Montana Natural Heritage Program Information

MONTANA STATE LIBRARY
NATURAL HERITAGE PROGRAM

https://mtnhp.mt.gov

Bryce Maxell, Program Coordinator bmaxell@mt.gov

NATURESERVE

Spatial Analysis Lab
UNIVERSITY OF MONTANA

O'Connor Center for the Rocky Mountain West
Ecological Mapping Monitoring and Analysis Group (EMMA)

Why have a Natural Heritage Program?

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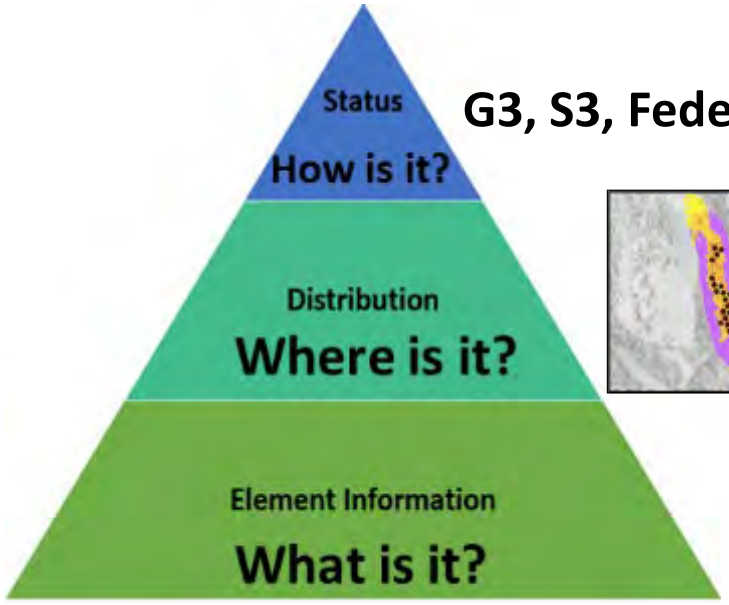
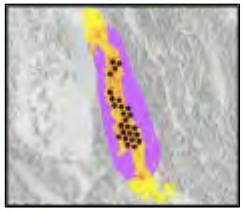
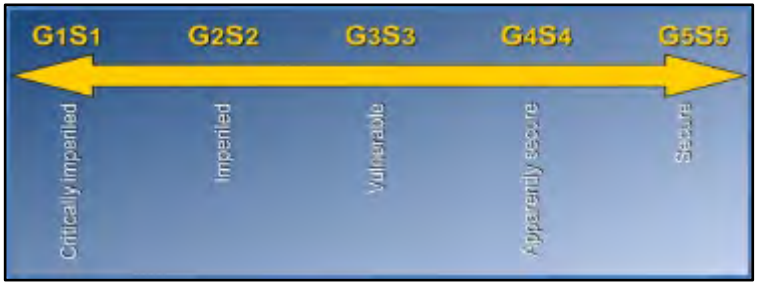
NATURAL HERITAGE PROGRAM

- Common set of information available to everyone
- Inform environmental review, permitting, and planning
- Inform species and habitat management decisions
- Inform disaster and invasive species response efforts
- Make informed decisions quickly
- Expedite processes to save time and money
- Provide certainty (avoid litigation and harm to species)
- Maintain local authority on species/habitat management



G3, S3, Federally Delisted





Water Howellia (*Howellia aquatilis*)

Species Data Products

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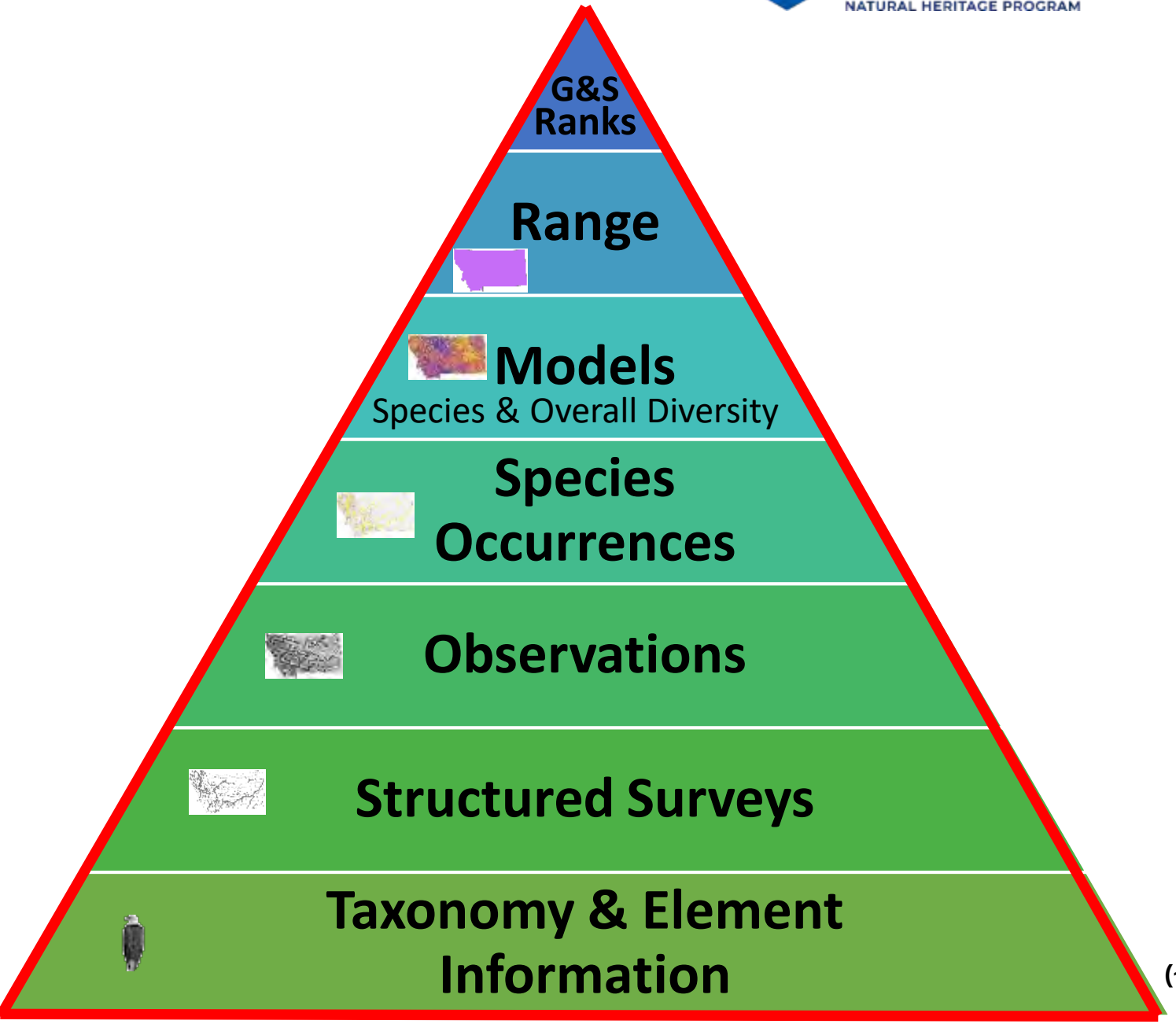

2025 Counts

G&S Ranks	4,887
Range	3,856
Models	2,117
Species Occurrences	99,197
Observations	6,043,955
Structured Surveys	485,365
Taxonomy & Element Information	16,691 (~1,250 new algae soon)

Status of Invasive Species Information

- 1,330 non-native species either present or potential to establish
- 981,660 (715,129 vascular plant) obs records & 150,921 structured surveys
- 628 Non-native Plant & 622 Non-native Animal Data Sources
- Quarterly emailed audit reports of new weed records
- AGOL feature services offered to weed managers
- Fully developed workflows in place for iNaturalist data

Palmer's Amaranth

Rush Skeletonweed

Escargot

1. Missoula County – Jed Little (162,460)
2. USFS Current Invasive Plants (140,963)
3. BLM NISMS (124,403)
4. MSU section-based weed mapping (57,720)
5. USFWS Strike Team EDRR (43,045)
6. MDT roadside mapping (25,334)
7. USFS ECODATA (19,569)
8. Glacier NP Exotic Species Database (18,568)
9. EDDMapS (18,319)
10. BLM Terrestrial AIM (10,995) and LMF (4,811)
11. FWP Fishing Access Site Surveys (11,754)
12. Consortium of Pacific Northwest Herbaria (10,297)
13. Great Yellowstone Area Weed Mapping (6,566)
14. iNaturalist (5,624)
15. PACFISH/INFISH Biological Opinion (5,477)
16. FWP AIS Surveys (4,922)
17. Invaders Database – Peter Rice (4,061)
18. USFS FIA (3,556)
19. MTNHP Russian Olive Mapping (3,269)
20. Gallatin County Weed District (2,736)
21. USFWS CMR Weeds (2,650)
22. Rocky Mountain Herbarium (1,825)
23. MT Dept Ag 2011-2014 AIS Surveys (1,417)
24. MSU Schutter Diagnostics Lab (1,385)
25. MTNHP Wetland Assessments (1,210)
26. Dean Pearson RMRS (1,086)
27. Vegbank (1,030)
28. DEQ Mine Vegetation Data (620)

Invasive Plant Predicted Risk Models
Montana Natural Heritage Program

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https://mtnhp.mt.gov/resources/botany/docs/Predicted_Risk_Models_Invasive_Plants_in_Montana_20250710.pdf

Bryce Maxell, Program Coordinator bmaxell@mt.gov
Braden Burkholder, Data Systems and Sciences Lead bburkholder@mt.gov

Montana Natural Heritage Program

Botany Resources

The Botany Program manages information on the distribution, status, and biology of native and non-native vascular plant, mos
that are of conservation concern.

Primary Web Applications

- Montana Field Guide
- Map Viewer
- Species Snapshot
- Species of Concern Report

Montana Native Plant Conservation Strategy

- The Strategy
- Presentations on Strategy to Montana Native Plant Society

Montana Citizen Botany Program

- Frameworks
- 2022 Presentation on Proposed Framework
- 2022-2024 Pilot Study Report

Checklists

- Montana Vascular Plants, 2013
- Montana Moss Checklist with Distributions

Botanical Tools

- Botanical Terminology (glossary)
- Winter Field Key to the Native Shrubs of Montana
- C-Value Spreadsheet

Predicted Models

- Predicted Suitable Habitat Models

Program Reports

- Botany Reports

Presentations

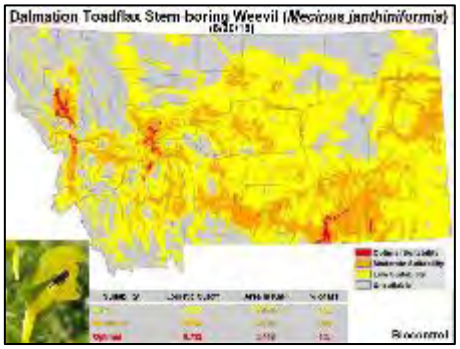
- Invasive Plant Predicted Risk Models – May 4, 2023

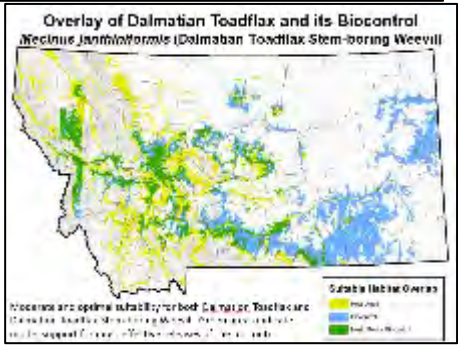
Websites of Interest

- Related Web Sites

- **Predicted Invasion Risk Models for 155 Non-native Plants and Biocontrols**
- **45 updated in 2025!**

