	Swift Fox	G3	S1	C	S	SS
Ursus arctos horribilis	Grizzly Bear	G4T3	S1S2	LT	T	SS
Martes pennanti	Fisher	G5	S2		S	SS
Mustela nigripes	Black-footed Ferret	G1	SH#	E	E	SS
Gulo gulo luscus	North American Wolverine	G5T4	S2		S	SS
Lynx canadensis	Lynx (US Lower 48 Population)	G5T?Q	S2	PT	PT	SS
Rangifer tarandus caribou	Woodland Caribou	G5T4	SX	LE	E	

Mollusks

Scientific Name	Common Name	Global Rank	State Rank	ESA	USFS	BLM
Discus brunsoni	Mission Range Disc	G1	S1			
Hemphillia danielsi	Marbled Jumping-slug	G1G3	S1S3			
Magnipelta mycophaga	Spotted Slug	G2G3	S1S3			
Zacoleus idahoensis	Sheathed Slug	G3G4	S2S3			
Oreohelix alpina	Alpine Mountainsnail	G1	S1			
Oreohelix amariradix	Bitterroot Mountainsnail	G1G2	S1S2			
Oreohelix carinifera	Keeled Mountainsnail	G1	S1			
Oreohelix elrodi	Carinate Mountainsnail	G1	S1			
Oreohelix strigosa berryi	Berry's Mountainsnail	G5T2	S1S2			
Oreohelix yavapai mariae	Gallatin Mountainsnail	G4?T1	S1			
Oreohelix sp 3	Bearmouth Mountainsnail	G1G2	S1S2			
Oreohelix sp 4	Drummond Mountainsnail	G1	S1			
Oreohelix sp 5	Brunson Mountainsnail	G1G2	S1S2			
Oreohelix sp 6	Kintla Lake Mountainsnail	G1	S1			
Oreohelix sp 7	Kitchen Creek Mountainsnail	G1G2	S1S2			
Oreohelix sp 10	Missoula Mountainsnail	G1G3	S1S3			
Oreohelix sp 11	Subcarinate Mountainsnail	G1	S1			
Oreohelix sp 31	Byrne Resort Mountainsnail	G1G2	S1S2			
Udosarx lyrata russelli	Russell Mantleslug	G1	S1			
Lyogyrus greggi	Rocky Mountain Duskysnail	G3G4	S1			
Amnicola sp 2	Washington Duskysnail	G1	S1			

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Mollusks (continued)

Scientific Name	Common Name	Global Rank	State Rank	ESA	USFS	BLM
Fluminicola fuscus	Columbia Pebblesnail	G2G3	SX			
Acroloxus coloradensis	Rocky Mountain Capshell	G?	S1			
Stagnicola elrodianus	Largemouth Pondsnail	G1	S1			
Stagnicola montanensis	Mountain Marshsnail	G3	S1S3			
Fisherola nuttalli	Shortface Lanx	G2?	S1S3			
Physa megalochlamys	Large-mantle Physa	G3	S1			

Insects

Scientific Name	Common Name	Global Rank	State Rank	ESA	USFS	BLM
Microcylloepus browni	Brown's Microcylloepus Riffle Beetle	G1	S1			
Caenis youngi	A Mayfly	G3	S2			
Phyciodes batesii	Tawny Crescent	G4	S2S3			
Euphydryas gillettii	Gillette's Checkerspot	G3	S3			
Erpetogomphus designatus	Eastern Ringtail	G5	S1			
Aeshna subarctica	Subarctic Darner	G5	S1S2			
Somatochlora albicincta	Ringed Emerald	G5	S1S3			
Somatochlora walshii	Brush-tipped Emerald	G5	S1S2			
Erythemis collocata	Western Pondhawk	G5	S1S2			
Leucorrhinia borealis	Boreal Whiteface	G5	S1			
Coenagrion interrogatum	Subarctic Bluet	G5	S1S2			
Enallagma optimolocus	Last Best Place Damselfly	G1G3Q	S1S3			
Isocapnia crinita	A Stonefly	G4	S2			
Isocapnia integra	A Stonefly	G4	S2			
Utacapnia columbiana	A Stonefly	G4	S2			
Lednia tumana	Meltwater Lednian Stonefly	G1	S1			
Zapada cordillera	A Stonefly	G3	S2			
Zapada glacier	Western Glacier Stonefly	G3	S1			
Isoperla petersoni	A Stonefly	G4	S2?			
Rhyacophila alexanderi	Alexander's Rhyacophilan Caddisfly	G2	S2			
Rhyacophila ebria	A Caddisfly	G1?	S1?			
Rhyacophila newelli	A Rhyacophilan Caddisfly	G2?	S2?			
Rhyacophila glacieri	A Rhyacophilan Caddisfly	G1	S1			
Agapetus montanus	An Agapetus Caddisfly	G2?	S2?			

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List of Montana Vertebrate Species with Predicted GAP Distributions

AAAA0108	AAAAA01080	LONG-TOED SALAMANDER	Ambystoma macrodactylum	
AAAA0114	AAAAA01140	TIGER SALAMANDER	Ambystoma tigrinum	
AAAD1227	AAAAD12270	COEUR D'ALENE SALAMANDER	Plethodon idahoensis	special concern
AAAH0103	AAAAH01030	IDAHO GIANT SALAMANDER	Dicamptodon aterrimus	special concern
AABA0101	AAABA01010	TAILED FROG	Ascaphus truei	watch list
AABB0103	AAABB01030	WESTERN TOAD	Bufo boreas	special concern
AABB0105	AAABB01050	GREAT PLAINS TOAD	Bufo cognatus	watch list
AABB0108	AAABB01080	CANADIAN TOAD	Bufo hemiophrys	special concern
AABB0118	AAABB01180	WOODHOUSE'S TOAD	Bufo woodhousii	
AABC0507	AAABC05070	WESTERN CHORUS FROG	Pseudacris triseriata	
AABC0510	AAABC05100	PACIFIC CHORUS FROG	Pseudacris regilla	
AABF0201	AAABF02010	PLAINS SPADEFOOT	Spea bombifrons	watch list
AABH0107	AAABH01070	BULLFROG	Rana catesbeiana	
AABH0117	AAABH01170	NORTHERN LEOPARD FROG	Rana pipiens	special concern
AABH0120	AAABH01200	WOOD FROG	Rana sylvatica	watch list
AABH0129	AAABH01290	COLUMBIA SPOTTED FROG	Rana luteiventris	
BNBA0103	ABNBA01030	COMMON LOON	Gavia immer	special concern
BNCA0201	ABNCA02010	PIED-BILLED GREBE	Podilymbus podiceps	
BNCA0301	ABNCA03010	HORNED GREBE	Podiceps auritus	
BNCA0302	ABNCA03020	RED-NECKED GREBE	Podiceps grisegena	
BNCA0303	ABNCA03030	EARED GREBE	Podiceps nigricollis	
BNCA0401	ABNCA04010	WESTERN GREBE	Aechmophorus occidentalis	
BNCA0402	ABNCA04020	CLARK'S GREBE	Aechmophorus clarkii	special concern
BNFC0101	ABNFC01010	AMERICAN WHITE PELICAN	Pelecanus erythrorhynchos	special concern
BNFD0102	ABNFD01020	DOUBLE-CRESTED CORMORANT	Phalacrocorax auritus	
BNGA0102	ABNGA01020	AMERICAN BITTERN	Botaurus lentiginosus	
BNGA0401	ABNGA04010	GREAT BLUE HERON	Ardea herodias	watch list
BNGA1101	ABNGA11010	BLACK-CROWNED NIGHT-HERON	Nycticorax nycticorax	special concern
BNGE0202	ABNGE02020	WHITE-FACED IBIS	Plegadis chihi	special concern
BNJB0201	ABNJB02010	TUNDRA SWAN	Cygnus columbianus	
BNJB0203	ABNJB02030	TRUMPETER SWAN	Cygnus buccinator	special concern
BNJB0304	ABNJB03040	GREATER WHITE-FRONTED GOOSE	Anser albifrons	
BNJB0401	ABNJB04010	SNOW GOOSE	Chen caerulescens	
BNJB0402	ABNJB04020	ROSS'S GOOSE	Chen rossii	
BNJB0503	ABNJB05030	CANADA GOOSE	Branta canadensis	
BNJB0901	ABNJB09010	WOOD DUCK	Aix sponsa	
BNJB1001	ABNJB10010	GREEN-WINGED TEAL	Anas crecca	
BNJB1006	ABNJB10060	MALLARD	Anas platyrhynchos	
BNJB1011	ABNJB10110	NORTHERN PINTAIL	Anas acuta	
BNJB1013	ABNJB10130	BLUE-WINGED TEAL	Anas discors	
BNJB1014	ABNJB10140	CINNAMON TEAL	Anas cyanoptera	
BNJB1015	ABNJB10150	NORTHERN SHOVELER	Anas clypeata	
BNJB1016	ABNJB10160	GADWALL	Anas strepera	
BNJB1018	ABNJB10180	AMERICAN WIGEON	Anas americana	
BNJB1102	ABNJB11020	CANVASBACK	Aythya valisineria	
BNJB1103	ABNJB11030	REDHEAD	Aythya americana	
BNJB1104	ABNJB11040	RING-NECKED DUCK	Aythya collaris	
BNJB1106	ABNJB11060	GREATER SCAUP	Aythya marila	
BNJB1107	ABNJB11070	LESSER SCAUP	Aythya affinis	
BNJB1501	ABNJB15010	HARLEQUIN DUCK	Histrionicus histrionicus	special concern
BNJB1801	ABNJB18010	COMMON GOLDENEYE	Bucephala clangula	
BNJB1802	ABNJB18020	BARROW'S GOLDENEYE	Bucephala islandica	
BNJB1803	ABNJB18030	BUFFLEHEAD	Bucephala albeola	
BNJB2001	ABNJB20010	HOODED MERGANSER	Lophodytes cucullatus	
BNJB2101	ABNJB21010	COMMON MERGANSER	Mergus merganser	
BNJB2102	ABNJB21020	RED-BREASTED MERGANSER	Mergus serrator	
BNJB2201	ABNJB22010	RUDDY DUCK	Oxyura jamaicensis	
BNKA0201	ABNKA02010	TURKEY VULTURE	Cathartes aura	
BNKC0101	ABNKC01010	OSPREY	Pandion haliaetus	
BNKC1001	ABNKC10010	BALD EAGLE	Haliaeetus leucocephalus	special concern
BNKC1101	ABNKC11010	NORTHERN HARRIER	Circus cyaneus	

BNKC1202	ABNKC12020	SHARP-SHINNED HAWK	Accipiter striatus	
BNKC1204	ABNKC12040	COOPER'S HAWK	Accipiter cooperii	
BNKC1206	ABNKC12060	NORTHERN GOSHAWK	Accipiter gentilis	special concern
BNKC1905	ABNKC19050	BROAD-WINGED HAWK	Buteo platypterus	
BNKC1907	ABNKC19070	SWAINSON'S HAWK	Buteo swainsoni	
BNKC1911	ABNKC19110	RED-TAILED HAWK	Buteo jamaicensis	
BNKC1912	ABNKC19120	FERRUGINOUS HAWK	Buteo regalis	special concern
BNKC1913	ABNKC19130	ROUGH-LEGGED HAWK	Buteo lagopus	
BNKC2201	ABNKC22010	GOLDEN EAGLE	Aquila chrysaetos	
BNKD0602	ABNKD06020	AMERICAN KESTREL	Falco sparverius	
BNKD0603	ABNKD06030	MERLIN	Falco columbarius	
BNKD0607	ABNKD06070	PEREGRINE FALCON	Falco peregrinus	special concern
BNKD0608	ABNKD06080	GYRFALCON	Falco rusticolus	
BNKD0609	ABNKD06090	PRAIRIE FALCON	Falco mexicanus	
BNLC0101	ABNLC01010	GRAY PARTRIDGE	Perdix perdix	
BNLC0301	ABNLC03010	CHUKAR	Alectoris chukar	
BNLC0701	ABNLC07010	RING-NECKED PHEASANT	Phasianus colchicus	
BNLC0901	ABNLC09010	SPRUCE GROUSE	Falcipennis canadensis	
BNLC0902	ABNLC09020	BLUE GROUSE	Dendragapus obscurus	
BNLC1003	ABNLC10030	WHITE-TAILED PTARMIGAN	Lagopus leucurus	watch list
BNLC1101	ABNLC11010	RUFFED GROUSE	Bonasa umbellus	
BNLC1201	ABNLC12010	SAGE GROUSE	Centrocercus urophasianus	watch list
BNLC1303	ABNLC13030	SHARP-TAILED GROUSE	Tympanuchus phasianellus	
BNLC1304	ABNLC13033	COLUMBIAN SHARP-TAILED GROUSE	Tympanuchus phasianellus columbianus	special concern
BNLC1401	ABNLC14010	WILD TURKEY	Meleagris gallopavo	
BNLC2102	ABNLC21020	NORTHERN BOBWHITE	Colinus virginianus	
BNME0101	ABNME01010	YELLOW RAIL	Coturnicops noveboracensis	special concern
BNME0503	ABNME05030	VIRGINIA RAIL	Rallus limicola	
BNME0802	ABNME08020	SORA	Porzana carolina	
BNME1402	ABNME14020	AMERICAN COOT	Fulica americana	
BNMK0101	ABNMK01010	SANDHILL CRANE	Grus canadensis	
BNMK0103	ABNMK01030	WHOOPING CRANE	Grus americana	special concern
BNNB0201	ABNNB02010	BLACK-BELLIED PLOVER	Pluvialis squatarola	
BNNB0306	ABNNB03060	SEMIPALMATED PLOVER	Charadrius semipalmatus	
BNNB0307	ABNNB03070	PIPING PLOVER	Charadrius melodus	special concern
BNNB0309	ABNNB03090	KILLDEER	Charadrius vociferus	
BNNB0310	ABNNB03100	MOUNTAIN PLOVER	Charadrius montanus	special concern
BNND0101	ABNND01010	BLACK-NECKED STILT	Himantopus mexicanus	special concern
BNND0201	ABNND02010	AMERICAN AVOCET	Recurvirostra americana	
BNNF0102	ABNNF01020	GREATER YELLOWLEGS	Tringa melanoleuca	
BNNF0103	ABNNF01030	LESSER YELLOWLEGS	Tringa flavipes	
BNNF0107	ABNNF01070	SOLITARY SANDPIPER	Tringa solitaria	
BNNF0201	ABNNF02010	WILLET	Catoptrophorus semipalmatus	
BNNF0402	ABNNF04020	SPOTTED SANDPIPER	Actitis macularia	
BNNF0601	ABNNF06010	UPLAND SANDPIPER	Bartramia longicauda	
BNNF0707	ABNNF07070	LONG-BILLED CURLEW	Numenius americanus	
BNNF0804	ABNNF08040	MARBLED GODWIT	Limosa fedoa	
BNNF1104	ABNNF11040	SEMIPALMATED SANDPIPER	Calidris pusilla	
BNNF1105	ABNNF11050	WESTERN SANDPIPER	Calidris mauri	
BNNF1110	ABNNF11100	LEAST SANDPIPER	Calidris minutilla	
BNNF1111	ABNNF11110	WHITE-RUMPED SANDPIPER	Calidris fuscicollis	
BNNF1112	ABNNF11120	BAIRD'S SANDPIPER	Calidris bairdii	
BNNF1113	ABNNF11130	PECTORAL SANDPIPER	Calidris melanotos	
BNNF1119	ABNNF11190	STILT SANDPIPER	Calidris himantopus	
BNNF1601	ABNNF16010	SHORT-BILLED DOWITCHER	Limnodromus griseus	
BNNF1602	ABNNF16020	LONG-BILLED DOWITCHER	Limnodromus scolopaceus	
BNNF1801	ABNNF18010	COMMON SNIPE	Gallinago gallinago	
BNNF2001	ABNNF20010	WILSON'S PHALAROPE	Phalaropus tricolor	
BNNF2002	ABNNF20020	RED-NECKED PHALAROPE	Phalaropus lobatus	
BNNM0302	ABNNM03020	FRANKLIN'S GULL	Larus pipixcan	special concern
BNNM0305	ABNNM03050	BONAPARTE'S GULL	Larus philadelphia	

BNNM0310	ABNNM03100	RING-BILLED GULL	Larus delawarensis	
BNNM0311	ABNNM03110	CALIFORNIA GULL	Larus californicus	
BNNM0802	ABNNM08020	CASPIAN TERN	Sterna caspia	special concern
BNNM0807	ABNNM08070	COMMON TERN	Sterna hirundo	special concern
BNNM0809	ABNNM08090	FORSTER'S TERN	Sterna forsteri	special concern
BNNM0810	ABNNM08100	LEAST TERN	Sterna antillarum	special concern
BNNM1002	ABNNM10020	BLACK TERN	Chlidonias niger	special concern
BNPB0101	ABNPB01010	ROCK DOVE	Columbia livia	
BNPB0404	ABNPB04040	MOURNING DOVE	Zenaida macroura	
BNRB0201	ABNRB02010	BLACK-BILLED CUCKOO	Coccyzus erythropthalmus	
BNRB0202	ABNRB02020	YELLOW-BILLED CUCKOO	Coccyzus americanus	special concern
BNSA0101	ABNSA01010	BARN OWL	Tyto alba	watch list
BNSB0102	ABNSB01020	FLAMMULATED OWL	Otus flammeolus	special concern
BNSB0103	ABNSB01030	EASTERN SCREECH-OWL	Otus asio	watch list
BNSB0104	ABNSB01040	WESTERN SCREECH-OWL	Otus kennicottii	watch list
BNSB0501	ABNSB05010	GREAT HORNED OWL	Bubo virginianus	
BNSB0601	ABNSB06010	SNOWY OWL	Nyctea scandiaca	
BNSB0701	ABNSB07010	NORTHERN HAWK OWL	Surnia ulula	watch list
BNSB0801	ABNSB08010	NORTHERN PYGMY-OWL	Glaucidium gnoma	
BNSB1001	ABNSB10010	BURROWING OWL	Athene cunicularia	special concern
BNSB1202	ABNSB12020	BARRED OWL	Strix varia	
BNSB1204	ABNSB12040	GREAT GRAY OWL	Strix nebulosa	special concern
BNSB1301	ABNSB13010	LONG-EARED OWL	Asio otus	
BNSB1304	ABNSB13040	SHORT-EARED OWL	Asio flammeus	
BNSB1501	ABNSB15010	BOREAL OWL	Aegolius funereus	special concern
BNSB1502	ABNSB15020	NORTHERN SAW-WHET OWL	Aegolius acadicus	
BNTA0202	ABNTA02020	COMMON NIGHTHAWK	Chordeiles minor	
BNTA0401	ABNTA04010	COMMON POORWILL	Phalaenoptilus nuttallii	
BNUA0101	ABNUA01010	BLACK SWIFT	Cypseloides niger	special concern
BNUA0301	ABNUA03010	CHIMNEY SWIFT	Chaetura pelagica	
BNUA0302	ABNUA03020	VAUX'S SWIFT	Chaetura vauxi	
BNUA0601	ABNUA06010	WHITE-THROATED SWIFT	Aeronautes saxatalis	
BNUC4501	ABNUC45010	RUBY-THROATED HUMMINGBIRD	Archilochus colubris	
BNUC4502	ABNUC45020	BLACK-CHINNED HUMMINGBIRD	Archilochus alexandri	
BNUC4801	ABNUC48010	CALLIOPE HUMMINGBIRD	Stellula calliope	
BNUC5102	ABNUC51020	RUFOUS HUMMINGBIRD	Selasphorus rufus	
BNXD0102	ABNXD01020	BELTED KINGFISHER	Ceryle alcyon	
BNYF0401	ABNYF04010	LEWIS'S WOODPECKER	Melanerpes lewis	
BNYF0404	ABNYF04040	RED-HEADED WOODPECKER	Melanerpes erythrocephalus	
BNYF0503	ABNYF05030	WILLIAMSON'S SAPSUCKER	Sphyrapicus thyroideus	
BNYF0504	ABNYF05040	RED-NAPED SAPSUCKER	Sphyrapicus nuchalis	
BNYF0703	ABNYF07030	DOWNY WOODPECKER	Picoides pubescens	
BNYF0704	ABNYF07040	HAIRY WOODPECKER	Picoides villosus	
BNYF0708	ABNYF07080	THREE-TOED WOODPECKER	Picoides tridactylus	
BNYF0709	ABNYF07090	BLACK-BACKED WOODPECKER	Picoides arcticus	special concern
BNYF1002	ABNYF10020	NORTHERN FLICKER	Colaptes auratus	
BNYF1202	ABNYF12020	PILEATED WOODPECKER	Dryocopus pileatus	
BPAE3201	ABPAE32010	OLIVE-SIDED FLYCATCHER	Contopus cooperi	
BPAE3205	ABPAE32050	WESTERN WOOD-PEWEE	Contopus sordidulus	
BPAE3303	ABPAE33030	ALDER FLYCATCHER	Empidonax alnorum	special concern
BPAE3304	ABPAE33040	WILLOW FLYCATCHER	Empidonax traillii	
BPAE3307	ABPAE33070	LEAST FLYCATCHER	Empidonax minimus	
BPAE3308	ABPAE33080	HAMMOND'S FLYCATCHER	Empidonax hammondii	
BPAE3309	ABPAE33090	DUSKY FLYCATCHER	Empidonax oberholseri	
BPAE3316	ABPAE33160	CORDILLERAN FLYCATCHER	Empidonax occidentalis	
BPAE3503	ABPAE35030	SAY'S PHOEBE	Sayornis saya	
BPAE5203	ABPAE52030	CASSIN'S KINGBIRD	Tyrannus vociferans	special concern
BPAE5205	ABPAE52050	WESTERN KINGBIRD	Tyrannus verticalis	
BPAE5206	ABPAE52060	EASTERN KINGBIRD	Tyrannus tyrannus	
BPAT0201	ABPAT02010	HORNED LARK	Eremophila alpestris	
BPAU0301	ABPAU03010	TREE SWALLOW	Tachycineta bicolor	

BPAU0304	ABPAU03040	VIOLET-GREEN SWALLOW	Tachycineta thalassina	
BPAU0701	ABPAU07010	NORTHERN ROUGH-WINGED SWALLOW	Stelgidopteryx serripennis	
BPAU0801	ABPAU08010	BANK SWALLOW	Riparia riparia	
BPAU0901	ABPAU09010	CLIFF SWALLOW	Petrochelidon pyrrhonota	
BPAU0903	ABPAU09030	BARN SWALLOW	Hirundo rustica	
BPAV0101	ABPAV01010	GRAY JAY	Perisoreus canadensis	
BPAV0201	ABPAV02010	STELLER'S JAY	Cyanocitta stelleri	
BPAV0202	ABPAV02020	BLUE JAY	Cyanocitta cristata	
BPAV0701	ABPAV07010	PINYON JAY	Gymnorhinus cyanocephalus	
BPAV0801	ABPAV08010	CLARK'S NUTCRACKER	Nucifraga columbiana	
BPAV0901	ABPAV09010	BLACK-BILLED MAGPIE	Pica pica	
BPAV1001	ABPAV10010	AMERICAN CROW	Corvus brachyrhynchos	
BPAV1011	ABPAV10110	COMMON RAVEN	Corvus corax	
BPAW0101	ABPAW01010	BLACK-CAPPED CHICKADEE	Poecile atricapillus	
BPAW0104	ABPAW01040	MOUNTAIN CHICKADEE	Poecile gambeli	
BPAW0106	ABPAW01060	BOREAL CHICKADEE	Poecile hudsonicus	
BPAW0107	ABPAW01070	CHESTNUT-BACKED CHICKADEE	Poecile rufescens	
BPAZ0101	ABPAZ01010	RED-BREASTED NUTHATCH	Sitta canadensis	
BPAZ0102	ABPAZ01020	WHITE-BREASTED NUTHATCH	Sitta carolinensis	
BPAZ0103	ABPAZ01030	PYGMY NUTHATCH	Sitta pygmaea	
BPBA0101	ABPBA01010	BROWN CREEPER	Certhia americana	
BPBG0301	ABPBG03010	ROCK WREN	Salpinctes obsoletus	
BPBG0401	ABPBG04010	CANYON WREN	Catherpes mexicanus	
BPBG0901	ABPBG09010	HOUSE WREN	Troglodytes aedon	
BPBG0905	ABPBG09050	WINTER WREN	Troglodytes troglodytes	
BPBG1002	ABPBG10020	MARSH WREN	Cistothorus palustris	
BPBH0101	ABPBH01010	AMERICAN DIPPER	Cinclus mexicanus	
BPBJ0501	ABPBJ05010	GOLDEN-CROWNED KINGLET	Regulus satrapa	
BPBJ0502	ABPBJ05020	RUBY-CROWNED KINGLET	Regulus calendula	
BPBJ0801	ABPBJ08010	BLUE-GRAY GNATCATCHER	Polioptila caerulea	special concern
BPBJ1501	ABPBJ15010	EASTERN BLUEBIRD	Sialia sialis	
BPBJ1502	ABPBJ15020	WESTERN BLUEBIRD	Sialia mexicana	
BPBJ1503	ABPBJ15030	MOUNTAIN BLUEBIRD	Sialia currucoides	
BPBJ1601	ABPBJ16010	TOWNSEND'S SOLITAIRE	Myadestes townsendi	
BPBJ1808	ABPBJ18080	VEERY	Catharus fuscescens	
BPBJ1809	ABPBJ18090	GRAY-CHEEKED THRUSH	Catharus minimus	
BPBJ1810	ABPBJ18100	SWAINSON'S THRUSH	Catharus ustulatus	
BPBJ1811	ABPBJ18110	HERMIT THRUSH	Catharus guttatus	
BPBJ2017	ABPBJ20170	AMERICAN ROBIN	Turdus migratorius	
BPBJ2201	ABPBJ22010	VARIED THRUSH	Ixoreus naevius	
BPBK0101	ABPBK01010	GRAY CATBIRD	Dumetella carolinensis	
BPBK0401	ABPBK04010	SAGE THRASHER	Oreoscoptes montanus	
BPBK0601	ABPBK06010	BROWN THRASHER	Toxostoma rufum	
BPBM0205	ABPBM02050	AMERICAN PIPIT	Anthus rubescens	
BPBM0206	ABPBM02060	SPRAGUE'S PIPIT	Anthus spragueii	
BPBN0101	ABPBN01010	BOHEMIAN WAXWING	Bombycilla garrulus	
BPBN0102	ABPBN01020	CEDAR WAXWING	Bombycilla cedrorum	
BPBR0102	ABPBR01020	NORTHERN SHRIKE	Lanius excubitor	
BPBR0103	ABPBR01030	LOGGERHEAD SHRIKE	Lanius ludovicianus	watch list
BPBT0101	ABPBT01010	EUROPEAN STARLING	Sturnus vulgaris	
BPBW0116	ABPBW01160	SOLITARY VIREO	Vireo solitarius	
BPBW0121	ABPBW01210	WARBLING VIREO	Vireo gilvus	
BPBW0124	ABPBW01240	RED-EYED VIREO	Vireo olivaceus	
BPBX0104	ABPBX01040	TENNESSEE WARBLER	Vermivora peregrina	watch list
BPBX0105	ABPBX01050	ORANGE-CROWNED WARBLER	Vermivora celata	
BPBX0106	ABPBX01060	NASHVILLE WARBLER	Vermivora ruficapilla	
BPBX0301	ABPBX03010	YELLOW WARBLER	Dendroica petechia	
BPBX0306	ABPBX03060	YELLOW-RUMPED WARBLER	Dendroica coronata	
BPBX0308	ABPBX03080	TOWNSEND'S WARBLER	Dendroica townsendi	
BPBX0323	ABPBX03230	BLACKPOLL WARBLER	Dendroica striata	
BPBX0501	ABPBX05010	BLACK-AND-WHITE WARBLER	Mniotilta varia	watch list

BPBX0601	ABPBX06010	AMERICAN REDSTART	Setophaga ruticilla	
BPBX1001	ABPBX10010	OVENBIRD	Seiurus aurocapillus	
BPBX1002	ABPBX10020	NORTHERN WATERTHRUSH	Seiurus noveboracensis	
BPBX1104	ABPBX11040	MACGILLIVRAY'S WARBLER	Oporornis tolmiei	
BPBX1201	ABPBX12010	COMMON YELLOWTHROAT	Geothlypis trichas	
BPBX1602	ABPBX16020	WILSON'S WARBLER	Wilsonia pusilla	
BPBX2401	ABPBX24010	YELLOW-BREASTED CHAT	Icteria virens	
BPBX4505	ABPBX45050	WESTERN TANAGER	Piranga ludoviciana	
BPBX6104	ABPBX61040	BLACK-HEADED GROSBEAK	Pheucticus melanocephalus	
BPBX6402	ABPBX64020	LAZULI BUNTING	Passerina amoena	
BPBX6403	ABPBX64030	INDIGO BUNTING	Passerina cyanea	
BPBX6501	ABPBX65010	DICKCISSEL	Spiza americana	special concern
BPBX7401	ABPBX74010	GREEN-TAILED TOWHEE	Pipilo chlorurus	
BPBX7408	ABPBX74080	SPOTTED TOWHEE	Pipilo maculatus	
BPBX9401	ABPBX94010	AMERICAN TREE SPARROW	Spizella arborea	
BPBX9402	ABPBX94020	CHIPPING SPARROW	Spizella passerina	
BPBX9403	ABPBX94030	CLAY-COLORED SPARROW	Spizella pallida	
BPBX9404	ABPBX94040	BREWER'S SPARROW	Spizella breweri	
BPBX9405	ABPBX94050	FIELD SPARROW	Spizella pusilla	
BPBX9501	ABPBX95010	VESPER SPARROW	Pooecetes gramineus	
BPBX9601	ABPBX96010	LARK SPARROW	Chondestes grammacus	
BPBX9801	ABPBX98010	LARK BUNTING	Calamospiza melanocorys	
BPBX9901	ABPBX99010	SAVANNAH SPARROW	Passerculus sandwichensis	
BPBXA001	ABPBXA0010	BAIRD'S SPARROW	Ammodramus bairdii	special concern
BPBXA002	ABPBXA0020	GRASSHOPPER SPARROW	Ammodramus savannarum	
BPBXA004	ABPBXA0040	LE CONTE'S SPARROW	Ammodramus leconteii	special concern
BPBXA007	ABPBXA0070	NELSON'S SHARP-TAILED SPARROW	Ammodramus nelsoni	special concern
BPBXA201	ABPBXA2010	FOX SPARROW	Passerella iliaca	
BPBXA301	ABPBXA3010	SONG SPARROW	Melospiza melodia	
BPBXA302	ABPBXA3020	LINCOLN'S SPARROW	Melospiza lincolnii	
BPBXA402	ABPBXA4020	WHITE-THROATED SPARROW	Zonotrichia albicollis	
BPBXA404	ABPBXA4040	WHITE-CROWNED SPARROW	Zonotrichia leucophrys	
BPBXA405	ABPBXA4050	HARRIS'S SPARROW	Zonotrichia querula	
BPBXA502	ABPBXA5020	DARK-EYED JUNCO	Junco hyemalis	
BPBXA601	ABPBXA6010	MCCOWN'S LONGSPUR	Calcarius mccownii	
BPBXA602	ABPBXA6020	LAPLAND LONGSPUR	Calcarius lapponicus	
BPBXA604	ABPBXA6040	CHESTNUT-COLLARED LONGSPUR	Calcarius ornatus	
BPBXA801	ABPBXA8010	SNOW BUNTING	Plectrophenax nivalis	
BPBXA901	ABPBXA9010	BOBOLINK	Dolichonyx oryzivorus	
BPBXB001	ABPBXB0010	RED-WINGED BLACKBIRD	Agelaius phoeniceus	
BPBXB203	ABPBXB2030	WESTERN MEADOWLARK	Sturnella neglecta	
BPBXB301	ABPBXB3010	YELLOW-HEADED BLACKBIRD	Xanthocephalus xanthocephalus	
BPBXB501	ABPBXB5010	RUSTY BLACKBIRD	Euphagus carolinus	
BPBXB502	ABPBXB5020	BREWER'S BLACKBIRD	Euphagus cyanocephalus	
BPBXB607	ABPBXB6070	COMMON GRACKLE	Quiscalus quiscula	
BPBXB703	ABPBXB7030	BROWN-HEADED COWBIRD	Molothrus ater	
BPBXB907	ABPBXB9070	ORCHARD ORIOLE	Icterus spurius	
BPBXB922	ABPBXB9220	BULLOCK'S ORIOLE	Icterus bullockii	
BPBY0201	ABPBY02010	BLACK ROSY-FINCH	Leucosticte atrata	
BPBY0203	ABPBY02030	GRAY-CROWNED ROSY-FINCH	Leucosticte tephrocotis	
BPBY0301	ABPBY03010	PINE GROSBEAK	Pinicola enucleator	
BPBY0402	ABPBY04020	PURPLE FINCH	Carpodacus purpureus	
BPBY0403	ABPBY04030	CASSIN'S FINCH	Carpodacus cassinii	
BPBY0404	ABPBY04040	HOUSE FINCH	Carpodacus mexicanus	
BPBY0501	ABPBY05010	RED CROSSBILL	Loxia curvirostra	
BPBY0502	ABPBY05020	WHITE-WINGED CROSSBILL	Loxia leucoptera	
BPBY0601	ABPBY06010	COMMON REDPOLL	Carduelis flammea	
BPBY0602	ABPBY06020	HOARY REDPOLL	Carduelis hornemanni	
BPBY0603	ABPBY06030	PINE SISKIN	Carduelis pinus	
BPBY0611	ABPBY06110	AMERICAN GOLDFINCH	Carduelis tristis	
BPBY0902	ABPBY09020	EVENING GROSBEAK	Coccothraustes vespertinus	

BPBZ0101	ABPBZ01010	HOUSE SPARROW	Passer domesticus	
MABA0101	AMABA01010	MASKED SHREW	Sorex cinereus	
MABA0103	AMABA01030	PREBLE'S SHREW	Sorex preblei	
MABA0107	AMABA01070	VAGRANT SHREW	Sorex vagrans	
MABA0108	AMABA01080	DUSKY OR MONTANE SHREW	Sorex monticolus	
MABA0113	AMABA01130	DWARF SHREW	Sorex nanus	special concern
MABA0115	AMABA01150	WATER SHREW	Sorex palustris	
MABA0123	AMABA01230	MERRIAM'S SHREW	Sorex merriami	special concern
MABA0125	AMABA01250	PYGMY SHREW	Sorex hoyi	
MABA0128	AMABA01280	HAYDEN'S SHREW	Sorex haydeni	
MACC0101	AMACC01010	LITTLE BROWN MYOTIS	Myotis lucifugus	
MACC0102	AMACC01020	YUMA MYOTIS	Myotis yumanensis	watch list
MACC0107	AMACC01070	LONG-EARED MYOTIS	Myotis evotis	
MACC0109	AMACC01090	FRINGED MYOTIS	Myotis thysanodes	special concern
MACC0111	AMACC01110	LONG-LEGGED MYOTIS	Myotis volans	
MACC0112	AMACC01120	CALIFORNIA MYOTIS	Myotis californicus	
MACC0114	AMACC01140	WESTERN SMALL-FOOTED MYOTIS	Myotis ciliolabrum	
MACC0115	AMACC01150	NORTHERN MYOTIS	Myotis septentrionalis	special concern
MACC0201	AMACC02010	SILVER-HAIRED BAT	Lasionycteris noctivagans	
MACC0401	AMACC04010	BIG BROWN BAT	Eptesicus fuscus	
MACC0503	AMACC05030	HOARY BAT	Lasiurus cinereus	
MACC0701	AMACC07010	SPOTTED BAT	Euderma maculatum	special concern
MACC0801	AMACC08010	TOWNSEND'S BIG-EARED BAT	Corynorhinus townsendii	special concern
MACC1001	AMACC10010	PALLID BAT	Antrozous pallidus	
MAEA0102	AMAEA01020	AMERICAN PIKA	Ochotona princeps	
MAEB0104	AMAEB01040	EASTERN COTTONTAIL	Sylvilagus floridanus	watch list
MAEB0106	AMAEB01060	MOUNTAIN COTTONTAIL	Sylvilagus nuttallii	
MAEB0107	AMAEB01070	DESERT COTTONTAIL	Sylvilagus audubonii	
MAEB0301	AMAEB03010	SNOWSHOE HARE	Lepus americanus	
MAEB0304	AMAEB03040	WHITE-TAILED JACKRABBIT	Lepus townsendii	
MAEB0305	AMAEB03050	BLACK-TAILED JACKRABBIT	Lepus californicus	special concern
MAEB0401	AMAEB04010	PYGMY RABBIT	Brachylagus idahoensis	special concern
MAFB0202	AMAFB02020	LEAST CHIPMUNK	Tamias minimus	
MAFB0203	AMAFB02030	YELLOW-PINE CHIPMUNK	Tamias amoenus	
MAFB0213	AMAFB02130	RED-TAILED CHIPMUNK	Tamias ruficaudus	
MAFB0219	AMAFB02190	UINTA CHIPMUNK	Tamias umbrinus	special concern
MAFB0302	AMAFB03020	YELLOW-BELLIED MARMOT	Marmota flaviventris	
MAFB0304	AMAFB03040	HOARY MARMOT	Marmota caligata	
MAFB0504	AMAFB05040	RICHARDSON'S GROUND SQUIRREL	Spermophilus richardsonii	
MAFB0505	AMAFB05050	UINTA GROUND SQUIRREL	Spermophilus armatus	
MAFB0507	AMAFB05070	COLUMBIAN GROUND SQUIRREL	Spermophilus columbianus	
MAFB0509	AMAFB05090	THIRTEEN-LINED GROUND SQUIRREL	Spermophilus tridecemlineatus	
MAFB0517	AMAFB05170	GOLDEN-MANTLED GROUND SQUIRREL	Spermophilus lateralis	
MAFB0519	AMAFB05190	WYOMING GROUND SQUIRREL	Spermophilus elegans	
MAFB0601	AMAFB06010	BLACK-TAILED PRAIRIE DOG	Cynomys ludovicianus	special concern
MAFB0602	AMAFB06020	WHITE-TAILED PRAIRIE DOG	Cynomys leucurus	special concern
MAFB0801	AMAFB08010	RED SQUIRREL	Tamiasciurus hudsonicus	
MAFB0902	AMAFB09020	NORTHERN FLYING SQUIRREL	Glaucomys sabrinus	
MAFC0104	AMAFC01040	NORTHERN POCKET GOPHER	Thomomys talpoides	
MAFC0107	AMAFC01070	IDAHO POCKET GOPHER	Thomomys idahoensis	
MAFD0101	AMAFD01010	OLIVE-BACKED POCKET MOUSE	Perognathus fasciatus	
MAFD0107	AMAFD01070	GREAT BASIN POCKET MOUSE	Perognathus parvus	special concern
MAFD0301	AMAFD03010	ORD'S KANGAROO RAT	Dipodomys ordii	
MAFD0505	AMAFD05050	HISPID POCKET MOUSE	Chaetodipus hispidus	special concern
MAFE0101	AMAFE01010	AMERICAN BEAVER	Castor canadensis	
MAFF0203	AMAFF02030	WESTERN HARVEST MOUSE	Reithrodontomys megalotis	
MAFF0304	AMAFF03040	DEER MOUSE	Peromyscus maniculatus	
MAFF0307	AMAFF03070	WHITE-FOOTED MOUSE	Peromyscus leucopus	
MAFF0601	AMAFF06010	NORTHERN GRASSHOPPER MOUSE	Onychomys leucogaster	
MAFF0809	AMAFF08090	BUSHY-TAILED WOODRAT	Neotoma cinerea	
MAFF0902	AMAFF09020	SOUTHERN RED-BACKED VOLE	Clethrionomys gapperi	

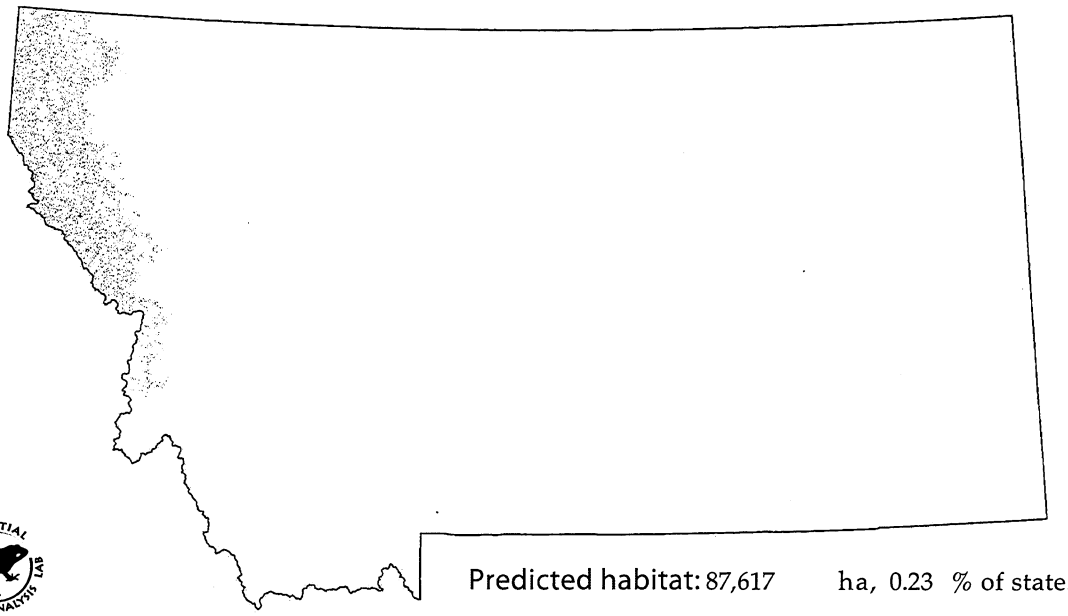
MAFF1001	AMAFF10010	HEATHER VOLE	Phenacomys intermedius	
MAFF1101	AMAFF11010	MEADOW VOLE	Microtus pennsylvanicus	
MAFF1102	AMAFF11020	MONTANE VOLE	Microtus montanus	
MAFF1106	AMAFF11060	LONG-TAILED VOLE	Microtus longicaudus	
MAFF1114	AMAFF11140	PRAIRIE VOLE	Microtus ochrogaster	
MAFF1119	AMAFF11190	WATER VOLE	Microtus richardsoni	
MAFF1301	AMAFF13010	SAGEBRUSH VOLE	Lemmiscus curtatus	
MAFF1501	AMAFF15010	MUSKRAT	Ondatra zibethicus	
MAFF1702	AMAFF17020	NORTHERN BOG LEMMING	Synaptomys borealis	special concern
MAFH0101	AMAFH01010	MEADOW JUMPING MOUSE	Zapus hudsonius	special concern
MAFH0102	AMAFH01020	WESTERN JUMPING MOUSE	Zapus princeps	
MAFJ0101	AMAFJ01010	COMMON PORCUPINE	Erethizon dorsatum	
MAJA0101	AMAJA01010	COYOTE	Canis latrans	
MAJA0103	AMAJA01030	GRAY WOLF	Canis lupus	special concern
MAJA0301	AMAJA03010	RED FOX	Vulpes vulpes	
MAJA0303	AMAJA03030	SWIFT FOX	Vulpes velox	special concern
MAJB0101	AMAJB01010	BLACK BEAR	Ursus americanus	
MAJB0102	AMAJB01020	GRIZZLY OR BROWN BEAR	Ursus arctos	special concern
MAJE0201	AMAJE02010	COMMON RACCOON	Procyon lotor	
MAJF0101	AMAJF01010	AMERICAN MARTEN	Martes americana	
MAJF0102	AMAJF01020	FISHER	Martes pennanti	special concern
MAJF0201	AMAJF02010	ERMINE	Mustela erminea	
MAJF0202	AMAJF02020	LEAST WEASEL	Mustela nivalis	
MAJF0203	AMAJF02030	LONG-TAILED WEASEL	Mustela frenata	
MAJF0204	AMAJF02040	BLACK-FOOTED FERRET	Mustela nigripes	special concern
MAJF0205	AMAJF02050	MINK	Mustela vison	
MAJF0301	AMAJF03010	WOLVERINE	Gulo gulo	special concern
MAJF0401	AMAJF04010	AMERICAN BADGER	Taxidea taxus	
MAJF0502	AMAJF05020	WESTERN SPOTTED SKUNK	Spilogale gracilis	watch list
MAJF0601	AMAJF06010	STRIPED SKUNK	Mephitis mephitis	
MAJF0801	AMAJF08010	NORTHERN RIVER OTTER	Lutra canadensis	
MAJH0102	AMAJH01020	MOUNTAIN LION	Felis concolor	
MAJH0301	AMAJH03010	LYNX	Lynx canadensis	special concern
MAJH0302	AMAJH03020	BOBCAT	Lynx rufus	
MALC0101	AMALC01010	WAPITI OR ELK	Cervus elaphus	
MALC0201	AMALC02010	MULE DEER	Odocoileus hemionus	
MALC0202	AMALC02020	WHITE-TAILED DEER	Odocoileus virginianus	
MALC0301	AMALC03010	MOOSE	Alces alces	
MALD0101	AMALD01010	PRONGHORN	Antilocapra americana	
MALE0101	AMALE01010	AMERICAN BISON	Bos bison	
MALE0201	AMALE02010	MOUNTAIN GOAT	Oreamnos americanus	
MALE0401	AMALE04010	MOUNTAIN SHEEP	Ovis canadensis	
RAAB0101	ARAAB01010	SNAPPING TURTLE	Chelydra serpentina	special concern
RAAD0101	ARAAD01010	PAINTED TURTLE	Chrysemys picta	
RAAG0103	ARAAG01030	SPINY SOFTSHELL	Apalone spinifera	special concern
RACB0101	ARACB01010	NORTHERN ALLIGATOR LIZARD	Elgaria coerulea	
RACF1203	ARACF12030	SHORT-HORNED LIZARD	Phrynosoma douglasii	watch list
RACF1403	ARACF14030	SAGEBRUSH LIZARD	Sceloporus graciosus	watch list
RACH0111	ARACH01110	WESTERN SKINK	Eumeces skiltonianus	watch list
RADA0101	ARADA01010	RUBBER BOA	Charina bottae	
RADB0701	ARADB07010	RACER	Coluber constrictor	
RADB1701	ARADB17010	WESTERN HOGNOSE SNAKE	Heterodon nasicus	special concern
RADB1905	ARADB19050	MILK SNAKE	Lampropeltis triangulum	special concern
RADB2601	ARADB26010	PINE OR GOPHER SNAKE	Pituophis melanoleucus	
RADB3605	ARADB36050	WESTERN TERRESTRIAL GARTER SNAKE	Thamnophis elegans	
RADB3610	ARADB36100	PLAINS GARTER SNAKE	Thamnophis radix	
RADB3613	ARADB36130	COMMON GARTER SNAKE	Thamnophis sirtalis	watch list
RADB4701	ARADB47010	SMOOTH GREEN SNAKE	Liochlorophis vernalis	special concern
RADE0212	ARADE02120	WESTERN RATTLESNAKE	Crotalus viridis	

Predicted Distributions for Species of Special Concern and Watch List Species and Potential Conflicts with Montana Highways

COEUR D'ALENE SALAMANDER

Plethodon idahoensis

State rank	S2	Element code	AAAAD12270
Global rank	G3	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by B. Maxell
MTNHP status	special concern		



Predicted habitat: 87,617 ha, 0.23 % of state.

State range

Rare and locally distributed in the Clark Fork, Kootenai and Bitterroot River drainages in northwestern Montana from Lake Koocanusa at the Canadian border south to the Bitterroot Valley. Range from 500 to 1,550 meters elevation (Wilson et al. 1997).

Habitat description

Coeur d'Alene salamanders respire through their skin and lose water to the environment through evaporation. They are therefore restricted to cool, damp environments (Groves et al. 1996). Primary habitats include springs or seeps, waterfall spray zones and damp streambanks in talus or fractured rock sites with conifer forest nearby (Wilson et al. 1997). However, habitats also include leaf litter, bark and rotting logs in damp conifer forests, north-facing talus slopes with abundant moist soil, and mesic forest types containing moist microhabitats (Groves et al. 1996). The species is found in conjunction with both persistent and intermittent surface waters, but depends on the presence of stable subterranean water flows (Groves et al. 1996). Adults are usually above ground only at night during moist weather; surface activity is negatively correlated with high daytime temperatures and days since last rain (Wilson and Larsen 1988). Adults breed terrestrially in late summer, fall and, to a lesser extent, in the spring. Females deposit eggs in April or May, presumably in underground rock crevices, although no nest sites have been found in Montana. Juveniles emerge directly from the eggs in mid-September (Lynch 1984).

Model assumptions & caveats

Model based on species' dependence on hydric stability of subterranean habitats immediately adjacent to springs, seeps, waterfalls and streamsides with canopy cover (Groves et al. 1996). An elevation limit of 1,650 meters was selected to eliminate areas 100 meters above the species known elevational limits (Wilson et al. 1997). Springs were not included in the model because an adequate GIS layer was not available. Buffers were not used because the species is not known to inhabit areas far from stable hydrographic features. Initial review of the model showed intermediate levels of accuracy in

predicting the species presence in areas where it is known to occur. The model is not likely to accurately represent the species' distribution because it cannot adequately identify specific microsites that support the species.

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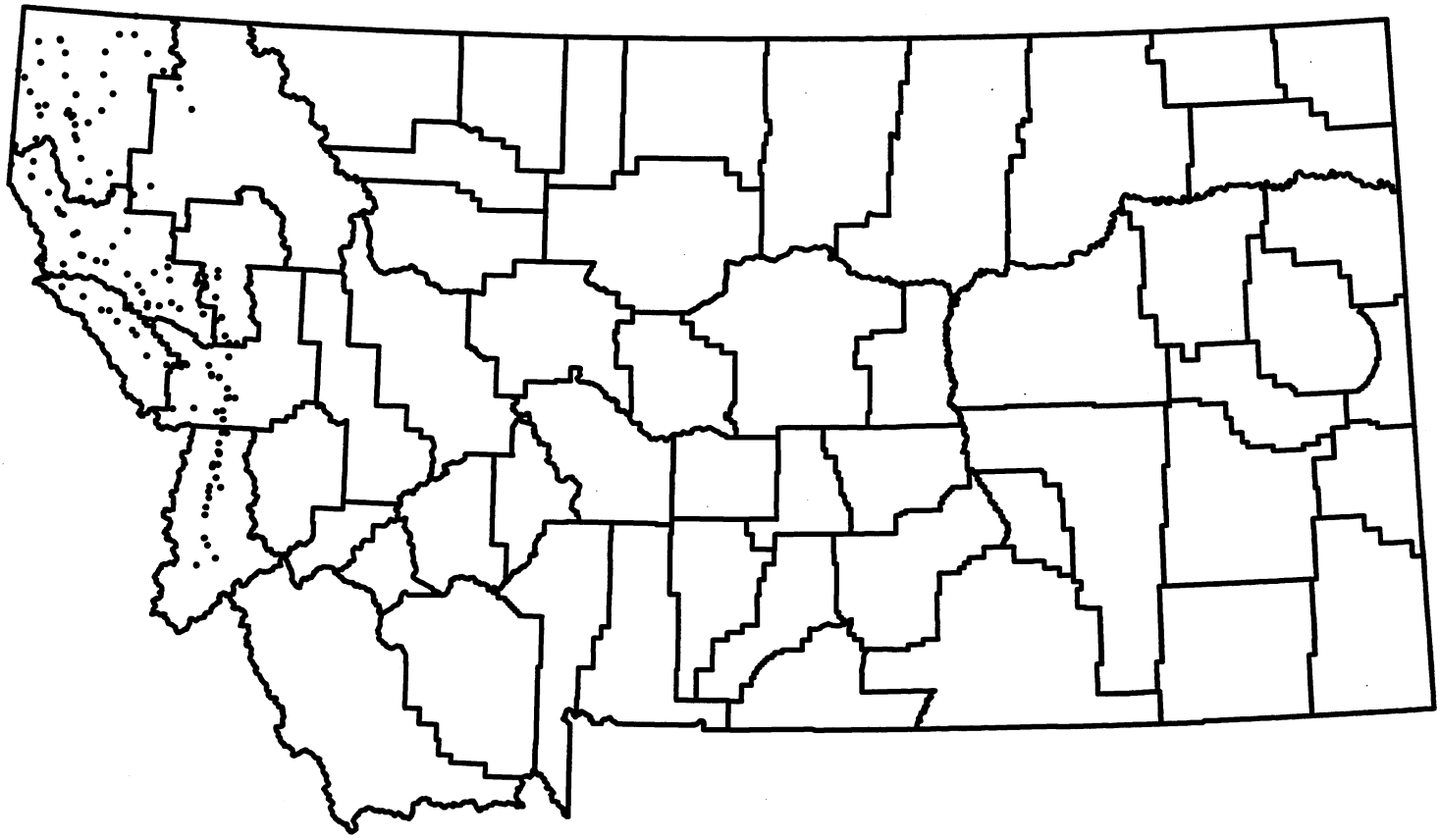
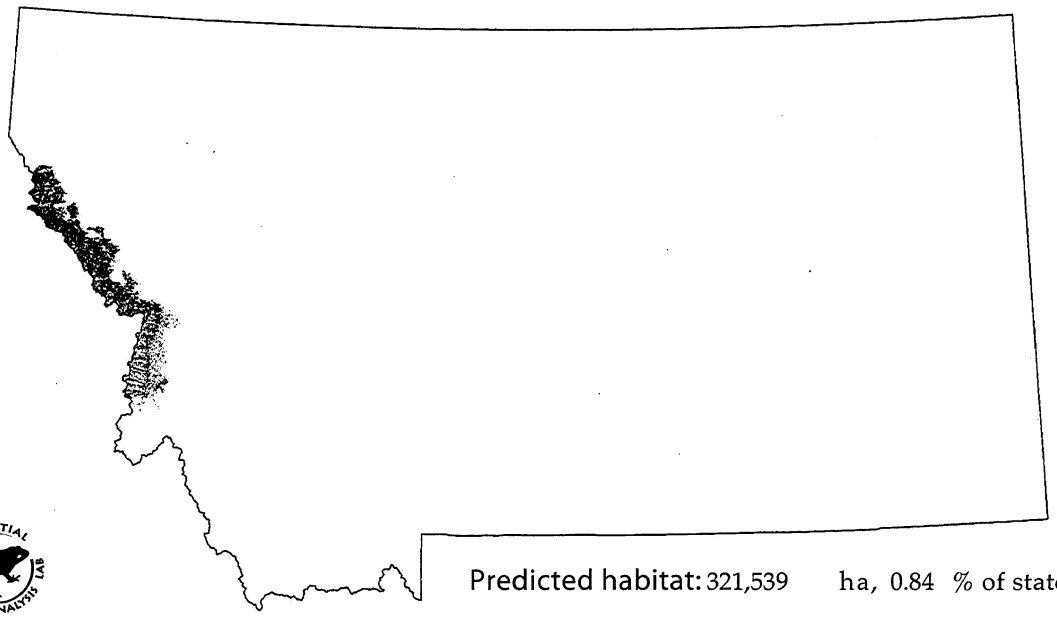


IDAHO GIANT SALAMANDER

Dicamptodon aterrimus

State rank	SR	Element code	AAAAH01030
Global rank	G3	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by B. Maxell
MTNHP status	special concern		



Predicted habitat: 321,539 ha, 0.84 % of state.

State range

Range unclear. Reported, but not confirmed, at only two locations near the town of Saltese in western Montana; however, found in Idaho adjacent to the state border from the Clark Fork River to the southern end of the Bitterroot Valley (Reichel and Flath 1995; Peterson and Fabian 1997). Ranges up to 2,165 meters elevation in Idaho (Nussbaum et al. 1983).

Habitat description

Although seldom seen, adults are found terrestrially in moist coniferous forests under rocks, bark and logs and aquatically under stones in mountain streams or lakes. Adults are active terrestrially on warm, rainy nights (Nussbaum et al. 1983). Adults breed in the spring or fall in hidden water-filled nest chambers beneath logs and stones or in crevices in mountain streams or lakes. Females subsequently deposit eggs in these chambers and guard the eggs throughout the incubation period (Nussbaum et al. 1983). Larvae are usually found in swift, cold mountain streams, but may occasionally be found in lakes or ponds. Larvae usually metamorphose in 18-24 months, but may become sexually mature (paedogenesis) and reproduce as larvae (Nussbaum et al. 1983).

Model assumptions & caveats

The species' range and status is unclear in the state. Model mostly developed for survey purposes; not to be included in final MT-GAP analyses.

Model based on species dependence on mountain streams, lakes and ponds for breeding and larval rearing and moist conifer forests for terrestrial adults. An elevation limit was not included because the species is known to occur at elevations exceeding those containing suitable habitat within its range in Montana (D. Pilliod, pers. comm.). Lacking observations, model accuracy could not be assessed. However, the model undoubtedly is an overestimate of the species' distribution.

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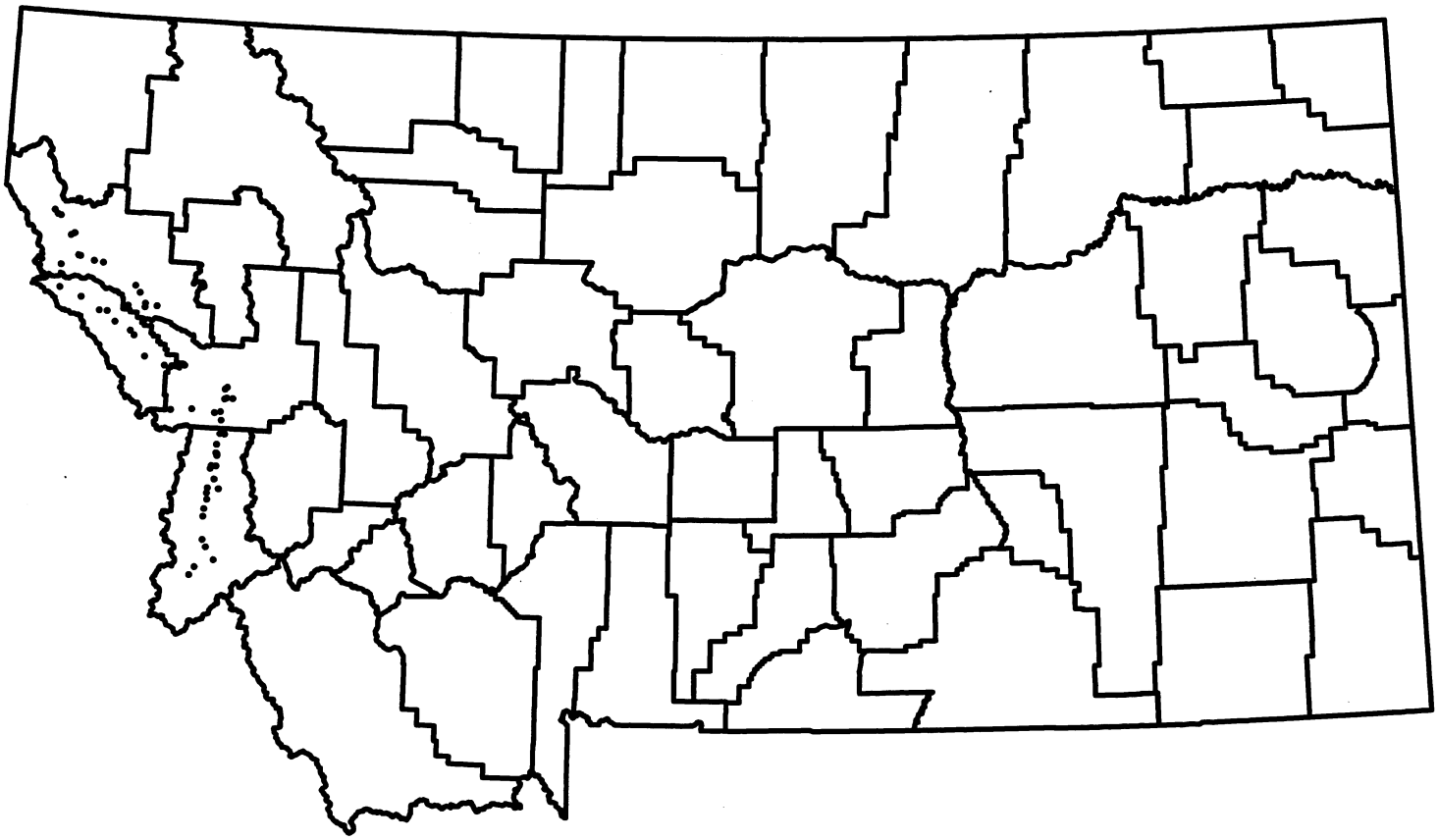
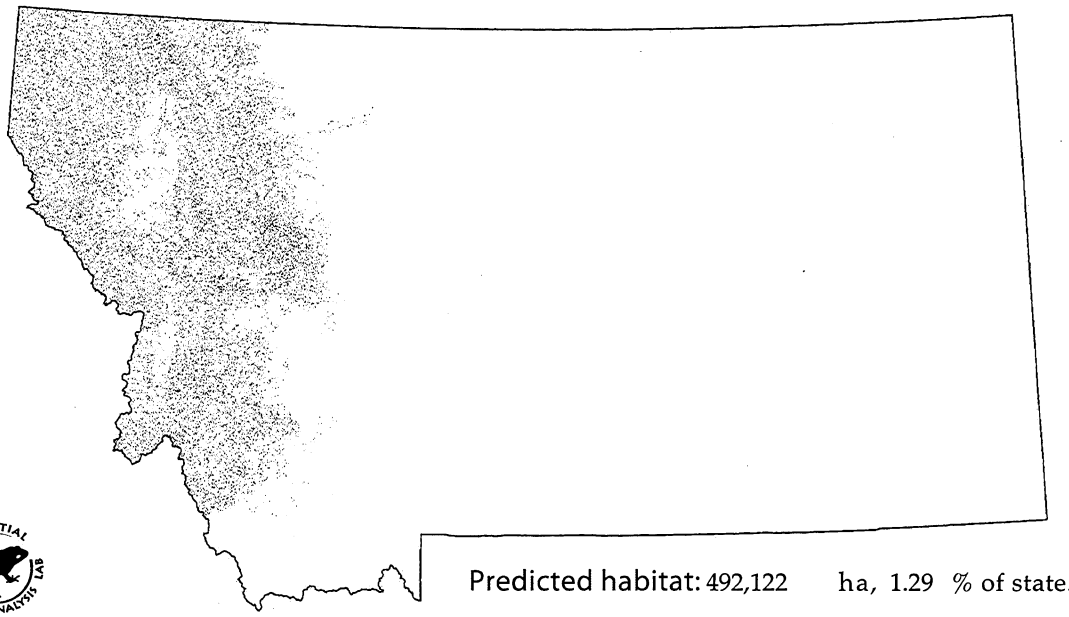


TAILED FROG

Ascaphus truei

State rank	S4	Element code	AAABA01010
Global rank	G4	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by B. Maxell
MTNHP status	watch list		



Predicted habitat: 492,122 ha, 1.29 % of state.

State range

Ranges west of the continental divide and in suitable habitats in the eastern front ranges immediately adjacent to the continental divide. Ranges to 2,590 meters elevation in Idaho (David Pilliod, pers. comm.).

Habitat description

Found in fast, small, permanent forest streams with clear, cold water, cobble or boulder substrates, and little silt (Franz 1971, Welsh 1990). In Montana, adults usually remain underwater hidden by rocks or debris and emerge at night or during humid weather from May to September to feed terrestrially along stream edges (Daugherty and Sheldon 1982a). Adults are highly philopatric, but are known to forage up to 25 or more meters away from water (Daugherty and Sheldon 1982b, Nussbaum et al. 1983). In Montana adults breed via internal fertilization in streams in August or September and females deposit eggs in long double strings under large stones in areas with slight current the following June or July (Franz 1970, Daugherty and Sheldon 1982a). Eggs hatch in August or September, and tadpoles cling to the undersides or tops of smooth rocks which lack periphyton or silt (Nussbaum et al. 1983). Tadpoles usually metamorphose in the third summer after hatching and adults reproduce for the first time four or five years after metamorphosis; females reproduce in alternate years thereafter (Daugherty and Sheldon 1982a).

Model assumptions & caveats

Model based on species' dependence on streams, riparian areas and moist conifer forests. Major rivers and lakes were removed because the species is not normally found in these habitats. An elevation limit was not included because the species is known to occur at elevations exceeding those containing suitable habitat within its range in Montana (D. Pilliod, pers. comm.). Buffers were not used because the species is not known to inhabit areas far from stable hydrographic features in Montana. Initial review of the model showed high levels of accuracy in predicting the species presence in areas where it is known to occur. The model is probably an accurate representation of the species' distribution, with

the exception of fragments of habitat propagated beyond the known range in southwestern Montana and on the East Front.

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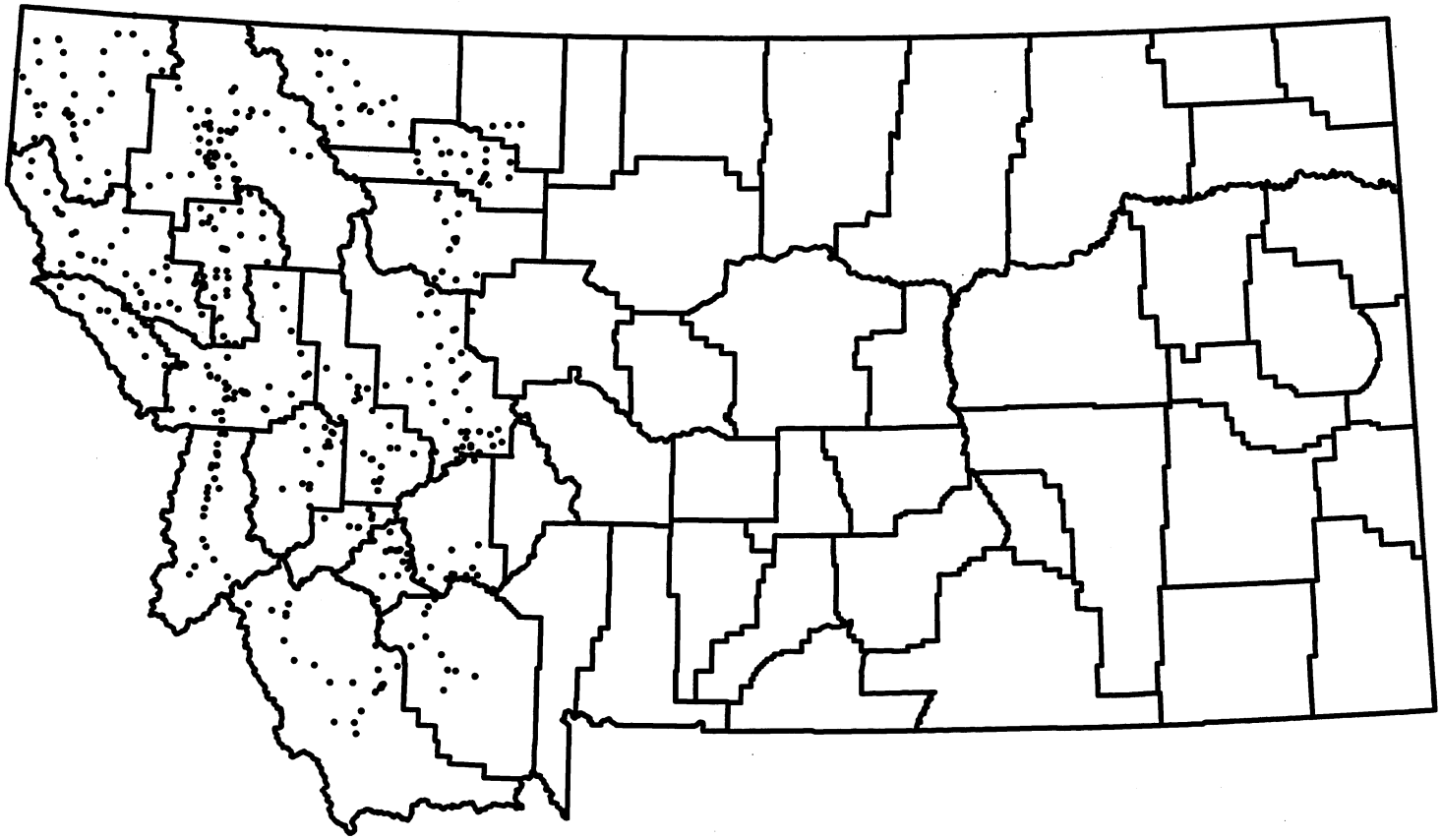
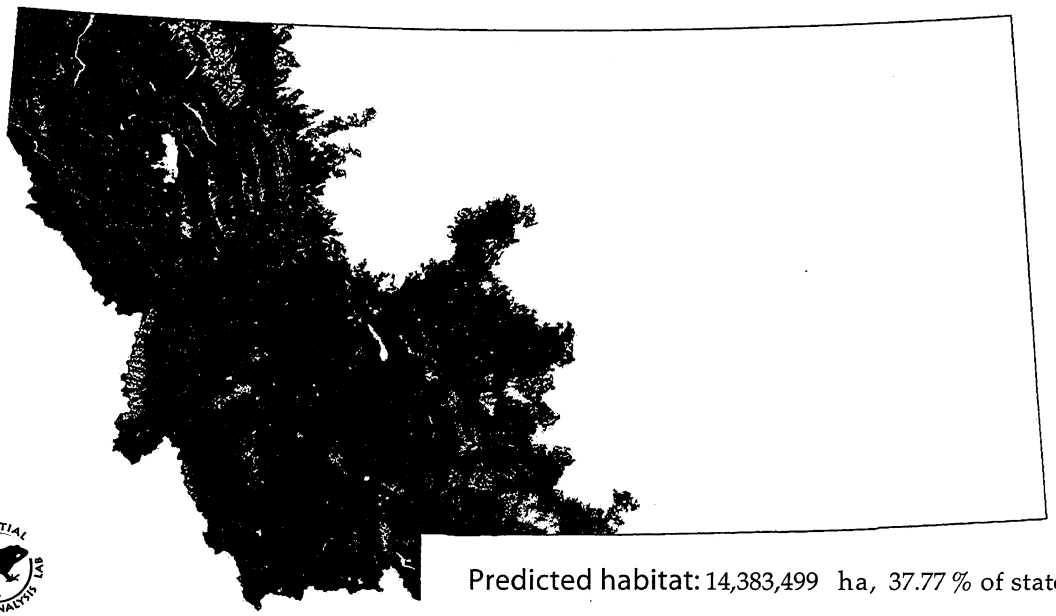


WESTERN TOAD

Bufo boreas

State rank	S3S4	Element code	AAABB01030
Global rank	G4	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by B. Maxell
MTNHP status	watch list		



Predicted habitat: 14,383,499 ha, 37.77 % of state.

State range

Ranges throughout the region west of the continental divide. Also present east of the continental divide in the eastern front ranges and in the mountainous areas of the southwest and central parts of the state. Known to range up to approximately 2,900 meters in Montana (Black 1970).

Habitat description

Found in a wide variety of habitats including mountain wetlands, forests, woodlands, sagebrush, meadows and deserts (Nussbaum et al. 1983); probably a coniferous forest species in Montana (S. Corn, pers. comm.). Adult toads hibernate and shelter in self-made burrows and rodent burrows or under logs and rocks. Adults may move more than two kilometers away from water after breeding, and can remain away from surface water for relatively long periods of time (Koch and Peterson 1995). Breeding and subsequent egg deposition is dependent on temperature and snowmelt, and takes place from May to July in shallow areas of large and small lakes, beaver ponds, temporary ponds, slow-moving streams, and backwater channels of rivers (Black 1970). In the Yellowstone area, water chemistry at most breeding sites generally has a high pH (>8.0), high conductivity, and high acid-neutralizing capacity (Koch and Peterson 1995). Tadpoles commonly form dense aggregations in shallow warmer waters and metamorphose in mass at various times during their first summer (Nussbaum et al. 1983, Koch and Peterson 1995).

Model assumptions & caveats

Original intent was to base model on a 2 km maximum migration distance from terrestrial burrows to breeding sites. Although a 2 km buffer on hydrography is biologically reasonable, when applied to the state, nearly all areas are within the buffer, except for 1:100,000 DLG tiles where hydrography was mapped less densely (thus highlighting limitations of the layer). Also, the buffer became quite blocky, rather than curving with the hydrographic features, because it could only be built in raster format. To reduce such buffering artifacts and to minimize processing time, the buffer was eliminated. An elevation limit of 3,450 meters was selected to eliminate areas 250 meters above those the species is

known to inhabit in Wyoming (Baxter and Stone 1985). Initial review of the model showed high levels of accuracy in predicting the species' presence in areas where it is known to occur. However, the model probably overestimates the species' distribution. Recent declines make modeling problematic. Propagation of predicted habitat onto the prairies east of the continental divide is also a problem, but may be informative in some instances.

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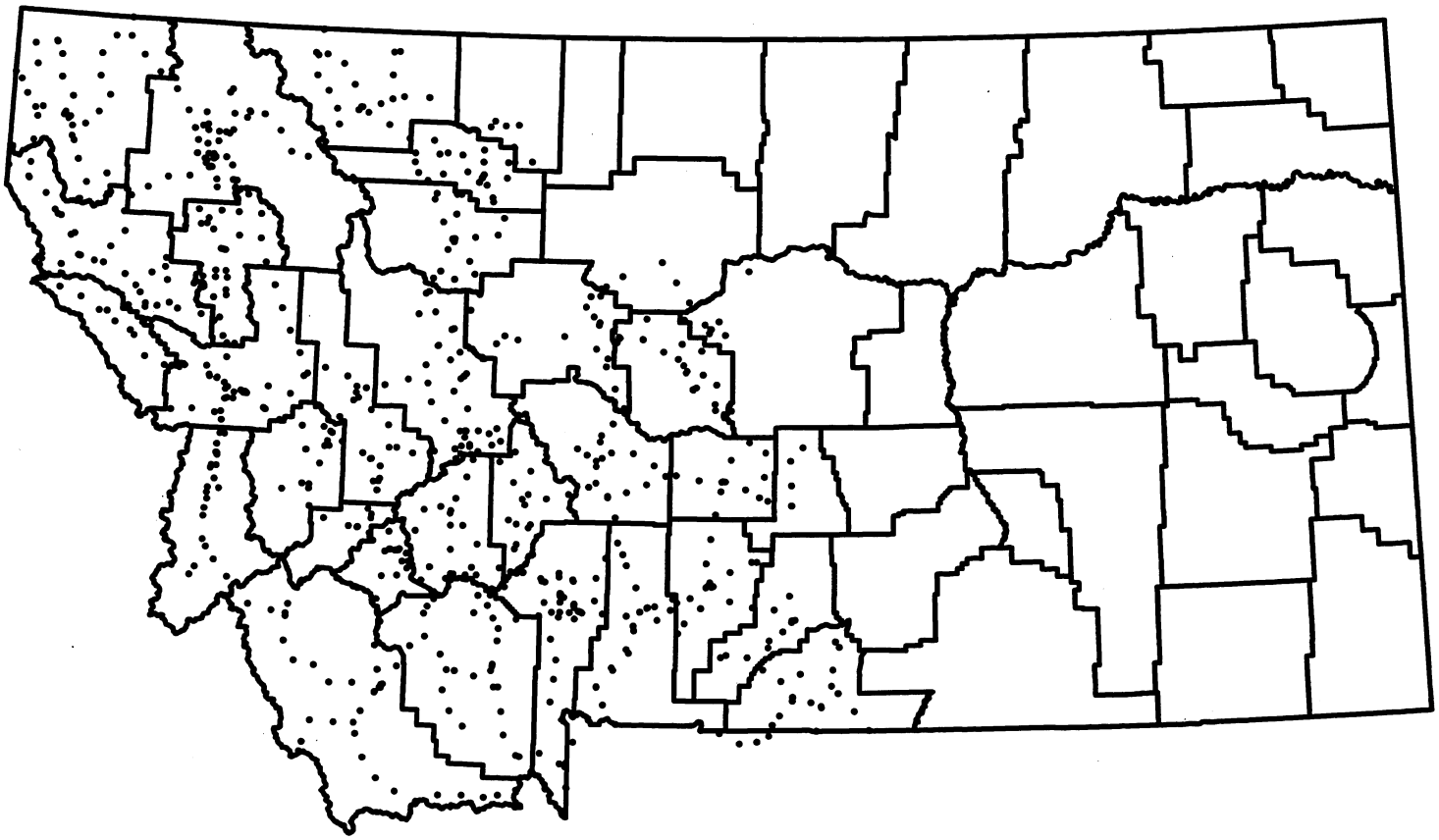
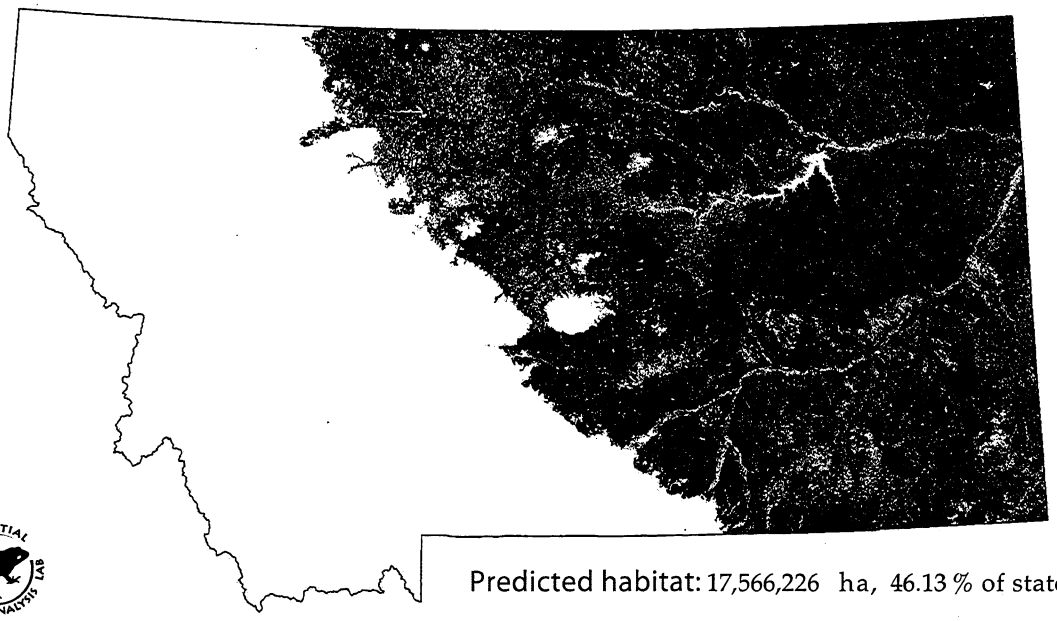


GREAT PLAINS TOAD

Bufo cognatus

State rank	S3S4	Element code	AAABB01050
Global rank	G5	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by B. Maxell
MTNHP status	watch list		



Predicted habitat: 17,566,226 ha, 46.13 % of state.

State range

Range unclear. Recorded from southeastern Alberta by Russell and Bauer (1993), north-central and southwest North Dakota by Wheeler and Wheeler (1966), and northeastern Wyoming by Baxter and Stone (1985). Range in Montana is likely to include much of the eastern plains. Known to range up to 1,220 meters in elevation in Montana (Black 1970).

Habitat description

Found in deserts, semidesert shrublands, grasslands, open floodplains and agricultural areas in stream valleys. In Montana they seem to prefer the higher elevations of short-grass prairies or undifferentiated grasslands, meadows within open stands of ponderosa pine, and areas near streams and irrigated lands (Black 1970, Bragg 1940). Adults hibernate and aestivate in self-excavated burrows during the long periods when terrestrial conditions aren't favorable (Wheeler and Wheeler 1966). Breeding takes place from May to July in clear, shallow temporary pools of flooded grasslands, ponds and reservoirs after suitable rains. Eggs are deposited in gelatinous strings on the pond bottom and are not attached to vegetation. Tadpoles metamorphose in about six weeks (Baxter and Stone 1985, Wheeler and Wheeler 1966).

Model assumptions & caveats

Original intent was to base model on a 2 km maximum migration distance from terrestrial burrows to breeding sites. Although a 2 km buffer on hydrography is biologically reasonable, when applied to the state, nearly all areas are within the buffer, except for 1:100,000 DLG tiles where hydrography was mapped less densely (thus highlighting limitations of the layer). Also, the buffer became quite blocky, rather than curving with the hydrographic features, because it could only be built in raster format. To reduce such buffering artifacts and to minimize processing time, the buffer was eliminated. An elevation limit of 1,500 meters was selected to eliminate areas 280 meters above that reported in Montana by Black (1970). The species' range and status is very unclear in the state. Not enough data points exist to assess model accuracy. However, the model probably overestimates the species'

distribution.

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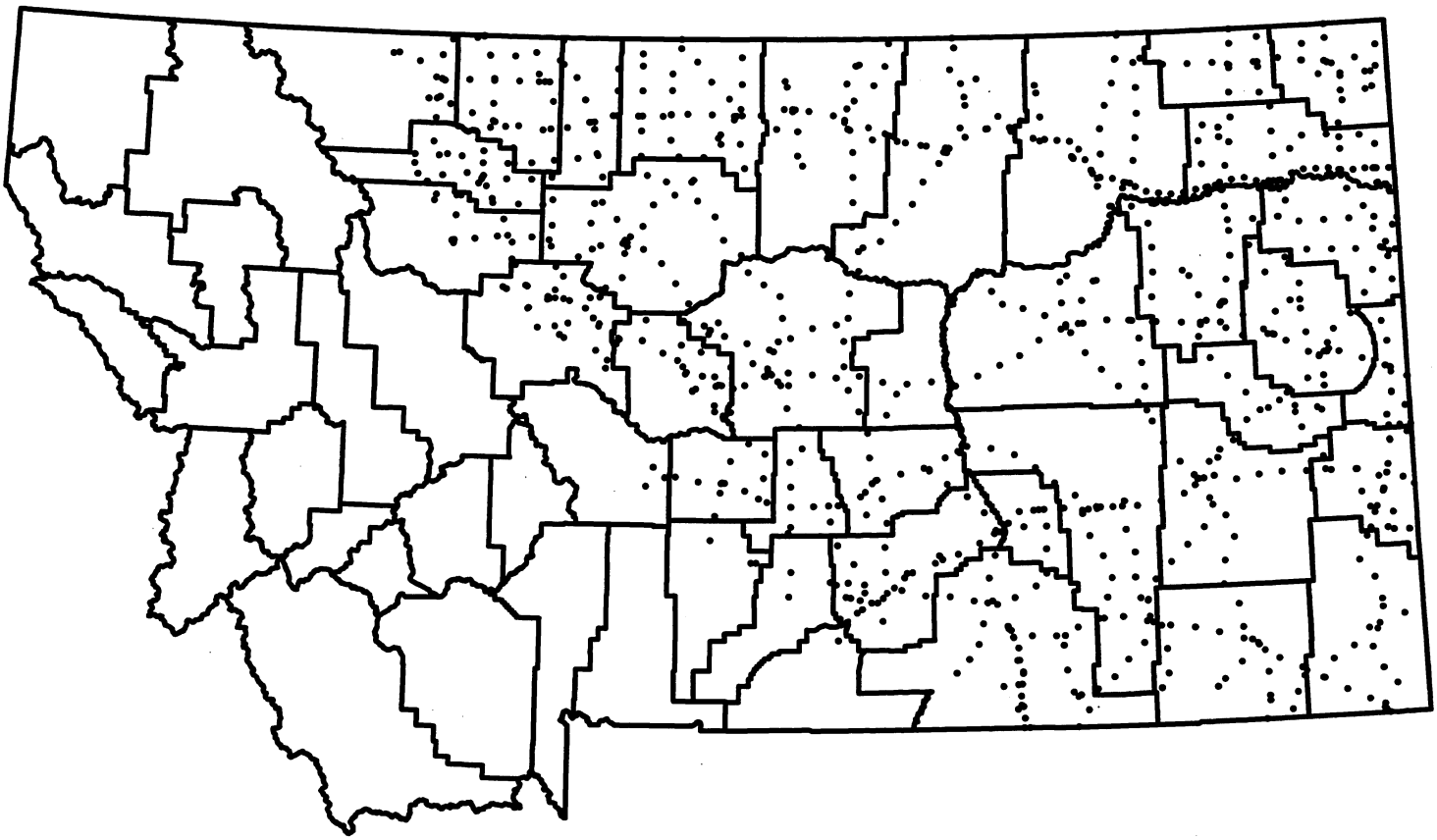
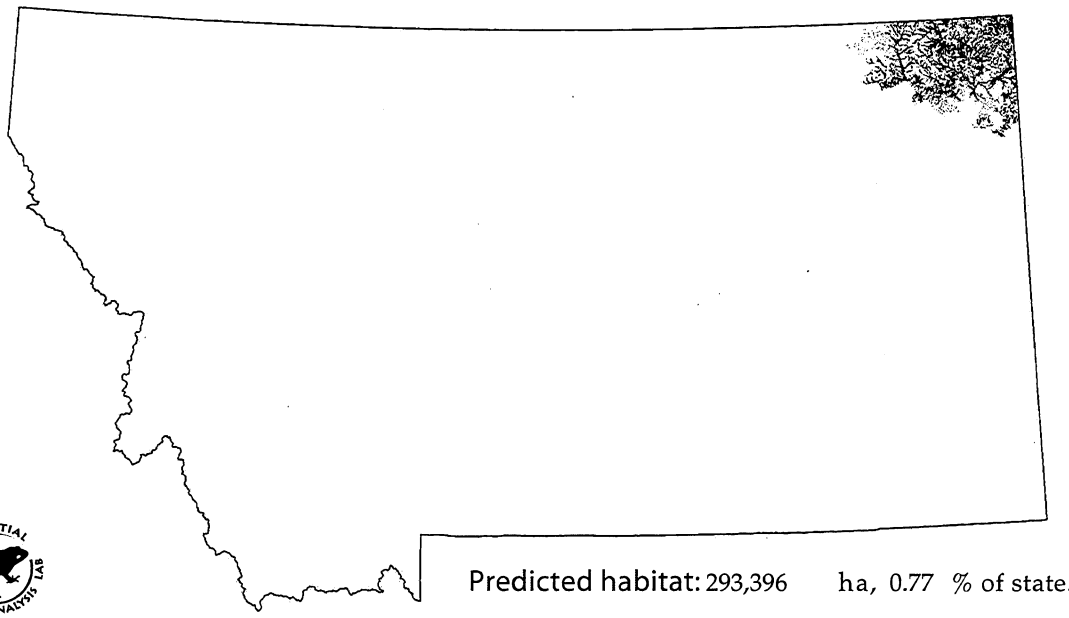


CANADIAN TOAD

Bufo hemiophrys

State rank	S1	Element code	AAABB01080
Global rank	G4	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by B. Maxell
MTNHP status	special concern		



Predicted habitat: 293,396 ha, 0.77 % of state.

State range

Range unclear. Recorded in eastern Alberta down to the Saskatchewan River by Russell and Bauer (1993) and in north-central North Dakota by Wheeler and Wheeler (1966). A subspecies of *Bufo hemiophrys*, the Wyoming toad, *Bufo hemiophrys baxteri*, exists as a small isolated population in the Laramie Basin of Wyoming (Baxter and Stone 1985). Range in Montana is likely to be limited to isolated remnant populations east of the Milk River and north of the Missouri River. Ranges up to 1,200 meters in Alberta (Russell and Bauer 1993).

Habitat description

Found in short-grass prairies, aspen parkland, boreal forest and floodplains (Baxter and Stone 1985, Russell and Bauer 1993). In Montana they seem to prefer ponds and marshes with relatively stable water levels surrounded by sedges and bulrushes in short-grass prairies and undifferentiated grasslands (Black 1970). Adults aestivate by burrowing into nearby friable soils and hibernate by burrowing into slight rises in the surrounding terrain (Tester and Breckenridge 1964). Breeding probably occurs with the first good rains from late April to early June and eggs are deposited in shallow waters of lakes, ponds, ditches, marshes, and temporary water bodies (Black 1970, Russell and Bauer 1993). Tadpoles usually transform by August (Baxter and Stone 1985).

Model assumptions & caveats

Model was based on a 500 m migration distance from terrestrial burrows to breeding sites (S. Corn, pers. comm.). An elevation limit was not included because the species is known to occupy habitats exceeding the elevations present within its range in Montana. The species' range and status is very unclear in the state. Not enough data points exist to assess model accuracy. However, the model probably overestimates the species' distribution.

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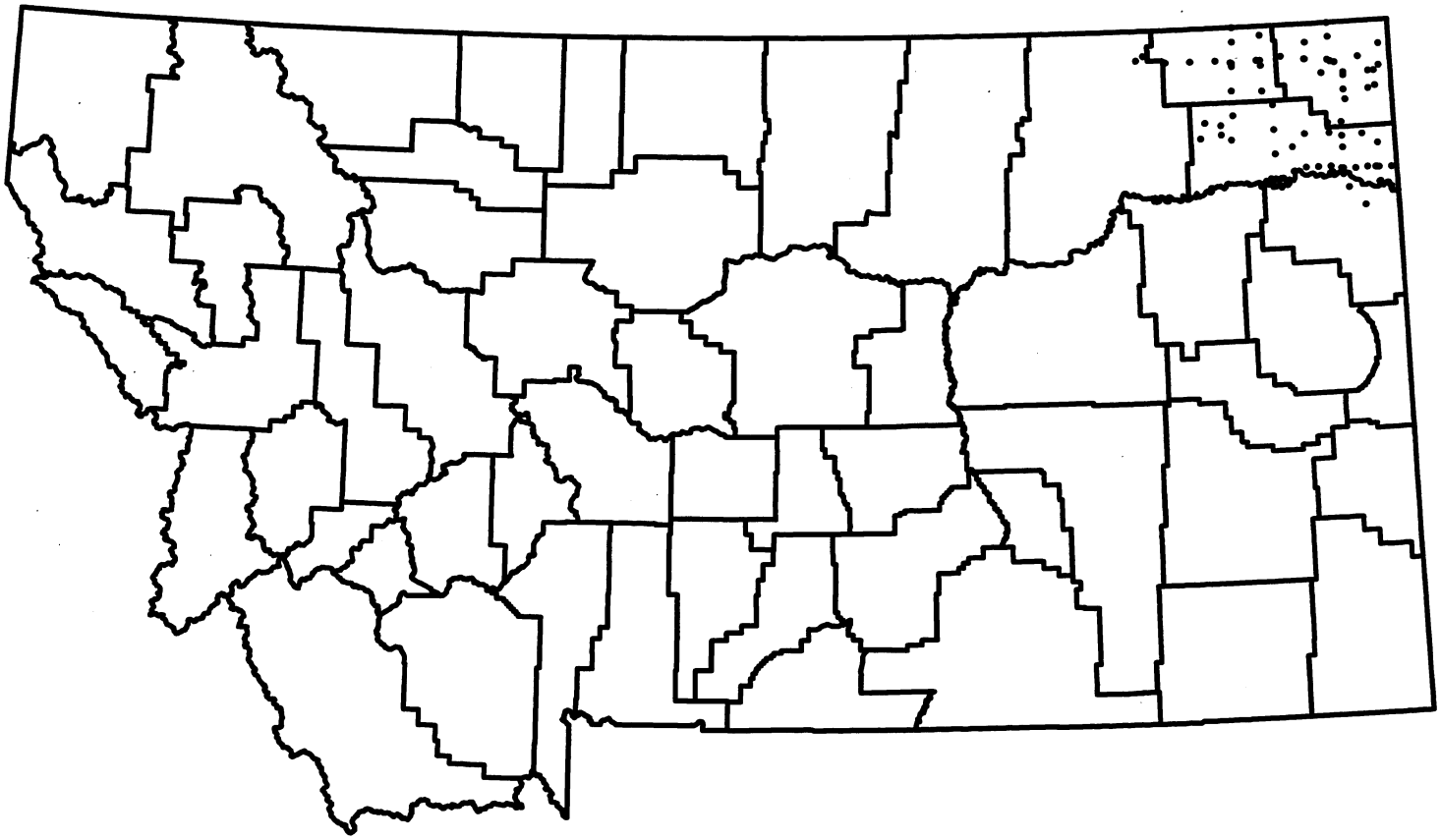
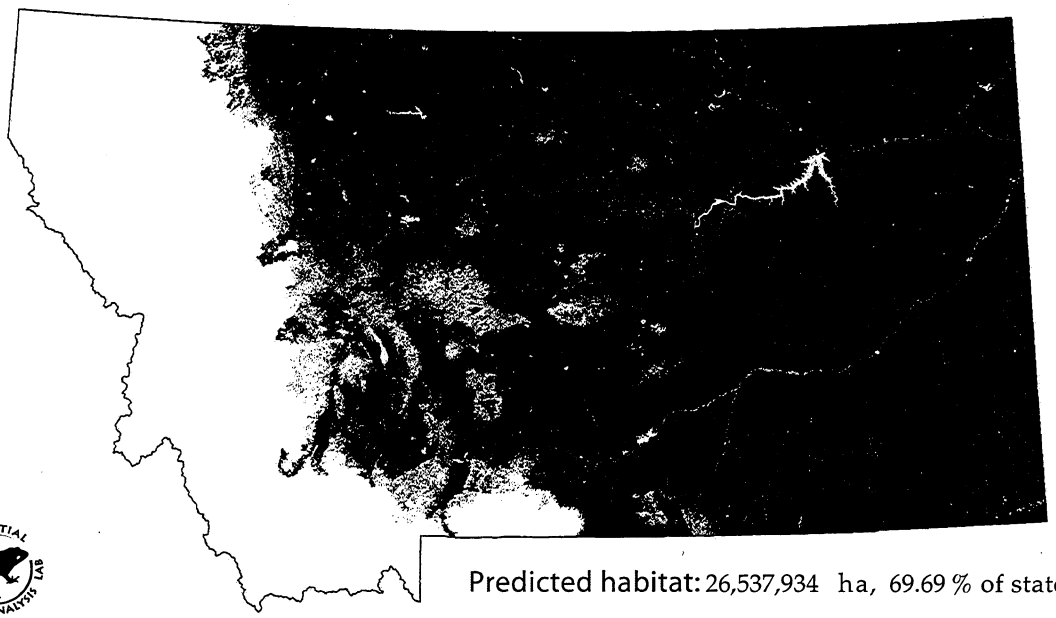


PLAINS SPADEFOOT

Spea bombifrons

State rank	S4?	Element code	AAABF02010
Global rank	G5	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by B. Maxell
MTNHP status	--		



Predicted habitat: 26,537,934 ha, 69.69 % of state.

State range

Spea bombifrons = *Scaphiopus bombifrons*. Range in Montana is likely to include most of the eastern plains wherever burrowing is possible. May also be present in isolated localities west of the continental divide where observations have been reported, but no specimens collected. Although only documented by a few specimens and observations throughout eastern Montana, the species' range is fairly certain in the state due to records in surrounding states and provinces. Recorded from southeastern Alberta by Russell and Bauer (1993), all along the North Dakota border by Wheeler and Wheeler (1966), and in northeastern Wyoming by Baxter and Stone (1985). Known to range up to 1,830 meters in elevation in Wyoming (Baxter and Stone 1985).

Habitat description

Found in arid grasslands and sagebrush with sandy or loose soils; usually near permanent or temporary water bodies (Baxter and Stone 1985, Russell and Bauer 1993). Adults hibernate and aestivate in burrows excavated to depths of three feet in damp loose soils during the long periods when terrestrial conditions aren't favorable. Adults are only present on the surface on warm nights when the surface is damp (Wheeler and Wheeler 1966). Breeding takes place in warm, often muddy, temporary water bodies formed by substantial spring or summer rains. Eggs are deposited on submerged vegetation and hatch in about 48 hours. Tadpoles are carnivorous and frequently become cannibalistic before metamorphoses approximately 40 days after hatching (Wheeler and Wheeler 1966, Russell and Bauer 1993).

Model assumptions & caveats

Model was intended to be based on the availability of sandy, loose soils for burrowing (i.e. the exclusion of clay soils). However, the resolution of the soils layer was too coarse and was, therefore, excluded from the model. Instead, model was based on suitable cover types and elevation. An elevation limit of 1,950 meters was selected to eliminate areas 120 meters above those the species is known to inhabit in Wyoming (Baxter and Stone 1985). Not enough data points exist to assess model

accuracy. However, the model probably greatly overestimates the species' distribution due to its inability to exclude improper soil types. Propagation of predicted habitat west of the continental divide is problematic in several instances.