Common Name	MT	ID	B.C.	AB	SK	ND	SD	WY
American Water-lily	AIS							
Blueweed	N1B	Control	Regional Noxious	Noxious			Watch	
Bohemian Knotweed	N1B	Control	Noxious	Prohibited Noxious				
Brazilian Waterweed	RD	LDRR						
Brittleleaf Naiad	AIS							
Canada Thistle	N2B	Containment	Noxious	Noxious	Noxious	Noxious	Noxious	Noxious
Cheatgrass	R3			Noxious	Noxious			
Common Buckthorn	N2A			Prohibited Noxious	Noxious			
Common Hound's-tongue	N2B	Containment	Noxious	Noxious	Prohibited	Noxious		Noxious
Common St. John's-wort	N2B		Invasive of Concern	Prohibited Noxious				Noxious
Common Tansy	N2B		Regional Noxious	Noxious	Noxious			Noxious
Common Water Hyacinth	AIS	LDRR						
Curly-leaf Pondweed	N2B/WS	Containment			Prohibited			
Dalmatian Toadflax	N2B	Containment	Noxious	Noxious	Prohibited	Noxious		Noxious
Diffuse Knapweed	N2B	Containment	Noxious	Prohibited Noxious	Prohibited	Noxious		Noxious
Dyer's Woad	N1A	Control		Prohibited Noxious			Watch	Noxious
Eurasian Water-milfoil	N2A/WS	Control		Prohibited Noxious	Prohibited			
European Common Reed	N1A	Control	Noxious					
Fanwort	AIS	EDRR						
Field Bindweed	N2B	Containment	Invasive of Concern	Noxious	Noxious			Noxious
Flowering-rush	N2A/WS	Containment	Noxious	Prohibited Noxious	Prohibited			
Giant Knotweed	N1B	Control	Noxious	Prohibited Noxious				
Hoary False-alyssum	N2B	Containment	Regional Noxious	Prohibited Noxious	Noxious			
Hydrilla	R3	EDRR						
Japanese Knotweed	N1B	Control	Noxious	Prohibited Noxious				





Data Centralization Philosophy: There is No One Right Way

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- Provide tools for observation submission