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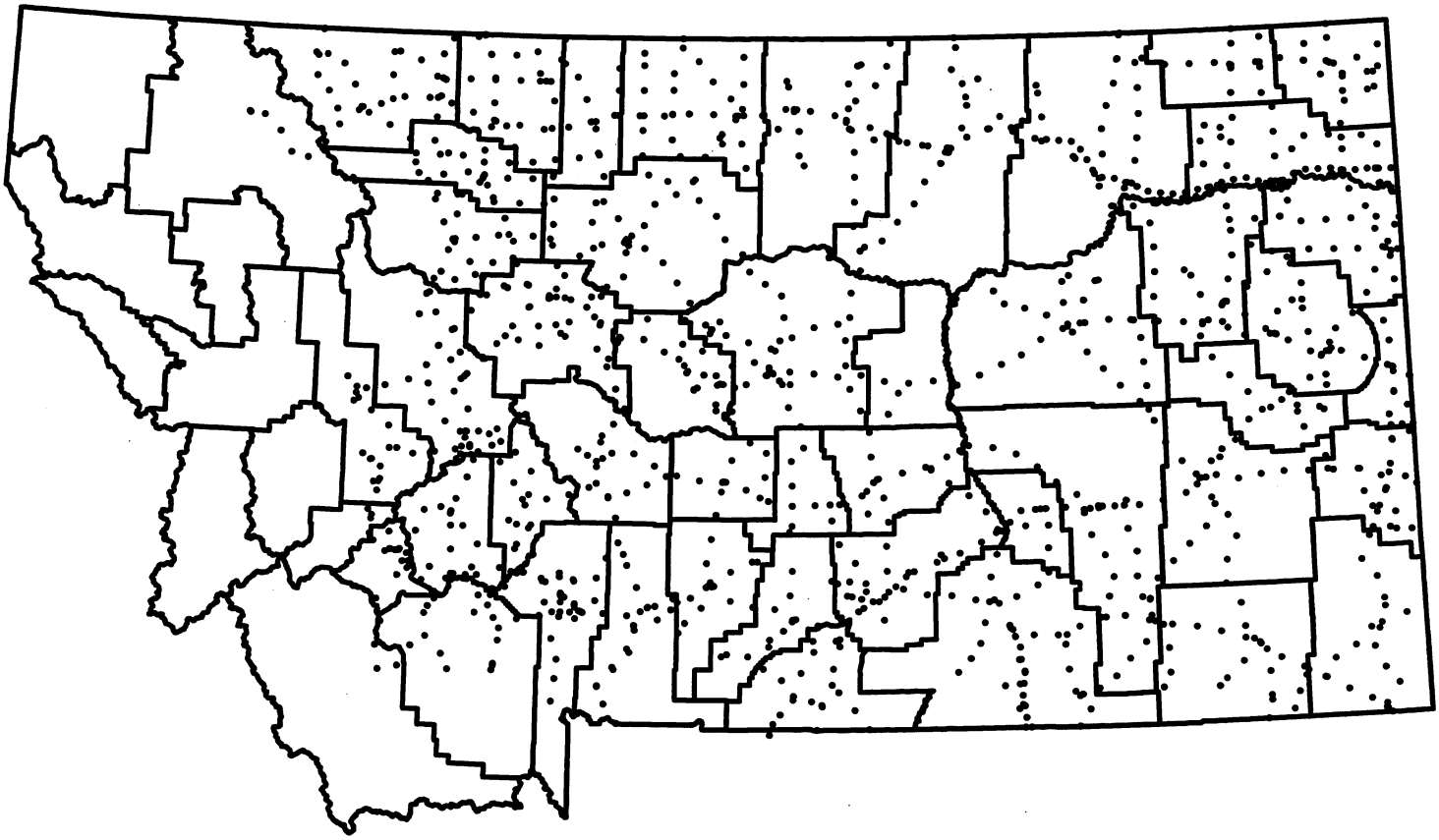
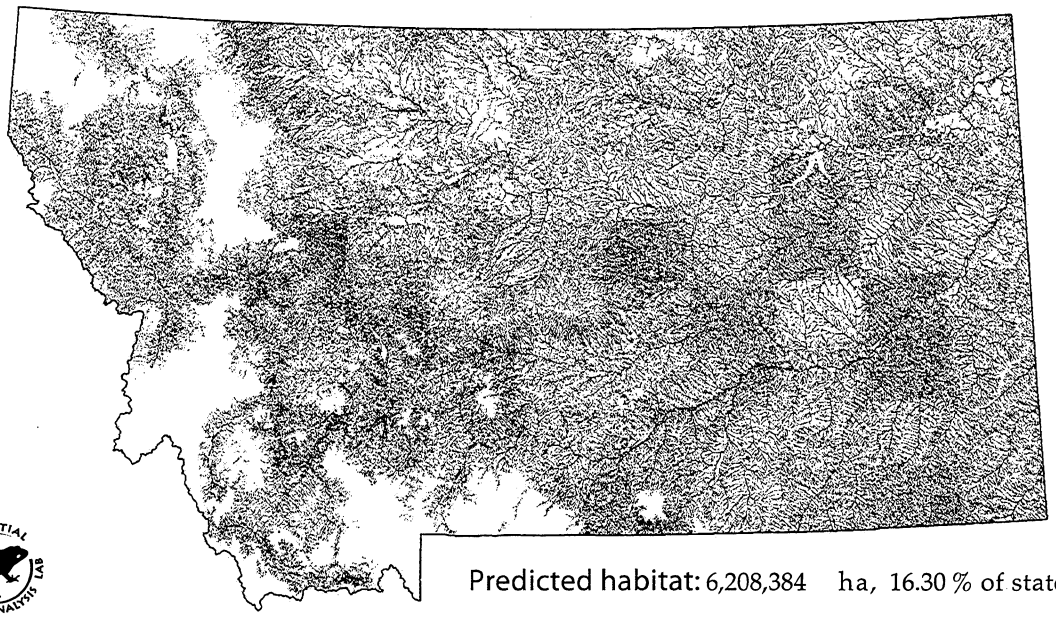


NORTHERN LEOPARD FROG

Rana pipiens

State rank	S3S4	Element code	AAABH01170
Global rank	G5	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by B. Maxell
MTNHP status	special concern		



Predicted habitat: 6,208,384 ha, 16.30 % of state.

State range

Occurred historically throughout Montana except for high mountain regions where species was mostly limited to lower valleys. Currently, nearly extirpated in western Montana, very localized in central Montana and abundant only in southeastern Montana (Reichel and Flath 1995). Ranges up to 2,743 meters in elevation in Wyoming (Baxter and Stone 1985).

Habitat description

Typically found in and adjacent to permanent slow-moving or standing water bodies with considerable vegetation. However, they may range widely into moist meadows, grassy woodlands and even agricultural areas (Nussbaum et al. 1983). In Montana adults are found primarily in riparian habitats or on the prairies near permanent waters without tall dense vegetation (Mosimann and Rabb 1952, Black 1969, Miller 1978). Adults hibernate underwater in permanent water bodies (Nussbaum et al. 1983). Breeding occurs from April to July, after individuals have migrated to preferred shallow water breeding sites from hibernation sites. Egg masses usually are deposited in March and April on vegetation or warm shallow pond bottoms exposed to sunlight (Corn and Livo 1989, Mosimann and Rabb 1952, Russell and Bauer 1993). Eggs hatch in 10-20 days and tadpoles metamorphose approximately two months later (Nussbaum et al. 1983).

Model assumptions & caveats

Model was based on the species' close dependence on permanent waters. An elevational limit of 2,250 meters was used to exclude high elevation areas (Chuck Peterson, pers. observ.). Initial review of the model showed high levels of accuracy in predicting the species presence in areas where it is currently known to occur. The species' distribution in western Montana is very much overestimated due to declines. Because the hydrography layer (assembled from USGS 1:100,000 digital line graphs) contains mapping inconsistencies among tiles, "squares" can be seen in the model output, especially in eastern Montana.

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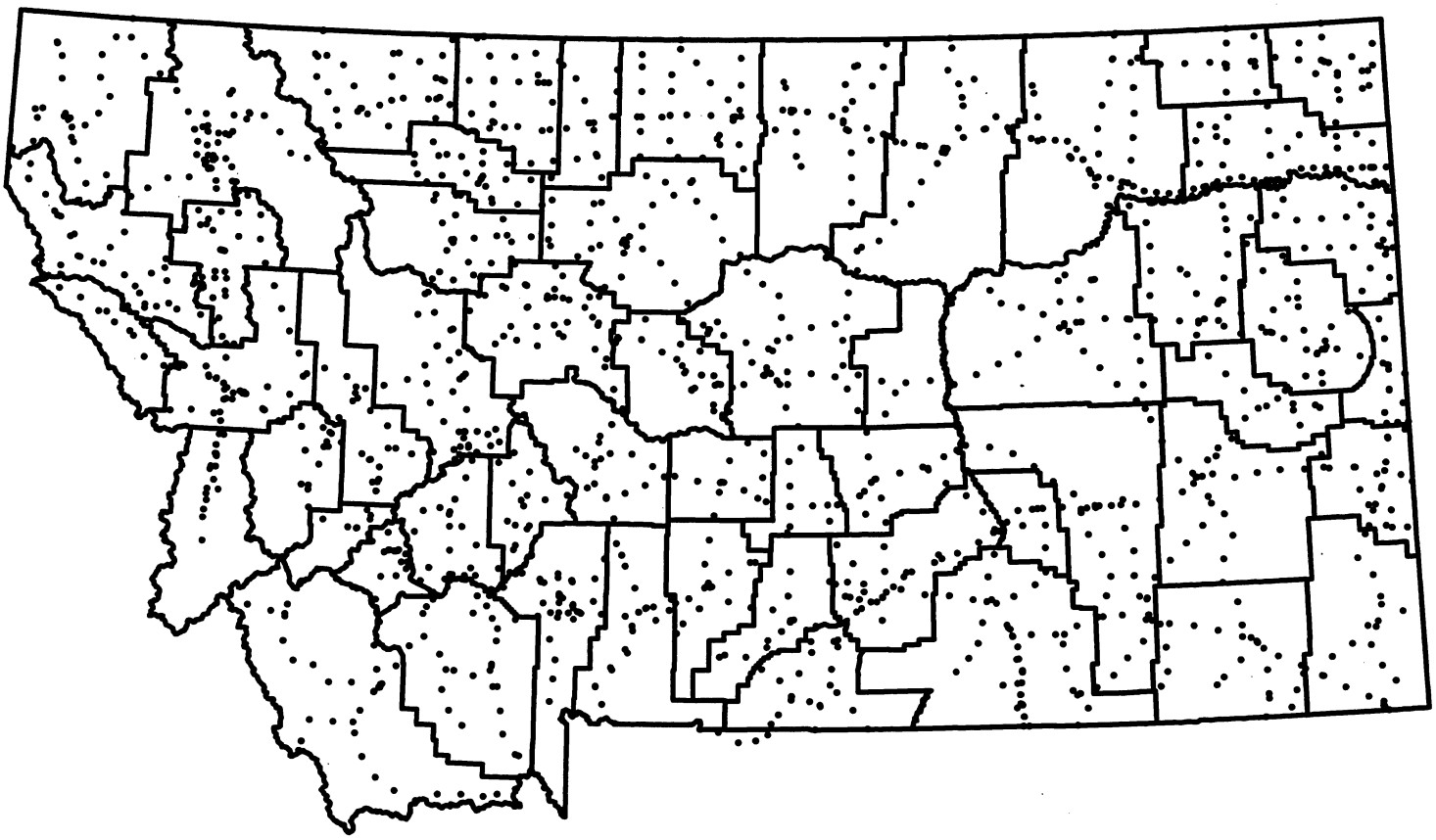
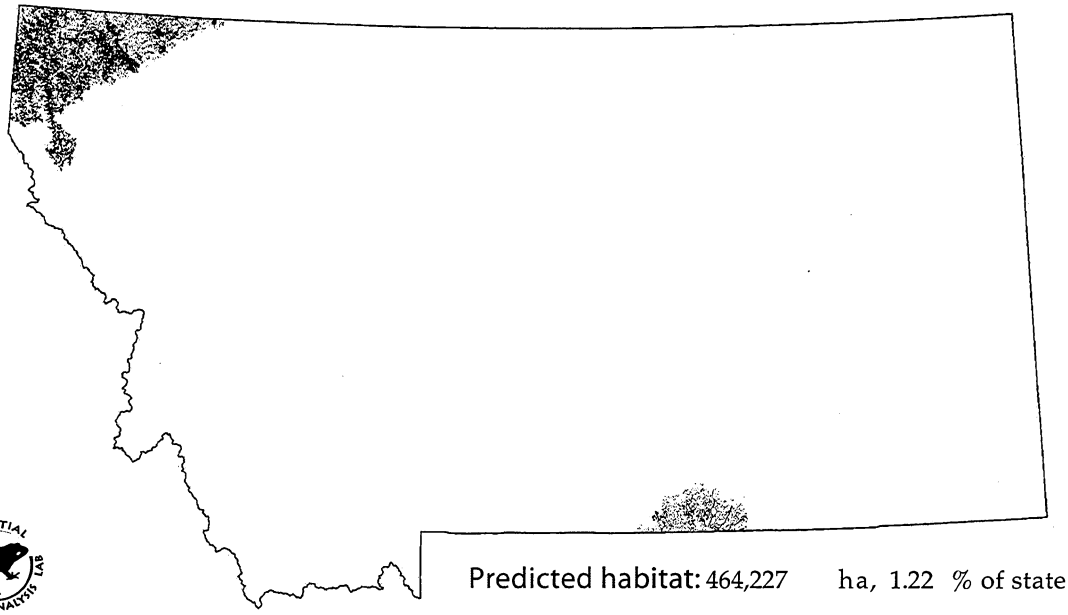


WOOD FROG

Rana sylvatica

State rank	SR	Element code	AAABH01200
Global rank	G5	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by B. Maxell
MTNHP status	special concern		



Predicted habitat: 464,227 ha, 1.22 % of state.

State range

No specimens recorded in Montana. However, the species has been reported in northern Idaho close to the Canadian and Montana border by Nussbaum et al. (1983), just north of Glacier National Park in Alberta by Russell and Bauer (1995), and in the Bighorn Mountains just south of the Montana border in Wyoming by Baxter and Stone (1985). The species may be present in the Bighorn Mountains in south-central part of the state, or in the northwest corner of the state. Ranges up to 8,200 meters elevation in Alberta (Russell and Bauer 1995).

Habitat description

Found along temporary ponds, lakes and stream shores, but adults also move into shaded portions of adjacent forests or brush where there is damp ground litter. Adults are largely terrestrial during the non-breeding season, but are usually not found far from water (Nussbaum et al. 1983). In Wyoming they were found only in shallow glacial kettle ponds without fish and most frogs were found in areas with extensive shallows and dense emergent sedges on the north side of the ponds (Garber 1992). Adults hibernate terrestrially in burrows, root channels and crevices. Adults may migrate up to 0.5 km to small pools, backwaters and beaver ponds which are used for breeding. Breeding takes place from March to June, and eggs are often deposited communally on emergent or submerged vegetation. Eggs hatch at different times depending on water temperatures and tadpoles metamorphose in about two months (Nussbaum et al. 1983).

Model assumptions & caveats

Modeled, but will not be included in final MT-GAP reporting. State rank SR -- reported, but lacking documentation that would provide a basis for accepting or rejecting observation.

Model based on species' dependence on hydrographic features and riparian areas. An elevation limit was not included because the species is known to occupy habitats exceeding the elevations present within its possible range in Montana. The model greatly overestimates the species' distribution.

Limiting the model to higher elevations (or to cover types at higher elevations), at least in south-central Montana, should be considered for the future.

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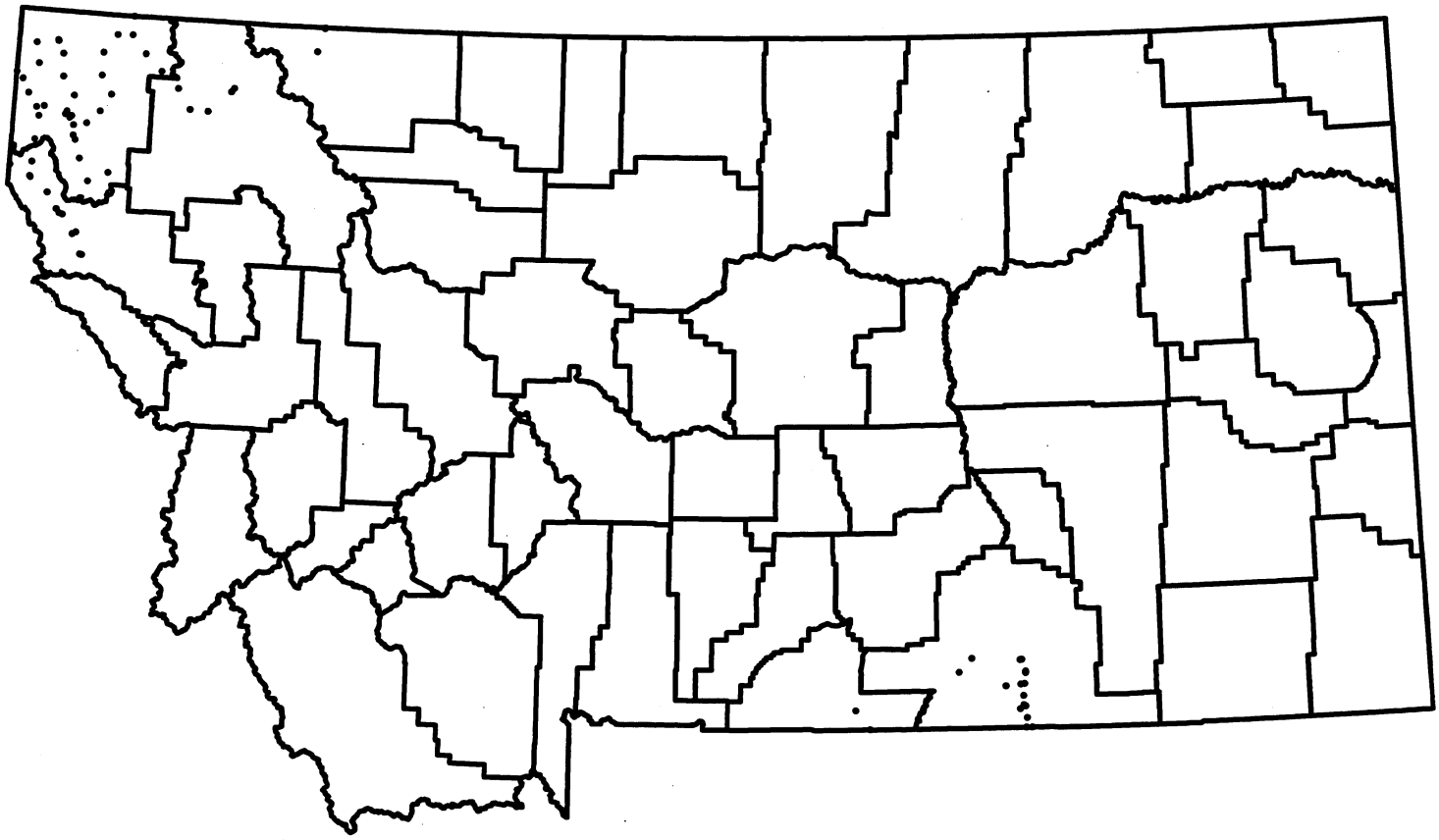
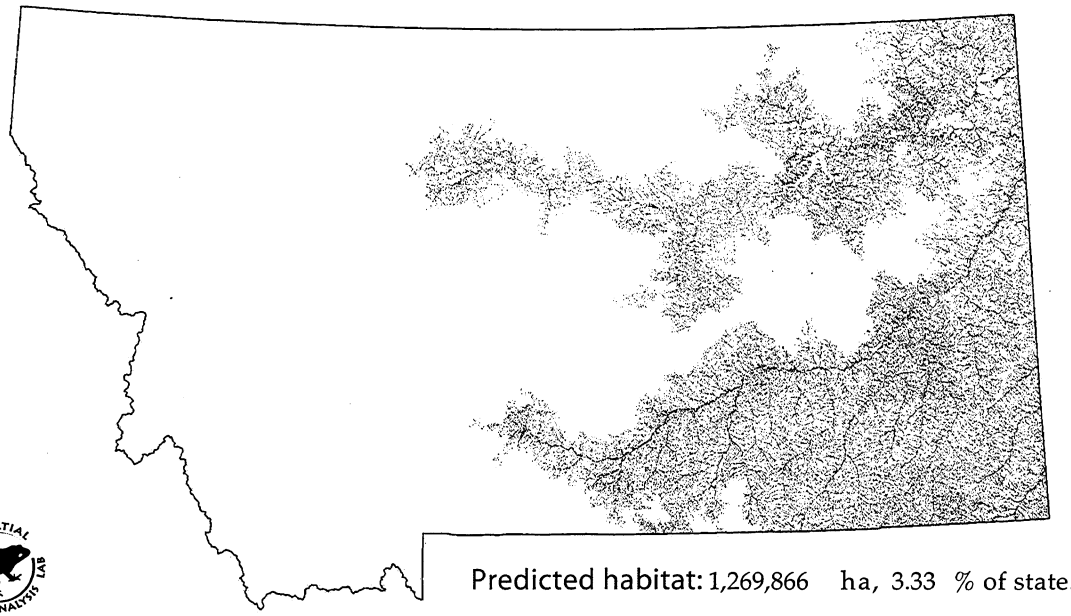


SNAPPING TURTLE

Chelydra serpentina

State rank	S3	Element code	ARAAB01010
Global rank	G5	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by P. Hendricks
MTNHP status	special concern		



Predicted habitat: 1,269,866 ha, 3.33 % of state.

State range

Throughout southeastern and far eastern Montana, although not common. Occurs in the Yellowstone River and major tributaries below Billings; probably in Missouri River and major tributaries below Fort Benton, although poorly documented in this drainage (Reichel and Flath 1995). Introduced locally west of the Continental Divide; status at these locations unknown.

Habitat description

Permanent freshwater bodies of nearly all kinds (ponds, lakes, streams, rivers), usually in shallow water; sometimes enters brackish coastal waterways and marshes. Typically in quiet or sluggish water with an abundance of aquatic plants and a soft mud or sand bottom or an abundance of submerged tree trunks and brush (Ernst et al. 1994). Hibernates in bottom mud or under submerged vegetation. Nests in soft soil, sometimes > 1.5 km from home range and overland > 0.5 km from water (Ernst et al. 1994).

In Montana: Almost any permanent and shallow fresh water with aquatic vegetation and muddy or sandy bottom and banks, although this is poorly documented. Nest habitat not described.

Model assumptions & caveats

Model based on hydrographic features and adjacent riparian habitats. An elevational limit was used to restrict predicted range around mountain ranges. Model may overestimate range by including lower order streams; would prefer to restrict model to ≥ 3rd order streams.

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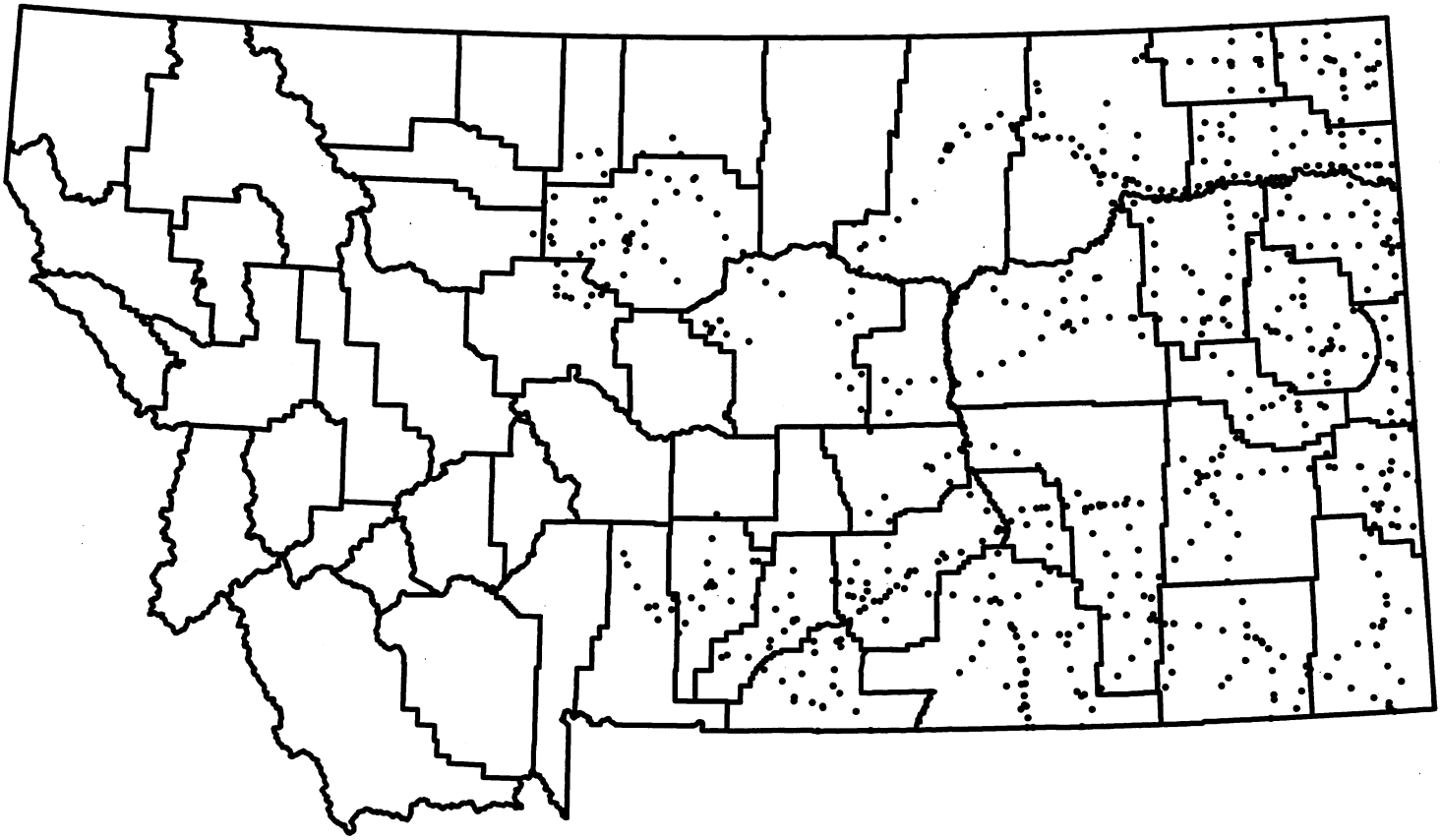
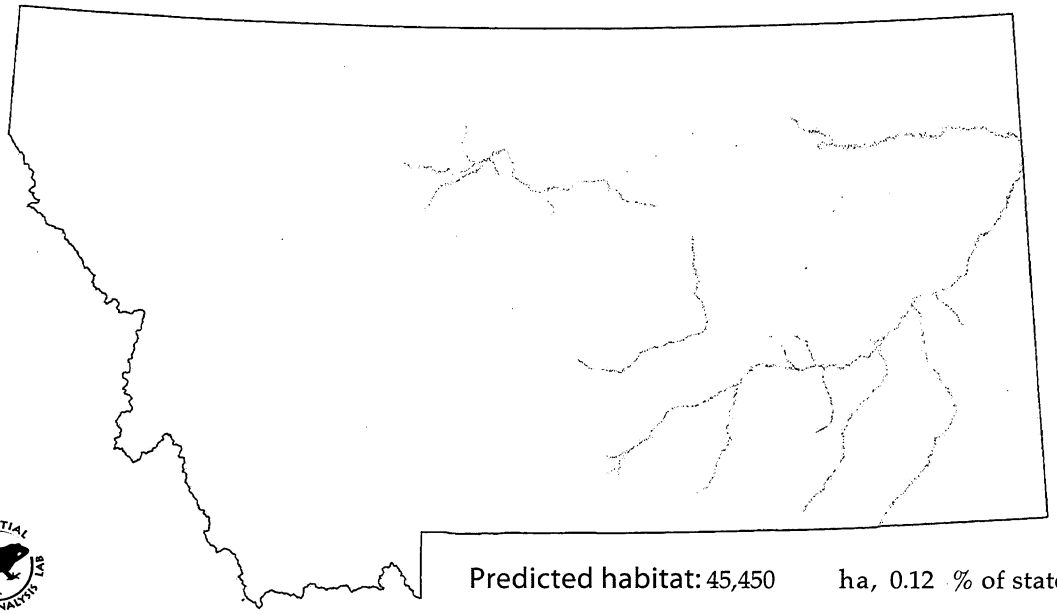


SPINY SOFTSHELL

Apalone spinifera

State rank	S3	Element code	ARAAG01030
Global rank	G5	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by P. Hendricks
MTNHP status	special concern		



Predicted habitat: 45,450 ha, 0.12 % of state.

State range

Apalone spinifera = *Trionyx spiniferus*. Eastern plains, mainly in the Missouri and Yellowstone rivers and their major tributaries (Reichel and Flath 1995); not yet documented below Fort Peck.

Habitat description

Primarily a riverine species of shallow well-oxygenated water, also inhabiting creeks, bayous, oxbows, lakes and reservoirs. Typically in water with a soft bottom and some aquatic vegetation; sandbars and mud flats often present, fallen trees with underwater limbs frequented (Ernst et al. 1994). Hibernates submerged in mud in the northern parts of its range. A highly aquatic turtle, with most nests located close to water in adjacent sand or gravel bars; rarely wanders as far as 100 m from water to nest (Ernst et al. 1994).

In Montana: Primarily in major rivers; in slower moving water with nearby mud flats and sandbars, sometimes in backwater sloughs (P. Hendricks, pers. observ.). Nest habitat not described.

Model assumptions & caveats

Model based on major rivers. An elevational limit was used to restrict predicted range around mountain ranges. Model may underestimate range slightly by excluding some lower stream orders.

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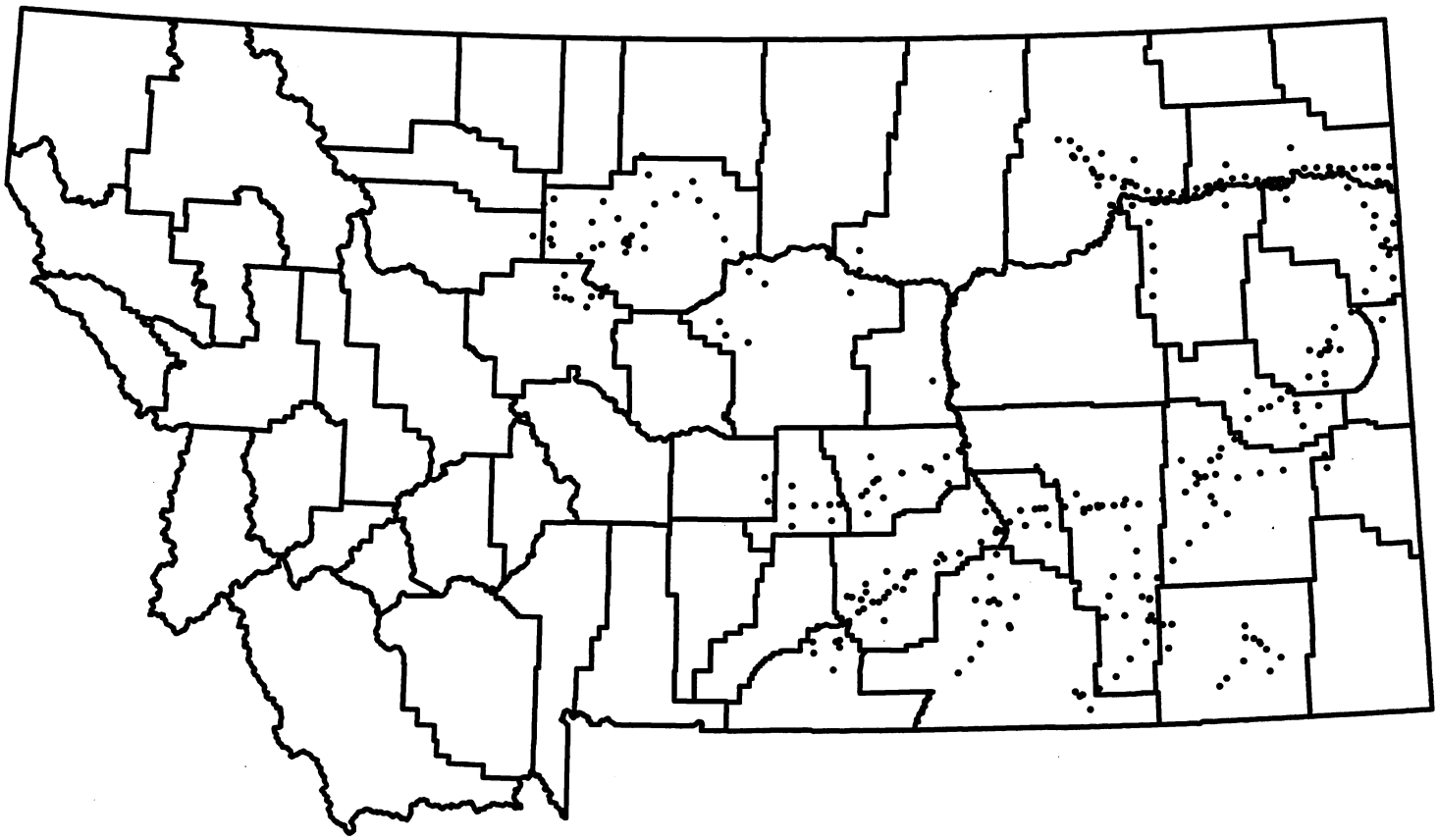
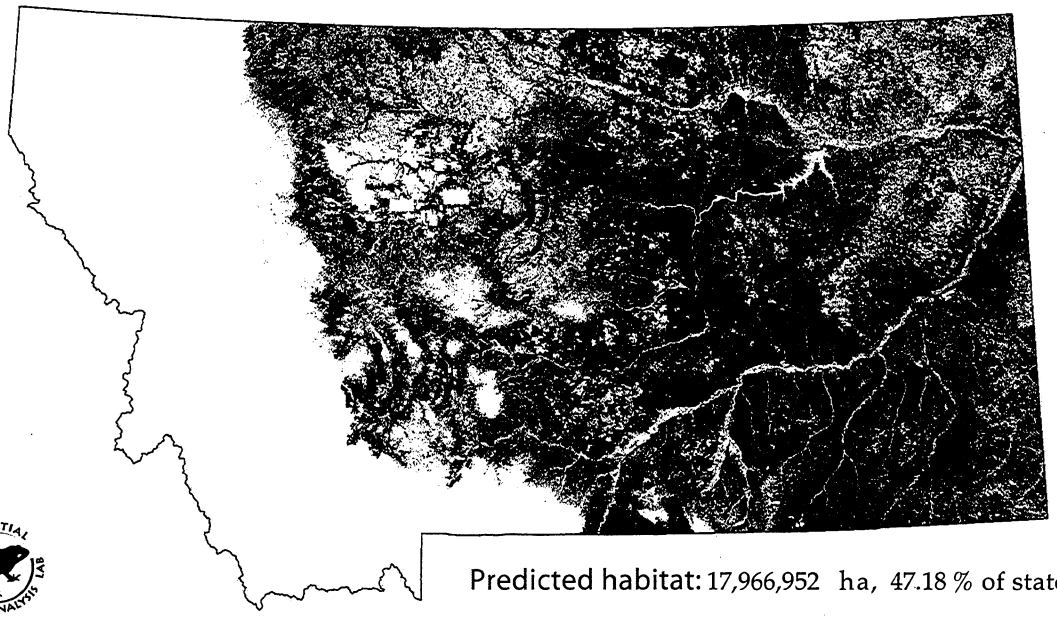


SHORT-HORNED LIZARD

Phrynosoma douglasii

State rank	S4	Element code	ARACF12030
Global rank	G5	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by P. Hendricks
MTNHP status	--		



Predicted habitat: 17,966,952 ha, 47.18 % of state.

State range

Phrynosoma douglasii = *Phrynosoma hernandezi*. Plains east of the Continental Divide (Reichel and Flath 1995); most common in the southeast quarter of the state. Zamudio and others (1997) split short-horned lizards into two species, *P. hernandezi* and *P. douglasii*. Only *P. hernandezi* has been documented in Montana.

Habitat description

Occurs in a variety of habitats, including sagebrush, prairie grassland, open juniper and pine forest; up to 3300 m elevation. Substrate can vary from hardpan to sandy to rocky, but patches of loose soil for burrowing always present (Hammerson 1982, Nussbaum et al 1983). Gives birth to live young.

In Montana: Occurs in habitats with loose soils, including grasslands, sagebrush, open forests of ponderosa pine, rocky mountain juniper, limber pine/Utah juniper, up to at least 1600 m elevation (Hendricks and Reichel 1996, P. Hendricks pers. observ.).

Model assumptions & caveats

Model based on cover types; unable to use soil layer. An elevational limit of 2100 m, consistent with range in Wyoming (Baxter and Stone 1985), was used to restrict predicted range upward into mountains. Model overestimates range because of inability to use loose, sandy soils in model.

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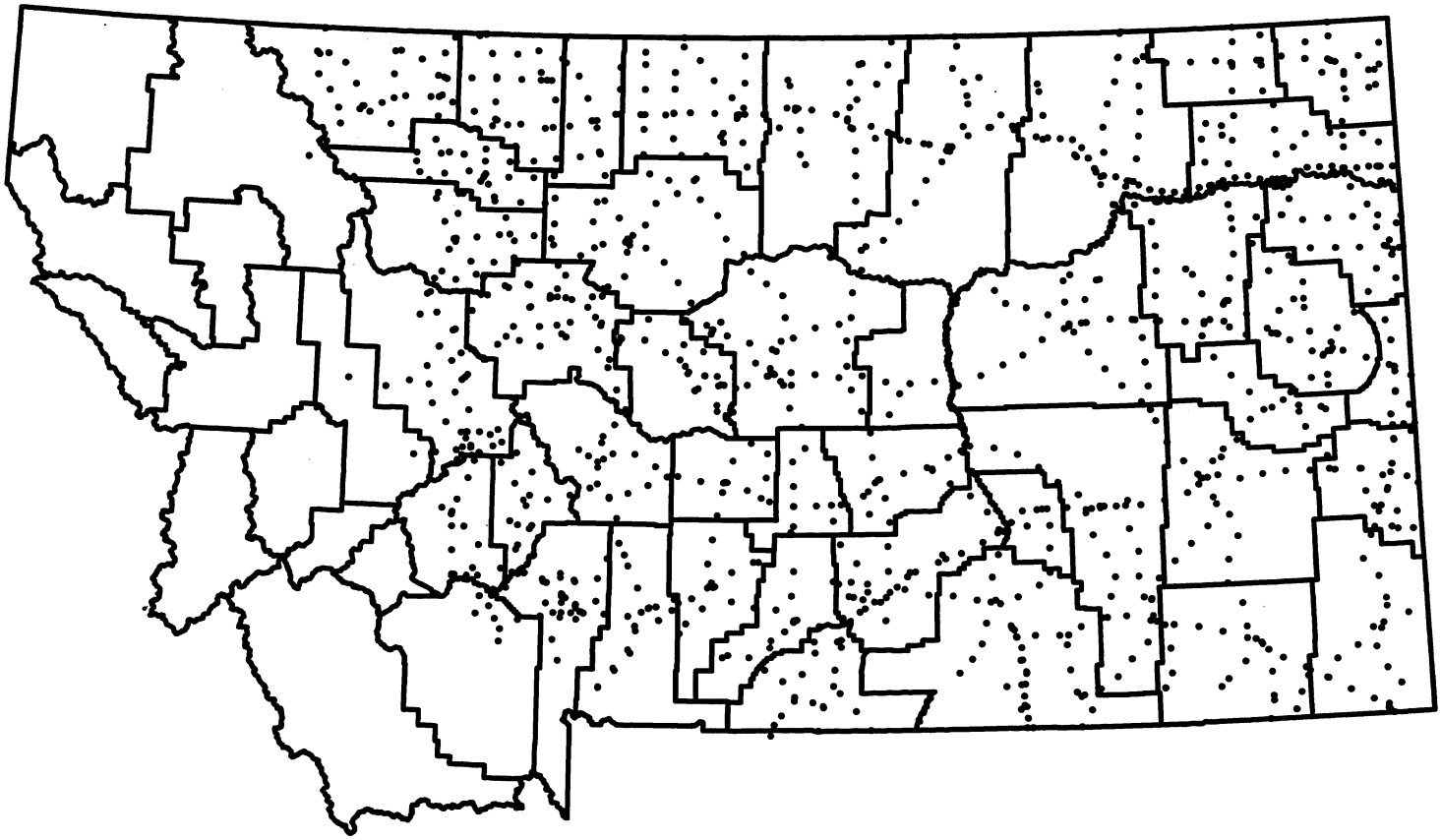
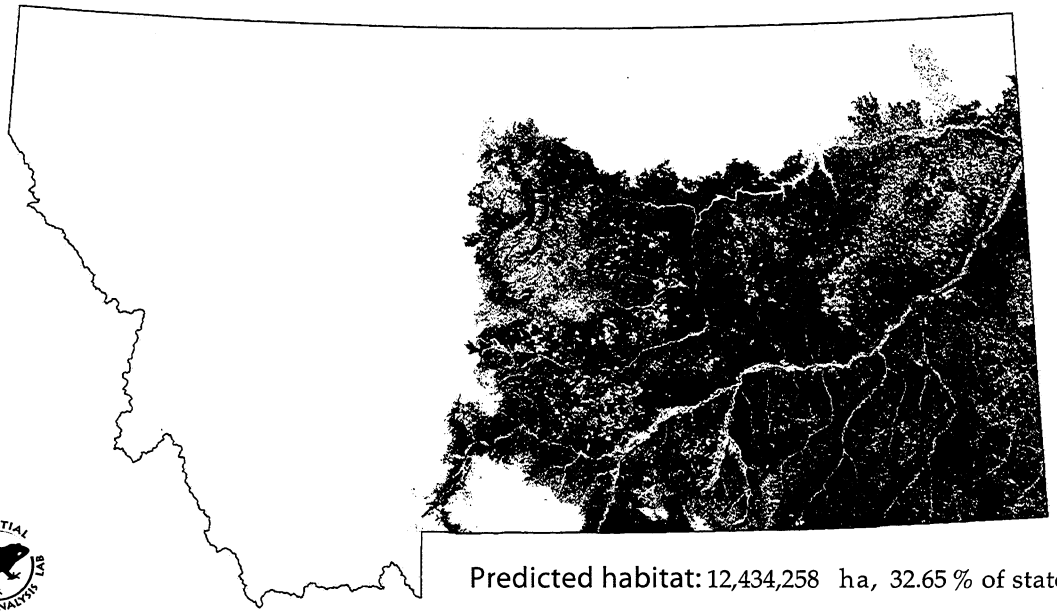


SAGEBRUSH LIZARD

Sceloporus graciosus

State rank	S3S4	Element code	ARACF14030
Global rank	G5	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by P. Hendricks
MTNHP status	watch list		



Predicted habitat: 12,434,258 ha, 32.65 % of state.

State range

East of Continental Divide, mostly in southern half of eastern Montana (Reichel and Flath 1995).

Habitat description

Sagebrush plains, greasewood and other desert shrubs, open juniper and pine woodlands with brushy cover, up to 3200 m elevation (Nussbaum et al. 1983), also geothermal areas in Yellowstone National Park (Koch and Peterson 1995). Eggs (typically 3-4) buried in clutches in loose soil, usually at the base of a shrub (Nussbaum et al. 1983).

In Montana: Sagebrush plains, open pine/juniper woodland with brushy cover and small rock outcrops (Koch and Peterson 1995, Hendricks and Reichel 1996); up to 2200 m in Yellowstone National Park, but usually below 1700 m elevation elsewhere (P. Hendricks, pers. observ.). Nest sites include loose soil at base of shrubs (Algard 1968).

Model assumptions & caveats

Model based on cover types; unable to use soil layer. An elevational limit of 2250 m, consistent with range in Wyoming (Baxter and Stone 1985), was used to restrict predicted range upward into mountains. Model overestimates range because of inability to use loose, sandy soils in model.

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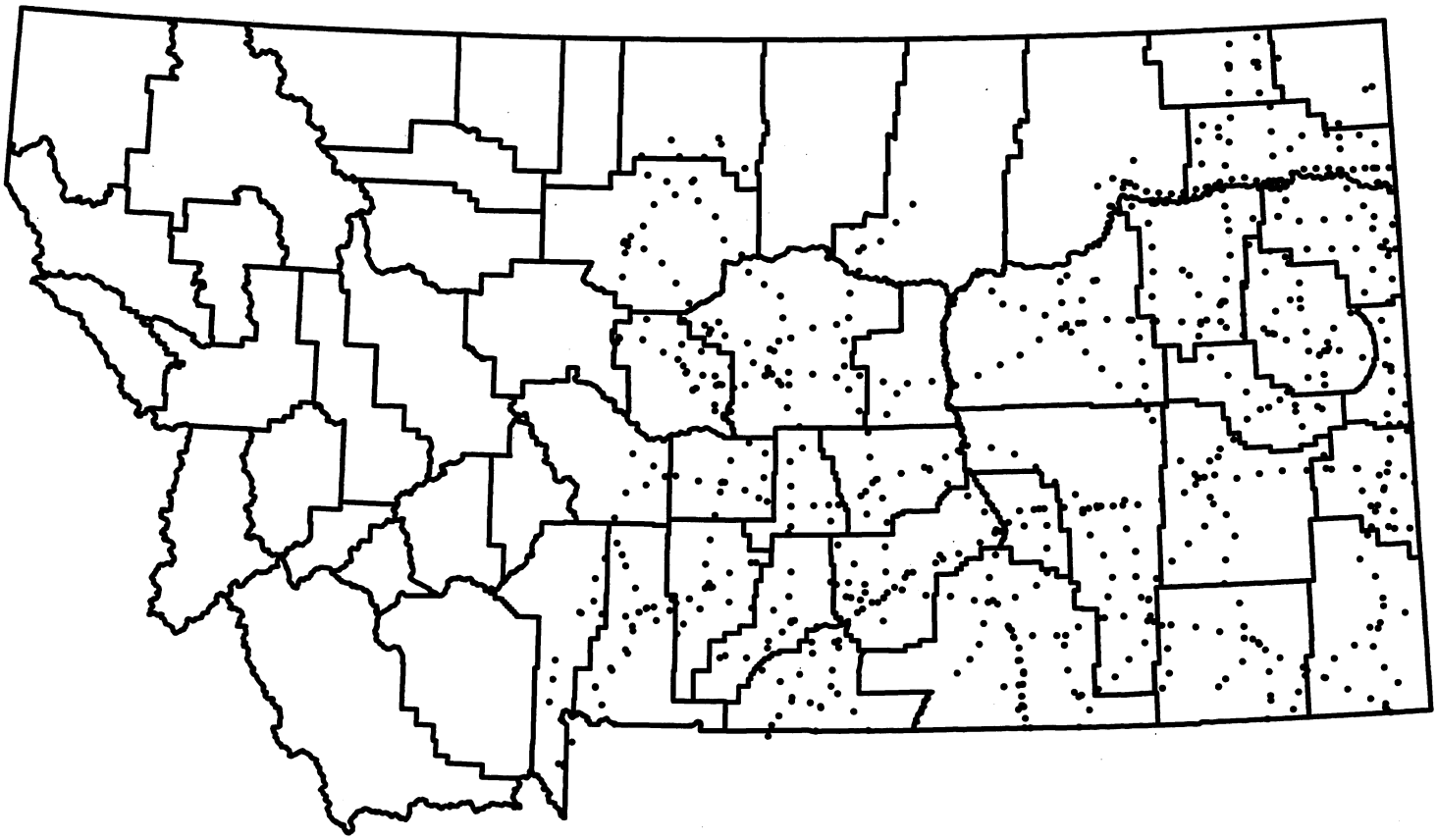
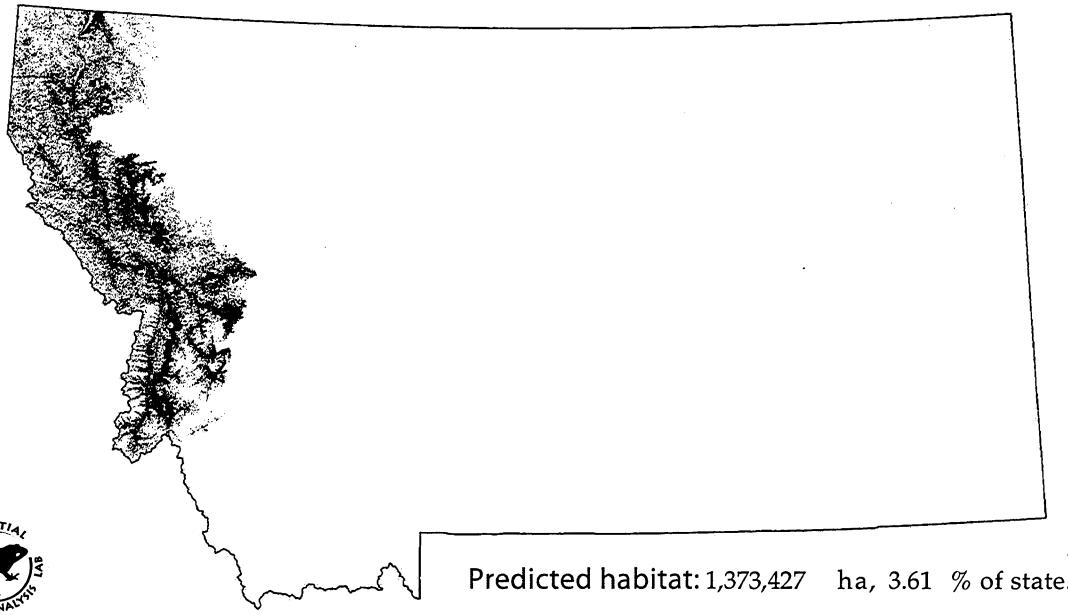


WESTERN SKINK

Eumeces skiltonianus

State rank	S3S4	Element code	ARACH01110
Global rank	G5	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by P. Hendricks
MTNHP status	watch list		



Predicted habitat: 1,373,427 ha, 3.61 % of state.

State range

West of the Continental Divide; near the Idaho border in the Clark Fork River and Kootenai River drainages in northwestern Montana (Reichel and Flath 1995).

Habitat description

Grassy slopes in oak woodland and mesic conifer forest, pine and juniper woodland, rocky canyons and rimrock up to 2150 m elevation; under rotting wood, surface litter and large flat stones (Nussbaum et al. 1983, Storm and Leonard 1995). Eggs (2-6) are laid in clutches in burrows or cavities under logs and stones (Nussbaum et al. 1983, Storm and Leonard 1995).

In Montana: Grassand low shrub-covered slopes in open ponderosa pine, Douglas-fir and juniper woodlands, rocky outcrops and talus; known up to 1750 m elevation (Hendricks and Reichel 1996, P. Hendricks pers. observ.). Nest habitat not described.

Model assumptions & caveats

Model based on cover types. An elevational limit of 2100 m, consistent with other areas in the Pacific Northwest (Nussbaum et al 1983), was used to restrict predicted range upward into mountains. Model overestimates range due to a lack of good information on habitat associations.

References

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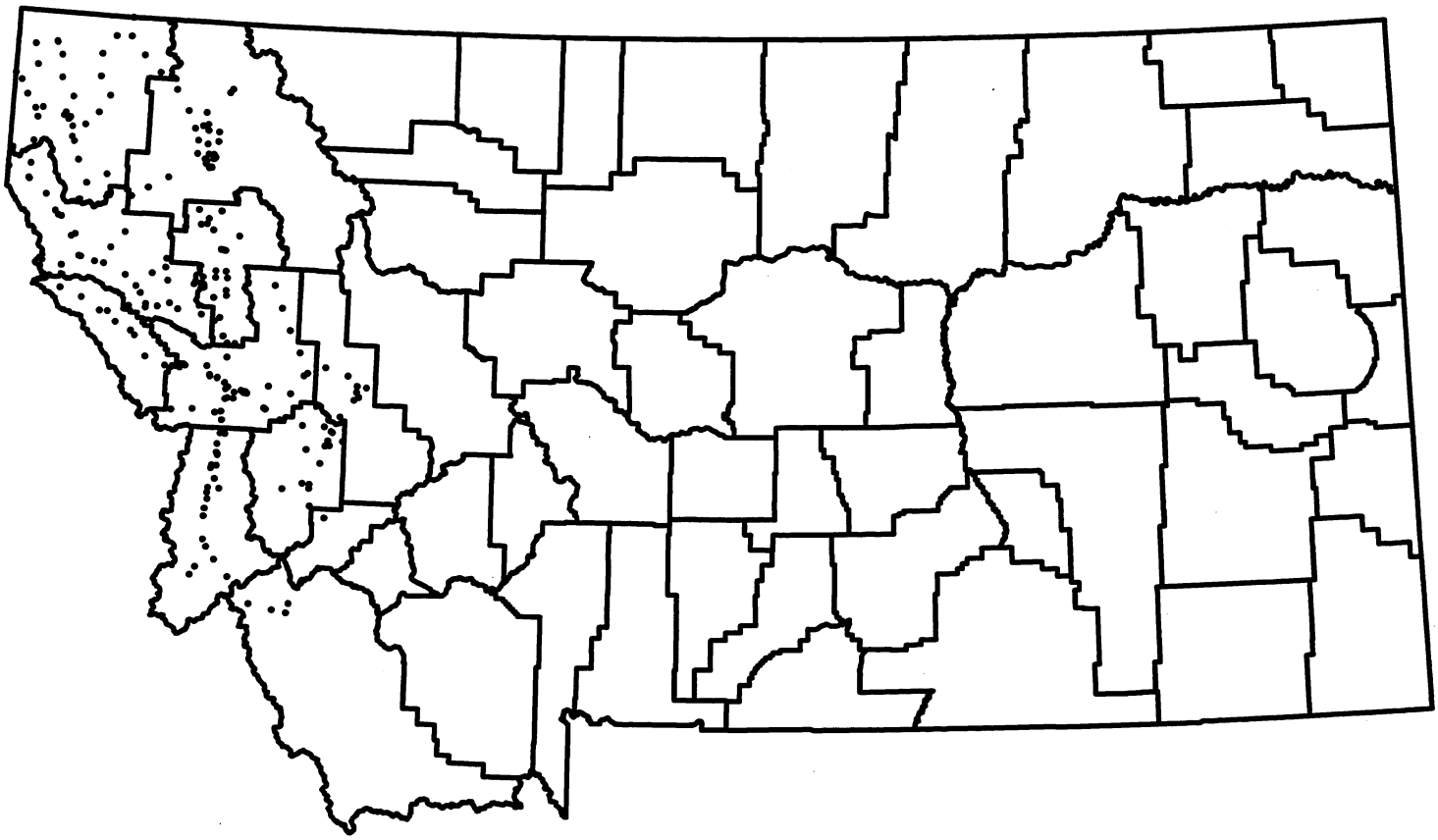
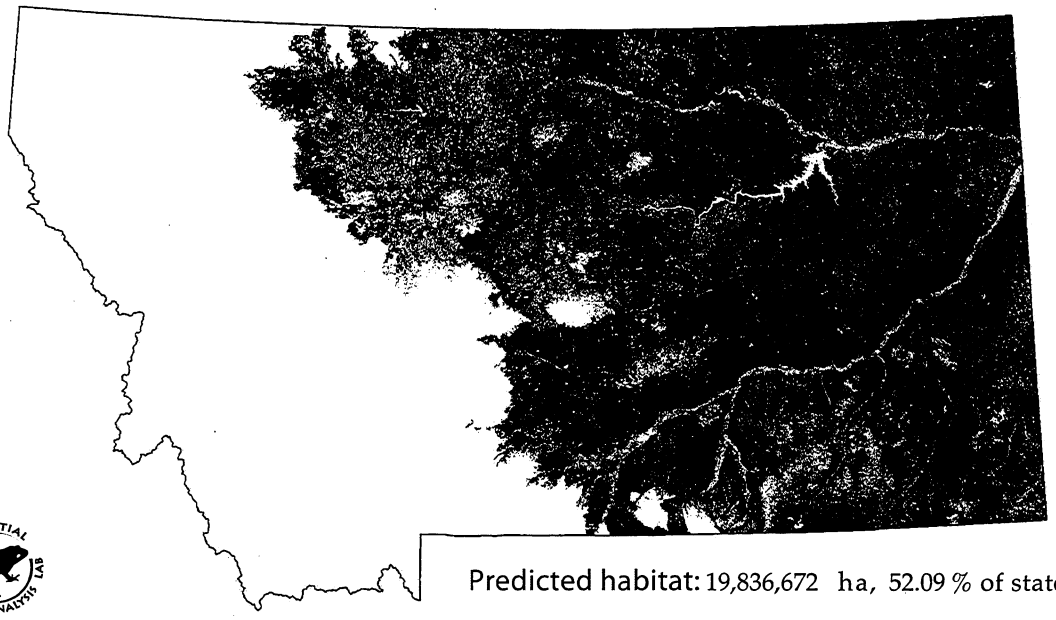


WESTERN HOGNOSE SNAKE

Heterodon nasicus

State rank	S3?	Element code	ARADB17010
Global rank	G5	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by P. Hendricks
MTNHP status	special concern		



Predicted habitat: 19,836,672 ha, 52.09 % of state.

State range

Plains of eastern Montana; western limits not well-known (Reichel and Flath 1995).

Habitat description

Sandy or gravelly soils in prairie, sandhills, open woodland, floodplains, semidesert, mountain canyon bottoms, badlands; near water (Hammerson 1982, Baxter and Stone 1985, Russell and Bauer 1993). Eggs laid in sandy soil.

In Montana: Arid areas, prairie grasslands and shrublands, floodplains with gravely or sandy soils (Reichel and Flath 1995). Nest and den sites not described.

Model assumptions & caveats

Model based on cover types and riparian habitat. An upper elevational limit of 1650 m was used to prevent predicted range upward into mountains; this limit may be too high. The model overestimates habitat because a loose, sandy soil layer was not available at sufficiently fine resolution.

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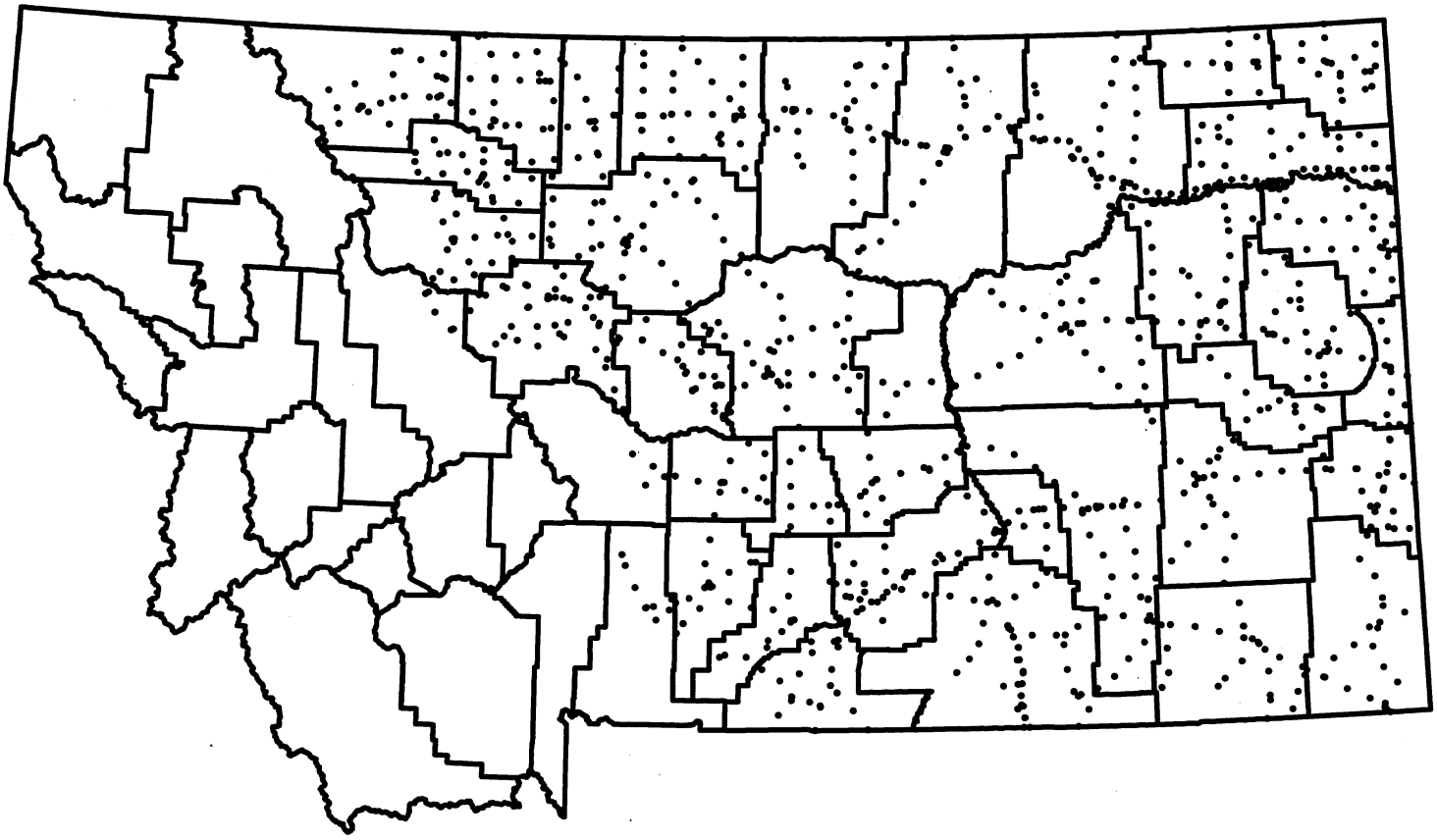
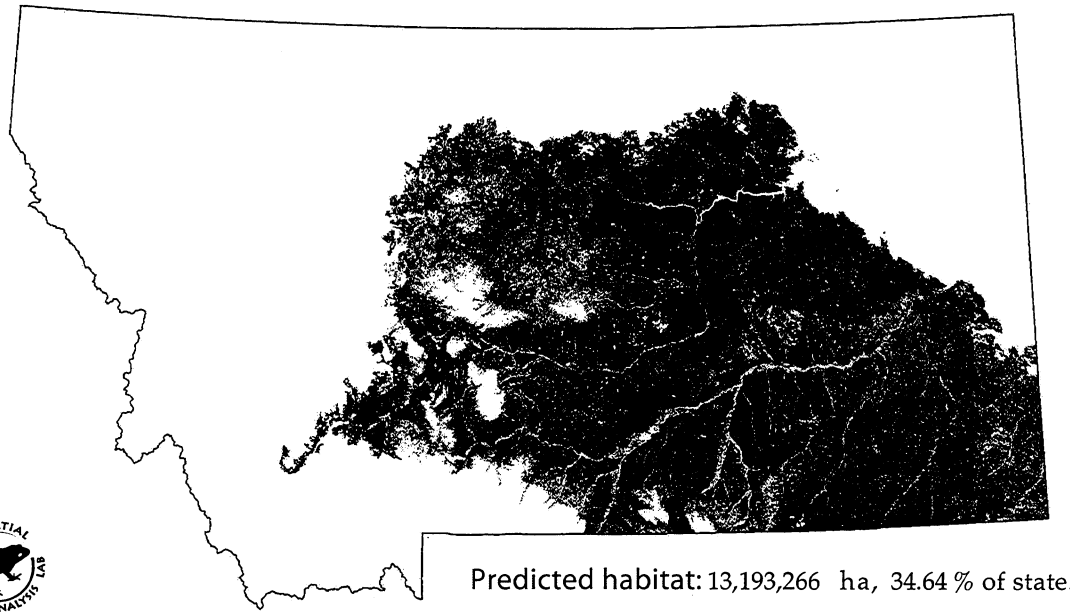


MILK SNAKE

Lampropeltis triangulum

State rank	S2	Element code	ARADB19050
Global rank	G5	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by P. Hendricks
MTNHP status	special concern		



Predicted habitat: 13,193,266 ha, 34.64 % of state.

State range

Southeastern Montana and along the Missouri River; may be localized (Reichel and Flath 1995).

Habitat description

Grasslands, sandhills, open ponderosa pine and juniper woodlands, arid river valleys, often associated with rock outcrops and scarps; usually below 2450 m elevation (Hammerson 1982, Baxter and Stone 1985). Dens in rock outcrops (Hammerson 1982).

In Montana: Sandstone bluffs, rock outcrops, grasslands, open ponderosa pine and juniper stands (Hendricks and Reichel 1996); den sites undescribed, habitat associations poorly known because of few observations.

Model assumptions & caveats

Model based on cover types. An upper elevational limit of 1950 m, based on range in Wyoming (Baxter and Stone 1985), was used to restrict predicted range upward into mountains. Model grossly overestimates suitable habitat; would have preferred to base model on sandstone outcrops and hogback rims. Predicted habitat extrapolated from known range into southwestern Montana may be problematic.

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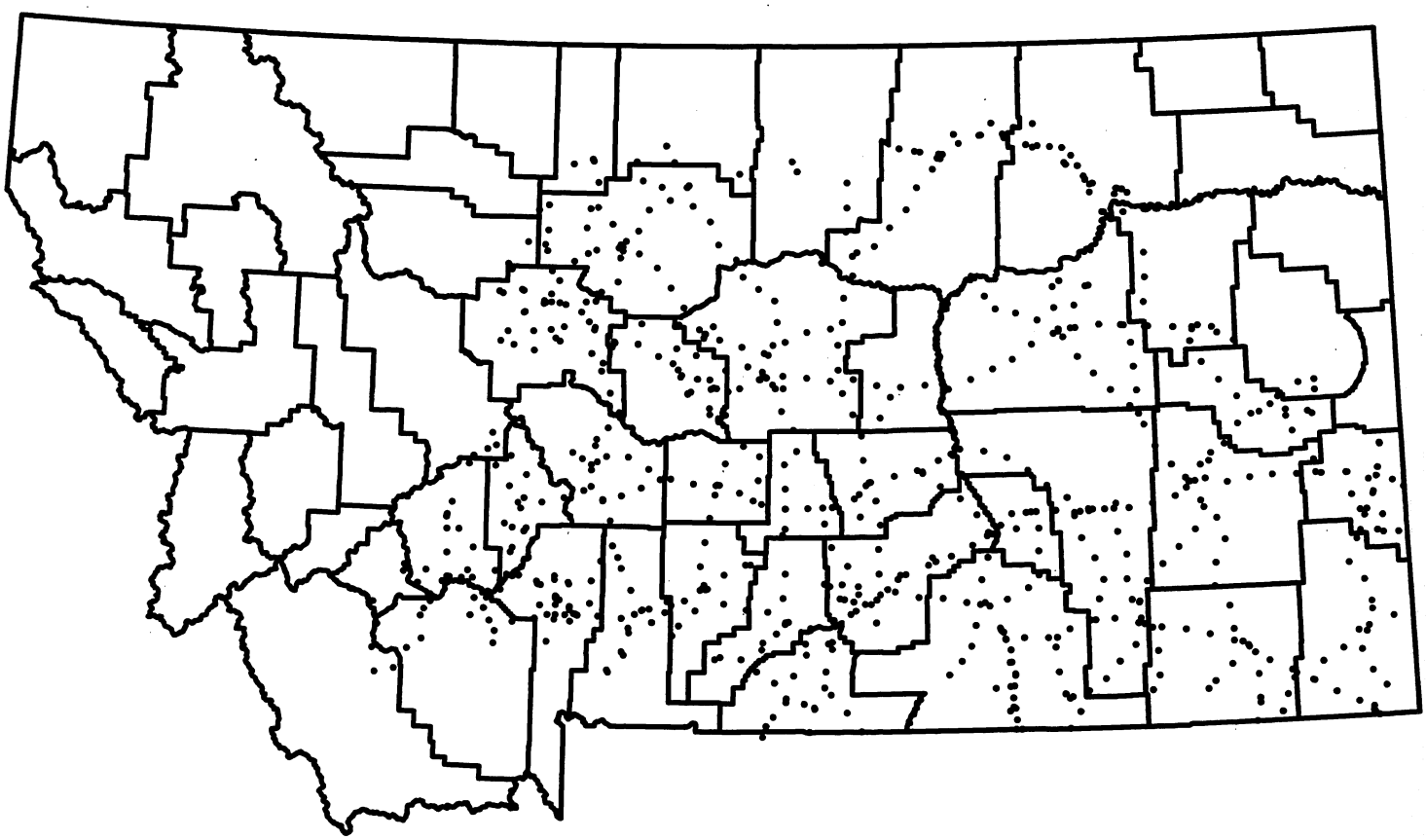
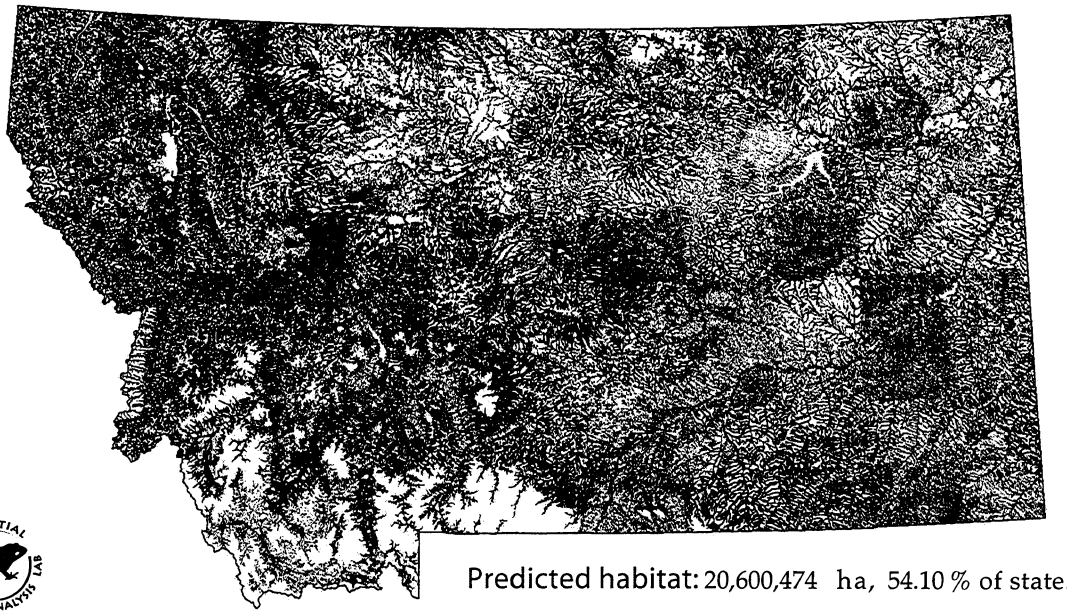


COMMON GARTER SNAKE

Thamnophis sirtalis

State rank	S4	Element code	ARADB36130
Global rank	G5	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by P. Hendricks
MTNHP status	--		



Predicted habitat: 20,600,474 ha, 54.10 % of state.

State range

Throughout Montana (Reichel and Flath 1995).

Habitat description

Prairie grassland, shrubland, coniferous woodland, farms and urban areas, usually associated with permanent water (lakes, streams, marshes, wet meadows); below 2100 m elevation (Russell and Bauer 1993, Koch and Peterson 1995, Storm and Leonard 1995). Dens in rocky sites near water; give birth to live young. May disperse many miles from dens (Storm and Leonard 1995).

In Montana: Coniferous (often ponderosa pine and Douglas-fir) forest, broadleaf woodlands, shrubland and grassland, urban areas, usually near water; recorded to 1700 m elevation (Werner and Reichel 1994, Reichel 1995a, Hendricks and Reichel 1996a, Hendricks and Reichel 1996b). Den sites not described.

Model assumptions & caveats

Model based on cover types and hydrography, using a 500 m buffer into selected cover types. An upper elevational limit of 2250 m was used, based on Koch and Peterson (1995). Model may underestimate suitable habitat; there is some biological justification for increasing the buffer distance, but most occurrences are near water. Elevational limit may be too high in the northwestern mountains. Because the hydrography layer (assembled from USGS 1:100,000 digital line graphs) contains mapping inconsistencies among tiles, "squares" can be seen in the model output, especially in eastern Montana.

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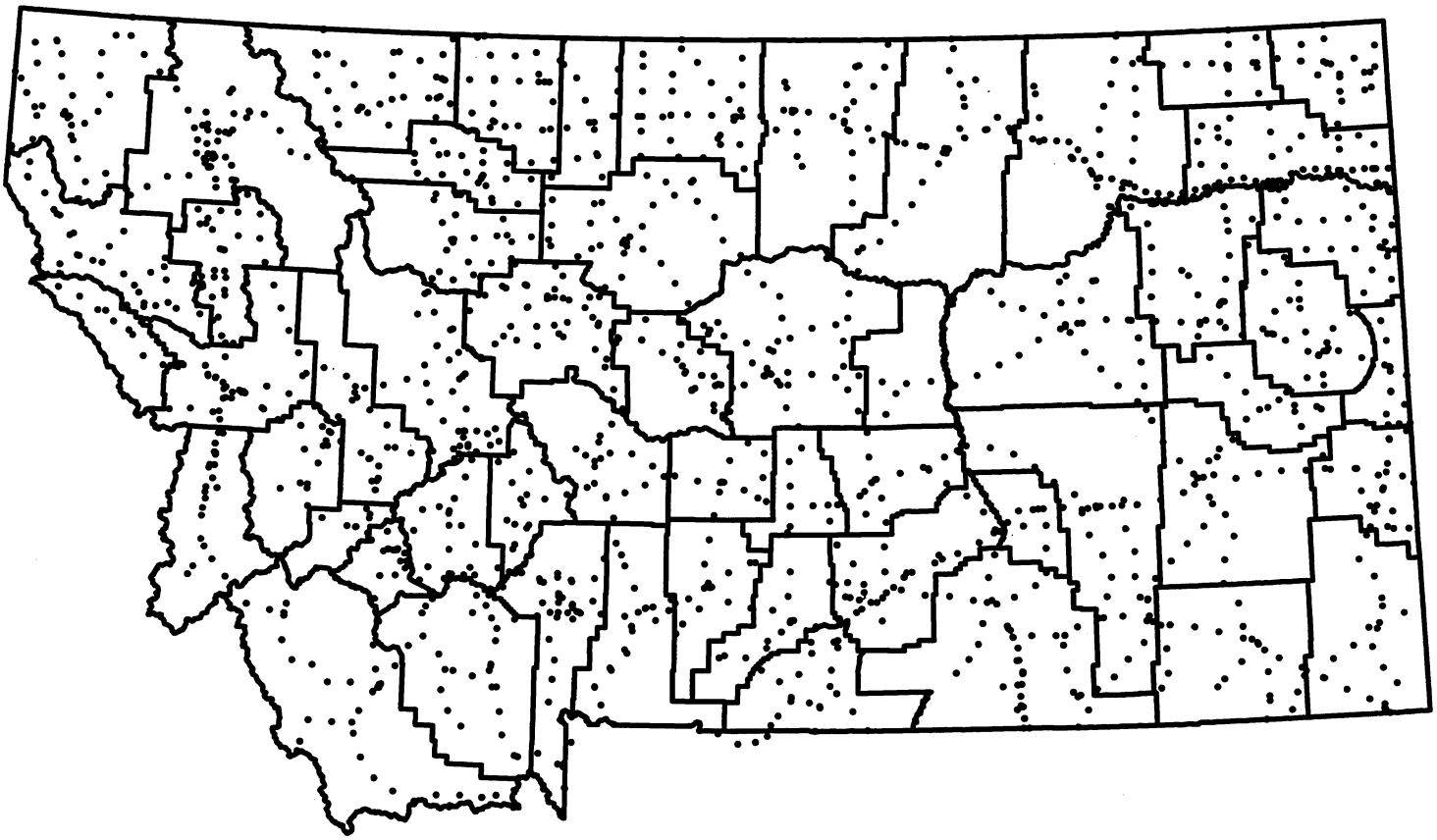
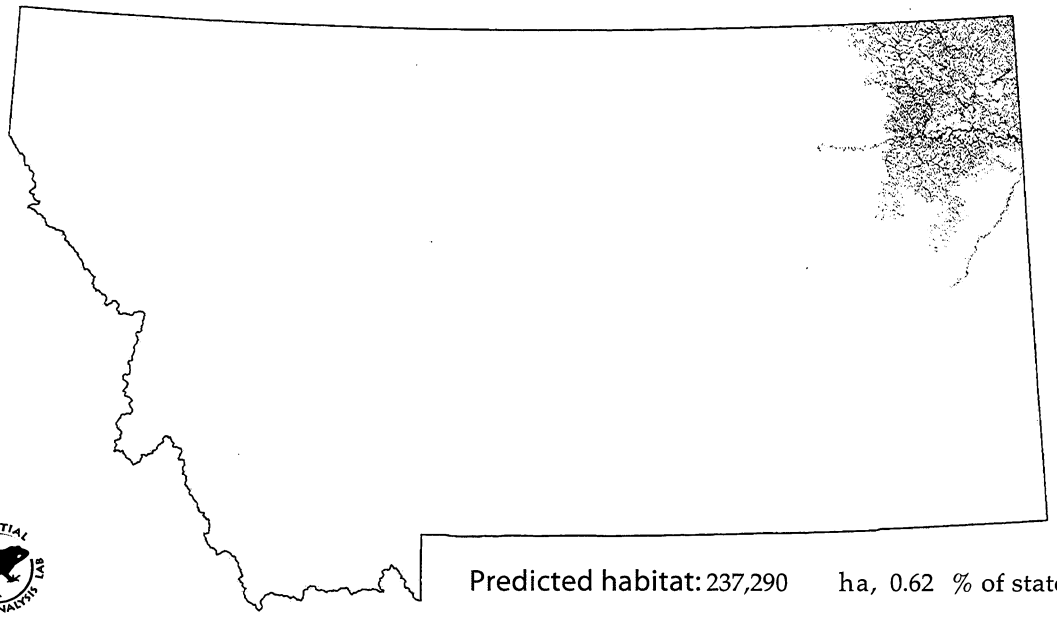


SMOOTH GREEN SNAKE

Liochlorophis vernalis

State rank	S2S3	Element code	ARADB47010
Global rank	G5	Modeled by	M. Hart, B. Maxell, P. Hendricks, C. Peterson, and J. Reichel; writeup by P. Hendricks
MTNHP status	special concern		



Predicted habitat: 237,290 ha, 0.62 % of state.

State range

Liochlorophis vernalis = *Opheodrys vernalis*. Far northeastern corner of the state (Sheridan and Roosevelt counties); distribution based on very few observations (Reichel and Flath 1995).

Habitat description

Riparian vegetation, often with dense herbaceous cover, mountain shrubland, woodland meadows, drier habitats adjacent to riparian areas; usually below 2750 m elevation (Hammerson 1982, Baxter and Stone 1985). Dens under rocks or wood, or in rotting logs.

In Montana: Riparian vegetation, irrigated lawns in rural communities (T. Nordhagen, pers. comm. to P. Hendricks); habitat associations poorly known (Reichel and Flath 1995). Dens undescribed.

Model assumptions & caveats

Model based on cover types, riparian habitats and hydrography; hydrography with a 500 m buffer into selected cover types to accommodate dispersal. No elevational limit seemed necessary. Model appears reasonable, although may overestimate range because of propagation of predicted habitat along major rivers.

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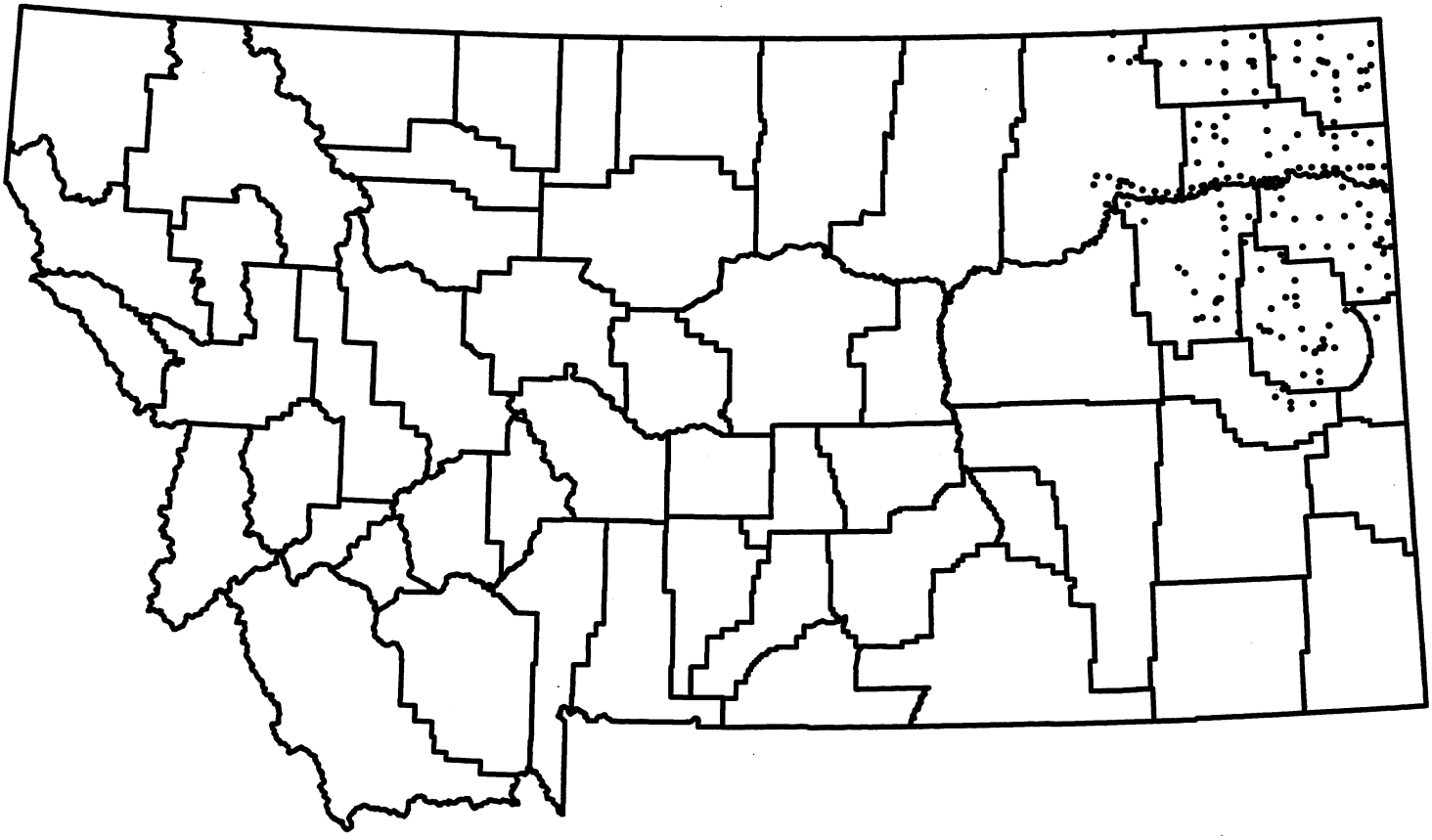
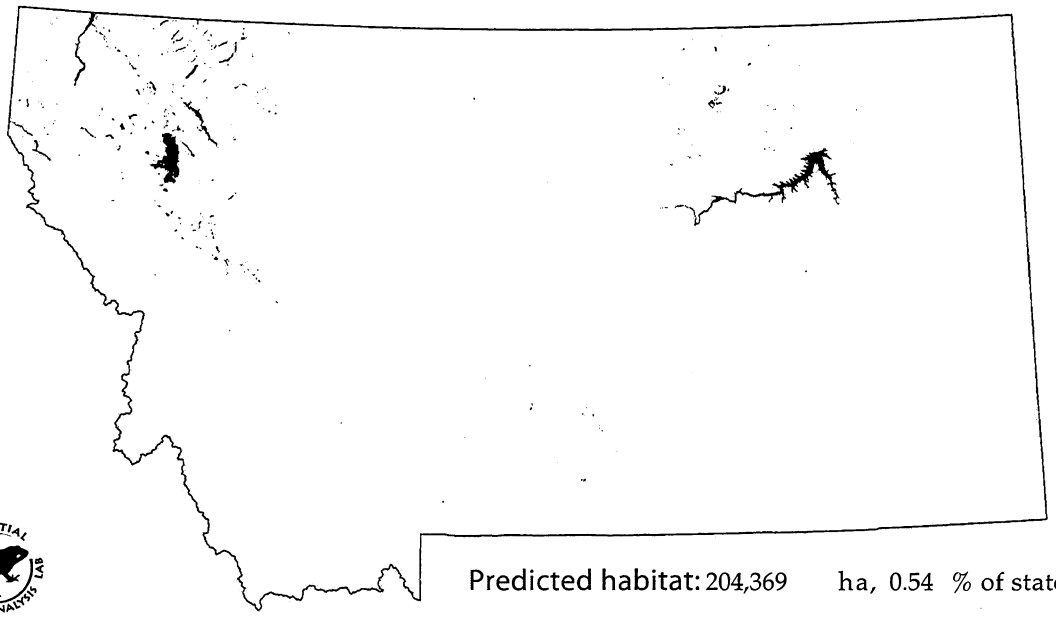


COMMON LOON

Gavia immer

State rank	S1S2B,SZN	Element code	ABNBA01030
Global rank	G5	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 204,369 ha, 0.54 % of state.

State range

Breeding range primarily restricted to low elevation (below ~1600m) glacial lakes (morainal, kettle) in the northwest corner of the state; smaller populations possibly breed locally in southcentral and eastern (Nelson Reservoir) Montana, but most records are from the early 1900's (Dolan 1994, Montana Bird Distribution Committee 1996). Transient sightings occur throughout the state; occasional overwintering also in northwest and possibly in southcentral and eastern MT breeding areas (Montana Bird Distribution Committee 1996).

Habitat description

Breeding habitat generally limited to glacial lakes within tundra and coniferous regions, although occasionally breed on northern prairies (Palmer 1962, Fitch in Clark et al. 1989, Dolan 1994). Larger, clear lakes with partially forested shorelines, varying depths, numerous islands, highly irregular shorelines that provide areas protected from winds and rough water, and that are free from human distrubance represent optimal breeding habitat (Palmer 1962, Johnsgard 1979, McIntyre 1988, Fitch in Clark et al. 1989, Heglund et al. 1994, McIntyre 1994). Avoid lakes with fluctuating water levels (dammed), moderate to high turbidity, unprotected bays and inlets, and entirely barren shorelines (Fitch in Clark et al. 1989, Heglund et al. 1994, McIntyre 1994). Water clarity is critical; in Ontario, abandoned breeding on lakes after industrial pollution caused high turbidity levels (Barr 1986). Typically, a 40-80ha lake is required to support one breeding pair, but a 20ha lake with irregular shoreline will suffice (McIntyre 1988, Kerekes et al. 1994). Nests built of mud and vegetation; always within 1-2m of water, preferably on islands, but muskrat houses, floating vegetation mats, rocks and shorelines also used (McIntyre 1983, Ehrlich et al. 1988, Fitch in Clark et al. 1989, Dolan 1994, McIntyre 1994, Ruggles 1994). In Alberta, preferentially nest on islands or muskrat houses (Salt and Salt 1976). Brood areas in shallower, protected bays or inlets of lakes where emergent vegetation provides cover and foraging habitat (McIntyre 1988, Ehrlich et al. 1988, McIntyre 1994). In the Turtle Mountains of ND, breeding restricted to larger, permanent, freshwater lakes with abundant fish

populations, bordered by extensive stands of woodland (Quaking Aspen), and with peripheral zones of deep-marsh emergent vegetation (Stewart 1975). In MT, lakes must be greater than 10ha, deep enough to avoid freezing solid in winter (to sustain fish food base), and be below ~1600m in elevation (Skaar 1989, Kelley 1992a). Small peat islands in marshy areas and shallow bays are typical nest sites on MT lakes (Kelley 1992a, Dolan 1994). Subsist primarily on fish (80% of the diet); also crustaceans, amphibians, insects, vegetation (DeGraaf et al. 1991). During migration, inland and coastal waters are used; may gather on larger lakes than used for breeding before migrating to wintering areas (Palmer 1962, Dolan 1994). Inland migration disperses widely throughout the U.S., on relatively large, obstruction free expanses of water (Palmer 1962, DeGraaf et al. 1991); Twin Lakes Reservoir, ID is an important staging area for the Rocky Mountain population (Fitch in Clark et al. 1989). Unknown where Northern Rocky Mountain populations winter - breeders of the east side of the Divide likely migrate to Gulf of Mexico; others winter on the Pacific Coast (Dolan 1994). Winter habitat primarily marine - coastal waters, bays, estuaries; also large freshwater lakes and reservoirs that remain ice free, usually near coasts (Palmer 1962, Dolan 1994). On nesting and staging lakes, sensitive to human disturbances (especially from boating), and water level fluctuations (Fitch in Clark et al. 1989). Globally, populations are secure, however unregulated hunting, chemical contamination, effects of acid rain, oil spills on wintering grounds, and increased human development and activity on/near breeding lakes continue to reduce the breeding range (Fitch in Clark et al. 1989, Dolan 1994). In Alberta, have been driven out of most deepwater breeding lakes by human recreation; only adult nonbreeders seen on these lakes, as breeders are locally restricted to more northern, remote areas (Salt and Salt 1976). In the Greater Yellowstone Ecosystem, many lakes ideal for nesting are not used because human disturbance is high (Fitch in Clark et al. 1989). Additionally, at higher elevations, the shorter ice-free season makes timing of nesting and chick rearing critical; therefore are particularly vulnerable to human disturbances (Fitch in Clark et al. 1989). Local declines are suspected within the MT breeding range due to habitat loss (shoreline development, dam construction), and lowered reproductive success induced by human distrubance/recreation (Dolan 1994). The Common Loon is a species of special concern in ID and MT, is considered "protected non-game" by MT Fish Wildlife & Parks, and is a priority 1 species in WY (Fitch in Clark et al. 1989, Dolan 1994).

Model assumptions & caveats

Breeding habitat modeled. Rare winter resident; primary winter range/habitat is coastal, therefore not included in model. Common migrant; preferred migration habitat used in MT assumed defined within breeding habitat parameters. Potential breeding habitat in prairie regions of MT not specified in model, but somewhat defined within breeding habitat parameters. Lake depth, clarity, island characteristics, and degree of human disturbance information not available to include in model. Assume adequate nest sites (lake islands, peat islands, muskrat houses) and brood rearing areas available within suitable habitat. Hydrography coverage may not be consistently accurate/true to mapping scale used. Most MT lakes are simple in shape, lacking highly irregular shorelines that provide marshy inlets/bays preferred for nesting - could not accurately resolve shoreline morphology at mapping scale used. Habitat associations (i.e., lakes with forest and emergent vegetation), could not be modeled at mapping scale used (must query lakes with forest or emergent vegetation). Potential for human disturbance in predicted habitat areas cannot be assessed at mapping scale uesd. Suitable breeding habitat overestimated.

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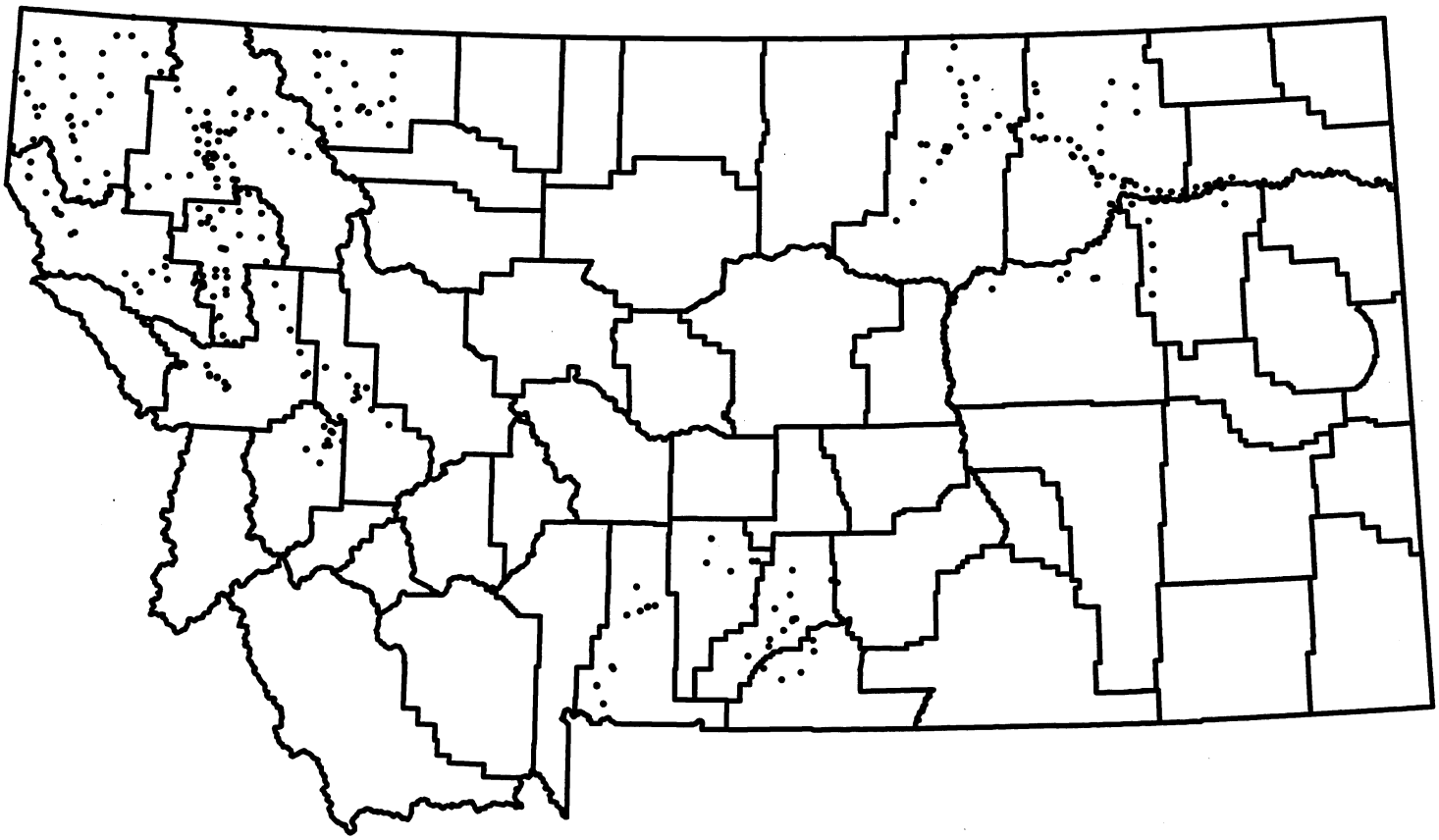
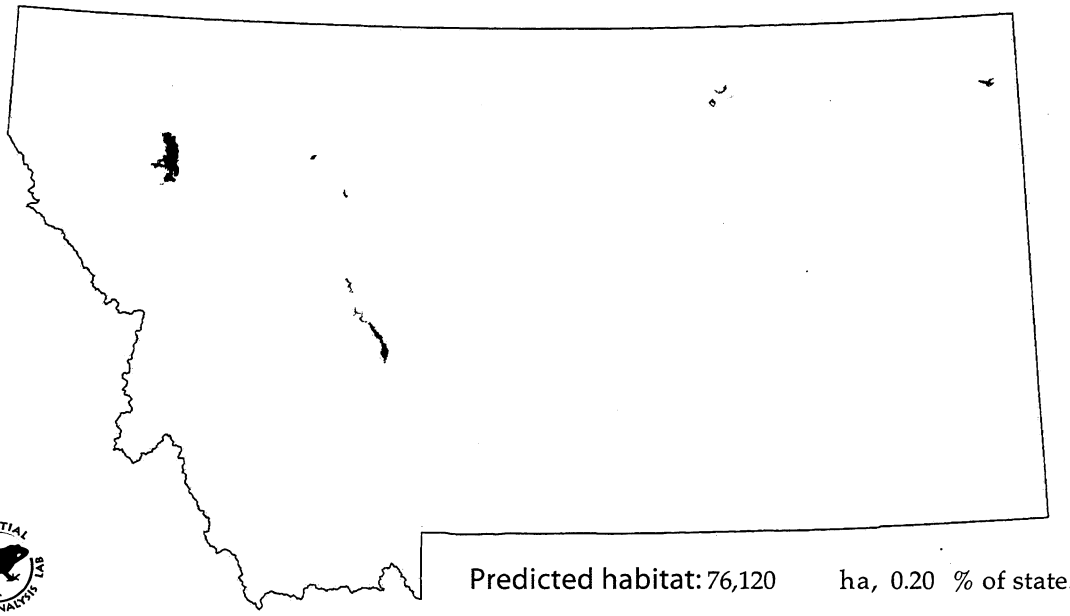


CLARK'S GREBE

Aechmophorus clarkii

State rank	S2S4B,SZN	Element code	ABNCA04020
Global rank	G5	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 76,120 ha, 0.20 % of state.

State range

Breed very locally in Montana; known or suspected to breed in Ninepipe NWR in w Montana, and Lake Helena, Canyon Ferry Reservoir, Freezout Lake WMA, and Bowdoin NWR in e Montana (Montana Bird Distribution Committee 1996). Transient sightings recorded for nw/cent, scen, and ne Montana; no confirmed or suspected overwintering recorded (Montana Bird Distribution Committee 1996).

Habitat description

Please see Western Grebe habitat description. Similar habitat requirements as for Western Grebes, differing only in distribution - Clark's and Western Grebes sympatric over entire range; Clark's more common in southern part of range, but numbers increasing in the north; has uncommon status in MT (Ehrlich et al. 1988, Wassink 1991, Wright 1996). Differences in breeding ecology between Western and Clark's Grebes not well studied/defined. All breeding reported for MT is on very large lakes and reservoirs - nesting on Lake Helena is near mid-lake on subsurface, aquatic vegetation mat (MNHP-VCA 1996). Nest colonially in large marshes and lakes near emergent vegetation; tend to forage farther from shore and in deeper water that Western Grebes (Ehrlich et al. 1988, Storer and Nuechterlain 1992). Winter on coastal waters, bays, and less frequently inland (Storer and Nuechterlain 1992).

Model assumptions & caveats

Breeding habitat modeled. Rare breeder, uncommon migrant; does not overwinter in the state. Migration habitat similar to that of breeding and is assumed is defined within breeding habitat parameters. Please see assumptions/caveats for Western Grebe. Since only known breeding sites within the state are on very large lakes and reservoirs, these hydrographic limitations were included in model. Suitable breeding habitat may be overestimated, however, limited information regarding breeding requirements, and difficulty in distinguishing this species from closely related Western

Grebe, may have underestimated state range, making habitat modeling difficult.

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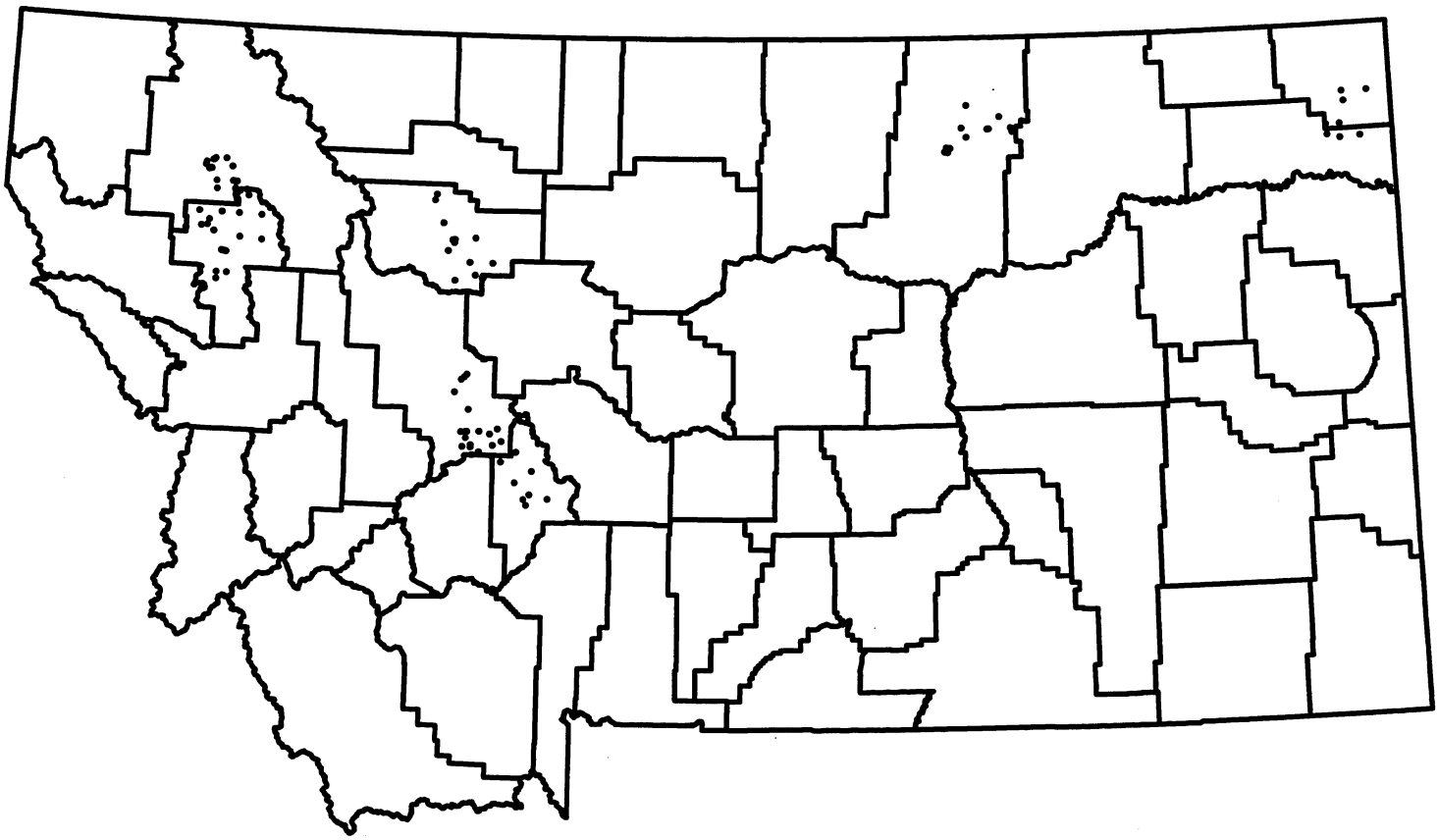
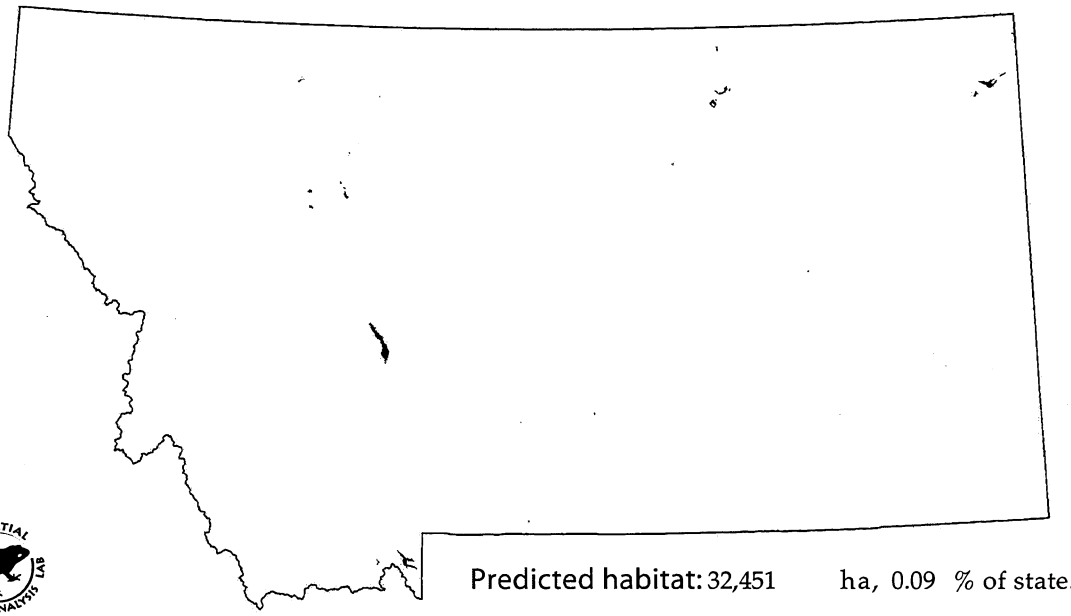


AMERICAN WHITE PELICAN

Pelecanus erythrorhynchos

State rank	S2B,SZN	Element code	ABNFC01010
Global rank	G3	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 32,451 ha, 0.09 % of state.

State range

Only four breeding sites known, in eastern Montana, but breeding birds may move 100 miles to forage, so are widely seen (Montana Bird Distribution Committee 1996). Successful colonies breed at Medicine Lake NWR, Bowdoin NWR, Canyon Ferry Reservoir, Arrod Lake, and Charles M. Russell NWR (Sidle et al. 1985, MNHP-VCA 1996). Widely distributed in migration; transient sightings recorded throughout the state, save extreme nw; overwintering does not occur in Montana (Palmer 1962, Montana Bird Distribution Committee 1996).

Habitat description

Breed mainly on isolated, sparsely vegetated islands in large freshwater lakes and reservoirs, inland rivers, and bays (Stewart 1975, Johnsgard 1979, Ehrlich et al. 1988, Evans and Knopf 1993). Prefer flat to gently sloped, loosely earthed islands free of obstructions that may interfere with flight access or visibility (Palmer 1962, Johnsgard 1979, Evans and Knopf 1993). Does nest at mainland (peninsula) sites but success is low as nests are vulnerable to mammalian predators (Findholt and Diem 1988, Hart in Clark et al. 1989). In 1993, low water levels at Alkali Lake, MT allowed cattle and coyote access to a breeding island; to date the island still has not been used (MNHP-VCA 1996). Breeding islands commonly 50+km from feeding areas; adults may travel 600km round trip to forage (Hart in Clark et al. 1989, Wassink 1991, Evans and Knopf 1993). Colonies often associated with Double-crested Cormorants; in the Prairie Pothole Region of ND Ring-billed Gulls and California Gulls are breeding associates as well (Sidle and Ferguson 1984). Nest on the ground; prefer loose soil or sand mounded with shells/stones to create a shallow depression with a low rim (Johnsgard 1979, Sidle and Ferguson 1984, Evans and Knopf 1993). Will nest adjacent to but not in available herbaceous or shrubby vegetation, or along lines of driftwood; avoid nesting on gravel substrates (Knopf 1979, Sidle and Ferguson 1984, Evans and Knopf 1993). In forested regions, occasionally nest under trees (poplars, spruce, fir, willows), but must then walk from nest to the forest edge to take flight (Evans and Knopf 1993). Diet consists mainly of fish, crayfish, salamanders; taken from shallow water (0.3-2.5m deep), open areas within marshes, along lakes, along river edges, or on or below rapids (Ehrlich et al. 1988,

Evans and Knopf 1993). Migration is inland, along river valleys, over deserts and over mountains, however the Rocky Mountains are generally not crossed; populations remain e or w of Continental Divide and migrate primarily south (Evans and Knopf 1993). Foraging/loafing stopovers in areas similar to breeding habitat; also including brackish and marine shallow bays and inlets (Palmer 1962, Evans and Knopf 1993). The American White Pelican western population has been identified by the U.S. Fish and Wildlife Service as "sensitive" and is listed as a "threatened, endangered, or sensitive species" in MT (Findholt and Diem 1988, Montana Bird Distribution Committee 1996). Highly sensitive to human distrubance; intrusions into the breeding colony will cause desertion, consequent nest destruction and increased predation by gulls and eagles (Findholt and Diem 1988, Evans and Knopf 1993). A 400m buffer around nest islands recommended to reduce human perturbations; foraging lakes should be protected as well (Findholt and Diem 1988, Hart in Clark et al. 1989, Evans and Knopf 1993).

Model assumptions & caveats

Breeding habitat modeled. Does not overwinter in the state. Common migrant; migration/stopover habitat similar to that of breeding, therefore assumed defined within breeding habitat parameters. Breeds on 'large' lakes, but minimum lake size not reported in literature - so that suitable habitat is not grossly overestimated, minimum lake size limitation set to sizes of smaller, known breeding lakes in MT. Island characteristics information not available; Hydrography and island coverage may not be consistently accurate/true to mapping scale used. Potential foraging areas not included in model, therefore model focused on suitable nesting habitat. Potential for/degree of human disturbance information not available. Suitable nesting habitat defined by known colony locations, however still may be overestimated. Foraging habitat, however, is likely underestimated.

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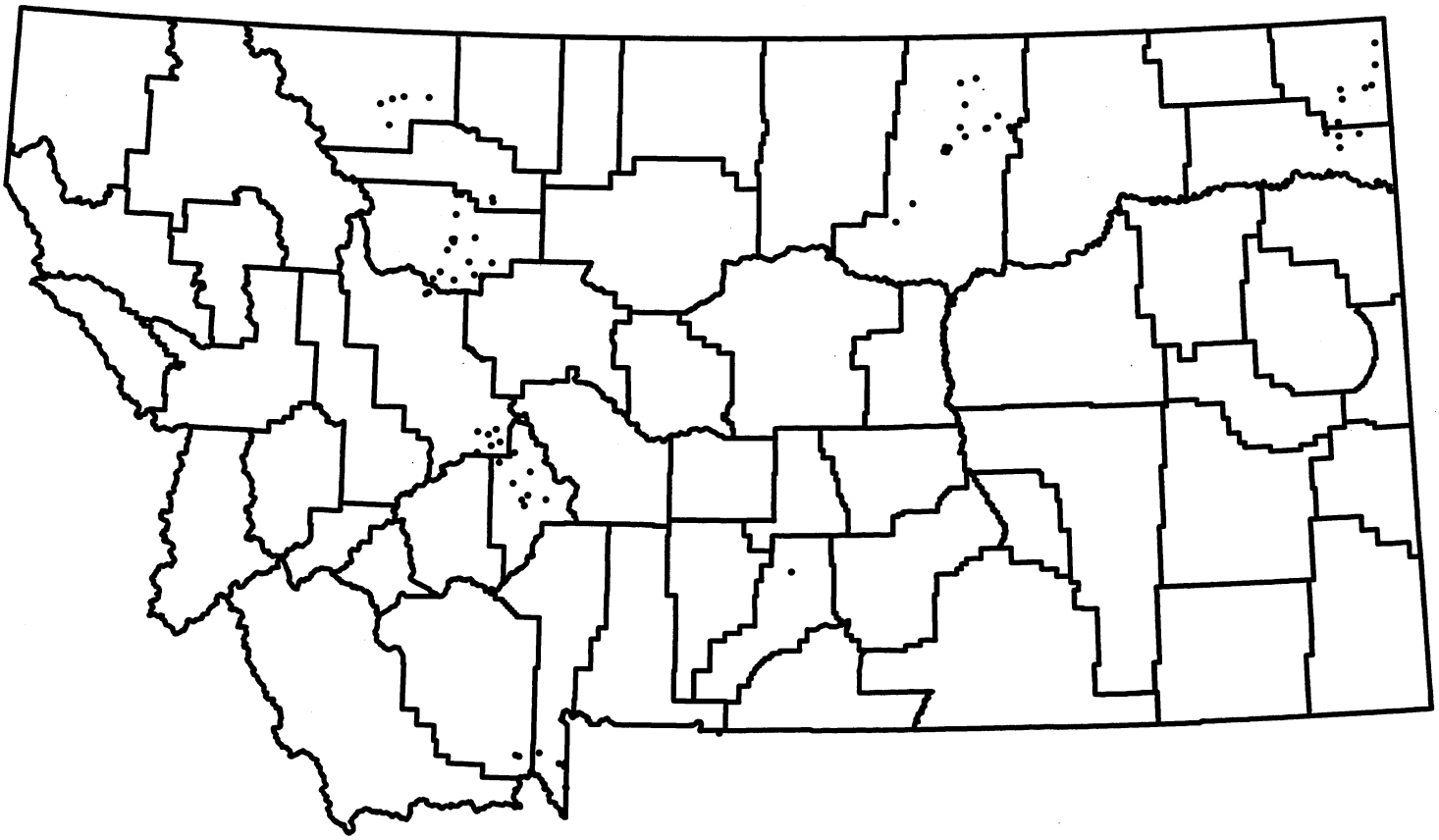
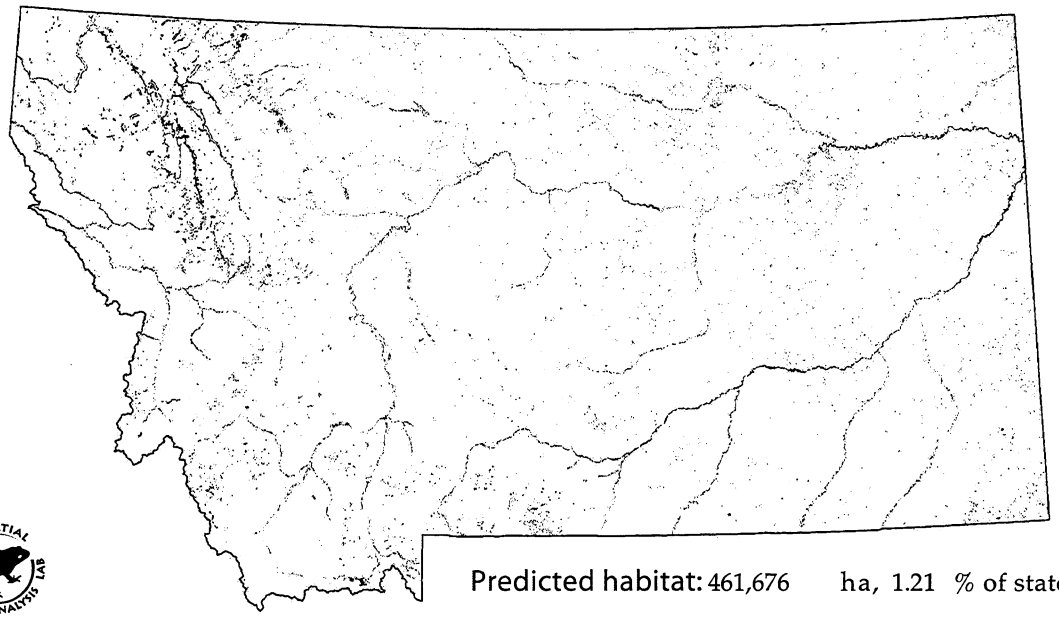


GREAT BLUE HERON

Ardea herodias

State rank	S4B,SZN	Element code	ABNGA04010
Global rank	G5	Modeled by	W. Williams
MTNHP status	watch list		



Predicted habitat: 461,676 ha, 1.21 % of state.

State range

Breed throughout Montana; transient sightings widely scattered; overwintering documented locally in western Montana (Montana Bird Distribution Committee 1996).

Habitat description

Widespread and adaptable; breed in a variety of aquatic habitats, usually where there are trees: freshwater and brackish marshes, swamps, river and lake edges, mangroves, tidal flats (Palmer 1962, Johnsgard 1979, Hancock and Kushlan 1984, Butler 1992). Nest sites often chosen to avoid mammalian predators and are fairly isolated on islands, trees in swamps, on high branches (Johnsgard 1979, Butler 1992). Nesting usually colonial in deciduous or conifer trees surrounded by water to 1,100m elevation; occasionally in shrubs; rarely ground or cliff (Hancock and Kushlan 1984, Ehrlich et al. 1988, Butler 1992). Colony location directly related to the distribution of foraging habitats (Butler 1992). In ME, colonies commonly form near wetlands as well as centrally within a wetlands complex (Gibbs 1991). In SD, typically nest in riparian woodlands (Dowd and Flake 1985); in eastern OR, cottonwoods frequently used (Henny and Kurtz 1978); in ID prefer willows or cottonwoods (Burleigh 1978). In nw MT, primarily nest in largest available cottonwoods of riparian areas; also conifers in drier sites (MNHP-VCA 1996). Colonies often nest in association with Double-crested Cormorants in the Great Plains, especially where reservoirs or waterfowl management impoundments have flooded areas of tall trees (Stewart 1975, Johnsgard 1979). Flooded tree nesting habitat somewhat temporary, as dead nest trees decay and eventually fall (Stewart 1975). Opportunistic forager: primarily fish; also small mammals, nestlings, amphibians, reptiles, invertebrates (Ehrlich et al. 1988, Butler 1992). Feeding habitat includes breeding areas; also mudflats, sandbars, wet meadows, pastures, dry fields, near emergent vegetation (Palmer 1962, Ehrlich et al. 1988, Butler 1992). Migration habitat is similar to that of breeding; in winter favor natural wetlands, river banks, estuaries, grasslands, coasts (Butler 1992). The Great Blue Heron was Blue-Listed 1980-81 and is considered an "SI" species in Montana, although overall, populations are apparently stable or increasing (Ehrlich et al. 1988, Montana Bird

Distribution Committee 1996). Are sensitive to human disturbance, road building, and logging activity within 0.5km of nesting colonies, and will abandon nests when perturbed (Butler 1992). Wetland loss, however, may have contributed more to population declines than human disturbance (Butler 1992).

Model assumptions & caveats

Breeding habitat modeled. Common migrant; uncommon winter resident. Migration habitat is similar to that of breeding and assumed defined within breeding habitat parameters. Winter habitat in MT not part of typical range and is exluded from model - winter survivability would better define suitable winter habitat in the state, but is unknown. Hydrography coverage not consistently accurate/true to mapping scale used. Cannot model elements of foraging habitat (indicator of suitable nesting habitat). Cannot determine extent of standing water in treed habitat at mapping scale used. Tree age/size class and potential for/degree of human disturbance information not available to include in model. Suitable breeding habitat likely overestimated.

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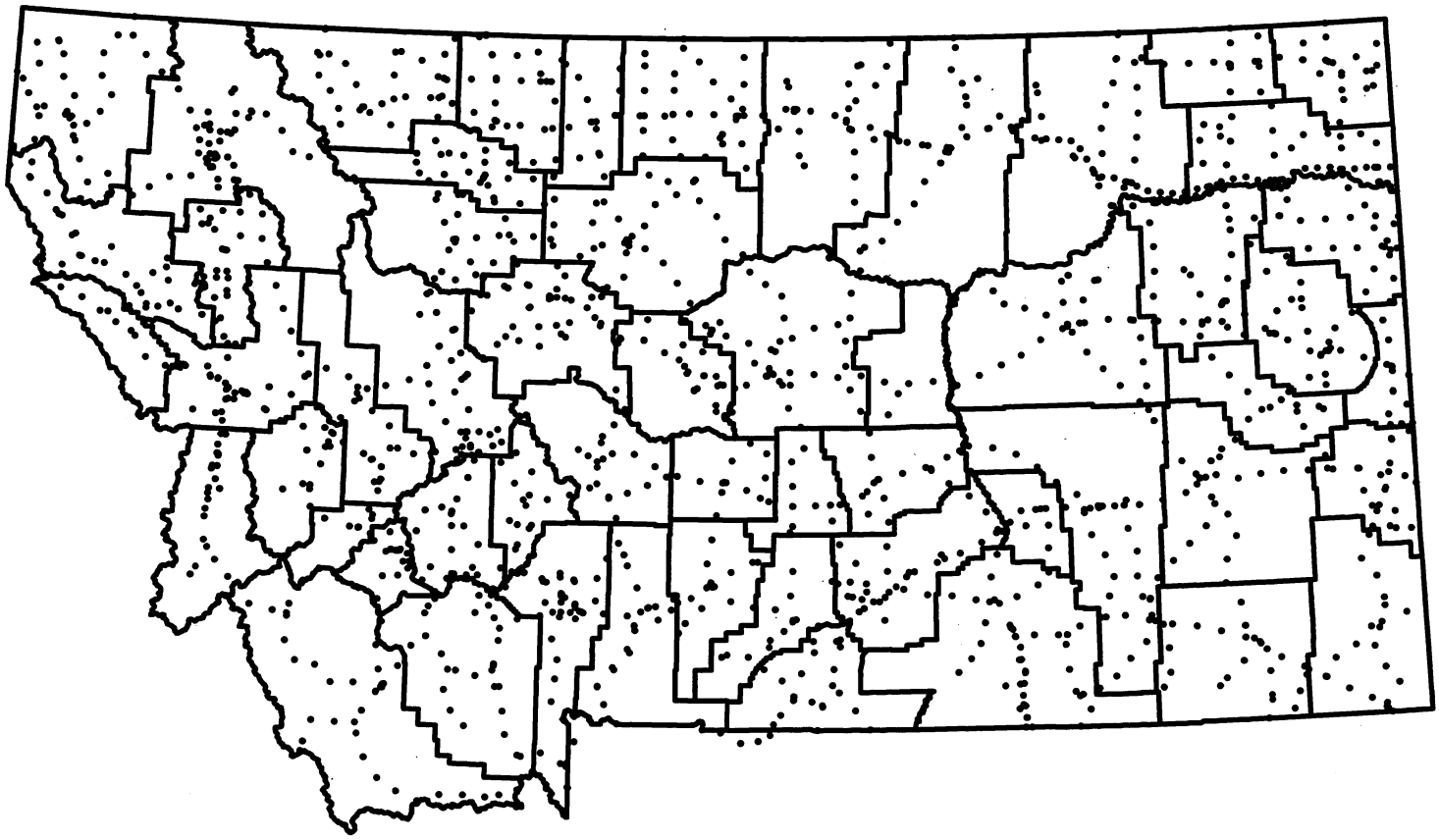
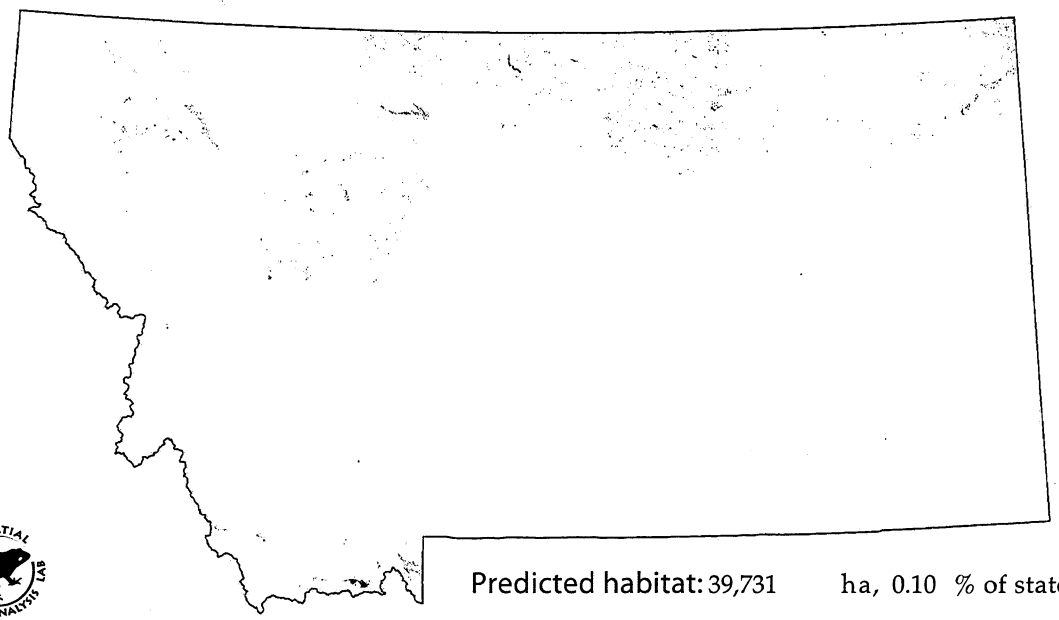


BLACK-CROWNED NIGHT-HERON

Nycticorax nycticorax

State rank	S2S3B,SZN	Element code	ABNGA11010
Global rank	G5	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 39,731 ha, 0.10 % of state.

State range

Fairly widely distributed in migration; more common in e Montana (Montana Bird Distribution Committee 1996). Breed mainly in n/ncen Montana, e of the Continental Divide, and in the extreme sw; does not overwinter in the state (Montana Bird Distribution Committee 1996).

Habitat description

Broad habitat preferences, including freshwater, brackish, and marine situations (Davis 1993). Most frequently nest on islands and margins of marshes/swamps; also margins of streams, rivers, pools, ponds, lakes, lagoons, tidal mudflats, tropical mangroves, salt marshes; man-made ditches, canals, ponds, reservoirs; wet agricultural fields and dry grasslands (Hancock and Kushland 1984, Davis 1993). Nest colonially, commonly in emergent vegetation over water, on islands, or in trees; trees preferred for roosting (Wolford and Boag 1971, Ehrlich et al. 1988, Davis 1993). Inland, colonies usually associated with large wetlands having equal proportions of open water and vegetated habitat (Davis 1993). Use of these wetlands fluctuates accordingly with rainfall conditions/water levels; occasionally may use dry grasslands and may fly up to 24 km to feeding areas (Hancock and Kushlan 1984, Davis 1993). In the Great Plains, commonly nest in bulrush or cattail dominated prairie marshes, or in groves of trees (often cottonwoods) near rivers (Johnsgard 1979, Greenwood 1981). Common throughout ND save areas with few wetlands; breeds in prairie marshes (Lokemoen 1979). In ID, prefer to nest in larger trees (alder), will also use bulrushes, willow (Burleigh 1972). Colony sites free from predators and human disturbance may persist 30-50 years (Davis 1993). Breeding distribution determined by suitable wetland habitat for feeding (aquatic and terrstrial invertebrates, fish, amphibians, reptiles, birds, rodents); breeding range has expanded to irrigated areas and water impoundments (Ehrlich et al. 1988, Davis 1993). Often nest in association with Franklin's Gulls, and may change location of the colony site if these gulls move (Wolford and Boag 1971, Davis 1993). Adequate nest cover, abundant feeding grounds, and security from predators are primary factors in nest/colony site choice (Wolford and Boag 1971, Hancock and Kushlan 1984, Davis 1993). Migration

habitat similar to that of breeding, but centers along coasts and the Mississippi Drainage (Davis 1993). Winter habitat primarily mangrove swamps in tropical areas, and marshes and swamps in FL; secondarily wetland breeding habitats (Davis 1993). Post breeding dispersal may include areas outside of the normal breeding or wintering range (Palmer 1962). Although Blue Listed by the National Audubon Society (1972-81) and listed as threatened or endangered by many states (1970s, 1980s) due to effects of pesticides and habitat loss, most populations stabilized and increasing (Ehrlich et al. 1988, Davis 1993). Trends, however, are difficult to assess because this species is nocturnal/crepuscular in nature and nests are well concealed (Ehrlich et al. 1988, Davis 1993). The Black-crowned Night-Heron is considered an "SI" species in Montana, as breeding ecology is not well known in the state (Montana Bird Distribution Committee 1996).

Model assumptions & caveats

Breeding habitat modeled. Uncommon migrant; does not overwinter. Migration habitat used in MT is similar to that of breeding and is assumed defined within breeding habitat parameters. Lake coverage not consistently accurate/true to mapping scale used. Assumed suitable wetland feeding habitat defined within breeding habitat parameters. Cannot model interspersion/extent of emergent marsh vegetation with open water.

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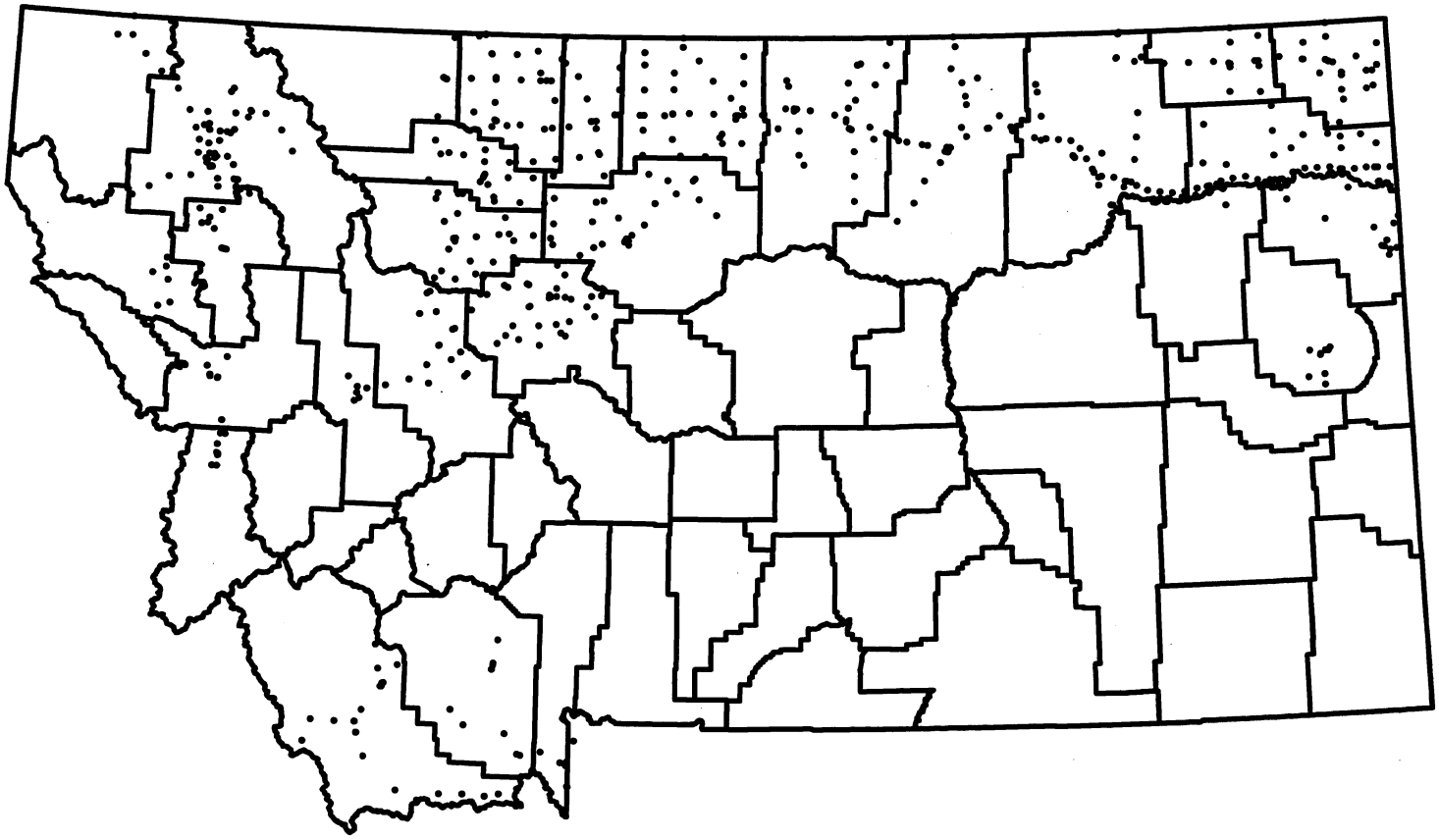
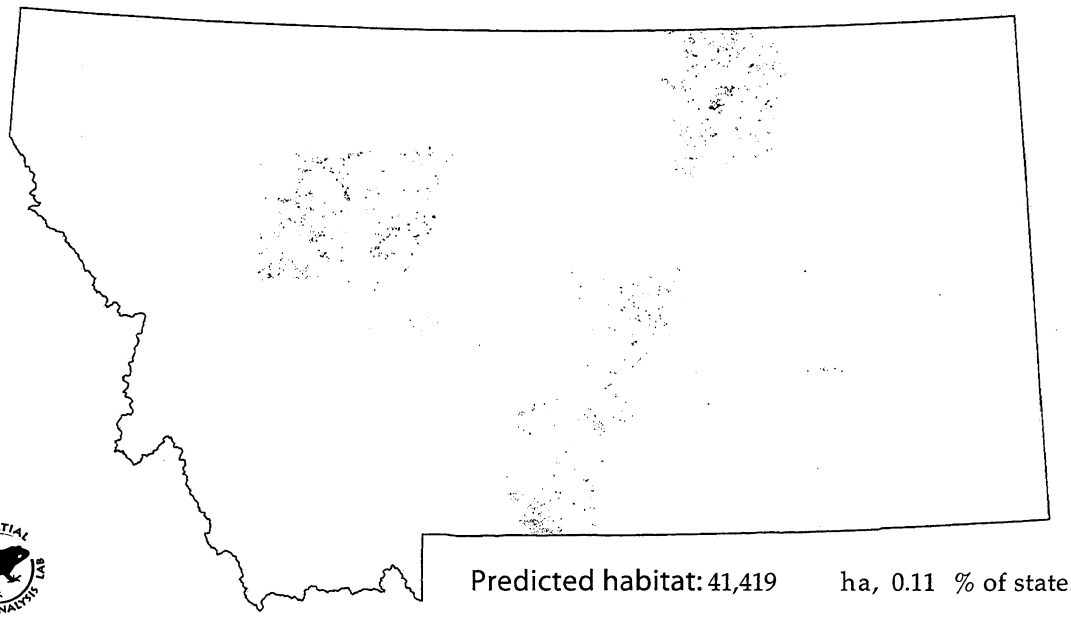


WHITE-FACED IBIS

Plegadis chihi

State rank	S1B,SZN	Element code	ABNGE02020
Global rank	G5	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 41,419 ha, 0.11 % of state.

State range

Widely distributed in migration; transient sightings generally scattered around breeding areas (Montana Bird Distribution Committee 1996). Breeding known in only a few locations including Benton Lake NWR (97 nests located in 1994), Red Rock Lakes NWR, Bowdoin NWR, and Freezout Lake WMA; does not overwinter in the state (S. Martin pers. comm., Montana Bird Distribution Committee 1996).

Habitat description

Typically use freshwater wetlands - marshes, ponds, swamps - with "islands" of emergent vegetation, e.g., cattail, bulrush (Johnsgard 1979, Ehrlich et al. 1988, Ryder and Manry 1994). Nest usually in emergent vegetation or shrubs, bushes, low trees in/or surrounded by shallow water; also on deserted muskrat houses; occasionally dredge spoil banks (Ryder 1967, Johnsgard 1979, Schmidt 1980, Ehrlich et al. 1988, Ryder and Manry 1994). Colonies often associated with Black-crowned Night-Herons, Cattle Egrets, Snowy Egrets, Great Blue Herons, Franklin's Gulls (Johnsgard 1979, Ehrlich et al. 1988, Ryder and Manry 1994); in the Rocky Mountain region and Great Basin area, a common nesting associate is the Cinnamon Teal (Ryder 1967). In ND, UT, and s AK, nest commonly within dense stands of bulrushes and/or cattails in large, shallow wetland complexes, near edges of open water (Ryder 1967, Schmidt 1980, Goosen et al. 1995). Are fairly versatile nesters; nest in emergent rushes or willows - primary breeding requirement is adequate isolation of both nesting colony and night roosting sites (Trost in Clark et la. 1989). Colonies established in CO above 7500ft elevation, and as high as 4300m in Bolivia (Ryder 1967, Ryder and Manry 1994). Food taken is primarily aquatic and moist soil invertebrates, insects, fish, small vertebrates; in breeding and migration season, frequently forage in larger, shallowly flooded wetlands of short emergent vegetation, lake and pond edges, irrigated/flooded alfalfa and small grain fields, and hay meadows (Ryder 1967, Ryder and Manry 1994). Drainage of wetlands, development, and intensive overgrazing destroy nesting habitat; many colonies have disappeared - breeding has not occurred in the once important Central Valley, CA since 1954 (Weller et al. 1958, Ryder 1967, Goosen et al. 1995). Entire colonies may move if breeding habitat conditions deteriorate (Trost in Clark et la. 1989); water diversion from wetlands with traditional

colony sites has caused temporary to permanent abandonment - wetland areas subject to periodic severe drought do not serve as consistent colony sites, since emergent vegetation may take up to two years to recover (Ryder and Manry 1994). Presence of Black-crowned Night-Herons may indicate favorable conditions; managed wetlands provide footholds to populations attempting to pioneer new areas (Goosen et al. 1995). Wetlands with relatively consistent water levels are critical to breeding habitat (Ryder and Manry 1994, Goosen et al. 1995). In ND, is casual migrant and summer resident mainly in the se; also breed in Alberta (Lokemoen 1979). Breeding populations have increased in the Great Basin area and expanded into the Great Plains due to pesticide banning, wildlife refuge management, and increased alfalfa planting (Ryder and Manry 1994). Regardless of population recoveries or range expansions, are sensitive to human disturbance, water level fluctuation, and are still vulnerabel to pesticides and insecticides on both breeding and wintering grounds (Trost in Clark et la. 1989). The White-faced Ibis is considered a 'threatened, endangered, or sensitive' species in MT - breeding is uncommon and MT is at the northern limit of range (Montana Bird Distribution Committee 1996, MNHP-VCA 1996) - and a 'species of management concern' and 'category 2 candidate' for listing as a threatened and endangered species by the USF&WS (for the Great Basin and Region 6) because few consistent breeding sites exist and population status is poorly known (Ryder and Manry 1994). Overall, populations are declining throughout North America (Ryder and Manry 1994).

Model assumptions & caveats

Breeding habitat modeled. Uncommon but fairly regular migrant; does not overwinter. Potential migration habitat used in MT assumed defined within breeding habitat parameters. Hydrography coverage not consistently accurate/true to mapping scale used. Although breeding lakes need not be permanent, water levels should be consistent; persistence of intermittent lakes (seasonal vs. semipermanent, etc.) is unknown therefore not included in model. Cannot model interspersion of cover types (islands of emergent vegetation within open water areas) at mapping scale used. Breeding associate relationships not modeled. Foraging habitats included in breeding habitat parameters, but may diminish relavance of model regarding nesting habitat requirements. Assume complex of wetlands inherent with buffer used in model.

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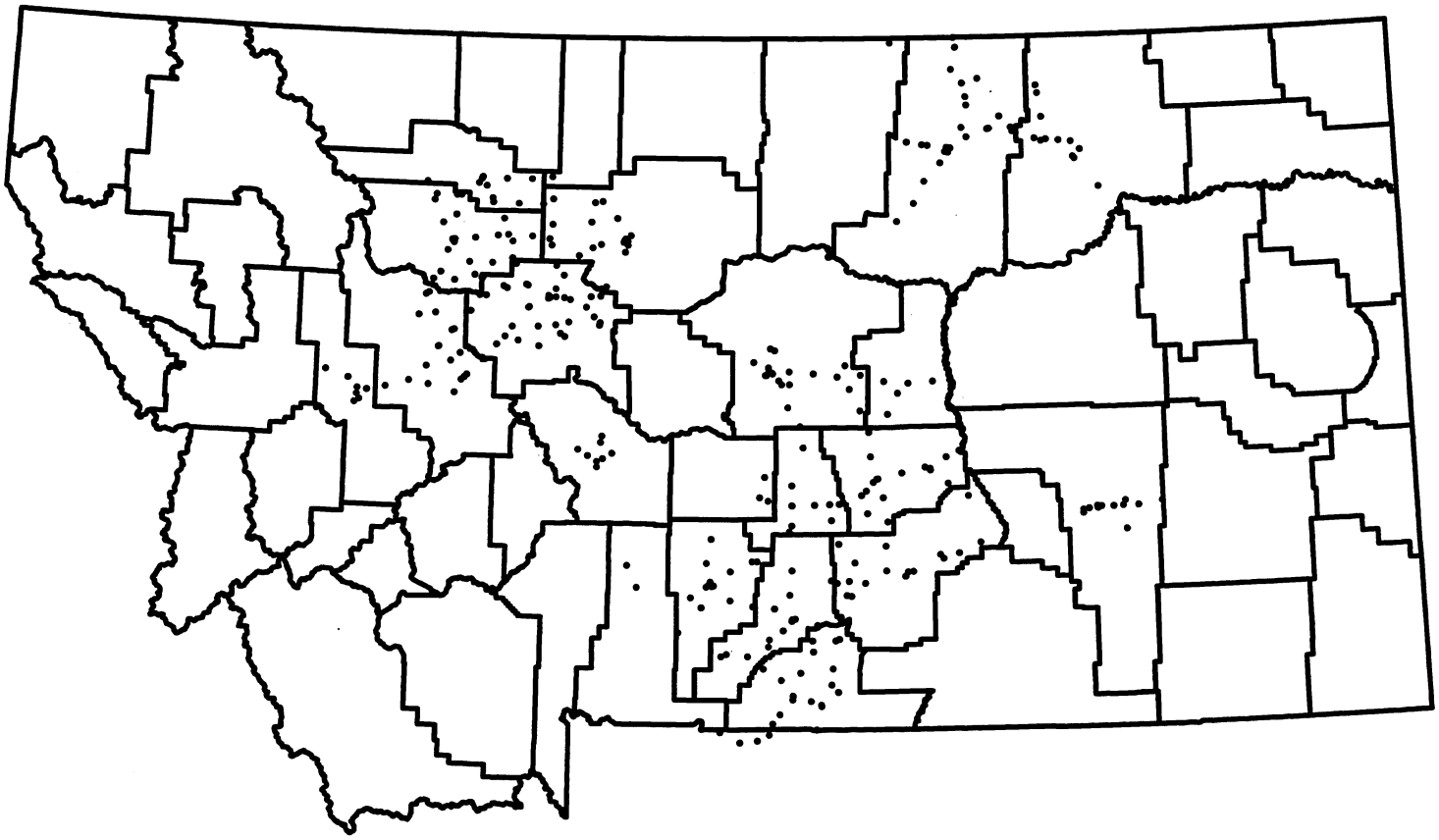
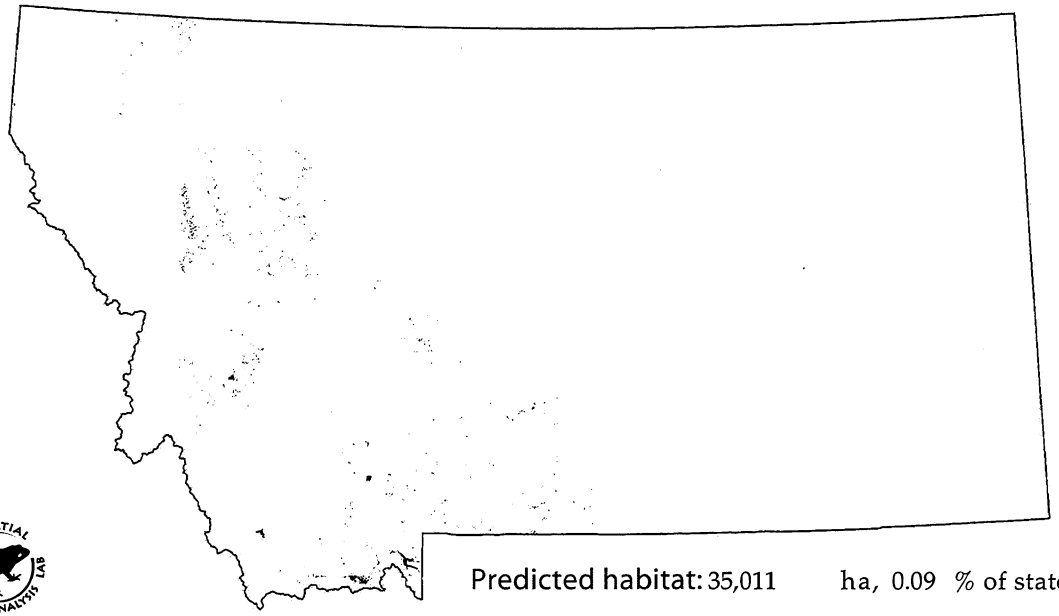


TRUMPETER SWAN

Cygnus buccinator

State rank	S2B,S2N	Element code	ABNJB02030
Global rank	G4	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 35,011 ha, 0.09 % of state.

State range

Isolated populations currently breed along the Continental Divide (Bean Lake) and in the Red Rock Lakes/Greater Yellowstone area, but old records exist for latilongs 2, 11, 15, 26, 28, & 40 (Hand 1969, Montana Bird Distribution Committee 1996,). Migration is mainly through western Montana and the East Front of the Rockies; overwintering occurs primarily within the Greater Yellowstone Ecosystem and in isolated areas in se and w Montana (T. McEneaney pers. comm., Montana Bird Distribution Committee 1996).

Habitat description

Breed on shallow freshwater marshes, ponds, lakes, and slow moving rivers with stable water levels and adequate area for take of, ~100m (Johnsgard 1979, Hampton 1981, Ehrlich et al. 1988, Mitchell 1994). Preferred nesting areas have abundant and diverse submerged aquatic vegetation for food, dense stands of emergent vegetation for cover, highly irregular shorelines, water depths <1.2m, nest site structures such as muskrat houses or sedge islands, and are protected from human disturbance (Johnsgard, 1979, Ehrlich et al. 1988, Mitchell 1994). Subsist on aquatic vegetation; cygnets feed primarily on insects, other invertebrates, and aquatic vegetation; secluded breeding habitats with abundant invertebrate populations and aquatic plants promote high productivity (Page 1976, Shea 1979, Hampton 1981, Gale et al. 1987, Mitchell 1994). On the Canadian prairie, prefer aspen parkland/pothole habitat, but breeding extends into boreal forest regions (Palmer 1962, Gale et al. 1987). Although the entire state of MT was once part of former breeding range, the Yellowstone/Centennial Valley region of nw WY and sw MT is now the most important breeding area in the contiguous U.S. (Palmer 1962, Bellrose 1978, Gale et al. 1987). Two remnant breeding populations are rare but permanent residents in the area: The Rocky Mountain population, which breeds along the Rocky Mountain corridor; the Tristate population, which breeds in the Red Rock Lakes/Centennial Valley area and includes scattered pairs breeding throughout the e ID/nw WY/YNP area (Johnsgard 1986, Gale et al. 1987). Nesting territories in these areas occurs between 1770-2515m elevation (Shea

1979), and include interconnected, shallow lakes and marshes, extensive wetlands, oxbow/pothole habitat adjacent to rivers, isolated ponds (0.4-14ha) surrounded by rangeland, braided river complexes in forest and sagebrush habitat, and areas of widely scattered ponds and lakes, 1.2-110.8ha in size (Shea 1979, Gale et al. 1987). Nests found very commonly on muskrat houses; also on hummocks, floating bogs, islands, abandoned beaver lodges (Page 1976, Shea 1979, Gale et al. 1987). At higher elevations, select lakes more isolated from human activity; at lower elevations, prefer water areas with stands of emergent vegetation for cover and as a buffer from human disturbance (Gale et al. 1987). Critical to breeding habitat: quiet waters with a highly irregular shoreline, shallow areas for foraging, stable permanent water levels, and isolation from human perturbations (Page 1976, Shea 1979, Hampton 1981, Gale et al. 1987, Mitchell 1994). In migration also use larger rivers and brackish estuaries, larger lakes and reservoirs as staging/foraging areas; in winter also use larger, open lakes, sheltered bays, estuaries (Palmer 1962, Mitchell 1994, MNHP-VCA 1996). In MT, winter habitat consists of larger areas of open, ice free water with adequate aquatic vegetation, sand/gravel areas for loafing, little shrub cover, and little human disturbance (Gale et al. 1987, Mitchell 1994). The geothermal activity of the YNP region keeps water open in subzero temperatures, however, aquatic vegetation that is available in winter is an inadequate food source (Gale et al. 1987). Supplemental grain sustains the resident population throughout the winter, but discourages normal migration patterns - seasonal movements of this population are limited to local flights between breeding and wintering areas (Gale et al. 1987, Palmer 1962). Future Trumpeter Swan management includes cessation of this feeding program, however, making both migration and winter habitat even more critical (A.Perkins, pers. comm.). Breeding range once extended across most of North America, but commercial and sport hunting, and habitat destruction in the 1920s-1930s pushed the Trumpeter Swan to near extinction, and eliminated it from most of its historic range (Ehrlich et al. 1988, Gale in Clark et al. 1989). Yellowstone and Centennial Valley populations have shown past declines; the Trumpter Swan is considered a threatened, endangered, or sensitive species in MT and is a sensitive species of concern in WY (Gale in Clark et al. 1989, Montana Bird Distribution Committee 1996)

Model assumptions & caveats

Breeding habitat modeled. Uncommon but regular migrant; local year round resident movements limited, hence most suitable winter/migration habitat assumed defined within breeding habitat parameters. Hydrography coverage not consistently accurate/true to mapping scale used. Water body size restrictions local, only minimum size limit included in model. Elevation limits specified in literature lowered to include known breeding lake (Bean Lake), therefore suitable predicted habitat will increase. River flow ('slow') and braiding information/coverage not available, therefore river habitat likely overestimated. Cannot model water body morphology (irregular shoreline) at mapping scale used. Water depth information not available. Principal food source, submerged aquatic vegetation not mapped. Cannot model nest site structures (muskrat houses, sedge islands) at mapping scale used. Potential for human disturbance information not available; cannot model potential human access at mapping scale used. Suitable breeding habitat is overestimated.

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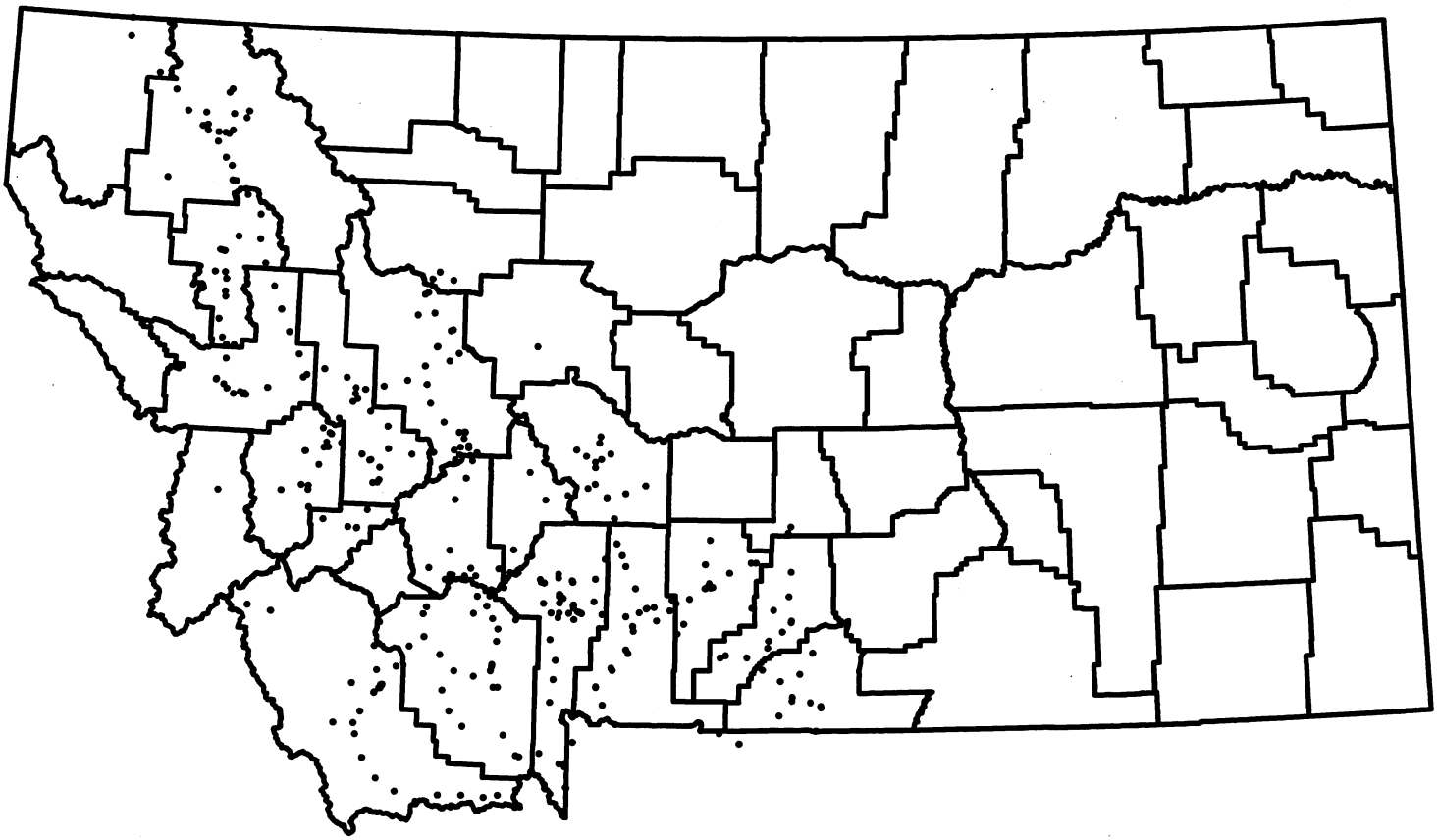
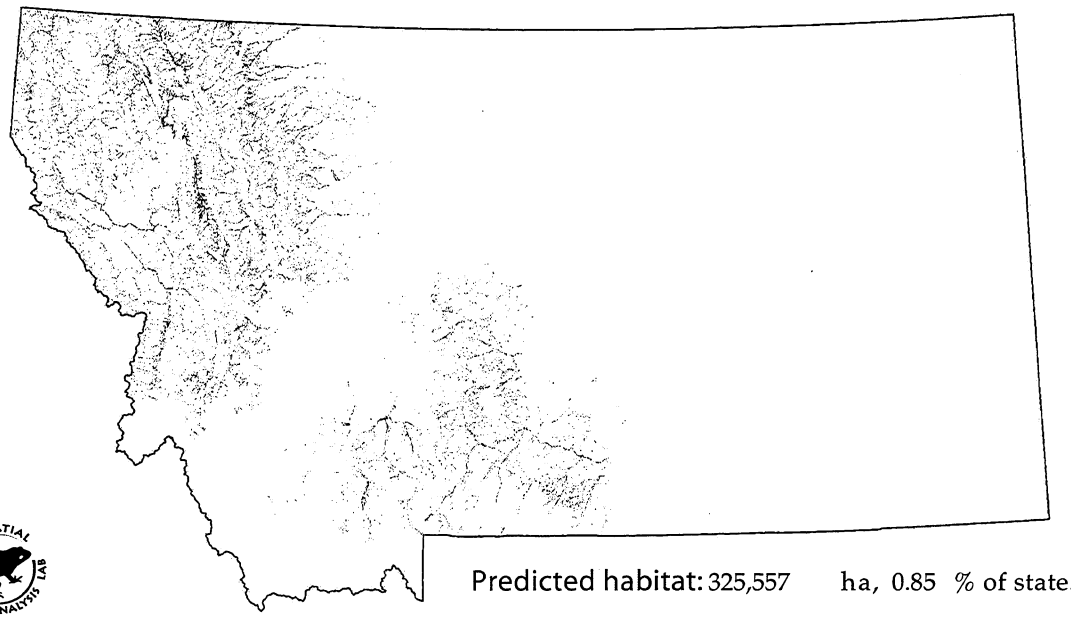


HARLEQUIN DUCK

Histrionicus histrionicus

State rank	S2B,SZN	Element code	ABNJB15010
Global rank	G4	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 325,557 ha, 0.85 % of state.

State range

Breed very locally on mountain streams in western Montana (Reichel and Genter 1995, Montana Bird Distribution Committee 1996). Occupied streams primarily tributaries of the Kootenai River, Flathead River, lower Clark Fork River, and upper Blackfoot River; and streams along the Rocky Mountain Front and in the mountains along the northern border of Yellowstone National Park (Reichel and Genter 1995). Transient sightings are rare; overwintering verified in latilong 26 only (Montana Bird Distribution Committee 1996).

Habitat description

Primarily a boreal and subarctic breeder; western breeding population center is in AK and B.C. (Bellrose 1978, Palmer 1962). Use riparian habitats for feeding, nesting, cover; breed near swiftly flowing, clear, forested or well vegetated, undisturbed mountain streams; occasionally on open tundra (Cassirer et al. 1996, Ehrlich et al. 1988, Johnsgard 1975). Adults and broods sited in areas 600m-2000+m elevation (Genter 1992, Cassirer et al. 1991). In the Rocky Mountain area, breeding streams fall into two subprovinces: the n Columbia Basin (nw MT incl. GNP, Rocky Mountain Front, n ID), and the Intermountain Province (ID, sw MT, WY incl. GYE) (Cassirer et al. 1996). Rocky Mountain breeding habitat requirements are fairly rigid: stream size >= second order; 1%-7% stream gradient with shallow riffle areas; clear water; gravel to boulder sized rocky substrate; forested stream bank vegetation; hiding cover along streams (dense shrub vegetation, undercut banks, logjams, etc.); absence of human access (roads, trails) and disturbance (Cassirer et al. 1996). In WY, occupy stream sections with bank shrub vegetation, gradients <= 2 degrees, >3 loafing sites per 10m, and braided channels (Wallen 1992). In ID use streams >=3m wide with flow velocities > 1m/sec, gravel substrates, and undisturbed forest along stream banks (Cassirer and Groves 1992). In n ID, occupy streams 600-1200m in elevation with associated riparian habitat dominated by Western Red Cedar or Western Hemlock; in se ID use streams 1770-1890m in elevation with riparian habitat dominated by shrubs and overstory of Douglas-fir (Cassirer et al. 1991). On the Rocky Mountain Front, favor streams 6-10m wide with cobble

substrate, in v-shaped valleys of Lodgepole Pine and Engelmann Spruce stands (Diamond and Finnegan 1992). In nw WA, however, timber stand characteristics are apparently not a factor in habitat use - stream morphology the primary factor in breeding habitat selection (Schirato and Sharpe 1992). Few nest sites have been described for the Pacific population (Cassirer et al. 1993). Nests found within 5m of streams in a variety of locations: on rocks/rock crevices; on the ground in dense vegetation cover; in mossy cliff crevices; in piles of woody debris; in undercut stream banks; in hollow tree cavities near tree base and as high as 1.8m (Cassirer et al. 1996, Cassirer et al. 1993). Brood rearing areas initially in ponds and slow meanders of streams, shifting to slower current areas, then swift water as broods mature (Kuchel 1977). Subsist primarily on aquatic insects and larvae, crustaceans, mollusks (Ehrlich et al. 1988, Bellrose 1978). Migration routes to inland breeding areas are likely along river corridors and ascending tributaries, with intermittent overland flights (Cassirer et al. 1996, Kuchel 1977). Winter almost exclusively on turbulant, rocky coastal waters, 1-2 fathoms deep (A.O.U. 1983, Palmer 1962). Productivity appears limited by human activities/developments in breeding areas, consequently, breeding is habitat restricted to remote, pristine areas of swiftly flowing streams with forested stream banks and calmer oxbow areas (Cassirer and Groves 1992, Kuchel 1977). Breeding populations in Grand Teton National Park and Jasper National Park are declining due to increases in human disturbance in/near breeding areas (Clarkston 1992, Wallen 1992). Stream food supply, high spring runoff, and winter/migration circumstances also limit population size and productivity (Cassirer et al. 1996, Cassirer and Groves 1992). The Harlequin Duck is classified as a C2 candidate for threatened and endangered status in the U.S., and is considered a USFS sensitive species in Regions 1 and 4 (Cassirer et al. 1996, Cassirer et al. 1991).

Model assumptions & caveats

Breeding habitat modeled. Rare migrant, very rare winter resident; potenital nonbreeding habitat available in Montana assumed defined within breeding habitat parameters. Hydrography may not be consistently accurate and/or true to mapping scale used. Stream morphology attributes - flow rate, clarity, order number, gradient, substrate characteristics - not available to include in model. Stream bank morphology and potential for human disturbance/access information not available to include in model. Suitable breeding habitat is overestimated.

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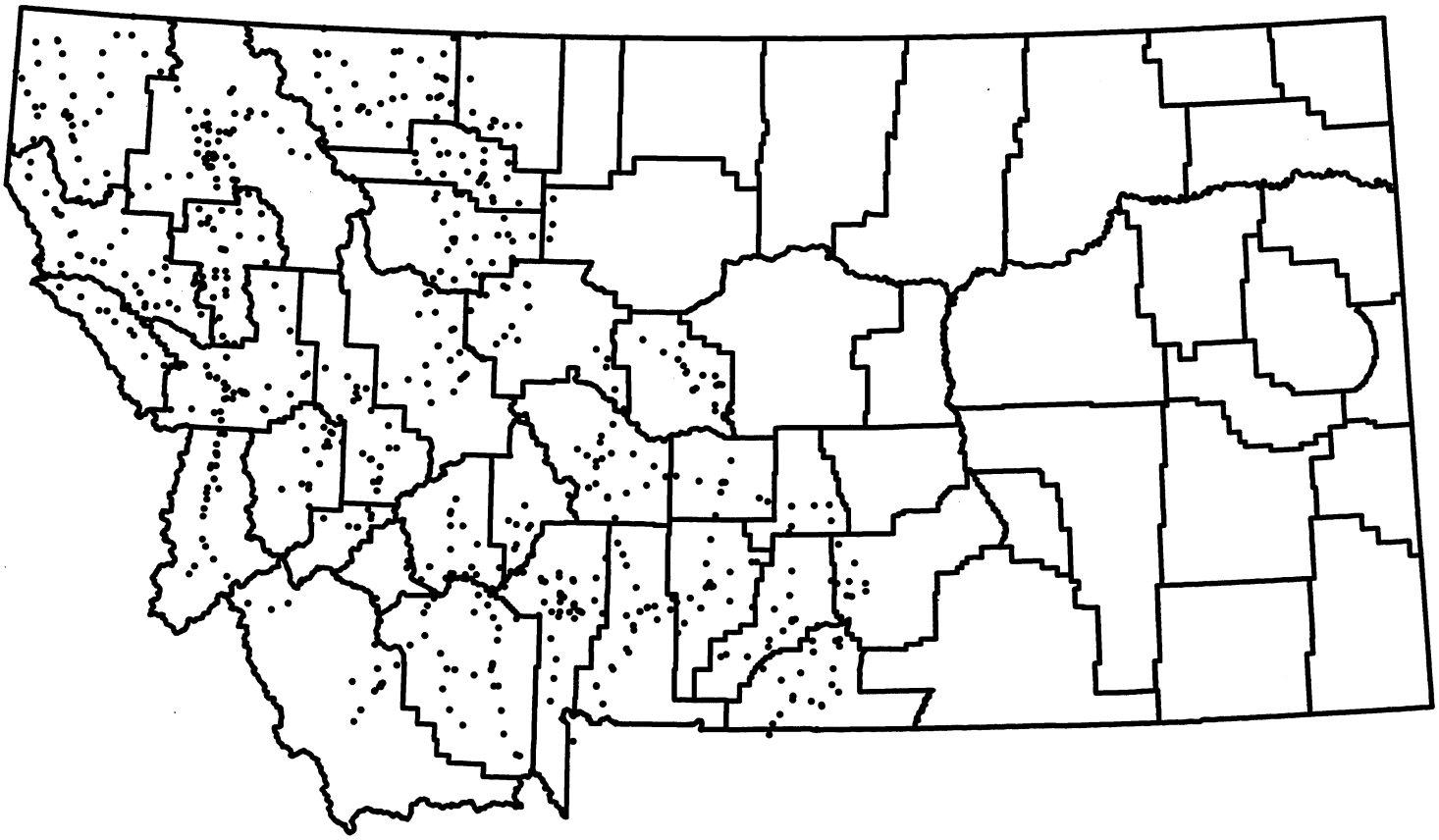
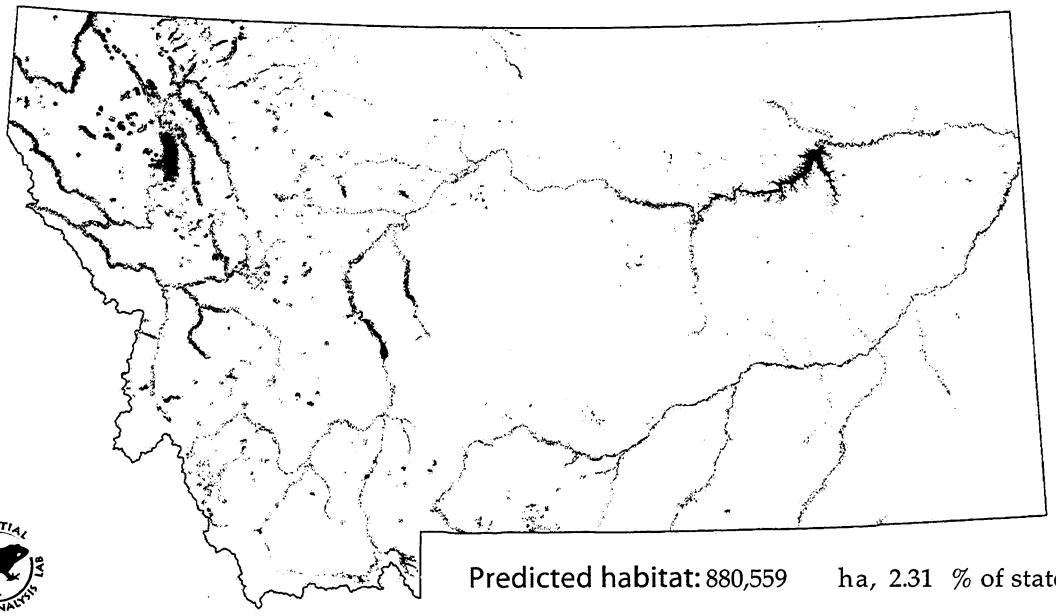


BALD EAGLE

Haliaeetus leucocephalus

State rank	S3B,S3N	Element code	ABNKC10010
Global rank	G4	Modeled by	C. Tobalske, W. Williams
MTNHP status	special concern		



Predicted habitat: 880,559 ha, 2.31 % of state.

State range

Breeds and winters widely throughout Montana (Montana Bird Distribution Committee 1996). Nests mostly in the western and central part of the state, especially along the Clark Fork River and tributaries; also on the Missouri River below Ft. Benton and the Greater Yellowstone area — range expansion is accelerating in eastern Montana (Bureau of Land Management 1986, T. McEneaney pers. comm.).

Habitat description

From Montana Bald Eagle Working Group (1991): In general, Bald Eagles prefer solitude, late-successional forests, and shoreline adjacent to open water; proximity of a large prey base and the presence of large, mature trees for nesting are important habitat components. Medium and high habitat quality are characterized by cottonwood, Douglas-fir, Ponderosa Pine or mixed conifer stands of 20 acres minimum, with low to moderate canopy closure, a slope less than 40%, a water body within 1 mile, and no southerly aspect. There should be more than two suitable nest trees, and more than three perch trees, in the stand. Because young are particularly vulnerable to food deprivation, an adequte prey base within the home range is essential (Stalmaster et al. 1985 in Montana Bald Eagle Working Group 1991). Feeding habitat should be greater than 80 acres with shallows, and present some grasslands and meadows. Distance to human activities should be greater than 0.25 miles, and less than 10% of the shoreline should be developed.

In the Greater Yellowstone Ecosystem, breed in riparian or lacustrine habitats, selecting older, larger trees for nesting that are usually within 1.5 km of a river or lake shore; occasionally forage in upland areas (Harmata in Clark et al. 1989). Outside of the breeding season population densities and distributions vary depending on adequate food supply and roosting sites (Johnsgard 1990). Roosting sites are well protected from wind and are usually in the tallest, dominant trees in a stand — in Glacier National Park preferred roost sites were in old growth stands of Western Larch (Crenshaw 1985). Bald Eagles are sensitive to human disturbance and may abandon nest sites or territories depending on its intensity (Montana Bald Eagle Working Group 1991).

Model assumptions & caveats

Hydrography coverage may not be consistently accurate/true to mapping scale used. Focus of model on suitable breeding habitat, however most nonbreeding habitat also defined within breeding habitat parameters. Slope not included in model — if included would diminish availability of wind protected roosting sites within cover types selected; assume suitable, level (<40% slope) nest sites present within hydrography buffer around major rivers/lakes. Human disturbance, prey base and water turbidity information not available to include in model — breeding habitat therefore likely overestimated, as high disturbance and marginal foraging habitat are defined within breeding habitat parameters.

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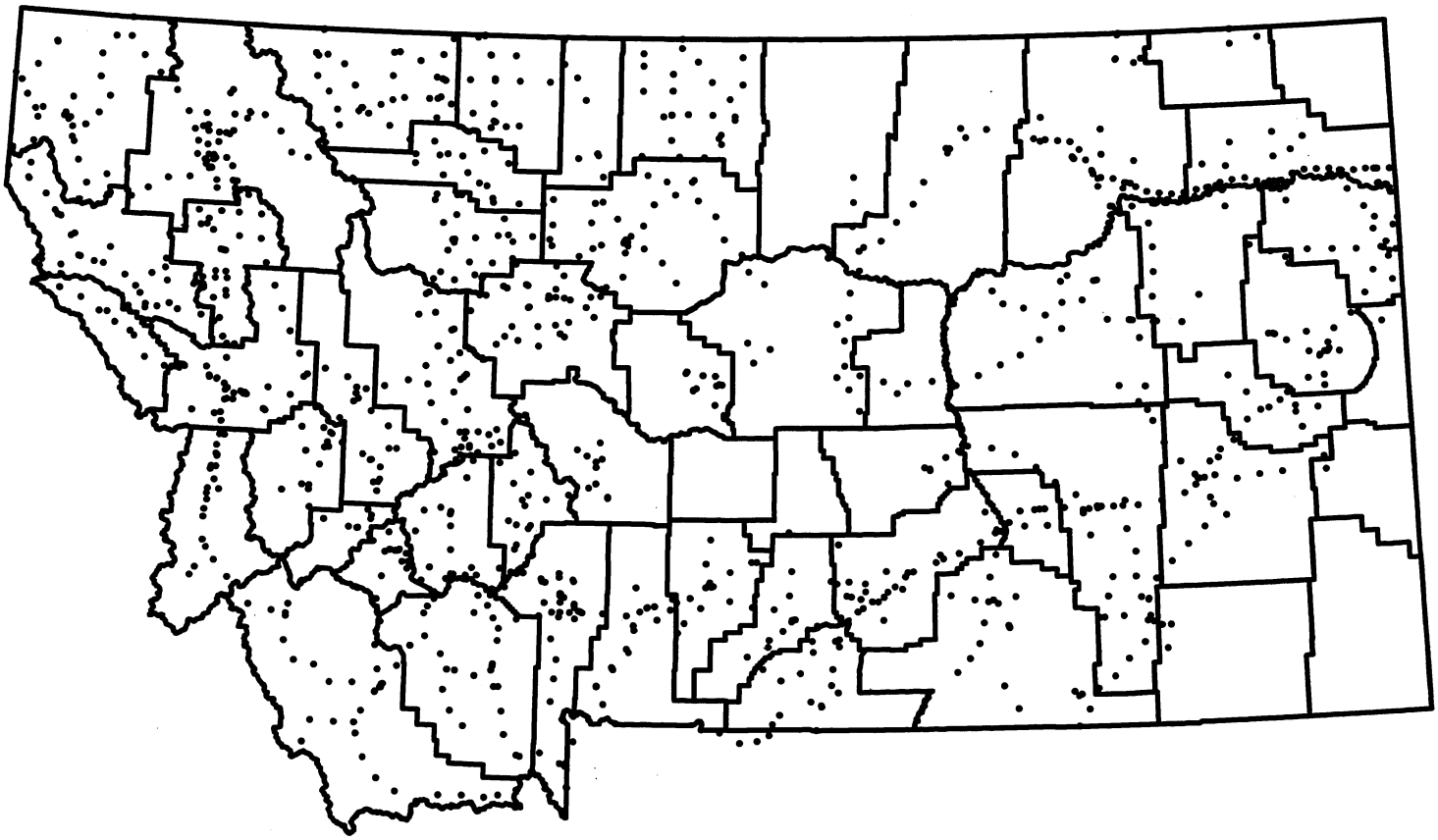
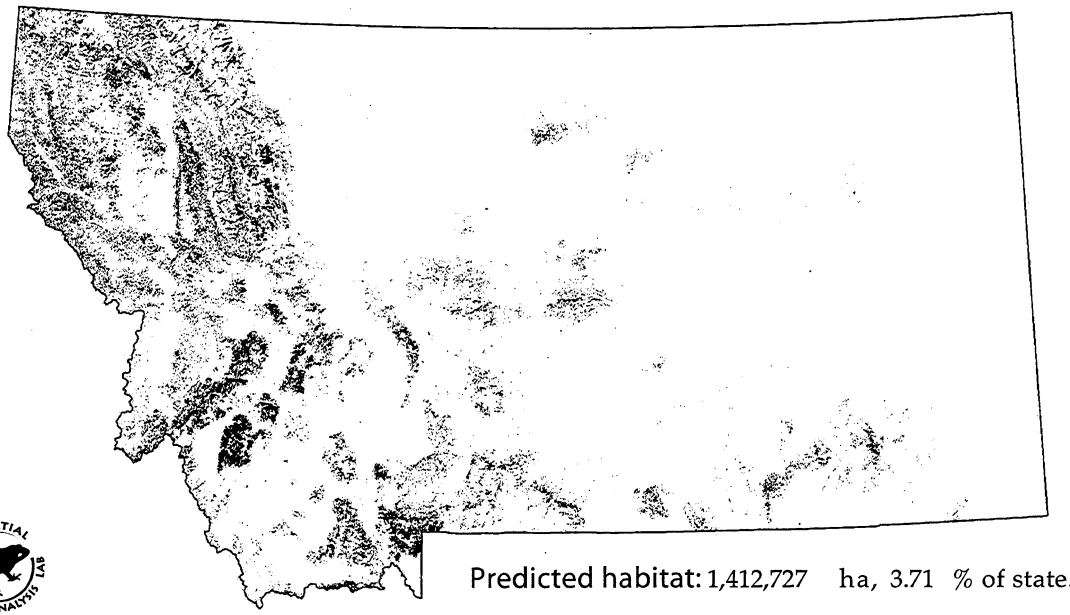


NORTHERN GOSHAWK

Accipiter gentilis

State rank	S3S4	Element code	ABNKC12060
Global rank	G5	Modeled by	C. Tobalske, W. Williams
MTNHP status	special concern		



Predicted habitat: 1,412,727 ha, 3.71 % of state.

State range

Breeds in mountainous or coniferous regions of the state (primarily in the west) and occasionally winters in the lower valleys of western Montana (Montana Bird Distribution Committee 1996, T. McEneaney pers. comm.).

Habitat description

A raptor usually found in mature, dense stands of mixed or pure forests, 50-100 m from a clearing, often with a permanent or temporary stream or lake nearby (Jones 1979). On the Kaibab Plateau, preferred nesting habitat consists of closed stands of Ponderosa Pine and mixed conifers (canopy closure > 80%), with most nests located on northern aspects; proximity to water important only in more open stands (Crocker-Bedford and Chaney 1988). In Wyoming, often nests in old-growth and mature forests, such as closed Lodgepole Pine and lodgepole-aspen forests composed of large, mature trees (Squires and Ruggiero 1996). In Oregon, nests are located in Douglas-fir, White, Ponderosa and Lodgepole Pines, and mixed conifer stands; prefer mature or old-growth stands on gentle slopes and northern aspects within 600m of water (Reynolds et al. 1982, Moore and Henny 1983). In the Inyo National Forest (California), criteria for primary habitat include: Red Fir, Lodgepole Pine, aspen, or mixed conifer stands; dbh > 61 cm, canopy closure > 40%, slope 0-20%, stand size 20-50 ha, and distance to water < 0.4 km (McCarthy et al. 1987). In Montana, typical nesting habitat consists of mature/overmature coniferous forests with a closed canopy (75-85%) on moderate (15-35%), north-facing slopes, with water or a large clearing within 500 m of the nest — in drier areas, nests can be found in even-aged stands if the canopy is closed (Hayward and Escano 1989, Whitford 1991, Hendricks and Dueholm 1995). A wide variety of habitats are used during the winter in Montana, particularly grass-shrub-steppe habitats which host upland gamebird prey (D. Casey pers. comm.). Data on abundance of breeding Northern Goshawks in the U.S. indicate highly variable densities, both spatially and temporally, but reportedly numbers are stable with no evidence to suggest range contraction (Kennedy 1997).

Model assumptions & caveats

Distance to water not included in model; hydro type (river, lake, etc.) not specified and water not clearly defined as breeding habitat requirement. Interspersion of forest and clearings could not be resolved and included at mapping scale used. High canopy closure was selected in attempt to also select for more mature stands — stand age information not available at mapping scale used.

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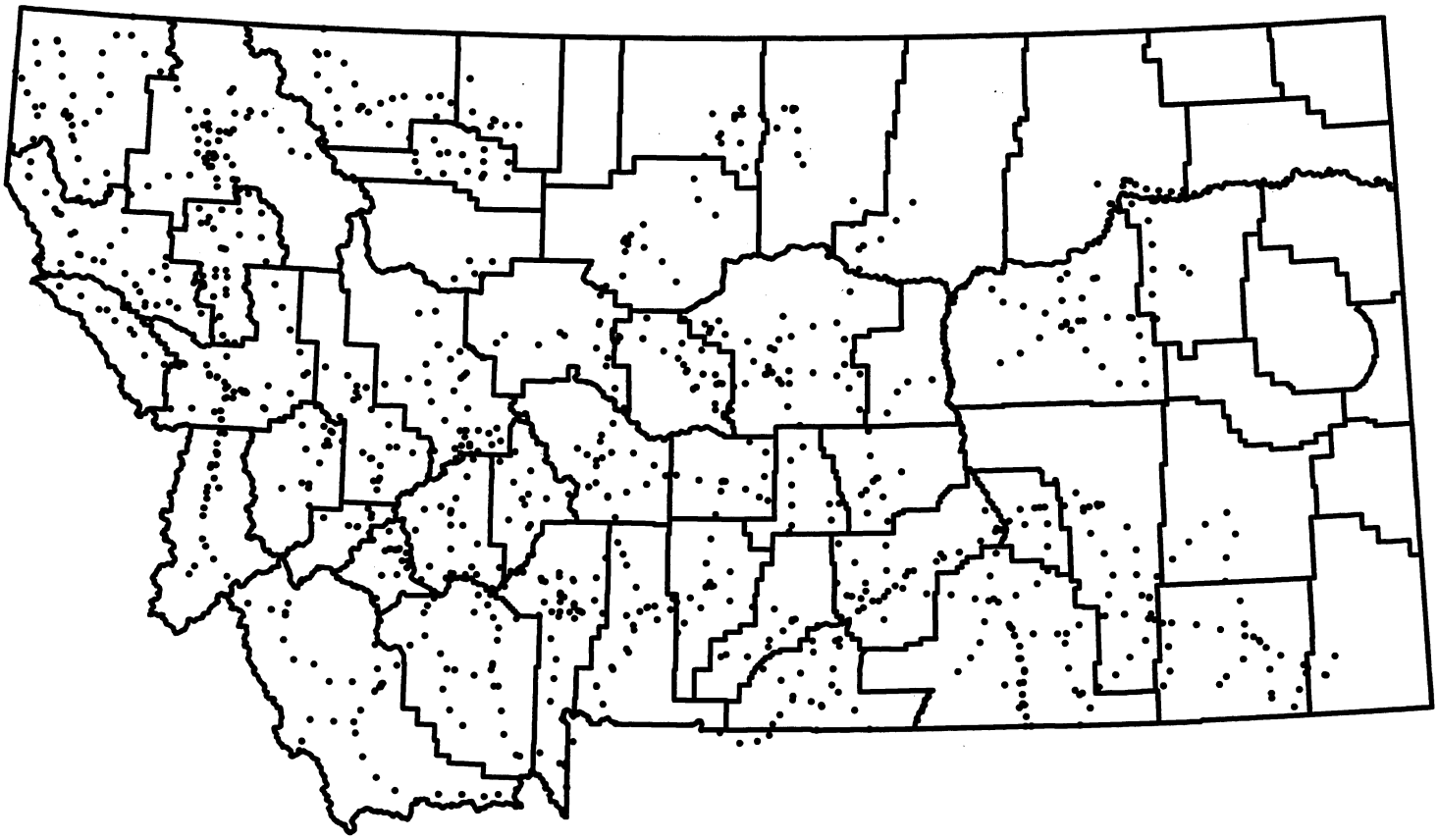
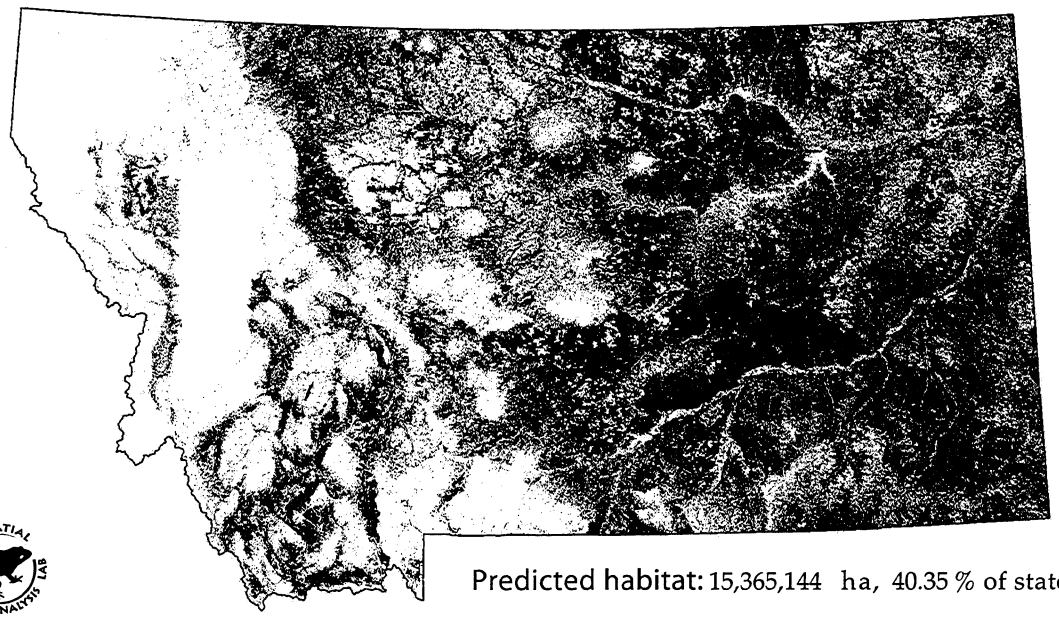


FERRUGINOUS HAWK

Buteo regalis

State rank	S3B,SZN	Element code	ABNKC19120
Global rank	G4	Modeled by	C. Tobalske, W. Williams
MTNHP status	special concern		



Predicted habitat: 15,365,144 ha, 40.35 % of state.

State range

Breed east (and very rarely west) of the Continental Divide (Montana Bird Distribution Committee 1996); highest numbers in southwestern (Atkinson 1992) and southeastern Montana (Ensign 1983). Sighted throughout the state during migration (Montana Bird Distribution Committee 1996).

Habitat description

A species found in undisturbed, western plains or shrub-steppe regions; in relatively unbroken terrain with scattered trees, rock outcrops, tall trees along creek bottoms (Evans 1982, Restani in Clark et al. 1989). Breed in grassland and sagebrush habitats, saltbush-greasewood shrublands, and forest edges, particularly western pinyon-juniper — avoids high elevations, heavily wooded areas/interiors, narrow canyons, and extensive agricultural lands (Snow 1974, Jasikoff 1982, Olendorff 1993, Bechard and Schmutz 1995). Prefer to nest in isolated trees and small groves of trees in grassland/shrubsteppe areas, sparse riparian forests, and broken bluffs, buttes, cliffs and rock outcrops in canyon/badland habitats (several studies in Bechard and Schmutz 1995). Several studies have described nest sites in Montana: in the southeast (Carter County), most nests were found on the ground (Wittenhagen 1992); in the Centennial Valley (south central), most nests were in willows along streams (Restani in Clark et al. 1989); in southwestern Montana, Atkinson (1992) located 50 nests upon rocky outcrops, on southern aspects; habitat within 100 m of the nests consisted of grasslands and shrublands (sagebrush steppe, foothill prairie, mountain mahogany associations); within 1600 m grassland was the dominant cover type. Other nest sites include trees, buttes, hay stacks, power poles, and other manmade structures (Hendricks and Dueholm 1995); elevated nest sites are strongly favored (Bechard and Schmutz 1995). Primary prey taken are rabbits, ground squirrels, prairie dogs; in many areas nesting pair densities are correlated with ground squirrel or jackrabbit abundance (Bechard and Schmutz 1995, Hendricks and Dueholm 1995). Winter in open terrain/grasslands, where prey is abundant — commonly around prairie dog towns; also near cultivated fields with pocket gophers (Olendorff 1993, Bechard and Schmutz 1995). Widescale conversion of native prairie into agricultural lands greatly diminished breeding habitat in North Dakota and Manitoba (Stewart 1975, Salt and Salt 1976). Currently,

numbers have increased in North Dakota, South Dakota, Montana, Alberta and Manitoba; populations reportedly stable in these areas (Olendorff 1993, Dobkin 1994), however, human disturbance, overgrazing (esp. in riparian areas), and continued agricultural activities threaten local breeding populations (Restani in Clark et al. 1989).

Model assumptions & caveats

Use of elevation in model not appropriate due to profound differences in habitats with latitide and elevation across the state — slope (≤ 20%) was used in attempt to filter out higher, more mountainous terrain. Versitile nester — assume suitable nest site defined within breeding habitat parameters. Interspersion of forested with grassland cover types could not be resolved at mapping scale used; suitable habitat for this fairly restricted breeder is likely overestimated.

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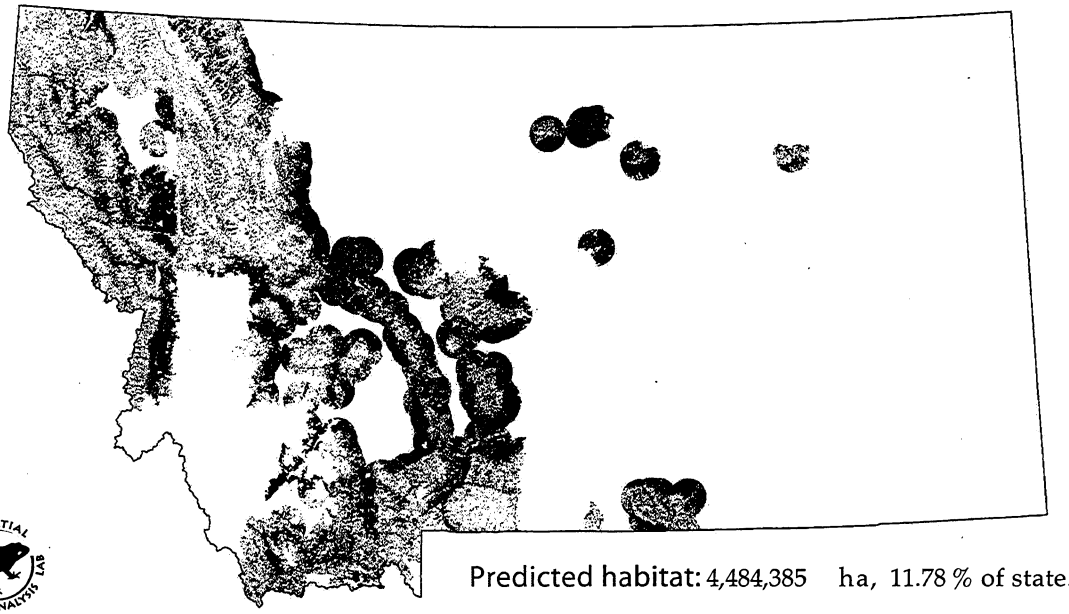
PEREGRINE FALCON

Falco peregrinus

State rank	S1S2B,SZN	Element code	ABNKD06070
Global rank	G4	Modeled by	C. Tobalske, W. Williams
MTNHP status	special concern		



Predicted habitat: 4,484,385 ha, 11.78 % of state.

State range

Breeding scattered widely but rare and localized in Montana; wintering also widespread throughout the state (Bergeron et al. 1992, Montana Bird Distribution Committee 1996).

Habitat description

A bird typically associated with water and tall cliffs; found in diverse, open country on every continent except Antarctica (Evans 1982, Johnsgard 1990). Peregrines nest almost exclusively in high cliffs, favoring those which are near to or overlooking water (Snow 1972, Hendricks and Dueholm 1995). In Utah, all nests found were within 1 mile from water and in cliffs at least 45 m tall; densely forested areas apparently avoided (Herman and Willard 1978). In the Greater Yellowstone Ecosystem, river gorges and mountain cliffs are typical nest sites — cliffs are at least 60 m tall (Langelier in Clark et al. 1986). Eyries are usually located below 9500', within 1 mile from water and within 10 miles of hunting habitat: wetland and riparian areas, meadows and parklands, croplands, gorges, mountain valleys, and lakes (U.S. Fish and Wildlife Service 1984). In the Rocky Mountains, most eyries are located near Ponderosa Pine forests or pinyon-juniper woodlands (U.S. Fish and Wildlife Service 1984). Preferred nest locations are in undisturbed areas with a wide view, near water and abundant prey; acceptability of a nesting cliff, however, is a complex combination of factors, including availablility and demand for nest sites, geological characteristics of the cliff, changing environmental conditions, increasing human disturbance, changes in prey density, individual behavioral variations, and longer term population shifts (Snow 1972). The diet consists primarily of small birds; hunting has been documented as far as 18 mi from nest sites, although a 10-mile hunting radius is more common (Langelier in Clark et al. 1986). Chlorinated hydrocarbon use contributed to dramatic past population declines; by 1970 breeding Peregrine Falcons were extirpated from the northern Rocky Mountain states (Langelier in Clark et al. 1986). Reintroduction efforts have been successful; in Montana numbers of breeding pairs increased from 1 in 1984 to 23 in 1997 — from inception of reintroduction efforts in Montana, 546 birds have been released into the wild from hack sites (T.

McEneaney pers. comm.). Subspecies breeding in the state is *F. p. anatum* — extent of migratory behavior is apparently within the interior U.S.; in the more northerly latitudes *anatum* will move southward if winter prey supply is inadequte (Snow 1972, MNHP-VCA 1996). Migratory behavior is largely restricted to*F. p. tundrius* populations, likely the widespread migrant in Montana (Snow 1972, MNHP-VCA 1996).

Model assumptions & caveats

Cliff cover type could not be resolved at mapping scale used — attempted to model potential cliff habitat by intersecting cover type classified as rock with slope greater than or equal to 40%. Potential cliff areas were then buffered by 10 miles (typical hunting radius from nest sites), and foraging cover types selected within the buffer. Assume suitable nesting and foraging habitats (water, Ponderosa Pine stands, etc.), are defined within these breeding habitat parameters. Although water is important component of breeding habitat, cliff sites were considered more limiting; buffering major water courses would have resulted in gross overestimation of habitat. Nest location records not currently available to include in model. Model focus was conservative but in current form likely overestimates suitable breeding habitat in known breeding areas, as local cliff geology/morphology and human disturbance information is not available. Suitable habitat in isolated, historical breeding areas in northeast Montana is not represented in current predicted habitat distribution.