Survey123 for ArcGIS

Heritage Obs Collector
Rapid Weed Reporter
***Many others**

Submit MT Animal Observations

- Youtube Playlist on How to Submit Data to MTNHP

  https://www.youtube.com/playlist?list=PLRaydtZpHu2qOHPoSPq9cnM9uXGmEXACx

- Seek out data submitted elsewhere

MONTANA FISH, WILDLIFE & PARKS

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

MONTANA AUDUBON

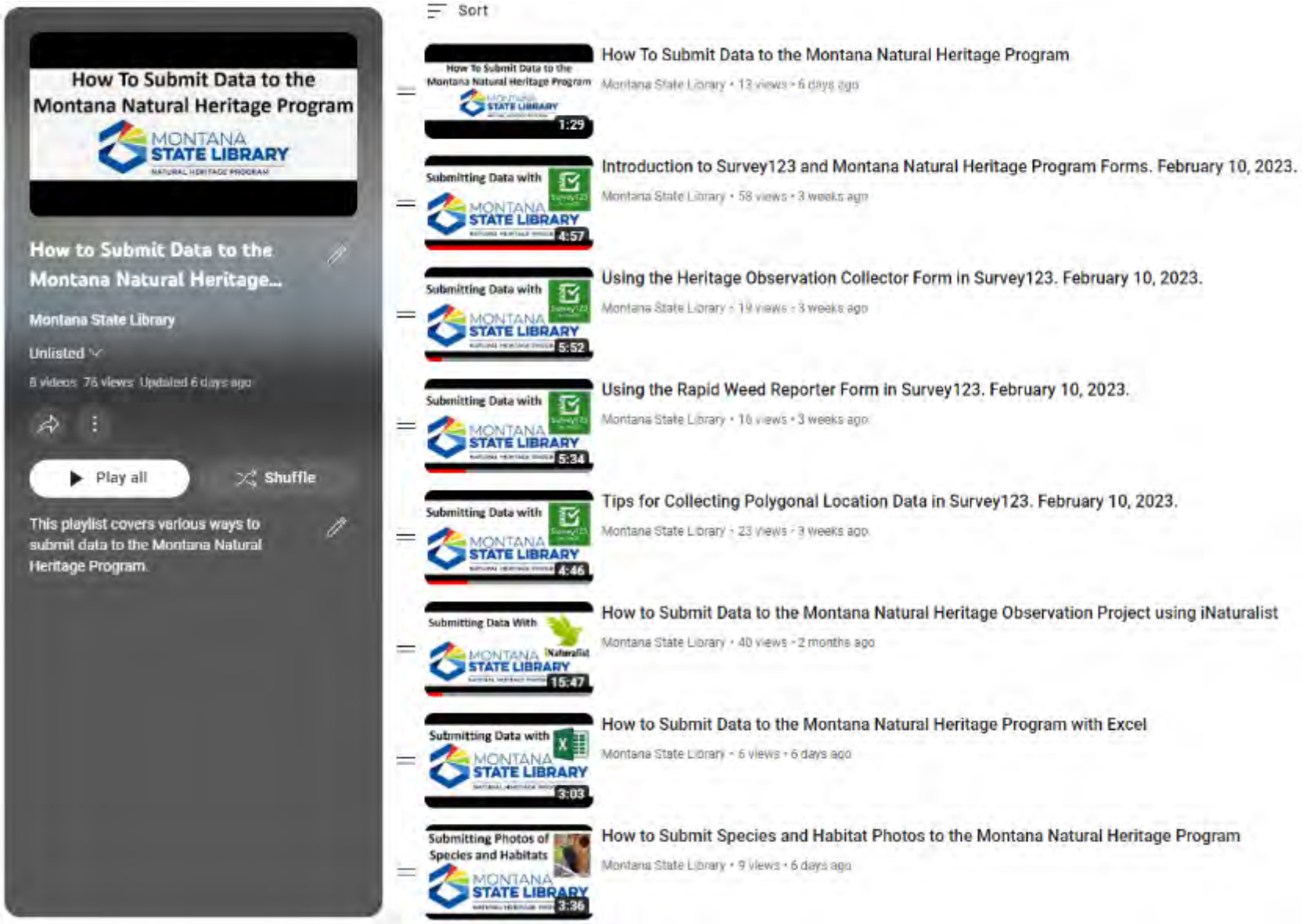
iNaturalist

EDDMapS Early Detection & Distribution Mapping System

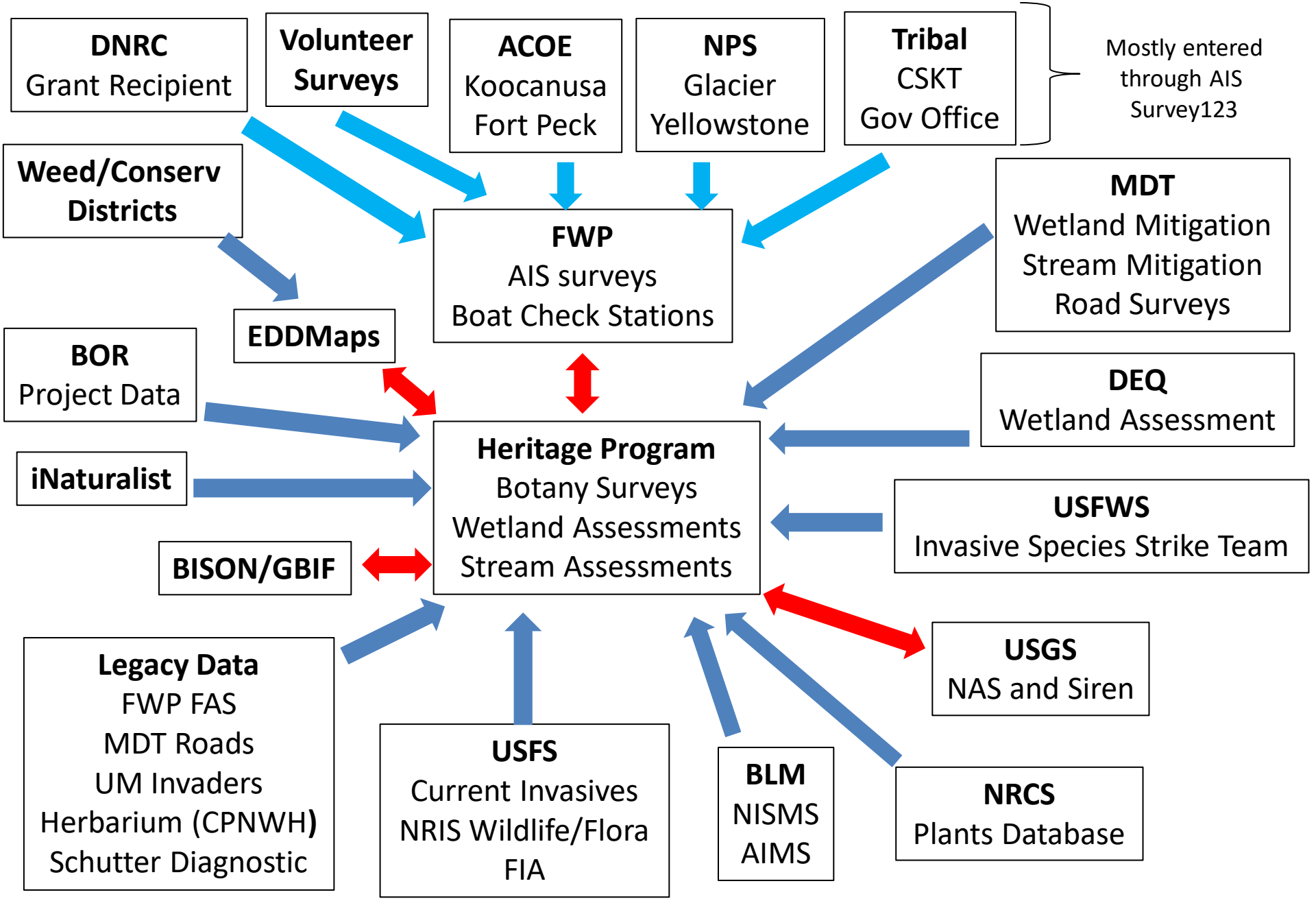
eBird

How to Submit Data to MTNHP - Youtube Playlist

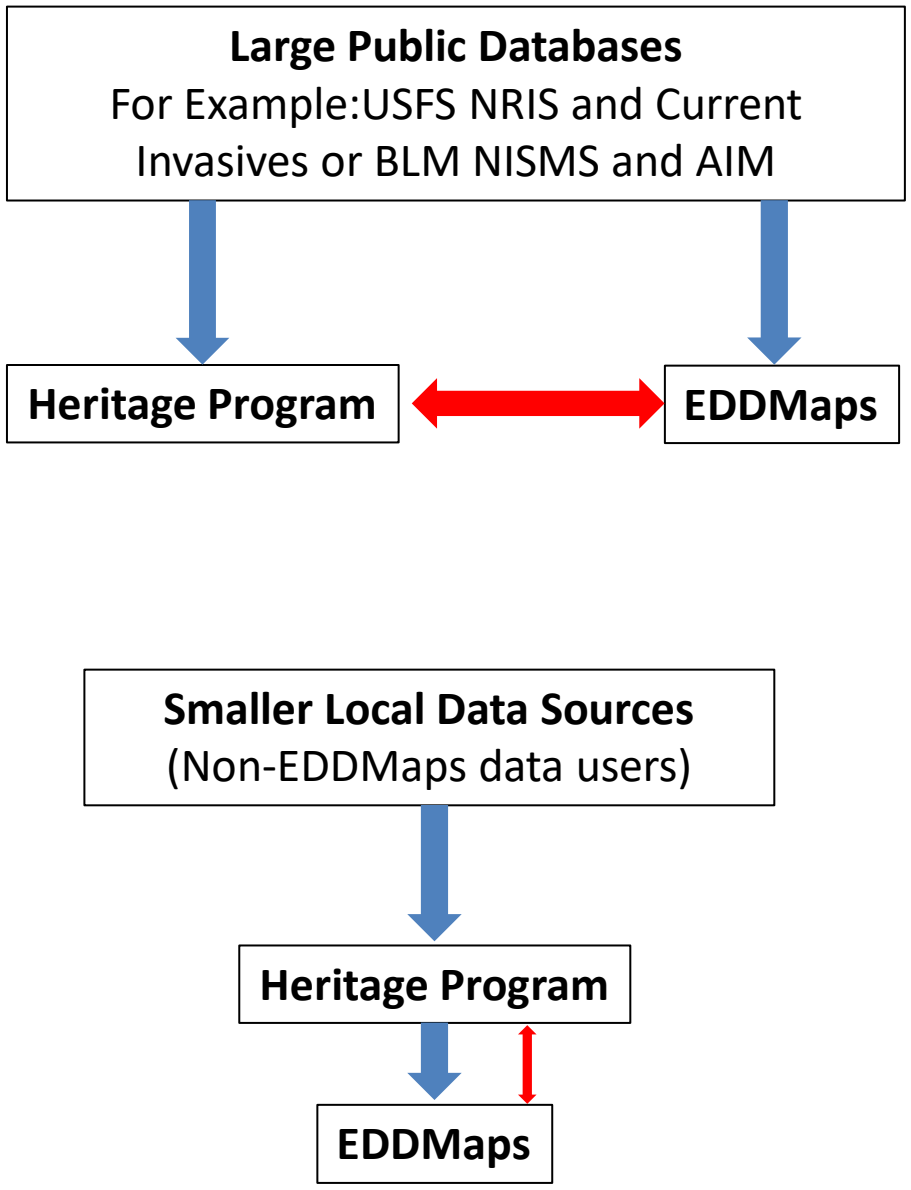
https://youtube.com/playlist?list=PLRaydtZpHu2qOHPoSPq9cnM9uXGmEXACx



Invasive Species Observation/Survey Data Flow



EDDMaps West and Heritage Data Exchange



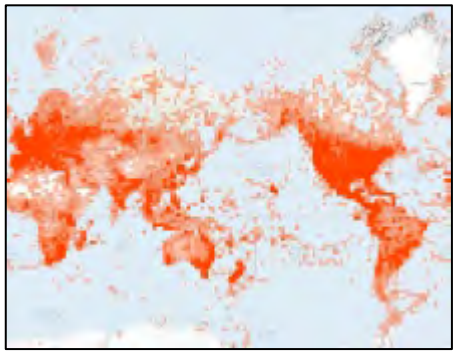
- MTNHP and EDDMaps will both consume, evaluate, and add data from major public data sources as they have time
- MTNHP will centralize smaller local data sources (including polygonal and linear features) and provide both the raw datasets and the final evaluated data to EDDMaps
- MTNHP and EDDMaps will create APIs to allow each other to take live pulls of “accepted observations”, “deleted observations”, and survey locations
- MTNHP and EDDMaps will maintain persistent ID numbers and the ID numbers from the original data sources to facilitate cross walks
- MTNHP and EDDMaps will populate “record update and date” fields to facilitate record reviews and needed updates on either end
- MTNHP and EDDMaps will share data dictionaries for all data fields in their databases

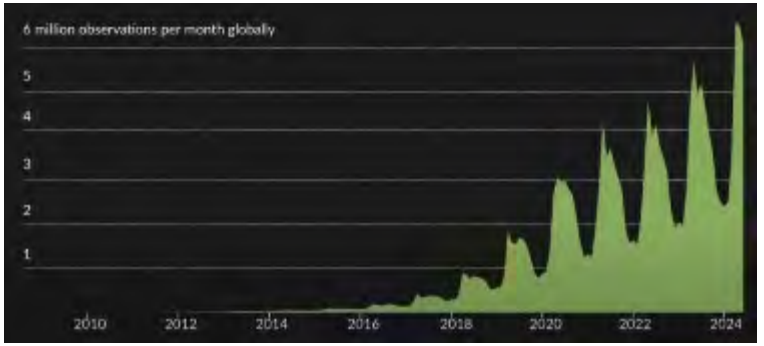
iNaturalist

seek by iNaturalist

Global	214,152,514 OBSERVATIONS	491,680 SPECIES	392,009 IDENTIFIERS	3,390,948 OBSERVERS
Montana	387,693 OBSERVATIONS	8,824 SPECIES	10,062 IDENTIFIERS	19,100 OBSERVERS

https://www.inaturalist.org/





Taxa	No. of Orders	Total No. of Obs	No. Obs for SOC	No. Obs for Non-natives
Vertebrates	40	31,301	5,649	944
Invertebrates	28	14,209	96	1,504
Fungi	22	535	?	39
Lichens	12	146	5	3
Mosses	7	13	1	0
Vascular Plants	58	47,959	291	9,111

- 45,510 zoological & 48,653 botanical records now appended (24% of MT iNat records)!
- 725 “expert identifers” whose identifications in iNaturalist can be fully trusted
- Collaborating on common workflows, best practices, & North America-wide expert list

Setting up an iNaturalist Account

Phone

1. Create an account at https://www.inaturalist.org/
2. Download iNaturalist app on your cell phone from your favorite app store

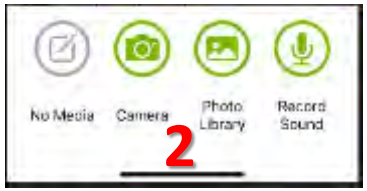
3. LogIn to your recently created account

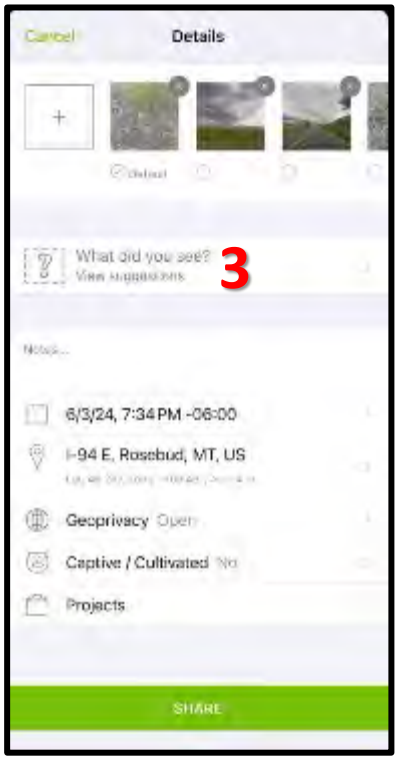
Phone

1. **Click Observe**
2. **Select photo or sound source**
3. **Identify what you saw as best you can. Use suggestions by iNaturalist for assistance.**

Desktop (see following slides)

1. **Subscribe to species of interest to get reports of observations for species & areas of interest**
2. **Identify observations of others**





iNaturalist Resources

- Seek by iNaturalist for assistance with identification
  - https://www.inaturalist.org/pages/seek_app
- iNaturalist Resources for observers
  - https://www.inaturalist.org/pages/video+tutorials
- Guide for taking iNaturalist photos
  - https://bcparksfoundation.ca/site/assets/files/1697/inaturalist_photo_guide_-_final.pdf
- Montana Natural Heritage Observations Project
  - https://www.inaturalist.org/projects/montana-natural-heritage-observations
- How to submit data to the Montana Natural Heritage Observations Project
  - https://www.youtube.com/watch?v=uiXwDiAuXxw
- Individuals with expertise willing to be tagged to assist with ID in Montana
  - Scott Mincemoyer (vascular plants): @scott_mt
  - Peter Achuff (vascular plants): @plachuff
  - Kenda Herman (vascular plants): @kendarae
  - Dan Bachen (general resource, vertebrates): @dbachen
  - Bryce Maxell (general resource, vertebrates): @bmaxell
  - Zach Shattuck (fish): @pantosteus
  - Alexis McEwan (amphibians, reptiles): @lex_13
  - Bo Crees (birds): @bocrees
  - Ian Foley (invertebrates): @ian26
  - Noah Siegel (fungi): @noah_siegel
  - Ryan Patrick (fungi): @biglaughinggym
  - Craig McLane (aquatic invasive species): @cmclane

iNaturalist Data Workflow

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Daily work in iNaturalist → **iNaturalist API Monthly Download**

Establish Projects for taxa of interest
- Heritage Obs
- Non-lichenizing fungi

Flag taxa for data obscuring/opening

Data Review and comments for:
- Taxa subscriptions
  - AIS
  - Noxious Weeds
  - Vert classes
- Reviews of projects
- Records identified by MTNHP audit reports

Communications on specific records to obscure or open

MTNHP Processing Server

- **Working Table**
- **Taxa Table**
- **Expert Table**
- **Other Lookup and Archive tables**

Monthly Audit Reports →

Audit Report Record Review in ArcPro and iNaturalist

- Species of Concern
- New species
- Records outside range
- Records >10km from previous records
- Obscuring changes

Annual Audit Report →

Review performance metrics for all identifiers relative to expert identifiers in order to add "experts"

Append "Expert" and Selected "Research Grade w 3 concurring IDs" to MTNHP Obs Database

Audit Reports →
Nightly
Weekly
Monthly
Quarterly

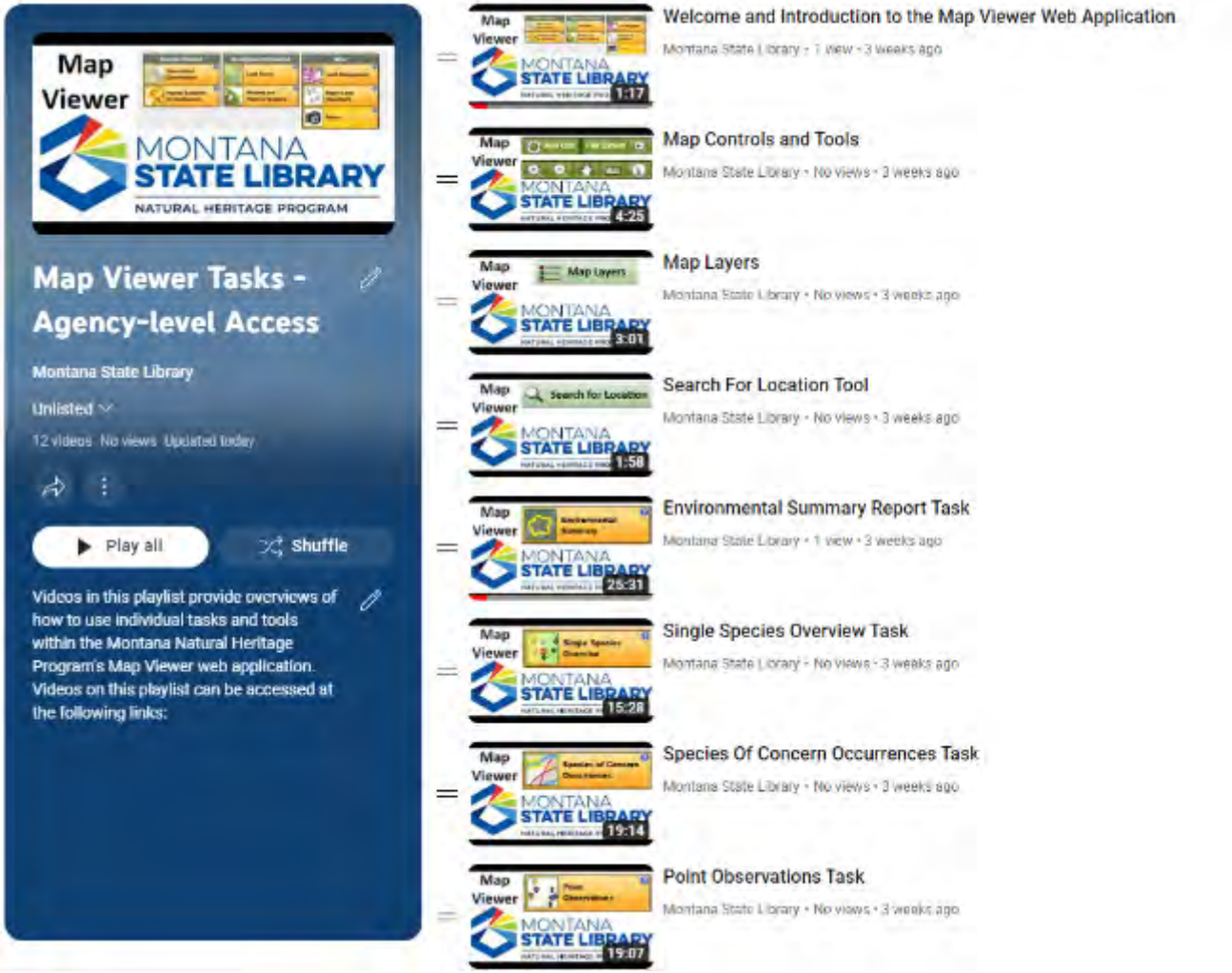
Standard MTNHP Review and Processing of Records for QA/QC