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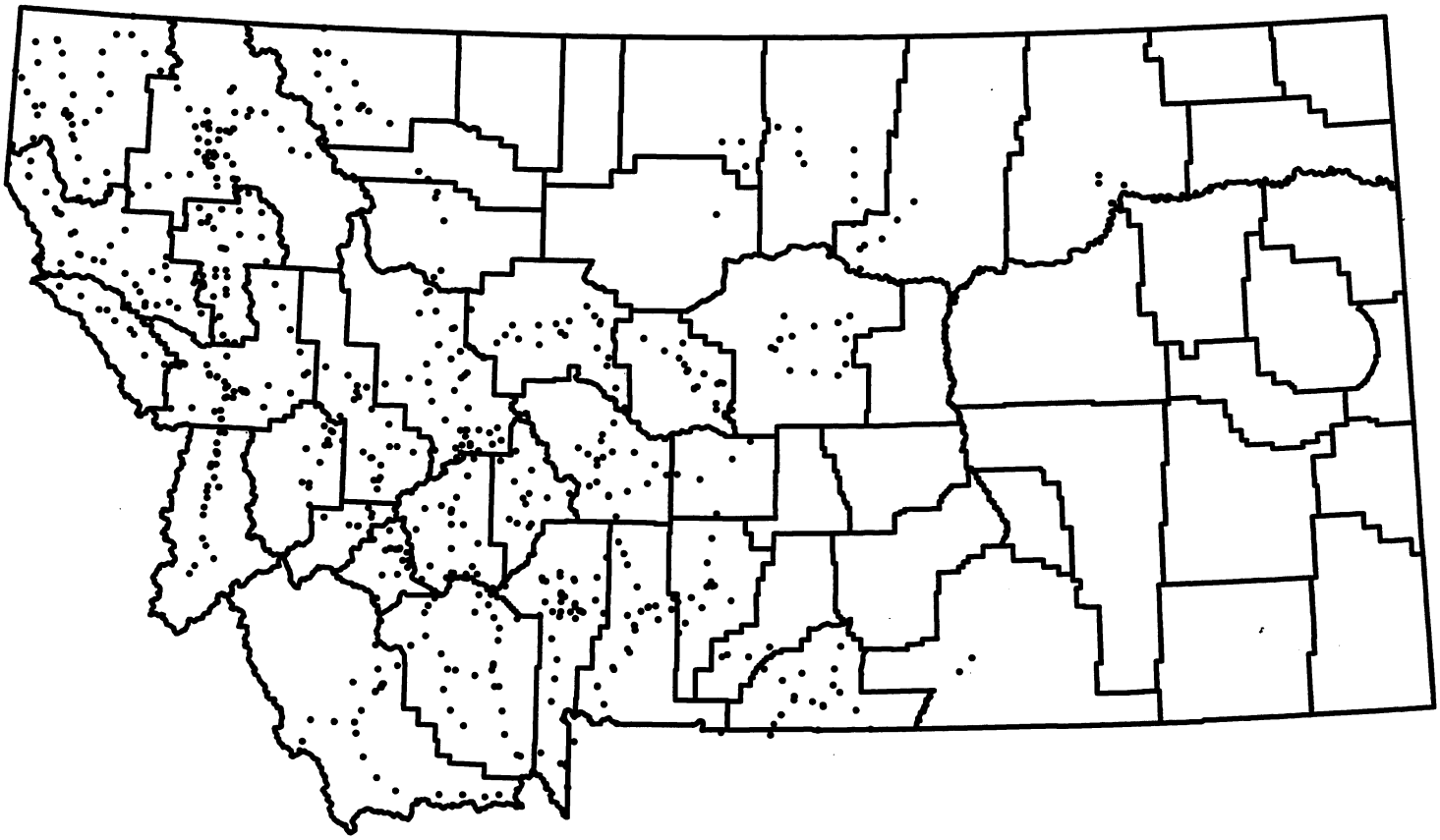
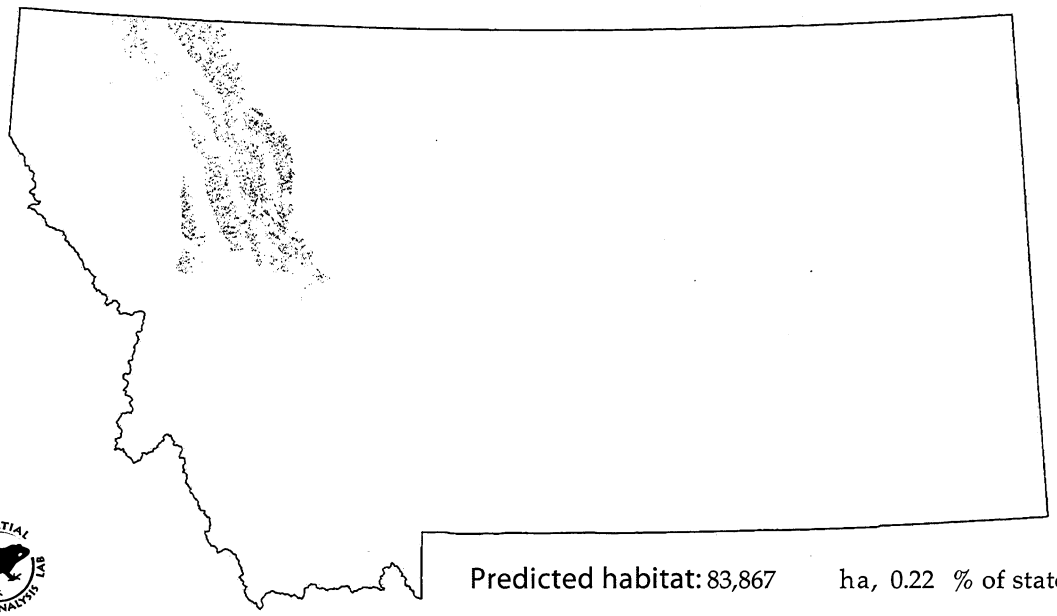


WHITE-TAILED PTARMIGAN

Lagopus leucurus

State rank	S2S3	Element code	ABNLC10030
Global rank	G5	Modeled by	C. Tobalske, W. Williams
MTNHP status	watch list		



Predicted habitat: 83,867 ha, 0.22 % of state.

State range

Currently found commonly in Glacier National Park and uncommonly in the Swan Range and Mission Mountains of the Bob Marshall/Scapegoat Wilderness complex (Montana Bird Distribution Committee 1996, Wright 1996). Old, questionable records exist for the Beartooth Mountains and Yellowstone National Park, but are not considered reliable (Montana Bird Distribution Committee 1996, Wright 1996).

Habitat description

The White-tailed Ptarmigan is a bird of alpine tundra in all seasons, at or above treeline (Scott 1982); typical habitat consists of snow, steep slopes, rocky areas, valleys, and glacial cirques (Chrest 1971). In Glacier National Park, its habitat consists of glacially leveled benchland covered with small ledges, and ranges from dry, rocky sites to wet and mossy streamside areas; most abundant on level or gently sloping grounds (Choate 1963). This species is not found in timber or shrubby vegetation taller than 18", or in boggy areas without rock cover (Choate 1963). Scott (1982) searched 72 areas in Montana and found birds at 8 sites in Glacier NP and at one site in the Mission Mountains, at elevations ranging from 1951 m to 2795 m. Ptarmigans favored moist habitats and used tundra with few herbaceous plants, more conifers and streams, such as krummholz habitat.

Model assumptions & caveats

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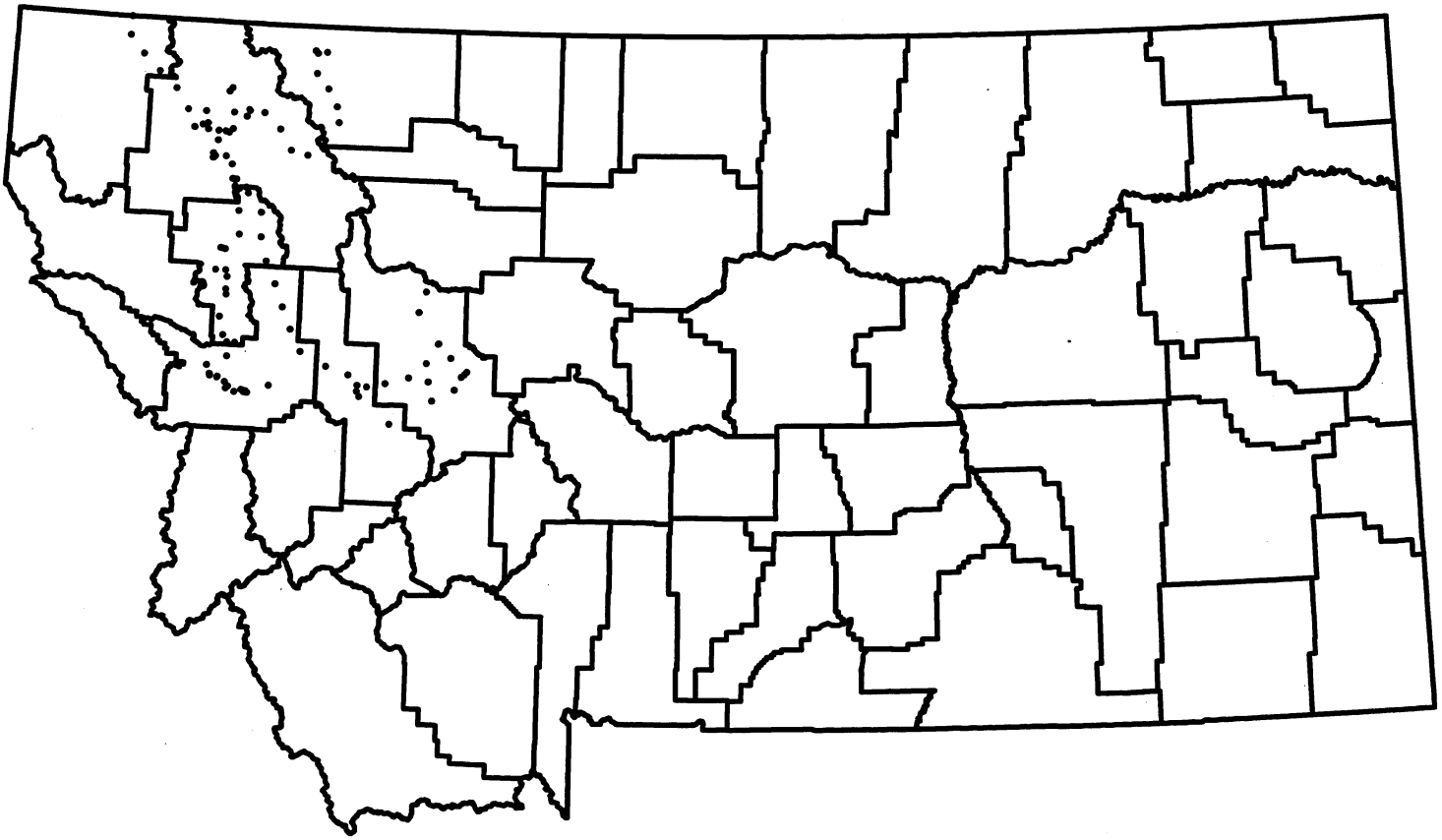
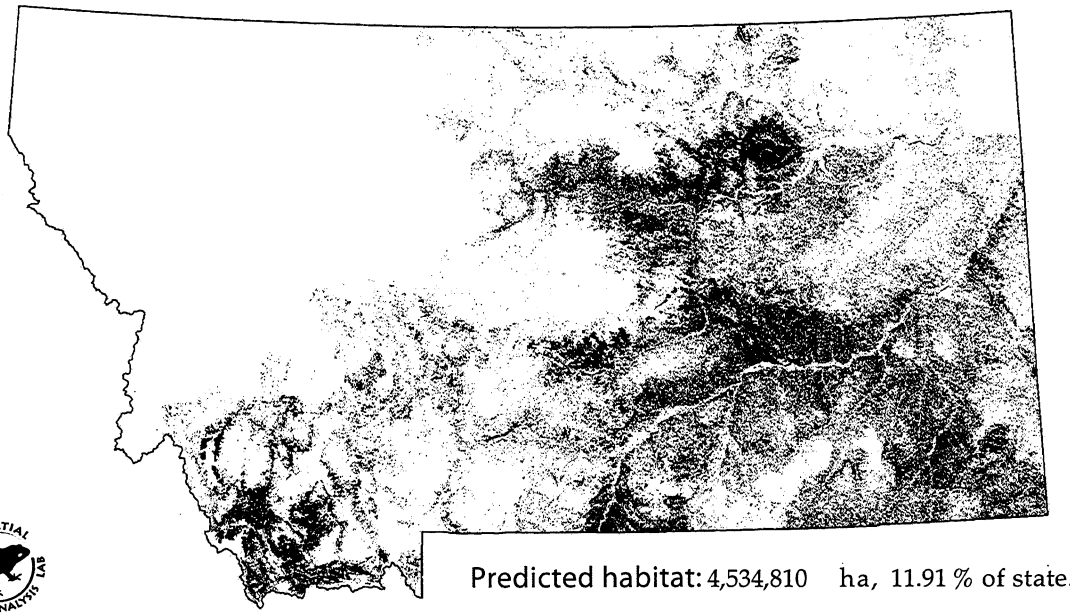


SAGE GROUSE

Centrocercus urophasianus

State rank	S5	Element code	ABNLC12010
Global rank	G5	Modeled by	C. Tobalske, W. Williams
MTNHP status	--		



Predicted habitat: 4,534,810 ha, 11.91 % of state.

State range

Lives year-round locally in southwestern, central, and eastern Montana, east of the Continental Divide; does not occur in mountainous areas west of the Divide (Wallestad 1975, Montana Bird Distribution Committee 1996).

Habitat description

A species strongly associated with mature sagebrush communities such as Big Sagebrush, Black Sage, and Bitterbrush (Dalke et al. 1963, Ehrlich et al. 1988, Klott and Lindzey 1990). In central Montana, Wallestad and Pyrah (1974) found 14 nests in areas with sagebrush canopy cover greater than 15%; this cover also preferred by broods (Wallestad 1971). In north-central Montana, wetlands are used for leks when they occur within sagebrush/grassland habitat; riparian areas, especially near hayfields, are used for brood rearing and also feeding in late summer when forbs become dessicated (H. Nyberg pers. comm.). In southwestern Montana, broods preferred sagebrush shorter in height, adults found in sagebrush consistently taller (Martin and Pyrah 1971). In Colorado, nest success and brood survival was related to the amount of residual grass/forb cover, and in winter survival was found to be dependent upon amount of available sagebrush (Braun 1995). Tall sagebrush on flat or slightly rolling terrain is used in winter in Montana (Eng and Schladweiler 1972, Wallestad and Pyrah 1974, Wallestad 1975). The original range of the Sage Grouse was similar to the distribution of sagebrush, but by the mid 1930s agricultural development and livestock grazing converted/destroyed 50% of this range (Martin and Pyrah 1971). Currently, Sage Grouse are found in sagebrush-grasslands of eastern, central, and southwestern Montana; attempts to establish populations west of the Divide and at former sites have been unsuccessful (Martin and Pyrah 1971).

Model assumptions & caveats

Canopy cover information not available for grass/herbaceous cover to include in model.

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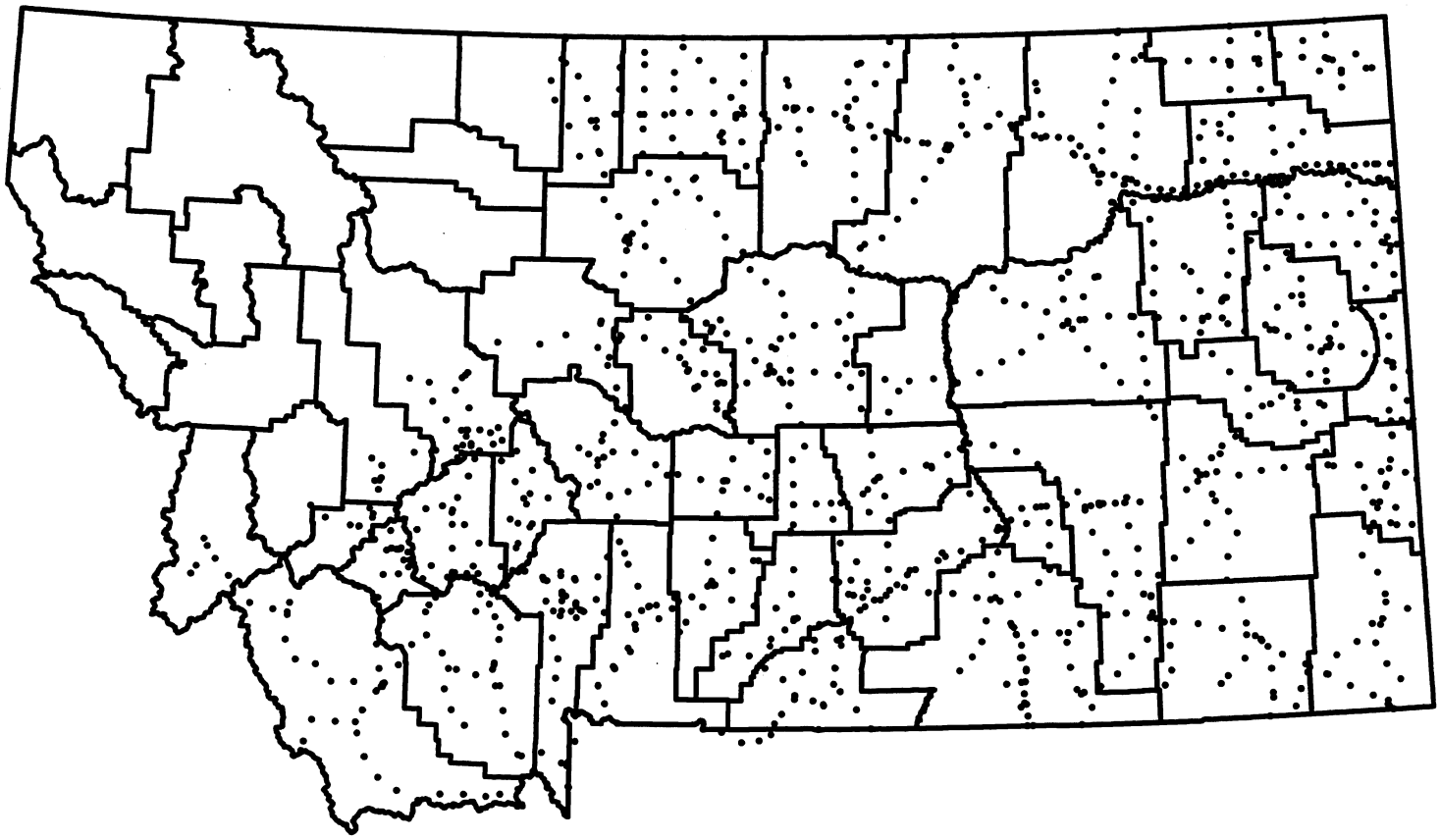
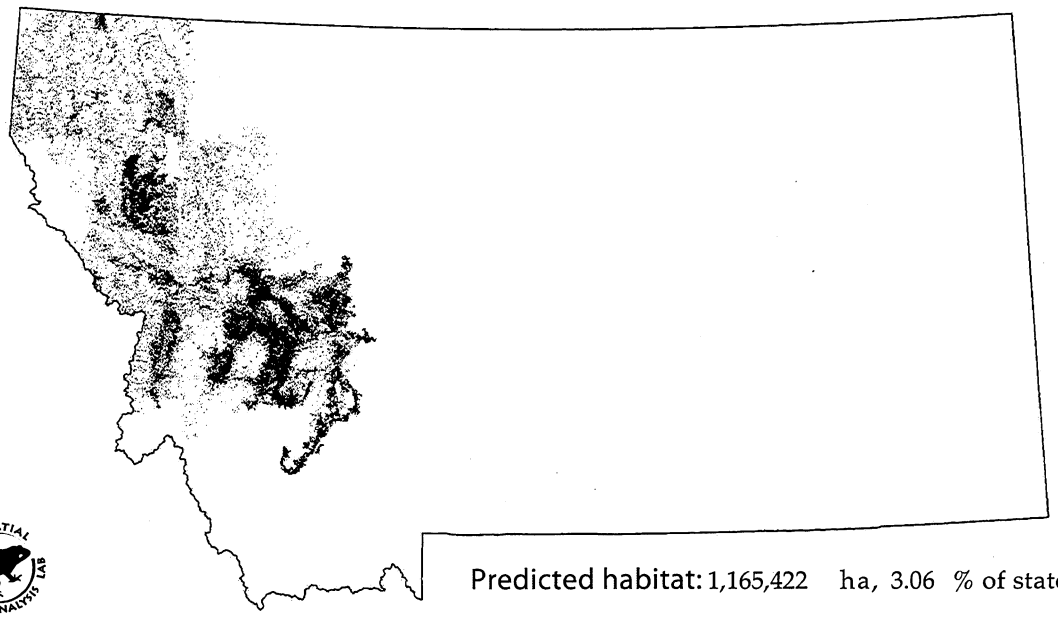


COLUMBIAN SHARP-TAILED GROUSE

Tympanuchus phasianellus columbianus

State rank	S1	Element code	ABNLC13033
Global rank	G4T3	Modeled by	C. Tobalske, W. Williams
MTNHP status	special concern		



Predicted habitat: 1,165,422 ha, 3.06 % of state.

State range

The Sharp-tailed Grouse subspecies occurring west of the Continental Divide, populations known as recently as 1970 in the Tobacco Plains area, Blackfoot River Valley, Flathead Valley, and Centennial Valley; recent populations persisting only in the Tobacco Plains and Blackfoot River Valley (Brown 1971, Deeble 1996). Recent status of these populations is discussed in Bown (1980) and Deeble (1994, 1996). Historically, range covered most intermountain valleys in western Montana (Brown 1971, Bown 1980).

Habitat description

A species favoring mesic shrubsteppe and grassland habitats, particularly fescue-wheatgrass and sagebrush-grass associations (Brown 1971, Deeble 1996). In Idaho, Big Sagebrush and Low Sagebrush are preferred nesting cover types, on relatively flat terrain (Marks and Marks 1987), but the breeding habitat can also contain bitterbrush, snowberry, alfalfa, and Crested Wheatgrass (Meints et al. 1992). In Colorado, summer habitat consists of shrub-steppe with a diversity of forbs and bunchgrasses (Giesen and Connelly 1993), whereas in Wyoming nests are located in sagebrush-snowberry and mountain shrub associations (Klott and Linzey 1990). In northwestern Montana, palouse prairie (Bluebunch wheatgrass and rough fescue) habitats used for nesting and brood rearing; brushy draws and hardwood riparian areas in fall/winter (H. Nyberg pers. comm.). In the Tobacco Valley of Montana, nesting and brood rearing occur in areas dominated by grass, with all nests in dense native grass; agricultural areas avoided (Cope 1992). In the Blackfoot River Valley, leks primarily used habitats dominated by Big Sagebrush and Intermediate Wheatgrass (Deeble 1996). Structural diversity is a fundamental habitat component — a mosaic of well-developed forbs, grasses, deciduous trees and shrub/grass communities is optimal — pure stands of any single community unsatisfactory (Deeble 1996). Winter habitat requirements are somewhat narrow; availability of winter habitat is critical in determining the suitability of an area to support sharptails (Giesen and Connelly 1993, Deeble 1996). Mountain shrubs (chockecherry, juniper, snowberry, serviceberry) and riparian shrubby areas provide essential food and thermal cover in winter (Marks and Marks 1987, Meints et al. 1992,

Giesen and Connelly 1993). Columbian Sharptail Grouse are highly philopatric, the longest recorded movements ~20 km between lek and winter range (Meints 1991 in Deeble 1996). Hunting and overgrazing at the turn of the century caused initial population declines, followed by ongoing habitat changes that have greatly reduced suitable habitat: conversion of shrub-steppe to agricultural lands; fire suppression; direct and indirect effects of agricultural chemical use; continued overgrazing (Deeble 1996). Populations in Montana persist only where major, nonfragmented stands of bunch grasses, shrubs and native prairie remain; attempts to establish populations in former range areas or augment current ones, have generally been unsuccessful (Deeble 1996).

Model assumptions & caveats

Model focus is breeding habitat, however suitable winter habitat is defined within breeding habitat parameters. Interspersion of cover types could not be resolved at mapping scale used. Extent of agricultural land use, livestock grazing, and fire management information not available to include in model. Basic habitat requirements demand finer scale resolution. Suitable habitat likely overestimated.

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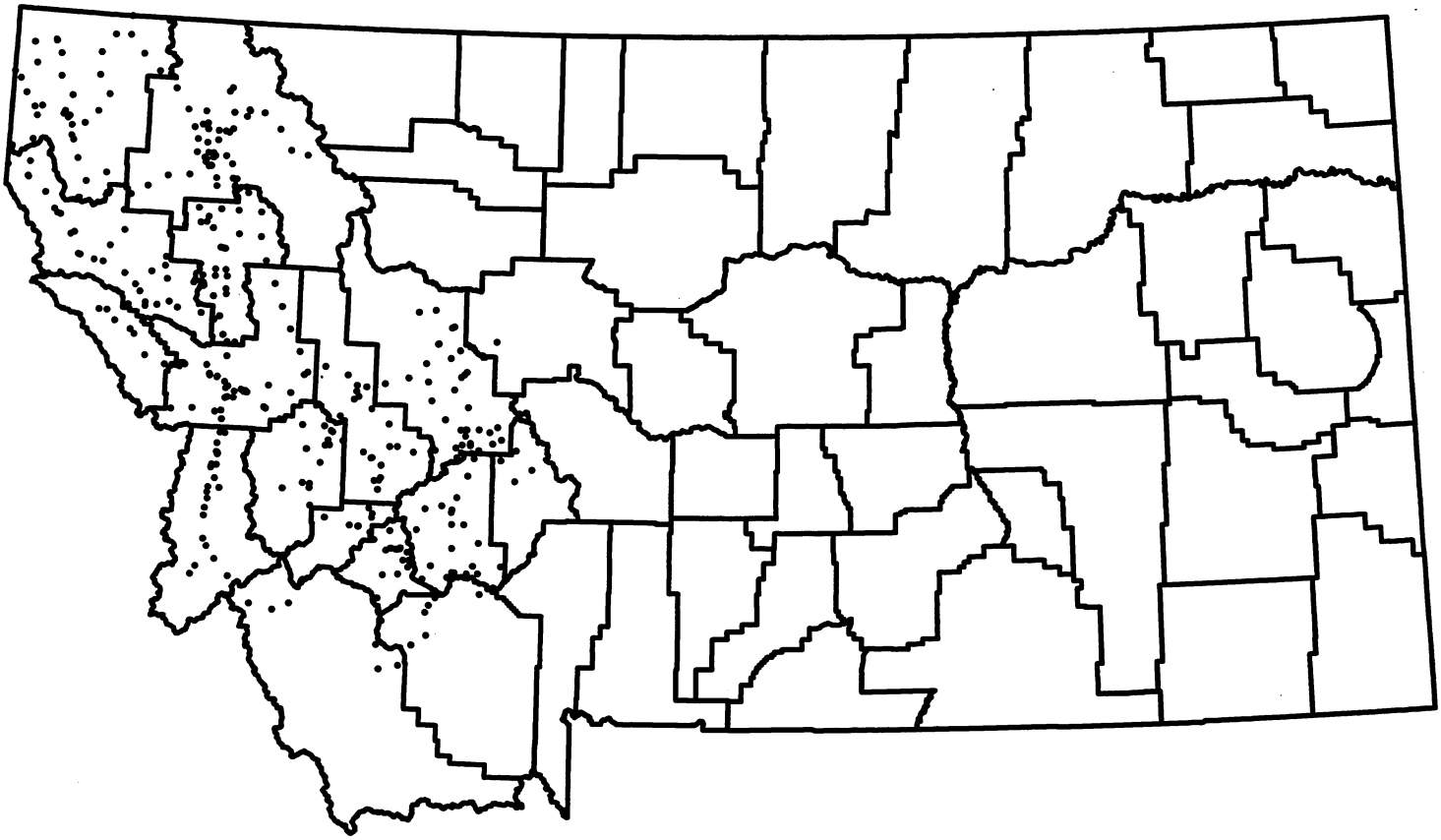
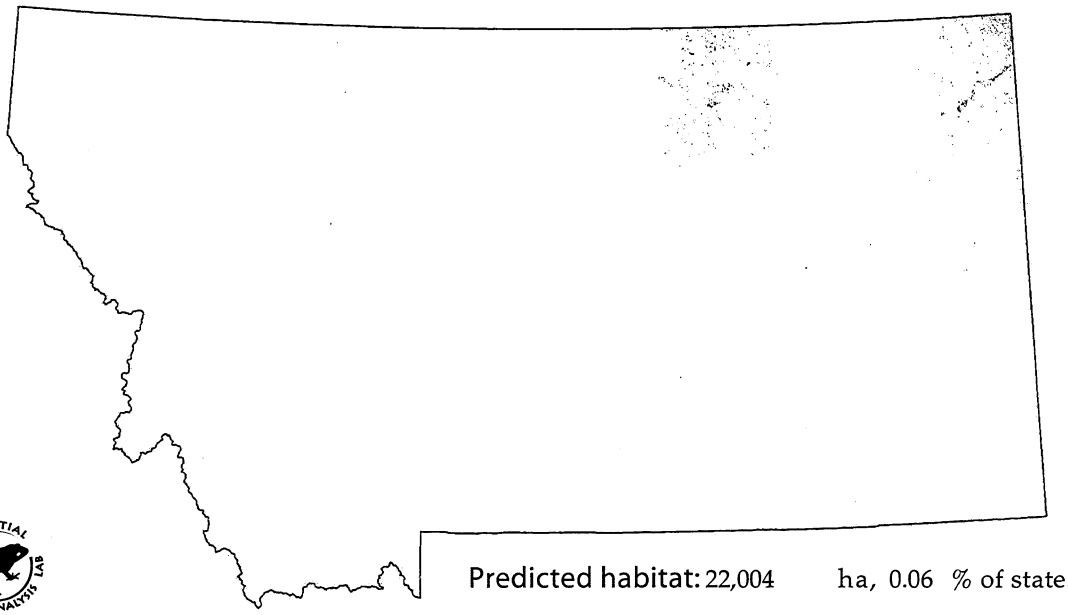


YELLOW RAIL

Coturnicops noveboracensis

State rank	S1B,SZN	Element code	ABNME01010
Global rank	G4	Modeled by	C. Tobalske, W. Williams
MTNHP status	special concern		



Predicted habitat: 22,004 ha, 0.06 % of state.

State range

Few records — main breeding range is north and east of Montana; occurs regularly in the northeastern corner of the state; is rare elsewhere (Montana Bird Distribution Committee 1996, Wright 1996). Secretive species making detection difficult — number of sightings increasing; potential breeding in northern/northeastern areas of the state (T. McEneaney pers. comm.)

Habitat description

Within breeding range (mainly east of the Rockies) are very locally distributed, inhabiting freshwater and brackish marshes, preferring slightly higher, drier margins, and wet meadows (Ehrlich et al. 1988, Bookhout 1995). In the upper peninsula of Michigan, yellow rails select seasonally flooded sedge meadow marshes (Bookhout and Stenzel 1987). In southern Oregon they breed in wet mountain meadows (1266-1524 m) located near a spring, a seep, a creek, or in a river floodplain; vegetation consists of broadleaf sedge associations, with Lodgepole, Ponderosa Pine, aspen and white fir growing around the meadows (Stern et al. 1993). In Montana, breeds in wet sedge meadows dominated by *Carex* (rarely found in cattail), with moist substrate and standing water — quality of the habitat is diminished by presence of woody species, such as willow (Bookhout 1995). Nests beneath dead, procumbent vegetation, situated on ground or up to 15 cm above it (Bookhout 1995). Within marshes and wetlands of breeding range, successful nesting requirements poorly understood; secretive nature precludes adequate population numbers and distribution estimates (Bookhout 1995).

Model assumptions & caveats

Suitable breeding habitat for this species is likely overestimatied - hydrography coverage may not be consistently accurate/true to mapping scale used; persistence of intermittent water (e.g., seasonal vs. semipermanent, etc.) information not available; interspersion of emergent vegetation with open water and standing water within emergent stands could not be resolved at mapping scale used.

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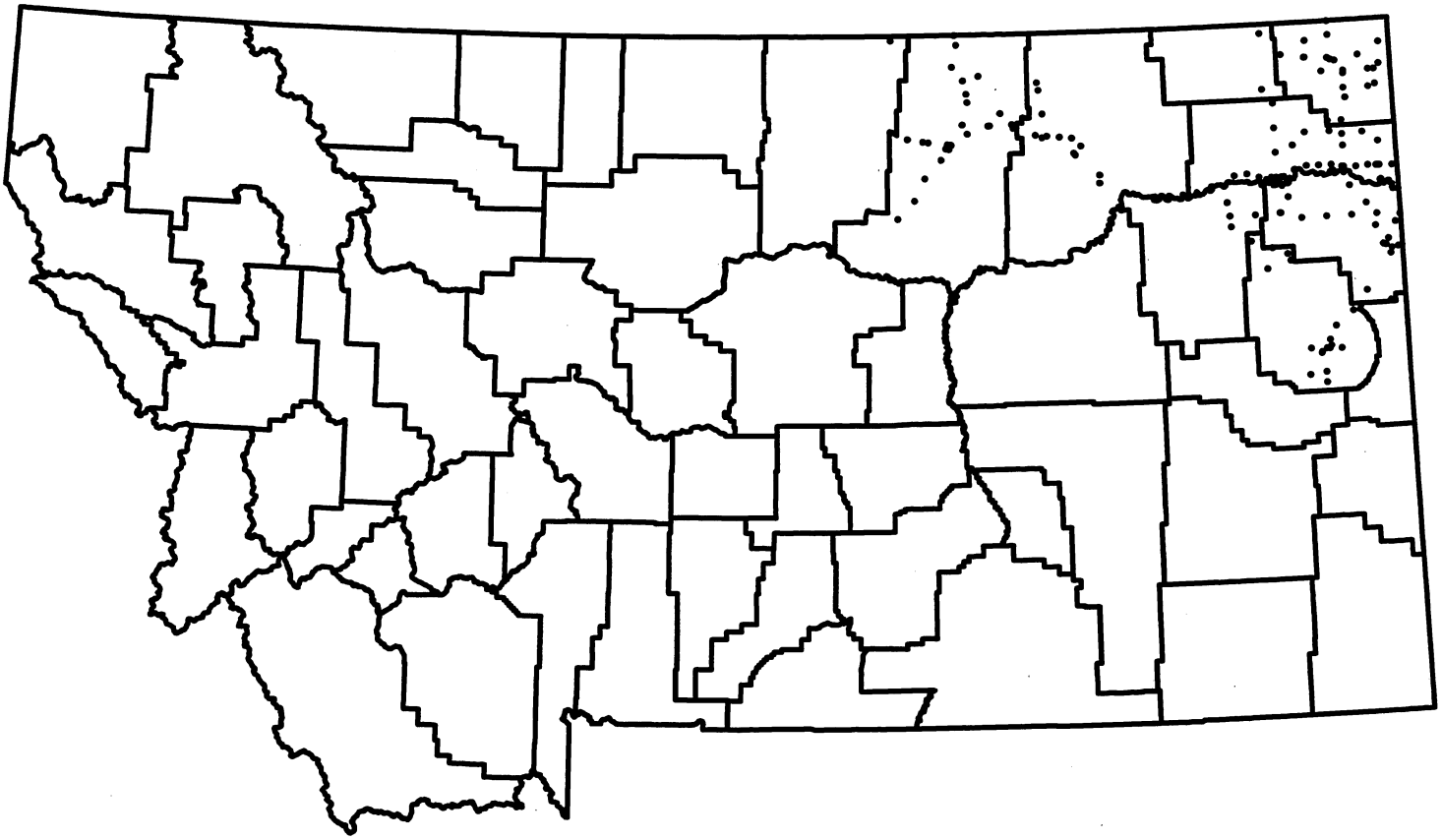
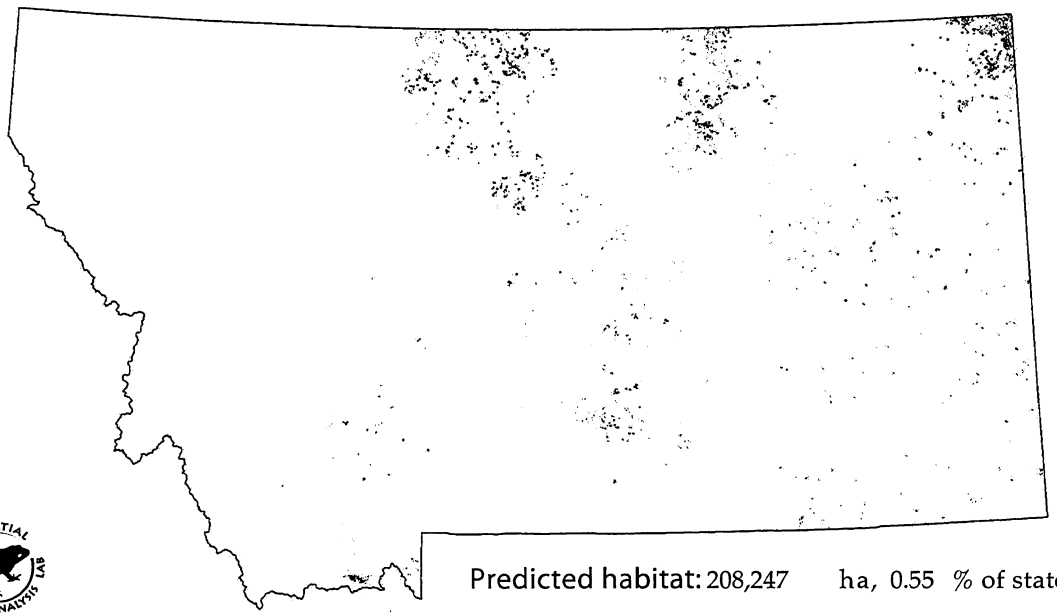


WHOOPING CRANE

Grus americana

State rank	SZN	Element code	ABNMK01030
Global rank	G1	Modeled by	C. Tobalske, W. Williams
MTNHP status	special concern		



Predicted habitat: 208,247 ha, 0.55 % of state.

State range

This species is not frequently observed (four sightings 1991-1995); transient records are scattered throughout the state, east of the Continental Divide; most observations in the extreme northeastern corner of Montana (Montana Bird Distribution Committee 1996, T. McEneaney pers comm.).

Habitat description

One of the rarest birds in North America, the Whooping Crane has recovered from 16 individuals in 1941 to three current wild populations — the only natural, wild population nests in the Northwest Territories and adjacent areas of Alberta (Lewis 1995). The Rocky Mountain population consists of a small number of individuals cross-fostered by Sandhill Cranes that summer in southeastern Idaho, western Wyoming, and southwestern Montana — in the Greater Yellowstone Ecosystem, the birds use shallow wetlands, wet meadows, and adjacent upland sites with minimal human disturbances (Drewien in Clark et al. 1989, Lewis 1995). The Northwest Territories population migrates from nesting grounds through northeastern Alberta, south-central Saskatchewan, northeastern Montana, and western North Dakota en route to wintering grounds in Texas (Lewis 1995). In Colorado, a study conducted along the Platte River found the species roosting in wide river channels (155 to 365 m) with low, exposed, bare sandbars, shallow water, and isolation from human disturbance — sites farther than 400 m from roads and houses (U.S. Fish and Wildlife Service 1981). Feeding sites were usually within 4.8 km of the river, in a variety of habitats; 80% were in upland agricultural lands (emerging small grains, small grain stubbles). Feeding habitat was devoid of tall trees or dense shrubs; vegetation shorter than 30 cm, topography generally flat — cranes also fed in wetlands with water lower than 60 cm, and very short or sparse emergent vegetation (U.S. Fish and Wildlife Service 1981). Armbruster (1990) characterized migration habitat as including mainly sites with good visibility, water depth of 30 cm or less, and minimum wetland size of 0.04 ha for roosting. The Northwest Territories population is somewhat flexible in habitat use during migration, generally feeding in a variety of croplands and roosting in freshwater, shallow wetlands — most wetlands used for roosting were <4 ha and were within 1 km of a suitable feeding area (Lewis 1995). Family groups fed mostly at

wetland sites; nonfamily groups fed primarily in croplands (Lewis 1995). The central Platte River, Nebraska, was historically a major fall stopover — the wide, shallow river area provided roosting sites adjacent to wetlands and cropland feeding sites (Allen 1952 in Lewis 1995). The Rocky Mountain population winters in the Rio Grande Valley; stopover in the San Luis Valley, Colorado to roost in ponds, streams, wet meadows and feed in nearby agricultural fields, particularly barley (Lewis 1995). Whooping Cranes are very sensitive to human perturbations and slight disturbance will often cause adults to desert nests — losses also suffered from illegal shooting, powerline collisions, barbed wire entanglement and avian tuberculosis (Drewien in Clark et al. 1989).

Model assumptions & caveats

No information on human disturbance/land use information available to include in model.

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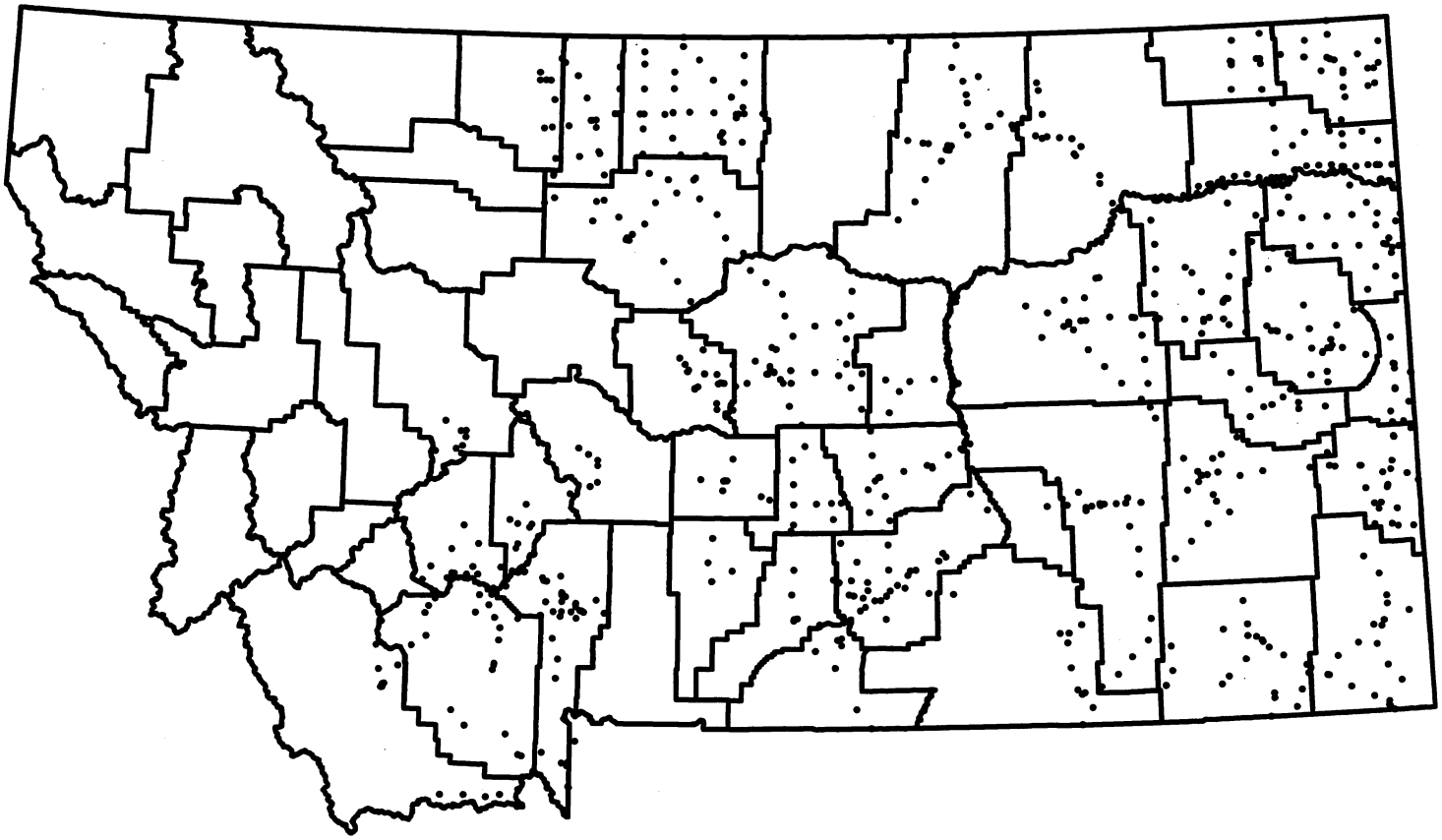
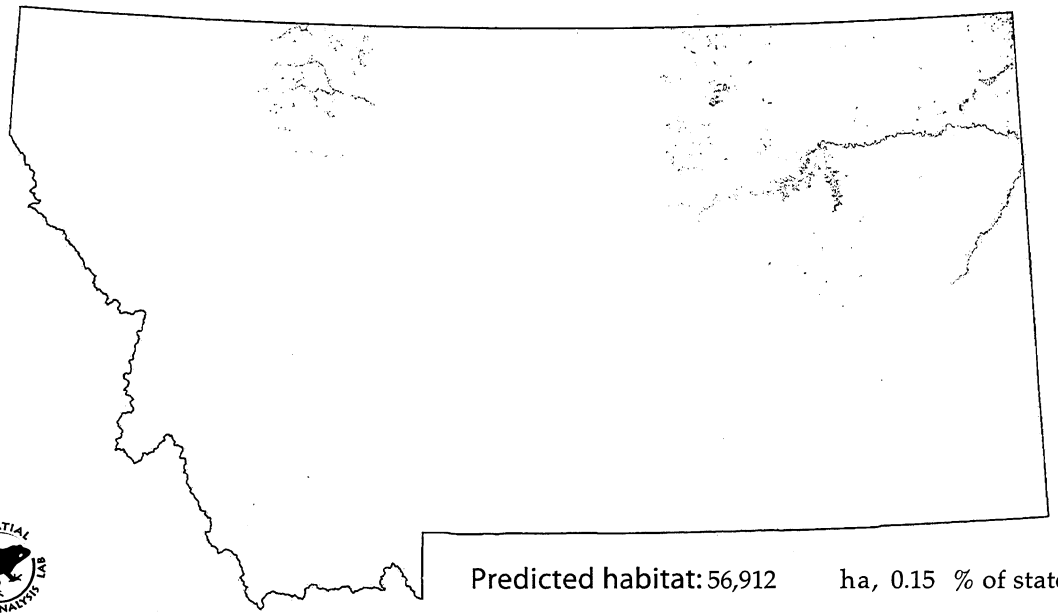


PIPING PLOVER

Charadrius melodus

State rank	S2B,SZN	Element code	ABNNB03070
Global rank	G3	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 56,912 ha, 0.15 % of state.

State range

Breed extremely locally in northeastern Montana near/in Charles M. Russell NWR, Bowdoin NWR, Nelson Reservoir, Medicine Lake NWR, and the Missouri River below Fort Peck dam; has bred in northcentral Montana in Pondera county (Carlson and Skaar 1976 in MNHP-VCA 1996; Montana Piping Plover Recovery Committee 1991, 1992, 1993, 1994 in MNHP-VCA 1996; Montana Bird Distribution Committee 1996). Transient sightings very rare; no winter records in Montana (Montana Bird Distribution Committee 1996).

Habitat description

Breed in three disjunct areas: Atlantic coastal beaches; sand or gravel shorelines of the Great Lakes; sand, gravel, or alkaline shores of lakes and rivers in the Great Plains (Gaines and Ryan 1988, Reel et al. 1989). Throughout the breeding range, wide beaches with minimal vegetation cover are used for nesting (A.O.U. 1983, Gaines and Ryan 1988). Inland, breed on open/exposed areas/beaches of sand, pebble or gravel, especially those with scattered clumps of vegetation that are associated with shores of islands, rivers, ponds, lakes, reservoirs, and alkaline wetlands (Johnsgard 1981, Ehrlich et al. 1988, Gaines and Ryan 1988, Ziewitz et al. 1992). Prefer salt-encrusted, sandy, gravelly, or pebble-mudded shorelines of alkaline wetlands; larger alkaline lakes of Canada and smaller subsaline, semipermanent potholes of the Great Plains represent optimal habitat (Stewart 1975, Johnsgard 1981, Kantrud and Stewart 1984, Weber and Martin 1991, Espie et al. 1996). Avoid vegetated areas or shorelines; on Atlantic beaches nesting areas were abandoned with encroachment of vegetation (Wilcox 1959). At Lake Diefenbaker, Saskatchewan, an important North American breeding lake, select beaches with greatest proportion of gravel/stones; nests located 50-75m from nearest water (Espie et al. 1996). On the Platte River, NE, favor sparsely vegetated, larger, higher sandbars in wider river channels - river reaches at least 1200m long with 275-400m widths, and at least 1.45ha of dry, sandbar or open, permanent islands represent optimal habitat (Ziewitz et al. 1992). In the northern grasslands of MT, ND, SD, and Manitoba, most nests found on unvegetated gravel or sand

substrates, at wetland edges surrounded by native grassland pasture (Kantrud and Higgins 1992). Use beaches of alkaline wetlands in northern Great Plains despite precipitation conditions; 60% use shorelines around alkaline lakes (Haig and Plissner 1993) - even in dry years will return to the same breeding sites, as basins with very little water are still productive (Weber and Martin 1991). River habitat is important (20% of the Great Plains population use river nest sites), but fluctuating/high water levels limit nest site availability and wave action may destroy nests (Gaines and Ryan 1988, Reel et al. 1989, Haig and Plissner 1993). At Lake Diefenbaker, a dammed reservoir, nesting was precluded after high water levels inundated shoreline habitat; normal nesting numbers still not reestablished two years later, even though ample suitable habitat was available (Goossen 1990). In the Chain-of-Lakes area, ND, beach territories average ~25m in width; narrower beaches not selected due to greater wave action and predation threat (Gaines and Ryan 1988). Established territories are characterized by more gravel, but sparse, scattered clumps of vegetation provide nest camouflage (Gaines and Ryan 1988). In the Great Plains area often nest in or adjacent to Least Tern or American Avocet colonies (MNHP-VCA 1996). Forage for worms, crustaceans, mollusks, insects, and marine invertebrates (Ehrlich et al. 1988, Reel et al. 1989). During migration and winter, use uplands, pond margins, flooded fields, and mudflats (Ehrlich et al. 1988, Reel et al. 1989). Populations have declined steadily in the last century, and migration routes of inland birds are poorly understood (Gaines and Ryan 1988, Haig and Plissner 1993). In winter, use primarily coastal habitats - ocean beaches, or sand/algal flats in protected bays (MNHP-VCA 1996). Piping Plovers are federally endangered in the Great Lakes region, threatened elsewhere in their breeding range, and have been extirpated from five central and eastern states due to human disturbance and habitat destruction (Gaines and Ryan 1988, Reel et al. 1989). Population growth may be limited by nest predation and lack of nesting habitat in wet years, but effects of human activities are an important factor in population declines (Flemming et al. 1988, Gaines and Ryan 1988). Human disturbances destroy nest sites, preclude nesting in suitable areas, and adversely affect fledging success - exclusion of human recreation and cattle from breeding habitat (minimum buffer of 160m around nesting areas), is strongly recommended for the preservation and enhancement of breeding populations (Flemming et al. 1988, Gaines and Ryan 1988, Reel et al. 1989).

Model assumptions & caveats

A TES species in Montana, breeding habitat modeled only - inclusion of migration habitat would diminish relevance of model as regards breeding habitat requirements. Hydrography coverage may not be consistently accurate and/or true to mapping scale used. Persistence of intermittent water (seasonal vs. semipermanent, etc.), alkalinity, and salinity information not available to include in model. Resolution of beach characteristics and morphology not obtainable at mapping scale used. Assume adequate nesting habitat defined within selected, buffered hydrography.

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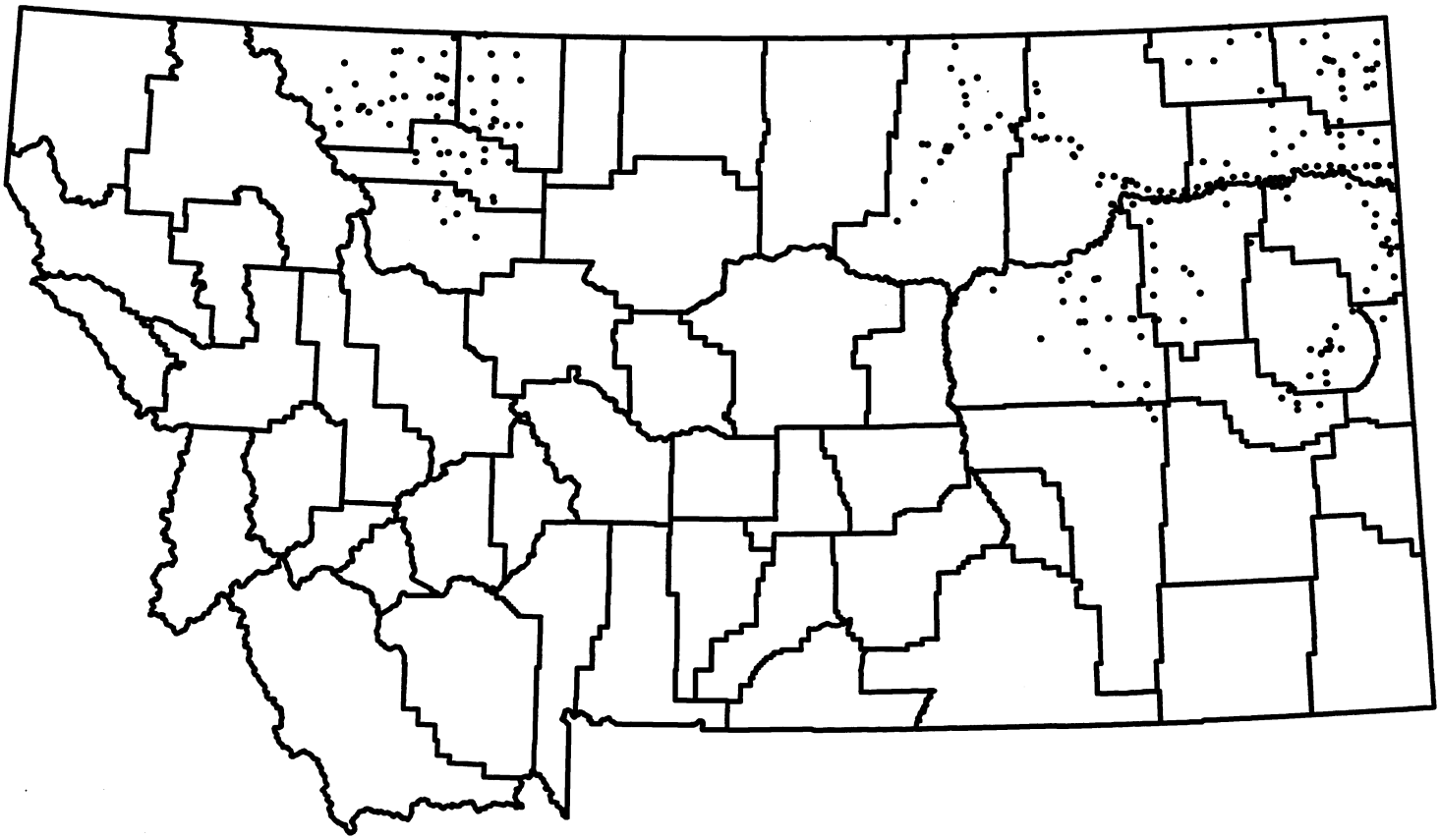
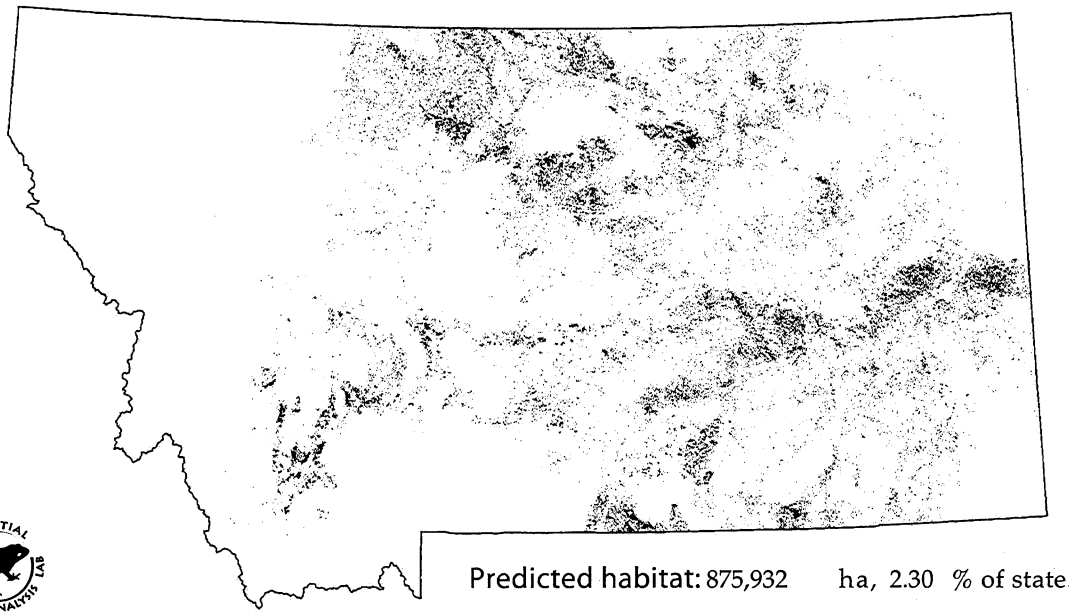


MOUNTAIN PLOVER

Charadrius montanus

State rank	S2B,SZN	Element code	ABNNB03100
Global rank	G2	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 875,932 ha, 2.30 % of state.

State range

Currently breed in central, north-central, and southwest Montana (FaunaWest Wildlife Consultants 1991 in MNHP-VCA 1996, Bergeron et al. 1992). Historic range probably encompassed most of eastern and parts of southwest MT; records are summarized in FaunaWest Wildlife Consultants (1991). Transitory through the Greater Yellowstone Ecosystem, sightings rare in Montana; overwintering does not occur (Knowles in Clark et al. 1989, Montana Bird Distribution Committee 1996).

Habitat description

High and arid plains and shortgrass prairie (particularly Blue Grama-Buffalo Grass commumities, although they are very limited in Montana), is primary habitat; secondarily use drier, open shrubland and sandy, semi-arid flats (D. Casey pers. comm., Johnsgard 1981, Hayman et al. 1986, Dobkin, 1994). Flat, open, short (<10cm tall) grasslands with little shrub cover are preferred; nests are simple scrapes usually amidst scattered clumps of cacti or Western Wheatgrass, often near conspicuous objects, such as piles of dried cow manure or similarly-sized rocks (Graul 1975, Olson and Edge 1985, Knowles in Clark et al. 1989, DeGraaf et al. 1991). Typically found in intensively grazed areas - bare ground cover of 30% is considered a minimum breeding habitat requirement (Wallis and Wershler 1981, Knowles et al. 1982, Parrish et al. 1993, Knopf and Miller 1994). Consistent use of areas with bare ground, during breeding and overwintering, indicate it is an important year-round habitat component (Knowles et al. 1982, Prellwitz 1993, Knopf and Rupert 1996). In Canada, nesting habitat is characterized by extensive tracts of heavily grazed pastures (burned or unburned), with short (<8cm), sparse grassland vegetation on level to slightly undulating terrain (Wallis and Wershler 1981, Parrish et al. 1993). In CO and WY similar grazed habitats are used for breeding - shortgrass areas dominated by Blue Grama-Buffalo Grass, and sparse grass/forb habitat, respectively (Knowles et al. 1982, Parrish et al. 1993). In MT, selectively breed in Black-tailed Prairie Dog towns - grazing pressure of prairie dogs and local livestock keep vegetation cover low, providing greater bare ground and more horizontal visibility providing optimal nesting habitat (Olson and Edge 1985, Knowles et al.

1982). In the Charles M. Russell National Wildlife Refuge (CMRNWR), select prairie dog towns at least 6ha in size (>=10ha preferred), in upland, level areas, characterized by short vegetation and moderate to heavy grazing pressure by cattle (Knowles et al. 1982, Olson and Edge 1985). Often nest far from water, however, prairie dog towns are usually close to livestock watering ponds (Knowles et al. 1982). In northeastern MT, sighted on habitat similar to that found in Black-tailed Prairie Dog towns, but on CMRNWR lands Moutain Plovers did not nest in heavily grazed areas outside of towns (Knowles et al. 1982, Prellwitz 1993). A minimum area of 28ha is needed to raise a brood (Knopf and Rupert 1996). Brood rearing habitat includes areas with forbs or objects such as fence posts for shade; in more disturbed prairie, broods use cattle watering and loafing sites, fallow agricultural fields (Knopf and Rupert 1996). Forage primarily on insects - grasshoppers, beetles, crickets (Ehrlich et al. 1988, DeGraaf et al. 1991). Often seen in flocks during migration and winter; use freshly tilled and recently burned fields, semi-desert or dry agricultural habitats, alkaline flats, heavily grazed grasslands (Hayman et al. 1986, Knopf and Rupert 1996). Populations declined 63% between 1966 and 1991 in North America, and continued to do so through 1993, due to habitat degredation on both breeding and wintering grounds (Page and Gill 1994, Knopf and Rupert 1996). Breeds across the western Great Plains, as well as locally in WY, CO, NM, and TX, however, Weld Co., CO and Phillips Co., MT provide suitable nesting habitat for over half of the North American population (Knopf and Miller 1994). The Mountain Plover has been extirpated from ND and SD, is endangered in Canada, has been petitioned for candidacy for Threatened and Endangered status in the U.S., and is considered a TES species in MT due to severe range contraction as a result of prairie conversion to agriculture and the extermination of prairie dogs (Johnsgard 1981, Olson and Edge 1985, Dobkin 1994, Page and Gill 1994, Montana Bird Distribution Committee 1996). In the breeding range of MT (CMRNWR lands), heavy cattle grazing alone does not create suitable nesting habitat - in this area, plovers were not sighted outside of prairie dog towns even though potential habitat was surveyed (Olson and Edge 1985). Maintaining prairie dog towns on the CMRNWR is critical to preserving breeding habitat; persistant prairie dog control efforts are deterimental to breeding populations on the refuge and limit suitable breeding habitat outside its boundaries (Olson and Edge 1985, Dobkin 1994).

Model assumptions & caveats

Breeding habitat modeled. Rare migrant, does not overwinter. Some migration habitat assumed defined within breeding habitat parameters, but other habitat excluded from model, as inclusion would diminish relevance of model as regards breeding habitat requirements. Cover type area (territory size) not included in model. Black-tailed Prairie Dog town locations were available, but sizes/area coverage of the towns were not available for all locations. Additionally, Mountain Plovers will breed outside of prairie dog towns in Montana, therefore inclusion of prairie dog towns as a habitat filter would underestimate breeding habitat in these areas. Breeding habitat requirements in Montana appear fairly rigid although are still not completely understood - ample heavily grazed areas are probably available in the state, however, suitable breeding habitat is likely overestimated.

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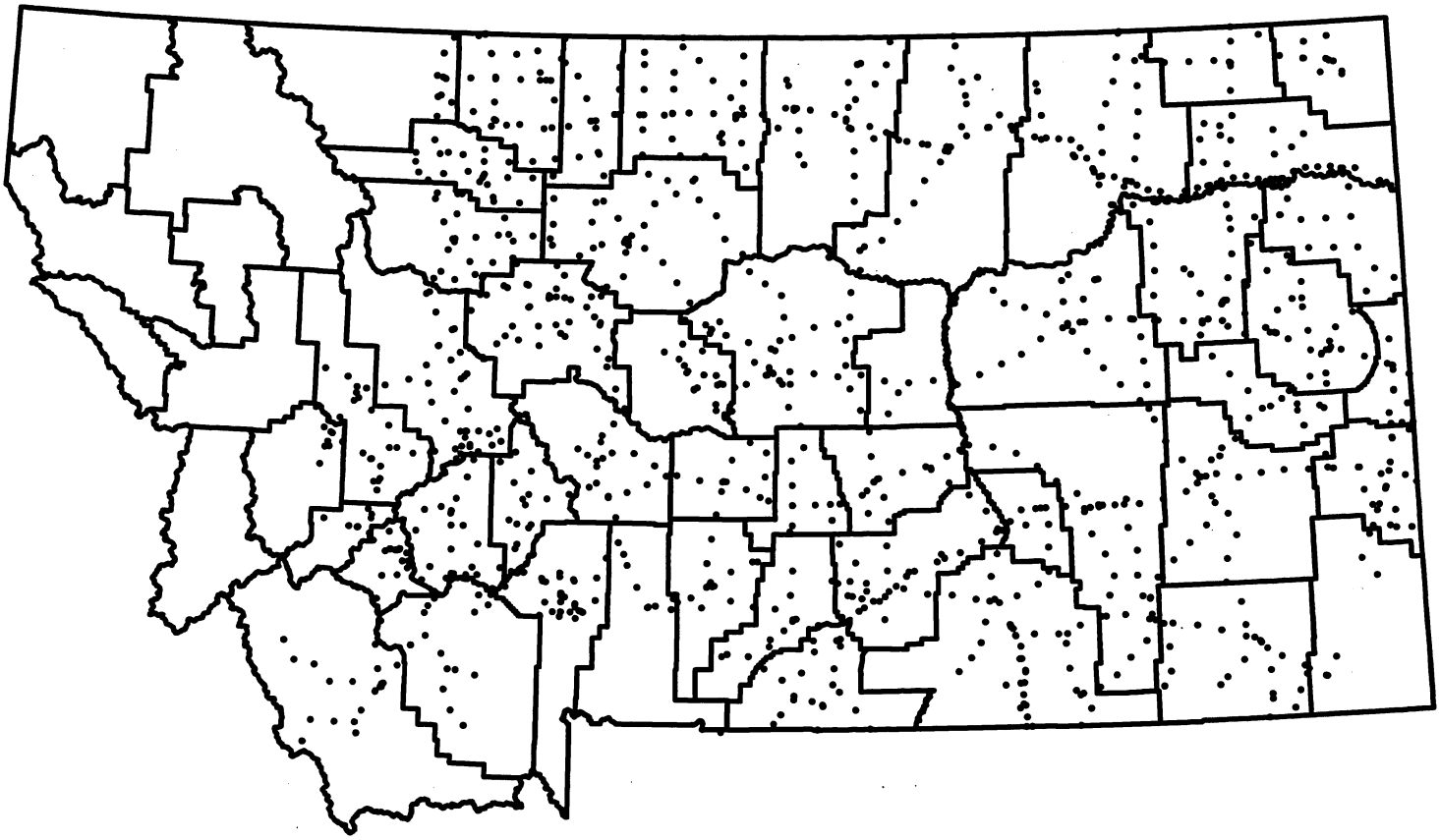
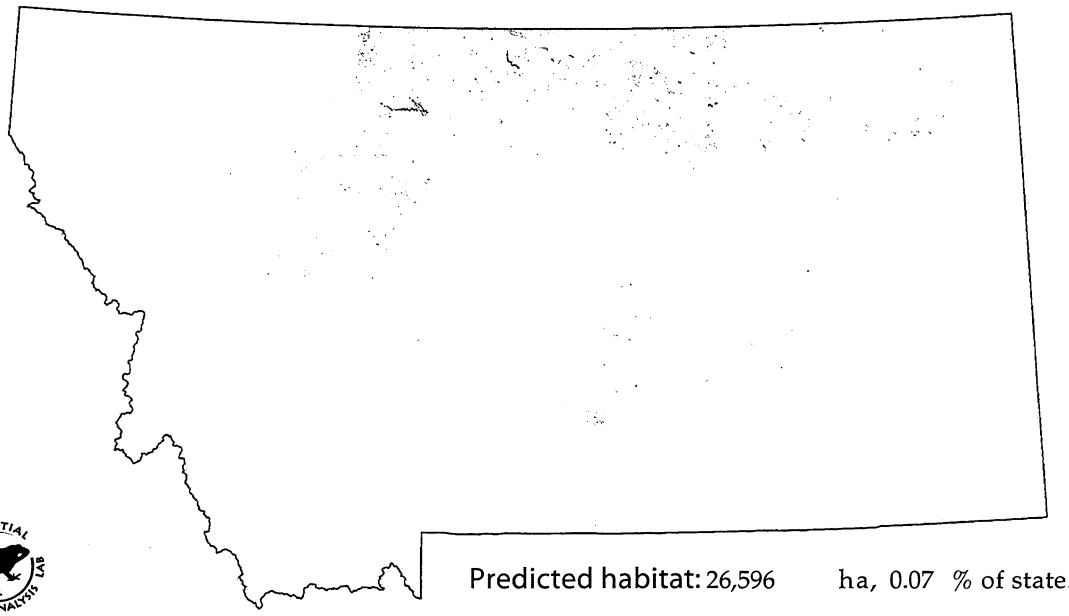


BLACK-NECKED STILT

Himantopus mexicanus

State rank	S2B,SZN	Element code	ABNND01010
Global rank	G5	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 26,596 ha, 0.07 % of state.

State range

Breeding range has expanded into WA, MT, Alberta, and Saskatchewan in response to drought throughout traditional ranges southwest (Page and Gill 1994). Breeding in Montana is somewhat rare and localized in central (Benton Lake NWR has largest known breeding population in Montana; > 100prs) and northeast (Bowdoin NWR) areas (S. Martin pers. comm., Montana Bird Distribution Committee 1996). Transient sightings recorded mainly for western Montana; overwintering does not occur in the state (Montana Bird Distribution Committee 1996).

Habitat description

Breed in a wide range of wetland habitats: coastal saltmarshes and lagoons; fresh or saline inland lakes, ponds, and marshes; wet savannas; mudflats (Hayman et al. 1986, Ehrlich et al. 1988). Found inland around grassy or bare sandy/gravelly shorelines of shallow, freshwater or brackish pools of wetlands with extensive mudflat areas; also flooded fields (Dekker et al. 1979, Johnsgard 1979, Johnsgard 1981). Nests may be exposed or well concealed in vegetation, and are always close to foraging areas (Johnsgard 1979, Ehrlich et al. 1988). Nest in loose colonies, occasionally singly and well outside normal breeding range; often associated with American Avocets (Hayman et al. 1986, Johnsgard 1986). In MT, nest in medium to large wetland complexes of open marshes and meadows; often in alkaline areas (MNHP-VCA 1996). Subsist on insect larvae - especially of brine flies and brine shrimp, and crayfish; also snails, tadpoles, seeds (Ehrlich et al. 1988). Migration and winter habitats similar to that of breeding (Hayman et al. 1986). With the substantial amount of wetlands lost during the past 200 years - over 90% of Black-necked Stilt wetland and breeding habitat in the Central Valley, CA has been destroyed - other populations breeding in North America have undoubtedly declined; the Black-necked Stilt is a TES species in MT (Page and Gill 1994, Montana Bird Distribution Committee 1996).

Model assumptions & caveats

Breeding habitat modeled. Uncommon migrant; potential inland migration habitat is similar to that of breeding and is assumed defined within breeding habitat parameters. Hydrography coverage may not be consistently accurate and/or true to mapping scale used. Sizes/areas of wetland complexes difficult to resolve at mapping scale used. Extent of wetland mudflat areas and wetland alkalinity information not available to include in model.

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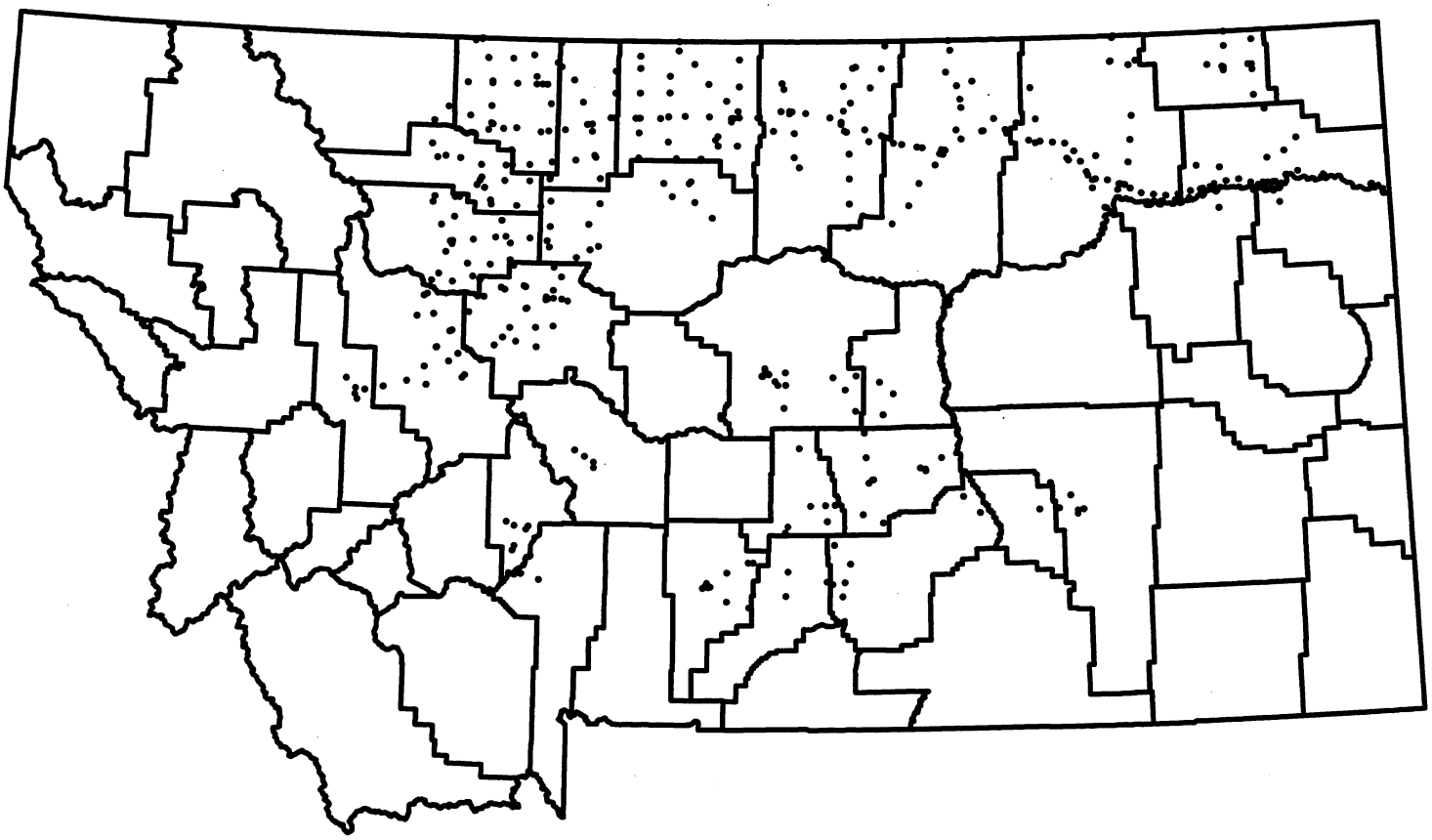
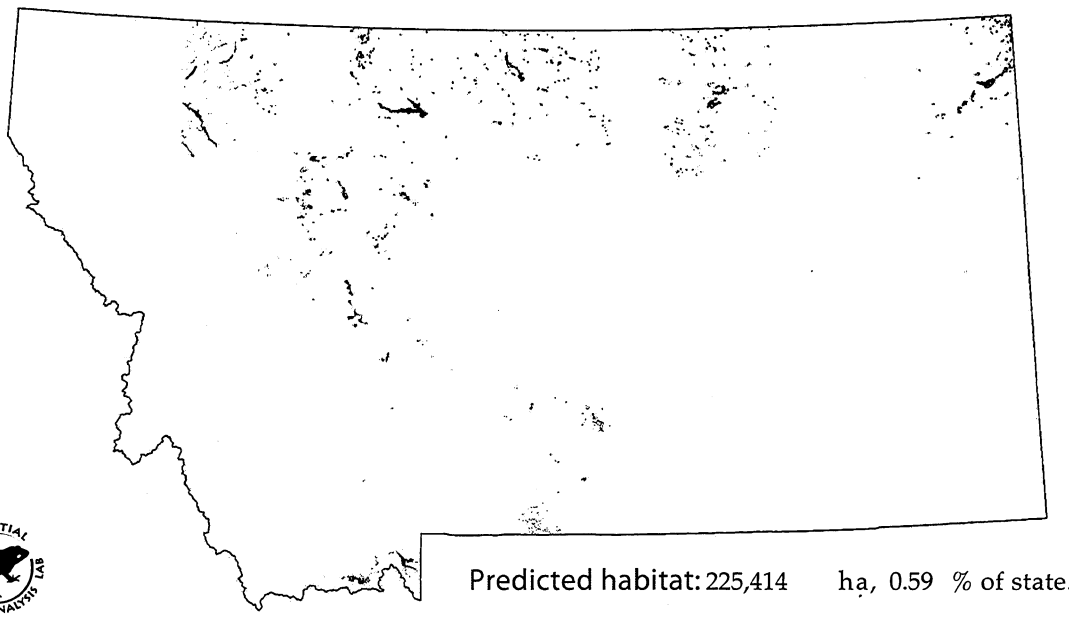


FRANKLIN'S GULL

Larus pipixcan

State rank	S3B,SZN	Element code	ABNNM03020
Global rank	G4G5	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 225,414 ha, 0.59 % of state.

State range

Breeds locally, mainly in eastern Montana along the Highline; also Red Rock Lakes NWR in southwestern Montana (Montana Bird Distribution Committee 1996). Migrates widely throughout Montana, most commonly east of the Continental Divide; overwintering does not occur in the state (Montana Bird Distribution Committee 1996).

Habitat description

Breed on freshwater prairie and steppe marshes, sloughs, and marshy lakes, rarely in flooded meadows; also shallow river impoundment marshes, as those managed for waterfowl (Stewart 1975, A.O.U. 1983, Johnsgard 1986, Ehrlich et al. 1988). Sensitive to precipitation conditions and human disturbance, stable colonies depend on extensive, more permanent and remote prairie marshes (Burger and Gochfeld 1994). Nesting requirements are large marshes with emergent vegetation (cattails, bulrushes, phragmites) in water deep enough (usually 30-60cm) to persist until young have fledged; in MN, nests were deserted when water reached 80cm deep (Burger and Gochfeld 1994). Nest on large, floating platforms of plant debris anchored to emergent vegetation, preferably in semi-open emergent cover to provide adverse weather protection, yet adjacent to open water to facillitate escape from predators (Johnsgard 1979, Ehrlich et al. 1988, Burger and Gochfeld 1994). Since frequently nest on larger, seasonal or semipermanent marshes, colonies are vulnerable to drought or wetland drainage, and often shift from year to yearin response to these conditions; in some years local populations may not breed (Stewart 1975, Burger and Gochfeld 1994). In MT, stable colonies breed at Bowdoin NWR, Freezout Lake WMA, and Benton Lake NWR (Benton Lake NWR hosts the largest breeding population in MT, with 10,000-12,000 pairs), with less stable colonies at Medicine Lake NWR and Red Rock Lakes NWR (S. Martin, pers. comm., Burger and Gochfeld 1994). White-faced Ibis, Black Terns, Black-necked Stilts, Forster's Terns and Black-crowned Night-Herons are often interspersed within Montana colonies (Burger and Gochfeld 1994). American Coots will compete for nest sites where ranges overlap (Burger 1973). Opportunistic feeders; subsist on adult and larval insects, earthworms,

vegetation (seeds and foliage), fish, small mammals, other invertebrates (Ehrlich et al. 1988, Burger and Gochfeld 1994). During nesting, feed in shallower waters adjacent to nest sites in surrounding meadows; forage in upland areas when grasshoppers are abundant (Littlefield and Thompson 1981). Post breeding dispersal in prairie regions extends in all directions from colony sites; mixed adult and juvenile flocks often follow agricultural machinery to forage on flushed insects (Littlefield and Thompson 1981, Ehrlich et al. 1988, Burger and Gochfeld 1994). Migration routes are generally south through the Great Plains, but some migrate over high tundra in CO (3900-4270m elevation), and over passes in MT (Burger and Gochfeld 1994). Migrating flocks feed in flooded fields, pastures, prairies, croplands; also estuaries, bays, mudflats, lagoons, lakes, and roost on inland lakes, bays, estuaries (Burger and Gochfeld 1994). Past wetland drainage coupled with the severe effects of the Dust Bowl have destroyed many colony sites; once abundant in Canada in the 1980s, many important colonies were lost due to wetland drainage (Burger and Gochfeld 1994). With the creation of national wildlife refuges and the protection of extensive marshes, however, populations are increasing (Burger and Gochfeld 1994). Franklin's Gulls are very sensitive to disturbance, especially early in nesting, and will desert a colony entirely with excessive exposure to humans (Burger and Gochfeld 1994).

Model assumptions & caveats

Breeding habitat modeled. Potential inland migration, post breeding, and foraging habitats defined within breeding habitat parameters. Hydrography coverage may not be consistently accurate and/or true to mapping scale used. Persistence of intermittent water (seasonal vs. semipermanent, etc.) and water depth information not available to include in model. Cannot resolve interspersion of emergent vegetation and open water areas at mapping scale used. Potential for human disturbance information not available to include in model. Suitable breeding habitat likely overestimated.

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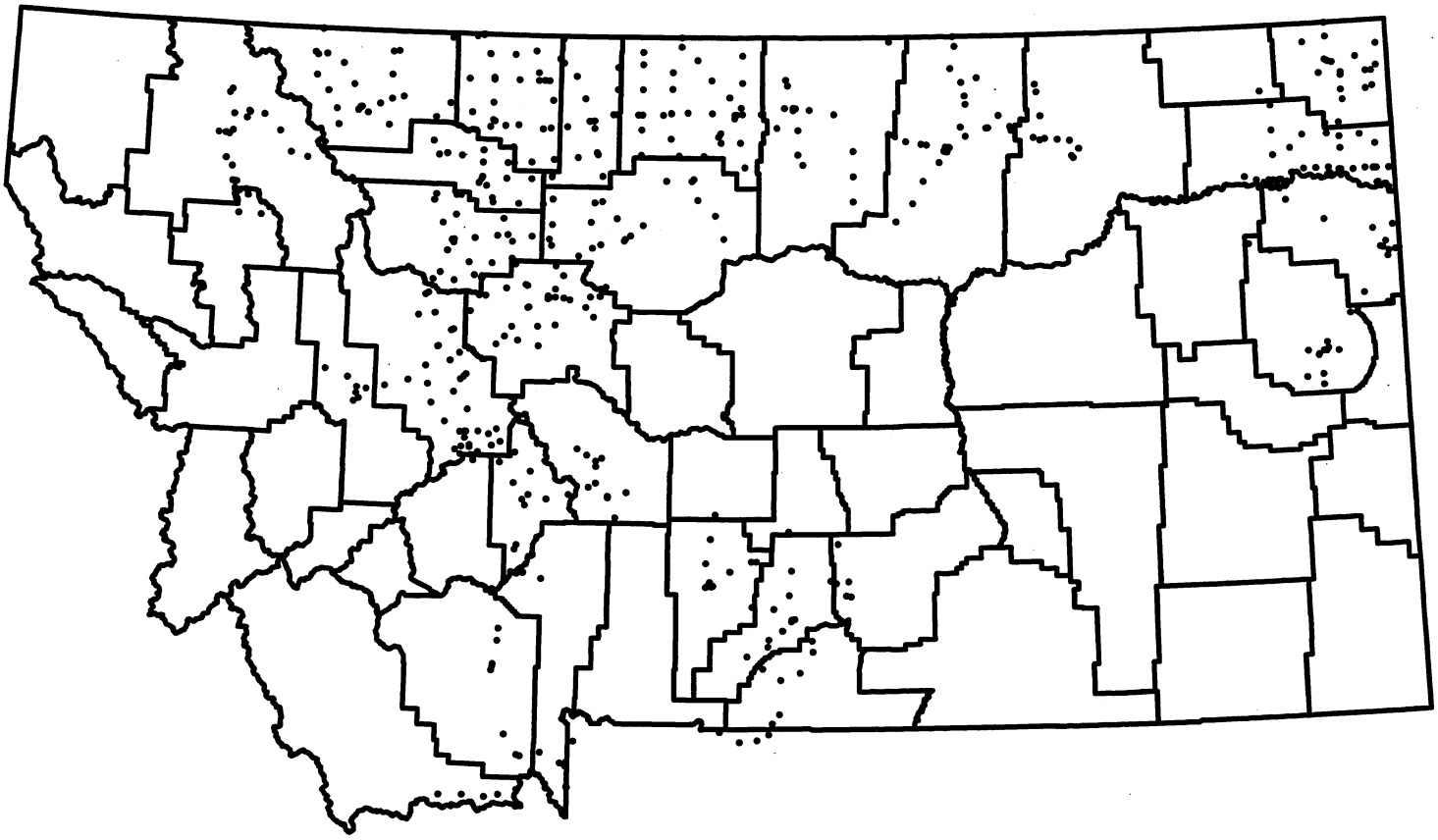
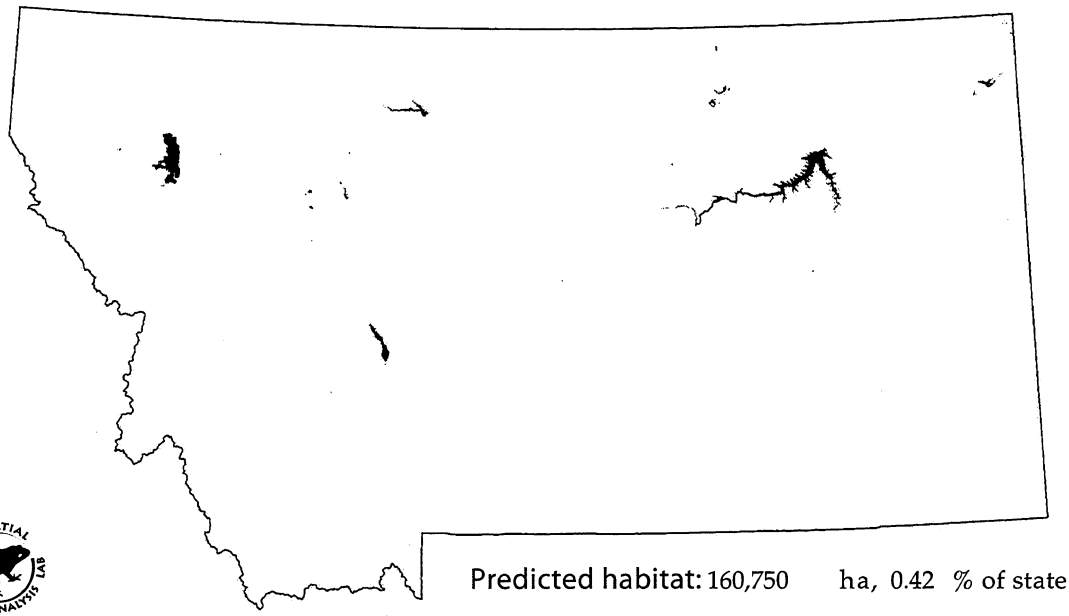


CASPIAN TERN

Sterna caspia

State rank	S2B,SZN	Element code	ABNNM08020
Global rank	G5	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 160,750 ha, 0.42 % of state.

State range

Breed very locally, mainly in northeast and northwest-central Montana; is an uncommon migrant found widely throughout the state; overwintering does not occur (Montana Bird Distribution Committee 1996).

Habitat description

Breed very locally in the Rocky Mountain region (Johnsgard 1986). Favor less-developed, less-polluted areas of the coast, nesting on sparsely vegetated sand, gravel, or shell beaches, barrier or spoil islands, shell berm in salt marshses; also found inland on sandy or gravelly shorelines or islands of large lakes or reservoirs (Johnsgard 1986, Ehrlich et al. 1988, DeGraaf et al. 1991). Nest in dense colonies; occasionally single pairs will nest among other tern or gull speices (Godfrey 1966, Johnsgard 1986, DeGraaf et al. 1991). Nests are shallow depressions in the substrate, often concealed among driftwood (Ehrlich et al. 1988, DeGraff et al. 1991). In WA, all colonies - whether coastal or inland - nested on sandy substrates; breeding population locations often varying with periods of erosion and deposition of sandy nesting habitat (Penland 1982). Subsist almost entirely on fish; also crayfish, insects, nestlings and eggs of other bird species; rarely carion (Ehrlich et al. 1988, DeGraaf et al. 1991). During migration use large lakes, reservoirs, water courses, large marshes (DeGraaf et al. 1991). Winter habitat primarily marine and estuarine, along beaches, spits - often roost with other birds on bars and beaches (Godfrey 1966, DeGraaf et al. 1991). Very sensitive to human disturbance; intrusions into breeding colonies results in significant reductions in reproduction success (Penland 1982, Ehrlich et al. 1988). The Caspian Tern is considered a threatened, endangered, or sensitive species in Montana, as little is known about the breeding/nesting requirements of this colonial breeder in the state (Montana Bird Distribution Committee 1996).

Model assumptions & caveats

Breeding habitat modeled. Migration habitat not specifically modeled; assume some potential inland migration habitat is defined within breeding habitat parameters. Hydrography coverage may not be consistently accurate and/or true to mapping scale used. Since potential for human disturbance information is not available to include in model, selected narrow hydrography buffer (90m) and only those permanent lakes and marshes having islands to represent suitable, predicted breeding habitat that is less likely to be disturbed. Island coverage, however, may not be accurately represented within the hydrography coverage.

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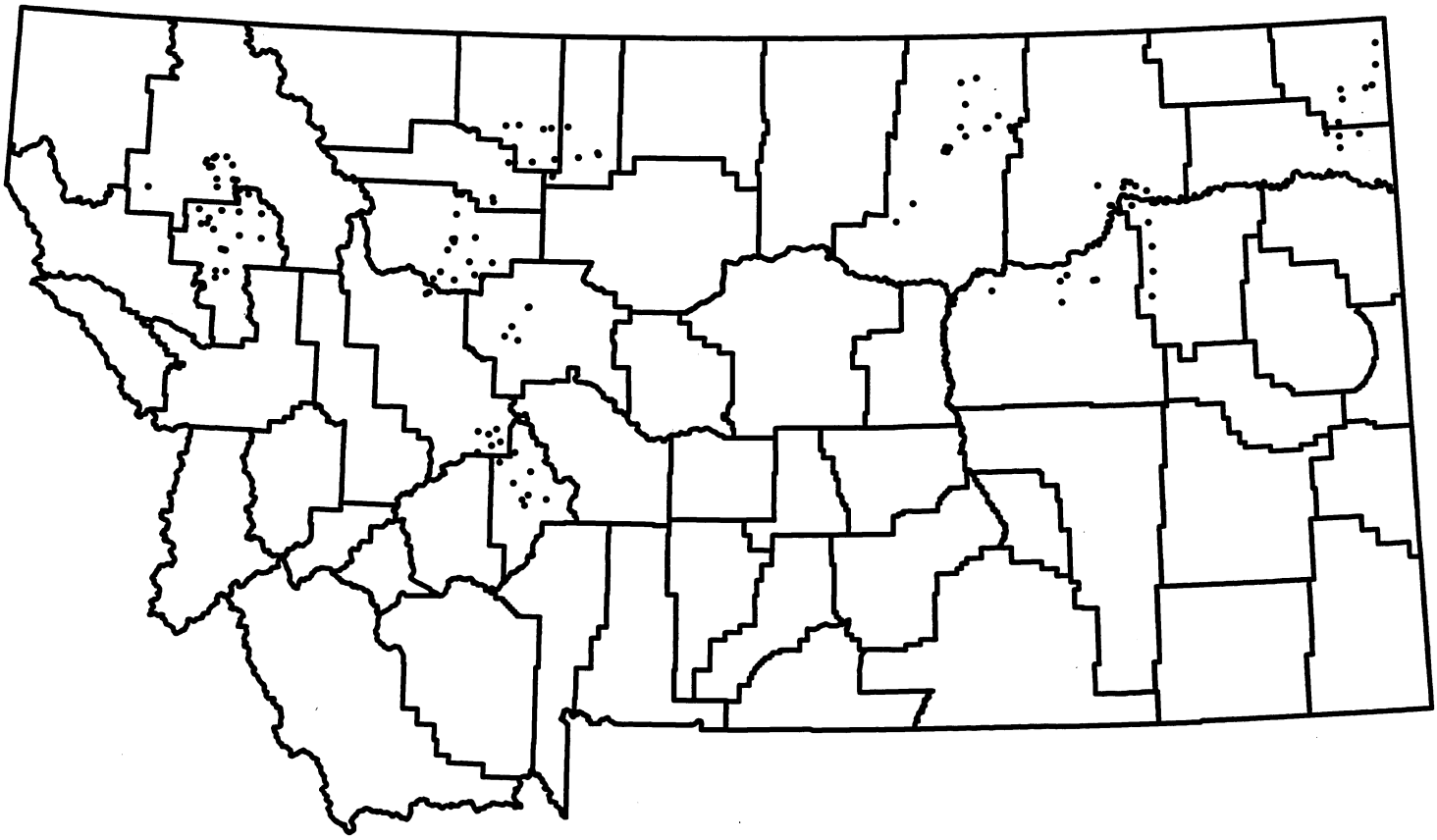
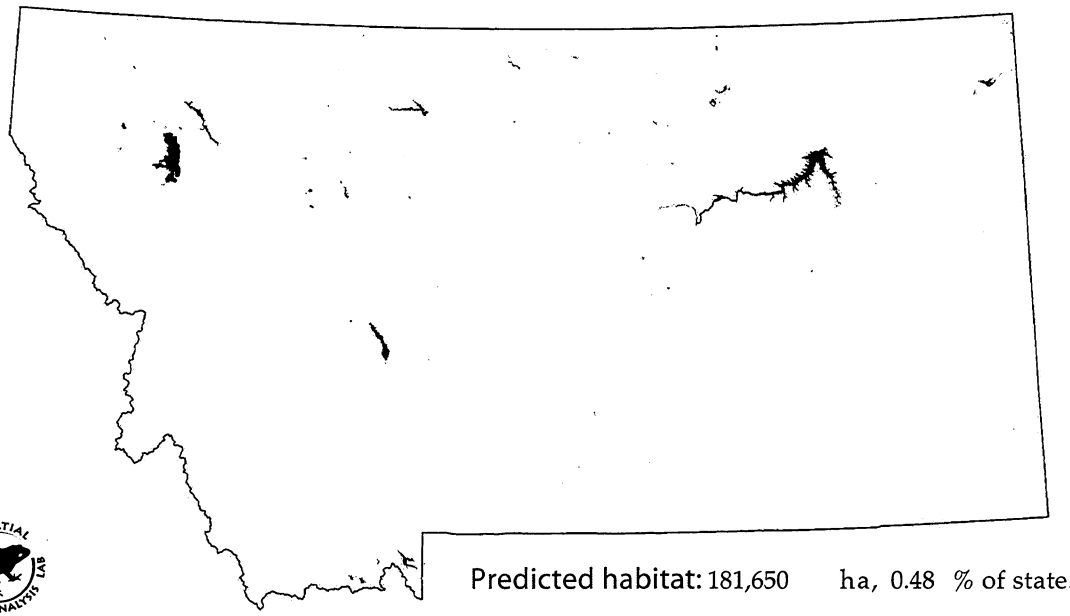


COMMON TERN

Sterna hirundo

State rank	S3B,SZN	Element code	ABNNM08070
Global rank	G5	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 181,650 ha, 0.48 % of state.

State range

Breed locally, mainly in northern and central areas of Montana (Montana Bird Distribution Committee 1996). Transient sightings uncommon and scattered; overwintering does not occur (Montana Bird Distribution Committee 1996).

Habitat description

Breed on coastal sandy or gravelly beaches, small islands in salt marshes, or small rocky islands in lakes, rivers, reservoirs (Stewart 1975, DeGraaf et al. 1991). In the Rocky Mountain region, breed primarily on lakes in the plains, rarely in the montane parks (Johnsgard 1986). Nest colonially on isolated, sparsely vegetated islands in large lakes and reservoirs; in ND, shallow river impoundments managaed for waterfowl are also used (Stewart 1975, DeGraaf et al. 1991). Frequently nest in low, sparse vegetation; nests are well built hollow mounds of vegetation or simple depressions in sandy substrates (Godfrey 1966, DeGraaf et al. 1991). In Saskatchewan, prefer very low, small, rocky islands with sparse vegetation; nests usually located near the lower edge of vegetation (Stelfox and Brewster 1979). May not nest near an adequate food source, and often travel 10+ miles to nearby lakes in search of food (Stewart 1975, Pinkowski 1977). Forage primarily for fish and crustaceans; also aquatic worms, insects (Ehrlich et al. 1988, DeGraaf et al. 1991). Winter habitat is typically along shorelines, rocky coasts, bays - over shallow, coastal waters (DeGraaf et al. 1991). The Common Tern is a species of special concern, on the Blue List; populations in the Great Lakes are declining due to nest site loss from a rise in water levels and increased nest site competition by increasing populations of Ring-billed Gulls (Ehrlich et al. 1988). In MT, due to a need for information regarding breeding/nesting requirements, this colonial nester is considered a threatened, endangered, or sensitive species (Montana Bird Distribution Committee 1996).

Model assumptions & caveats

Breeding habitat modeled. Migration habitat not specifically modeled; assume potential inland migration habitat is defined within breeding habitat parameters. Hydrography coverage may not be consistently accurate and/or true to mapping scale used. Unable to resolve island charateristics in the land cover layer at mapping scale used. Island coverage may not be accurately represented within the hydrography layer.