How to Access Weed Information on Map Viewer

https://mtnhp.org/mapviewer

Youtube Playlist of Training Videos

https://youtube.com/playlist?list=PLRaydtZpHu2rAl8P7VJUIoV4zoTu7eQFG



Montana Weed Dashboard

http://tinyurl.com/2krv3w9r

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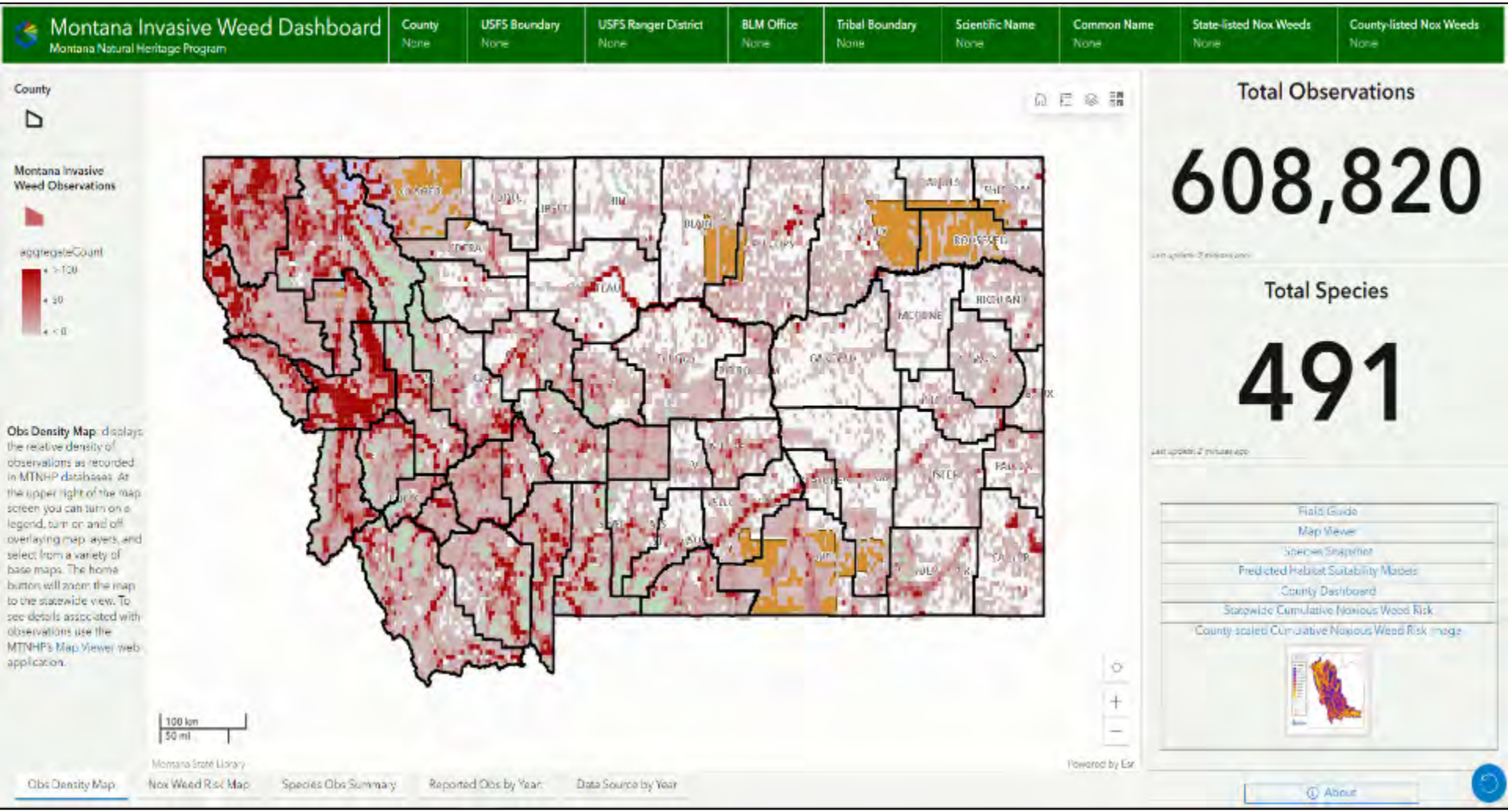

iNaturalist Non-native Species Watchlist

https://tinyurl.com/5n8sn6az

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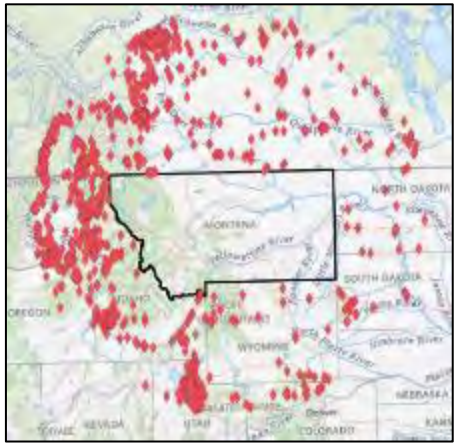
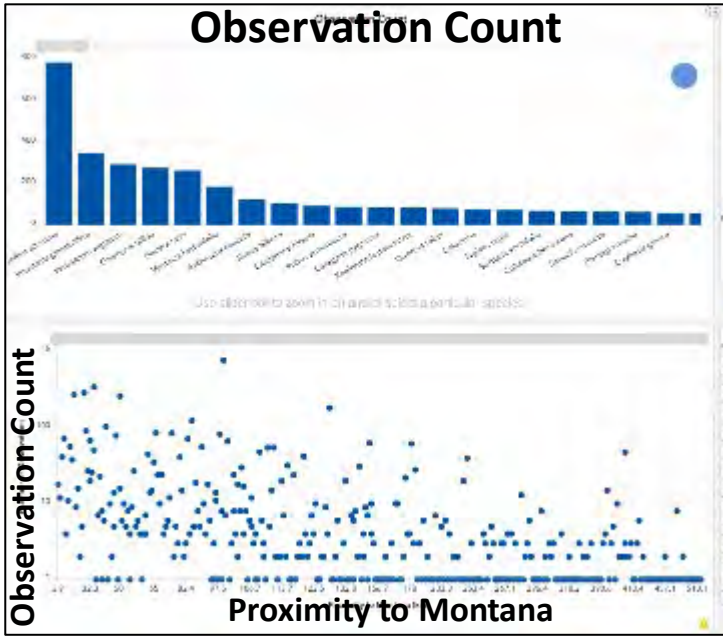
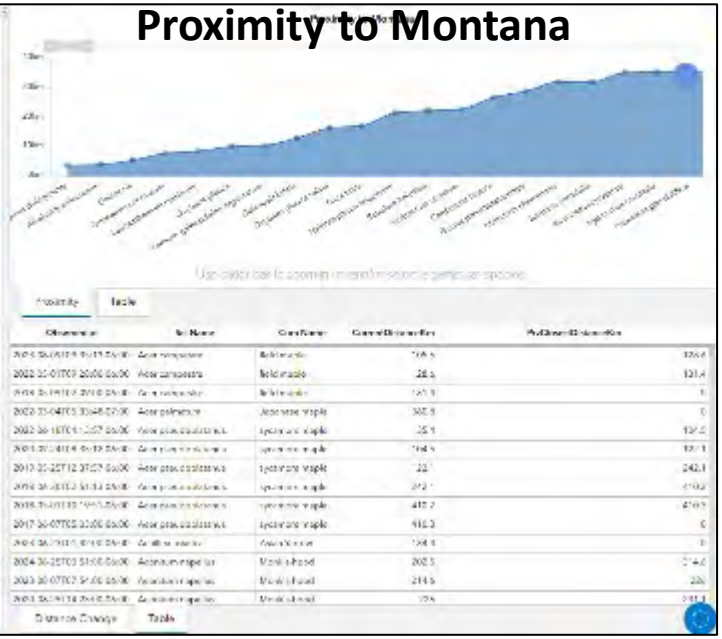
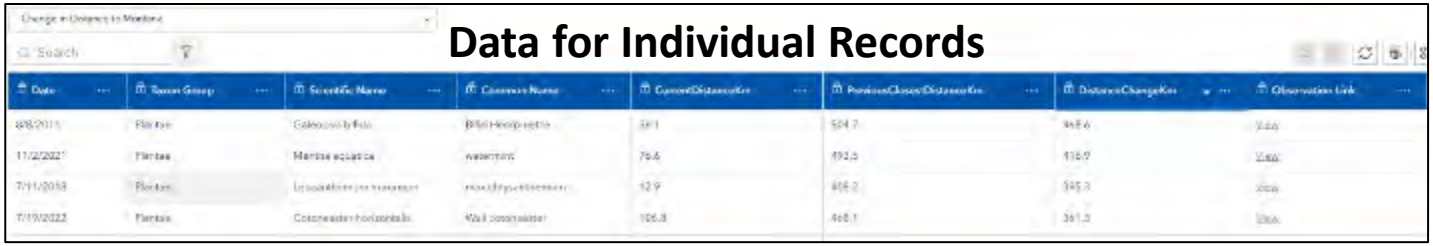


Non-native records outside state within 800-km radius of center of Montana







Audit Reports eMailed Directly to Agency Staff

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New Weed Observations - by USFS Ranger District

These noxious weed observations were added to the MTNHP database in the last quarter. Observations are organized by USFS Ranger District. **Actual observation dates may be before this period.** See these and other records in https://mtnhp.org/mapviewer/

Rerun this report: http://intranet.nhp.mt.gov/SQLPRDNightlyAuditRunOne.asp?i=178

250 records in this report This report runs every First of Quarter morning

RANGER_DISTRICT	MT_Weed_Status	Field_Guide_Link	MapViewer_Link	S_Com_Name	Num_Obs_Last_Quarter_in_USFS_RD	Tot_Obs_For_USFS_RD	Tot_Obs_For_State
Beaverhead-Deerlodge National Forest, Butte Ranger District	State Listed Weed: N2B	PDAST2E090	Cirsium arvense	Canada Thistle	4	229	54018
Beaverhead-Deerlodge National Forest, Butte Ranger District	County Listed Only	PDAST1S040	Carduus nutans	Musk Thistle	3	73	10738
Beaverhead-Deerlodge National Forest, Butte Ranger District	State Listed Weed: N2B	PDAST1Y140	Centaurea stoebe	Spotted Knapweed	1	1282	144060

New Invasive Species - Quarterly Report

These non-native species observations were added to the MTNHP database in the last quarter. Observations are organized by County.

See these and other records in https://mtnhp.org/mapviewer/

Rerun this report: http://intranet.nhp.mt.gov/SQLPRDNightlyAuditRunOne.asp?i=57

1278 records in this report This report runs every First of Quarter morning

County	MT_Status	Field_Guide_Link	S_Com_Name	Num_Obs_Last_Quarter	Tot_Obs_For_County	Tot_Obs_For_State
Beaverhead	R3	PMPOA151H0	Cheatgrass	3	450	10203
Beaverhead	N2B	PDAST1Y140	Spotted Knapweed	3	6232	144587
Beaverhead	N2B	PDAST2E090	Canada Thistle	23	2971	54589

New Weeds Observations >2km from Existing Obs

These noxious weed observations were added to the MTNHP database in the last week and are >2km from all previous observations (if mapped precisely). **Actual observation dates may be before this period.**

See these and other records in https://mtnhp.org/mapviewer/

Rerun this report: http://intranet.nhp.mt.gov/SQLPRDNightlyAuditRunOne.asp?i=172

1 records in this report This report runs every Sun morning

Field_Guide_Link	S_Com_Name	MT_Status	Obs_ID	Location	Latitude	Longitude	Distance_fromOldObs_km	Date_Added	Date_Observed
PMPOT03060	Curly-leaf Pondweed	N2B/AIS	2314213	Flathead Lake | FWP WaterbodyID: 39716 | FWP SectionID: 42345848	47.86318	-114.27468	5.4	2024-01-25	2023-10-10

Spatial Data Web Services

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Description:

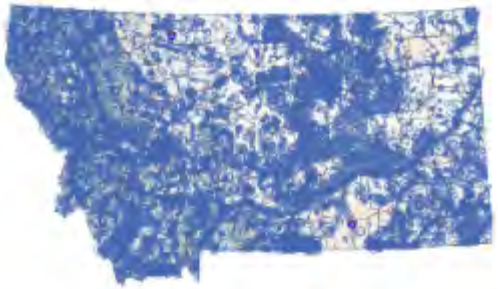
The Montana Natural Heritage Program (MTNHP) provides access to our species spatial data to our collaborating partners via ArcGIS Online (AGOL). We have published seven feature services:

- Botanical Species Occurrences
- Zoological Species Occurrences
- Botanical Observations of Montana Species of Concern (SOC) and Potential Species of Concern (PSOC)
- Zoological Observations of Montana Species of Concern (SOC) and Special Status Species (SSS)
- Noxious Weeds
- Aquatic Invasive Species
- Other Species of Management Interest (USFS & BLM Sensitive, SWAP SGIN, and Potential Species of Concern)

These data are only available through a restricted access ArcGIS Online group. Data can be queried by taxa, location, or other attributes. The services are updated on the first of each month.

Example services:

Zoological Species Occurrences



Botanical Species Occurrences

Requirements for access:

An Organizational AGOL account with one of MTNHP's collaborating partners.

See also: MTNHP Data Use Terms and Conditions.

Requesting access:

To request access to these resources, please reach out to Braden Burkholder, bburkholder@mt.gov. Include your **AGOL username** in your correspondence.

Accessing the data:

Once you have accepted the invitation to the AGOL group (NHP Data Resources), you may either use an online map viewer/application or desktop GIS software (e.g. ArcGIS Pro) to view and query the data. Either:

1. navigate to a service under the AGOL group content in a web browser or
2. log in to ArcGIS Pro and add the service(s) listed in My Groups (found in Catalog or Add Data).

Inductive Modeling with Maxent

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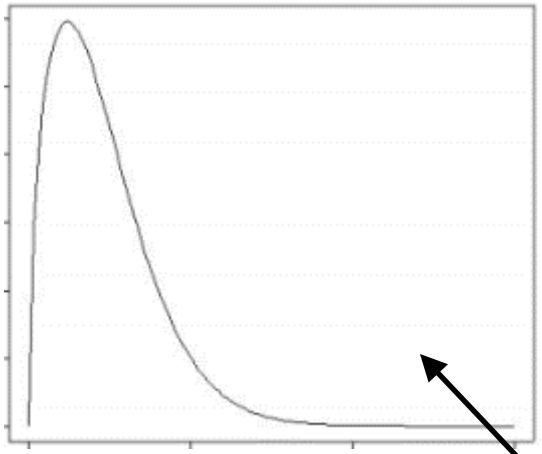
- **Ideal for positive data only**
- **Uses random background points as pseudo-absences**
- **Uses different levels of complexity depending on amount of data available**
- **Logistic output interpretable as relative habitat suitability**
- **Output is generally satisfactory in regions with at least some observation points**
- **Equivalent or superior to other predictive modeling approaches (*Elith et al. 2006 - Ecography 29: 199-151*)**
- **Uses empirical distributions to constrain estimated distributions**
- **Iterative machine learning approach with deterministic outcome**

Maxent Algorithm

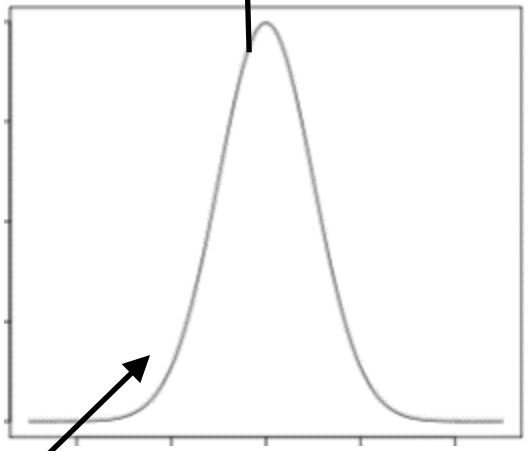
Phillips et al. 2006 - Ecological Modelling 190:231-259
Phillips and Dudik 2008 – Ecography 31:161-175

$$P(x) = \exp(c1 * f1(x) + c2 * f2(x) + c3 * f3(x)\ldots) / Z$$

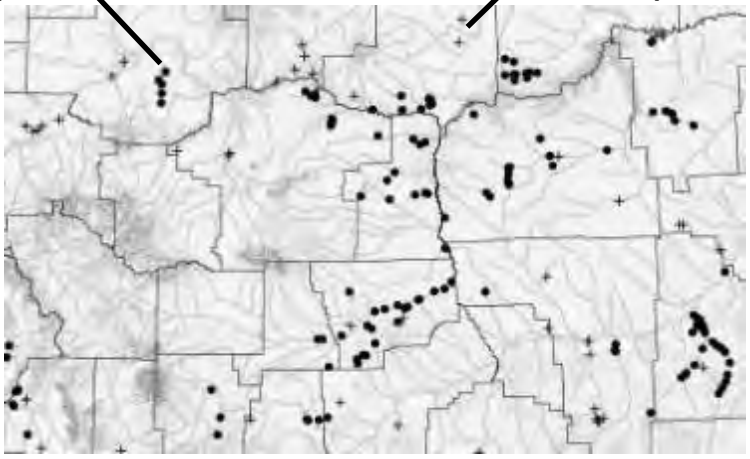


Empirical Distribution
(Positive Observations)

→ Constraints →



Estimated Distribution
(Background Points)



Constraints

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NATURAL HERITAGE PROGRAM

Number of Samples	Feature Class
0-9	Linear (variable)
≥ 10	above + Quadratic (square of variable)
≥ 15	above + Hinge (linear, but constant below a threshold)
≥ 80	above + Product (product of two variables) and Threshold (0 or 1, binary transformation)

44 Environmental Input Layers

Layer Name	Class	Variable	Original Scale
NED_AspectEW	Landform	Aspect (East-West)	≈10m
NED_AspectNS	Landform	Aspect (North-South)	≈10m
NED_Elevation	Landform	Elevation	≈10m
NED_Ruggedness	Landform	Ruggedness	≈10m
NED_Slope	Landform	Slope	≈10m
NED_SRISummer	Landform	Summer Solar Radiation	≈10m
NED_SRIWinter	Landform	Winter Solar Radiation	≈10m
NED_TPI	Landform	Topographic Position Index	≈10m
NHD_Dist2WaterEdge	Hydrography	Distance to Water Edge	vector
NHP_AnthroInfl	Human	Anthropogenic Influence	vector
NRCS_FrostFreeDays	Climate	Frost Free Days	30m
NRCS_REAP	Climate	Relative Effective Annual Precipitation	10m
PRISM_Precipitation	Climate	Annual Precipitation	≈800m
PRISM_WinPrecip	Climate	Percent Winter Precipitation	≈800m
SoilGrid_BD	Soils	Bulk Density	100m
SoilGrid_Clay	Soils	Percent Clay	100m
SoilGrid_EC	Soils	Electric Conductivity	100m
SoilGrid_OrgC	Soils	Organic Carbon	100m
SoilGrid_pH	Soils	Soil pH	100m
SoilGrid_Sand	Soils	Percent Sand	100m
SoilGrid_Silt	Soils	Percent Silt	100m
SoilGrid_TotN	Soils	Total Nitrogen	100m

Layer Name	Class	Variable	Original Scale	D
LC_AgDry_97	Landcover	Developed - Dry Agriculture	30m	P I r
LC_AgIrr_97	Landcover	Developed - Irrigated Lands	30m	P I r
LC_Alpine_97	Landcover	Alpine	30m	P v
LC_Barren_97	Landcover	Sparse and Barren	30m	P v
LC_Developed_97	Landcover	Developed - All Other	30m	P t (
LC_ForestBurn_97	Landcover	Forest - Burned	30m	P v
LC_ForestConif_97	Landcover	Forest - Conifer	30m	P v
LC_ForestDecid_97	Landcover	Forest - Deciduous	30m	P v
LC_ForestHarv_97	Landcover	Forest - Harvested	30m	P v
LC_ForestInsct_97	Landcover	Forest - Insect Killed	30m	P v
LC_Grassland_97	Landcover	Grasslands	30m	P t
LC_IntroVeg_97	Landcover	Introduced Vegetation	30m	P V r
LC_ShrubBurn_97	Landcover	Shrublands - Burned	30m	P v
LC_Shrubland_97	Landcover	Shrublands	30m	P t
LC_WetRip_97	Landcover	Wetland Riparian	30m	P R r
LC_Dist2Forest	Landcover	Distance to Forest	30m	D c
MCO_DegreeDays	Climate	Degree Days	800m	A f
MCO_MaxSumTemp	Climate	Maximum Summer Temp	800m	A 2
MCO_MinWinTemp	Climate	Minimum Winter Temp	800m	A 1
MCO_NDVI	Climate	Normalized Difference Vegetation Index	925m	N y s
MTGeol_Dist2Alluv	Geology	Distance to Alluvium	vector	D u
MTGeol_Dist2C03	Geology	Distance to Carbonate Rock	vector	D c
Layer Name	**Class**	**Variable**	**Original Scale**	**D**
NED_AspectEW	Landform	Aspect (East-West)	≈10m	A
NED_AspectNS	Landform	Aspect (North-South)	≈10m	A
NED_Elevation	Landform	Elevation	≈10m	E

Example Modeling for Dyer's Woad

- 945 total records
- 885 with acceptable locational uncertainty (≤800 m)
- 32 spatially independent (separated by ≥1,600 meters)
- Use ~29 training and 3 test points per fold