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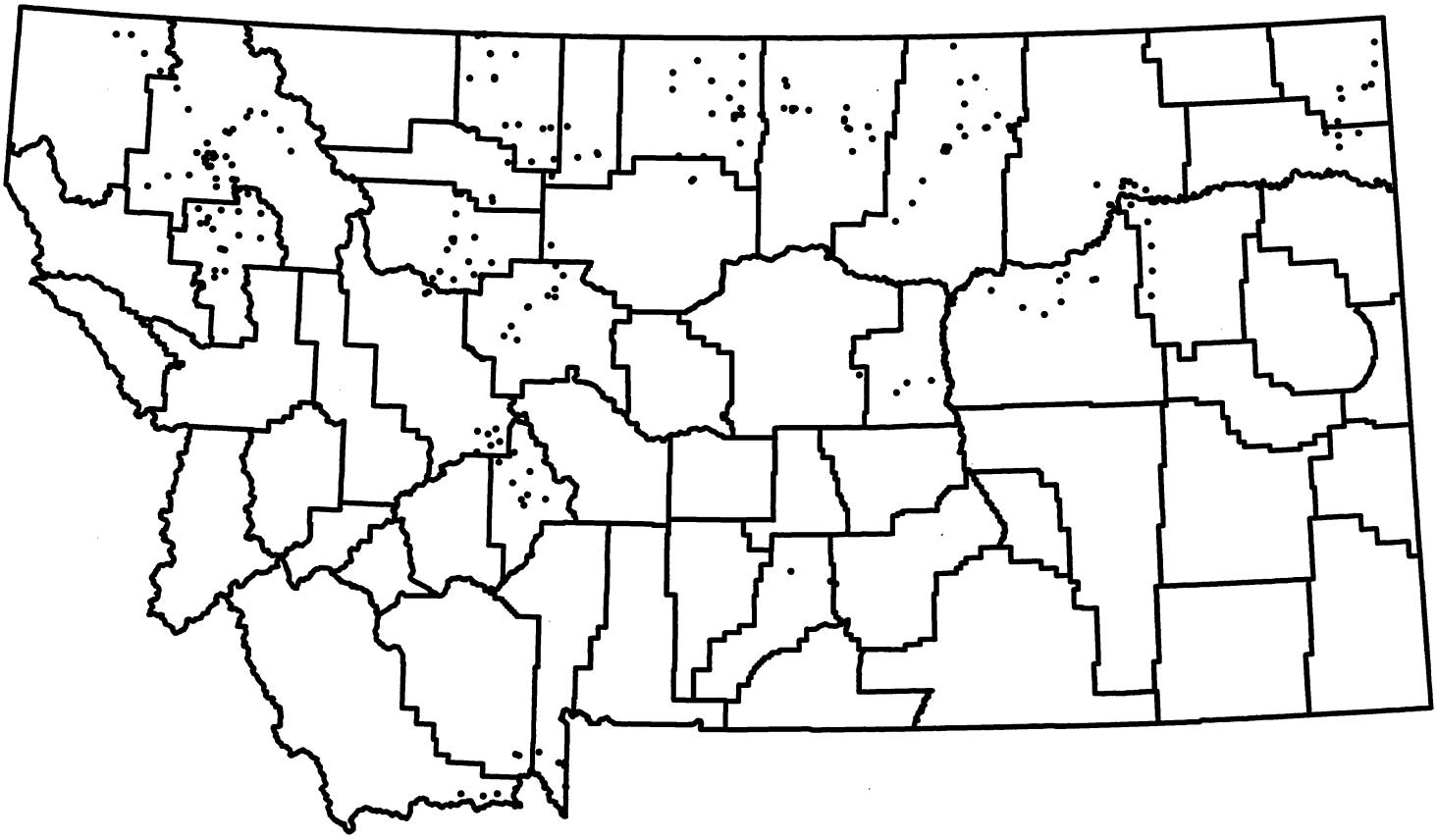
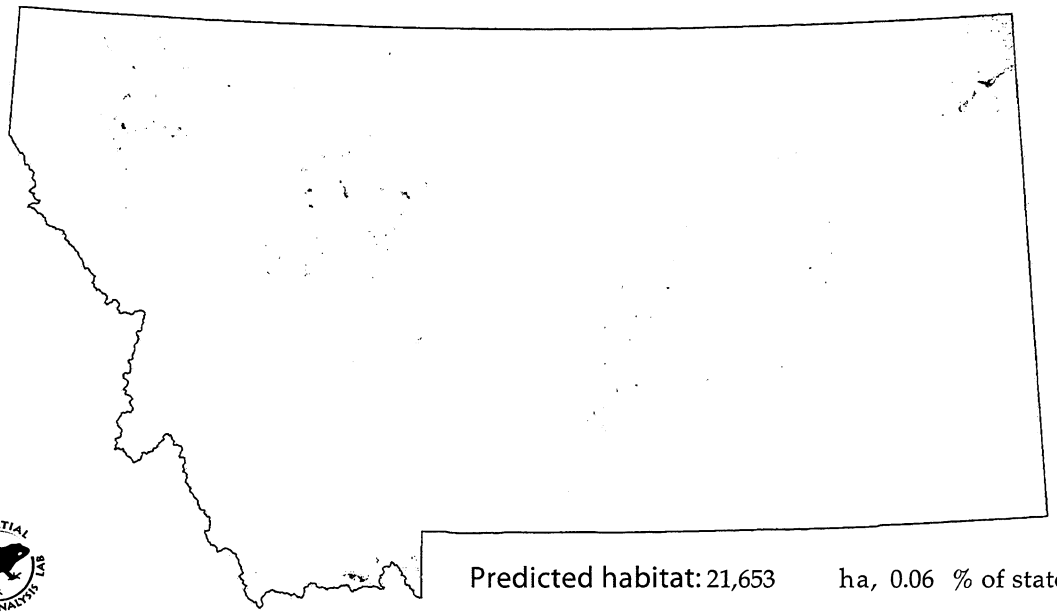


FORSTER'S TERN

Sterna forsteri

State rank	S2B,SZN	Element code	ABNNM08090
Global rank	G5	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 21,653 ha, 0.06 % of state.

State range

Breeding is known at 6 scattered locations in Montana; migration occurs throughout the state, although off the breeding areas, few are seen; overwintering does not occur (Montana Bird Distribution Committee 1996).

Habitat description

Breed primarily on large saltwater and freshwater marshes with extensive stands of emergent vegetation; in the Rocky Mountain region are mainly associated with shallow prairie marshes (Johnsgard 1986, Ehrlich et al. 1988, DeGraaf et al. 1991). A variety of habitats are suitable for nesting: marshy areas of bays, ponds, lakes, sloughs, and river impoundments; muddy lake or estuarine islands dominated by emergent vegetation; dikes in evaporation ponds; vegetated dredge spoil islands (Stewart 1975, Scharf and Shugart 1984, DeGraaf et al. 1991). Usually nest in colonies, often with Common and Black Terns, and often associated with Yellow-headed Blackbirds; American Coots and Red-necked Grebes occasionally parasitize nests (Bergman et al. 1970, Scharf and Shugart 1984, Ehrlich et al. 1988). If present, muskrat houses near open pools of water are especially favored for nesting; also nest on compact, usually floating, platforms of emergent/submergent vegetation; sometimes in a simple sand or mud depression; occasionally use abandoned nests of Western or Pied-billed Grebes (Bergman et al. 1970, Stewart 1975, Johnsgard 1986, DeGraaf et al. 1991). Essentially piscivorous; also eats insects, crustaceans, amphibians (DeGraaf et al. 1991). Winter habitat is primarily coastal - harbors, marshy bays, estuaries, lagoons; occasionally inland ponds and lakes (DeGraaf et al. 1991). The Forster's Tern is considered a threatened, endangered, or sensitive species in Montana - conversion of wetlands for agricultural purposes may seriously affect this marshland breeder; more information is needed on the breeding/nesting requirements of this species (Ehrlich et al. 1988, Montana Bird Distribution Committee 1996).

Model assumptions & caveats

Breeding habitat modeled. Migration habitat not specifically modeled; assume potential inland migration habitat is defined within breeding habitat parameters. Hydrography coverage may not be consistently accurate and/or true to mapping scale used. Persistence of intermittent water (seasonal vs. semipermanent, etc.), water depth, presence of muskrat houses, and submerged vegetation information not available to include in model. Interspersion of emergent vegetation near/in water cannot be resolved at mapping scale used. Suitable habitat likely overestimated.

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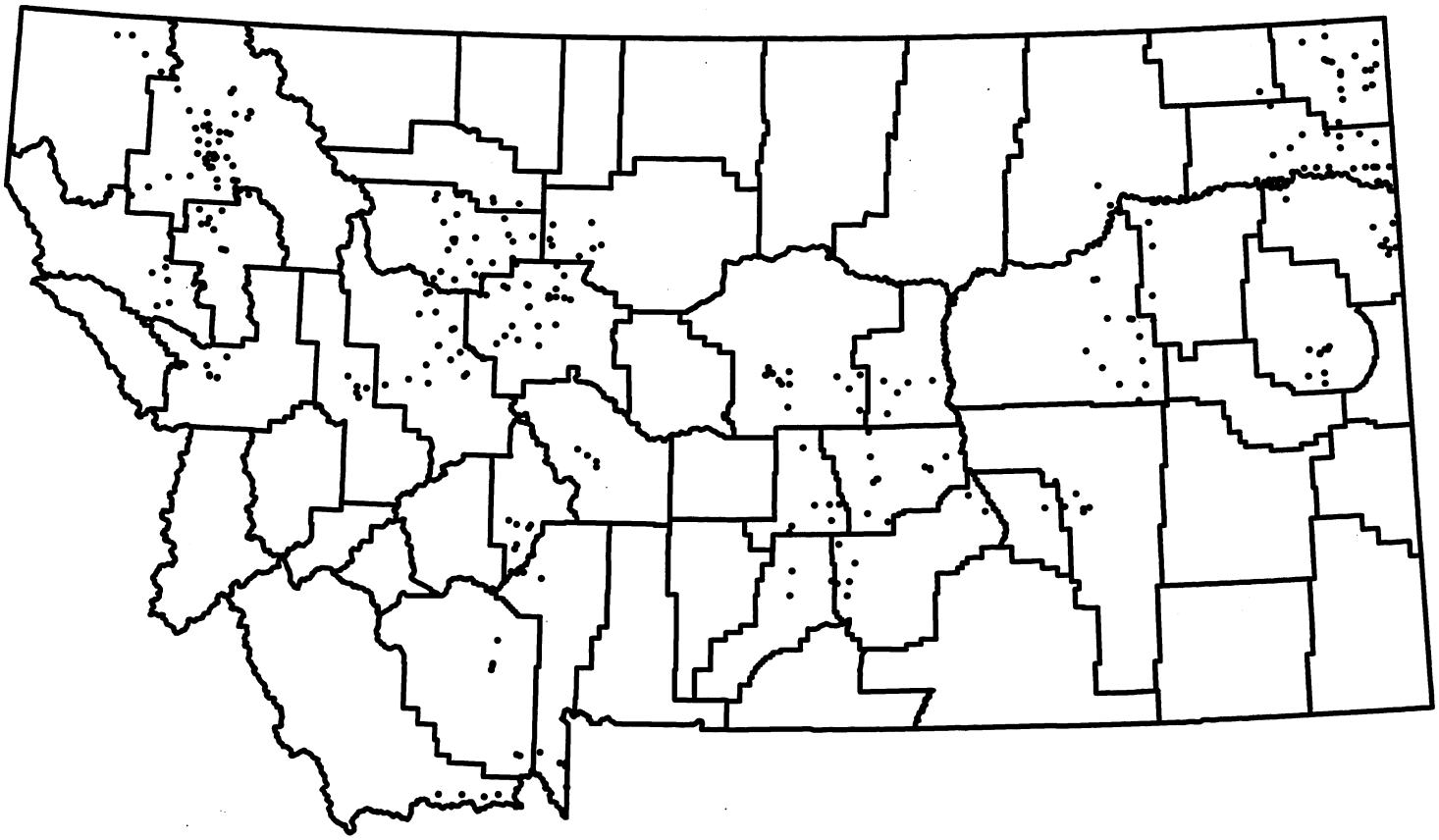
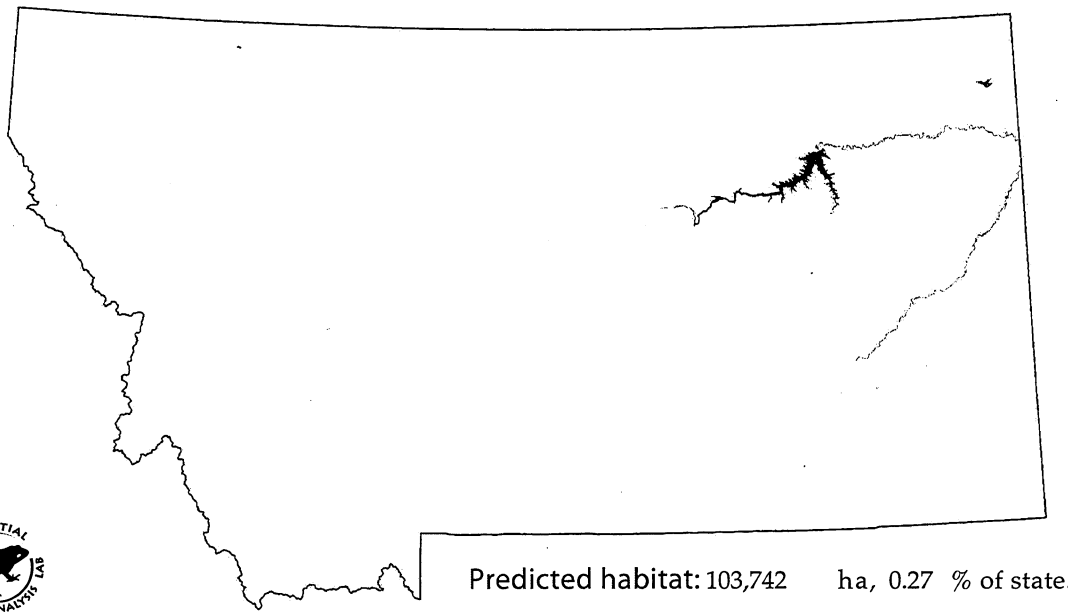


LEAST TERN

Sterna antillarum

State rank	S1B,SZN	Element code	ABNNM08100
Global rank	G4	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 103,742 ha, 0.27 % of state.

State range

Breeding restricted to east-northeast Montana; recorded in low numbers along the lower Yellowstone River and the Missouri River below Fort Peck dam and on small islands in the Fort Peck Reservoir (USFWS 1990, Montana Bird Distribution Committee 1996). Transient sightings rare in Montana; overwintering does not occur (Montana Bird Distribution Committee 1996).

Habitat description

Breed on open, flat areas of sandy coastal beaches, and inland on sand/gravel bars, shorelines and islands of rivers and reservoirs (Ehrlich et al. 1988, DeGraaf et al. 1991). Interior populations nest on sparsely vegetated to barren areas of sand or gravel along the Mississippi and Missouri River systems (Ziewitz et al. 1992, Kirsch 1996); also the salt plains of Oklahoma (USFWS 1990). In the upper Missouri River Basin (Great Plains area), often nest in association with Piping Plovers (Ziewitz et al. 1992); in the Arkansas River system, American Avocets and Snowy Plovers are breeding associates (Grover and Knopf 1982, USFWS 1990). Throughout the interior breeding range, preferred nesting habitat is similar: Sparsely vegetated riverine sand and gravel bars within open, wide channel areas, or salt flats of lake shorelines (USFWS 1990, Ziewitz et al. 1992, Kirsch 1996). Due to high river flow at the onset of nesting, nest sites are usually higher on the sandbar, away from the waters edge (USFWS 1990, Kirsch 1996). Along the Platte River, NE, ideal nesting habitat is 1200m stretches of river with the channel at least 275m wide, with sandbars or islands 1.45-4.0ha in size and at least 0.5m tall, but >=0.9m in height offers better protection from inundation (Ziewitz et al. 1992). Also nest on artificial substrates - dikefields, sand and gravel pits, and dredgespoil islands (Reel et al. 1989, USFWS 1990). Nest solitarily or in colonies; nests are shallow depressions in the substrate, often near conspicuous objects such as stones or wood debris (USFWS 1990, DeGraaf et al. 1991). Breeding home range is usually limited to the river reach of/near the nest site sandbar (USFWS 1990). Nest site location is often adjacent to shallow areas of lakes or river backwaters that offer an abundant food source (Reel et al. 1989). Primarily piscivorous; also forage for crustaceans and insects (Reel et al. 1989,

USFWS 1990). Winter habitat includes coastal beaches, bays, and estuaries, as well as inland rivers and lakes (A.O.U. 1983). Interior populations have been estimated to be 3,360 pairs, and are declining due to alteration of river systems and destruction of nesting habitat (e.g., channelization, irrigation, reservoir construction), and lower productivity caused by human distrubance/recreation (Reel et al. 1989, UWFWS 1990, Kirsch 1996). Although the silty, fine sand of the Yellowstone River shorelines represents marginal nesting habitat, Least Terns do nest there due to the absence of developments and human disturbance (Kreil and Dryer 1978). Along dammed rivers, irregular fluctuations in water levels flood existing nests, or promote vegetative growth on naturally scoured sandbars rendering them unsuitable for nesting (Reel et al. 1989, USFWS 1990). The Interior Least Tern is considered an endangered species by the USFWS and USFS Region 1 (Reel et al. 1989, Montana Bird Distribution Committee 1996). Conservation efforts include protection of existing breeding habitat by fencing off nesting areas to restrict human receration (200m buffer distance around nests), developing reservoir control policies, and creation of suitable habitat by dredging sand/gravel to elevate existing sandbars and establish new ones in suitable river reaches (USFWS 1990, Ziewitz et al. 1992, Kirsch 1996).

Model assumptions & caveats

Breeding habitat modeled. Migration habitat not specifically modeled; assume potential inland migration habitat is defined within breeding habitat parameters. Hydrography coverage may not be consistently accurate and/or true to mapping scale used. Island or shoreline/river bar substrate characteristics cannot be resolved at mapping scale used; presence of river bars and islands may not be accurately represented in the land cover and hydrography, respectively. Potential for human disturbance information not available to include in model. Suitable breeding habitat likely overestimated.

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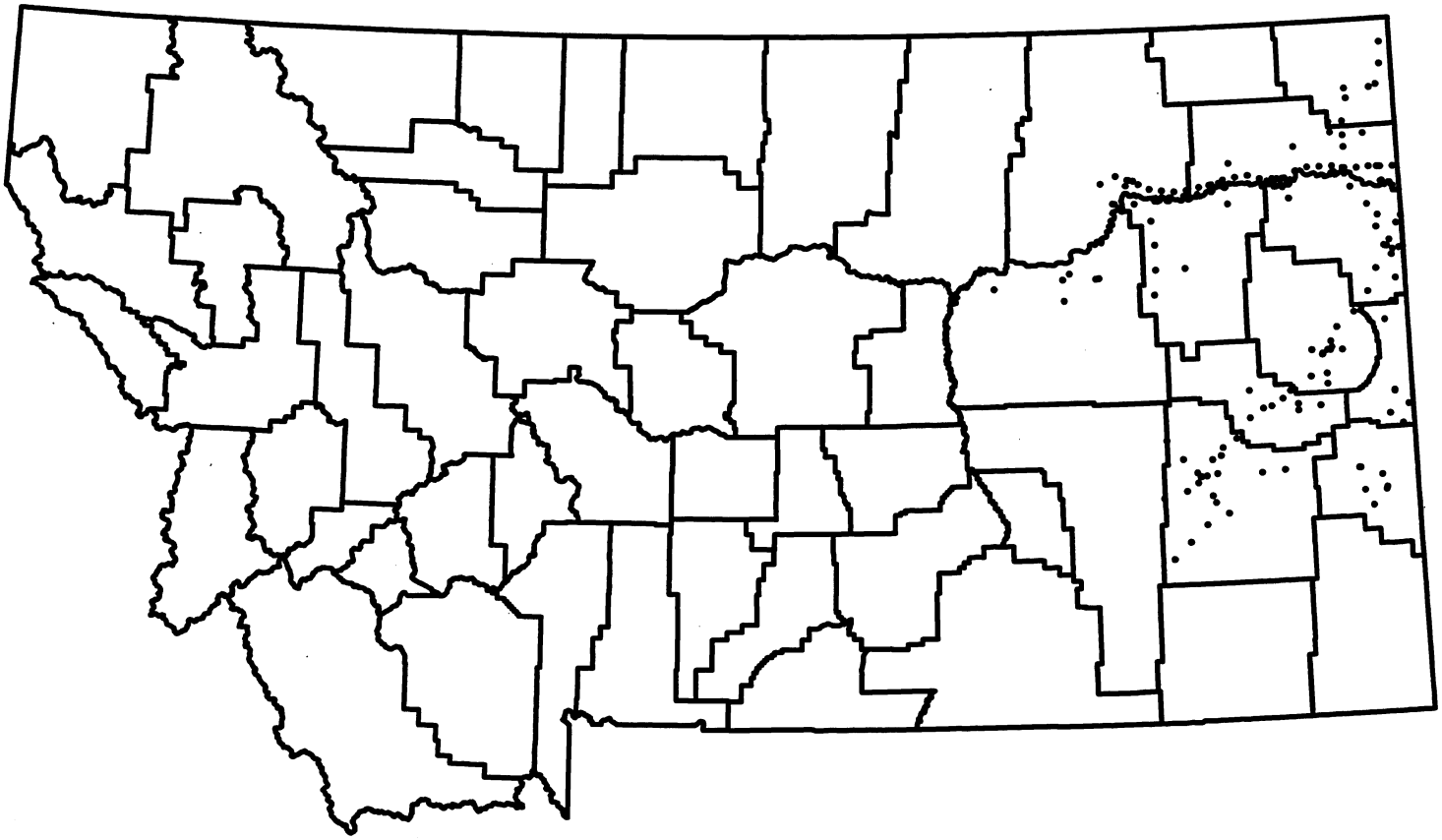
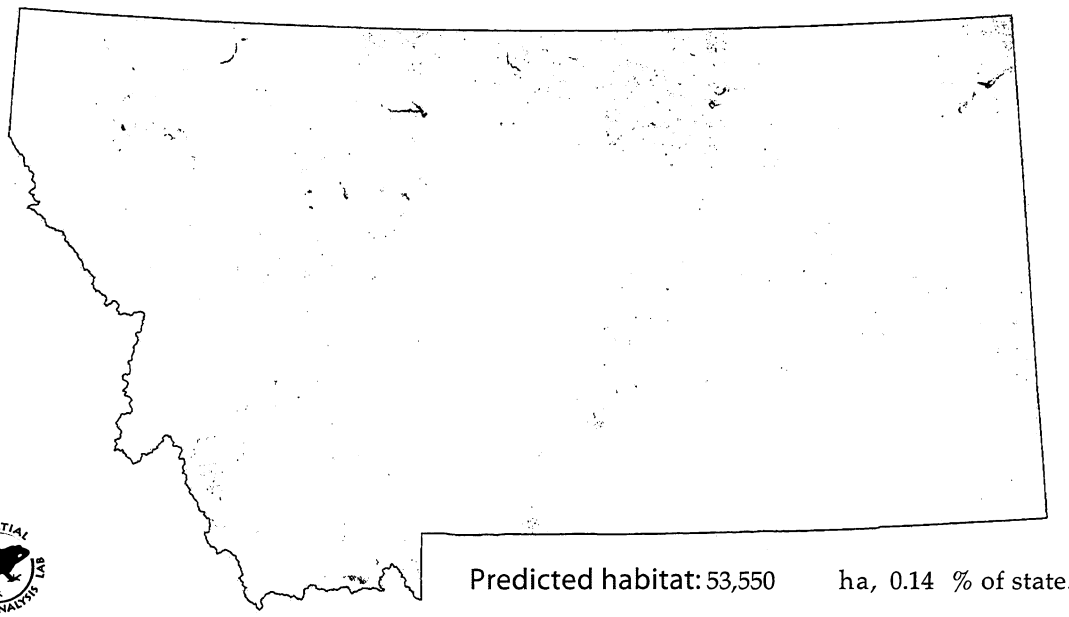


BLACK TERN

Chlidonias niger

State rank	S3B,SZN	Element code	ABNNM10020
Global rank	G4	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 53,550 ha, 0.14 % of state.

State range

A fairly common summer resident in the Rocky Mountain region, breed locally (more prevailent in the western Montana) and migrate widely throughout the state; overwintering does not occur (Montana Bird Distribution Committee 1996).

Habitat description

Breed in shallow freshwater marshes with extensive stands of emergent vegetation and areas of open water, in forested or open water habitats up to 1540m elevation - including prairie sloughs, lake or pond margins, shallow river impoundments; occasionally river or island edges, wet meadows, swampy grasslands; sometimes cultivated rice fields, large stock ponds (Stewart 1975, Johnsgard 1986, DeGraaf et al. 1991, Dunn and Agro 1995). In the Rocky Mountain region, breed mainly in marshland or shallow grassy sloughs on the prairies, sedge dominated ponds in the parklands, and marshy cattail margins of northern lakes (Salt and Salt 1976, Johnsgard 1986). In the Prairie Pothole region of ND, highest numbers and densities breed on semipermanent wetlands (Stewart and Kantrud 1984). In IA, marshes or marsh complexes of 11-20+ha are preferred for nesting (Brown and Dinsmore 1986). Nests consist of low, loose, damp vegetation debris built on floating mats of dead marsh vegetation or boards; occasionally on nonfloating substrates such as muskrat houses or abandoned grebe nests - favored sites are surrounded by emergent vegetation to reduce wind and wave perturbations (Bergman et al. 1970, Ehrlich et al. 1988, Dunn and Agro 1995). Nest colonially or singly; frequent renesting and low site tenacity are adaptations to highly variable reproductive success (DeGraaf et al. 1991, Dunn and Agro 1995). Primarily insectivorous (both aquatic and terrestrial species consumed); also forage for worms, mollusks, crustaceans, small fishes (DeGraaf et al. 1991, Dunn and Agro 1995). During migration, frequent freshwater lakes, reservoirs, rivers, and other interior wetlands; also cultivated fields (DeGraaf et al. 1991, Dunn and Agro 1995). Winter habitat is primarily marine - usually within 30km of the coast; also coastal wetlands, estuaries (DeGraaf et al. 1991, Dunn and Agro 1995). The Black Tern is listed as a federal, category 2 candidate species and is considered a threatened, endangered or

sensitive species in Montana (Dunn and Agro 1995, Montana Bird Distribution Committee 1996). Populations have declined in many areas due to wetland conversion/degradation in both breeding and migration stopover areas (Ehrlich et al. 1988, Dunn and Agro 1995). Agricultural chemicals and pesticides have also contributed to declines by reducing hatching success and the insect food base in some areas (Ehrlich et al. 1988, Dunn and Agro 1995). Will readily nest in artificial (e.g., settling ponds) or restored wetlands, and will tolerate human activity near the nesting marsh as long as colonies are not entered (Delehanty and Svedarsky 1993, Dunn and Agro 1995). River impoundments and wetlands managed for waterfowl are suitable for nesting if water levels are held stable throughout the nesting season and emergent vegetation is maintained (Dunn and Agro 1995).

Model assumptions & caveats

Breeding habitat modeled. Migration habitat not specifically modeled; potential inland migration habitat is assumed defined within breeding habitat parameters - agricultural areas not included, as would diminish relevance of model as regards breeding habitat requirements and greatly overestimate habitat. Hydrography coverage may not be consistently accurate and/or true to mapping scale used. Persistence of intermittent water (e.g., seasonal vs. semipermanent, etc.) and water depth information not available to include in model.

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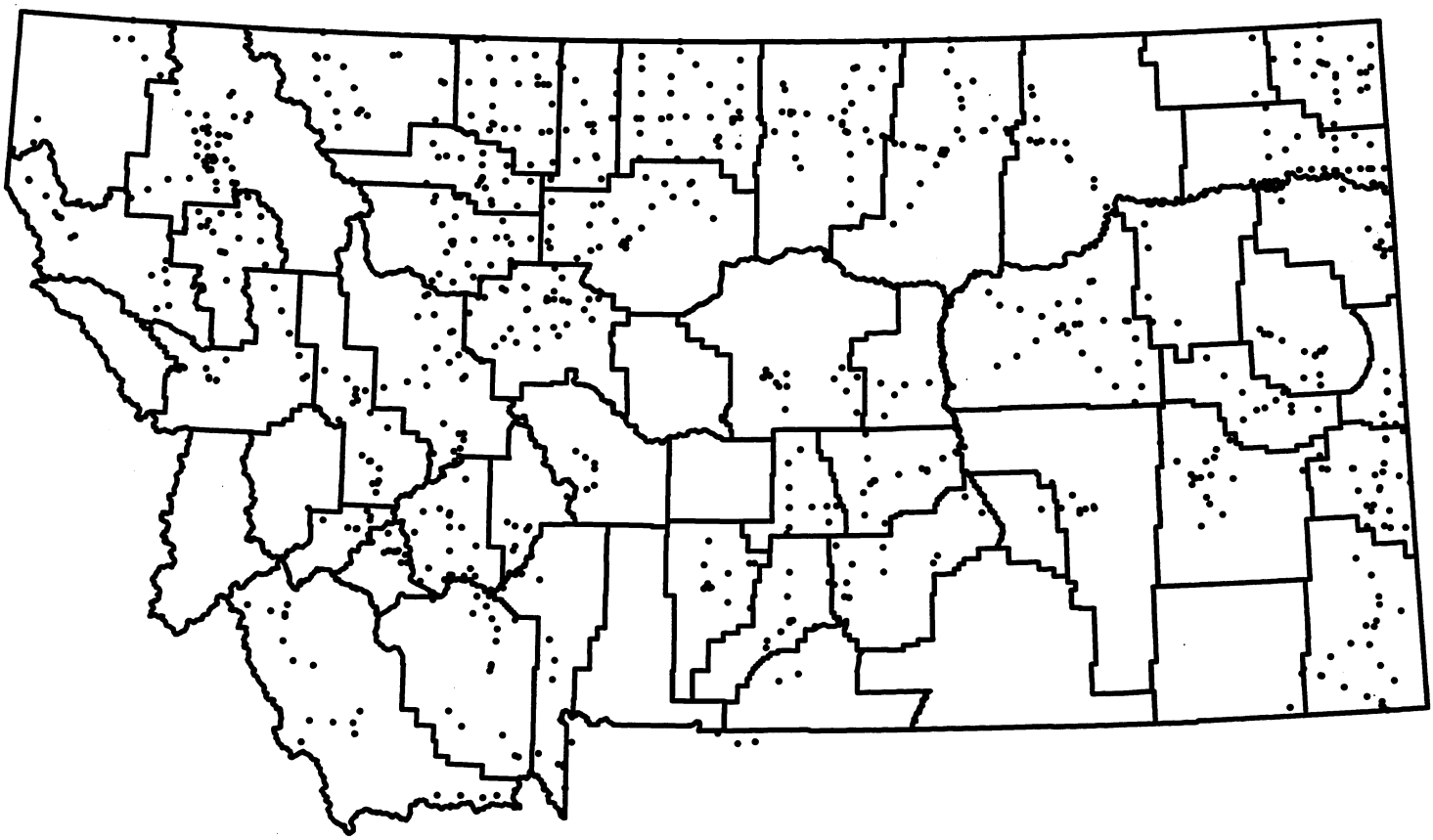
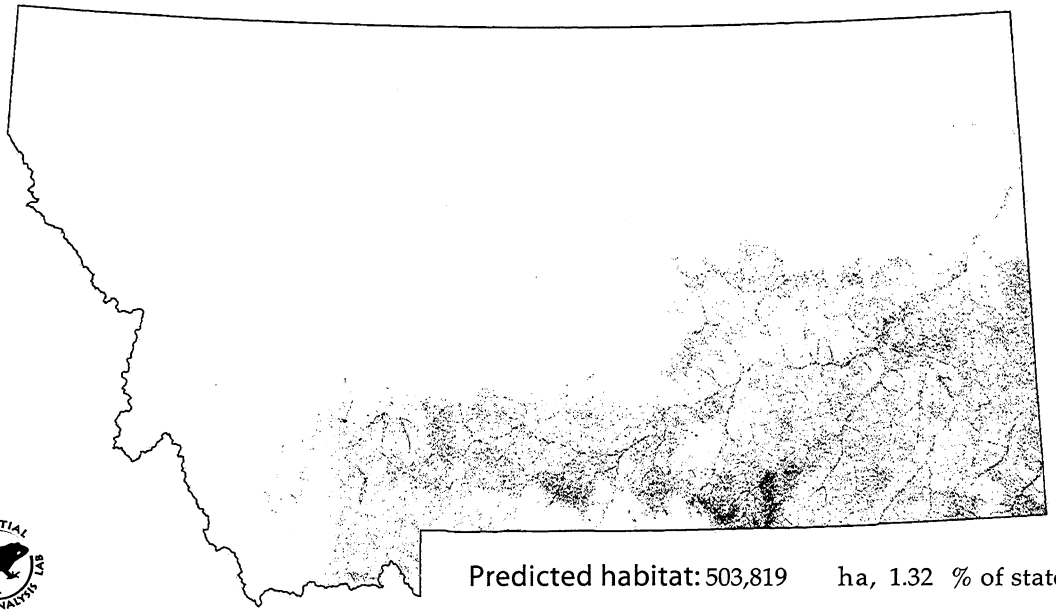


YELLOW-BILLED CUCKOO

Coccyzus americanus

State rank	S3B,SZN	Element code	ABNRB02020
Global rank	G5	Modeled by	C. Tobalske
MTNHP status	special concern		



Predicted habitat: 503,819 ha, 1.32 % of state.

State range

Breeds in southeastern Montana (T. McEneaney pers. comm.). Although records show no breeding since 1991, there are likely more occurences in eastern and southeastern Montana than the database reflects, due simply to a shortage of submitted observations (Montana Bird Distribution Committee 1996, T. McEneaney pers. comm.).

Habitat description

Preferred habitat includes moderately dense thickets near watercourses, second-growth shrublands, deserted farmlands overgrown with shrubs and brush, and brushy orchards (Johnsgard 1979). Also nests in extensive, mature riparian woodlands, especially of cottonwood or willow (Dobkin 1992), and open woodlands where undergrowth is thick (AOU 1983). In Arizona at 4100', breeds in cottonwoods and willows (Hamilton and Hamilton 1965). In Montana, rare at high elevations (Johnsgard 1986).

Model assumptions & caveats

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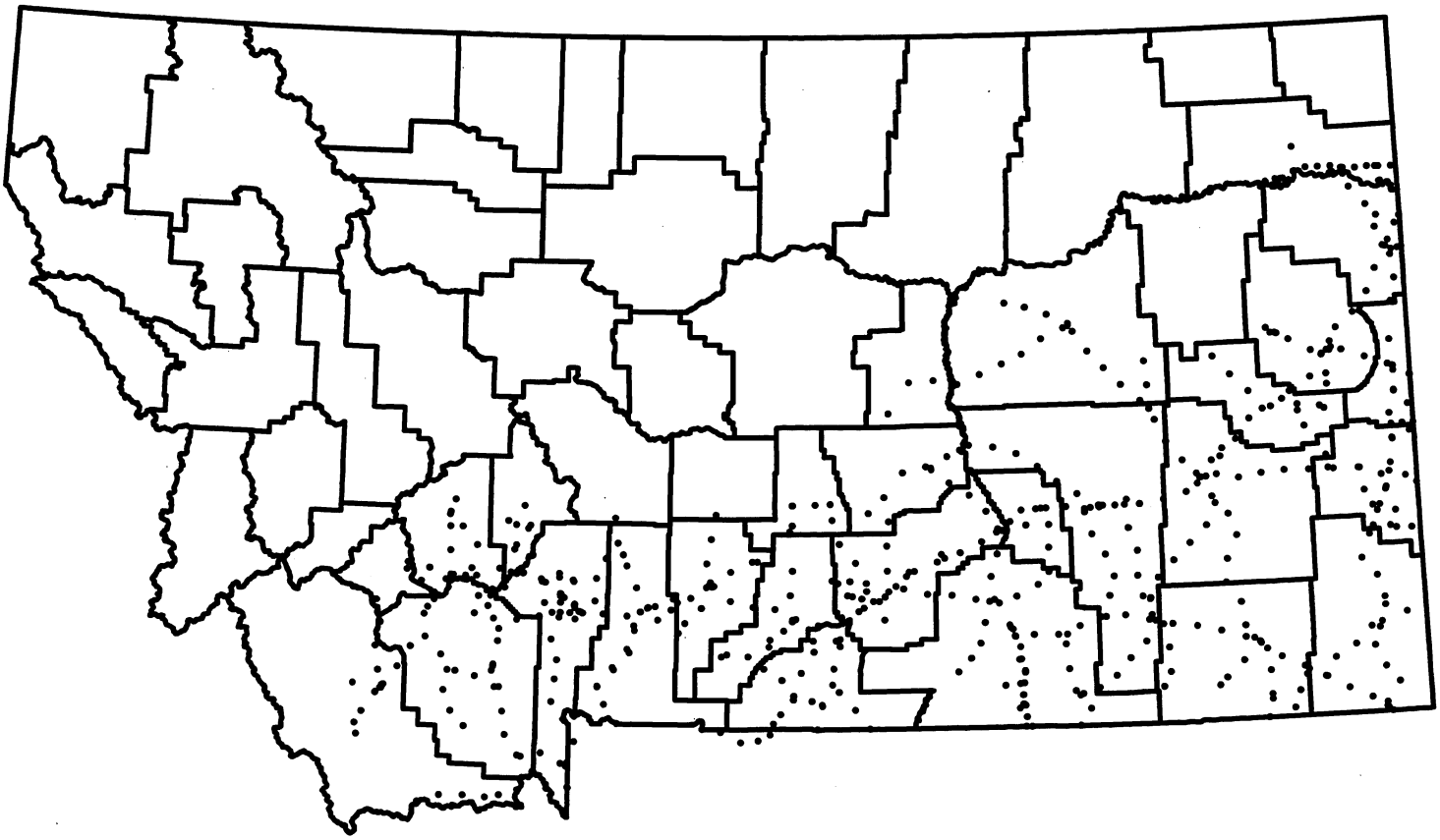
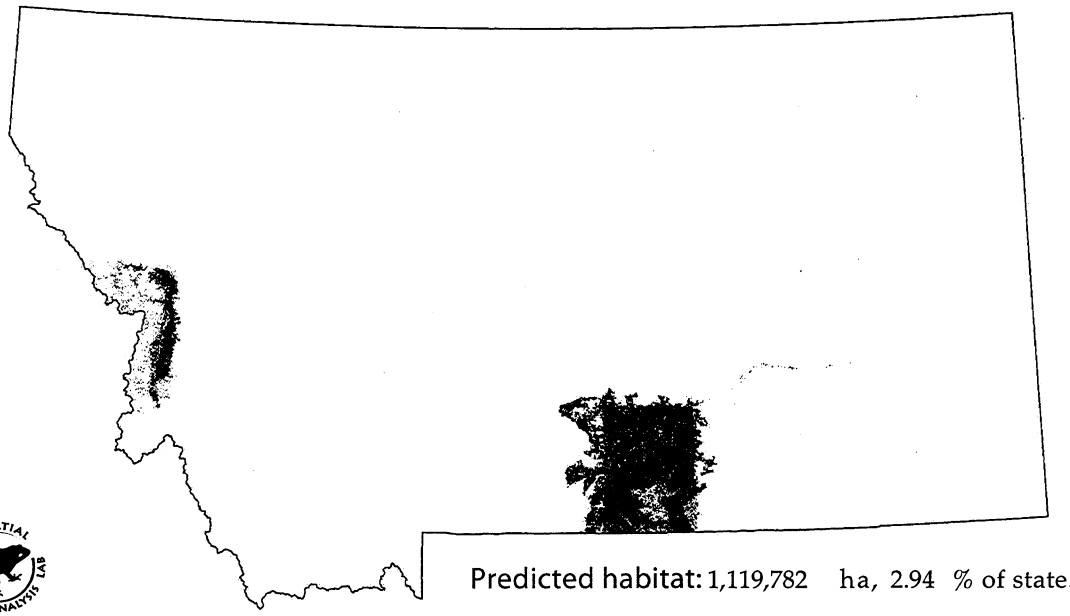


BARN OWL

Tyto alba

State rank	SAB,SAN	Element code	ABNSA01010
Global rank	G5	Modeled by	M. Hart
MTNHP status	watch list		



Predicted habitat: 1,119,782 ha, 2.94 % of state.

State range

An accidental breeder, sparsely and patchily distributed, with a few records spread widely throughout the state (Montana Bird Distribution Committee 1996). Montana is at the northern periphery of the species' breeding range, which is apparently limited by winter weather (Marti 1994). Currently, there are two confirmed breeding records, both near the state borders (one south-central, one southwestern), in Carbon and Ravalli counties (Wright 1996). The first was in 1989 (Holt et al. 1992). A nest also has been reported farther north in Manitoba (Nero 1995).

Habitat description

See review by Marti (1992): Uses a wide range of open habitats at low elevations, including urban and agricultural areas as well as grasslands, deserts, and marshes. Nests in cavities of both natural and anthropogenic sources: trees, cliffs, caves, riverbanks, church steeples, barn lofts, hay stacks, and nest boxes. The availability of nest cavities limits use of suitable foraging habitat. However, Barn Owls show great adaptability in selecting nest sites and foraging habitat, and are able to exist in many landscapes dominated by humans. Breeding and wintering ranges are generally the same for all but the most northerly populations (i.e, Montana), which are reported to be partly migratory. In northern winter often roosts in dense conifers; also roosts in nest boxes if available (Marti and Wagner 1985).

Nero (1995) speculates that an increase in numbers of derelict structures (e.g., houses, barns, sheds) in the northern Great Plains over the past several decades has provided a new source of shelter for Barn Owls. Such a factor could be critical in the species' ability to successfully inhabit Montana and other northern regions, because the Barn Owl is susceptible to starvation during prolonged low temperatures and snow cover (Marti and Wagner 1985). Near the northern end of the normal breeding range in northern Utah, winter weather has been found to cause great variations in reproductive performance (Marti 1994).

Model assumptions & caveats

Modeled, but because of the rarity and peripheral nature of breeding records in the state relative to the large size of the latilongs, overestimation of habitat/predicted distribution seems probable. Presence of human-created structures for nesting could not be evaluated, but is inferred in the selected cover types.

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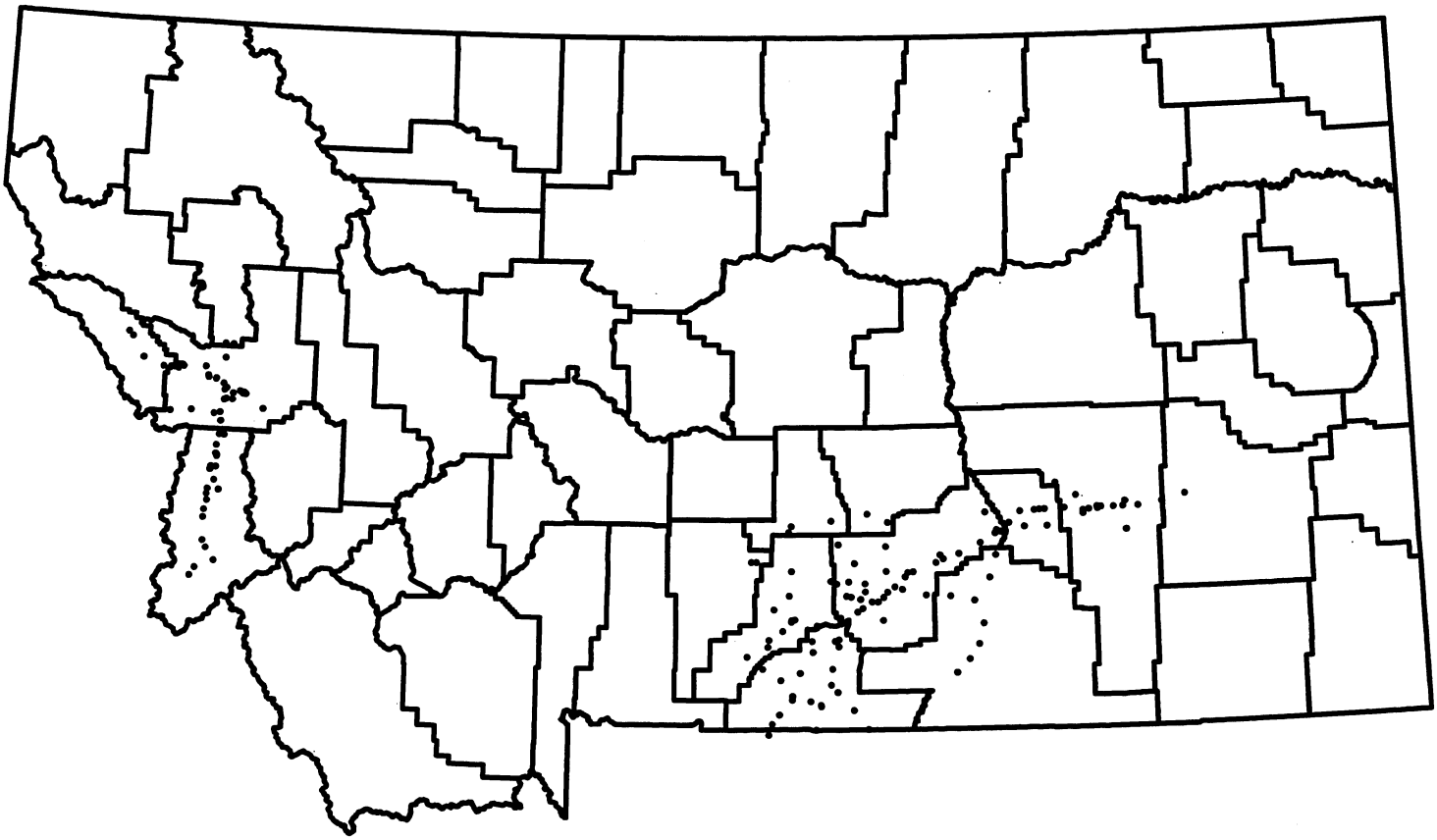
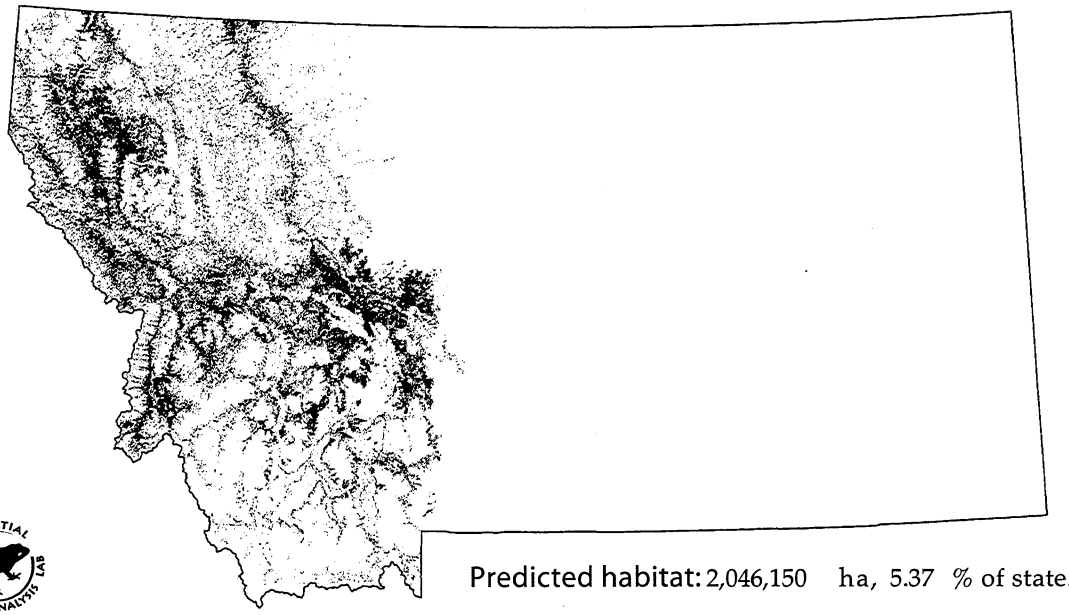


FLAMMULATED OWL

Otus flammeolus

State rank	S2S3B,SZN	Element code	ABNSB01020
Global rank	G4	Modeled by	M. Hart
MTNHP status	special concern		



Predicted habitat: 2,046,150 ha, 5.37 % of state.

State range

Found in western Montana; breeding has been confirmed in six latilongs, generally in the southwest (Montana Bird Distribution Committee 1996). Because of its widespread presence in Missoula and Ravalli counties, should not be considered rare in the state (P.L. Wright 1996).

Habitat description

See review by McCallum (1994): Flammulated Owls occupy primarily open ponderosa pine/ Douglas-fir or similar forests, e.g., dry montane conifer or aspen forests. The species is associated with mature to old-growth ponderosa pine and Douglas-fir forests throughout the northern and central Rocky Mountains (Bull and Anderson 1978, Goggans 1986, Holt and Hillis 1987, Howie and Ritcey 1987, Reynolds and Linkhart 1987, Atkinson and Atkinson 1990, Bull et al. 1990, Reynolds and Linkhart 1992, V. Wright 1996). Stands used by Flammulated Owls also tend to be relatively open (Goggans 1986, Howie and Ritcey 1987, McCallum and Gehlbach 1988, Atkinson and Atkinson 1990).

In northeastern Oregon, stands of large-diameter (>50 cm DBH) ponderosa pine and Douglas-fir or grand fir with ponderosa pine in the overstory were identified as nesting habitat (Bull and Anderson 1978, Bull et al. 1990). Similarly, Goggans (1986) described nesting habitat as stands of ponderosa pine/Douglas-fir, 30-50 cm DBH, with less than 50% canopy closure. Owls foraged in the edge between forest and grassland, as well as in ponderosa pine/Douglas-fir forests of low or moderate density. Density appeared to be a crucial aspect of roosting habitat: owls roosted in mixed conifer stands, and avoided open stands of ponderosa pine.

Reynolds and Linkhart (1987, 1992) have found a strong association between Flammulated Owls and old-growth ponderosa pine/Douglas-fir habitat in Colorado, noting that such forests were used more than expected for nesting, foraging, and singing. They speculate that the presence of cavities and snags, the abundance of arthropods, and a stand structure suitable for foraging may be factors in this preference (Reynolds and Linkhart 1992). Owls have also been found to nest in live aspen ($n = 3$) in

Colorado (Richmond et al. 1980).

Marcot and Hill (1980) also recorded use of hardwoods; California black oak (*Quercus kelloggii*) was present at 67% of locations in northwestern California, while ponderosa pine was present at 50% of locations. All territory sites were on xeric midslopes or near ridgetops. Also in California, Bloom (1983) observed 3 owls, all in stands dominated by ponderosa pine.

In central Idaho, territorial owls occupied relatively open, multistoried Douglas-fir, ponderosa pine, and mixed conifer stands with some mature trees usually present (Atkinson and Atkinson 1990). Territories were often near more open areas, including old burns, grassy hillsides, natural clearings, or clearcuts. Atkinson and Atkinson (1990) also noted a clumped distribution of territorial males, leaving apparently suitable habitat vacant. Similarly, Marcot and Hill (1980) found "quasi-colonies" of territorial males, along with unoccupied areas of apparently optimal habitat.

At the northern edge of the owl's range in British Columbia, Howie and Ritcey (1987) identified mature/old-growth (>100 year-old) Douglas-fir and Douglas-fir/ponderosa pine stands as nesting habitat, finding that owl densities were highest in stands 140-200+ years old. Stands were open, with canopy closures between 35-65%, and at least 2 canopy layers were present. Although Howie and Ritcey (1987:253) found a clearer association with mature/old-growth Douglas-fir than with ponderosa pine, they stated that "...the open nature of the fir forests coupled with natural or artificial openings created by logging probably resembles the physical structure of preferred forests in the southern portion of the owl's range."

Most recently, V. Wright (1996) found that owls in the Bitterroot and Sapphire ranges of southwestern Montana used mature and old-growth ponderosa pine/Douglas-fir stands rather than young stands or stands of other conifers, but noted that 48% of the plots in the study area with suitable microhabitat were unoccupied. Examined at multiple scales, owls responded to the presence of snags and large trees (microhabitat); the presence of openings (home range); and the overall abundance of low/moderate canopy closure ponderosa pine/Douglas-fir (landscape). Occupied landscapes were described as a mosaic of grass/xeric shrub and forest edge habitat, which is characteristic of most of the species' range.

Model assumptions & caveats

Model does not include forest stand structure/size class, and thus overestimates potential habitat. Unable to evaluate presence of suitable nest sites (snags) or stand understory. Forest edge habitats were addressed by placing a 90 m buffer around selected cover types, and selecting openings (grass and shrub) when they fall within this narrow buffer. Model queries for nesting and foraging habitat.

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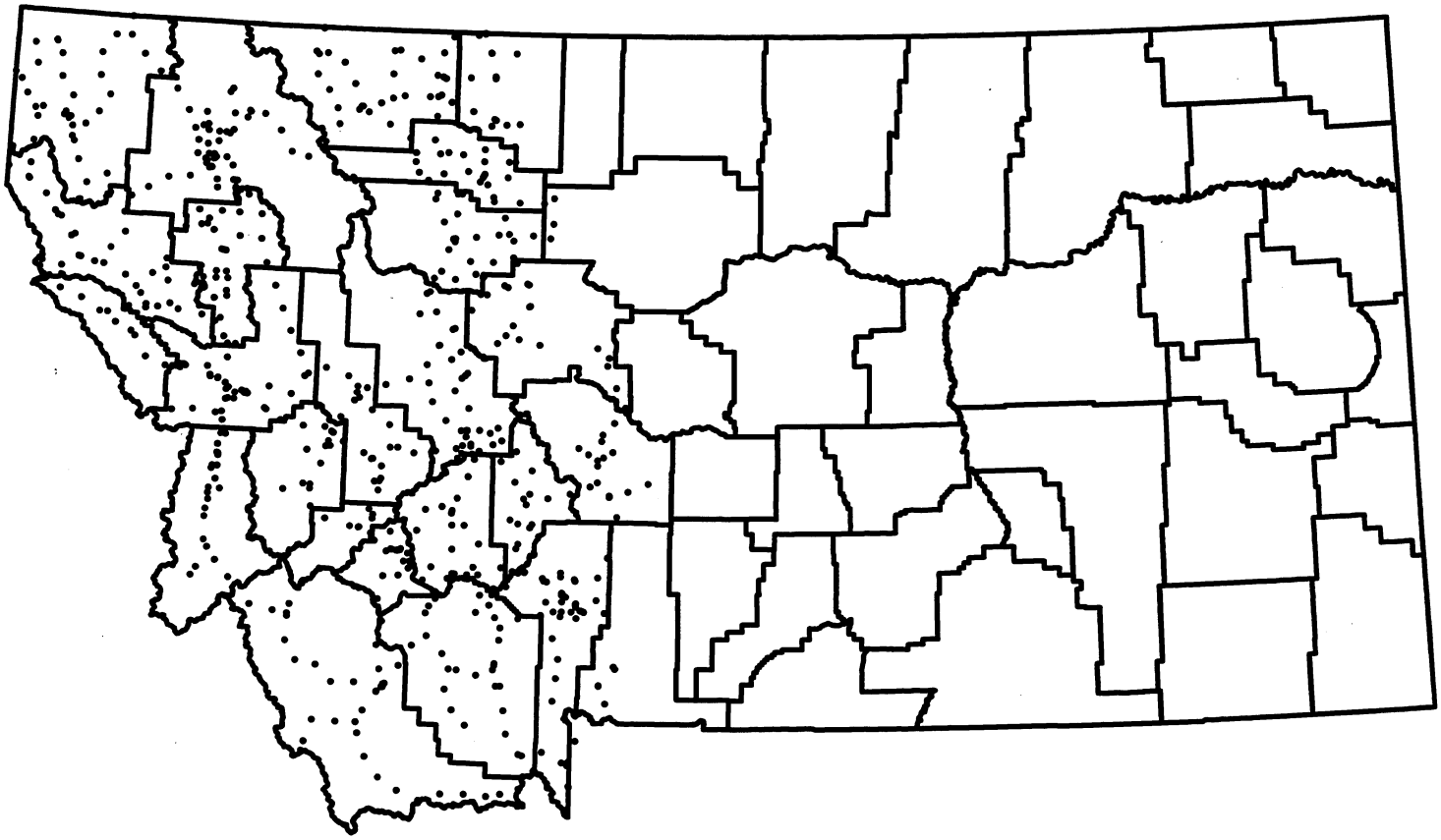
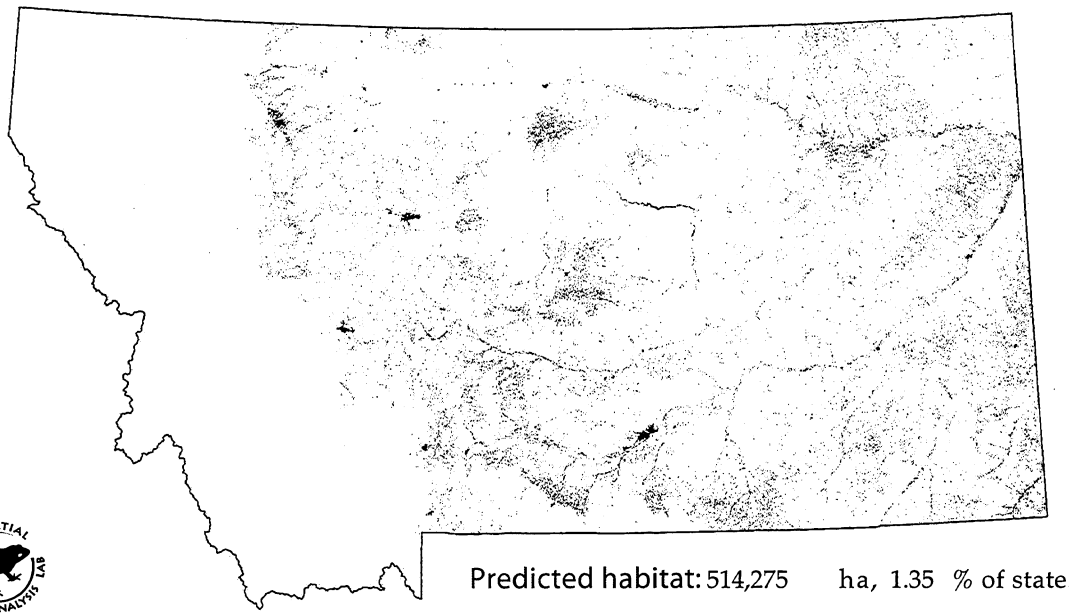


EASTERN SCREECH-OWL

Otus asio

State rank	S3S4	Element code	ABNSB01030
Global rank	G5	Modeled by	M. Hart
MTNHP status	watch list		



Predicted habitat: 514,275 ha, 1.35 % of state.

State range

Riparian corridors in eastern Montana extending west as far as the main Rocky Mountain chain; most locations in southeastern Montana (Montana Bird Distribution Committee 1996). Exact range limits are not well known (Johnsgard 1986, Adam 1987). Probably relatively common across much of eastern and central Montana (Wright 1996). May be common in preferred habitat along the Milk River (D. Prellwitz, pers. comm.). Specimen collected at Mammoth, Yellowstone National Park, Wyoming (T. McEneaney, pers. comm.) may offer insight on the species' western limits in southern Montana.

Habitat description

Open woodlands, deciduous forest, parklands, residential areas in towns, scrub, and riparian woodland in drier regions (AOU 1983). In Montana, probably is largely restricted to riparian woodlands along major streams and rivers (J. Marks, pers. comm, T. McEneaney, pers. comm.). See review by Gehlbach (1995): The Eastern Screech-Owl occupies the broadest ecological niche of any owl in its range; although common, it is poorly studied. It is found in tree-dominated landscapes of most types, natural and anthropogenic, early to late successional, river valleys to mountain slopes. Generally found <1800 m. Marginal in boreal and montane conifer forests. Requires only a suitable cavity tree or substitute (e.g., nest box). Forages in forest and woodland understory, openings, and edges. Most habitat descriptions are based on studies from the eastern U.S. Habitats listed by Gehlbach (1995) that would apply to Montana include northern mixed and deciduous forest, urban and suburban yards, parks, and green belts.

Two attempts have been made to better define the range overlap between *O. asio* and *O. kennicottii* in Wyoming (Fitton 1993, Dorn and Dorn 1994). Fitton (1993) reports Eastern Screech-Owls at four locations, all east of the Continental Divide and in riparian woodlands dominated by Plains cottonwood. The highest location was at 1920 m. Dorn and Dorn (1994) report 21 locations; again, all are east of the divide. All were also <1890 m. Large-sized Plains cottonwoods were noted to be an important habitat component, followed by willow and boxelder, all of which tend to grow along

streams on the plains. Similarly, in southeastern Saskatchewan, Adam (1987) describes the Eastern Screech-Owl as a rare resident of riparian habitats, typically Manitoba maple river bottom woodlands. Of 17 singles or pairs observed by Adam (1987), most were associated with farms, or were near villages or houses.

Model assumptions & caveats

Model does not assess presence of suitable cavities for nesting.

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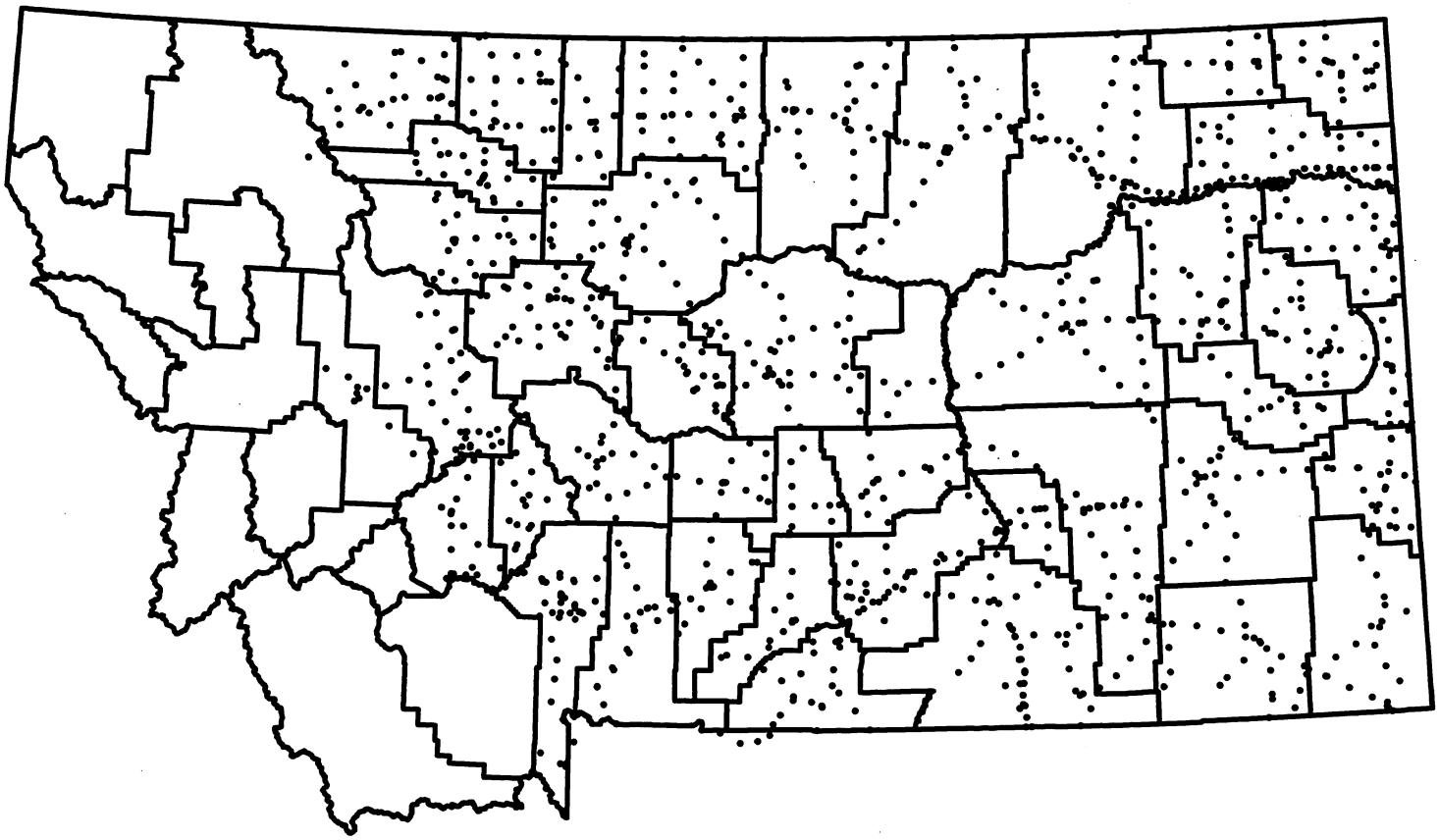
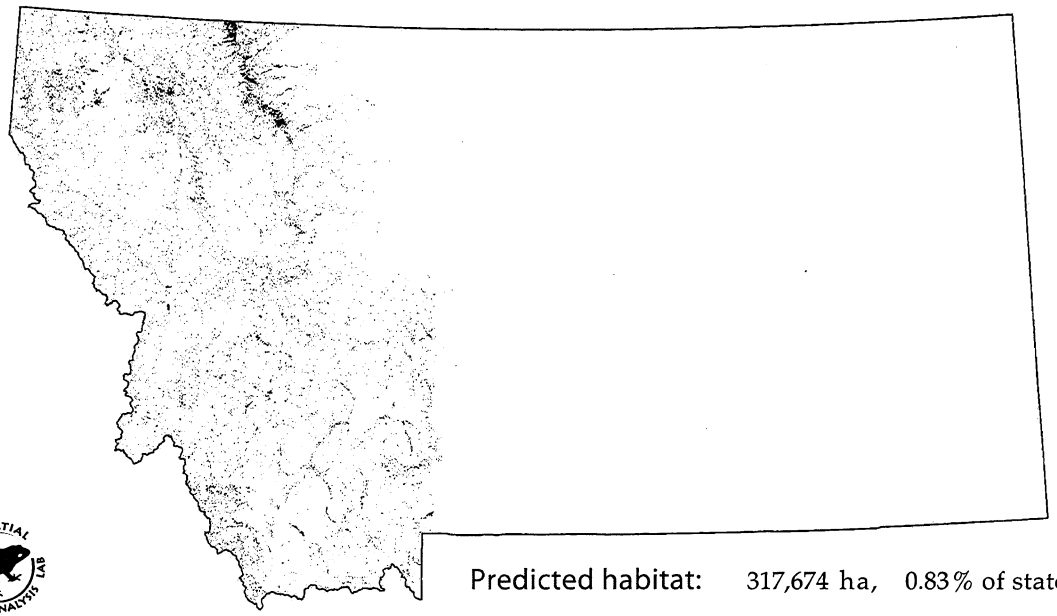


WESTERN SCREECH-OWL

Otus kennicottii

State rank	S3S4	Element code	ABNSB01040
Global rank	G5	Modeled by	M. Hart
MTNHP status	watch list		



Predicted habitat: 317,674 ha, 0.83% of state.

State range

Western Montana, as far east as the eastern edge of the Rocky Mountain chain; most locations in west-central Montana (Montana Bird Distribution Committee 1996). Easternmost records are from Choteau (north) and Bozeman (south). Exact range limits are not well known (Johnsgard 1986, Holt and Hills 1987).

Habitat description

Throughout range, woodlands, especially oak and riparian woodlands, and scrub (AOU 1983); in Montana, most often found in riparian areas with gallery forests (T. McEneaney, pers. comm.). See Holt and Hillis (1987), who reviewed status and habitat use of forest owls in western Montana. For the Western Screech-Owl, they could only find three nest sites, located in black cottonwood and quaking aspen, but noted that several observers have reported fledglings in cottonwood habitats near Missoula. Holt and Hillis (1987:282) further suggest "This is undoubtedly a more common species closely associated with riparian habitats." They also note that the owls are occasionally seen away from riparian areas, in mixed conifer forests.

Two attempts have been made to better define the range overlap between *O. asio* and *O.kennicottii* in Wyoming (Fitton 1993, Dorn and Dorn 1994). Dorn and Dorn (1994) located no Western Screech-Owls. Fitton (1993) found them at two locations in the Wind River Mountains, elevation 2400 m. In both areas, aspen was most abundant, followed by Douglas-fir.

Model assumptions & caveats

Model does not assess presence of suitable nest sites.

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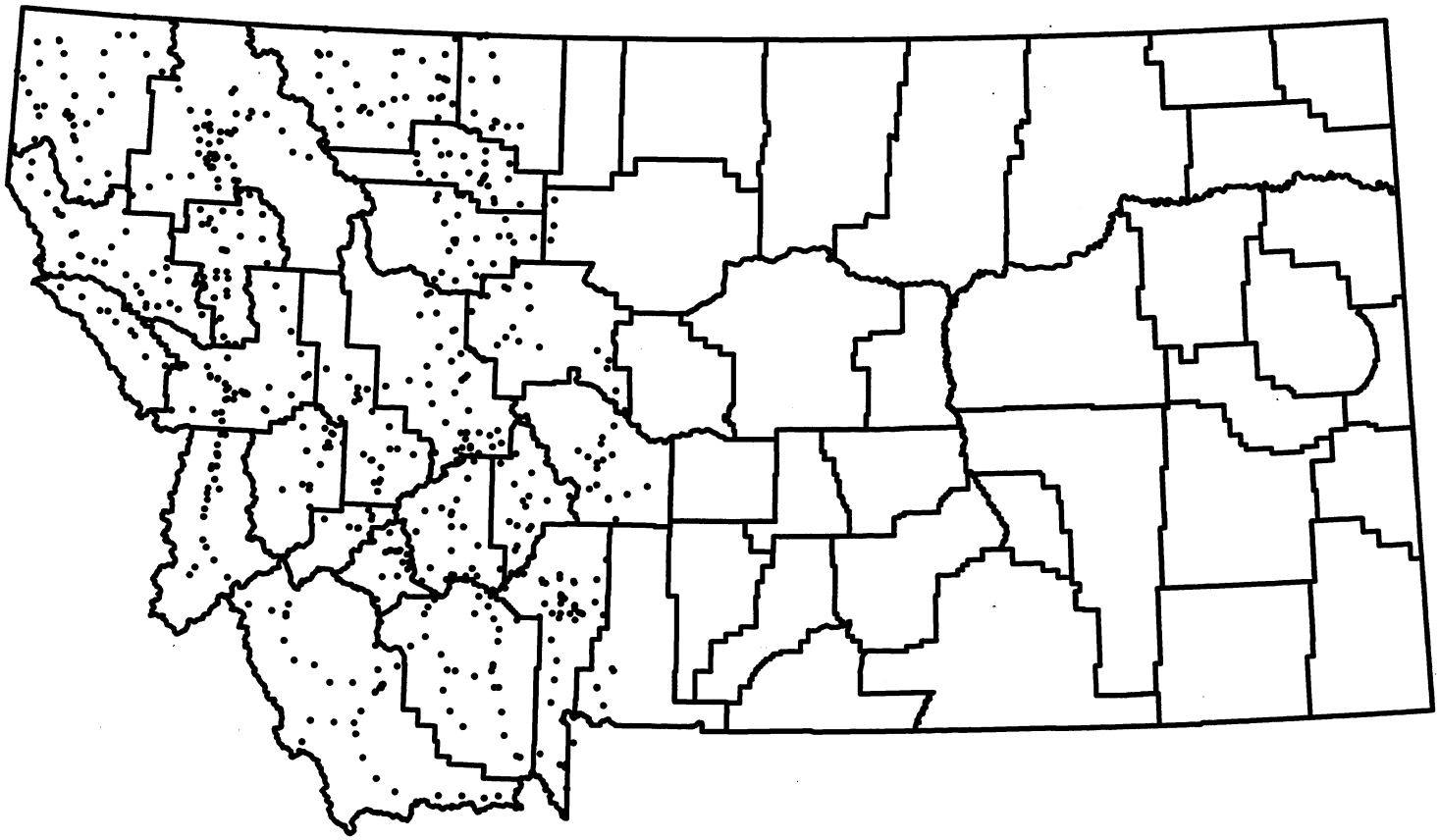
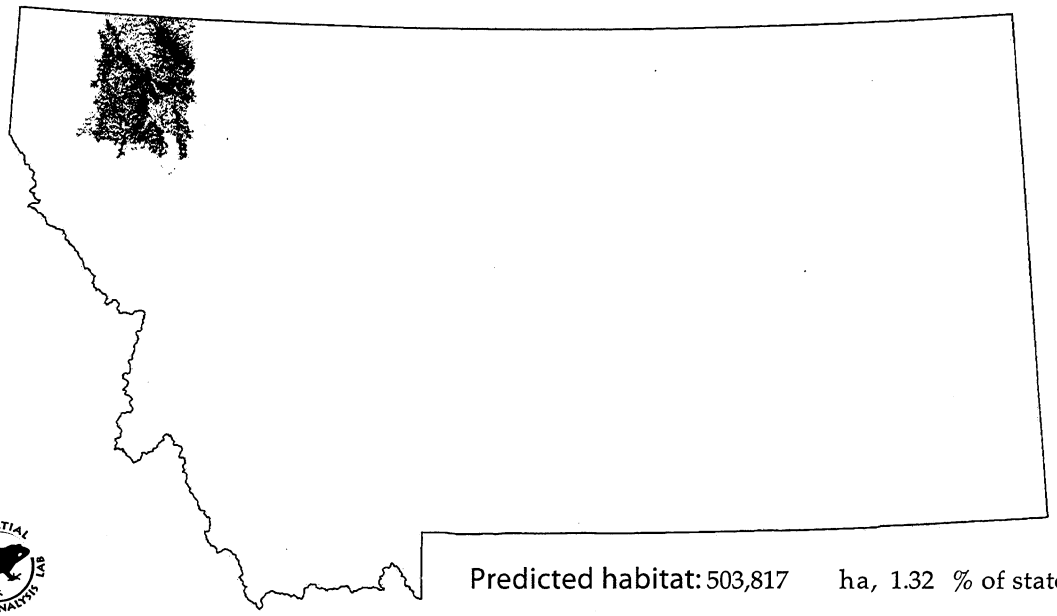


NORTHERN HAWK OWL

Surnia ulula

State rank	SAB,SAN	Element code	ABNSB07010
Global rank	G5	Modeled by	M. Hart
MTNHP status	watch list		



Predicted habitat: 503,817 ha, 1.32 % of state.

State range

Occurs primarily in northwestern Montana, although scattered observations have been recorded throughout other parts of the state (Montana Bird Distribution Committee 1996). The single confirmed breeding took place near Polebridge in Glacier National Park in 1994. Nevertheless, the species should no longer be considered rare in the state (Wright 1996).

Habitat description

Widely distributed across the northern boreal forest from Alaska to Newfoundland, yet among North America's least studied birds (Rohner et al. 1995). Found in open mixed or coniferous forest, forest edge and clearings, old burns in deciduous forest, dense shrubby areas (especially tamarack), swamps, scrubby second-growth woodland and muskeg (AOU 1983). Clark and others (1987) describe Northern Hawk Owl habitat as clearings and patchy areas in northern coniferous forest, and low scrub and trees near water.

Model assumptions & caveats

Model based on very limited information. As a result, cover types included may be overly generous.

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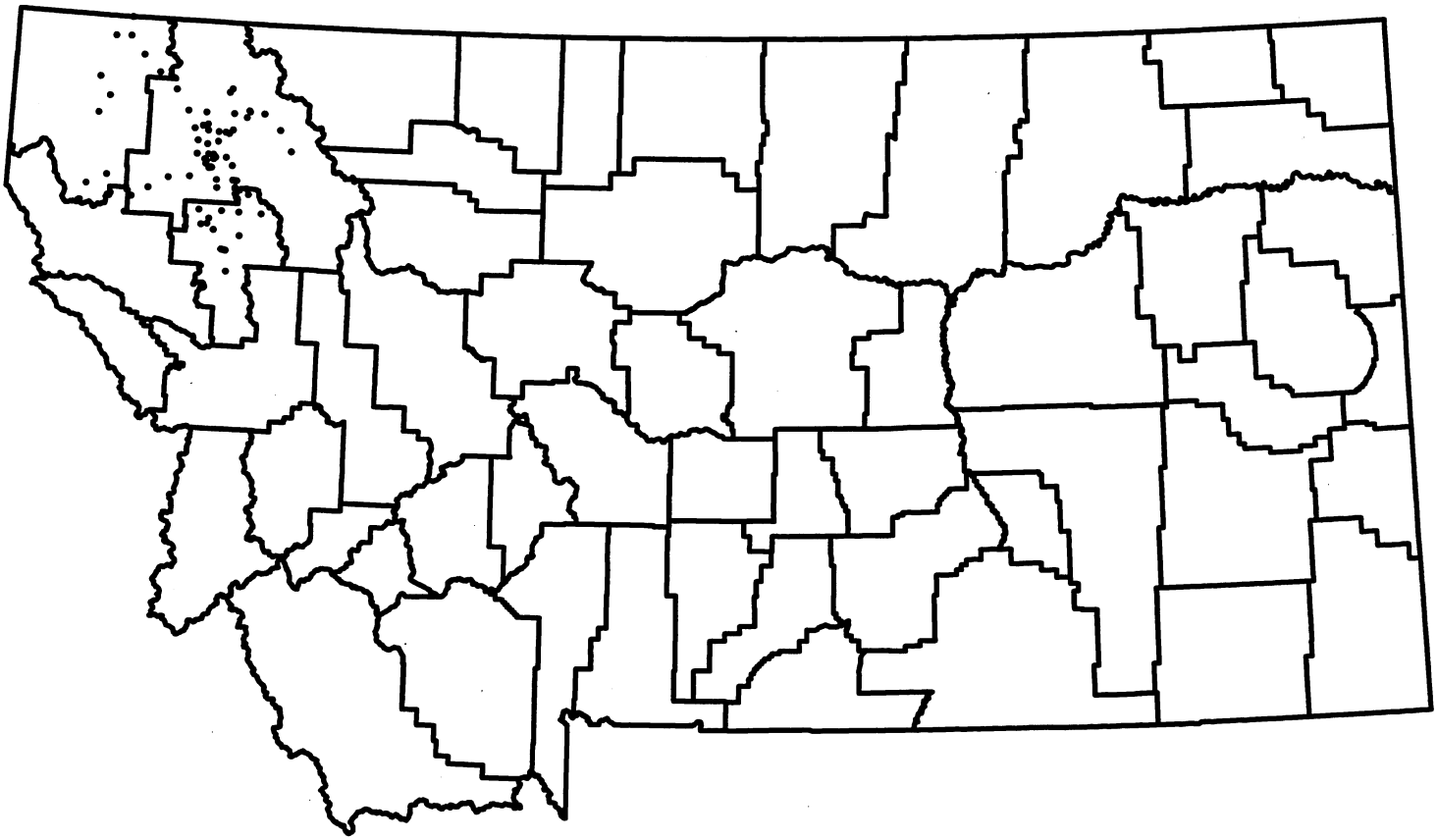
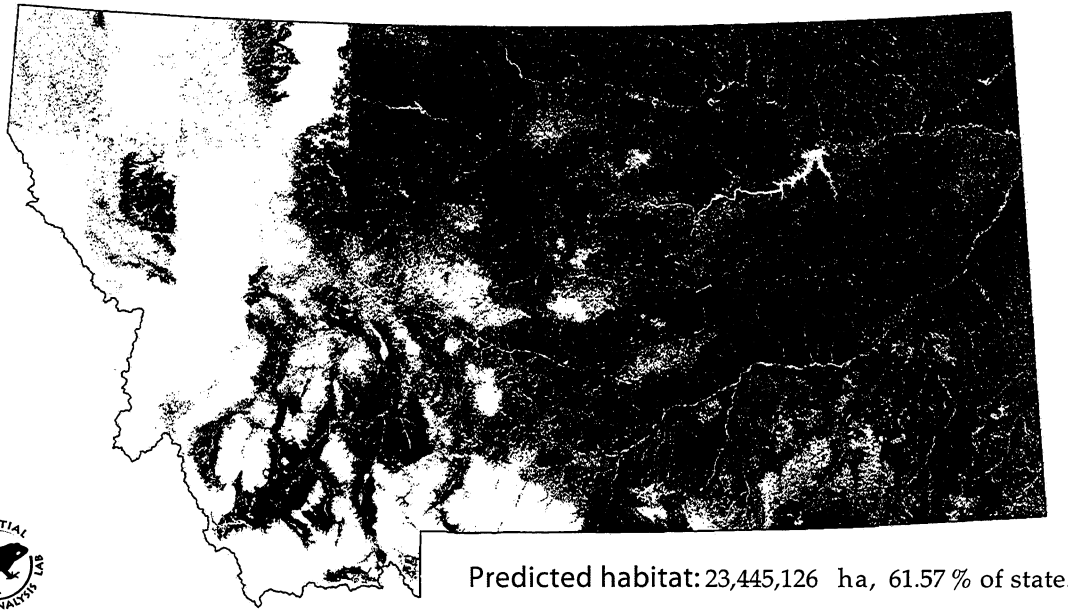


BURROWING OWL

Athene cunicularia

State rank	S3B,SZN	Element code	ABNSB10010
Global rank	G4	Modeled by	M. Hart
MTNHP status	special concern		



Predicted habitat: 23,445,126 ha, 61.57 % of state.

State range

Breeds widely east of the Rockies, but also occurs regularly in southwestern Montana, and scattered records exist elsewhere in intermountain valleys west of the Divide (Montana Bird Distribution Committee 1996). In Montana, may be declining even more precipitously than mountain plovers (R. Matchett, pers. comm.).

Habitat description

Open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports, typically nesting and roosting in burrows dug by mammals (AOU 1983). See Haug and others (1993) for review of this ground-dwelling inhabitant of the western deserts and grasslands, which nests in loose colonies in a wide variety of open environments, including agricultural lands. Presence of a nest burrow seems to be this owl's critical requirement; in fact, this species' close association with burrowing mammals suggests dependence upon them. Typically forages in shortgrass, mowed, or overgrazed pastures, but also uses golf courses, airports, and road rights-of-way. In Colorado, Burrowing Owls tend to select burrows that are close to other burrows and to roads, and that are surrounded by bare ground or short grass (Plumpton 1992).

Model assumptions & caveats

Presence of burrowing mammals assumed, not assessed. Model would be improved by inclusion of prairie dog town locations. An elevation limit was used primarily to filter out the mixed barren cover type (7800), which has a broad range, at higher elevations. Distribution is very likely overpredicted, based on recent declines.

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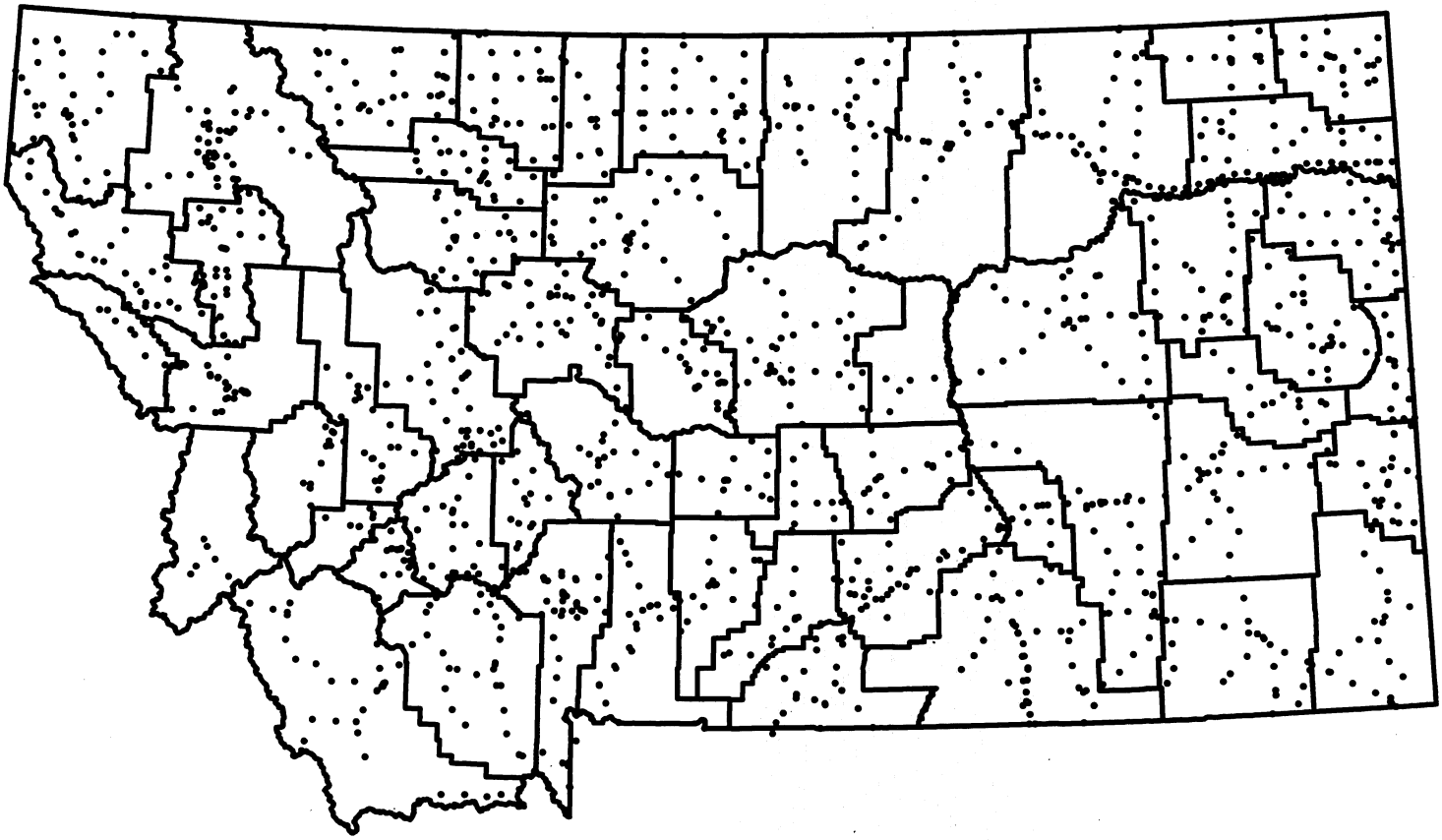
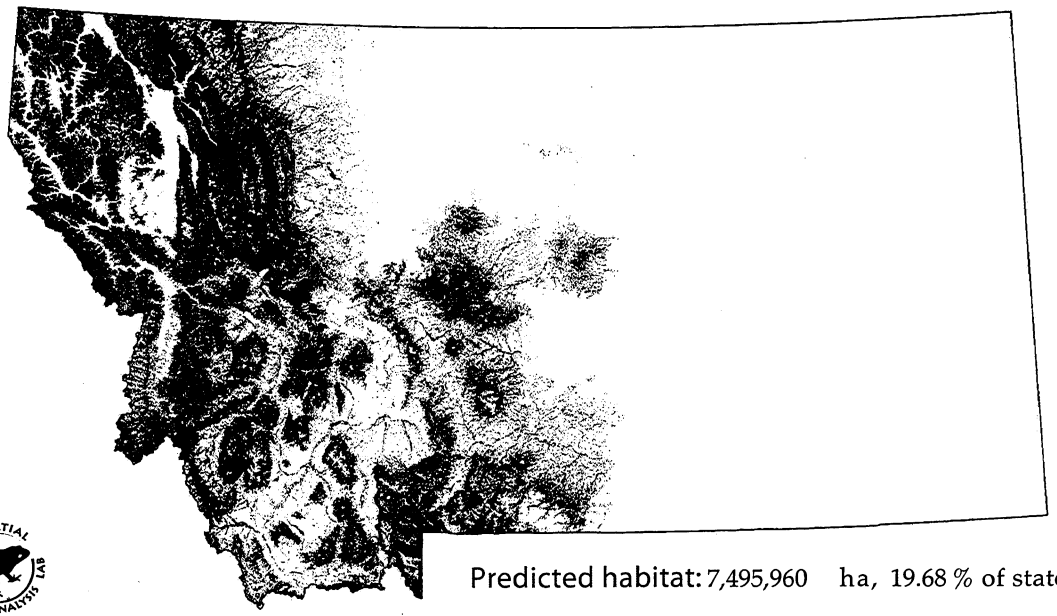


GREAT GRAY OWL

Strix nebulosa

State rank	S3	Element code	ABNSB12040
Global rank	G5	Modeled by	M. Hart
MTNHP status	special concern		



Predicted habitat: 7,495,960 ha, 19.68 % of state.

State range

A year-round resident of the montane areas of western and central Montana; winter records are less numerous (Montana Bird Distribution Committee 1996).

Habitat description

See review by Bull and Duncan (1993): Primarily a bird of dense, northern boreal forests, the Great Gray Owl finds suitable coniferous habitat southward into the Northern Rocky and Sierra mountains. Favors areas near bogs, forest edge, montane meadows and other openings. Breeding distribution appears to be limited by availability of prey and of nest sites. In the southern parts of the species' range, it is found in deciduous or coniferous forests up to 2800 m. In Idaho and Wyoming, nearly all observations have been made in the lodgepole pine/Douglas-fir/aspen zone (Franklin 1988). In Montana, the species most often is associated with spruce-fir, lodgepole pine, and Douglas-fir forests, as well as mixed conifer and whitebark pine forests farther east on the Lewis and Clark National Forest; elevations are described as "high", ~7000 ft., and ~7200 ft. for various National Forests (Verner 1994). Wintering habitat is the same as breeding habitat (Duncan and Hayward 1994).

Model assumptions & caveats

Presence of suitable nest sites not evaluated. Interspersion of forest/openings not evaluated. Elevation limit set low so that the selected cover types themselves define the elevation range for the most part; used elevation to filter included cover types like 4280 (mixed mesic forest) which occur at lower elevations. Focus placed on habitats used in the breeding season, assuming that those will include the best habitats for the rest of the year as well. Habitat is likely overpredicted.

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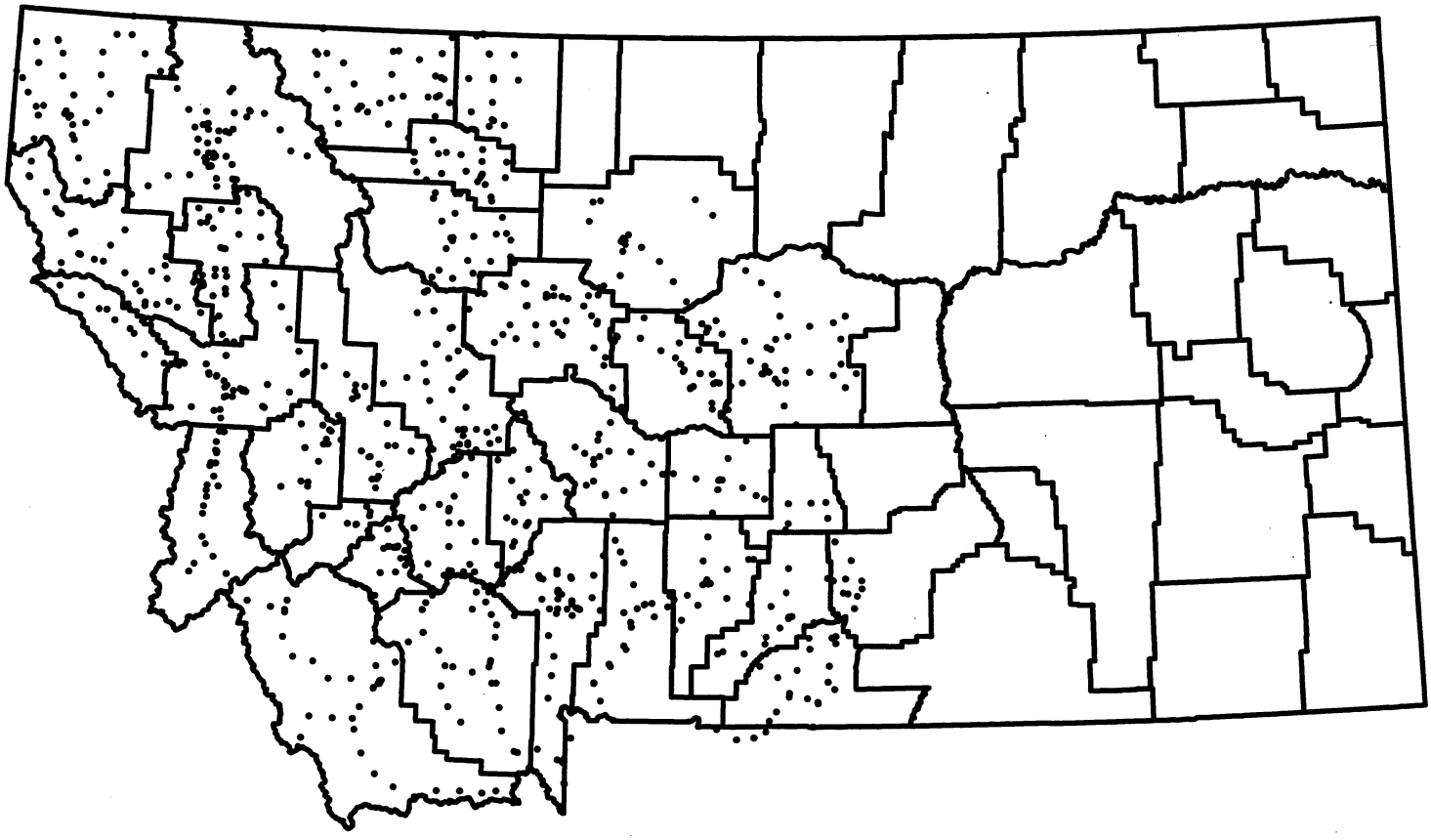
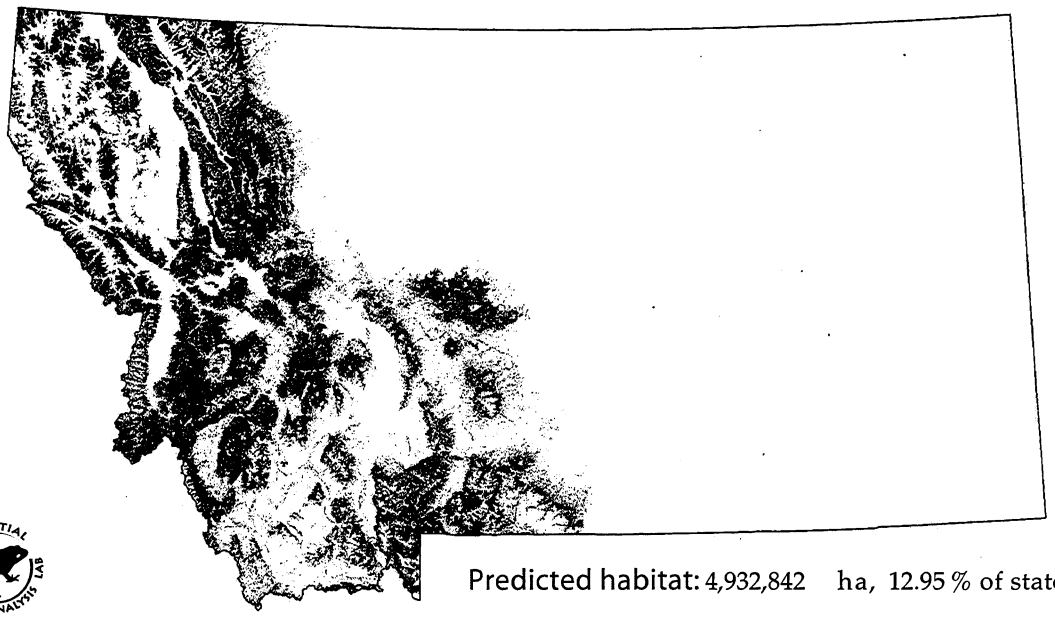


BOREAL OWL

Aegolius funereus

State rank	S3S4	Element code	ABNSB15010
Global rank	G5	Modeled by	M. Hart
MTNHP status	special concern		



Predicted habitat: 4,932,842 ha, 12.95 % of state.

State range

Mountainous regions of western and central Montana (Montana Bird Distribution Committee 1996). Should no longer be considered rare in the state (Wright 1996).

Habitat description

See review by Hayward and Hayward (1993): Found in boreal and subalpine forests across North America, with scattered populations extending southward into the subalpine forests of the Rocky, Blue, and Cascade Mountains. Breeding and wintering habitats are similar.