Continuous Model Output for Dyer's Woad

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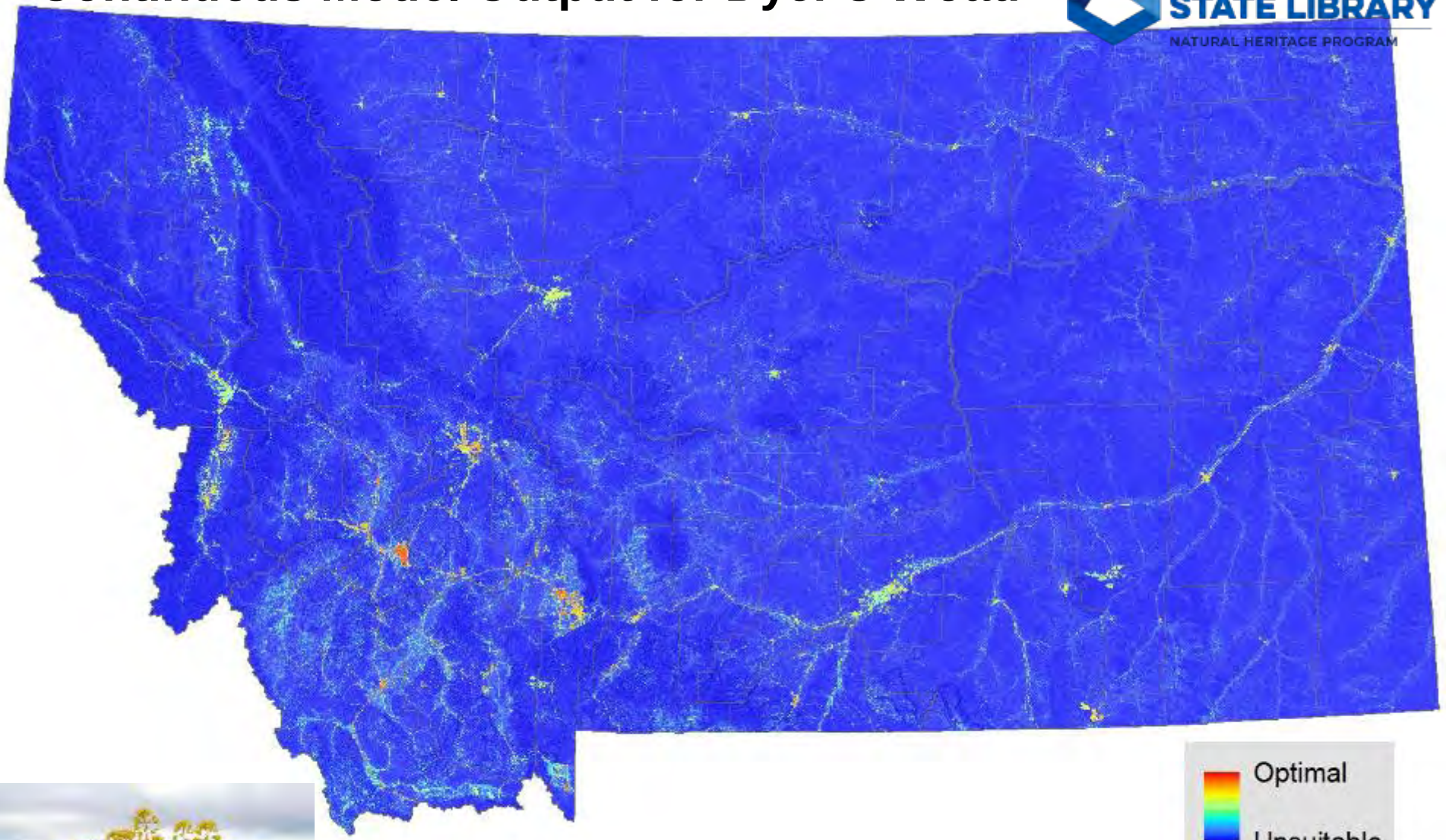
NATURAL HERITAGE PROGRAM



Delineating Habitat Suitability Classes

(Hirzel et al. 2006)

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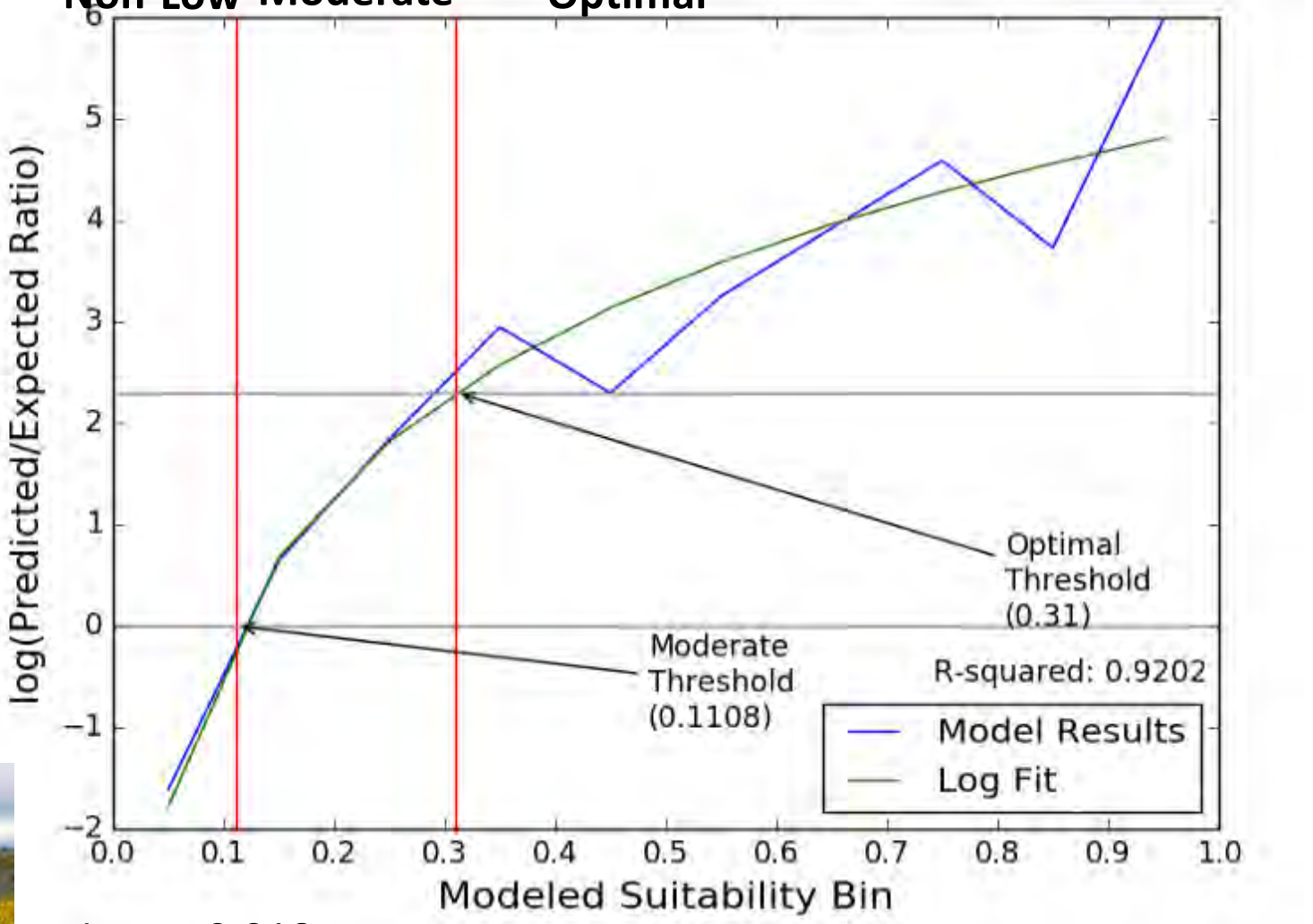
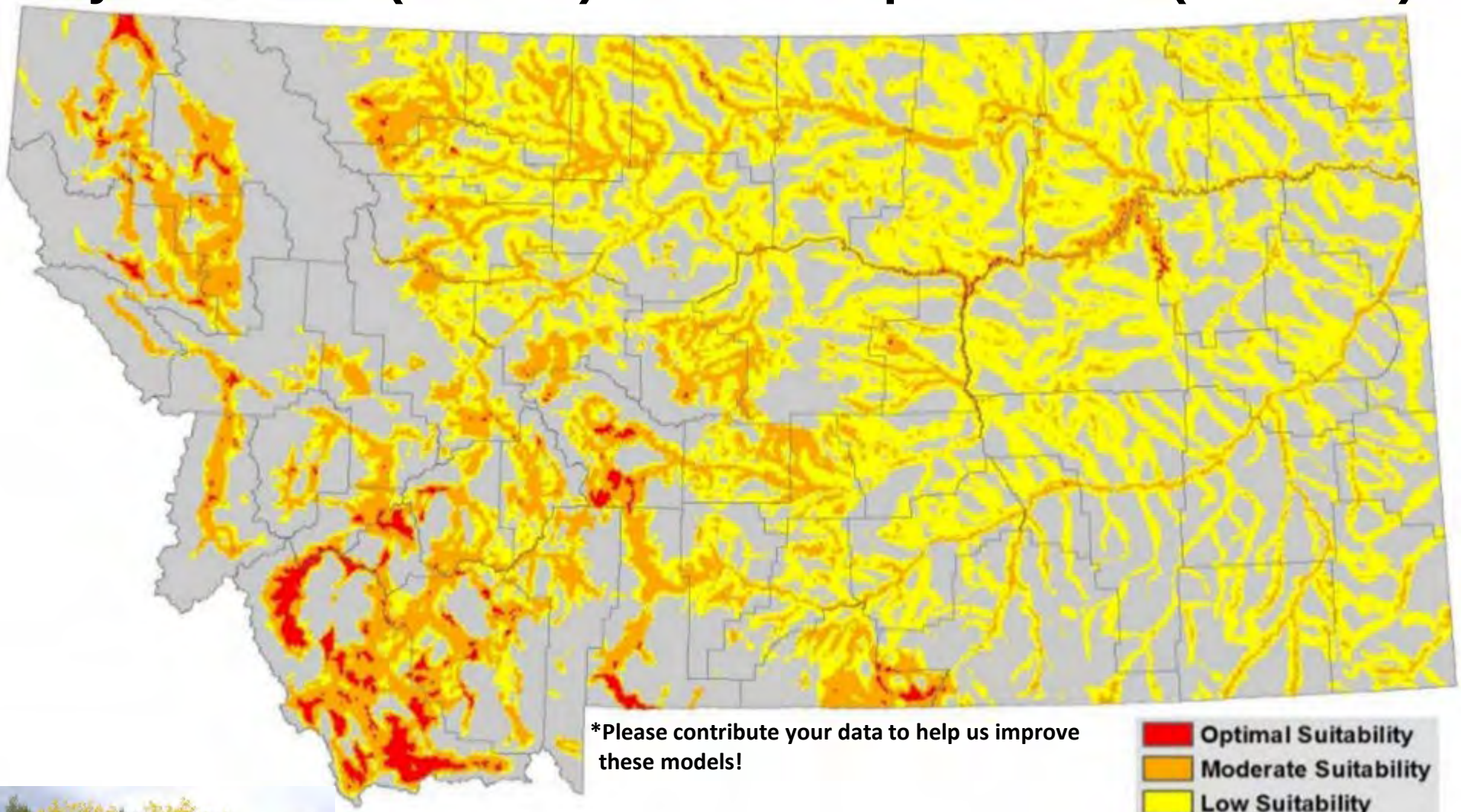
Non Low Moderate Optimal