Boreal Owls are typically found in mature/old-growth spruce-fir forests in the northern and central Rocky Mountains (Palmer 1986, Hayward et al. 1987, Holt and Hillis 1987, O'Connell 1987, Ryder et al. 1987, Holt and Ermatinger 1989, Hayward et al. 1993). Although Boreal Owls may be relatively common in certain habitats, until recently they have remained little known in the Rocky Mountain states, probably due to their breeding chronology and high elevation associations (Holt and Hillis 1987).

Based on limited surveys in Montana, Holt and Hillis (1987) noted a preference for mature/overmature Engelmann spruce/subalpine forests above 1500 m. Holt and Ermatinger (1989) recorded the first confirmed nest in Montana, also in an Engelmann spruce/subalpine fir stand over 120 years old.

An extensive description of habitat use by Boreal Owls in the northern Rocky Mountains is provided by Hayward et al. (1993). Forests in Montana, Idaho, and northern Wyoming were surveyed for Boreal Owls, and 49 nests or singing males were found. No owls were detected below 1292 m, and 75% of locations were above 1584 m. Forest cover types in which owls were located included lodgepole pine, Douglas-fir, western hemlock/western larch/subalpine fir, Engelmann spruce, and Engelmann spruce/subalpine fir. Stands were classified as mature or older at 76% of locations.

Hayward et al. (1993) also studied Boreal Owls more intensively in the River of No Return Wilderness (RNRW) in central Idaho. Of 28 breeding sites in RNRW, 39% were in mixed conifer, 25% in Engelmann spruce/subalpine fir, 18% in Douglas-fir, and 18% in aspen stands. Lodgepole pine was not used for nesting, although it was the most common forest type in the study area. Nest sites were found only in structurally complex mature and old forests; characteristic features included high density of large trees, open understory, and multilayered canopy. The mean size of nest stands was 7.6 ha (range 0.8-14.6 ha). Average roost-to-nest distance was approximately 1730 m; Hayward et al. (1993) suggested that this measure is probably a good approximation of foraging distance. The best foraging habitat was associated with Engelmann spruce/subalpine fir stands, where prey densities were highest and open stand structure facilitated hunting. Mature/overmature Engelmann spruce/subalpine fir stands also provided cool sites for summer roosting, and Hayward et al. (1993) proposed that roosting habitat can be maintained through management of foraging habitat. Finally, Hayward et al (1993) further recommended that all forested sites within the spruce-fir zone be considered as potential Boreal Owl habitat, as well as forests 100-200 m below this zone, which may provide the most important nesting habitats.

Model assumptions & caveats

Assume that broadleaf forest (4140) is most likely to be aspen in the elevation zones in which Boreal Owls are found. Also assume that foraging/roosting habitat will be adequately captured by queries for nesting habitat; similarly, that wintering habitat will be adequately captured by breeding habitat. Model does not include forest stand structure/size class, nor does it assess presence of suitable nest sites. Model probably overestimates habitat because large cavities are likely limited at highest elevations (N. Warren, pers. comm.).

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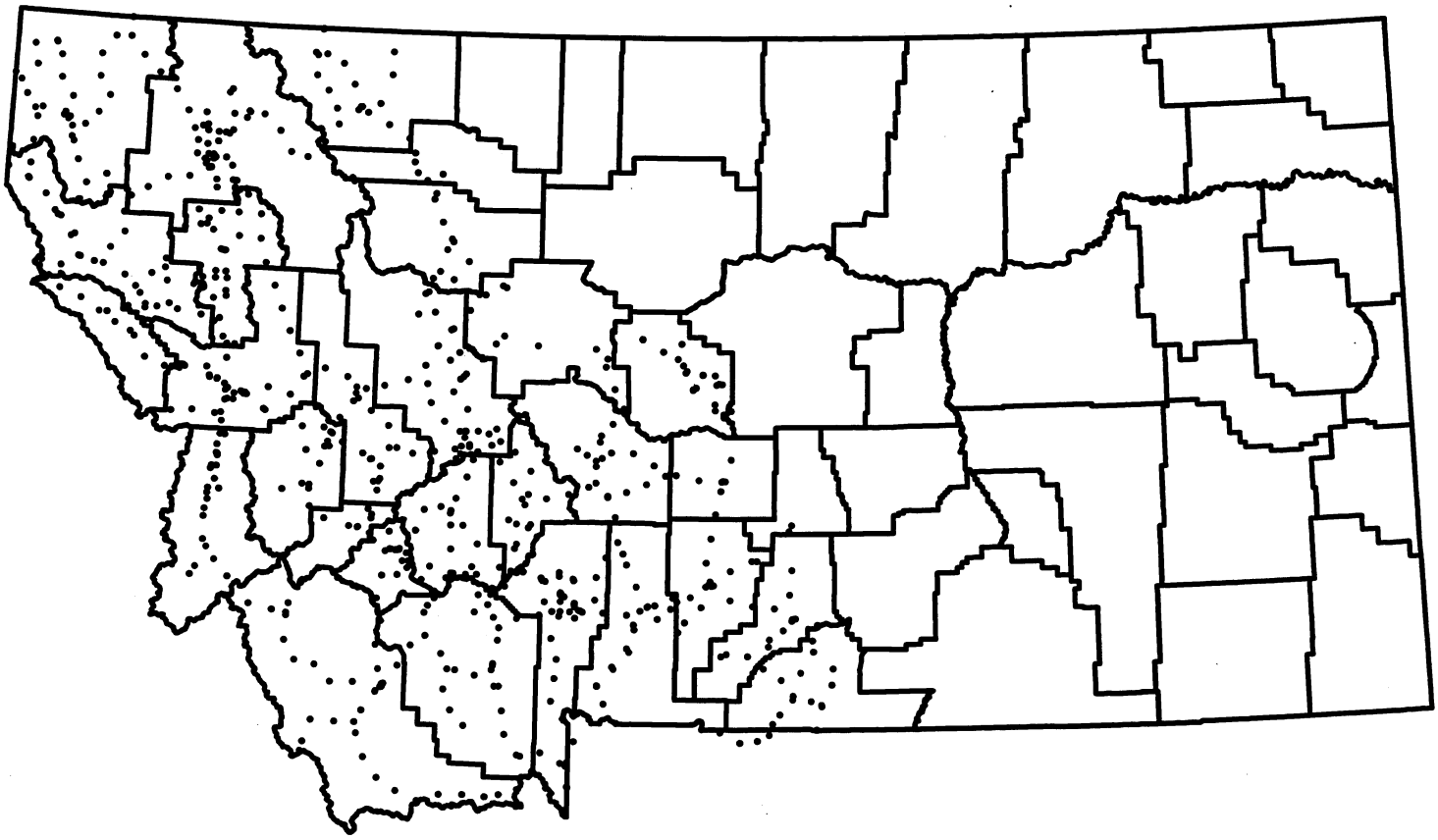
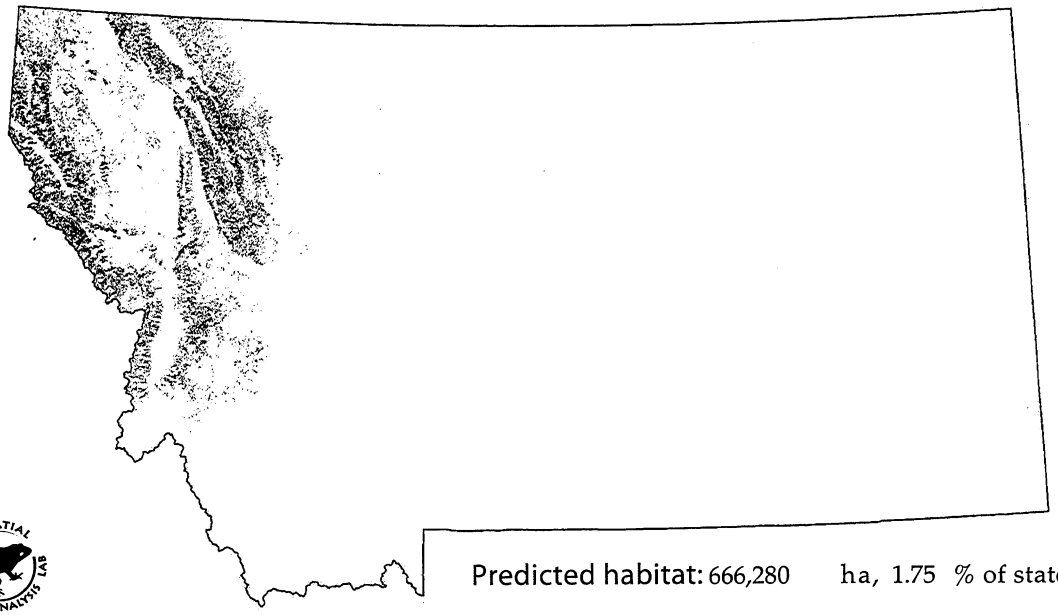


BLACK SWIFT

Cypseloides niger

State rank	S3B,SZN	Element code	ABNUA01010
Global rank	G4	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 666,280 ha, 1.75 % of state.

State range

Considered rare to uncommon in the U.S.; somewhat rare in Montana, breeding records limited to the northwest; overwintering does not occur (Montana Bird Distribution Committee 1996).

Habitat description

Breed in a variety of open, montane habitats, frequently seen over more rugged terrain, from sea level to 11,000ft (DeGraaf et al. 1991, Chantler and Driessens 1995). Habitat defined by mountainous areas associated with steep cliffs or narrow canyons; always near water (Johnsgard 1986, Dobkin 1994). Nest in small colonies, from 1-15 pairs, in high cliff crevices or ledges, steep rock canyon walls, shallow caves, sea cliffs, occasionally sea caves; preferably near or behind a waterfall (DeGraaf et al. 1991, Dobkin 1994, Chantler and Driessens 1995). Nests are pads of moss, ferns, pine needles bound with little mud (Ehrlich et al. 1988, Chantler and Driessens 1995). High relief, inaccessibility, unobstructed flyways, at least partial darkness, and water are nest site requirements (Knorr 1961, Hunter and Baldwin 1962). Black Swifts show strong nest site fidelity - even when severe drought greatly affects waterfall flow, they will return each year - but apparently do not nest on truly intermittent streams (Knorr 1993). In nw MT, a small colony was found nesting behind or immediately adjacent to a 150m wide, cascading waterfall, at 4,700ft elevation, amidst transition-zone vegetation: Lowland Fir (*Abies grandis*), Douglas-fir, Englemann Spruce, Mountain Maple, willow, alder, dogwood, and juniper (Hunter and Baldwin 1962). Aerially forage over both forested and open montane areas, exclusively for flying insects (Ehrlich et al. 1988). In nw Montana, often forage in valley bottoms, pariticularly over water; often many kilometers from nesting habitat, especially during stormy weather (D. Casey pers. comm.). Winter from Mexico, south to Costa Rica (Ehrlich et al. 1988, Dobkin 1994), and may be seen in large flocks during migration (Chantler and Driessens 1995). Black Swifts are one of the least known land birds in North America, and are considered a threatened, endangered, or sensitive species in Montana; BBS data, however, are not sufficient enough to determine population trends (Dobkin 1994, Montana Bird Distribution Committee 1996).

Model assumptions & caveats

Breeding habitat modeled. Migration habitat is assumed similar to that of breeding. Foraging habitat in addition to that defined for breeding, not well described, therefore not specifically included in model. Assume potential migration and foraging habitats are adequately defined within breeding habitat parameters, which include 1km buffer around potential nest areas. Waterfall information not available in hydrography coverage and cliffs could not be accurately resolved at mapping scale used. Attempted to target nest areas by intersecting stream coverage with slope >= 40%. Unable to model most nesting requirements, due to limitations of mapping scale and resolution; suitable breeding habitat may be overestimated, however, foraging ranges may extend beyond 1km buffer therefore foraging habitat is likely underestimated.

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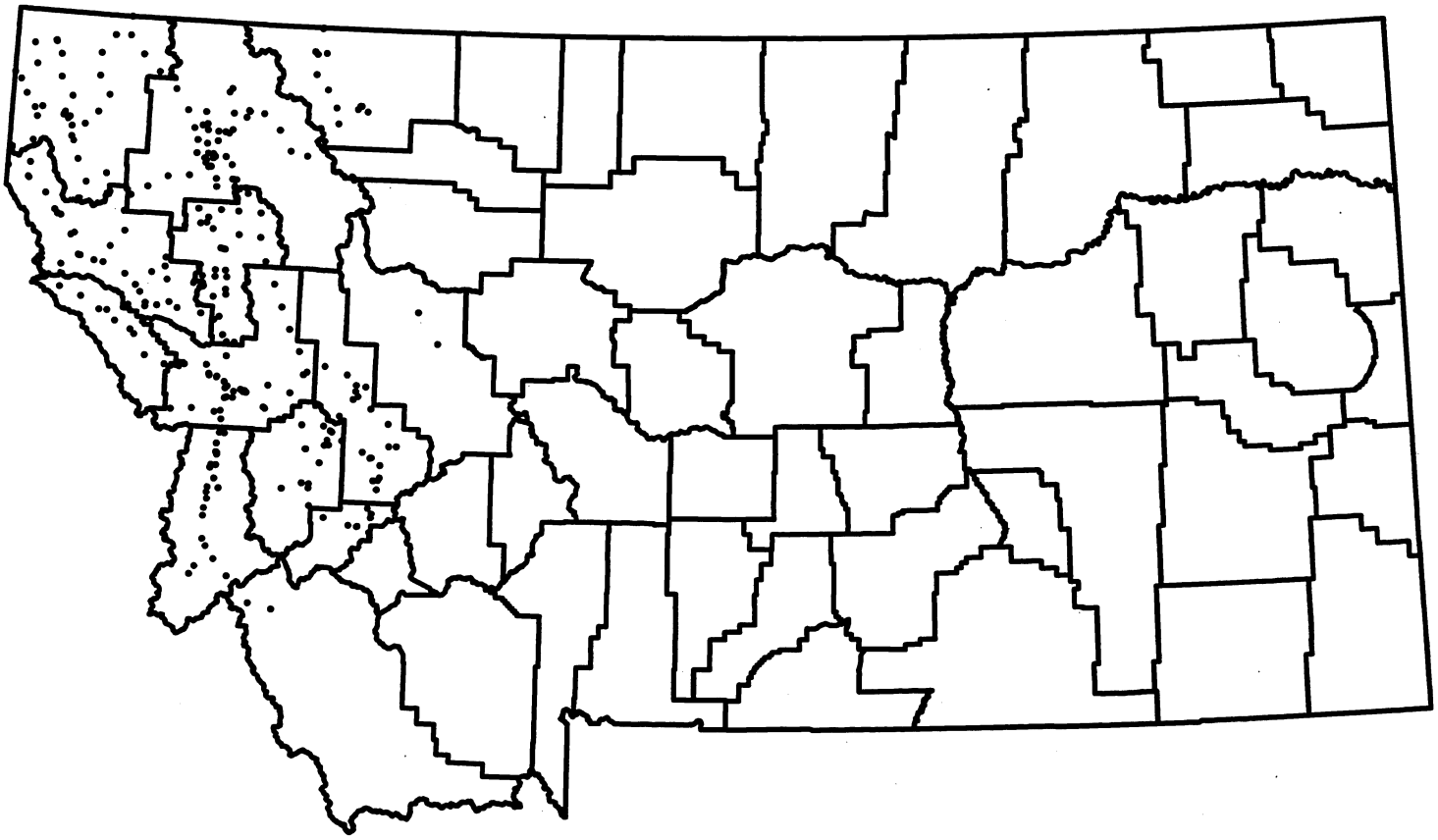
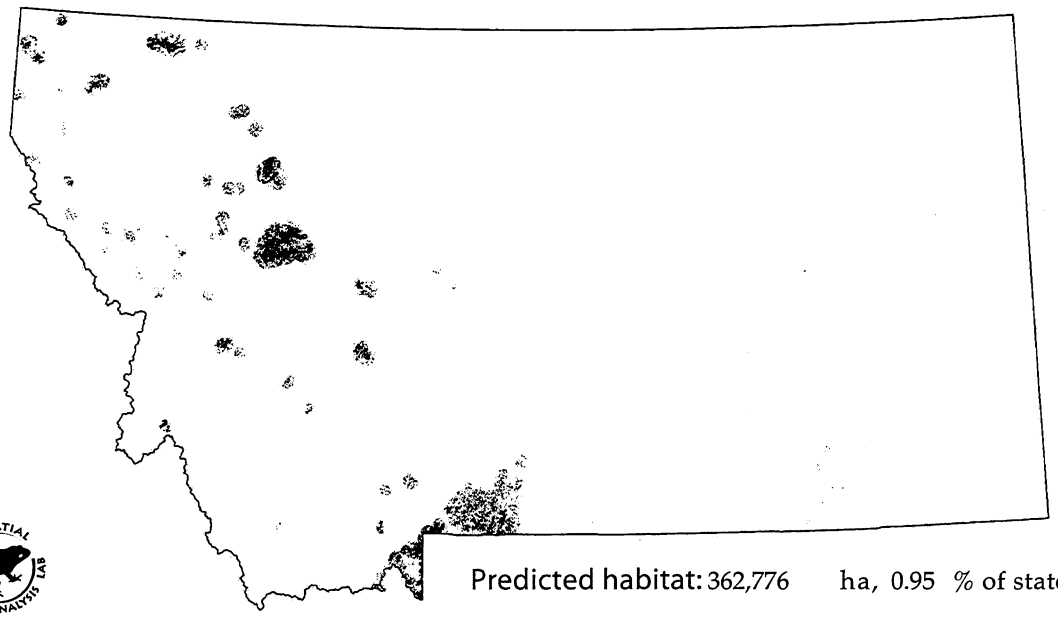


BLACK-BACKED WOODPECKER

Picoides arcticus

State rank	S3	Element code	ABNYF07090
Global rank	G5	Modeled by	C. Tobalske, W. Williams
MTNHP status	special concern		



Predicted habitat: 362,776 ha, 0.95 % of state.

State range

Breed in montane areas of western Montana; winter range may be more restricted to northwestern Montana (Montana Bird Distribution Committee 1996).

Habitat description

A species associated with coniferous forests, often in openings where burns, logged areas, lake and stream shores, swamps, and bogs occur (Campbell et al. 1990). Prefers denser forests containing a mixture of coniferous species (Bock and Bock 1974). In Oregon, favors various mature and overmature mixed conifer types and pure lodgepole forests, and avoids seedling, sapling, pole stands and cut areas (Marshall 1992, Goggans et al. 1989). Nests also in Ponderosa Pine forests with moderate canopy closure (Bull et al. 1986). In Montana, preferred habitat consists of coniferous forests (fir, spruce), especially windfall and burned sites; the species nests and forages in recent burns (younger than 4 years), and also nests in dense forest stands (MNHP-VCA 1996). Management recommendations include the conservation of pine-dominated habitat blocks of about 1000 acres (MNHP-VCA 1996). In Lincoln County it was rarely found in Subalpine Fir and Lodgepole Pine woods, but occurred in Ponderosa Pine forests at low elevation, and in mixed conifer and Douglas-fir associations higher up (Weydemeyer and Weydemeyer 1928). Although an opportunistic species, it is much more abundant in burned forest that other "green" forests (S. Hejl pers. comm.), and may be suffering from the transition from extensive burned areas to second growth stands since the 1940s (McClelland 1977). The Black-backed Woodpecker is virtually restricted to early post-fire habitat in Montana; prevention of stand-replacement fires and post-fire salvage cutting have seriously reduced suitable breeding habitat (Hutto 1995b). Unburned forests may be sinks for birds emigrating from burns when those are 5-6 years old (Hutto 1995).

Model assumptions & caveats

Burn cover type temporally limited by acquisition date of satellite imagery. Burn cover type was

buffered by 5 km to focus on burned areas, yet include alternate habitat, albeit secondary. Suitable breeding habitat is likely over- and inaccurately estimated.

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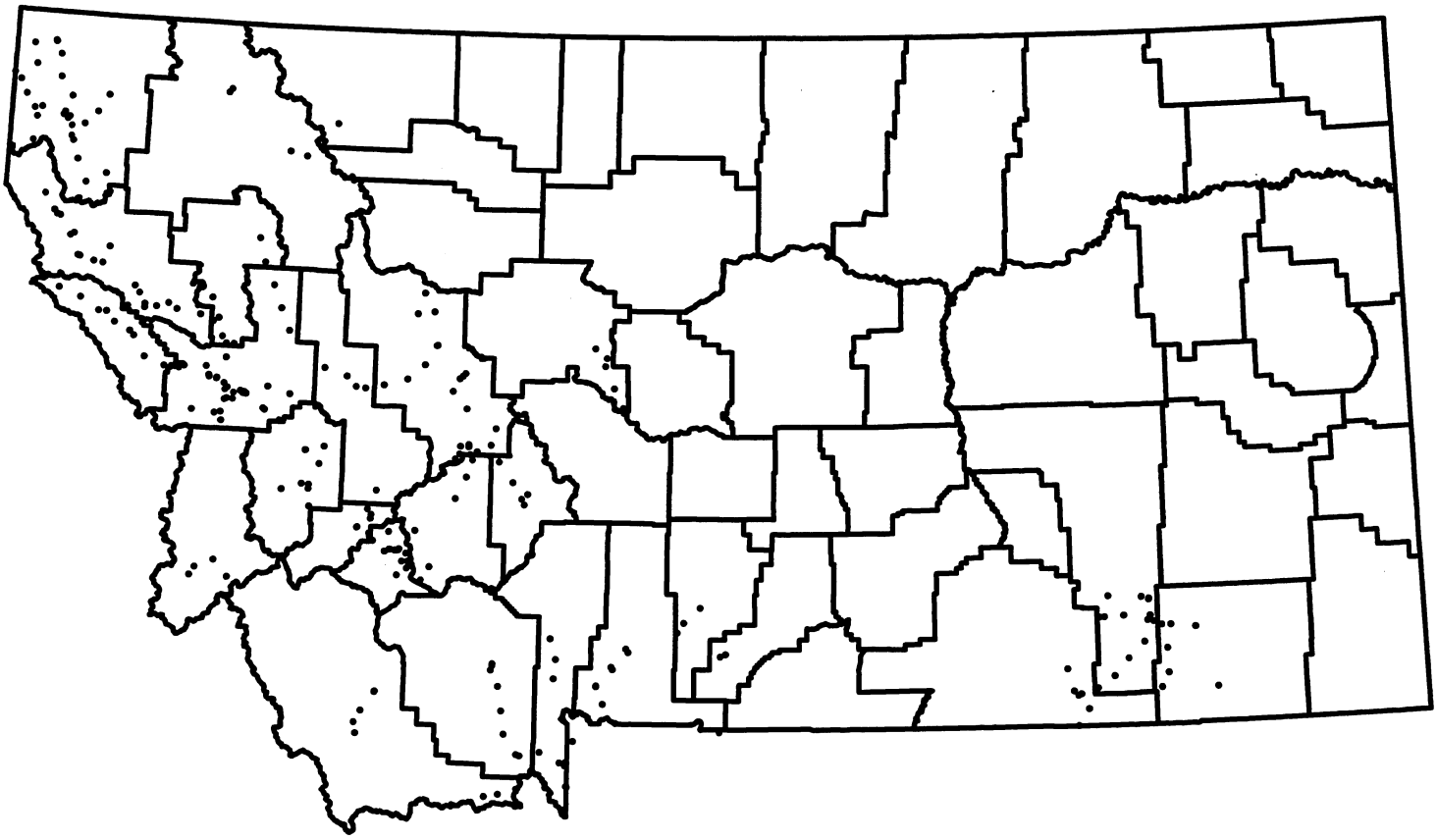
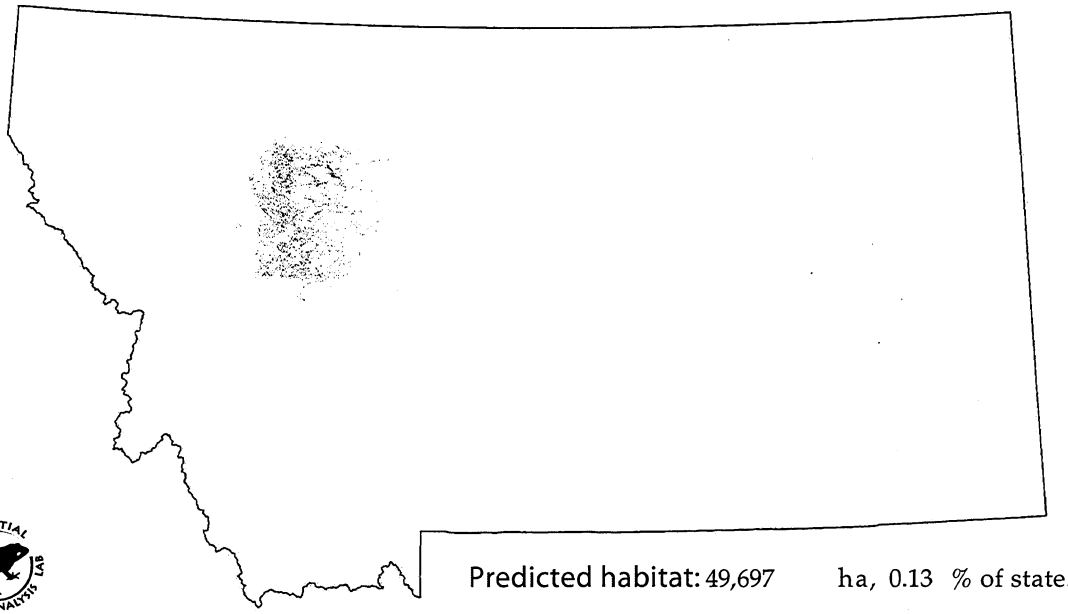


ALDER FLYCATCHER

Empidonax alnorum

State rank	S1B,SZN	Element code	ABPAE33030
Global rank	G5	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 49,697 ha, 0.13 % of state.

State range

Uncommon summer resident in the northwestern Rocky Mountain region; breed primarily east and north of Montana (Johnsgard 1986, Wright 1996). Although there is no direct evidence of breeding in Montana to date, strong indirect evidence has been recorded, particularly in the Pine Butte Swamp area - nesting is also likely along the northern border of the state (Montana Bird Distribution Committee 1996, Wright 1996).

Habitat description

A common inhabitant of northern alder swamps and aspen parklands; breed in alder or willow thickets and deciduous forest edges bordering streams, lakes, ponds, bogs, swamps, muskegs; also brushy, scrubby growth in damp cut-over areas; occasionally low spruces in bogs (Godfrey 1966, A.O.U. 1983, Johnsgard 1986, DeGraaf et al. 1991). Usually found near water; require open forest areas and edges with low, dense shrubby growth (DeGraaf et al. 1991). Nests are built 2-6ft above ground, saddled in upright fork of low tree or shrub branch (Godfrey 1966, DeGraaf et al. 1991). Forage for flying insects, particularly beetles, by hawking/sallying from a perch; also glean spiders and berries from vegetation (Ehrlich et al. 1988, DeGraaf et al. 1991). In migration and winter also use open woodland habitats; winter in South America (A.O.U. 1983, Ehrlich et al. 1988). Closely related to Willow Flycatchers (*Empidonax traillii*); were formerly considered the same species (A.O.U. 1983, Ehrlich et al. 1988). The Alder Flycatcher is considered a threatened, endangered, or sensitive species in Montana - recently considered a separate species from the Willow Flycatcher, little is known about its breeding habitat requirements in the state (Montana Bird Distribution Committee 1996).

Model assumptions & caveats

Breeding habitat modeled. Migration habitat is somewhat similar to that of breeding and is assumed

defined within breeding habitat parameters. Difficult to model edge habitats at mapping scale used. Undergrowth/shrub cover density information not available to include in model.

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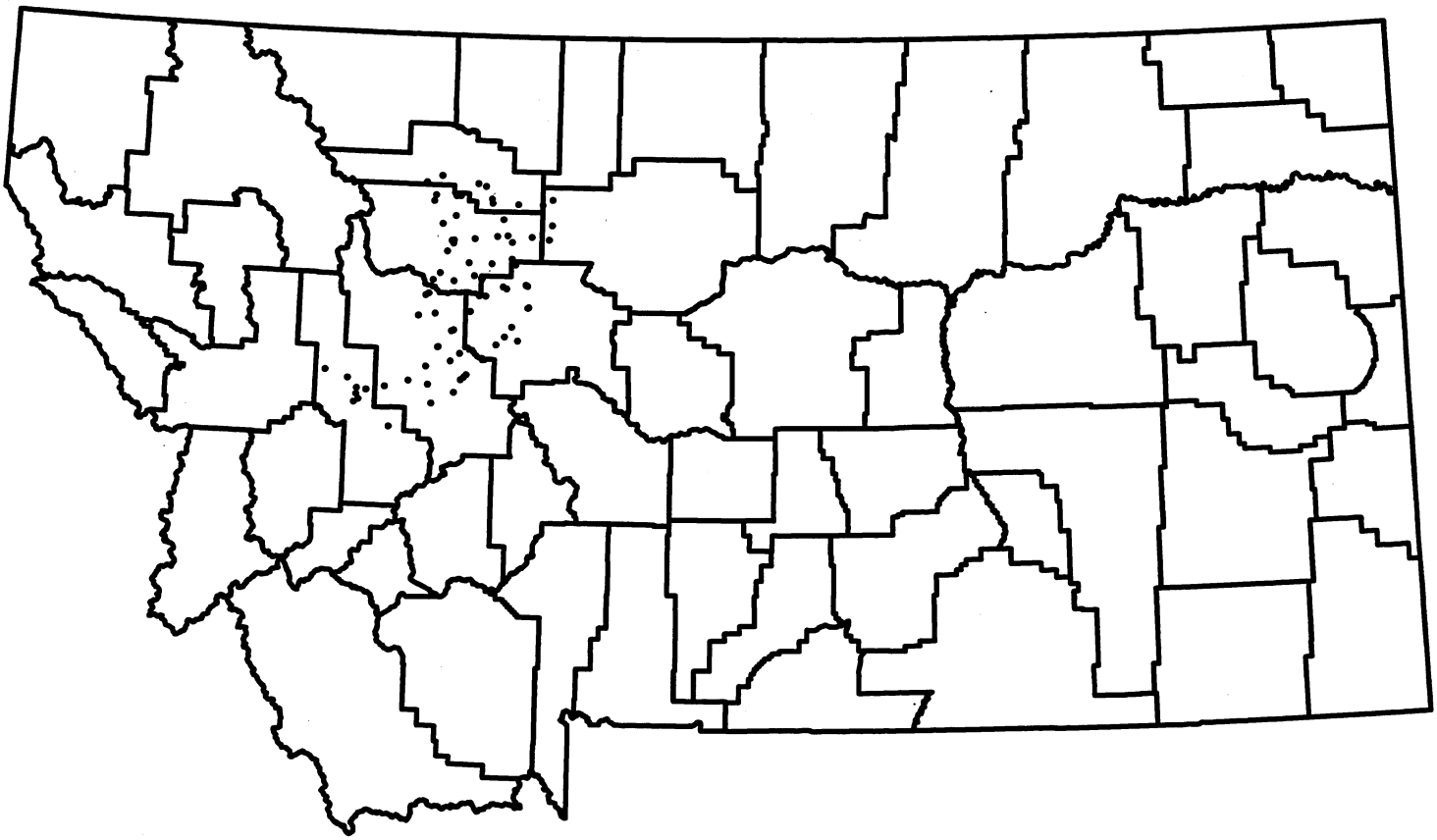
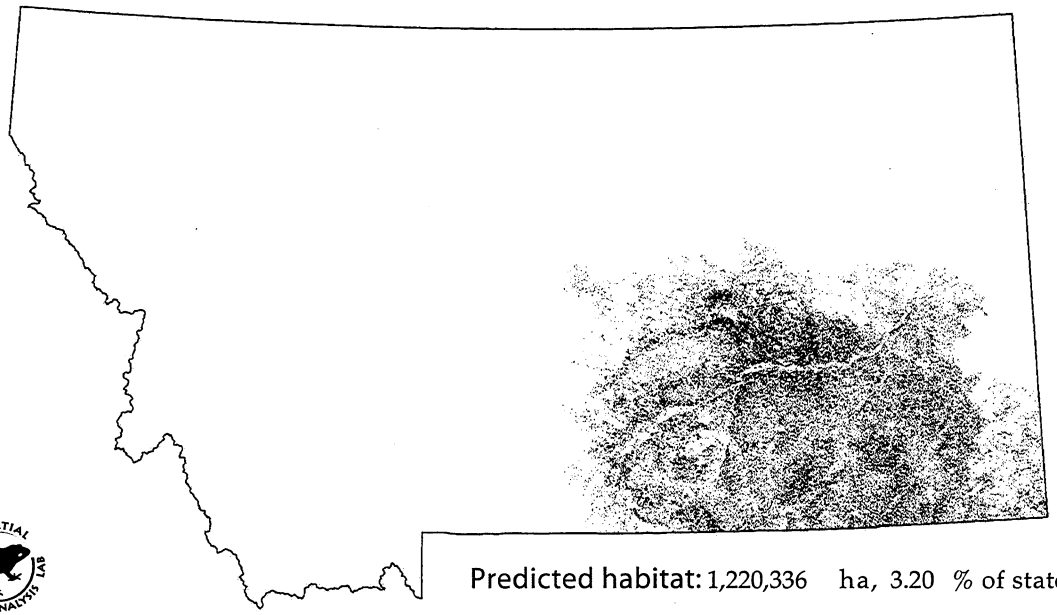


CASSIN'S KINGBIRD

Tyrannus vociferans

State rank	S1S3B,SZN	Element code	ABPAE52030
Global rank	G5	Modeled by	W. Williams
MTNHP status	special concern		



Predicted habitat: 1,220,336 ha, 3.20 % of state.

State range

Local breeder in the high plains east of the Rocky Mountains; breeding in Montana is limited to the southeast; overwintering does not occur (Johnsgard 1986, Montana Bird Distribution Committee 1996).

Habitat description

Breed in open, semi-desert habitats, up to 7500ft (DeGraaf et al. 1991). In CA, use open valley woodlands and foothill grasslands with scattered oaks, cottonwoods, sycamores (DeGraaf et al. 1991). In the northern Rocky Mountains/Great Plains region, breed in open country with scattered trees, especially pinyon-juniper woodlands; also dry savanna, Ponderosa Pine woodlands, open scrub, shrubsteppe, pine-oak associations; extending into grasslands and agricultural areas (Johnsgard 1986, DeGraaf et al. 1991, Dobkin 1994). Prefer habitats less open than do Western Kingbirds, such as pine-oak-juniper woodlands in TX and closed canopy riparian forests in AZ (Gamble and Bergin 1996). Nest near ends of horizontal branches in fairly tall deciduous trees, 8-55ft above ground; occasionally in bushes or on fence posts (Ehrlich et al. 1988, DeGraaf et al. 1991). Winter south into South America, in dry habitats such as highland pine-oak associations and dry scrub (A.O.U. 1983, Dobkin 1994). Forage primarily for insects, usually by sallying from perch; also take spiders, berries (DeGraaf et al. 1991, Dobkin 1994). Populations appear to be declining slightly in the West, but BBS data is insufficient (Dobkin 1994). The Cassin's Kingbird is considered a threatened, endangered, or sensitive species in Montana; eastern Montana is the extreme northern limit of the breeding range (Montana Bird Distribution Committee 1996, Dobkin 1994).

Model assumptions & caveats

Breeding habitat modeled. Cannot resolve interspersion of cover types at mapping scale used.

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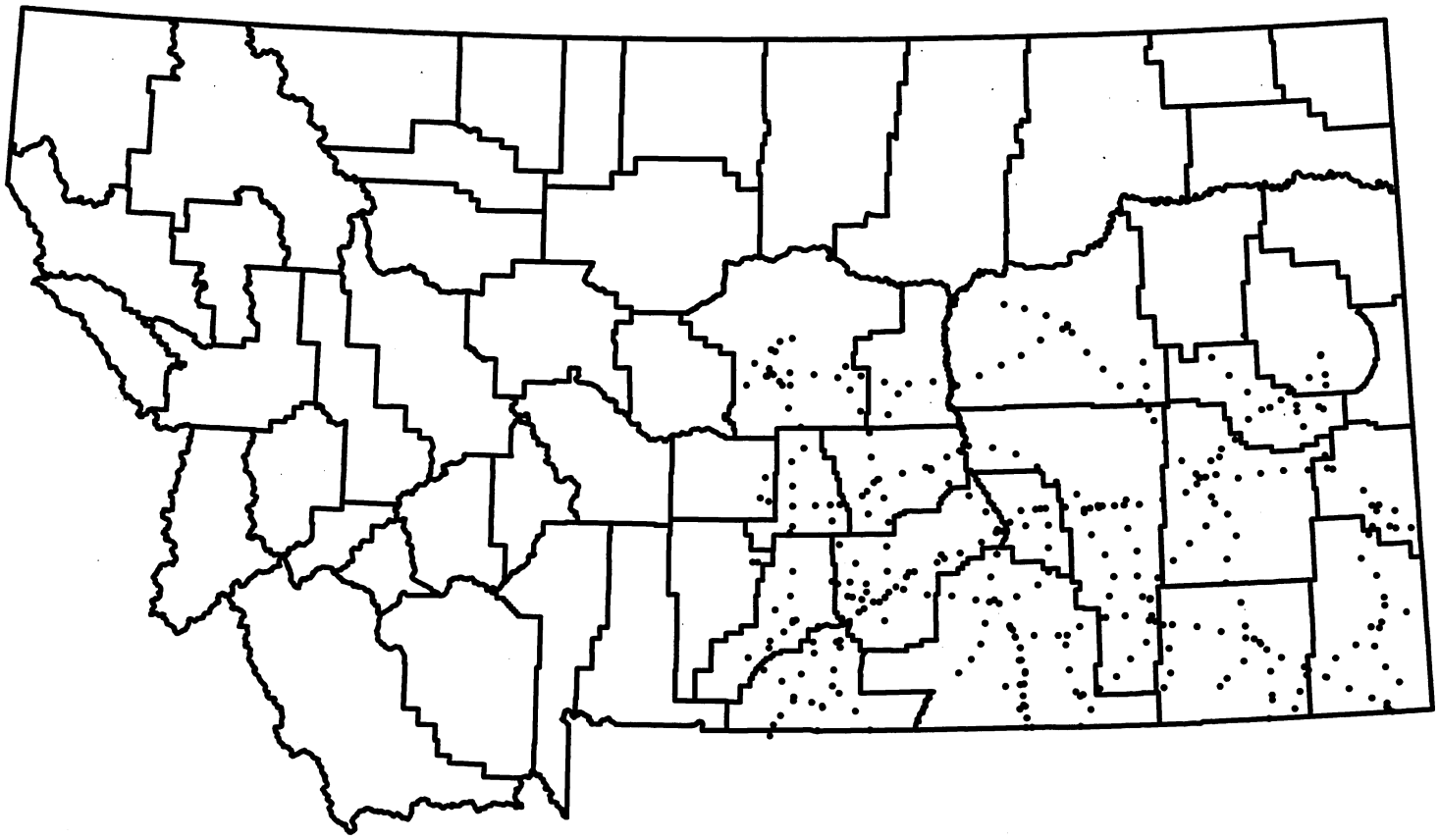
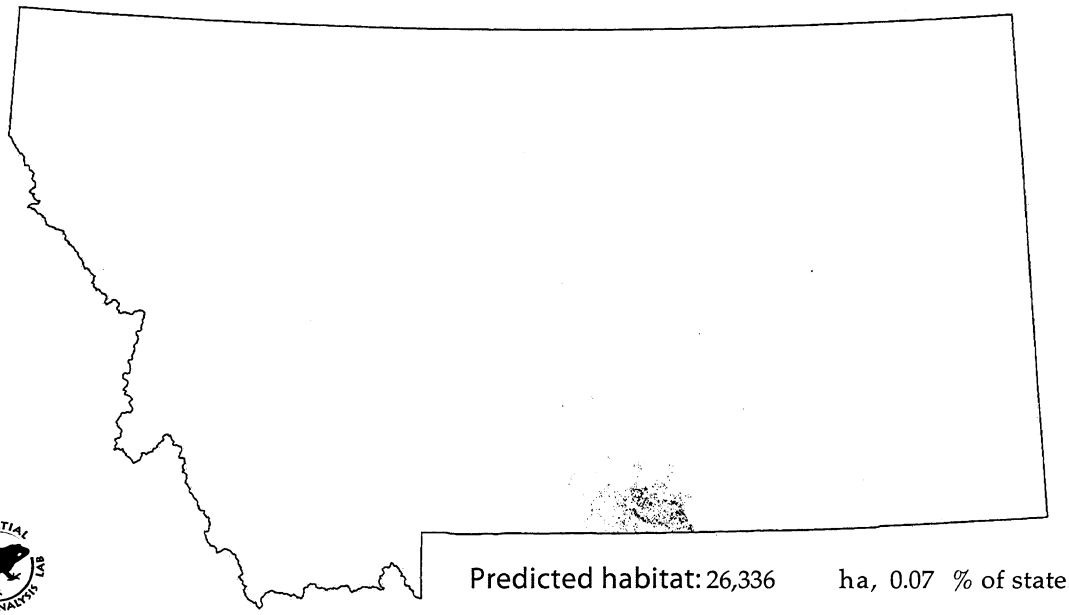


BLUE-GRAY GNATCATCHER

Polioptila caerulea

State rank	S1B,SAN	Element code	ABPBJ08010
Global rank	G5	Modeled by	P. McLaughlin
MTNHP status	special concern		



Predicted habitat: 26,336 ha, 0.07 % of state.

State range

The only records are in the Glasgow-Fort Peck area and in the Pryor Mountains, Carbon County. The latter, found in 1996, constitutes a small nesting population, which is the first breeding record for the state (Montana Bird Distribution Committee 1996, Wright 1996).

Habitat description

The blue-gray gnatcatcher is on the Montana Natural Heritage Program's Special Concern list due to the discovery of a breeding population in Bear Canyon in the Pryor Mountains (Wright 1996, P. Hendricks pers. comm.). In this area it is associated with Utah juniper and limber pine on the south side of the Pryors; Rocky Mountain juniper may also be present (P. Hendricks pers. comm.). In the west generally, the species frequents chaparral, scrub-oak, and pinyon-juniper habitats (Farrand 1983, Hejl et al. 1995). The species nests especially where tracts of brush, scrub, or chaparral are intermixed with taller vegetation (e.g. forest edge, riparian corridors), often near water. The nest is in the branch or fork of a tree or shrub, usually 1-25 m above ground, by both adults (Harrison 1978). Populations of this species have increased over the past 25 years, expanding northward (Ellison 1992).

Model assumptions & caveats

References

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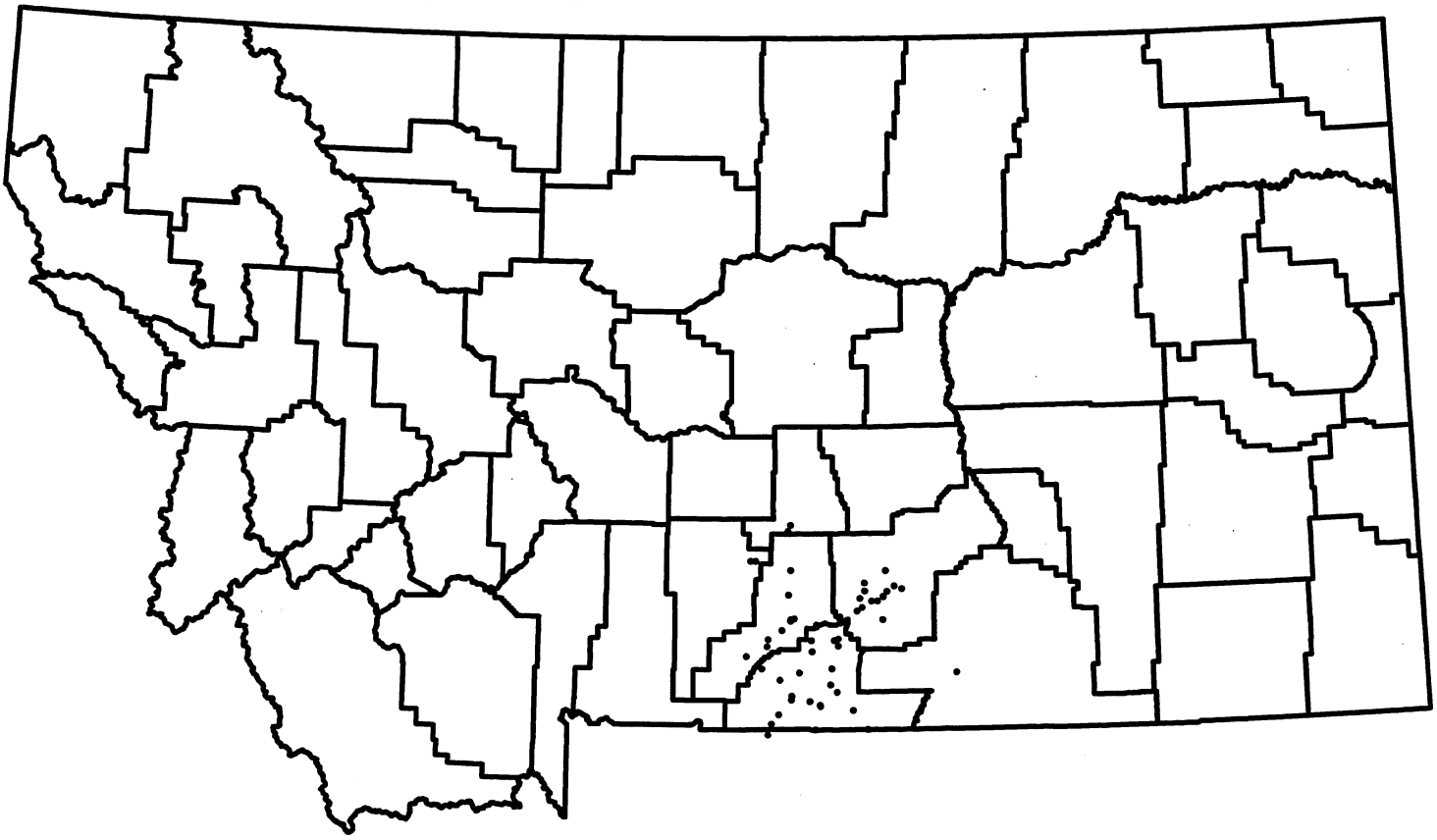
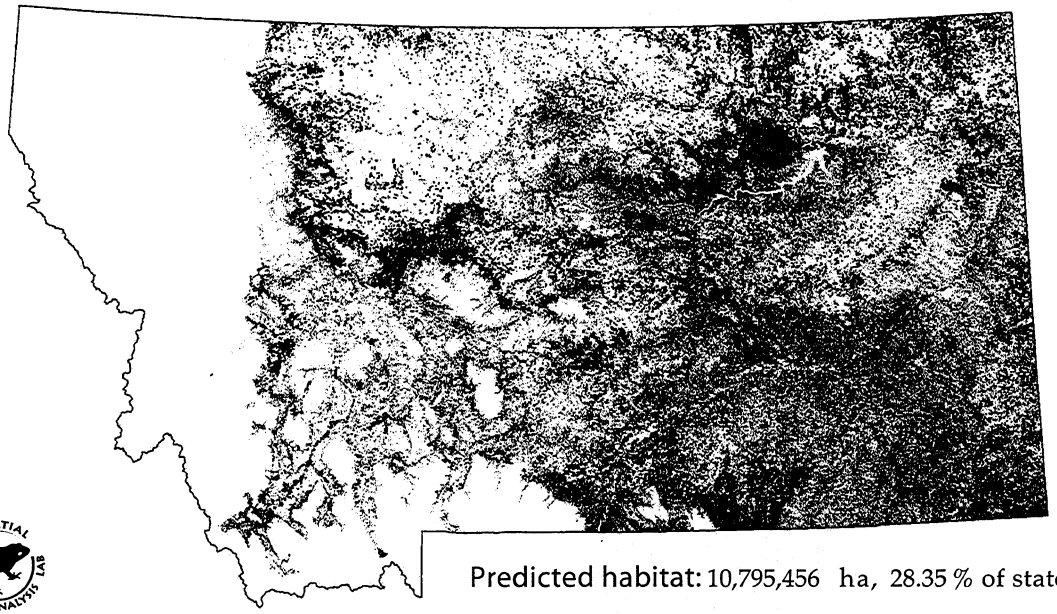


LOGGERHEAD SHRIKE

Lanius ludovicianus

State rank	S4B,SZN	Element code	ABPBR01030
Global rank	G5	Modeled by	P. McLaughlin
MTNHP status	watch list		



Predicted habitat: 10,795,456 ha, 28.35 % of state.

State range

Confirmed breeding throughout the eastern two thirds of the state; east of the Continental Divide is its primary breeding range in the state (Montana Bird Distribution Committee 1996, T. McEneaney, pers. comm.). Migrants recorded thoughout the state (Montana Bird Distribution Committee 1996).

Habitat description

Unique as both a passerine and a top-level predator, the loggerhead shrike is one of the few passerines whose populations have decreased throughout the continent in recent decades (Yosef 1996). Breeding Bird Survey (BBS) data show a current decrease of ~3.5-5% / yr across its range (Robbins et al. 1986). The use of organochlorines and pesticides as well as habitat destruction contribute to the species' decline (Yosef 1996). It is listed as a Species of Management Concern in Region 6 (U.S. Fish & Wildlife Service 1995). Dobkin (1994) notes that the species is more or less stable in Montana, although its numbers fluctuate greatly. Based on BBS data, Peterjohn and Sauer (1995) suggest that Montana had stable or increasing populations from 1966-1989; there is evidence in western states that suggests these populations are stable (C. McCarthy, pers. comm.). The loggerhead breeds in open fields and prairies containing scattered trees and shrubs (often spiny), savanna, and open woodland that are usually interspersed with grasses, forbs, and bare ground (Stewart 1975, Johnsgard 1979, AOU 1983, Ehrlich et al. 1988, Yosef 1996). In Montana this open terrain is often heavily grazed (T. McEneaney, pers. comm.) and can be relatively barren of vegetation, such as badlands with few scattered shrubs and trees (E. Atkinson, pers. comm.). In Idaho the species prefers sage-steppe habitat where it nests in sagebrush (65%), bitterbrush, and greasewood and is equally successful in all three (Woods 1993, Woods and Cade 1996). Jewett et al. (1953) suggest that nest sites are often conspicuous bushes relatively larger and more prominent than surrounding sagebrush. It also regularly uses disturbed sites providing open woody growth such as shelterbelts adjacent to croplands, farmsteads, mowed roadsides, and cemeteries (Stewart 1975, Johnsgard 1979, Dobkin 1994, Yosef 1996). Since it favors fence lines and utility lines and poles for perching and takes invertebrates from areas containing bare ground, roadsides are frequented (AOU 1983, Yosef 1996, E. Atkinson, pers. comm.). Suitable hunting

perches are an important part of the habitat (Yosef and Grubb 1994). In Alberta breeding areas, it was found more often than expected in medium (15-35cm) and tall (>35cm) grass (Prescott and Collister 1993). Increasing the prevalence of medium and perhaps tall grasses could mitigate population decreases of the eastern loggerhead shrike east of the Great Plains (Yosef 1996, E. Atkinson, pers. comm.). However, in western Canada it prefers shortgrass pastures (Telfer 1993). Nest sites, which are generally located in open country, are apparently selected based more on degree of cover provided than on particular tree or shrub species. Trees and thickets with thorns are usually preferred for the nest: Russian olive, sagebrush, bitterbrush, greasewood, buffaloberry, elm, and hawthorn (Johnsgard 1979, Yosef 1996, E. Atkinson, pers. comm.). Woodland draws and shelterbelts provide nest sites in Montana and North Dakota (C. McCarthy, pers. comm.).

Model assumptions & caveats

Shrub and tree height cannot be modeled. Mesic shrub (3200) is buffered 500m; within the buffer, agriculture (2010, 2020) and altered herbaceous, very low-low, low-medium, and medium-high grasslands (3110, 3130, 3150, 3170) are selected. Other cover types are included in their entirety. An elevation limit of 1950m (6398′) was added to restrict higher elevation predicted habitat.

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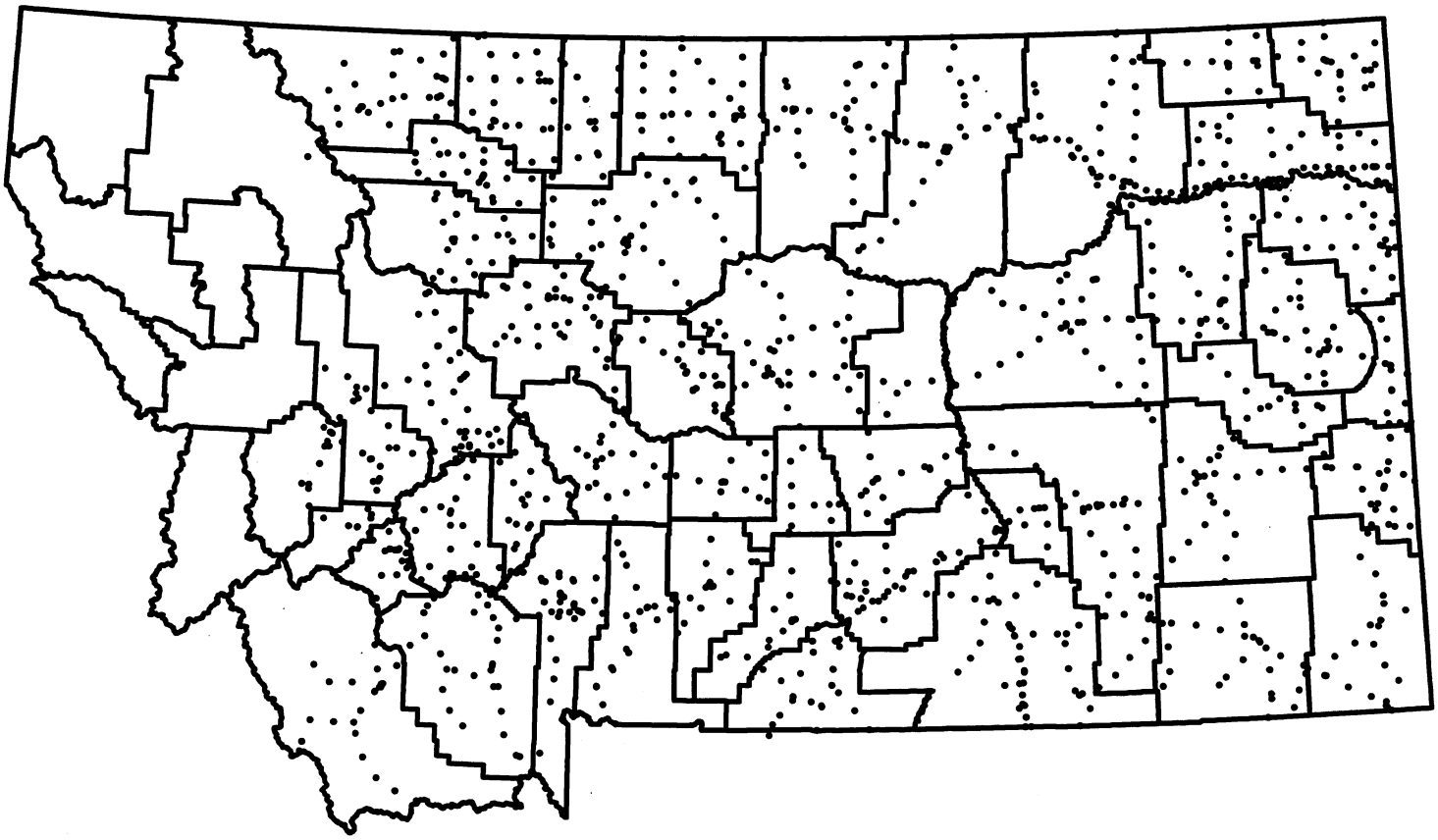
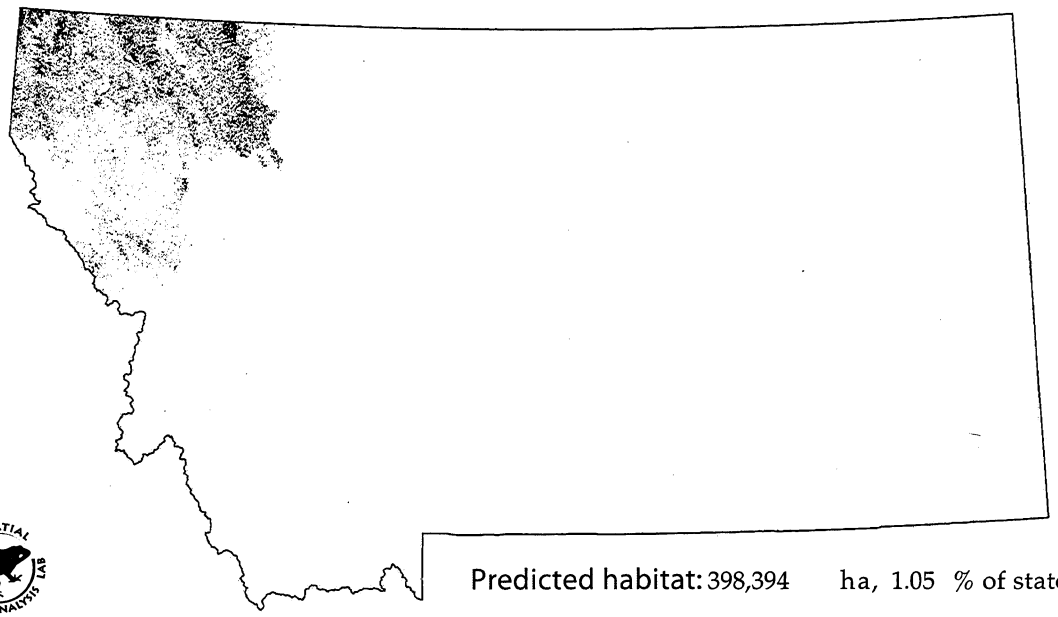


TENNESSEE WARBLER

Vermivora peregrina

State rank	S3S4B,SZN	Element code	ABPBX01040
Global rank	G5	Modeled by	P. McLaughlin
MTNHP status	watch list		



Predicted habitat: 398,394 ha, 1.05 % of state.

State range

Migrates widely throughout Montana, with indirect evidence of breeding in the Kootenai National Forest-Libby area, as well as in the the Flathead Indian Reservation area and the eastern Glacier National Park area. Direct evidence of breeding in the Flathead National Forest-Whitefish area. No overwintering exhibited (Montana Bird Distribution Committee 1996).

Habitat description

The clutch size of the Tennessee warbler increases in response to outbreaks of forest insects, especially the spruce budworm (Ehrlich et al. 1988, Dobkin 1994, Dunn and Garrett 1997). Although overall population numbers are abundant, the species responds rapidly to budworm outbreaks and crashes, resulting in regional abundance fluctuations from year to year (Dobkin 1994, Dunn and Garrett 1997). A breeder in boreal forests, the Tennessee warbler prefers open, regenerating, or second-growth forests (Johnsgard 1979, AOU 1983, Dunn and Garrett 1997). Bogs and swamps of deciduous (aspens,poplar, willow, alder) or mixed deciduous-coniferous (especially spruce) woodland are preferred habitats, provided there is a well-developed mossy or herbaceous ground layer and an understory (AOU 1983, Ehrlich et al. 1988, Dobkin 1994, Dunn and Garrett 1997). In Alberta and British Columbia the species may be primarily in deciduous associations of aspen, willow, alder, or poplar, usually along streams (Dunn and Garrett 1997); in Montana it prefers deciduous growth as well (T. McEneaney, pers. comm.). In the northern Rockies, spruce forests are occupied (Hejl et al. 1995, Dunn and Garrett 1997). The nest is often hidden at the base of a bush or on a sphagnum hummock, and occasionally on drier hillsides (Ehrlich et al. 1988, Dunn and Garrett 1997). In migration, the species uses a variety of forest, woodland, scrub, and thicket habitats, including urban areas (AOU 1983, Dunn and Garrett 1997).

Model assumptions & caveats

Canopy closure up to 69% is selected. A relatively open tree canopy is selected with the assumption that a well-developed understory is present. Yearly fluctuations in populations cannot be modeled. Species' density augments in areas of bark beetle infestation; food may be limiting factor. Only breeding habitat is modeled, with the assumption that migratory habitat is included as well.

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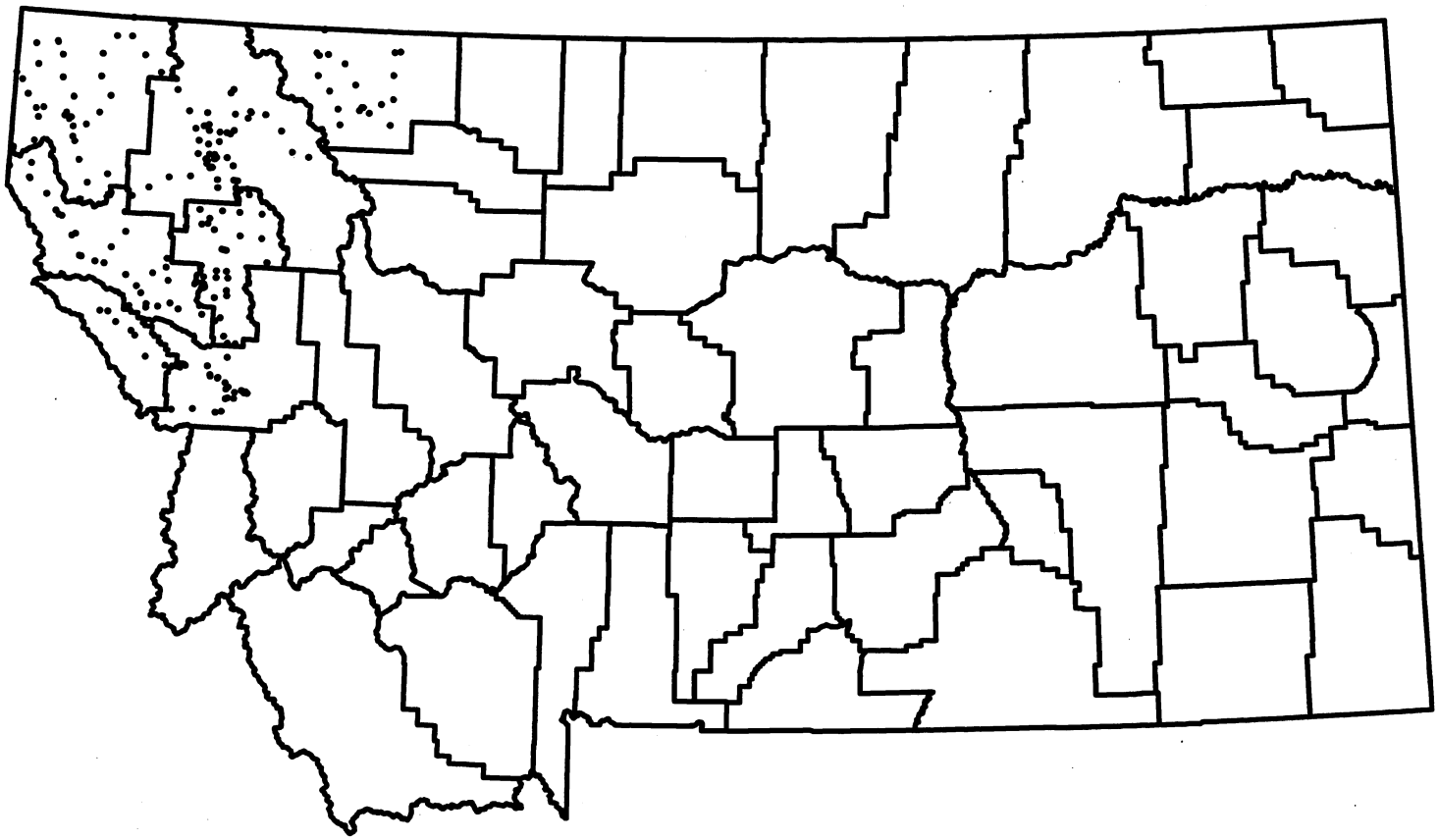
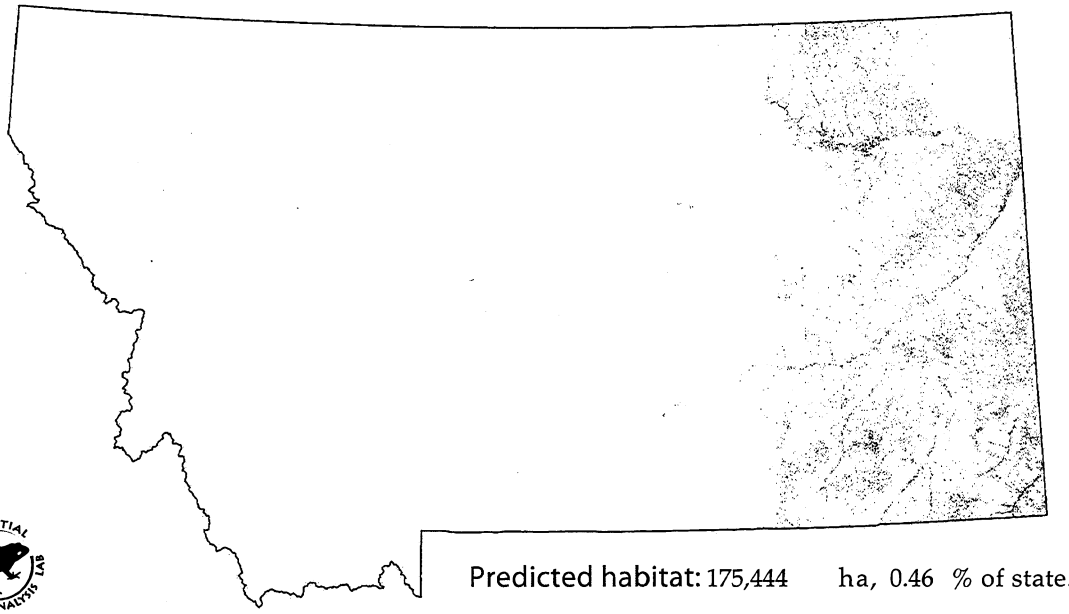


BLACK-AND-WHITE WARBLER

Mniotilta varia

State rank	S2S3B,SZN	Element code	ABPBX05010
Global rank	G5	Modeled by	P. McLaughlin
MTNHP status	watch list		



Predicted habitat: 175,444 ha, 0.46 % of state.

State range

Direct evidence of breeding in northeastern Montana, Glasgow-Fort Peck Reservoir area. Indirect breeding evidence observed throughout the eastern part of the state, extending westward only as far as the Northern Cheyenne Indian Reservation area and northward to Fort Peck reservoir. It is a summer resident in the eastern third of Montana (Dobkin 1994). Migrants have been observed extensively east of the Continental Divide, with 2 of 24 sightings west of the divide. No overwintering exhibited (Montana Bird Distribution Committee 1996).

Habitat description

The species is characteristic of semi-open stands of upland forest that are composed of second-growth or mature deciduous or deciduous-coniferous forests; less commonly it uses coniferous forests (Stewart 1975, Johnsgard 1979, Ehrlich et al. 1988, Kricher 1995). Large trees are a critical component of its habitat (Dunn and Garrett 1997). These forest types include mixed stands of juniper/green ash and green ash, American elm, boxelder, and other deciduous trees (Stewart 1975, Johnsgard 1979). Overall, the black-and-white warbler is a habitat generalist with broad tolerances throughout its range (Kricher 1995). James (1971) found that the species showed a strong preference for mature forest over early successional habitat. In central Ontario, it frequents forests with high tree density and high canopy volume, which indicate a preference for mid- to late-successional forests (Clark et al. 1983). The species may also be found in hillside or ravine groves with thin understories and in riparian forests adjacent to grasslands (Johnsgard 1979). Its breeding is restricted to extreme eastern Montana, where it is a bird of woody draws and cottonwood riparian forests (D. Casey and T. McEneaney, pers. comm.). The black-and-white warbler is adapted for gleaning arthropods from tree trunks similar to creepers or nuthatches (Johnsgard 1979, Dobkin 1994). Its nest is usually in a depression on the ground against a shrub, tree, base of a stump, rock, or log (Kricher 1995). It generally migrates east of the Rocky Mountains and is found in interior forest, forest edge, parkland, woodland, second growth, and suburban areas (AOU 1983, Kricher 1995).

Model assumptions & caveats

Of the 25 sightings for the state, six are from the period 1991-1995 (Montana Natural Heritage database). The species was last reported in 1995. Predicted distribution may be overestimated. Size class cannot be modeled.

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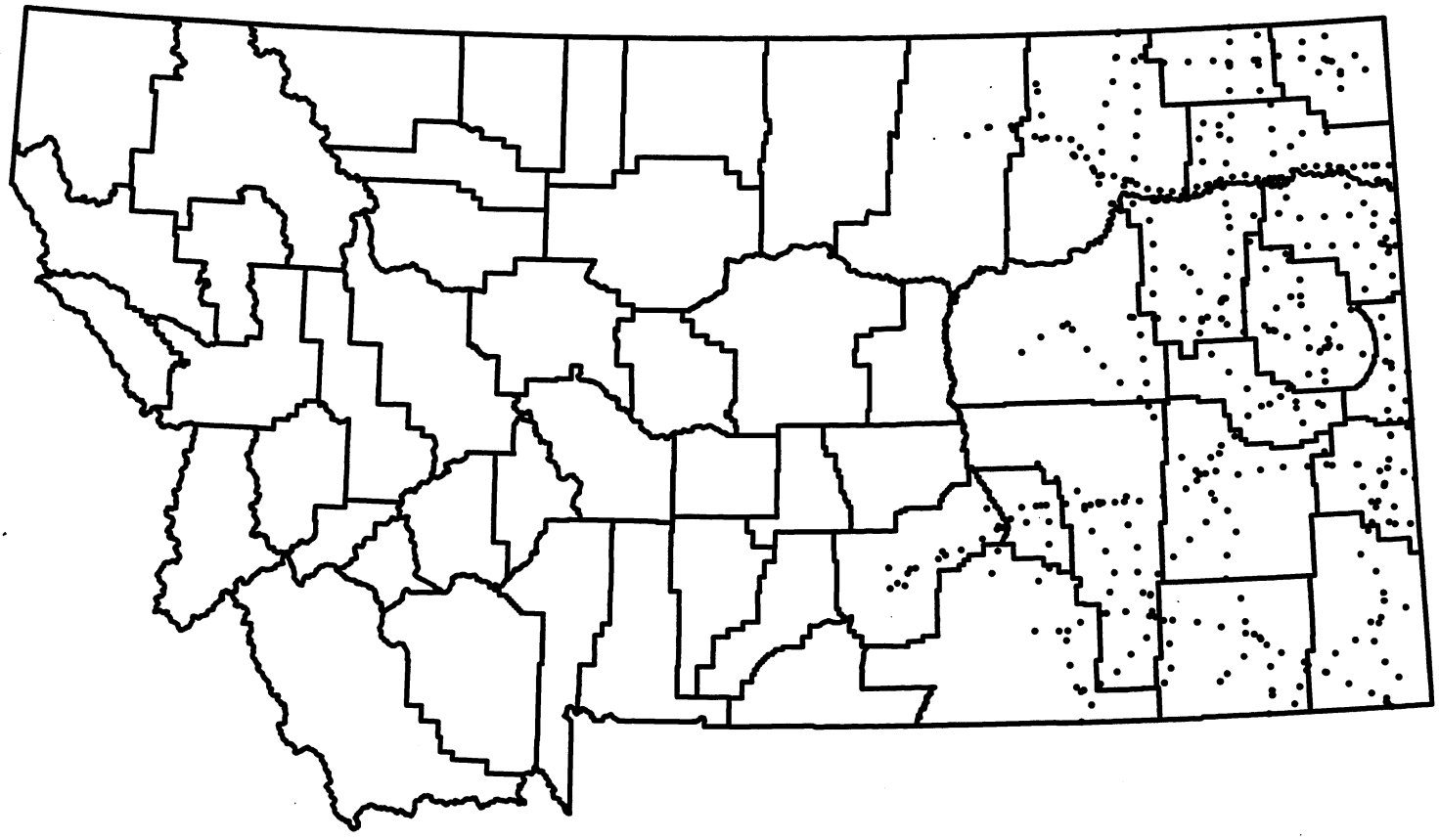
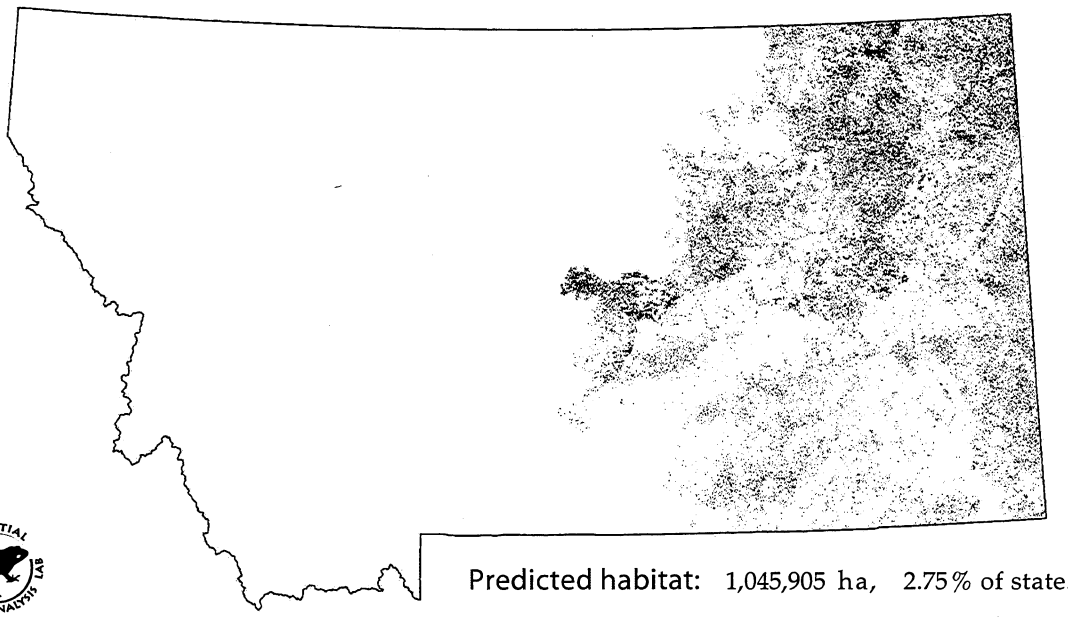


DICKCISSEL

Spiza americana

State rank	S1S2B,SZN	Element code	ABPBX65010
Global rank	G5	Modeled by	P. McLaughlin
MTNHP status	special concern		



Predicted habitat: 1,045,905 ha, 2.75% of state.

State range

There are about 15 records in the state; the most recent is from June 1986 at Toston, Broadwater County, which is also the westernmost state record (Wright 1996). There is confirmed breeding only in latilong 34, Custer County. Summer birds have been observed widely throughout eastern 1/4th of state. There is no evidence of overwintering (Montana Bird Distribution Committee 1996).

Habitat description

The dickcissel, a summer resident, is listed as a Species of Management Concern in Region 6 (U.S. Fish and Wildlife Service 1995) and as a sensitive species by the Montana Natural Heritage Program (Montana Bird Distribution Committee 1996). Its numbers are declining significantly throughout its entire range (Dobkin 1994, Johnson and Igl 1995). Pronounced fluctuations in local numbers between years are the rule rather than the exception (Fretwell 1986, Ehrlich et al. 1988, Dobkin 1994). The species breeds in meadows, savanna, brushy fields, ungrazed native prairie, grasslands having tall grasses, forbs, or shrubs, weedy croplands, and in croplands planted to crops such as timothy, alfalfa and clover (Johnsgard 1979, AOU 1983). In North Dakota the species is especially characteristic of alfalfa hayfields; it also frequents sweetclover fields and weedy cropland fields that have been temporarily retired from agriculture (Stewart 1975). Crop mowing and harvesting destroys nests and nestlings, plus the species is a frequent cowbird host (Dobkin 1994). Agricultural lands may pose a significant biological sink for the species (C. McCarthy, pers. comm.). In North Dakota, Conservation Reserve Program (CRP) fields are especially important for the dickcissel during the breeding season; if CRP habitat were returned to cropland and densities of breeding birds were substituted in cropland for densities in CRP, the dickcissel's numbers would be reduced by 17.1% (Johnson and Igl 1995).

Model assumptions & caveats

There are too few observers in eastern Montana to allow for accurate determination of the species' presence (Wright 1996). Two cover types were chosen for this model: altered herbaceous grasslands (3110) and moderate/high cover grasslands (3170). CRP land (included in 3110) is often non-native species. Agricultural cover types were not selected since crop types (per Johnsgard 1979) cannot be specified and will vary from year to year. The low-medium grassland (3150) cover type, the state's largest at >10 million ha, was not included because its selection would largely overestimate predicted habitat.

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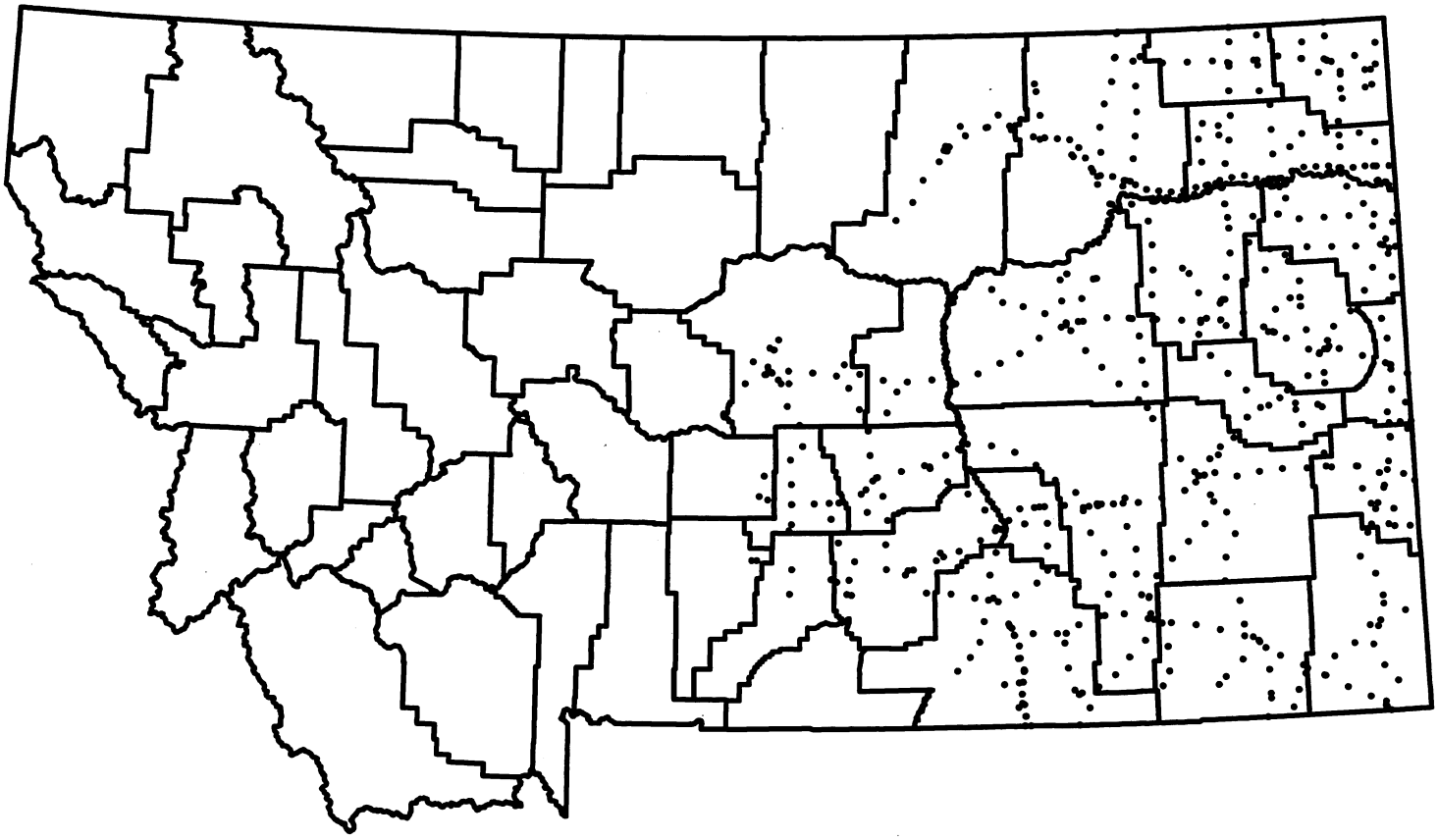
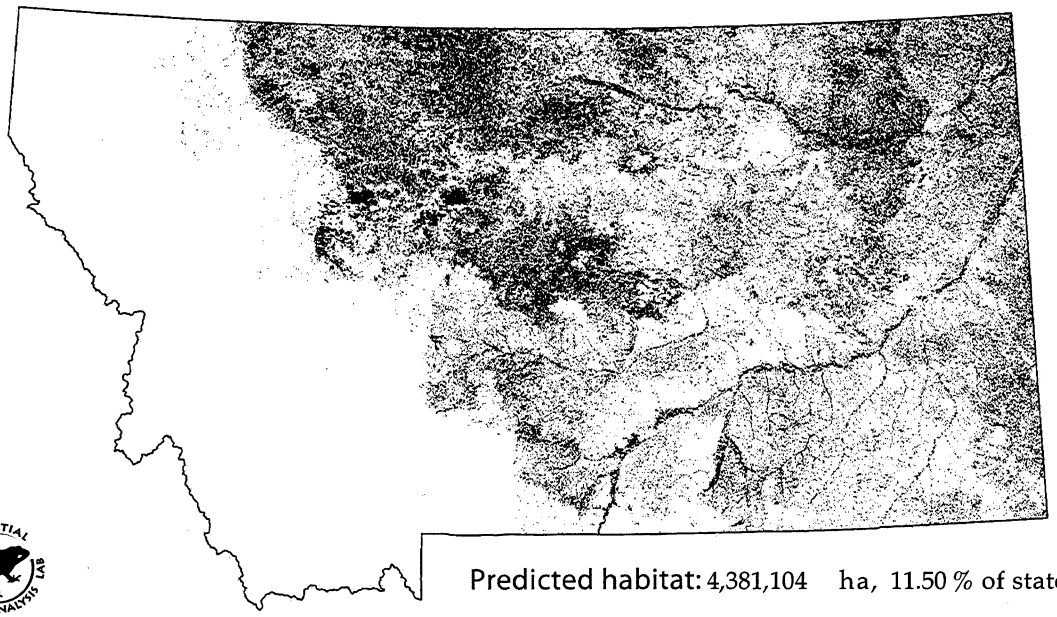


BAIRD'S SPARROW

Ammodramus bairdii

State rank	S3S4B,SZN	Element code	ABPBXA0010
Global rank	G4	Modeled by	P. McLaughlin
MTNHP status	special concern		



Predicted habitat: 4,381,104 ha, 11.50 % of state.

State range

Summering birds occur in north-central and the eastern half of Montana (Bergeron et al. 1992). Direct evidence of breeding found only in northern half of the state, east of the Continental Divide, i.e. in the Choteau and Great Falls area, and east in the Fort Peck Indian reservation-Plentywood area. Only migrants found west of the divide and no overwintering exhibited throughout the state (Montana Bird Distribution Commitee 1996). The species breeds extensively throughout northern Phillips and Blaine counties and Bowdoin NWR, where the most nests have been documented in the state 1994-1997 (D. Prellwitz, pers. comm.). Medicine Lake is also a stronghold for this species (T. McEneaney, pers. comm.).

Habitat description

A local and generally uncommon species, the Baird's sparrow is a mixed-grass prairie specialist endemic to the northern Great Plains (Dobkin 1994, Rising 1996, C. McCarthy, pers. comm.). It is a Species of Management Concern in Region 6 (U.S. Fish and Wildlife Service 1995). However, the species is very common in ungrazed grasslands in northeastern and north-central Montana (D. Prellwitz, pers. comm.). Its optimal habitats include extensive ungrazed or lightly grazed tracts of mixed-grass prairie and local pockets of wet meadow zones or tall-grass prairie that are associated with wetlands and intermittent streams (Stewart 1975, Johnsgard 1979, Rising 1996). These grasslands may be interspersed with scattered clumps of grass and low shrubs with tangled, matted grass on the ground (A.O.U. 1983, Rising 1996), although it generally prefers grasslands having little or no shrub cover (Dobkin 1994). Large populations in northeastern Montana are located in native mixed-grass grasslands that have not been grazed by cattle or disturbed by fire for approximately 20 years (Hammond et al. 1997). Such habitat is found at Bowdoin NWR, where the nest success for the Baird's sparrow in 1997 was 46.6%, slightly above the mean nest success of 42% reported for open-cup nesting neotropical migrants in North America (Hammond et al. 1997). Based on 1995-1997 data, current populations have increased from the period 1979-1981 when transects were done by the Bureau of Land Management (D. Prellwitz, pers. comm.). Conservation Reserve Program (CRP) and crested wheatgrass

(CWG) fields have in part contributed to this population increase (D. Prellwitz, pers. comm.). The species will use vegetation <2' tall, but will not use taller, 3'-3.5' vegetation of moister areas as in parts of North Dakota and the Midwest (D. Prellwitz, pers. comm.). Although it especially prefers native grasslands over disturbed grasslands (Owens and Myres 1973), the Baird's will use disturbed habitats such as retired croplands, hay and alfalfa fields, crested wheatgrass, and weedy stubble fields (Johnsgard 1979, Dobkin 1994, C. McCarthy and D. Prellwitz, pers. comm.). While agricultural practices and grazing have decreased available habitat (Ehrlich et al. 1988), the species can tolerate light grazing regimes (Kantrud and Kologiski 1982). The Baird's sparrow will use a forb or small hummock for a perch, but will not use a fence or wire for elevation (D. Prellwitz, pers. comm.). This may bias population censuses such as Breeding Bird Surveys (BBS) that rely on driven routes to gather data (D. Prellwitz, pers. comm.). The species is thought to be highly nomadic across its breeding range: in wet years it commonly uses suitable grasslands of eastern Montana and the Dakotas; in dry years it appears to be more common in suitable grasslands of the Canadian prairie (C. McCarthy, pers. comm.).

Model assumptions & caveats

Breeding habitat only is modeled; assumed potential migration habitats defined within breeding habitat parameters. Irrigated agriculture (2020) is selected because the species will use croplands that follow a rest-rotation regime; such land-use practices cannot be modeled. Seasonal weather patterns affecting the species' distribution cannot be modeled.

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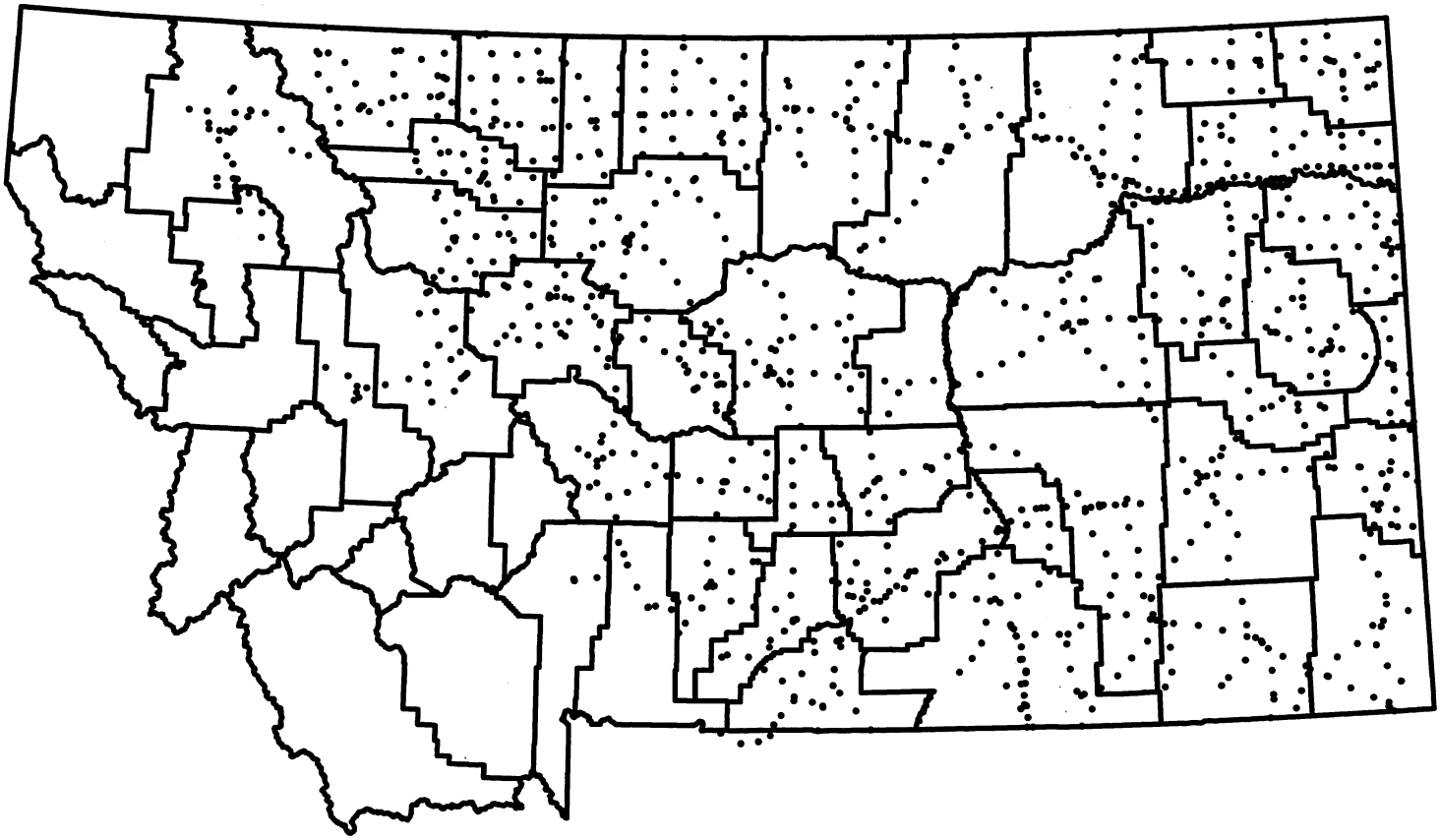
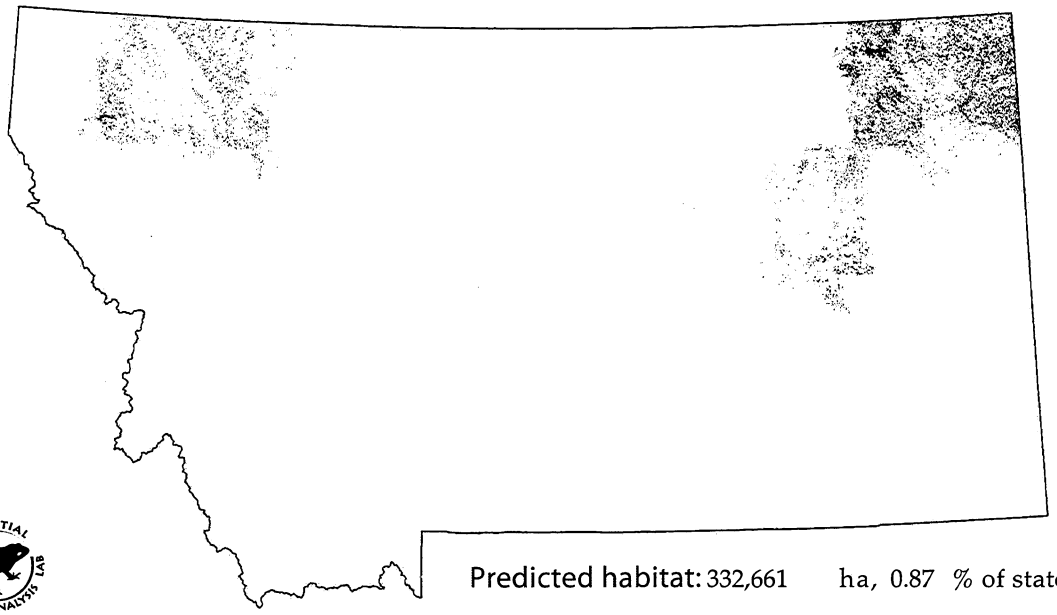


LE CONTE'S SPARROW

Ammodramus leconteii

State rank	S1S2B,SZN	Element code	ABPBXA0040
Global rank	G4	Modeled by	P. McLaughlin
MTNHP status	special concern		



Predicted habitat: 332,661 ha, 0.87 % of state.

State range

Confirmed breeding is only on Camas Creek, Glacier National Park, and in Sheridan County in northeastern Montana. Transients recorded rarely throughout the state, though distributed east and west of the divide, as well as northern and southern Montana. No overwintering exhibited (Montana Bird Distribution Committee 1996, Wright 1996).

Habitat description

Listed as a sensitive species in Montana (Montana Bird Distribution Committee 1996), the LeConte's sparrow is an uncommon breeder with a disjunct and restricted breeding range in the state (T. McEneaney, pers. comm.). Preferred breeding habitats include moist grass or sedge meadows that are occasionally mixed with cattails or phragmites, and often interspersed with small alders and birches; and hummocky alkaline wetlands (fens) (Johnsgard 1979, A.O.U. 1983, Lowther 1996, Rising 1996). The species is less commonly found in lowland tracts of tall-grass prairie and wet-meadow zones on the periphery of prairie ponds and lakes or along intermittent streams (Stewart 1975, Johnsgard 1979, Ehrlich et al. 1988). Disturbed habitats occupied are hayfields and reitured croplands, and in migration it is found in tall, dense grasses, damp weedy fields, or cattails (A.O.U. 1983, Rising 1996). In mountainous areas, it is found in flooded sedge and grass meadows (Semenchuk 1992). Despite its preference for marshy, wet areas, moist habitats do not seem to be a requirement (Lowther 1996): North Dakota censuses have found LeConte's sparrows in 6-9 year-old fields of alfalfa and wheatgrass (Renken and Dinsmore 1987). Population densities can fluctuate yearly; usually this species reaches peak numbers in wet years, and may be scarce or absent during dry years (Stewart 1975, Lowther 1996). In 1994 during surveys of Conservation Reserve Program fields in Sheridan County, 52 pairs were found (Wright 1996).

Model assumptions & caveats

The species responds negatively to any level of livestock grazing in mixed-grass prairie (Maher 1979).

Altered herbaceous (3110) and montane parklands and subalpine meadows (3180) cover types are selected in their entirety. Altered herbaceous (3110) includes, as well as CRP fields, disturbed lands with noxious weeds and bare soil coverages from 10-50%. However, the noxious weed component of 3110 is primarily included in the southern and western parts of the state. Graminoid & forb riparian (6200) is selected only within a 500m hydrography buffer of marshes / swamps. Breeding habitat only is modeled; assumed potential migration habitats defined within breeding habitat parameters.