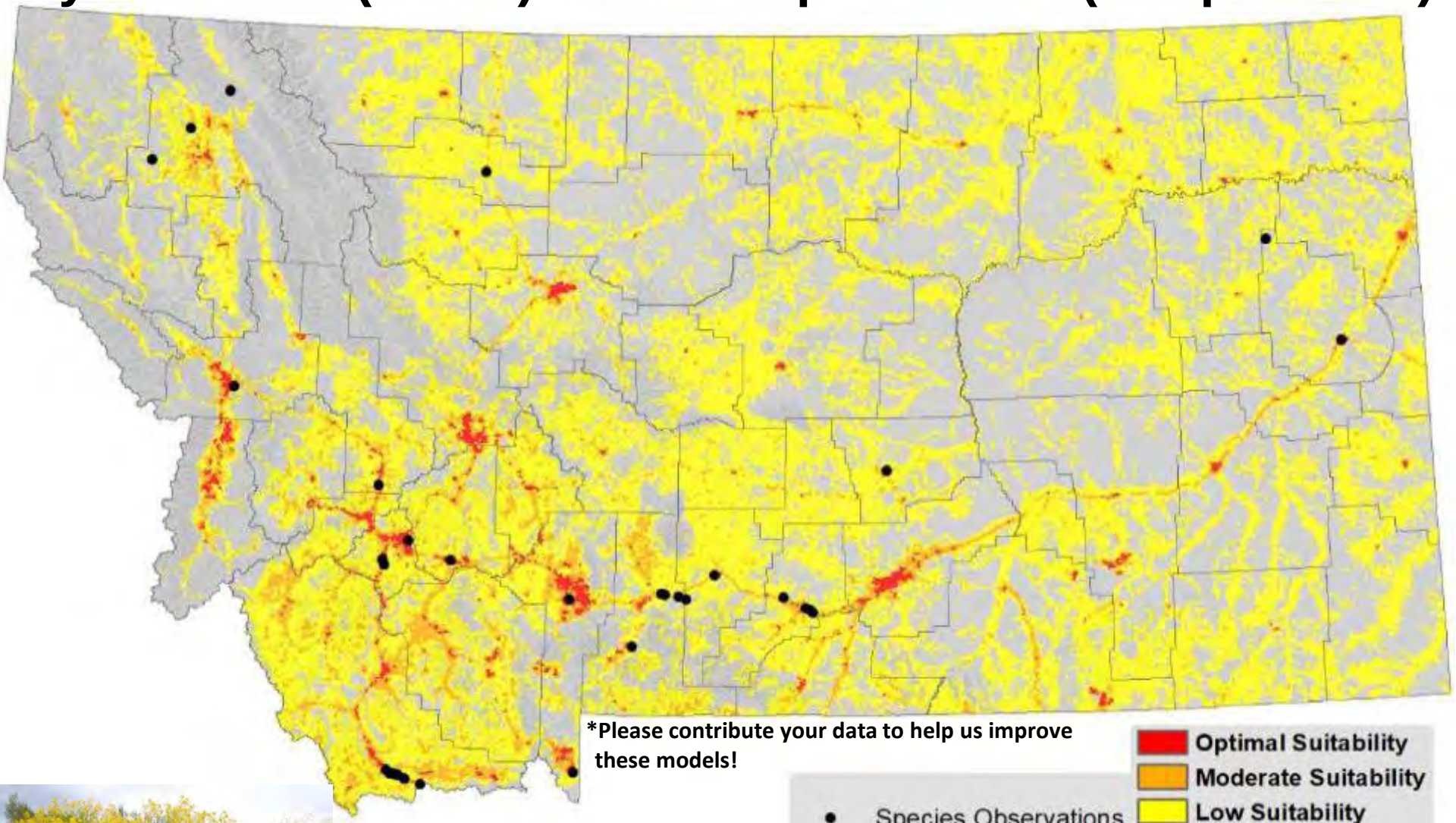
Low = 0.018

Dyer's Woad (1/25/19)…model improvement (see next)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.095	113,617	30%
Moderate	0.231	54,220	14%
Optimal	0.627	8,146	2%

Dyer's Woad (4/7/21)..model improvement (see previous)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.018	117,956	31%
Moderate	0.111	13,878	4%
Optimal	0.310	6,065	2%

Dalmatian Toadflax (*Linaria dalmatica*) (3/26/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.048	110,643	29%
Moderate	0.175	42,841	11%
Optimal	0.521	10,130	3%

N2B

Dalmation Toadflax Stem-boring Weevil (*Mecinus janthiniformis*)

(8/20/18)

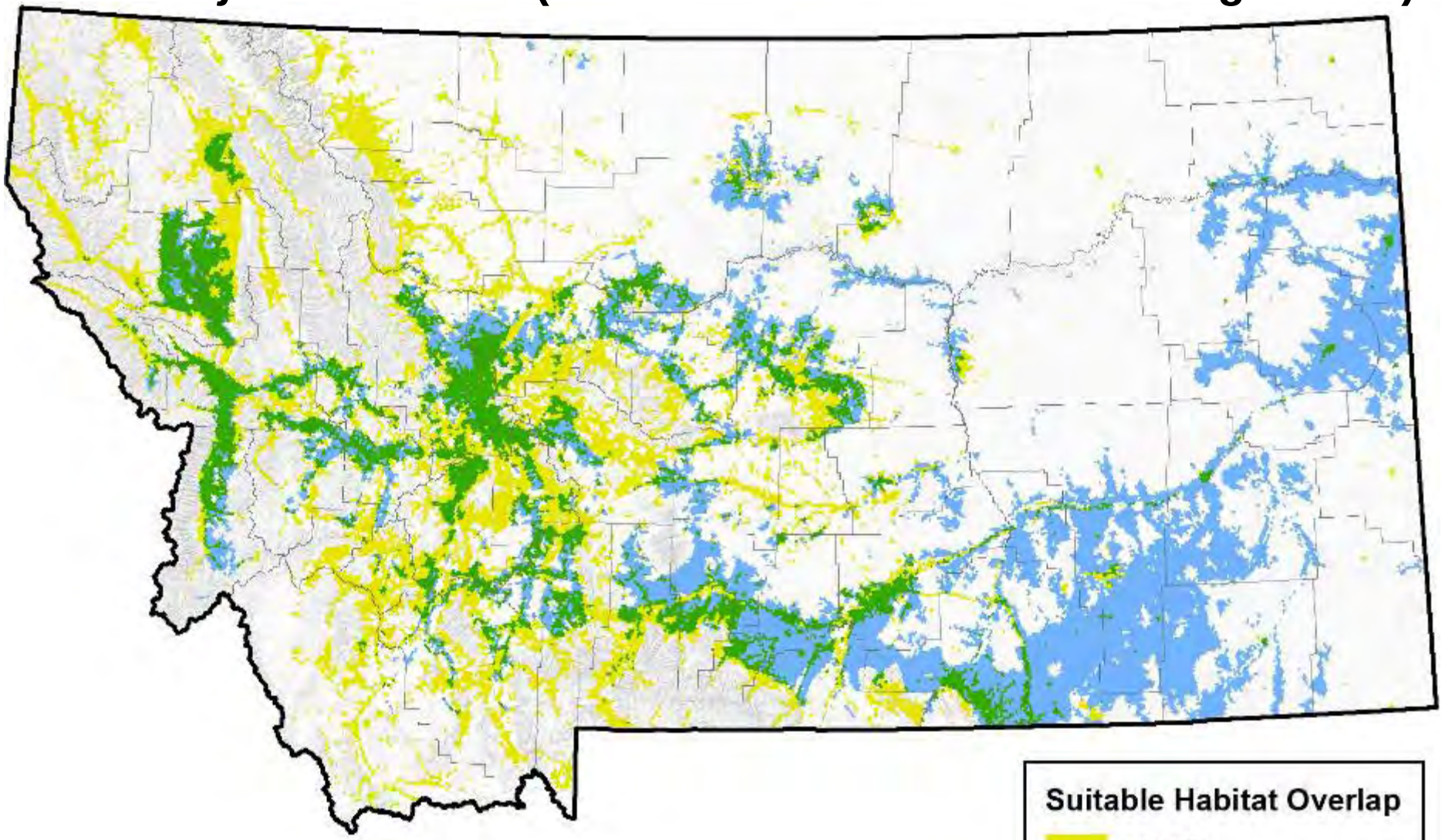
Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.048	179,606	47%
Moderate	0.324	62,501	16%
Optimal	0.732	5,448	1%

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

Biocontrol

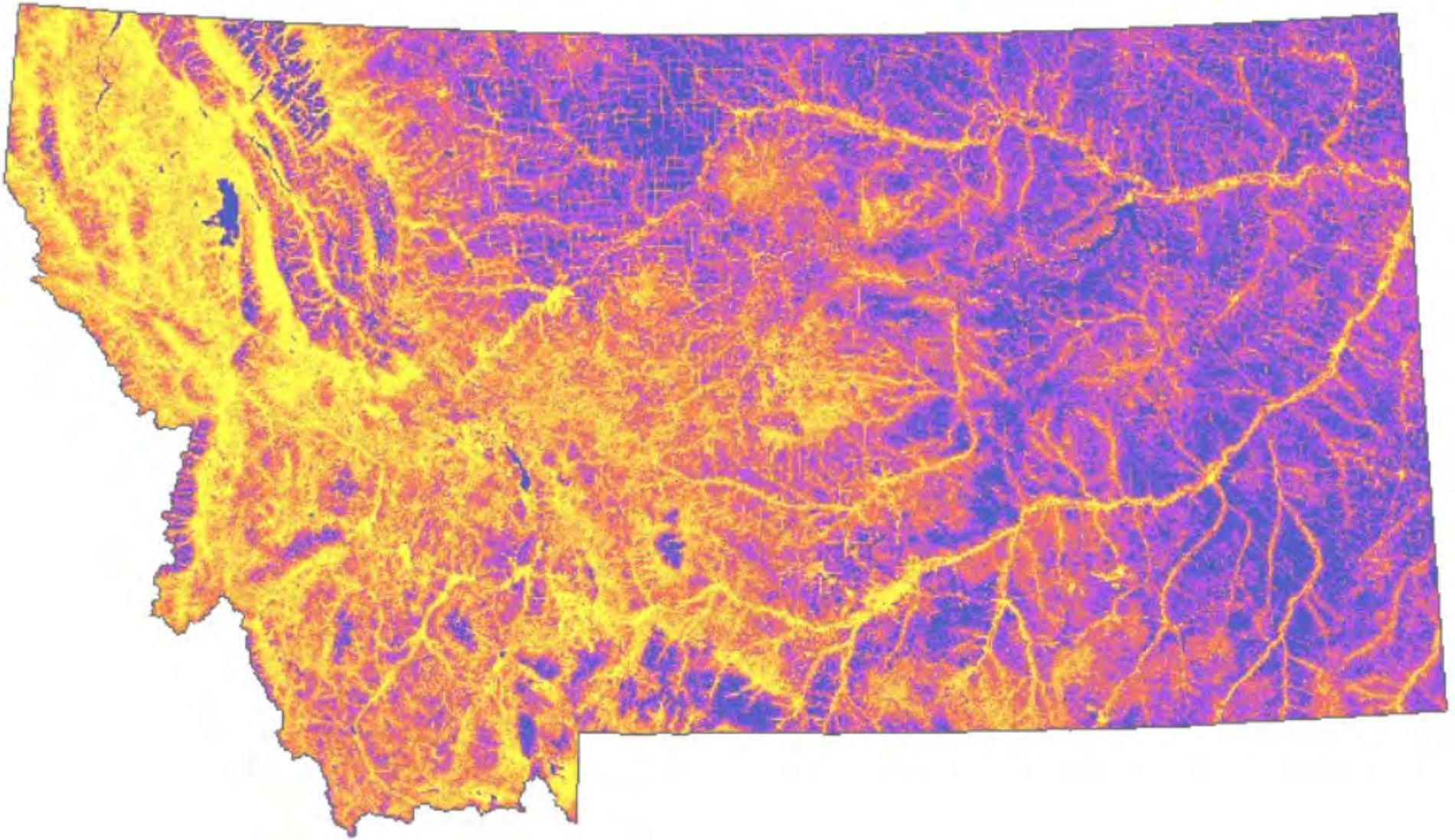
Overlay of Dalmatian Toadflax and its Biocontrol

Mecinus janthiniformis (Dalmatian Toadflax Stem-boring Weevil)