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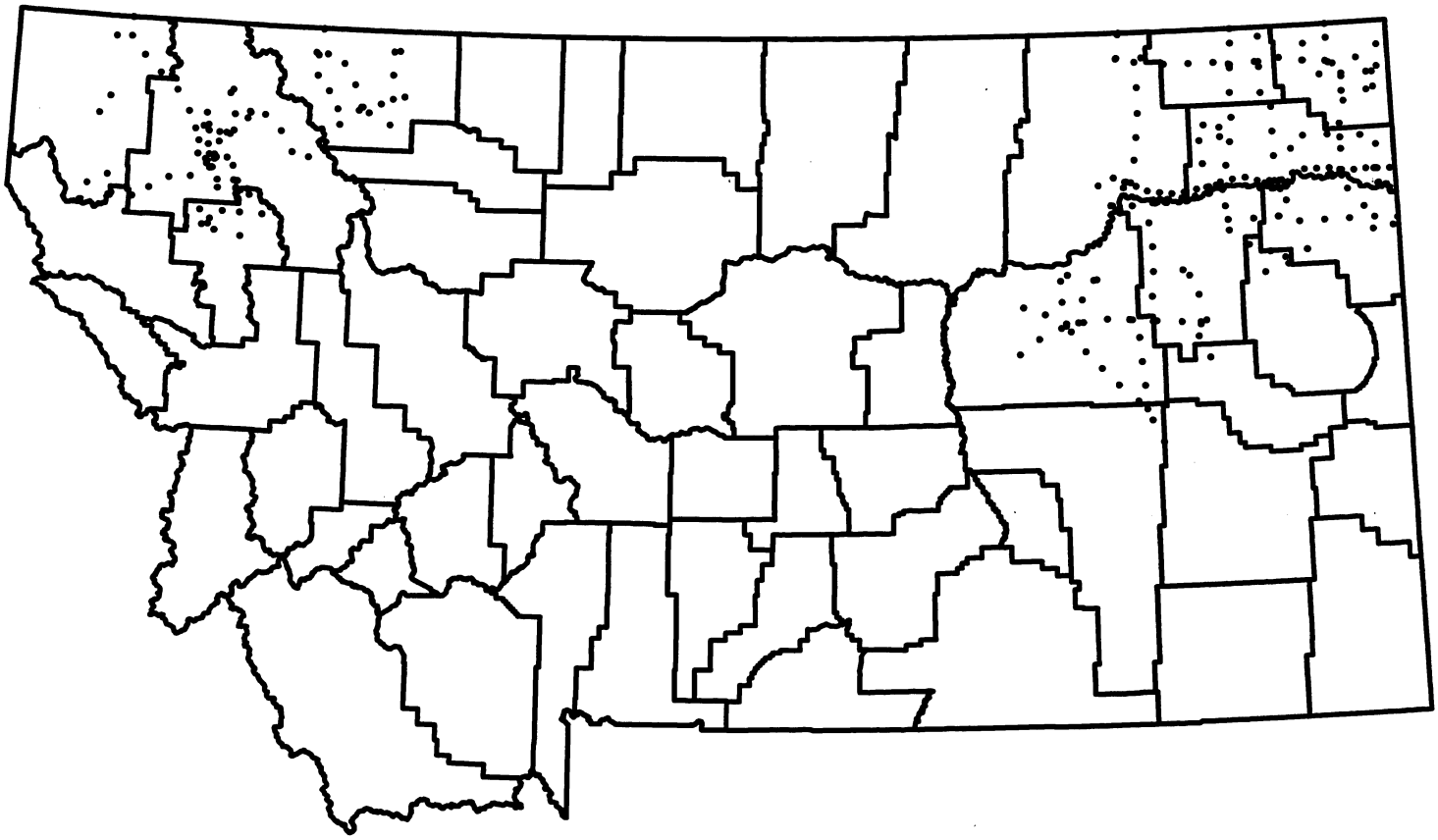
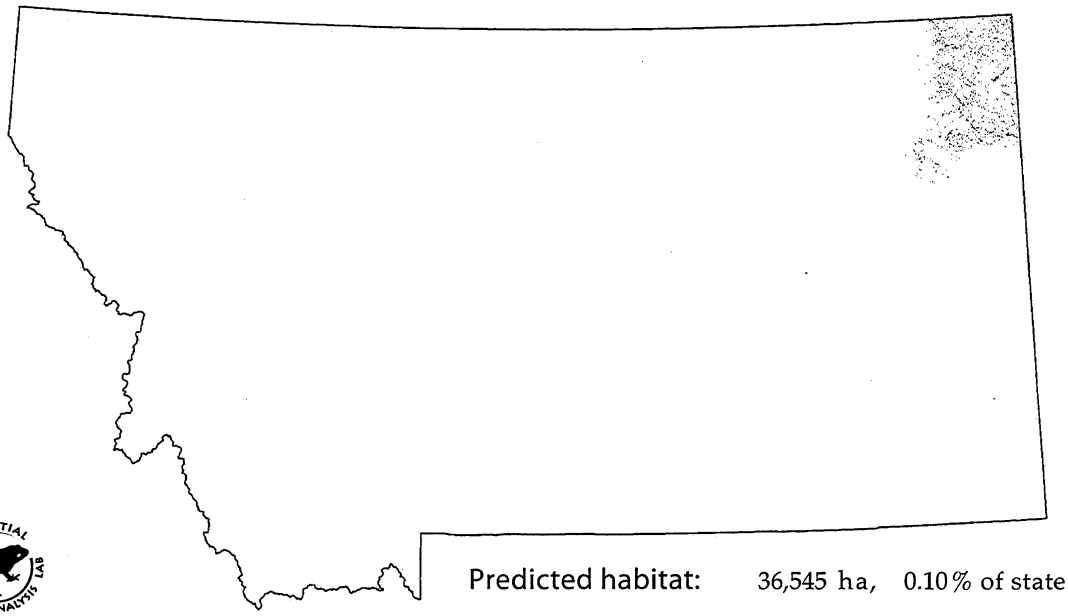


NELSON'S SHARP-TAILED SPARROW

Ammodramus nelsoni

State rank	S1B,SZN	Element code	ABPBXA0070
Global rank	G5	Modeled by	P. McLaughlin
MTNHP status	special concern		



Predicted habitat: 36,545 ha, 0.10% of state.

State range

Three records of breeding evidence; one direct and two indirect, both in the Plentywood-Fort Peck Indian Reservation area of northeastern Montana. No transient or overwintering records (Montana Bird Distribution Committee 1996).

Habitat description

A highly localized species, the Nelson's sharp-tailed sparrow is listed as a sensitive species in the state, and breeds only in extreme northeastern Montana (Greenlaw and Rising 1994, Montana Bird Distribution Committee 1996, Rising 1996). In breeding season, the species is restricted to wet meadows and grasslands, the edges of marshes, herbaceous wetlands, and alkaline hummocky bogs (fens) (Johnsgard 1979, A.O.U. 1983, Ehrlich et al. 1988, Greenlaw and Rising 1994, Rising 1996). Within fens, it is largely restricted to patches of coarse emergent vegetation including cattails, bulrushes, and phragmites (Stewart 1975). When water levels are low, the species will use the marshy zones of prairie lakes and ponds and shallow-marsh and deep-marsh zones (Stewart 1975, Johnsgard 1979). Locally fairly common in the prairie pothole region of North Dakota, the species' populations often fluctuate greatly in number from year to year. Unlike the LeConte's sparrow, Nelson's sharp-tailed sparrow populations reach their peak numbers in drought years and are reduced to minimal number during wet years (Stewart 1975). In migration it may occur in wet fields and marshes, often in cattails, and in brushy areas and overgrown fields (A.O.U. 1983, Rising 1996).

Model assumptions & caveats

The Nelson's sharp-tailed sparrow responds negatively to any level of livestock grazing in mixed-grass prairie (Maher 1979). Breeding habitat only is modeled; assumed that potential migration habitats defined within breeding habitat parameters.

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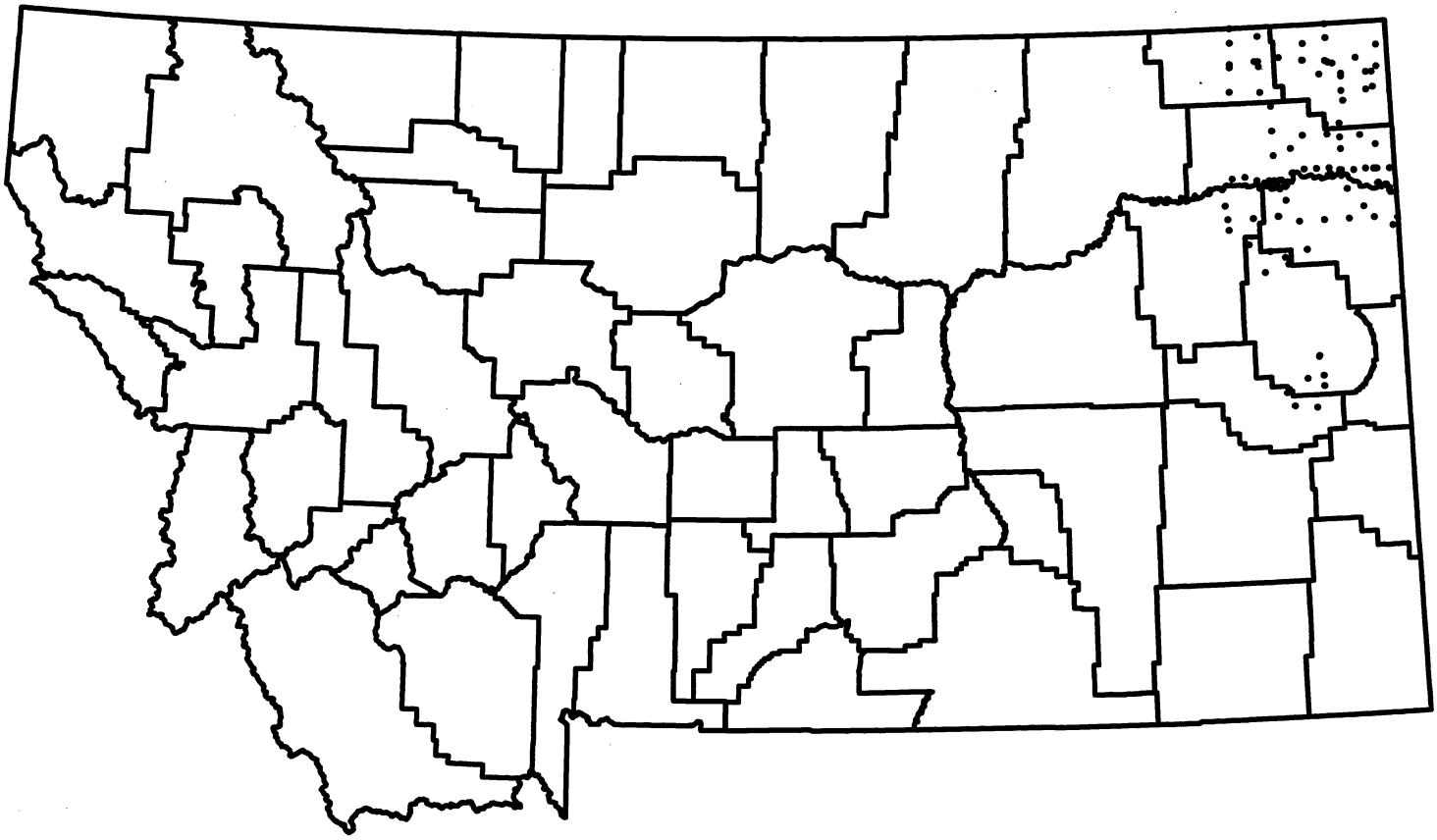
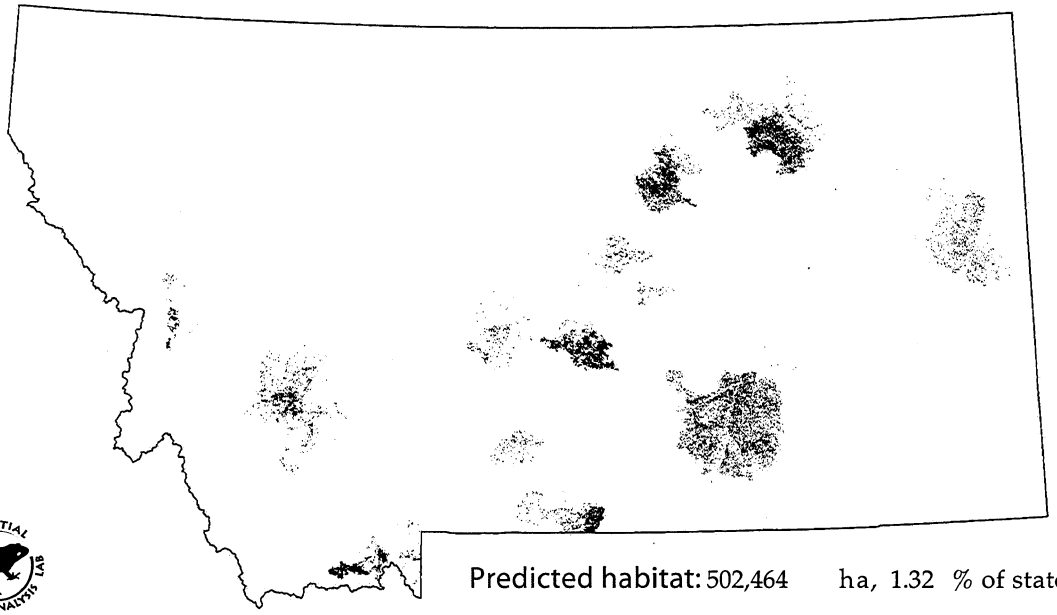


PREBLE'S SHREW

Sorex preblei

State rank	S3	Element code	AMABA01030
Global rank	G4	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 502,464 ha, 1.32 % of state.

State range

Thought to be rare (Flath 1984). However, range has expanded as sampling has increased. Possibly more widespread than previously apparent (Hoffmann and Fisher 1978).

Habitat description

Most Montana specimens from dry sage and sage-grasslands (Hoffman and Pattie 1968). Also riparian shrubs and Douglas-fir forest (Allen et al. 1994; Ports and George 1990). Captured in subalpine conifers in eastern Washington, may be restricted by *S. cinereus*. In Utah: saltgrass, greasewood, sagebrush and sage openings in conifers (Tomasi and Hoffmann 1984).

Model assumptions & caveats

Limited habitat association information.. May be found near rock outcrops. Cannot model for rock outcrops, hence distribution likely overestimated.

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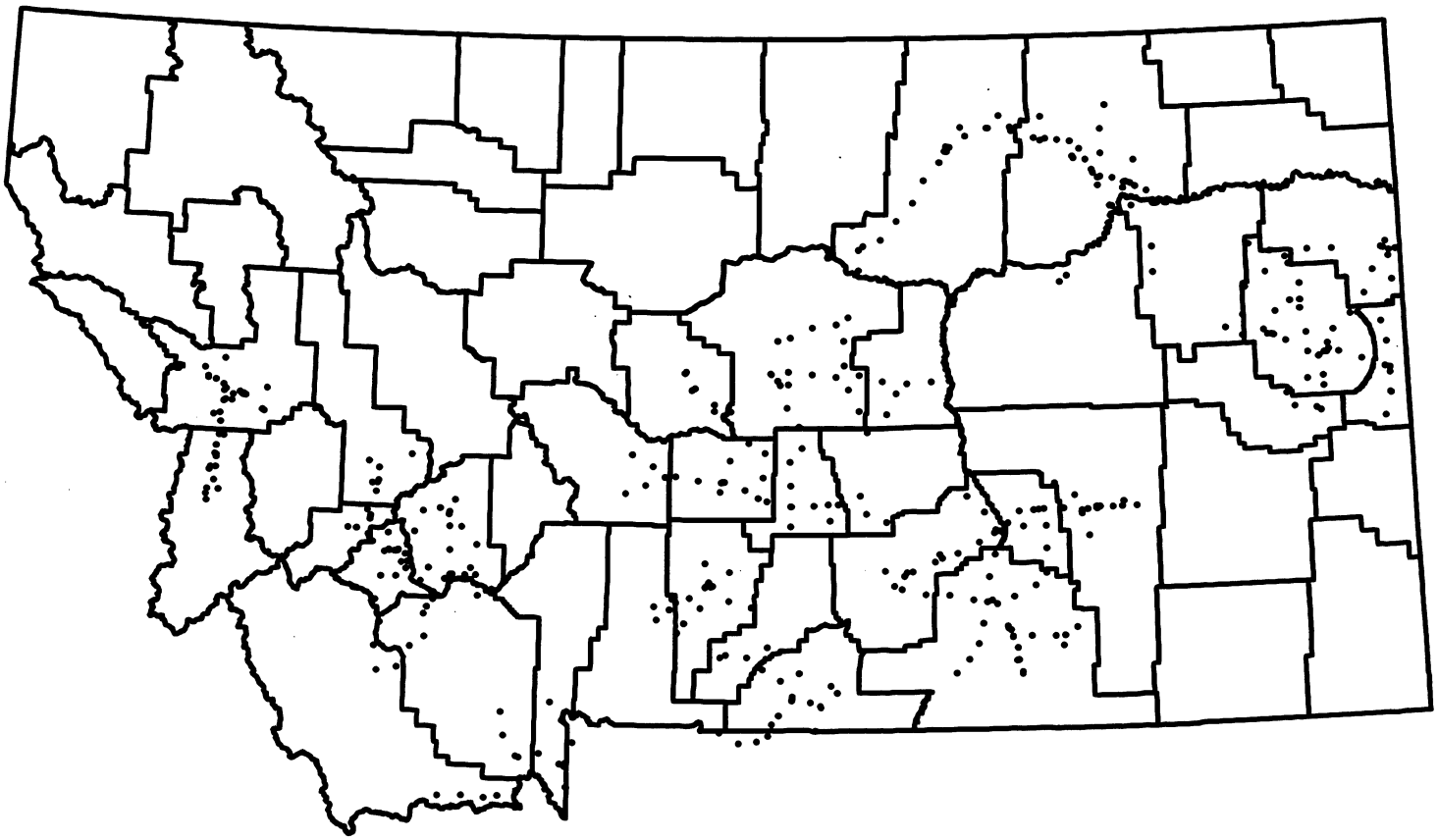
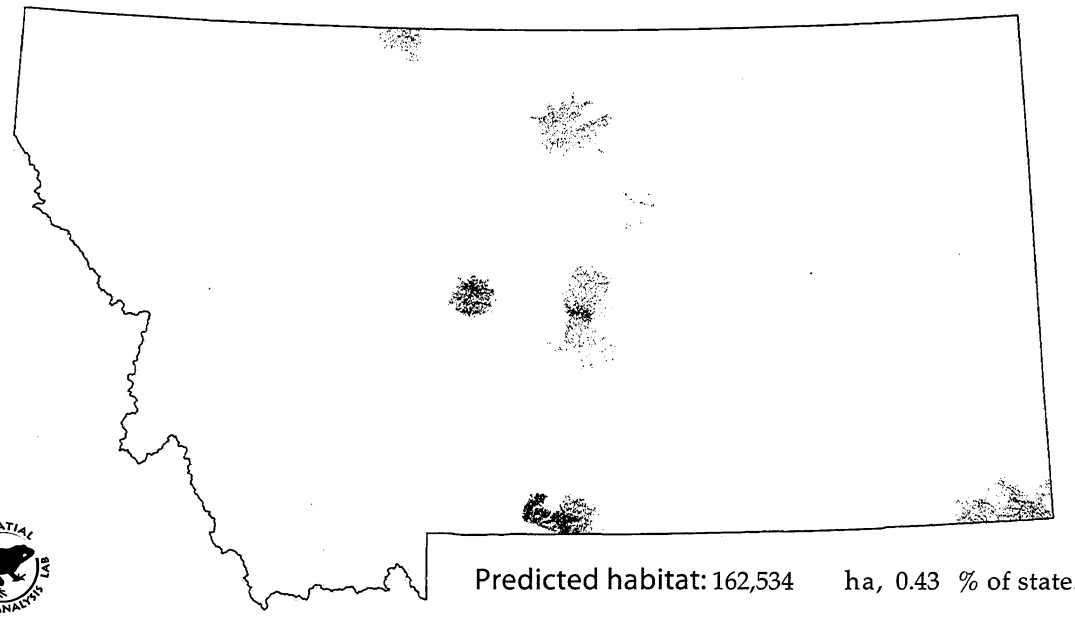


DWARF SHREW

Sorex nanus

State rank	S3	Element code	AMABA01130
Global rank	G4	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 162,534 ha, 0.43 % of state.

State range

Known from several high mountain ranges in central Montana: Sweetgrass Hills (Thompson 1977); Bears Paw Mountains (Thompson 1977); Little Belt Mountains (Hoffmann and Taber 1960); Beartooth Mountains (Pattie and Verbeek 1967, Hoffmann and Taber 1960). More recently found at low elevation in southeastern Montana (MacCracken et al. 1985). May be more widespread than currently known (Flath 1984). Has been captured in low elevation prairie habitat in South Dakota. Known from the Holocene in the East Pryor Mountains (Geppert 1984).

Habitat description

Spruce-fir-lodgepole forest, forest meadows and clearcuts, will occupy drier forest than other shrews (Hoffmann and Owen 1980). Open ponderosa pine (Allen et al. 1994). Marsh and riparian areas. Will occupy sage at high population densities (MacCracken et al. 1985). Rocky alpine tundra (Hoffmann and Owen 1980). Individuals found on alpine and subalpine talus slopes in Sweetgrass Hills, Bears Paw Mountains (Thompson 1977), Hellroaring Plateau (Pattie and Verbeek 1967) and Medicine Bow Mountains (Brown 1967).

Model assumptions & caveats

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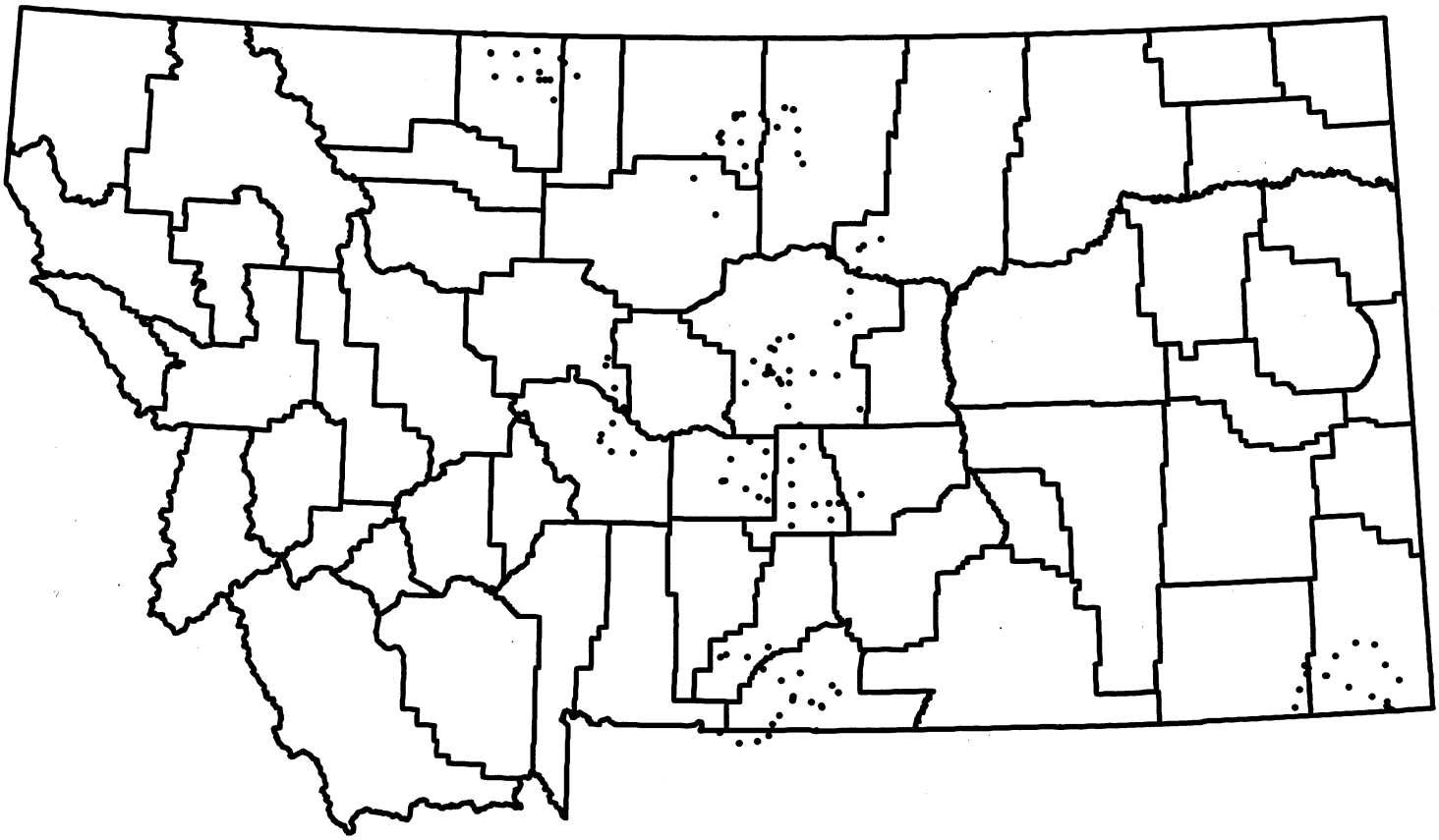
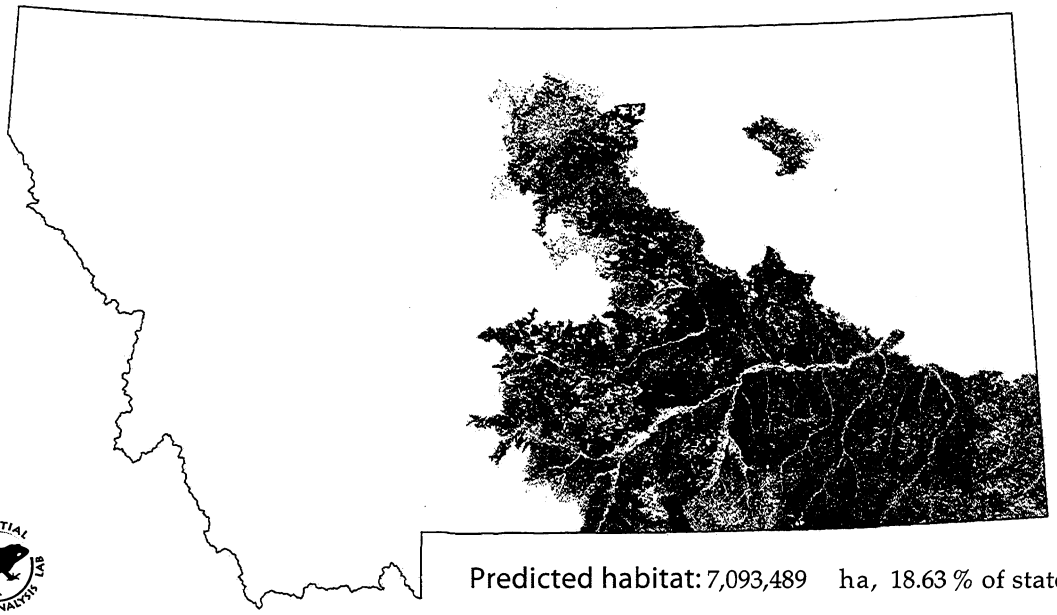


MERRIAM'S SHREW

Sorex merriami

State rank	S3	Element code	AMABA01230
Global rank	G5	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 7,093,489 ha, 18.63 % of state.

State range

Thought to be rare (Flath 1984). Patchy distribution in the eastern half of the state (Thompson 1982).

Habitat description

Dry sagebrush, sage-grasslands and grasslands (Brown 1967, Armstrong and Jones 1971, MacCracken et al. 1985). Riparian shrubs. Fencerows of agricultural fields (Hooper 1944). Open ponderosa pine (Allen et al. 1994).

Model assumptions & caveats

References

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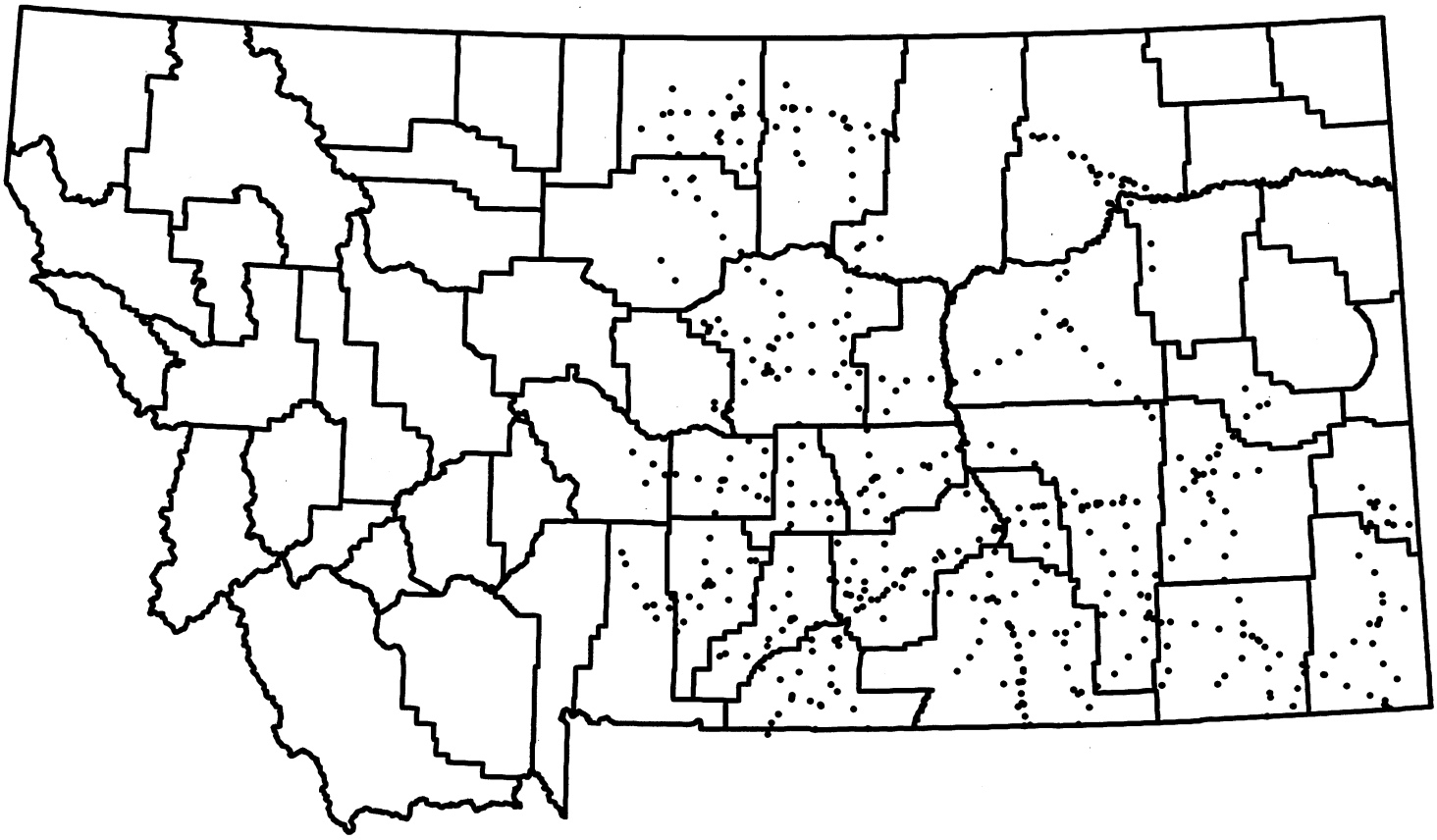
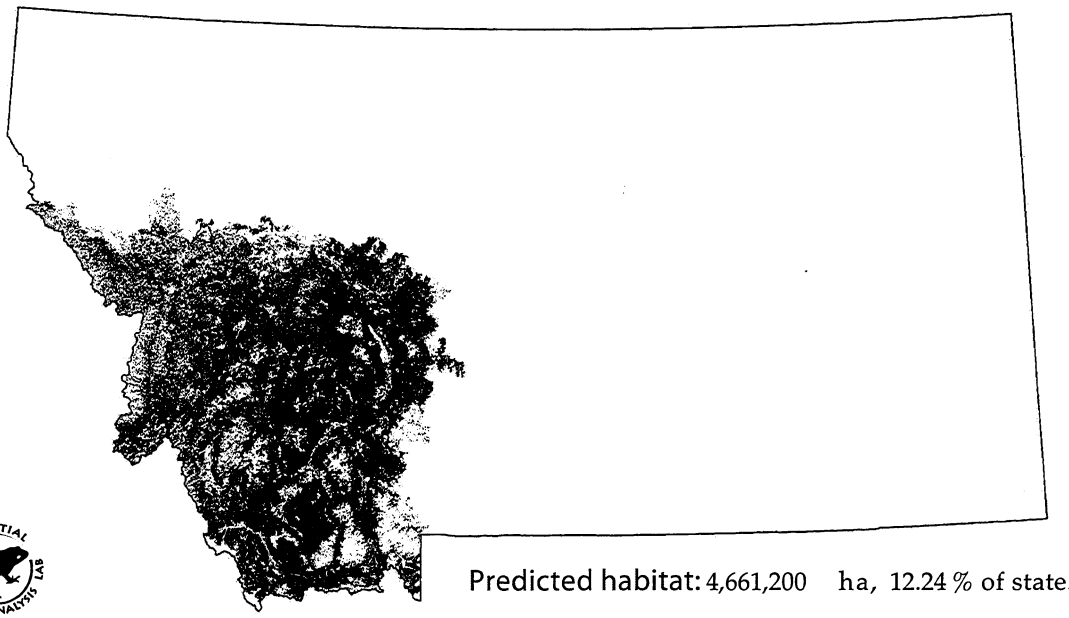


FRINGED MYOTIS

Myotis thysanodes

State rank	S3	Element code	AMACC01090
Global rank	G5	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 4,661,200 ha, 12.24 % of state.

State range

Range records of *Myotis thysanodes* are very limited (Hoffmann et al. 1969) Specimens from Lewis and Clark Caverns and Ravalli county exist (Flath 1984). This species is probably found throughout southwestern Montana (Hoffmann et al. 1969).

Habitat description

Primarily at middle elevations of 1,200-2,150 m in desert, grassland, sage, and juniper habitats; has been recorded at 2,850 m in spruce-fir forests in New Mexico, and at low elevations along Pacific Coast. Roosts in caves, mines, rock crevices, buildings, and other protected sites.

Model assumptions & caveats

References

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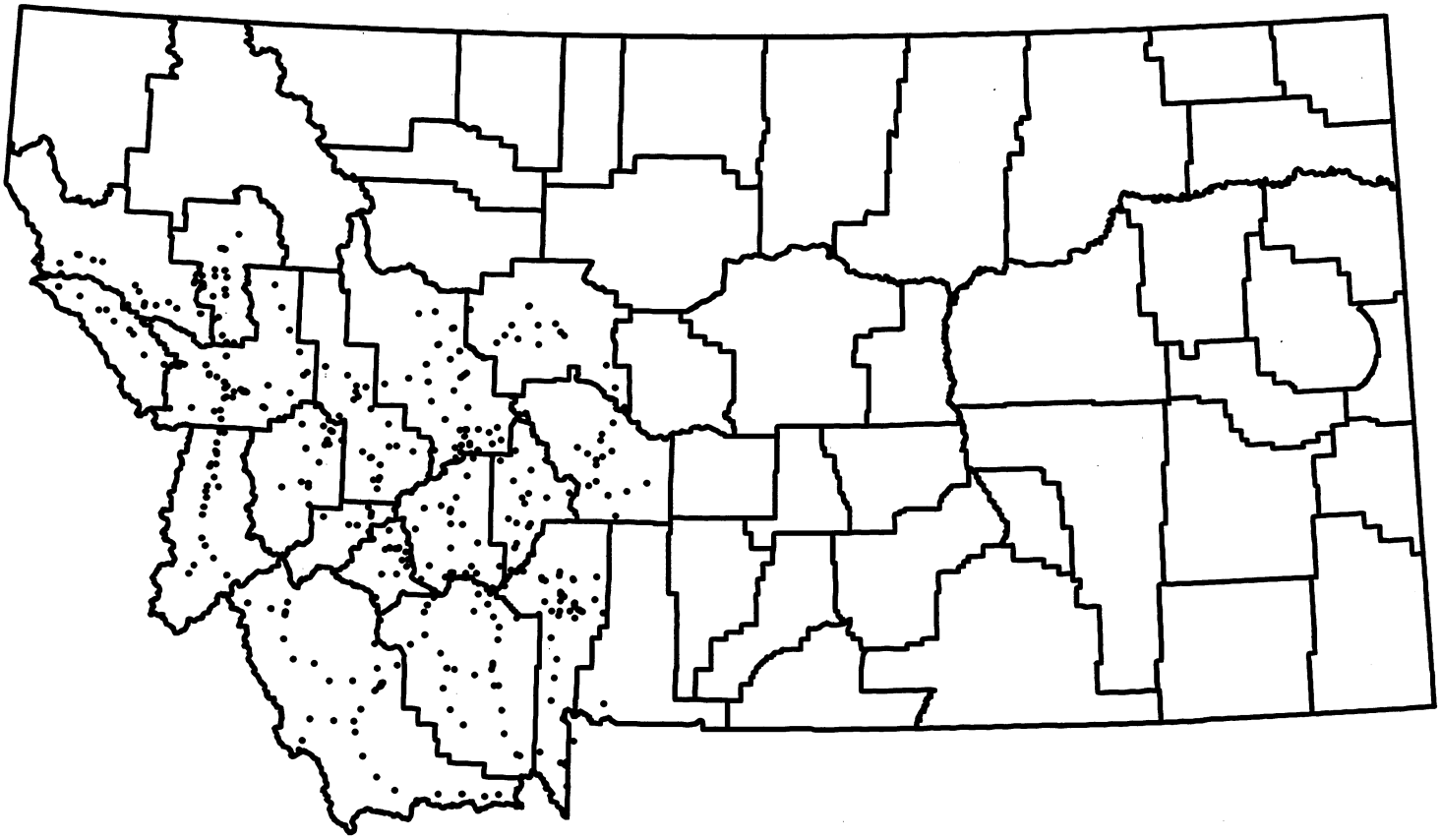
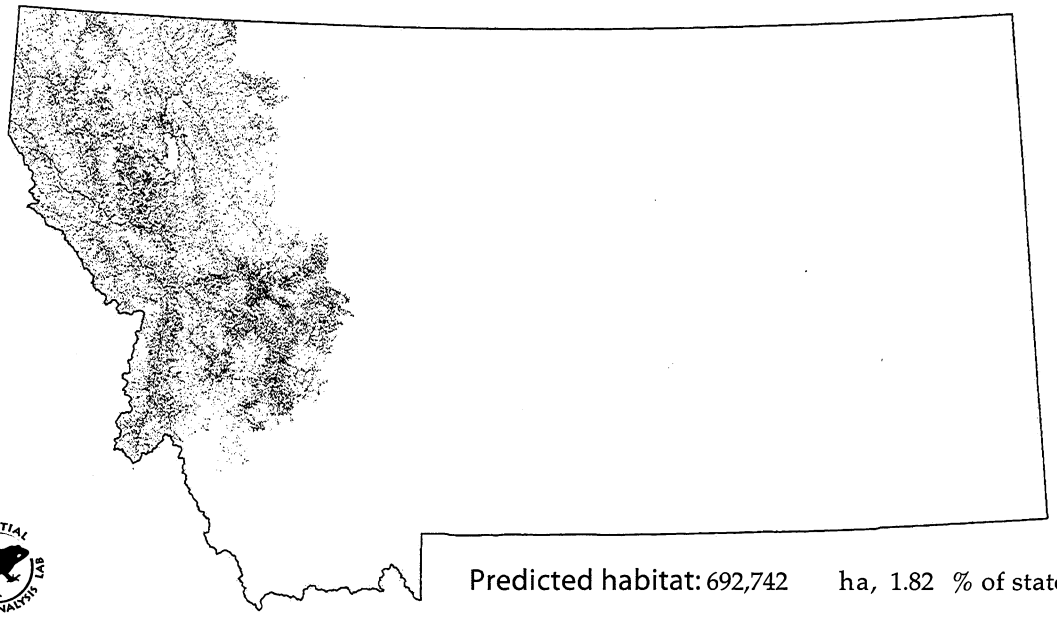


YUMA MYOTIS

Myotis yumanensis

State rank	S3	Element code	AMACC01020
Global rank	G5	Modeled by	P. Thornton
MTNHP status	watch list		



Predicted habitat: 692,742 ha, 1.82 % of state.

State range

Widely distributed in western Montana, but probably very limited in occurrence east of the Continental Divide (Hoffmann et al. 1969).

Habitat description

More closely associated with water than most other North American bats. Found in a wide variety of upland and lowland habitats, including riparian, desert scrub, moist woodlands and forests, but usually found near open water. Flies low over flowing water to forage (van Zyll de Jong 1985).

Model assumptions & caveats

References

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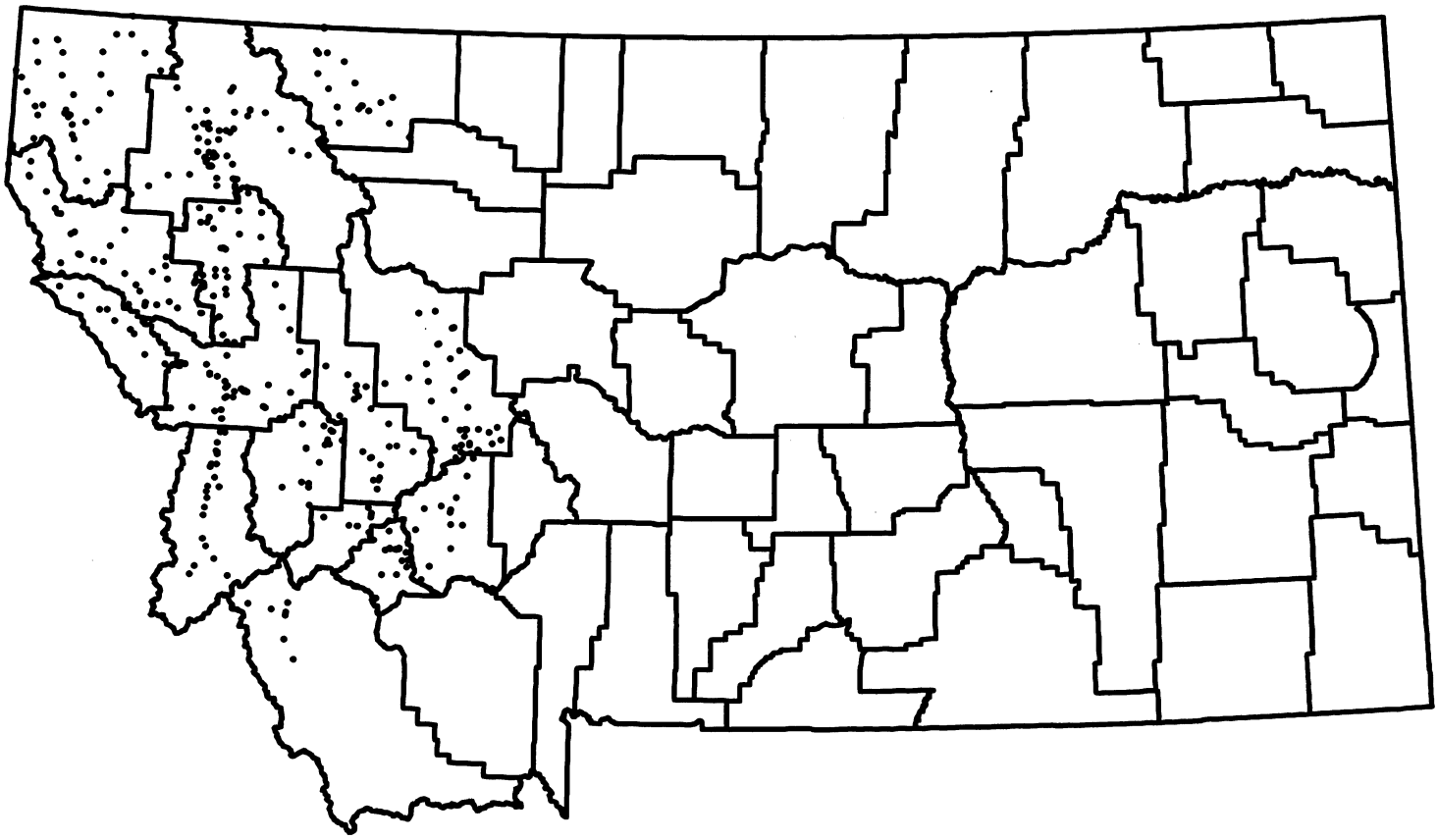
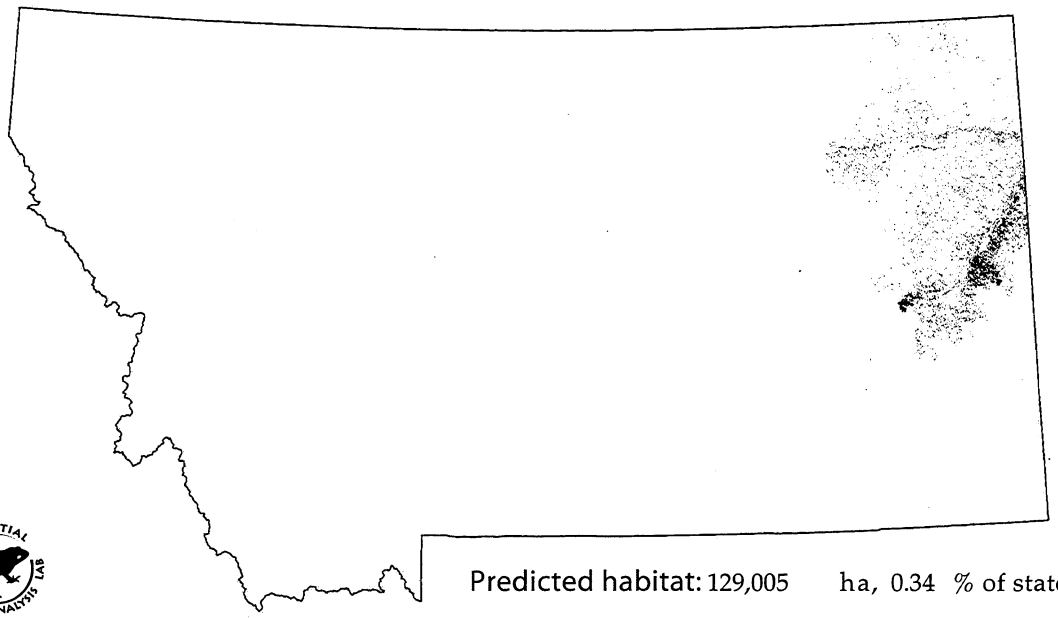


NORTHERN MYOTIS

Myotis septentrionalis

State rank	S2	Element code	AMACC01150
Global rank	G4	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 129,005 ha, 0.34 % of state.

State range

This bat is known from a few sites in eastern Montana along the lower Missouri River, and in Montana is probably confined to riparian corridors of the lower Missouri River system (MT-NHP VCA).

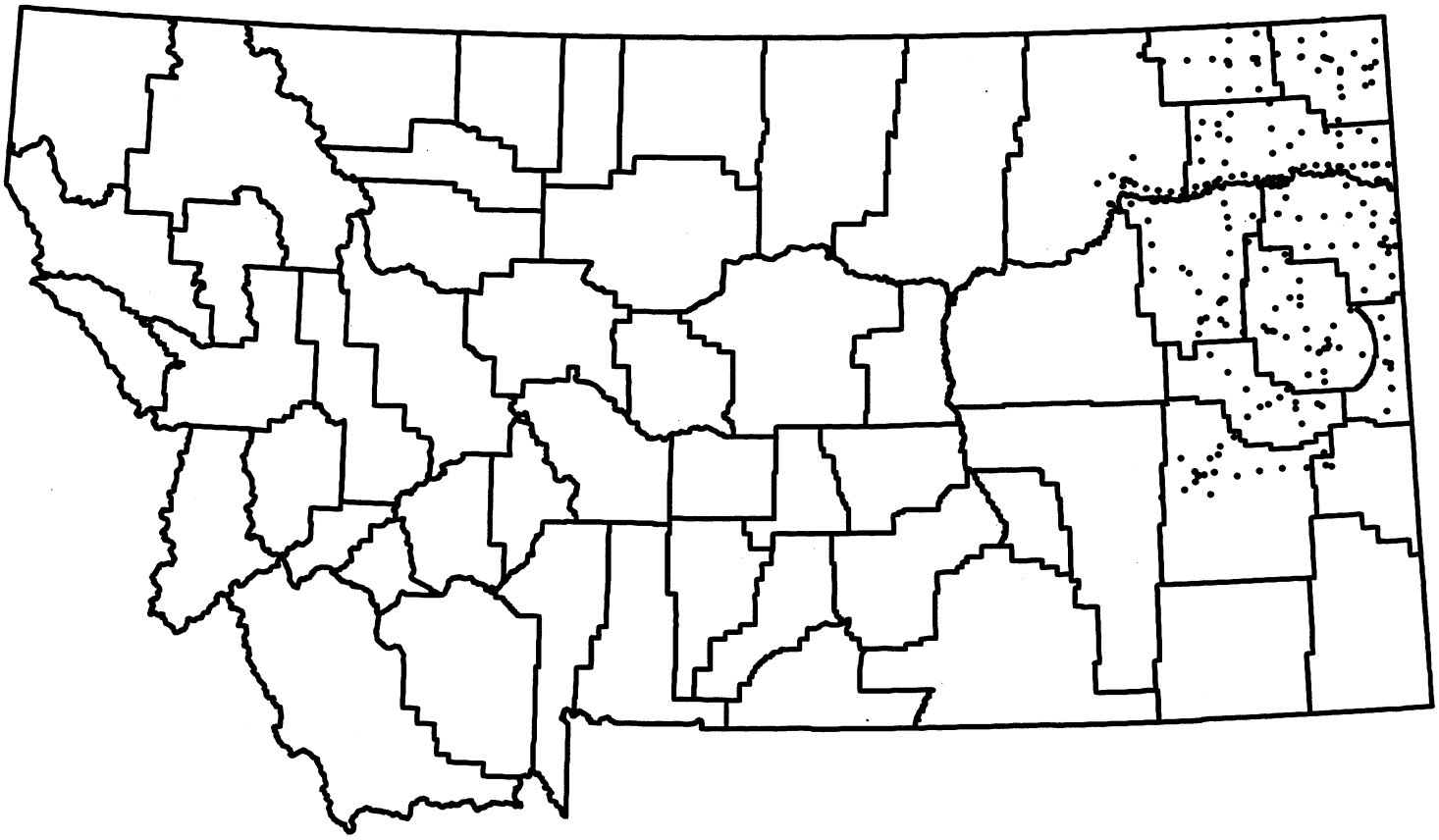
Habitat description

In Montana, Northern Myotis has been located hibernating in an abandoned mine in river breaks habitat in Richland County (Swenson and Shanks 1979).

Model assumptions & caveats

References

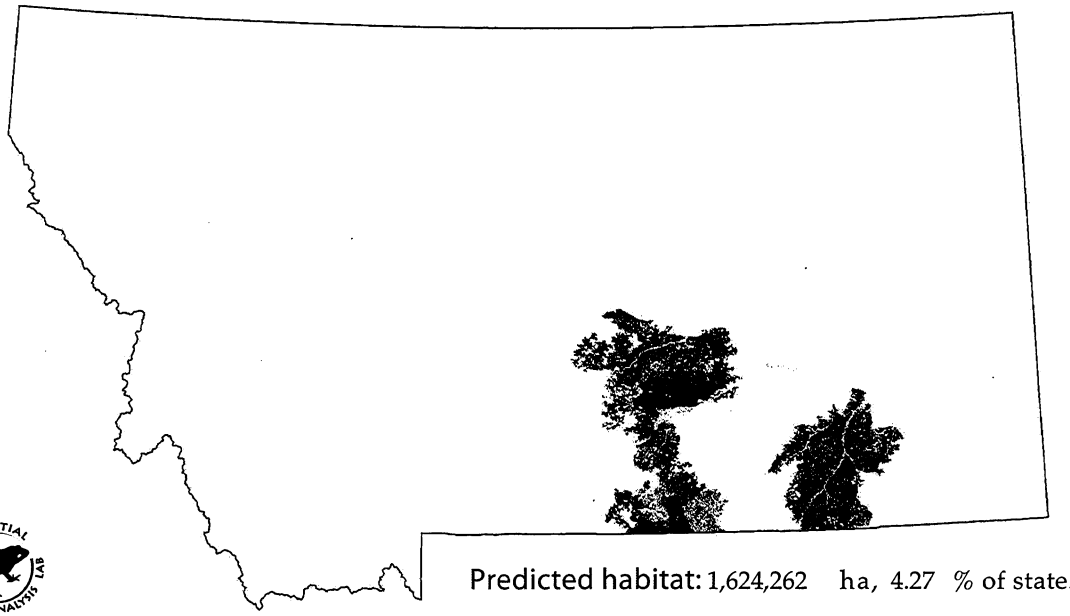
Swenson, J.E., and G.F Shanks, Jr. 1979. Noteworthy records of bats from northeastern Montana. J. Mammal. 60:650-652



SPOTTED BAT

Euderma maculatum

State rank	S1	Element code	AMACC07010
Global rank	G4	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 1,624,262 ha, 4.27 % of state.

State range

Few definite locations in Montana; all from south-central part of state (Thompson, 1982, MT-NHP VCA).

Habitat description

Found in various habitats from desert to montane coniferous stands, including open ponderosa pine, pinyon-juniper woodland, open pasture, and hayfields. Speculation has been made that captures outside coniferous forests reflect post-breeding wandering (Snow 1974). Roosts in caves and in cracks and crevices in cliffs and canyons, with which this species consistently is associated (Snow 1974, van Zyll de Jong 1985). Winter habits poorly known. Handley (1959) found that spotted bats were found primarily on open or scrub country. Of his 22 recorded occurrences, 13 were around houses.

Model assumptions & caveats

References

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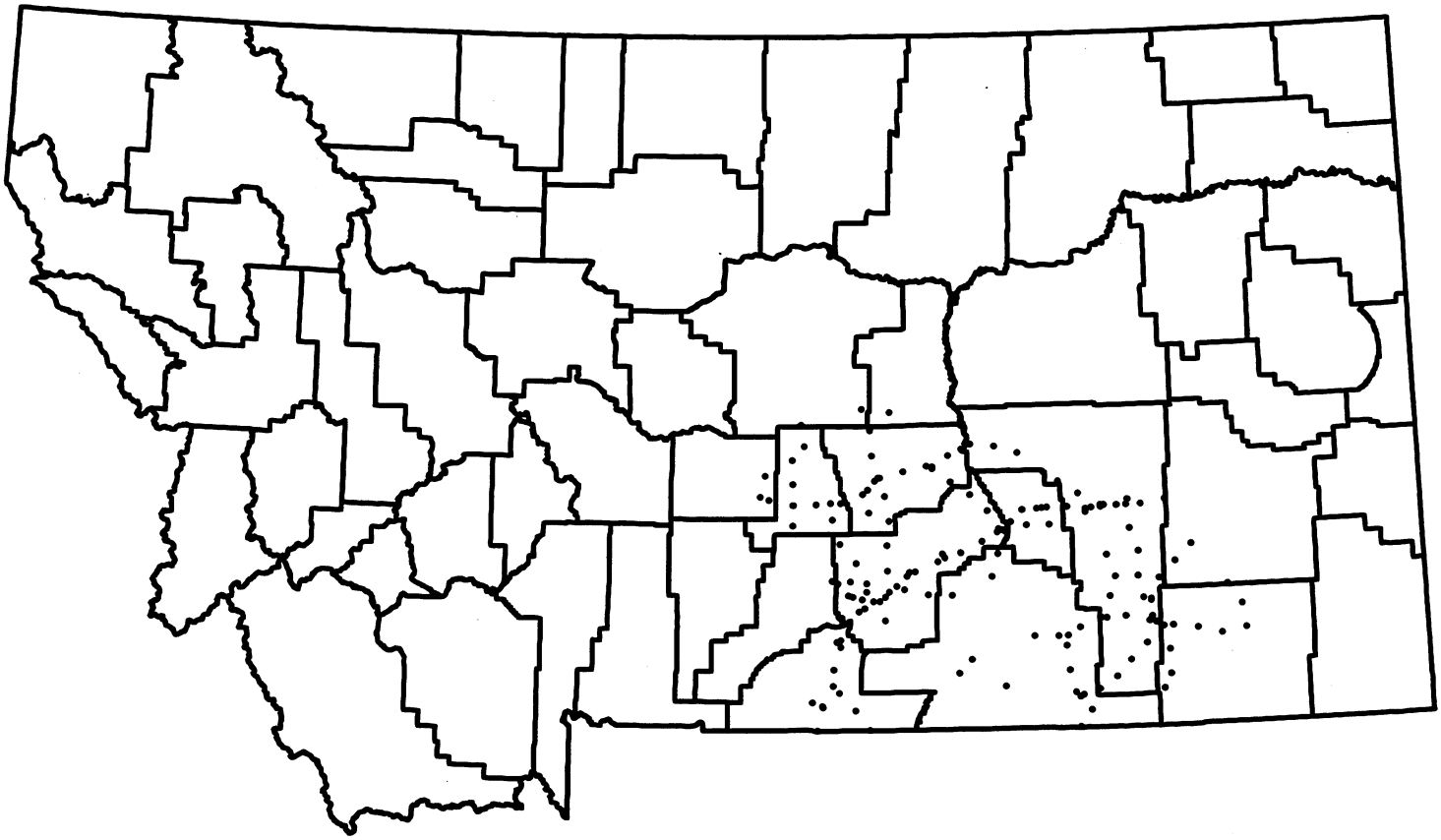
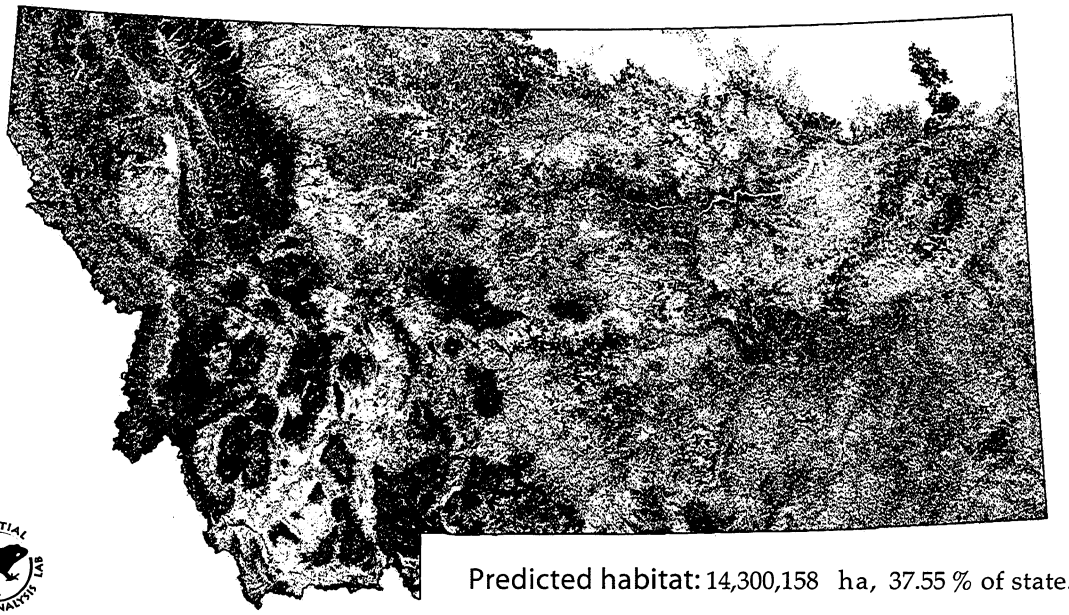


TOWNSEND'S BIG-EARED BAT

Corynorhinus townsendii

State rank	S2S3	Element code	AMACC08010
Global rank	G4	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 14,300,158 ha, 37.55 % of state.

State range

Scattered records imply that this species has a statewide distribution (Thompson 1982). Only two confirmed breeding colonies; several confirmed hibernacula.

Habitat description

Generally found in low densities, occupying a range of habitats including moist forests (Thomas and West 1991) as well as arid regions (Genter and Metzgar 1985), including desert shrub and junipers. In western Montana they are most closely associated with cavernous habitat and rocky outcrops of sedimentary or limestone origin, which are used for roosting. In old-growth forests, large diameter hollow trees may be used for roosting. Occasionally, individuals may be found in buildings. Maternity colonies are found in warm areas of caves, mines and occasionally buildings (Pearson et al. 1952, D. Genter, pers. obs., Idaho State Conservation Effort 1995). Hibernacula are typically in caves or mines with winter temperatures 2-7° C and relative humidity >50%.

Model assumptions & caveats

References

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Fitzgerald, T. 1989. New records of bats from northeastern Colorado. Journal of the Colorado-Wyoming Academy of Science 21:22.

Genter, D. L. 1986. Wintering bats of the upper Snake River plain: occurrence in lava-tube caves. Great Basin Nat. 46(2):241-244.

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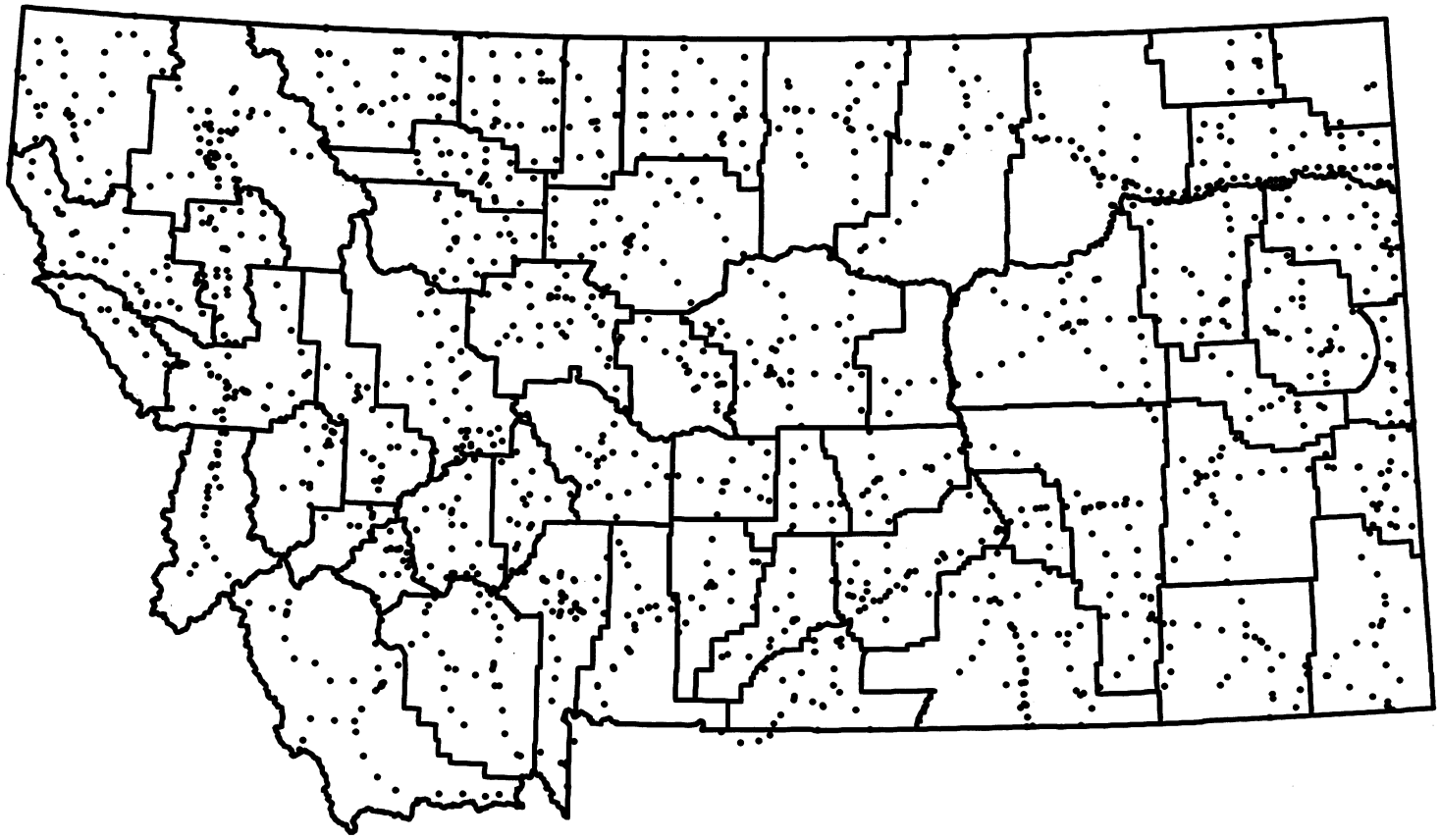
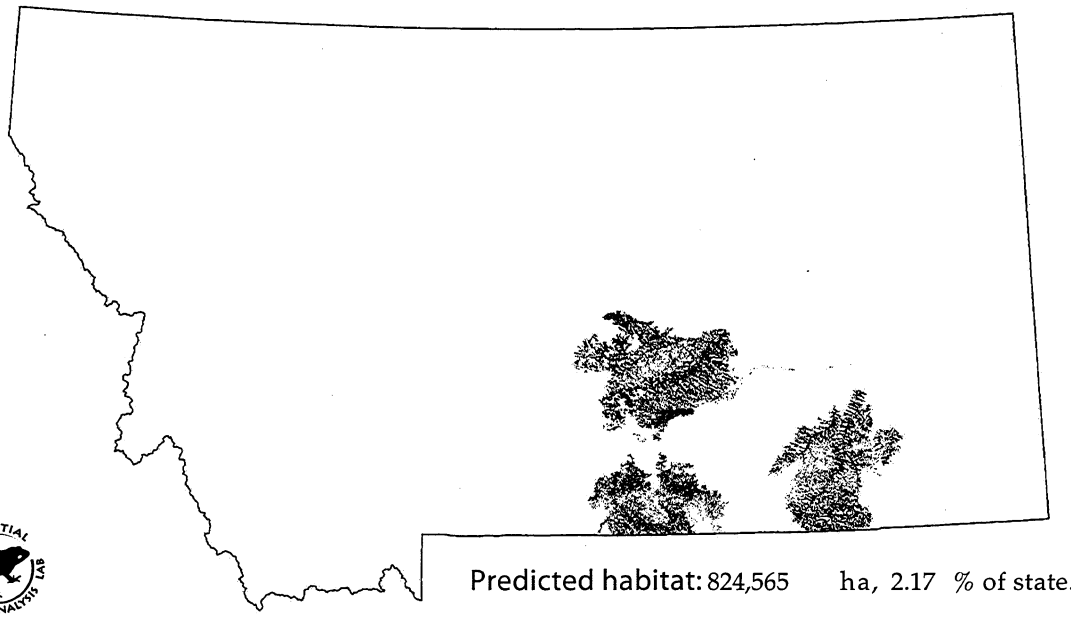


PALLID BAT

Antrozous pallidus

State rank	S1	Element code	AMACC10010
Global rank	G5	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 824,565 ha, 2.17 % of state.

State range

First state record was in Billings area (Shryer and Flath 1980); otherwise no available information (MT-NHP VCA).

Habitat description

Arid deserts and grasslands, often near rocky outcrops and water. Less abundant in evergreen and mixed conifer woodland. Usually roosts in rock crevice or building, less often in cave, tree hollow, mine, etc. Night roosts often or typically are in caves in Oklahoma (Caire et al. 1989). In Oregon, night roosts were in buildings, under rock overhangs, and under bridges; bats generally were faithful to particular night roosts both within and between years (Lewis 1994). Prefers narrow crevices in caves as hibernation sites (Caire et al. 1989). Young are born in maternity colonies usually in rock crevices or buildings.

Model assumptions & caveats

References

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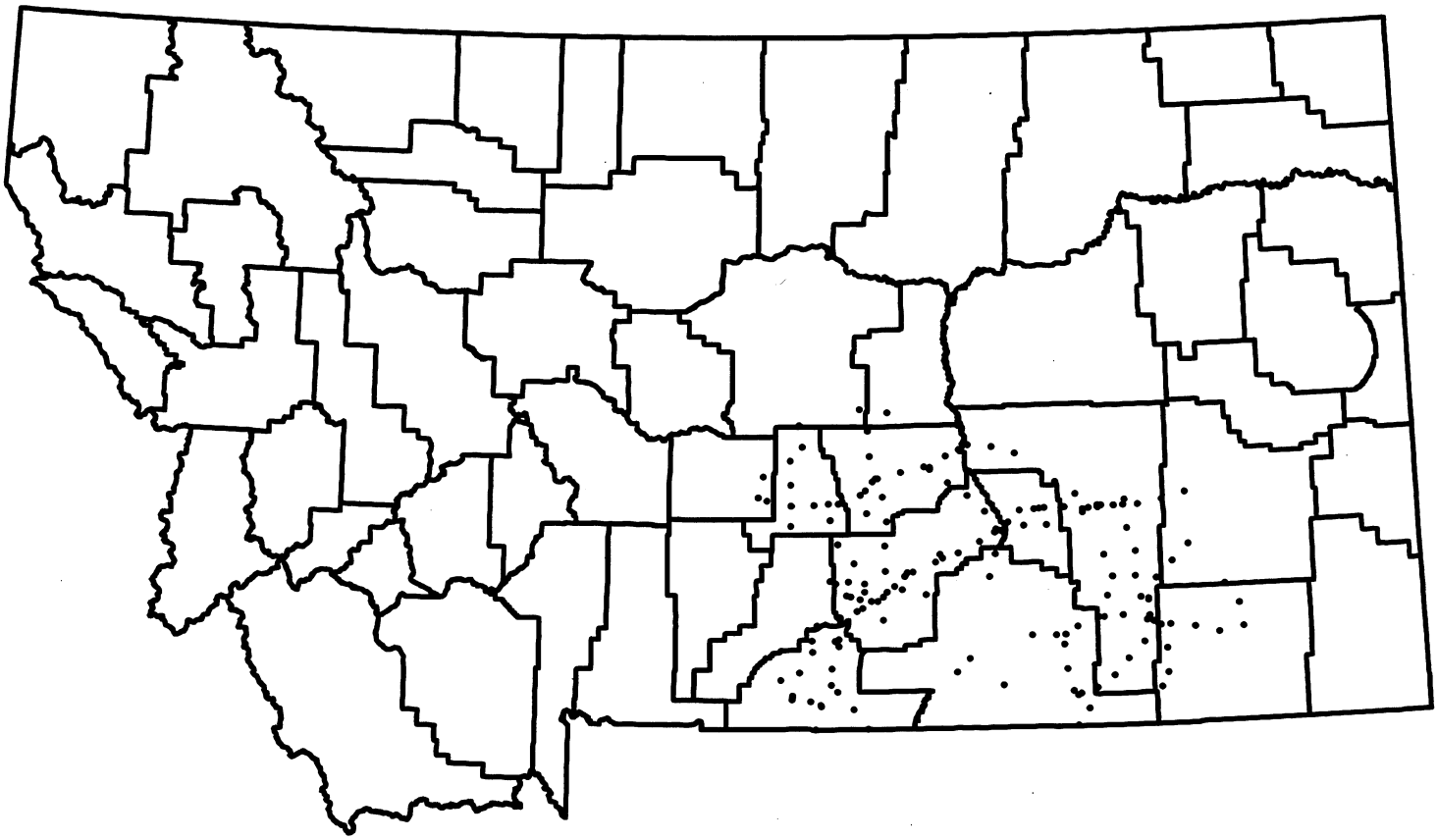
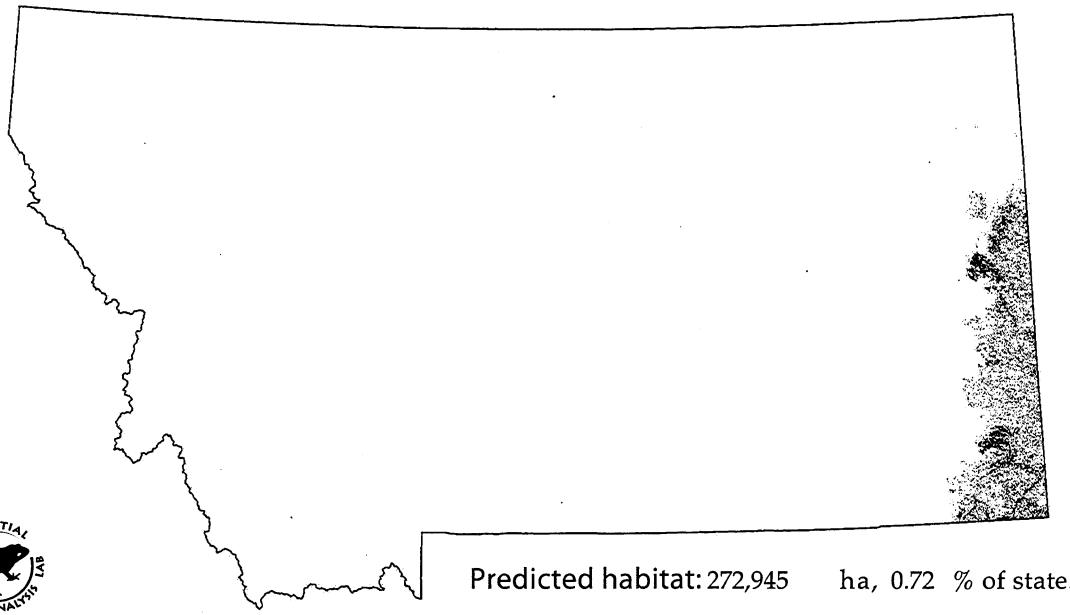


EASTERN COTTONTAIL

Sylvilagus floridanus

State rank	S2?	Element code	AMAEB01040
Global rank	G5	Modeled by	P. Thornton
MTNHP status	watch list		



Predicted habitat: 272,945 ha, 0.72 % of state.

State range

Only known to occur in Carter County, southeastern Montana, where it is apparently restricted to riparian habitats (Lampe et al. 1974). Western edge of its range is in the Great Plains.

Habitat description

Wide variety of habitats (Chapman et al. 1980), but prefers dense, shrubby undergrowth (Hoffmann and Pattie 1968). Riparian shrubs. Hardwood draws along intermittent streams (Bergeron and Seabloom1981).

Model assumptions & caveats

References

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Chapman, J. A., J. G. Hockman, and M. M. Ojeda. 1980. Sylvilagus floridanus. Mamm. Species 136:1-8.

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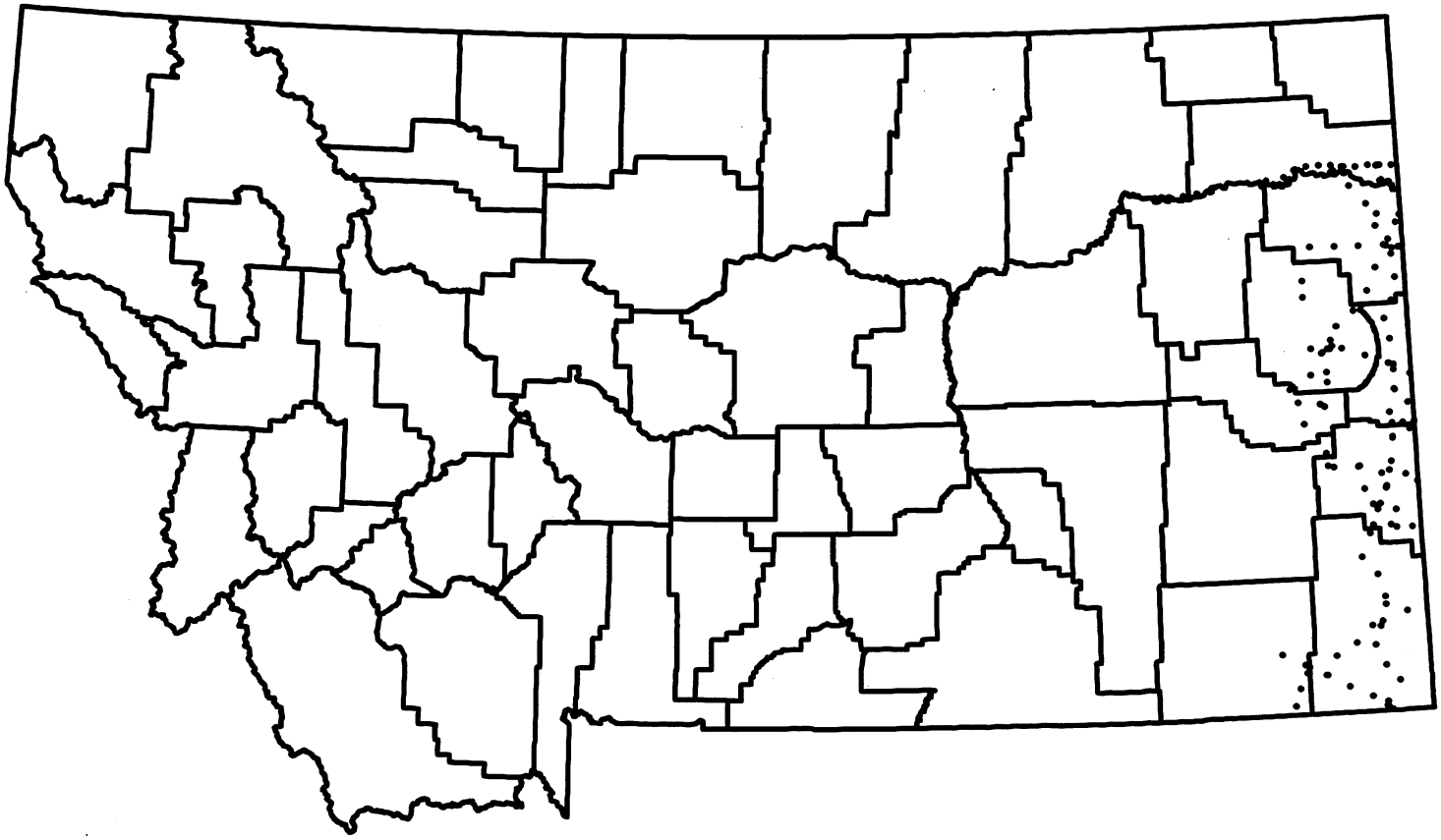
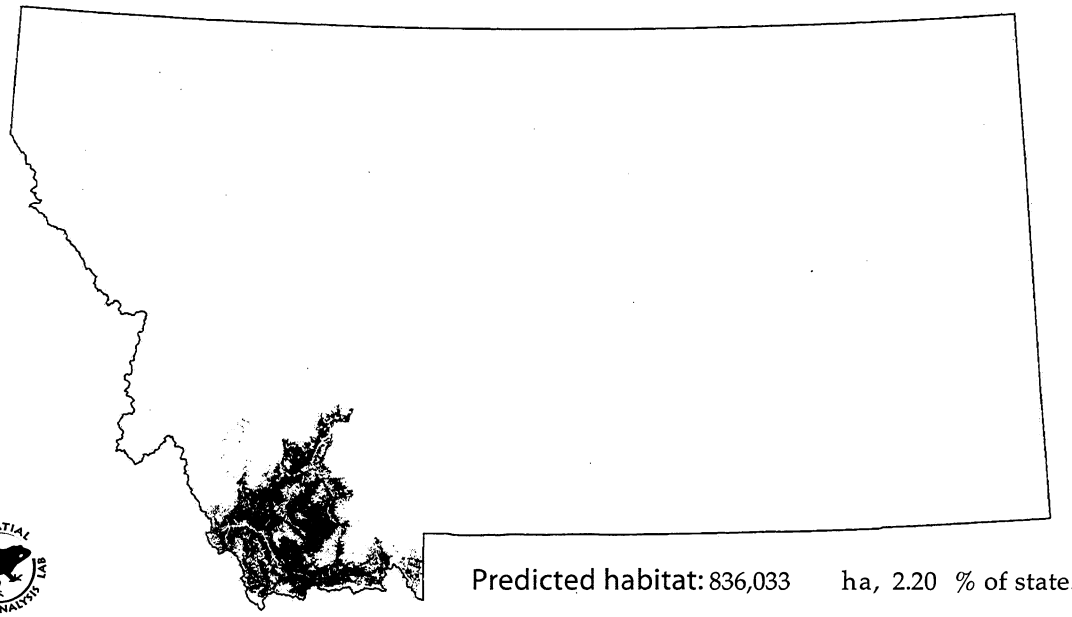


BLACK-TAILED JACKRABBIT

Lepus californicus

State rank	S2S3	Element code	AMAEB03050
Global rank	G5	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 836,033 ha, 2.20 % of state.

State range

May have entered Montana during this century. Occurs in Beaverhead and Madison Counties.

Habitat description

Sagebrush; short grass prairie with or without brush (Hoffmann and Pattie 1968, Flinders and Hansen 1973, Johnson and Hansen 1979).

Model assumptions & caveats

Number of snow-free days important for defining range limits, but not included in the model.

References

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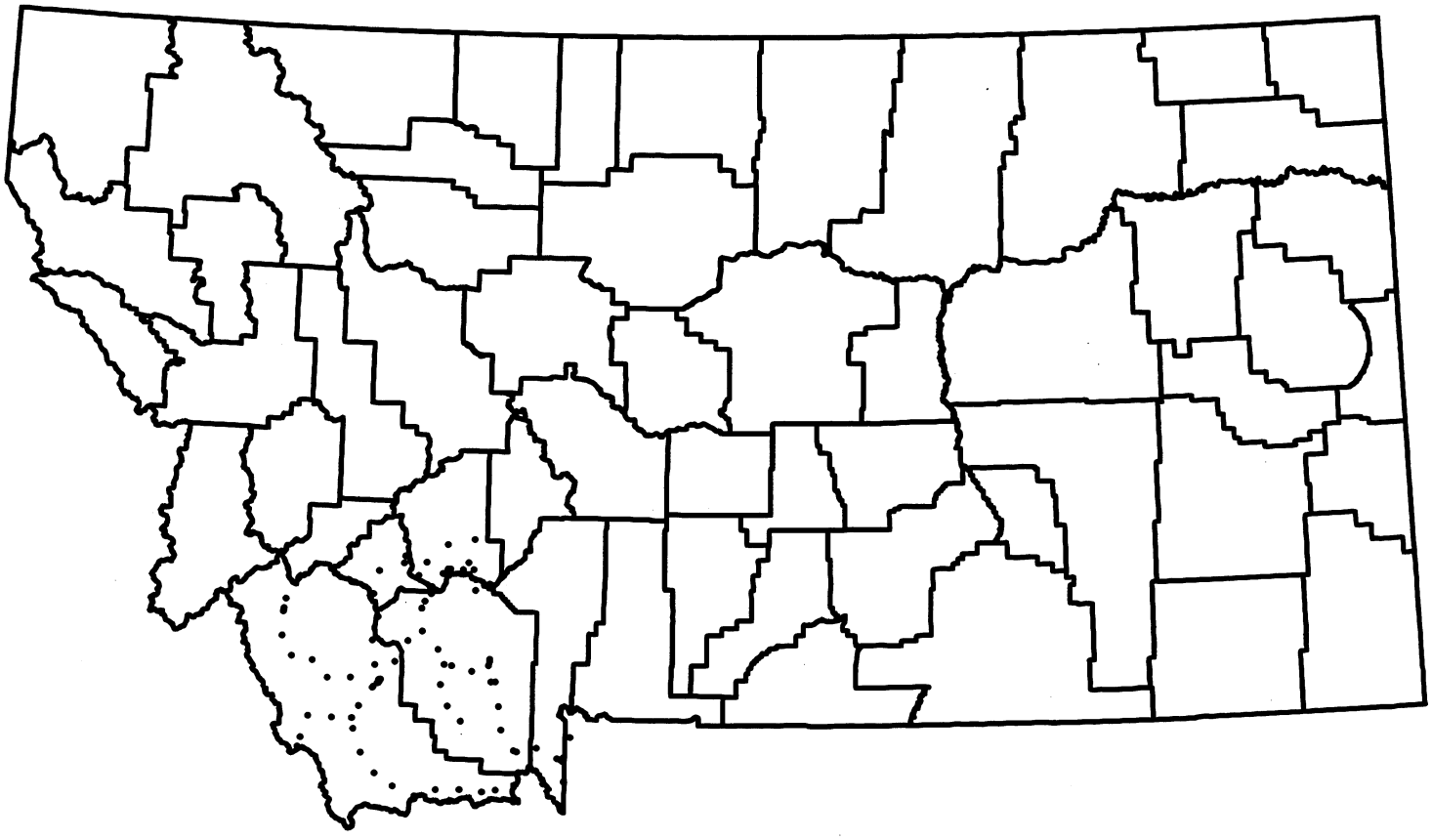
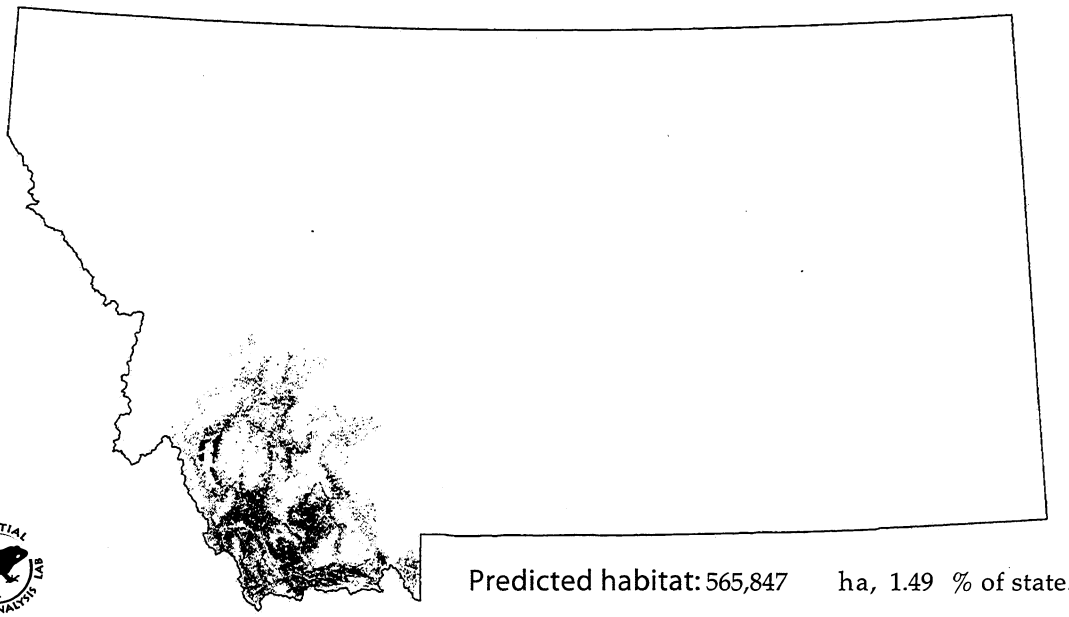


PYGMY RABBIT

Brachylagus idahoensis

State rank	S2S3	Element code	AMAEB04010
Global rank	G4	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 565,847 ha, 1.49 % of state.

State range

Suitable sagebrush habitat in Beaverhead County and possibly adjacent counties (Hoffmann et al. 1969).

Habitat description

Sagebrush and greasewood. Tall clumps of Big Sage (Green and Flinders 1980), shrub canopy cover > 21%. Soil depth > 36cm; loose, friable soil (Weiss and Verts 1984). At least 46% sage cover on US Sheep Experimental Station; bushes 56cm in height; Snake River Plain sage habitat (Johnson and Hansen 1979).

Model assumptions & caveats

Loose soil originally defined as soil texture other than clay; soil later eliminated from the model because scale of available statewide layer was too coarse.

References

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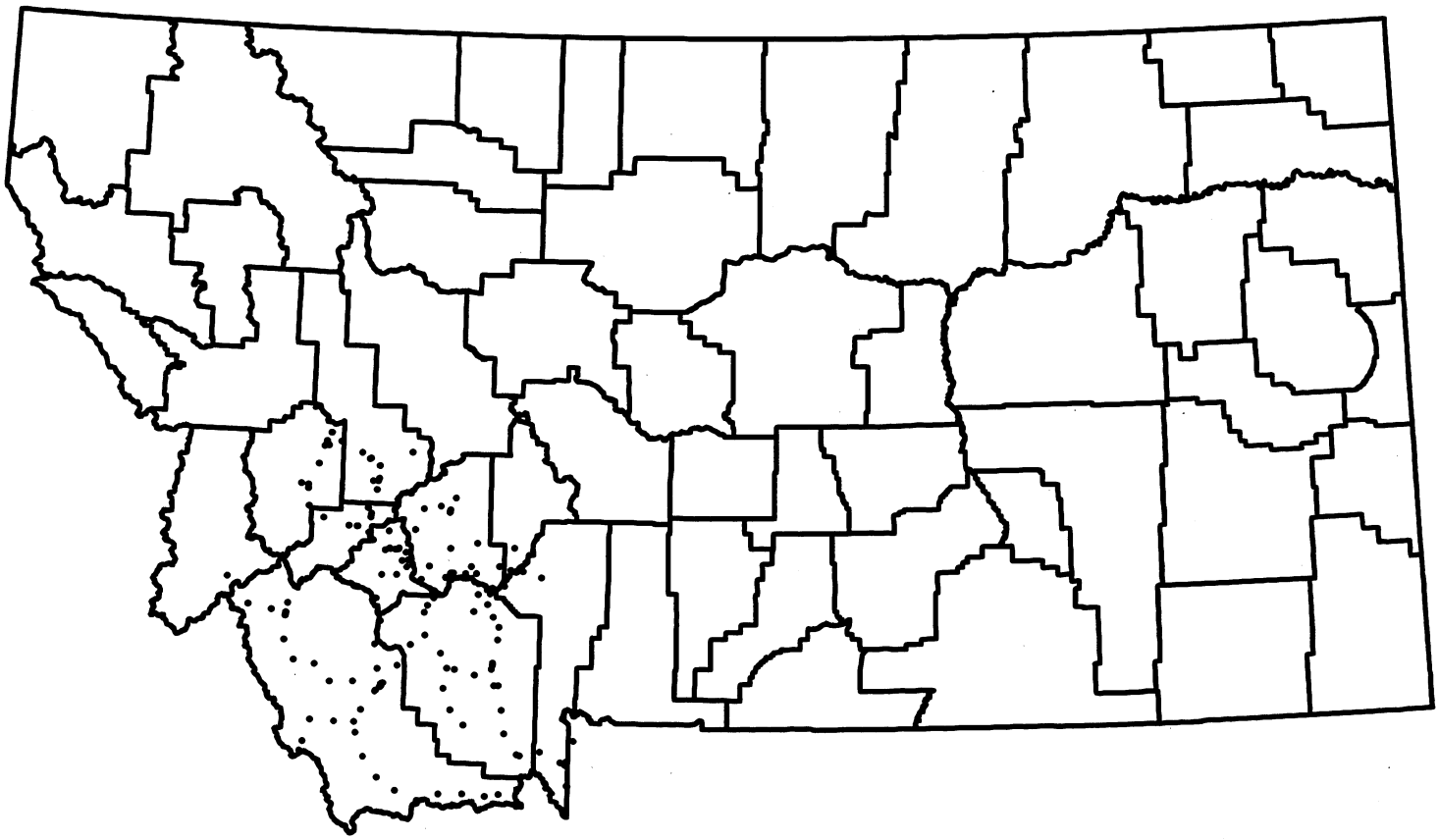
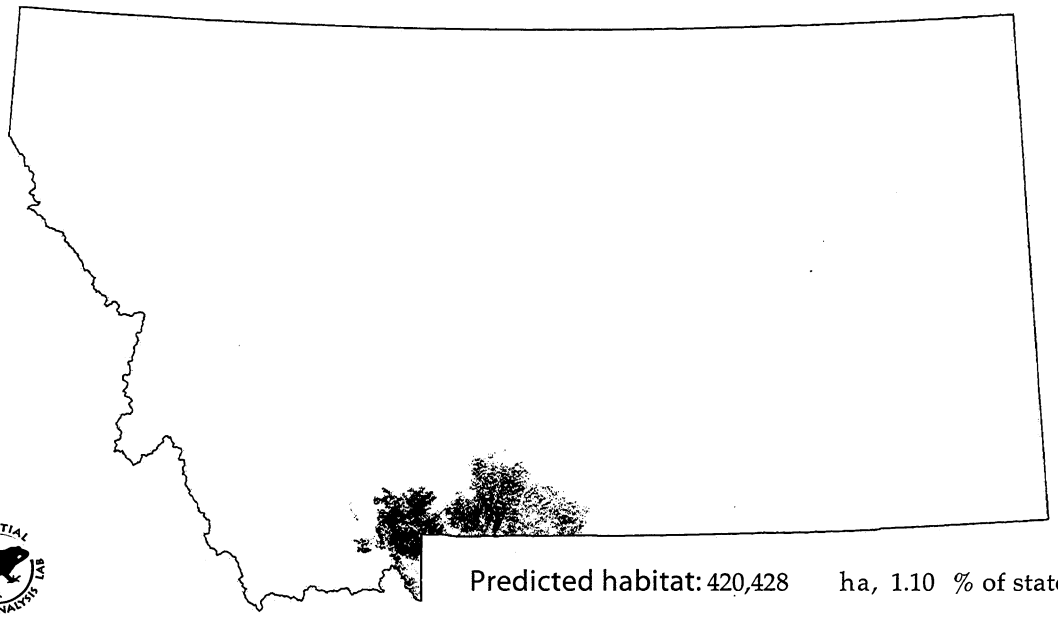


UINTA CHIPMUNK

Tamias umbrinus

State rank	S3?	Element code	AMAFB02190
Global rank	G5	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 420,428 ha, 1.10 % of state.

State range

Recorded at high elevations in the Beartooth Mountains. May occur in the Absaroka Range and/or other areas around Yellowstone N.P. (Hoffmann et al. 1969, Flath 1984).

Habitat description

Subalpine spruce-fir forest, mountain meadows (Dice 1923, Hoffmann and Pattie 1968); talus slopes up into alpine (Pattie and Verbeek 1967).

Model assumptions & caveats

References

Dice, L.R. 1923. Mammal associations and habitats of the Flathead Lake Region, Montana. Ecology 4(3):247-260.

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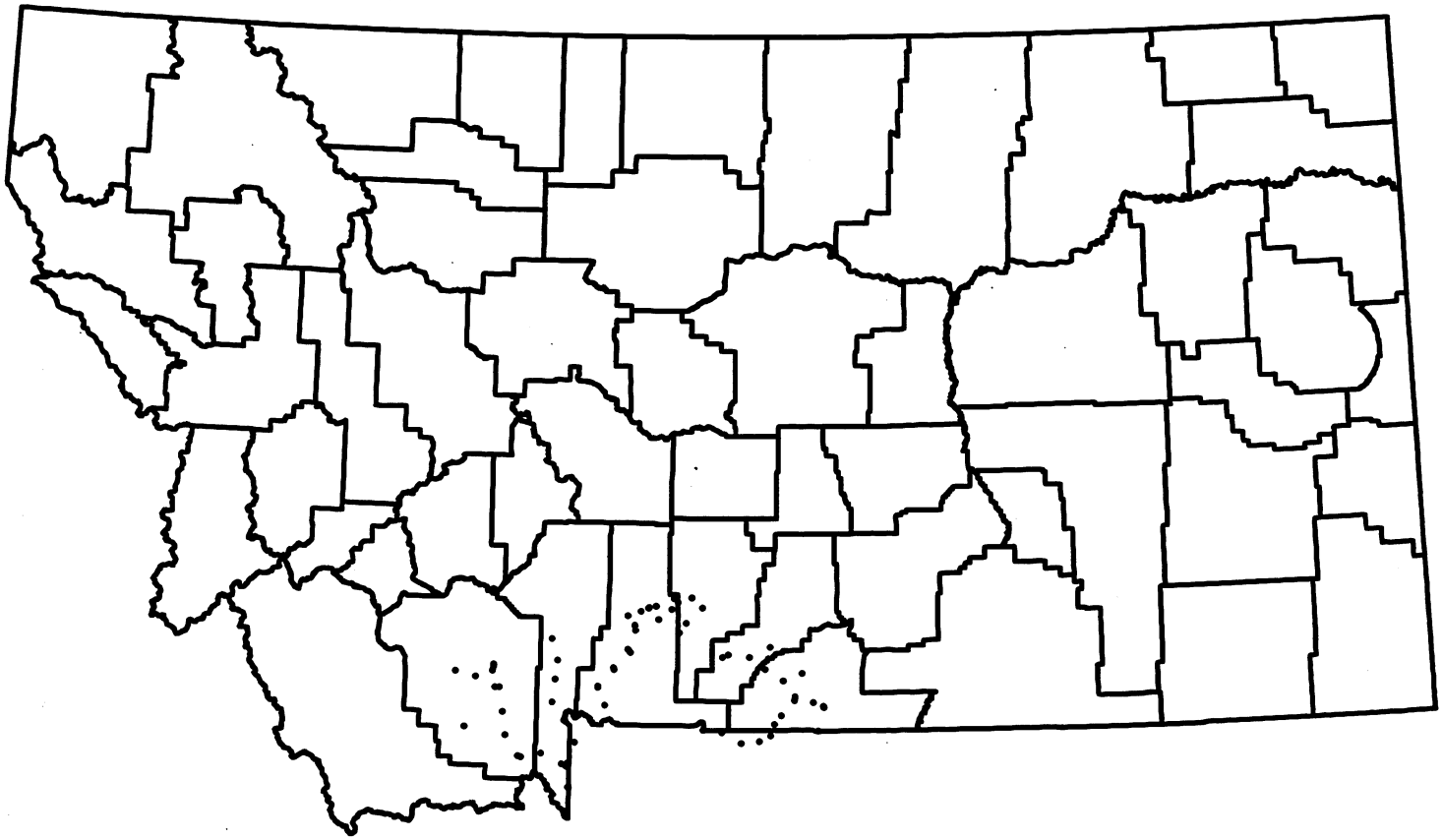
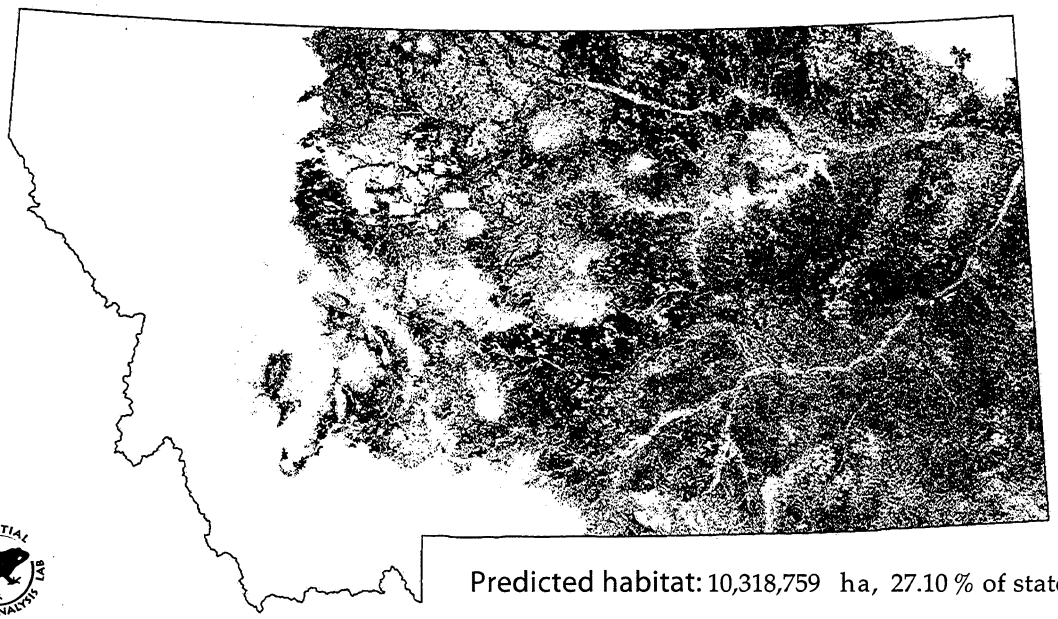


BLACK-TAILED PRAIRIE DOG

Cynomys ludovicianus

State rank	S3S4	Element code	AMAFB06010
Global rank	G4	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 10,318,759 ha, 27.10 % of state.

State range

Does not occur west of the Continental Divide. Distribution reduced because of eradication efforts (MT-NHP VCA).

Habitat description

Formerly very abundant in grasslands and sagebrush-grassland semi-desert (Hoffmann and Pattie 1968). An indicator of overgrazing (Knowles 1982).

Model assumptions & caveats

Model would better reflect species' distribution if prairie dog town layer were incorporated.

References

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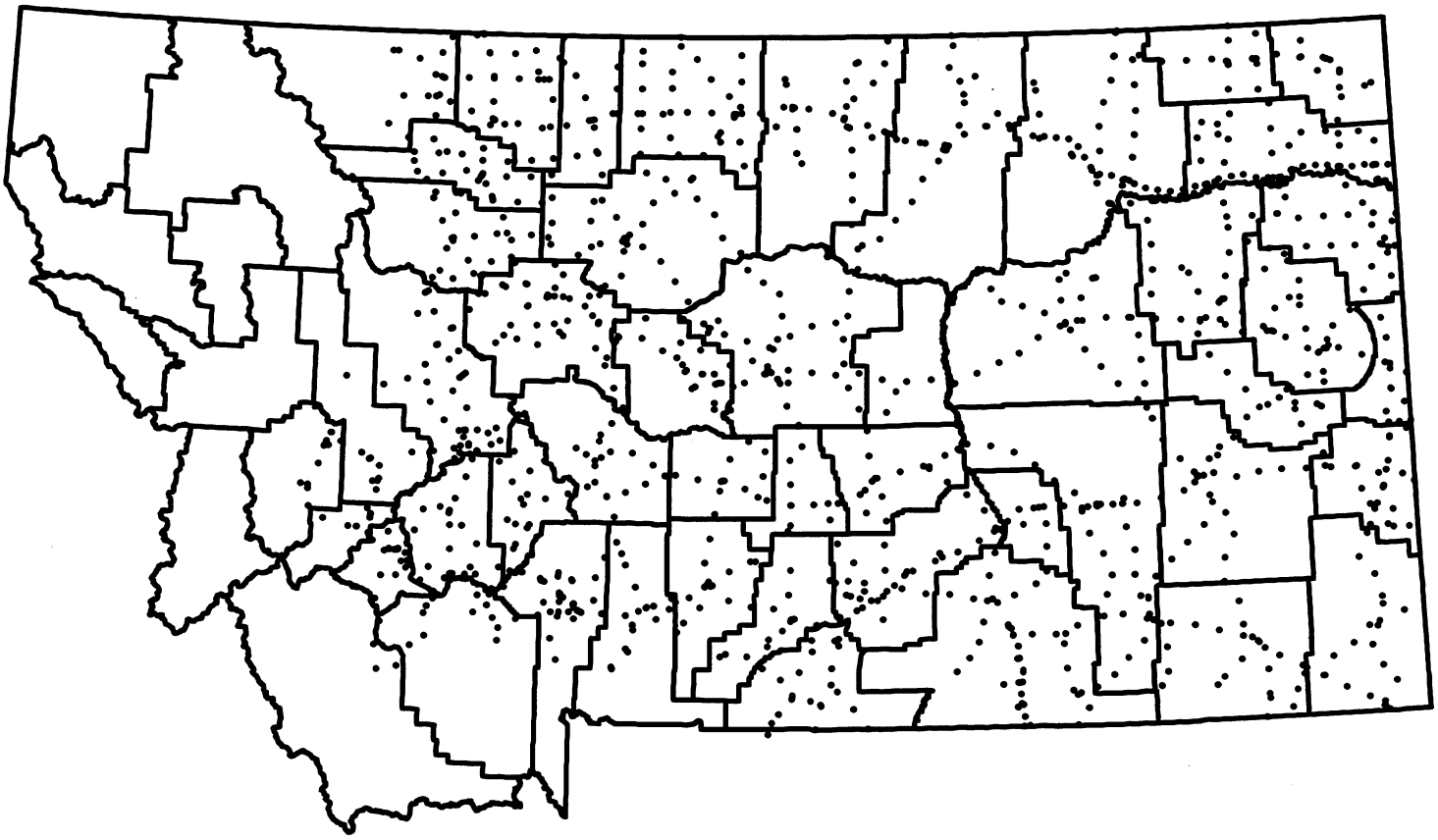
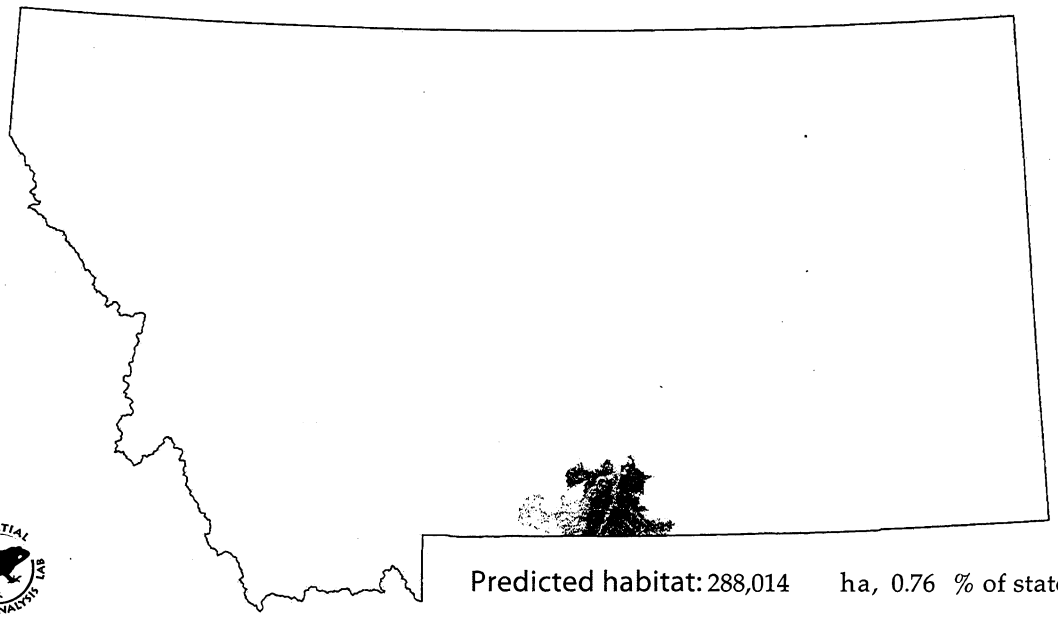


WHITE-TAILED PRAIRIE DOG

Cynomys leucurus

State rank	S2	Element code	AMAFB06020
Global rank	G4	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 288,014 ha, 0.76 % of state.

State range

Peripheral; reaches northern limit in Carbon County, south-central Montana (Thompson 1982, MT-NHP VCA).

Habitat description

Salt sage *(Ivs axillaris)* and white sage *(Eurotia lanata)* (Hoffmann and Pattie 1968). Grassland and rangeland (Clark et al. 1971). Found along the Clarks Fork of the Yellowstone and its tributaries in arid, and atypical, habitat; elsewhere, the species is associated with mountain meadows (MT-NHP VCA).

Model assumptions & caveats

Model would better reflect species' distribution if prairie dog town layer were incorporated.

References

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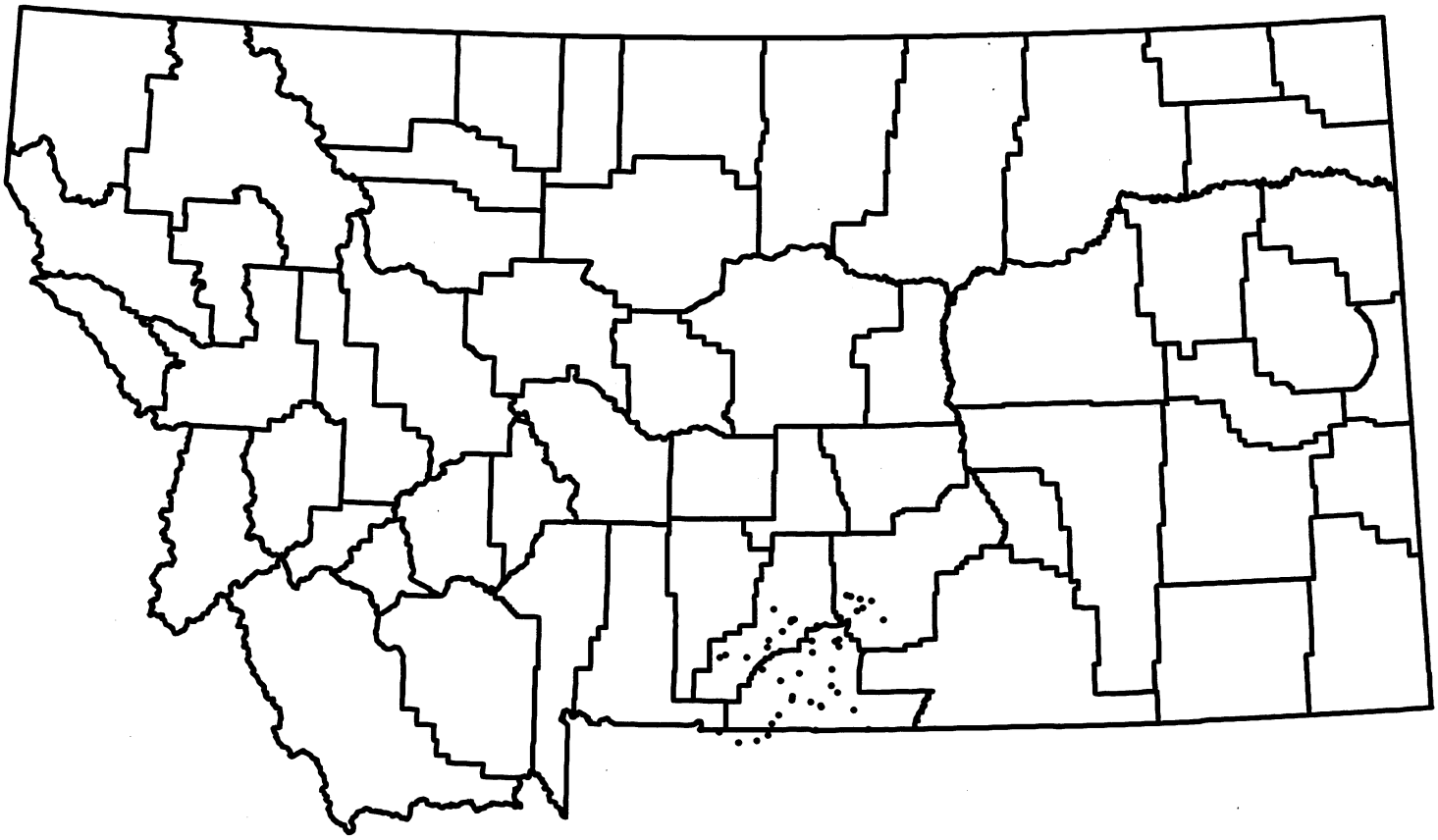
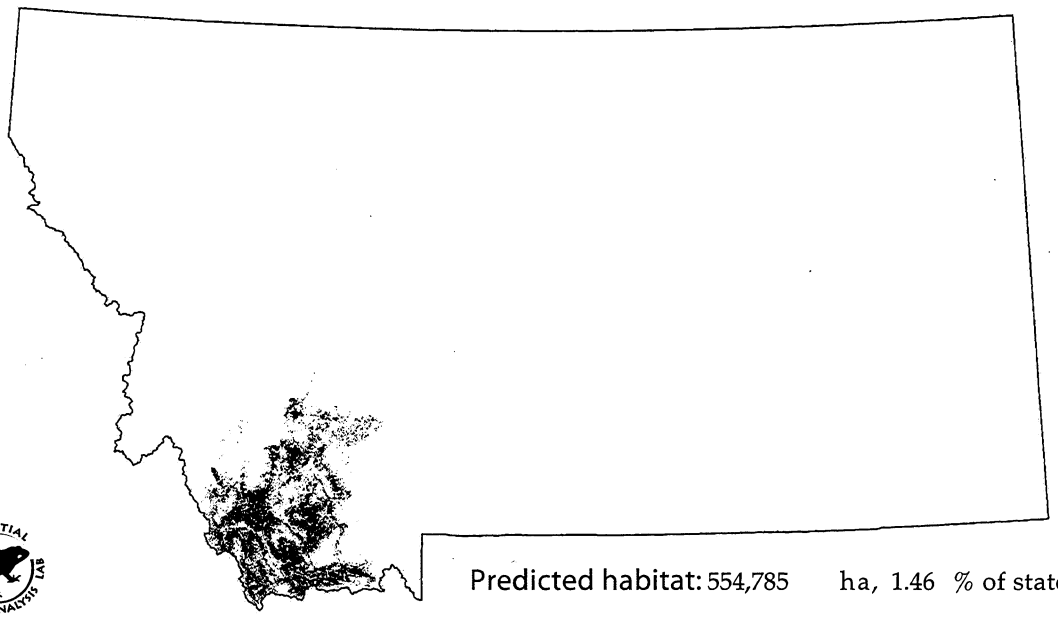


GREAT BASIN POCKET MOUSE

Perognathus parvus

State rank	S2S4	Element code	AMAFD01070
Global rank	G5	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 554,785 ha, 1.46 % of state.

State range

Known from Beaverhead, suspected in Madison County (Flath 1984). Probably limited to arid areas in southwestern Montana.

Habitat description

Sage, greasewood, saltbrush, and dry grassland with sandy soils, not more than 50% clay (Feldhamer 1979, Verts and Kirkland 1988). Big Sage of shrub-steppe with continuous cover (O'Farrell et al. 1975). Arid, semi-arid habitat (Hoffmann and Pattie 1968).

Model assumptions & caveats

Soil texture not included because scale of available statewide soils map was too coarse.

References

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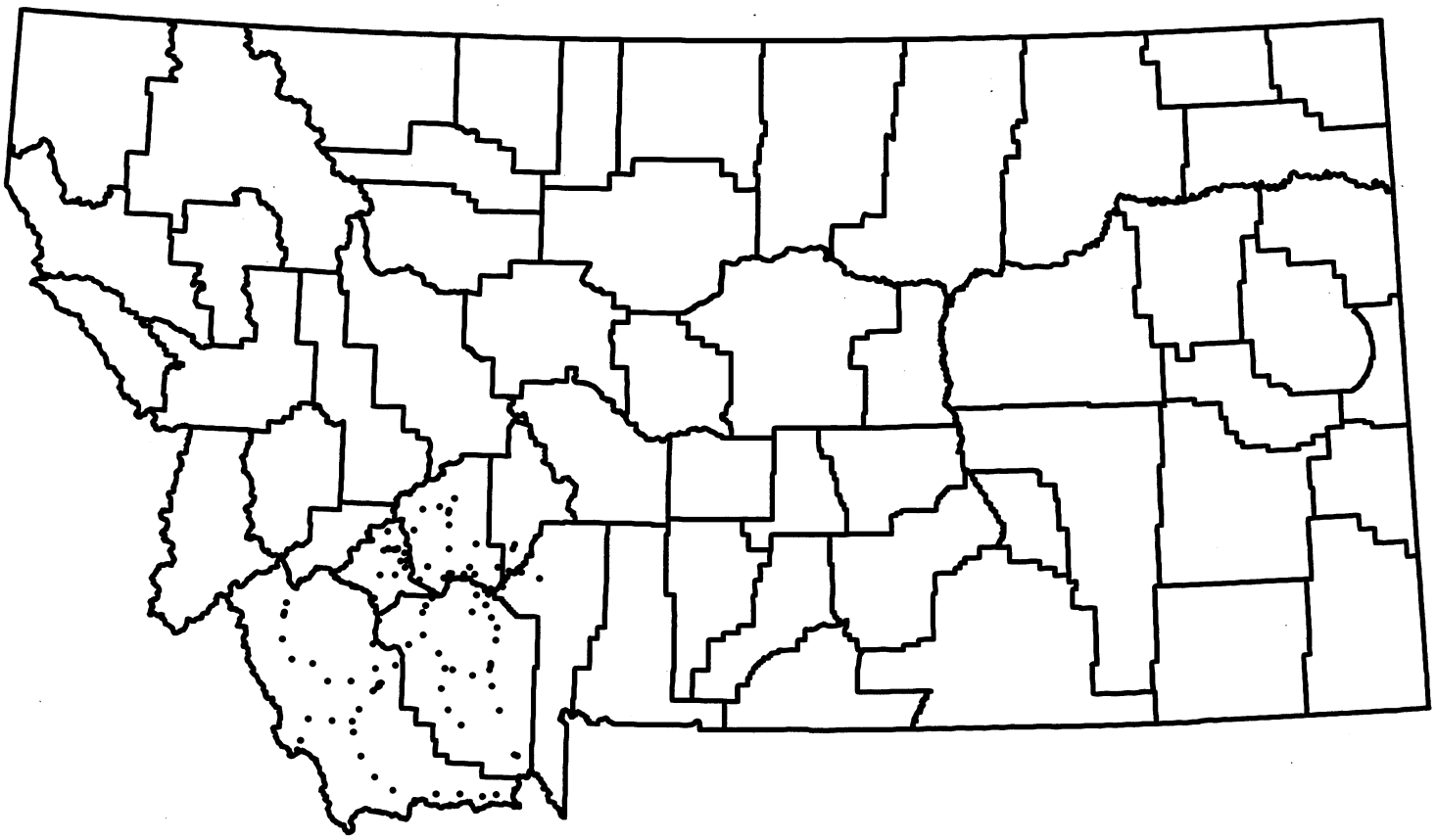
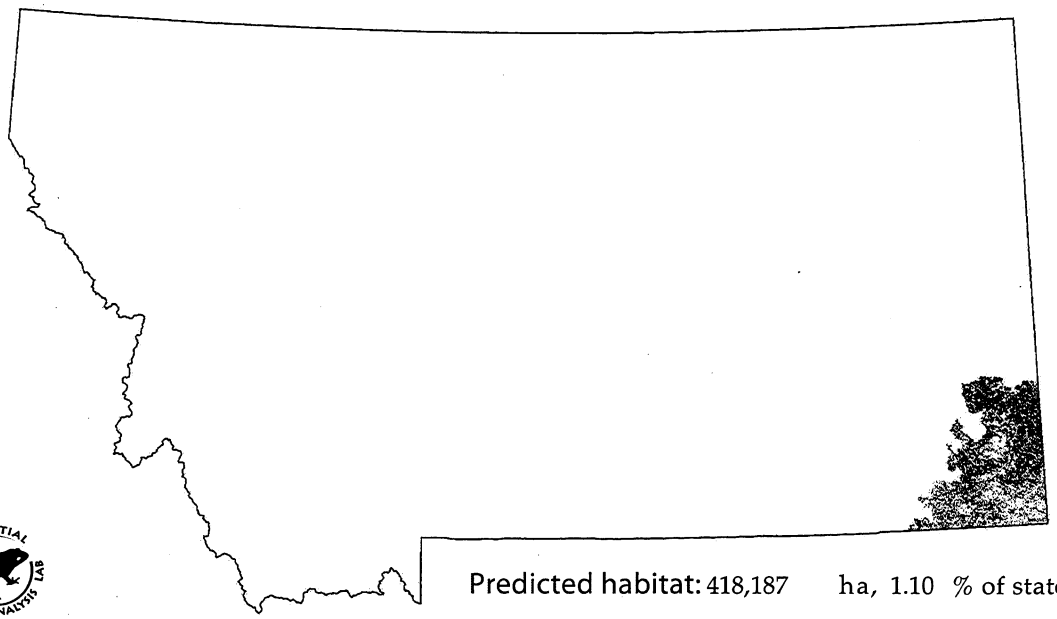


HISPID POCKET MOUSE

Chaetodipus hispidus

State rank	S1	Element code	AMAFD05050
Global rank	G5	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 418,187 ha, 1.10 % of state.

State range

One capture in Montana on a north-facing grassland slope in Carter County at 1,040m elevation (Pefaur and Hoffmann 1971). Has been recorded 20 miles south of Montana in Wyoming and in North Dakota near eastern Montana (Jones et al. 1983).

Habitat description

Prefers prairie areas with sparse or moderate vegetation; various dry grassland habitats. Has been found in irrigated cornfields. In underground burrow when inactive. Can occur in a variety of upland habitats. Usually loamy soil areas with some bare ground; not restricted to sandy soils like other pocket mice. Sometimes rocky prairie areas. Mid- and shortgrasses, shrubs, forbs, cactus, and yucca vegetation (Jones et al. 1983).

Model assumptions & caveats

References

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Paulson, D. D. 1988. Chaetodipus hispidus. Mamm. Species 320:1-4.

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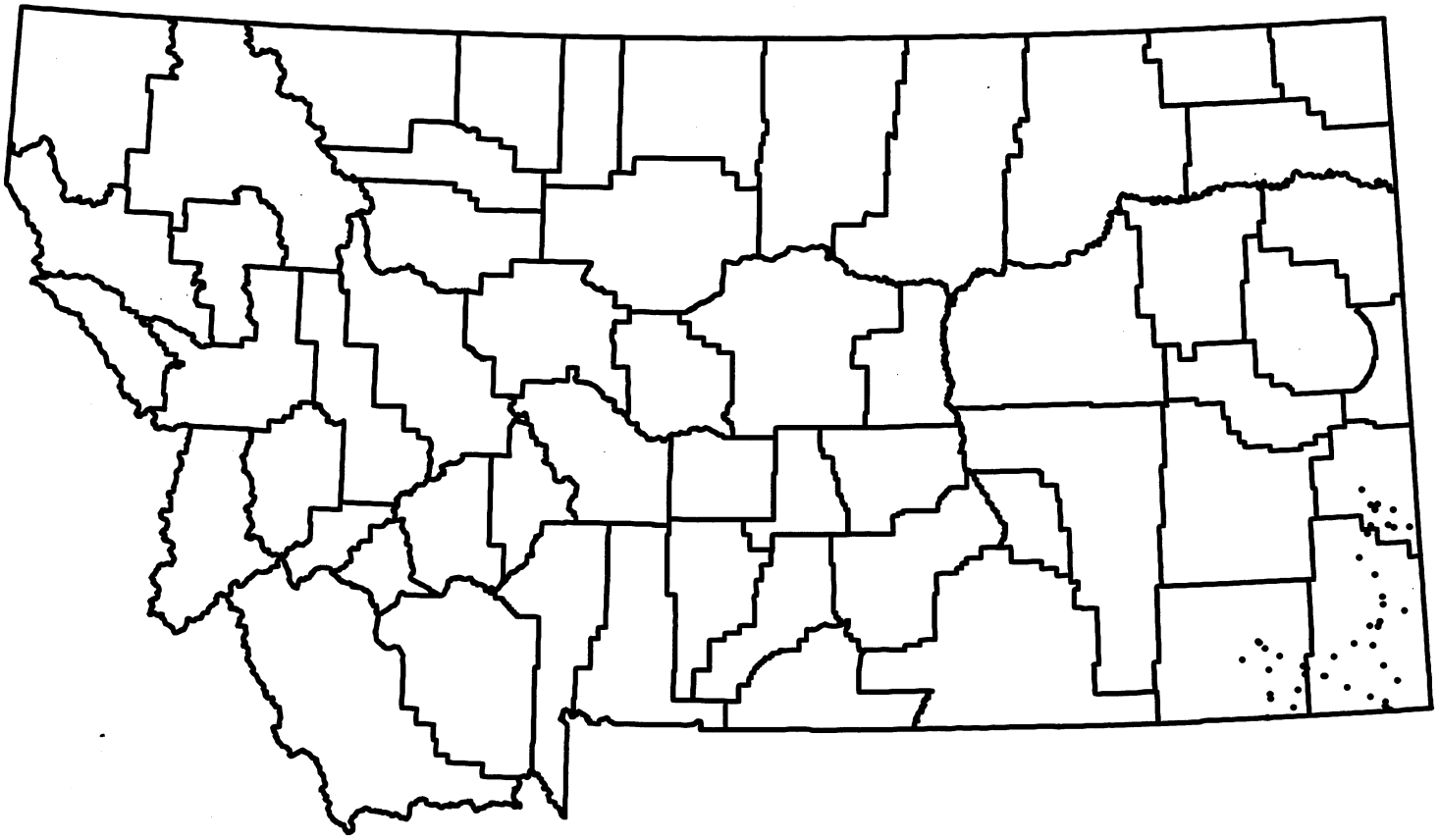
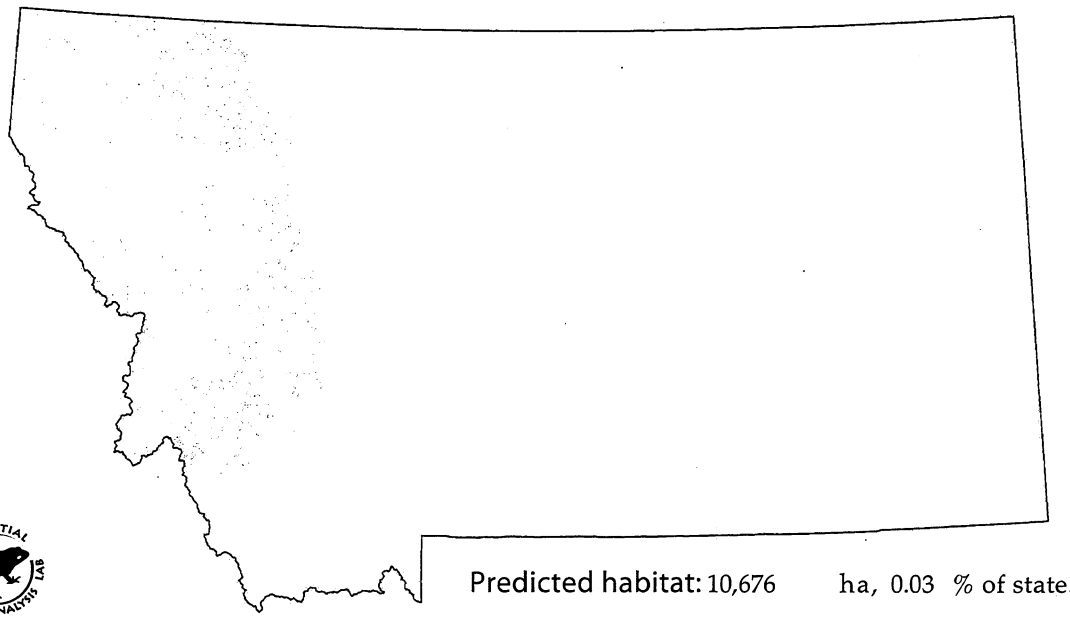


NORTHERN BOG LEMMING

Synaptomys borealis

State rank	S2	Element code	AMAFF17020
Global rank	G4	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 10,676 ha, 0.03 % of state.

State range

Until recently, there were few locations known in Montana: several in Glacier National Park (Wright 1950, Weckwerth and Hawley 1962) and one in the Rattlesnake drainage north of Missoula (Adelman 1979). During 1992-93, 10 additional sites were found, with locations ranging from the northwestern corner of Montana south to just north of Lost Trail Pass in Beaverhead County and east to the Rocky Mountain Front (Reichel and Beckstrom 1993, 1994). The northern bog lemming may eventually be found to occur locally across much of western Montana.

Habitat description

Sedge-alder-willow bogs within or on edge of dense spruce-fir and lodgepole forest (Dice 1923, Hoffmann and Pattie 1968). Sphagnum moss mats important (Reichel and Beckstrom 1993).

Model assumptions & caveats

Marshes and bogs not well mapped.

References

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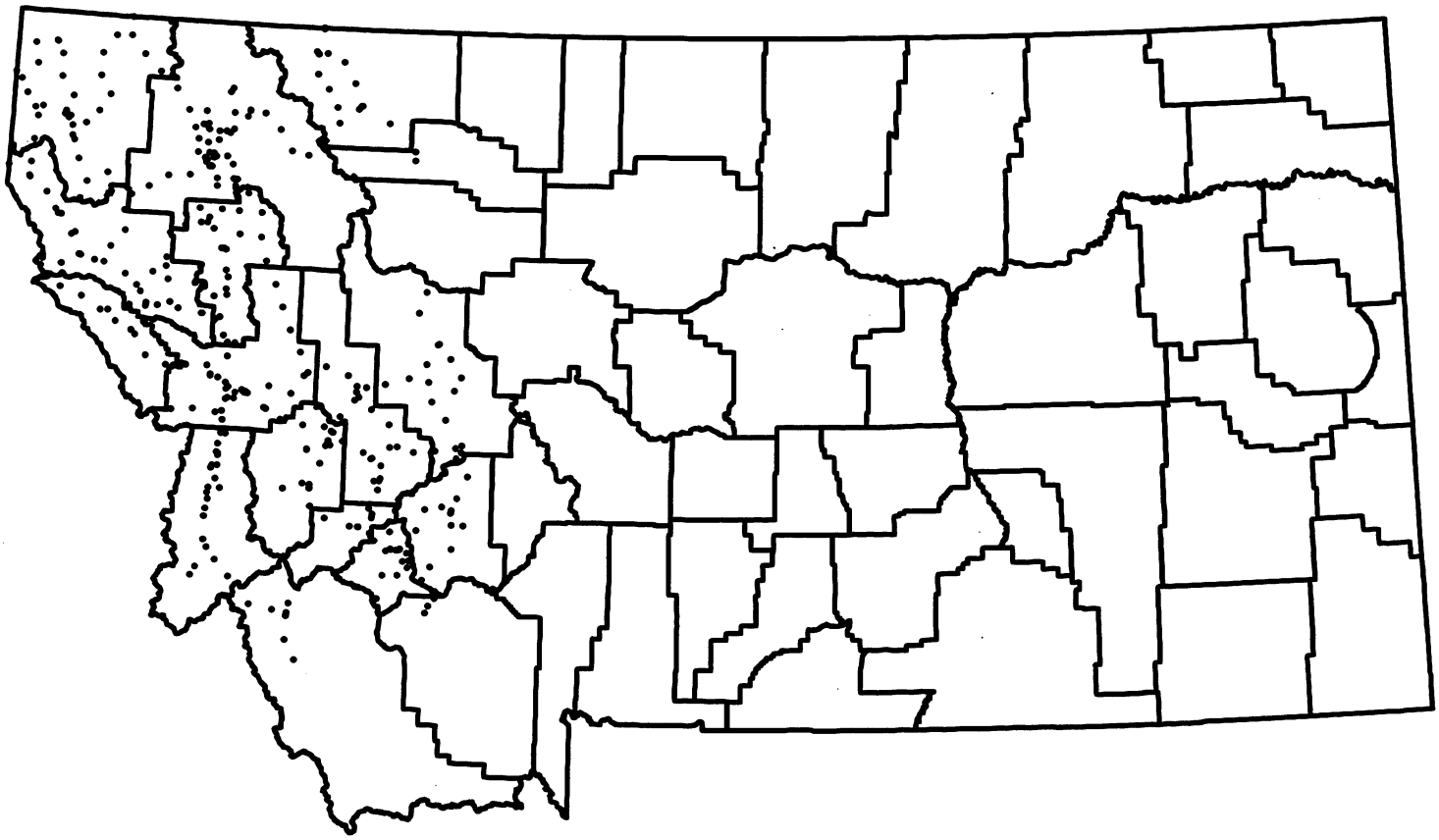
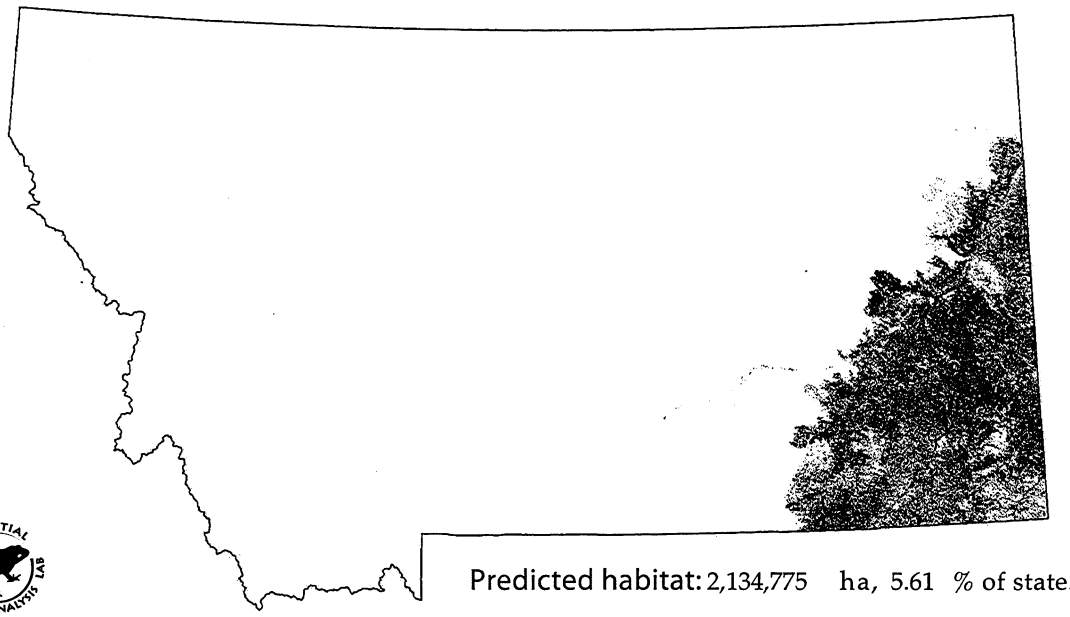


MEADOW JUMPING MOUSE

Zapus hudsonius

State rank	S2S3	Element code	AMAFH01010
Global rank	G5	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 2,134,775 ha, 5.61 % of state.

State range

Several counties in eastern Montana (Flath 1984).

Habitat description

Grassland, meadows, and streamsides with thick and tall grass or forbs (Hoffmann and Pattie 1968, Pefaur and Hoffmann 1971, Matthews 1980).

Model assumptions & caveats

References

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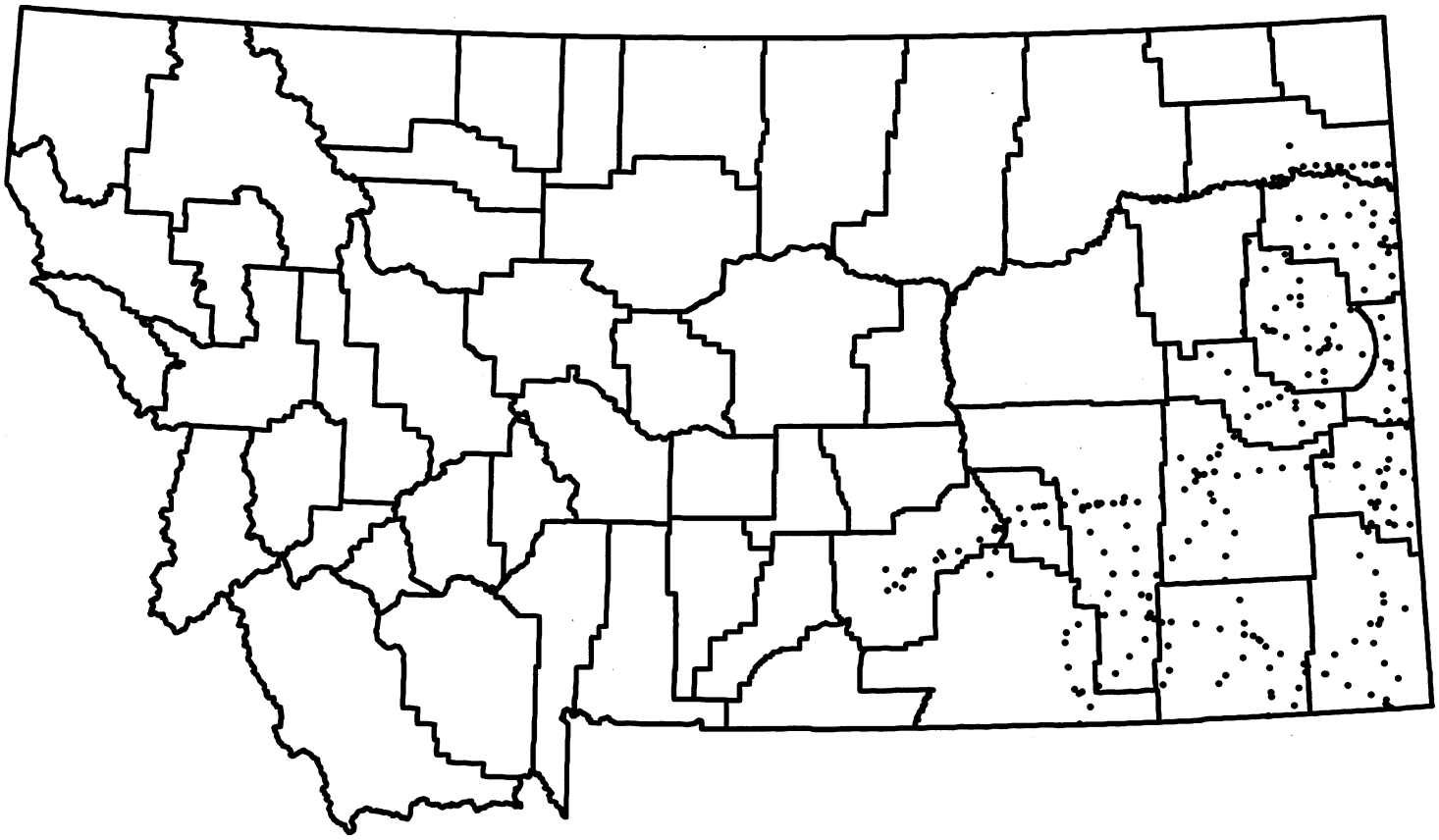
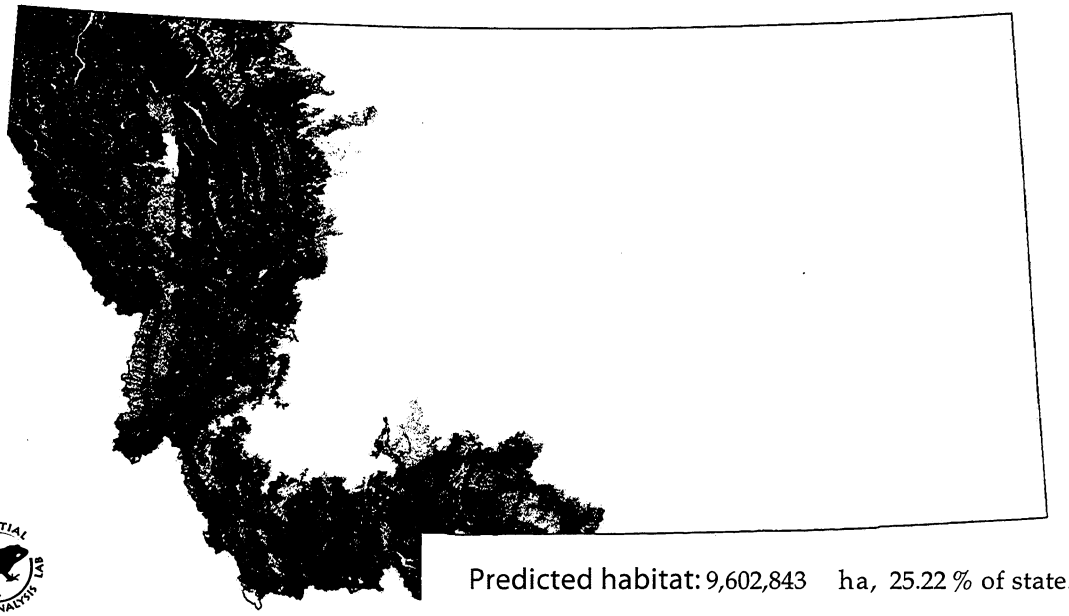
Whitaker, J.O., and R. E. Wrigley. 1972. Zapus hudsonius. Mamm. Species No. 11. 7 pp.



GRAY WOLF

Canis lupus

State rank	S1	Element code	AMAJA01030
Global rank	G4	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 9,602,843 ha, 25.22 % of state.

State range

Resides in the Glacier N.P. area adjacent to Canada — present on east side, pack on west side. Also reports from northern Yellowstone NP and movements along Bitterroot divide. Occasional reports from other areas (Hoffmann et al. 1969, Northern Rocky Mountain Wolf Recovery Team 1980, Kaminski and Hansen 1984, Robbins 1986).

Habitat description

No particular habitat preference. Requires areas with low human population and high prey densities. In Minnesota and Wisconsin, usually found in areas with few roads, which increase human access and land uses incompatible with wolf presence (Thiel 1985, Mech et al. 1988, Mech 1989). Minimum of 10,000-13,000 sq km (with low road density) might be necessary to support a viable population (USFWS 1990); a single pack does not constitute a "minimum viable population." Young are born in an underground burrow that has been abandoned by another mammal or dug by wolf. In Minnesota, dens usually were not near territory boundaries, although they were used traditionally by most denning alpha females studied for more than 1 year; possibly the availability of a stable food supply source helped determine den location (Ciucci and Mech 1992). Remote montane and forest areas; uses valley bottoms and flood plains, and deer/elk winter ranges (Ream 1985, Ream et al. 1985, Ream 1986). Occasionally moves through atypical habitat (Hoffmann et al. 1969).

Model assumptions & caveats

References

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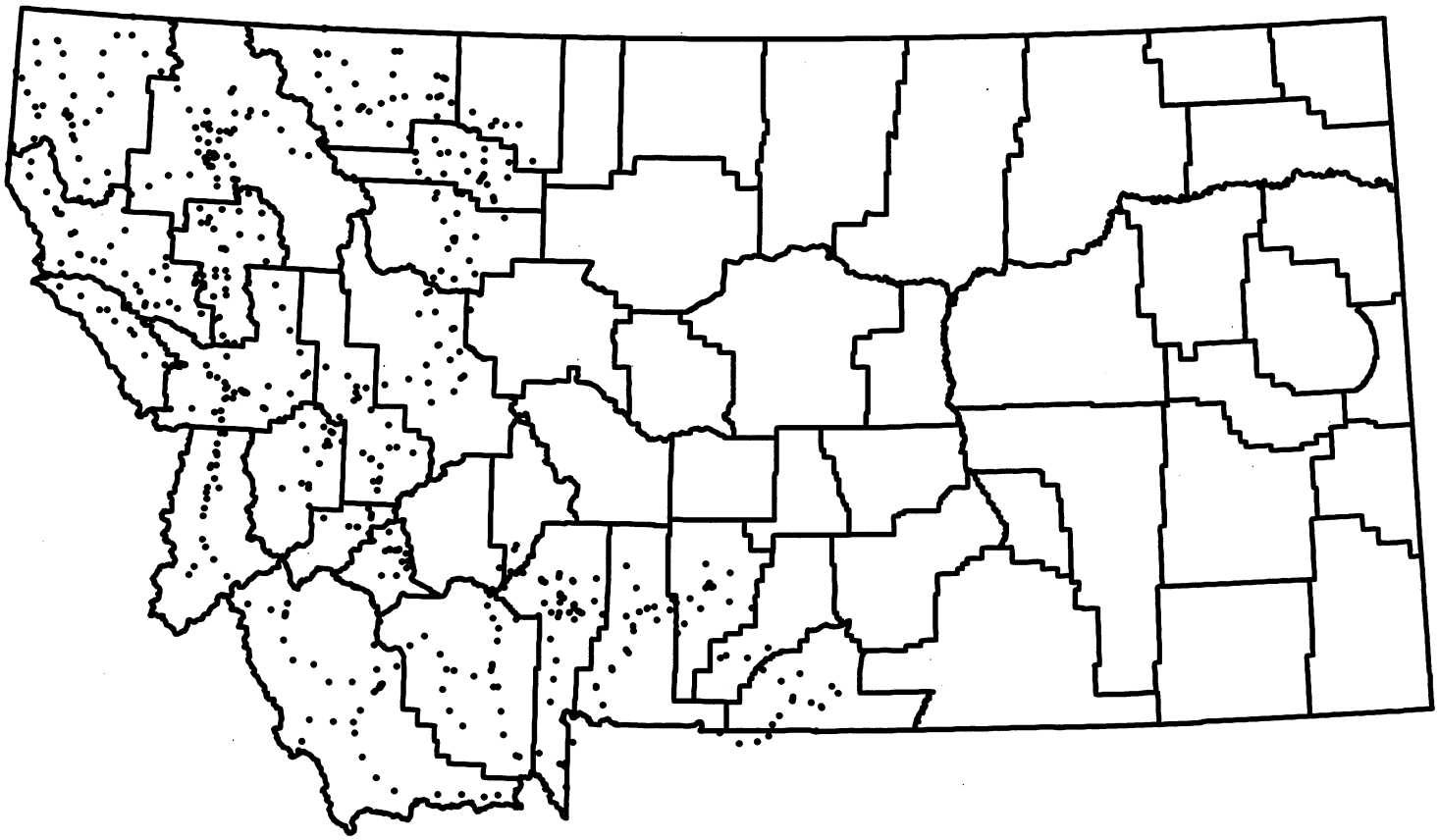
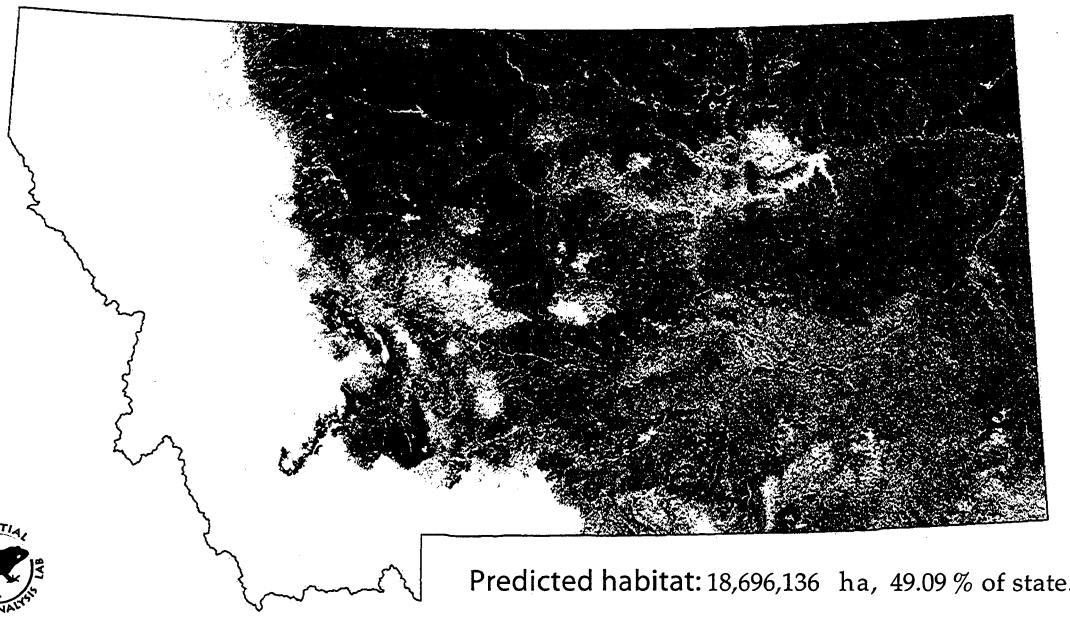


SWIFT FOX

Vulpes velox

State rank	S1	Element code	AMAJA03030
Global rank	G3	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 18,696,136 ha, 49.09 % of state.

State range

Once common and widespread on the prairie grasslands east of the Rocky Mountains, the species was believed to have been extirpated from Montana sometime between 1918 and 1978; however, recent records and sightings indicate that the species is recolonizing in southeastern and north-central Montana. These observations presumably represent dispersing individuals from populations outside of Montana, but a small resident population may actually exist in the north-central portion of the state north of Chinook and around Circle, Terry, and Wilsall (Giddings and Knowles 1995, Knowles et al. 1995).

Habitat description

Great Basin habitat types, prairie, badlands, shrub and shrub/grassland (Egoscue 1962, Hoffmann and Pattie 1968, Uresk and Sharps 1986, Allen 1987). Soils from clay-loam to sandy or gravelly loam; easy to dig (Scott-Brown et al. 1987).

Model assumptions & caveats

Soil texture not included because scale of available statewide soils map is too coarse.

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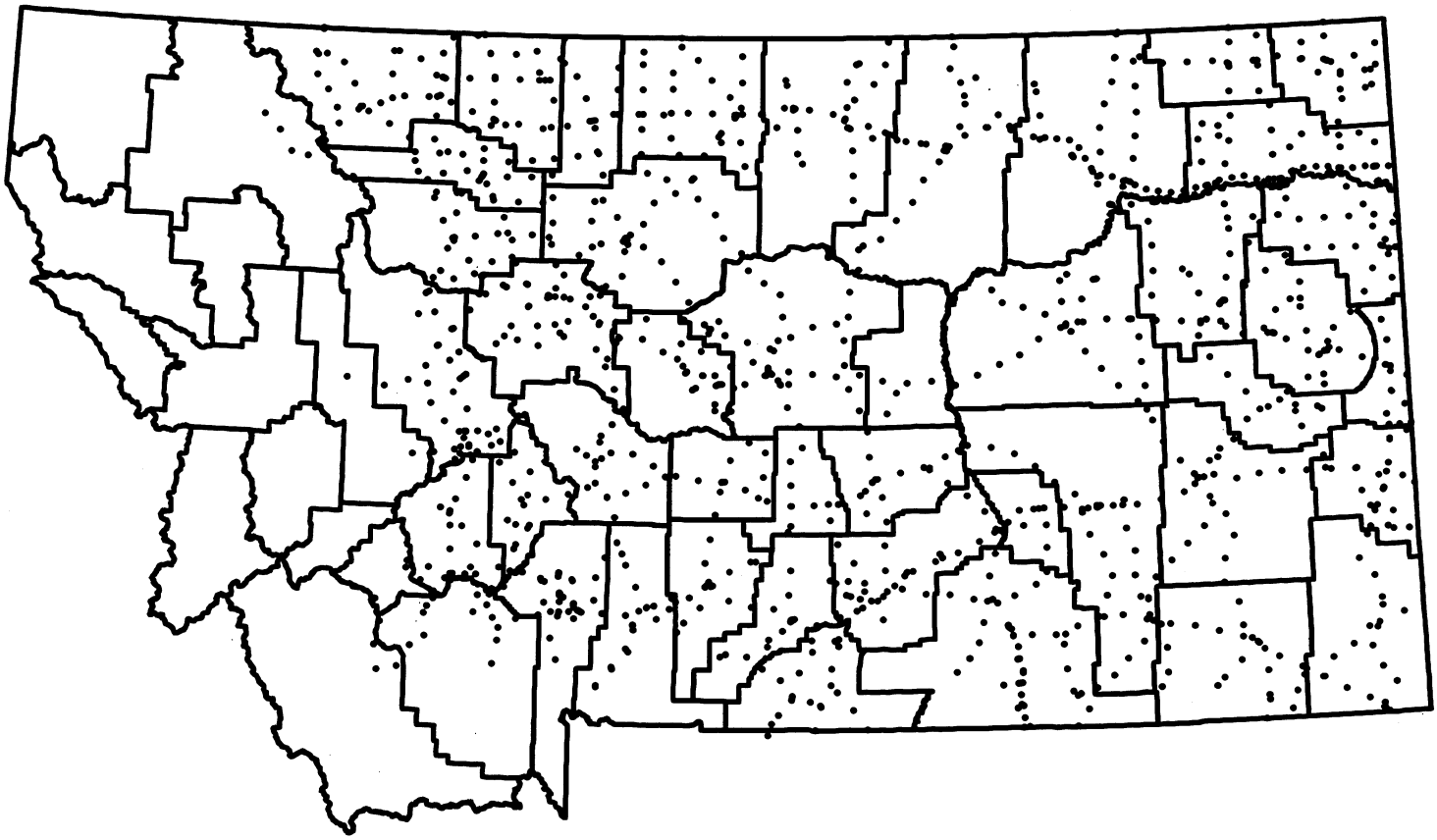
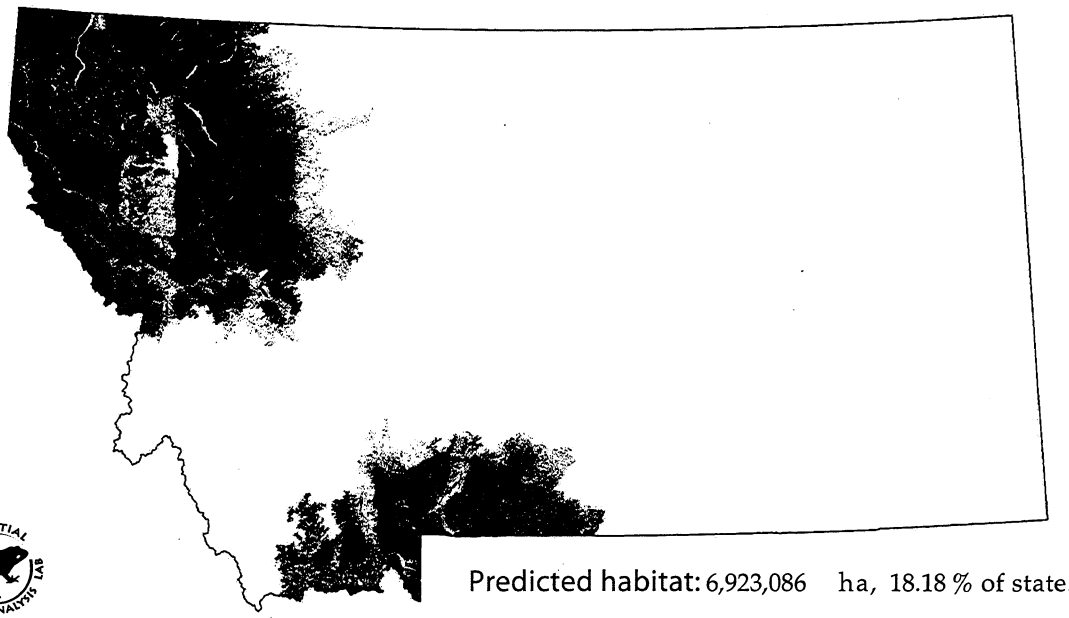


GRIZZLY OR BROWN BEAR

Ursus arctos

State rank	S1S2	Element code	AMAJB01020
Global rank	G4	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 6,923,086 ha, 18.18 % of state.

State range

Occurs in the Northern Continental Divide ecosystem and Yellowstone ecosystems, and also at low numbers in the Cabinet-Yaak ecosystem. Suspected in the Selway-Bitterroot ecosystem. Scattered individuals may occur in other mountainous areas of western Montana. Extinct in eastern Montana (Thompson 1982, MT-NHP VCA).

Habitat description

Now found mostly in arctic tundra, alpine tundra, and subalpine mountain forests. Once found in a wide variety of habitats including open prairie, brushlands, riparian woodlands, and semidesert scrub. Ranges widely at the landscape level. Most populations require huge areas of suitable habitat. Common only where food is abundant and concentrated (e.g., salmon runs, caribou calving grounds, berry patches, glacier lilies). Typically digs own hibernation den, usually on steep northern slope where snow accumulates. See LeFranc et al. (1987). Young are born in den in cave, crevice, hollow tree; hollow dug under rock, or similar site. Use of summit or ridge for mating (in May-June) reported for Banff National Park, Alberta, but not elsewhere (Hamer and Herrero 1990). In Spain, remnant deciduous forests and upland creek drainages were prime feeding areas (Clevenger et al. 1992). Meadows, seeps, riparian zones, mixed shrub fields, closed timber, open timber, sidehill parks, snow chutes, alpine slabrock. Varies between area, season, local populations and individuals (Chapman and Feldhamer 1982, Craighead et al. 1982, Servheen 1983, Aune 1984, Kasworm 1985).

Model assumptions & caveats

Distribution likely overestimated due to lack of road density data.

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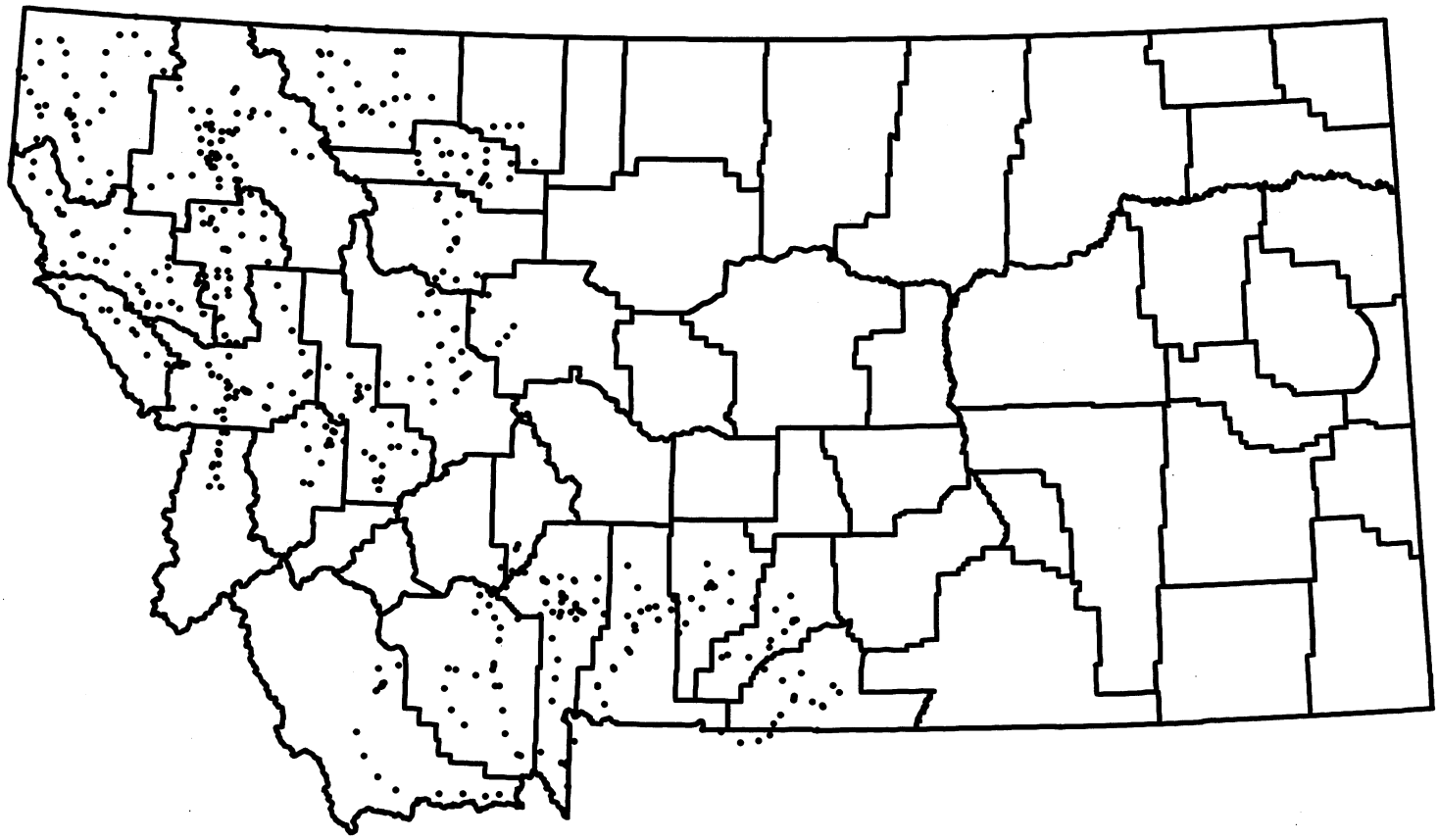
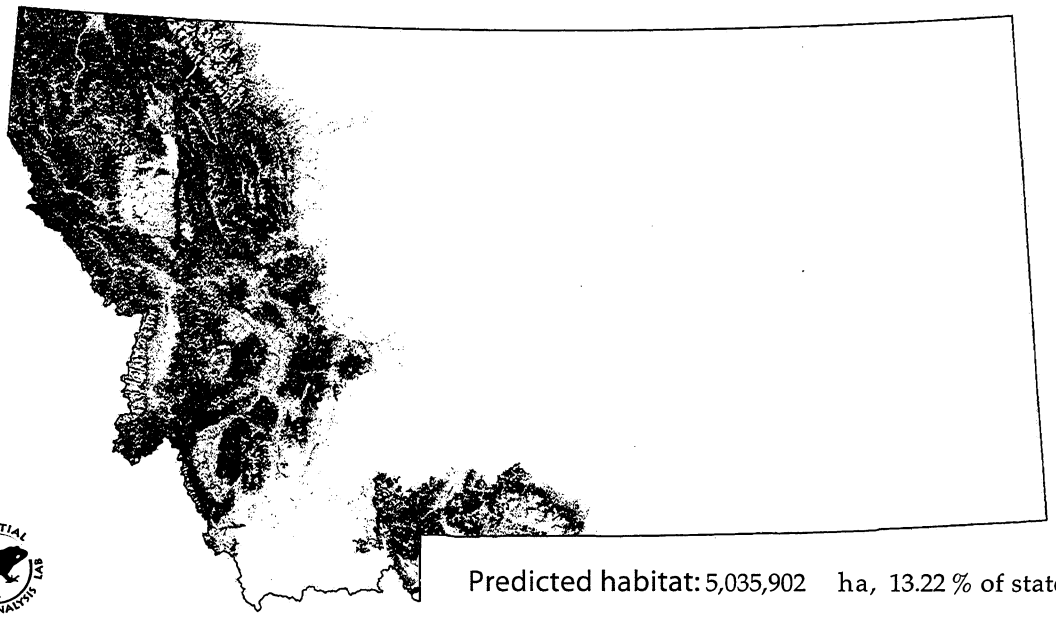


FISHER

Martes pennanti

State rank	S2	Element code	AMAJF01020
Global rank	G5	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 5,035,902 ha, 13.22 % of state.

State range

Apparently was previously extirpated in state. No documentation for 1920-1960. In 1959, 36 fishers from central British Columbia were released at three sites in western Montana; at least one transplant was successful and is apparently increasing (Weckwerth and Wright 1968). Recently recorded in southwestern Montana (Thompson 1982).

Habitat description

Prefers continuous canopy, dense old-growth conifer forest (Powell 1982, Allen 1987, Clark et al. 1989, Heinemeyer and Jones 1994). Also found at timberline (Aubry and Houston 1992). At least 70% canopy closure, fallen logs, stumps and seedlings, shrubs and herbaceous cover important (Powell 1982, Clark et al. 1989). Riparian areas especially important (Powell 1982, Heinemeyer and Jones 1994). Preys on snowshoe hares, voles, shrews, red squirrels, and birds (Raine 1987).

Model assumptions & caveats

Size class not available, so old-growth conditions are not well mapped. No information on coarse woody debris, stumps, and understory so suitable habitat is overestimated.

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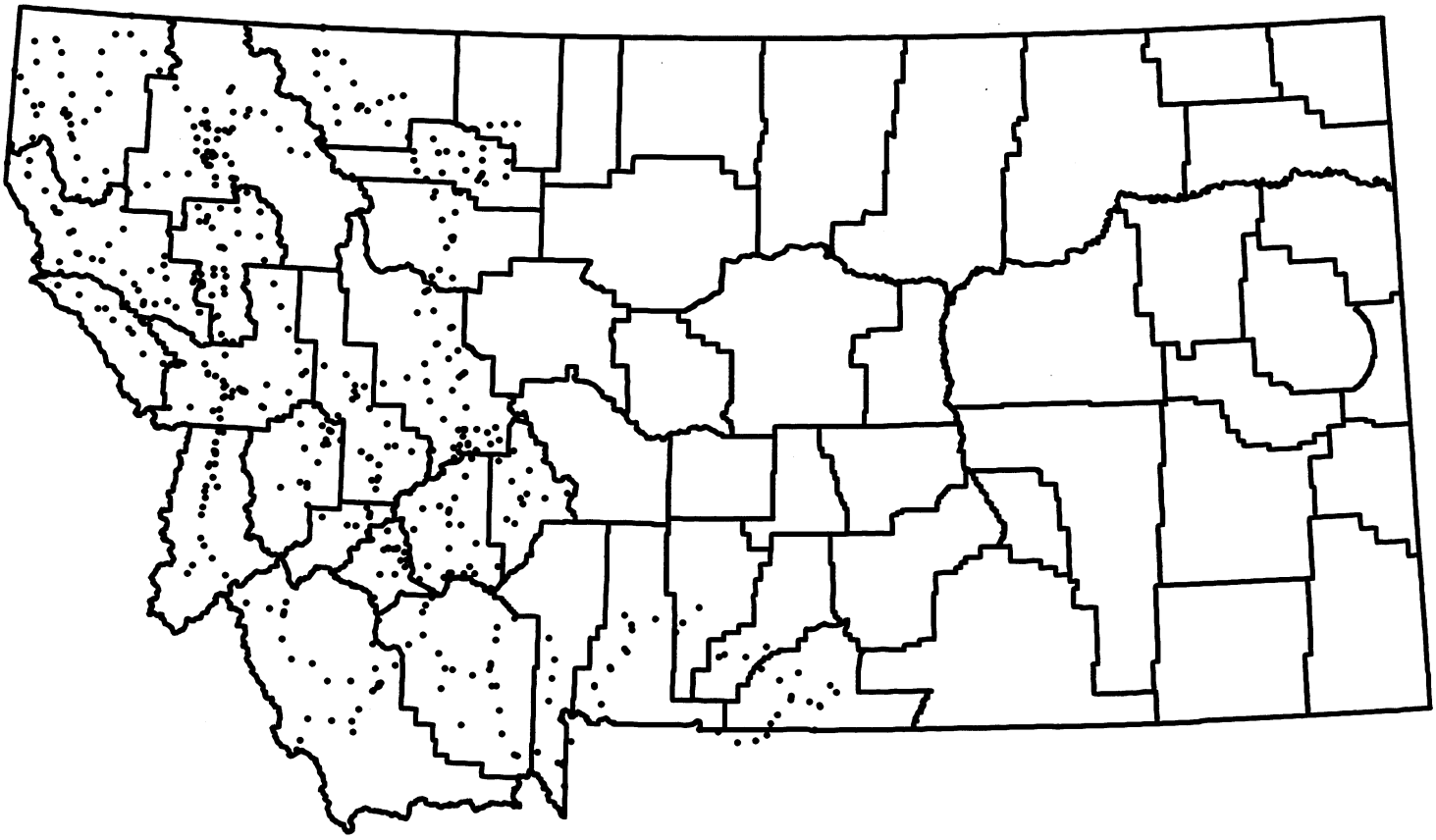
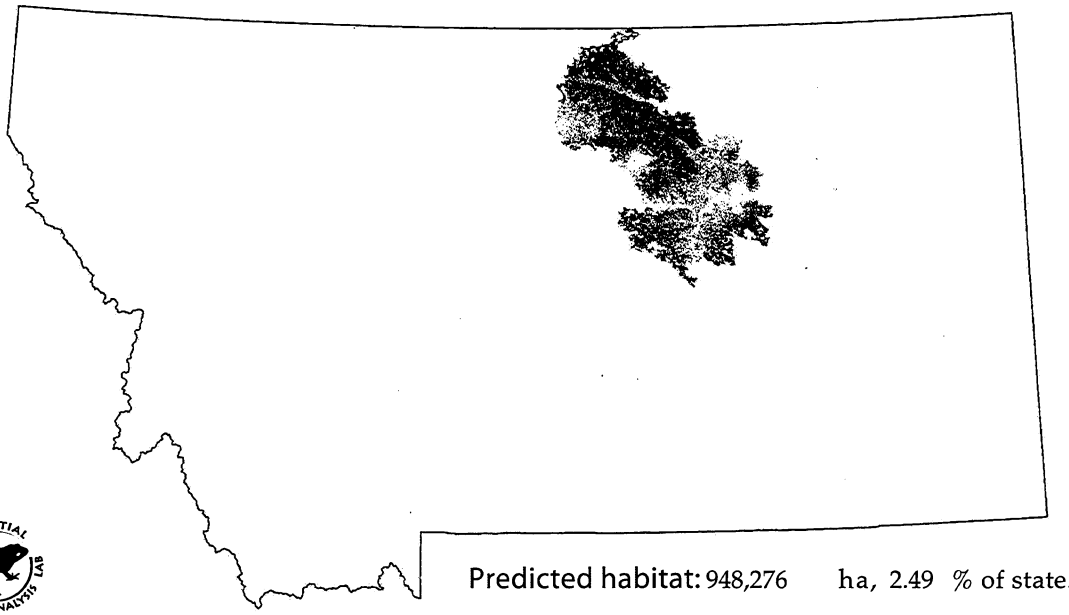


BLACK-FOOTED FERRET

Mustela nigripes

State rank	SH#	Element code	AMAJF02040
Global rank	G1	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 948,276 ha, 2.49 % of state.

State range

Historically found throughout eastern Montana. Reintroduced at UL Bend in Phillips County in fall 1994 with continued releases through 1997. Also released on Fort Belknap Reservation in fall 1997. Extirpated elsewhere in the state. Could possibly occur in several counties of southeastern Montana: Carter, Custer, and Rosebud (MT NHP VCA).

Habitat description

Limited to open habitat, the same habitat used by prairie dogs: grasslands, steppe, and shrub steppe. Occupies underground burrows made by prairie dogs; either black-tailed or white-tailed prairie dog colonies offer acceptable habitat. Young are born in underground burrows made by prairie dogs. It has been estimated that about 40-60 ha of a prairie dog colony is needed to support one ferret, but little is known about what truly constitutes ferret habitat, and reintroductions are providing new insights every year (R. Matchett, pers. comm.). See Biggins et al. (*in* Oldemeyer et al. 1993) for information on evaluating areas as potential ferret habitat. Such habitat factors include size of prairie dog complex, prairie dog population density, spatial arrangement of prairie dog colonies, potential for disease in prairie dogs and ferrets, potential for prairie dog expansion, abundance of predators, future resource conflicts and ownership stability, and public and landowner attitudes. Only large prairie dog complexes (several thousand acres of closely-spaced colonies) can support a breeding ferret population.

Model assumptions & caveats

Model would be greatly improved by inclusion of prairie dog town layer.

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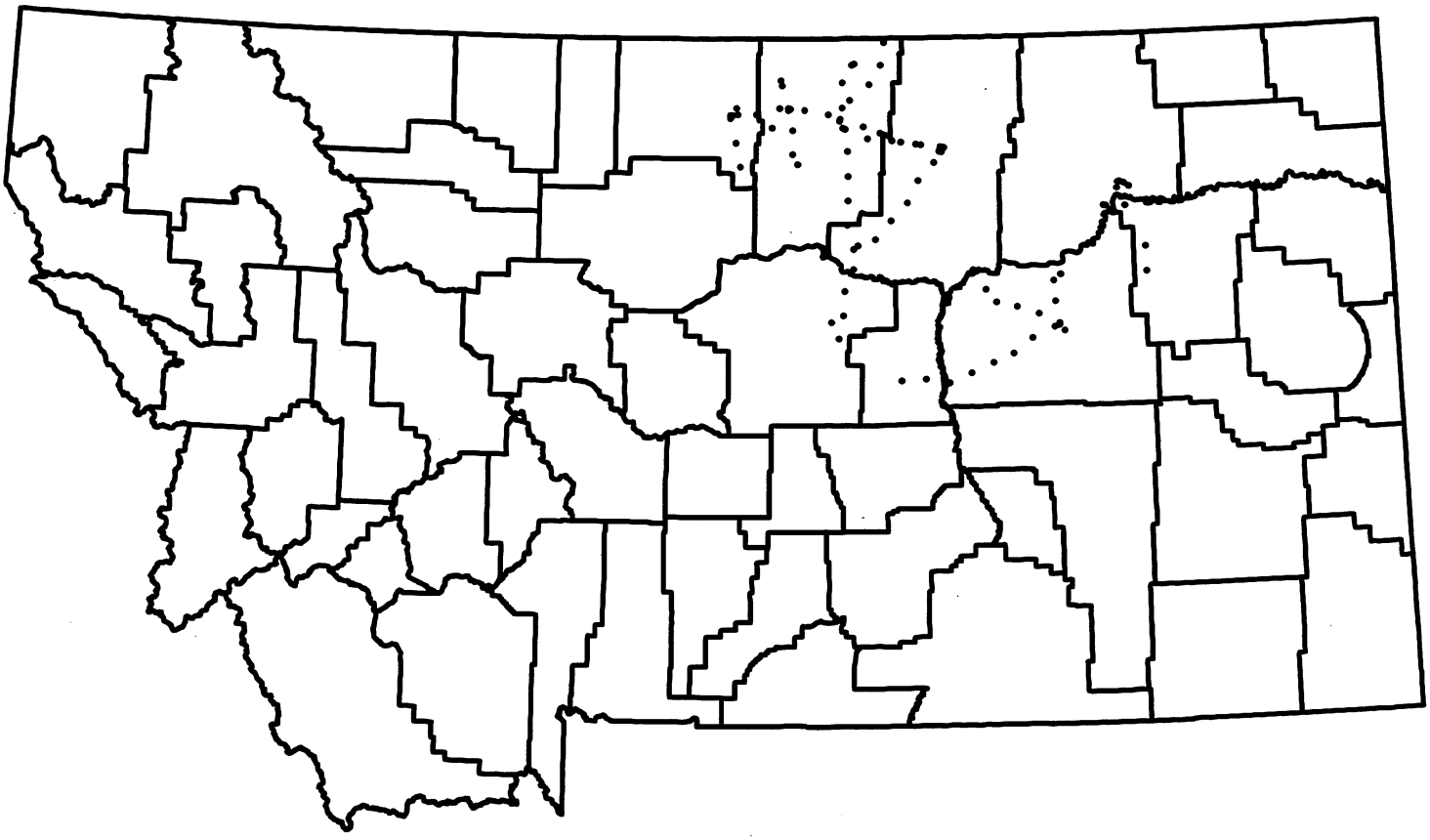
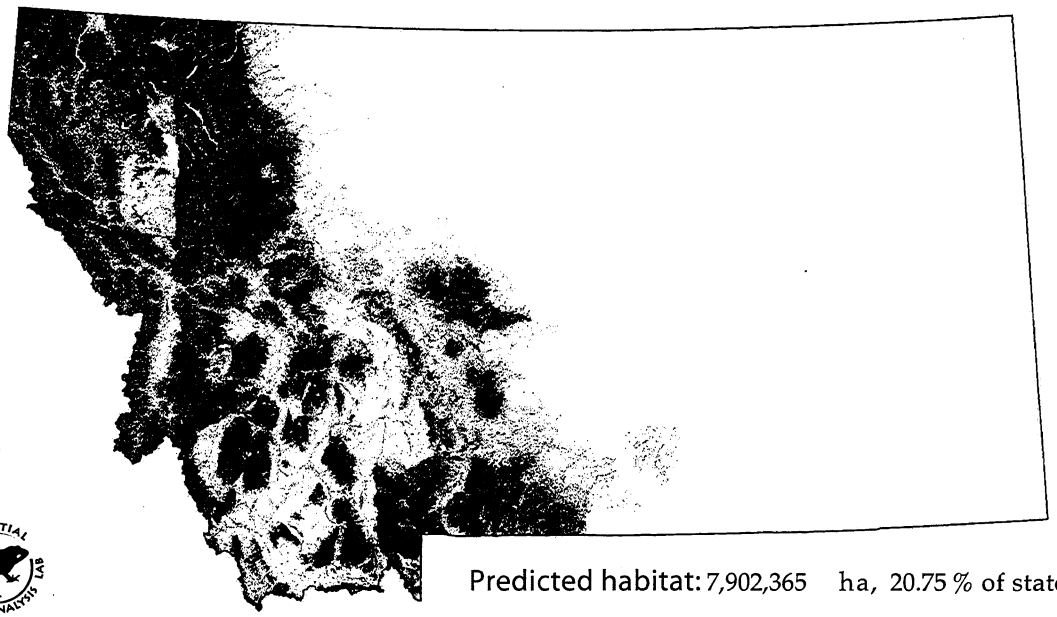


WOLVERINE

Gulo gulo

State rank	S2	Element code	AMAJF03010
Global rank	G4	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 7,902,365 ha, 20.75 % of state.

State range

Nearly extinct from 1920-1940, with increasing numbers and range since. "Recovery" originated in northwestern Montana-Glacier Park area and spread from there (Newby and Wright 1955, Newby and McDougal 1964). Current distribution primarily from western Montana through Greater Yellowstone area (Thompson 1982). May exhibit dispersal movements in and through atypical habitat (MT-NHP VCA).

Habitat description

Found in mature and old-growth fir, pine and larch forests (Hornocker and Hash 1981, Banci and Harestad 1990, Reichel et al. 1992). Also in alpine shrub, talus slopes, and riparian cottonwoods (Banci and Harestad 1990, Reichel et al. 1992). Requires large areas of habitat with little or no human disturbance (Hash 1987).

Model assumptions & caveats

Old-growth conditions are not well mapped.

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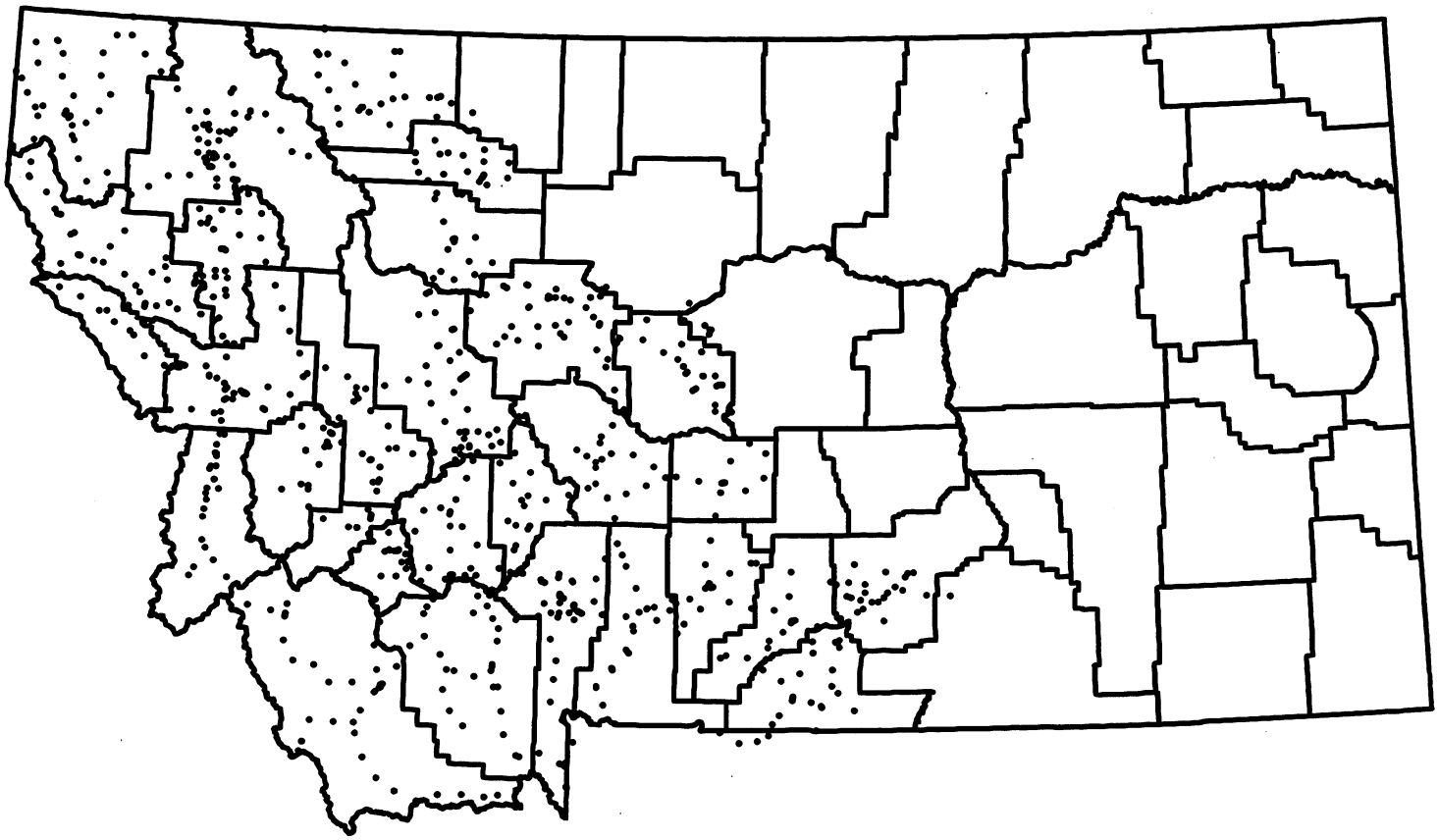
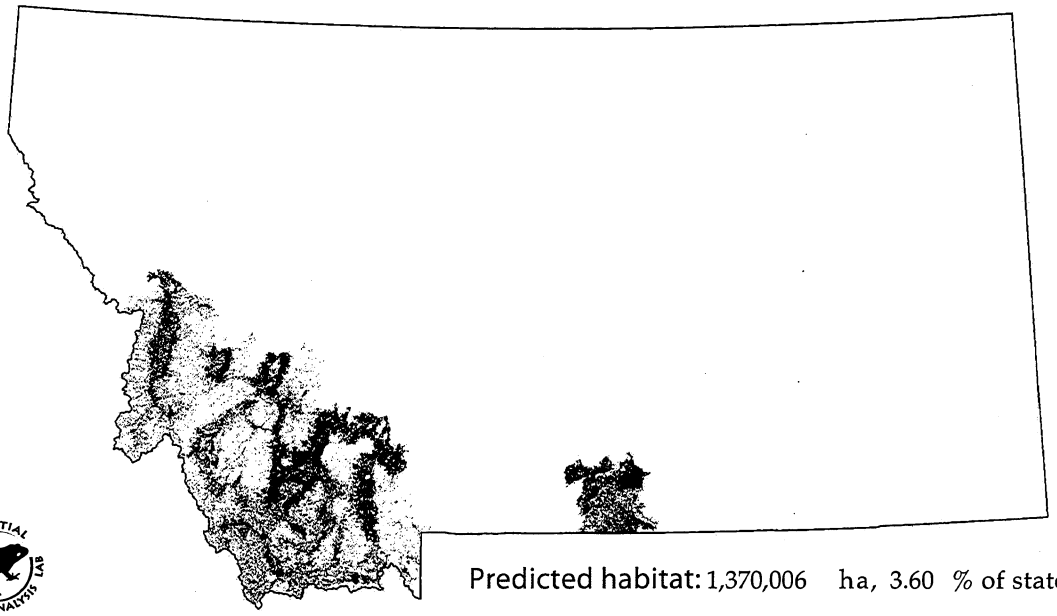


WESTERN SPOTTED SKUNK

Spilogale gracilis

State rank	SU	Element code	AMAJF05020
Global rank	G5	Modeled by	P. Thornton
MTNHP status	watch list		



Predicted habitat: 1,370,006 ha, 3.60 % of state.

State range

Occurs in southwestern Montana (Thompson 1982, MT-NHP VCA).

Habitat description

Rocky brush/grassland, grassland, riparian areas, and forest/shrub ecotones (Verts 1967, Hoffmann and Pattie 1968, Chapman and Feldhamer 1982, Allen 1987)

Model assumptions & caveats

References

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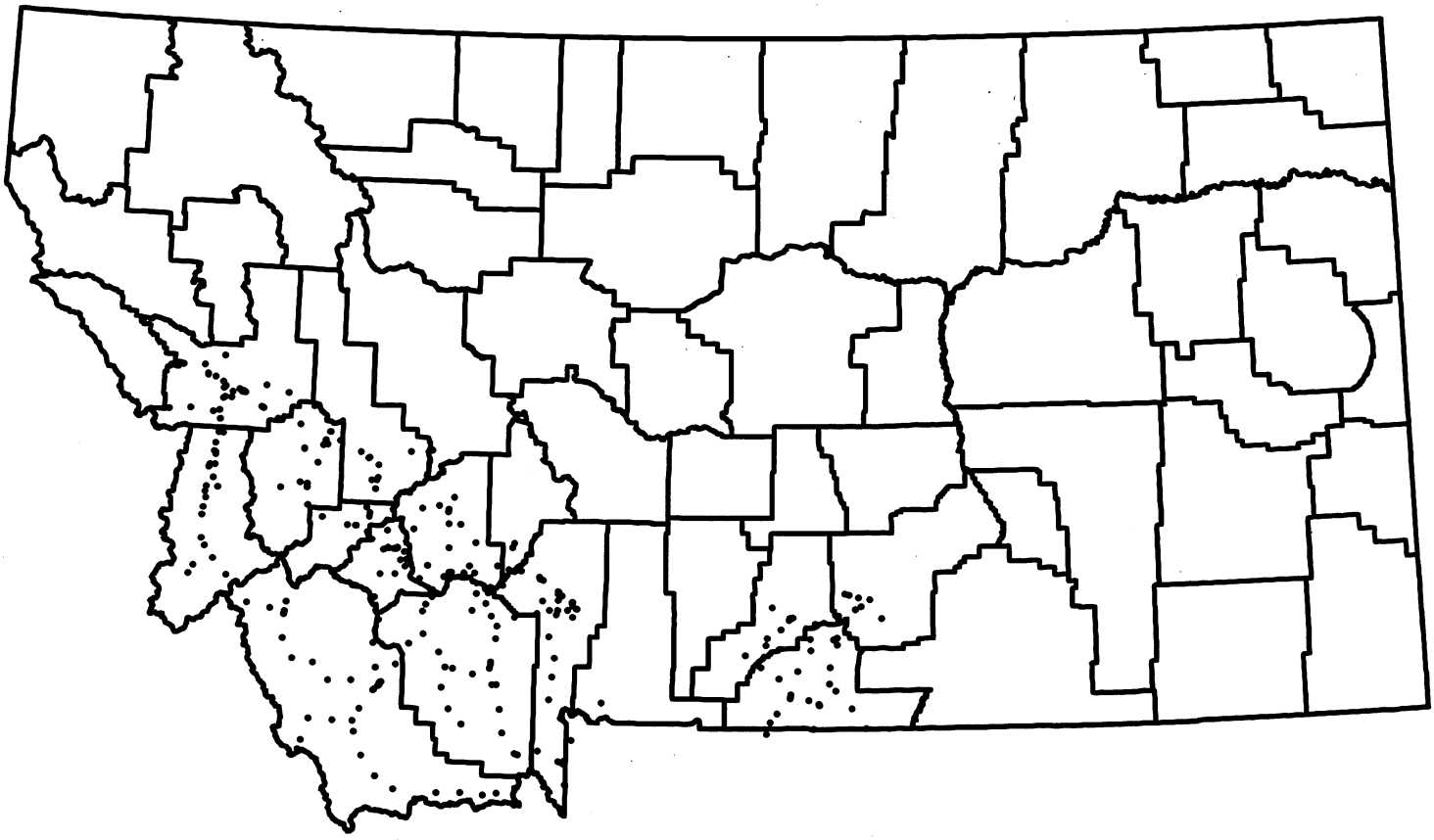
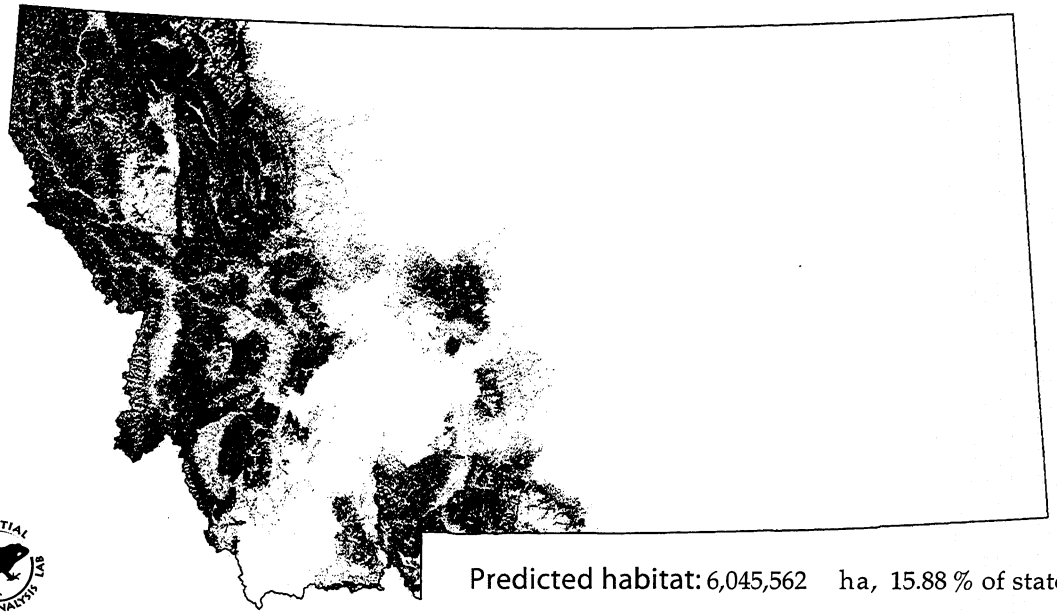


LYNX

Lynx canadensis

State rank	S2	Element code	AMAJH03010
Global rank	G5	Modeled by	P. Thornton
MTNHP status	special concern		



Predicted habitat: 6,045,562 ha, 15.88 % of state.

State range

Resident in western Montana (Thompson 1982). Appearances in eastern Montana may be residents or movements from Canada, possibly a response to periodic shortages of snowshoe hares (MT-NHP VCA).

Habitat description

Dependent on snowshoe hares; found in same habitats (Reichel et al. 1992). Dense, mature old-growth lodgepole pine, Douglas-fir, Engelmann spruce and subalpine fir forests (Koehler et al. 1979, Chapman and Feldhamer 1982, Koehler 1990, Reichel et al. 1992). Willow flats (Nellis in Clark et al. 1989). Above 4000' hunt in dense, early successional stage lodgepole pine forest, den in mature lodgepole pine and spruce-fir forests (Koehler and Brittell 1990). Well-developed understory important (Allen 1987).

Model assumptions & caveats

Understory conditions not mapped, therefore suitable habitat may be overestimated.

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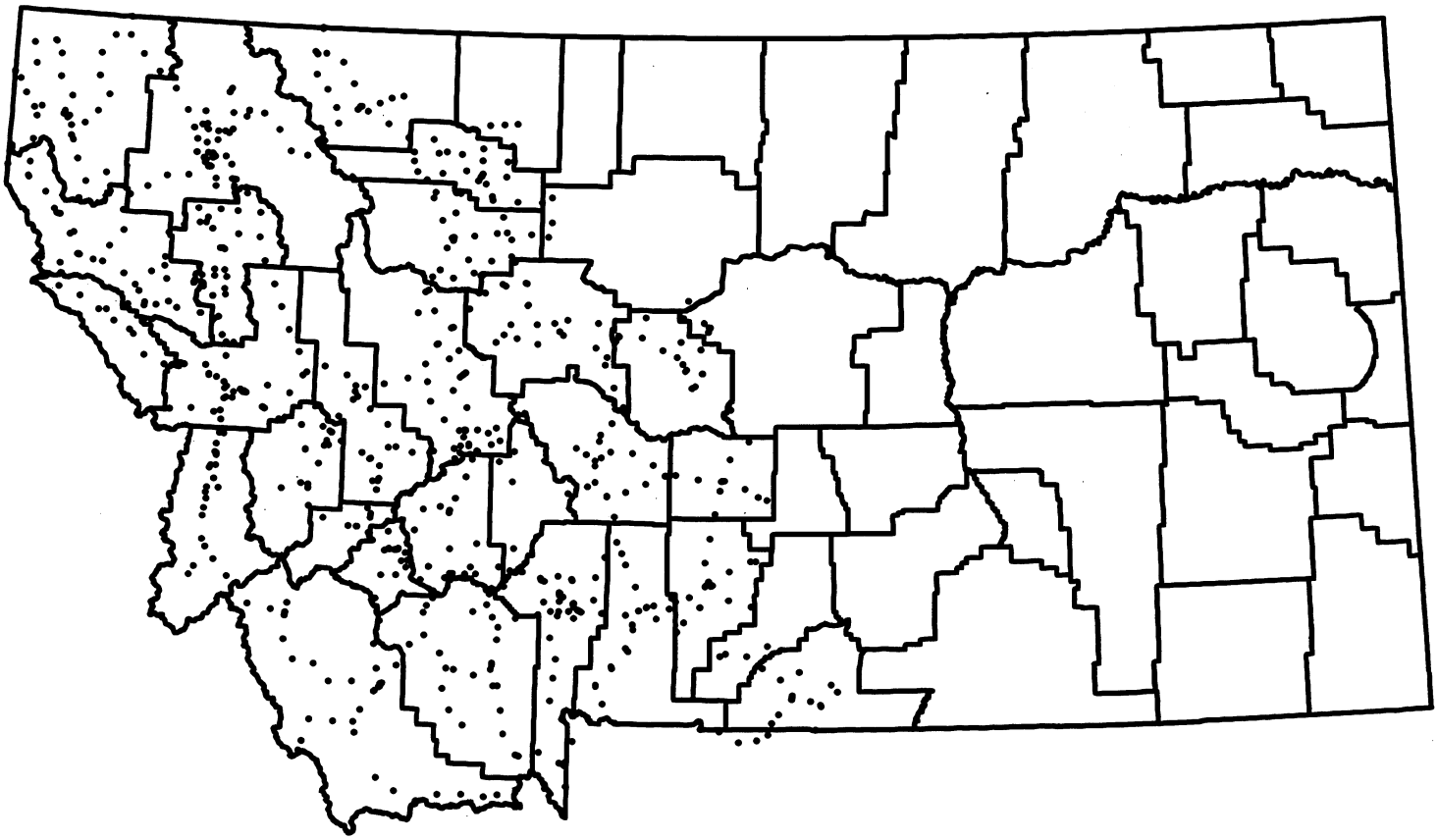
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