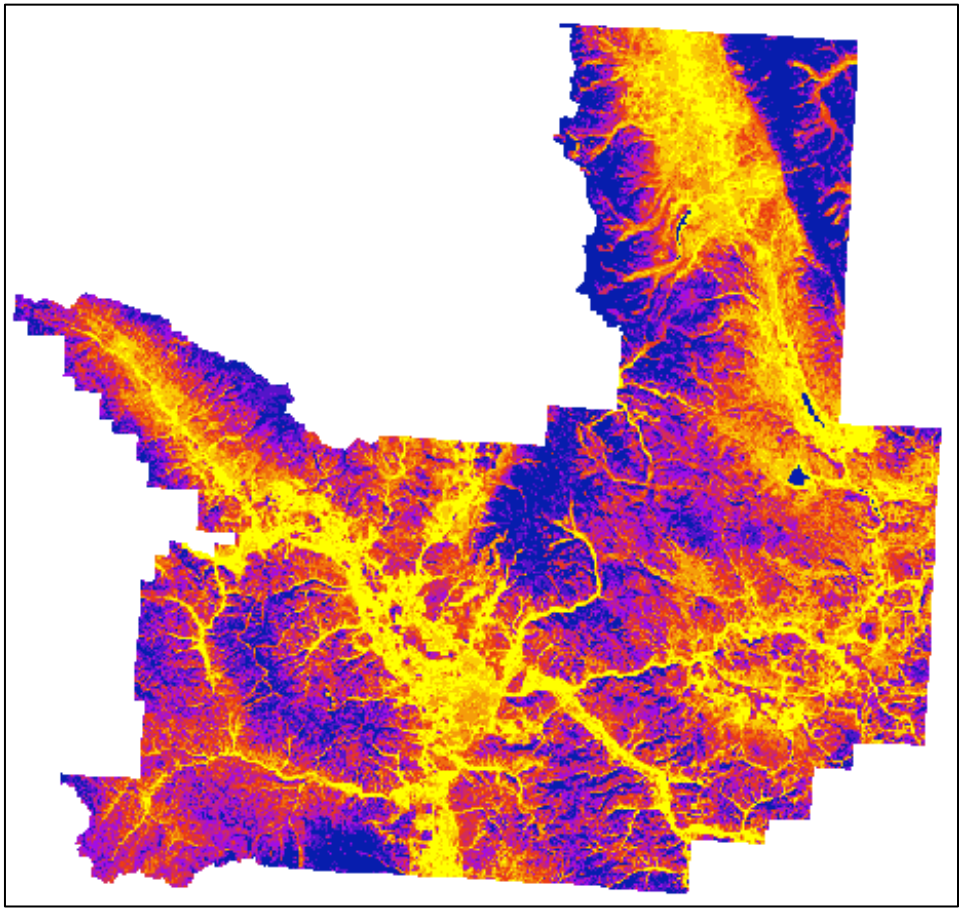
Moderate and optimal suitability for both Dalmation Toadflax and Dalmation Toadflax Stem-boring Weevil. Green areas indicate model support for most effective releases of the biocontrol.

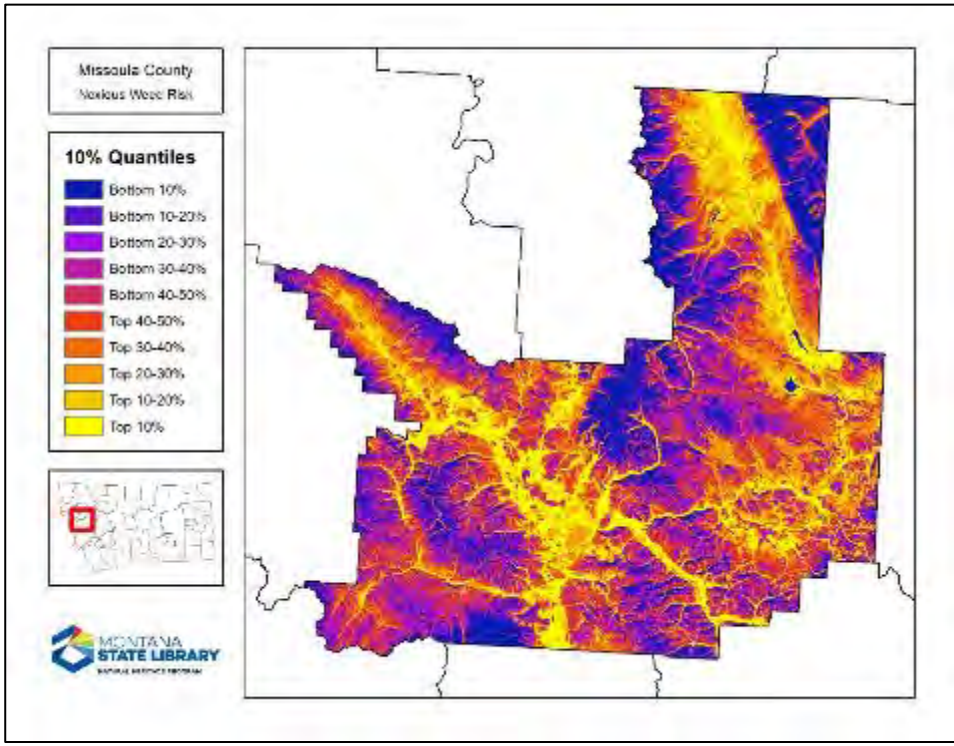
Cumulative Statewide Risk of Invasion by 41 Modeled State-listed Noxious Weeds



*** Statewide categorical 90 x 90-meter pixel outputs for individual species' models were scored as (Optimal = 1, Moderate = 0.75, Low = 0.25, unsuitable = 0), added across all species, binned into 10 equal quantiles, and displayed with hotter to cooler colors representing higher to lower cumulative risk of invasion.**

Rescaled Output to show Cumulative Risk of Invasion within Missoula County for State-listed Noxious Weeds





*** Output available with and without legend for all counties, BLM Field Offices, National Forests, FWP Regions, and Tribal Reservations.**

*** Cumulative risk relative to within County. Compare with previous slide with relative risk statewide.**

*** At statewide and county scales, categorical 90 x 90-meter pixel outputs for individual species' models were scored as (Optimal = 1, Moderate = 0.75, Low = 0.25, unsuitable = 0), added across all species, binned into 10 equal quantiles, and displayed with hotter to cooler colors representing higher to lower cumulative risk of invasion.**

Species Where Climate Variables Were In the Top Three of Importance for 44 Environmental Variables Used

Climate Variables Included: Growing Degree Days, Maximum Summer Temperature, Minimum Winter Temperature, Number of Frost-Free Days, Total Annual Precipitation, Winter Precipitation, and Relative Effective Annual Precipitation (REAP)

*Numbers in table indicate importance rank of variable.

**Future climates may be conducive to enhanced spread of these species.

***Tabulated for models completed in 2021 & 2022. Not updated for models completed in 2023 or later.

Common Name	Growing Degree Days	Max Summer Temperature	Min Winter Temperature	Frost Free Days	REAP	Annual Precipitation	Winter Precipitation
American Water-lily	3						
Black Bindweed							3
Black Henbane	1			2			
Bladder Campion						2	
Bladder-vetch						1	
Blueweed		1	3				2
Bull Thistle				2			
Cheatgrass							1
Climbing Nightshade		2	1				
Clover Dodder			2				1
Common Blue-mustard						1	
Common Bugloss			3				2
Common Burdock						1	
Common Crupina	1						
Common Mullein	3						
Common Shepherd's Purse						2	
Common St. John's-wort							1
Common Tansy		1					3
Common Teasel	2	1	3				
Common Wormwood	2						
Curly Dock							2
Desert Alyssum	1						
Diffuse Knapweed					2		1
Eurasian Water-milfoil		1			2		
Field Bindweed						3	2

Common Name	Growing Degree Days	Max Summer Temperature	Min Winter Temperature	Frost Free Days	REAP	Annual Precipitation	Winter Precipitation
Garlic Mustard					2		
Germander Speedwell			1				
Ground-cherry Nightshade					2		
Halogeton						1	
Hoary False-alyssum		3					
Japanese Knotweed			2				3
Knotweed	2		3				
Leafy Spurge						3	1
Lenspod Whitetop					3		
Medusahead					1	2	
Musk Thistle		2					
Narrowleaf Dock						3	1
Narrowleaf Hawksbeard					1		
Night-flowering Catchfly	3						
Orange Hawkweed	2						
Oxeye Daisy							2
Prickly Lettuce							2
Puncture-vine		3					
Reed Canarygrass	3			1			
Rush Skeletonweed			1				
Russian Thistle						1	
Scentless Chamomile							1
Scotch Broom							3
Scotch Thistle	3						
Sheep Sorrel			2				

Common Name	Growing Degree Days	Max Summer Temperature	Min Winter Temperature	Frost Free Days	REAP	Annual Precipitation	Winter Precipitation
Small-flowered Forget-me-not				3			
Spotted Cat's-ear							3
Spotted Knapweed						3	
Sprangletop		2					
Stork’s Bill			2				
Sulphur Cinquefoil		3					2
Tall Baby's-breath					3		
Tansy Ragwort	1			3			
Urban Spurge					1		3
Ventenata	2	3					
Whitetop	2						3
Yellow Mignonette							3
Yellow Sweetclover	2	1					3
Yellow Toadflax	2						3
Yellowflag Iris		1	2				

State-listed Noxious Weeds & Regulated Plants

Models can be viewed in the Single Species Overview Task in Map Viewer with agency-level sign in at:
https://mtnhp.org/mapviewer

Model write ups are available for download at:
https://mtnhp.org/models/

You can request geodatabases of model outputs at:
https://nris.mt.gov/reqapp/userMain.asp

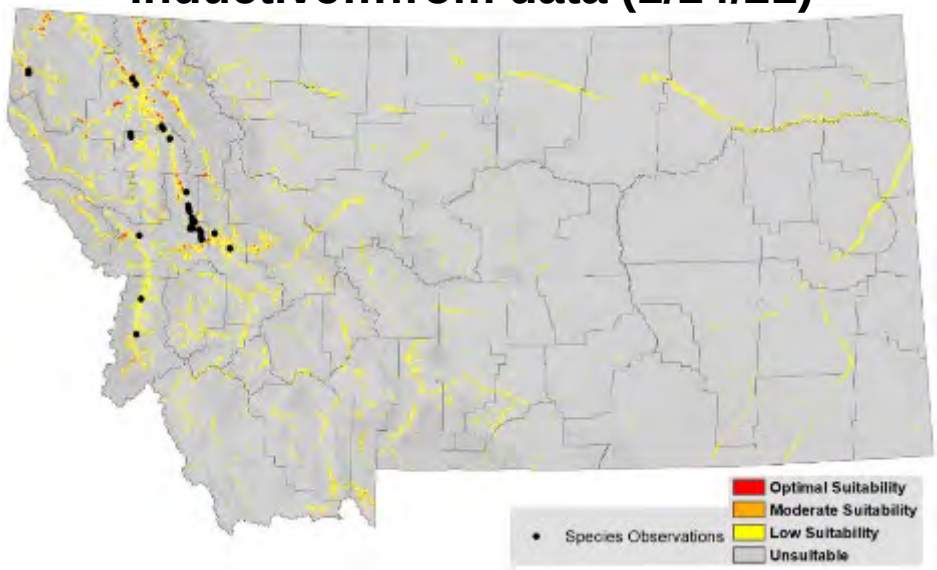
Status listings highlighted in yellow have changed since the 2023 version of this presentation.

Common Name	MT	ID	B.C.	AB	SK	ND	SD	WY
American Water-lily	AIS							
Blueweed	N1B	Control	Regional Noxious	Noxious			Watch	
Bohemian Knotweed	N1B	Control	Noxious	Prohibited Noxious				
Brazilian Waterweed	R3	EDRR						
Brittleleaf Naiad	AIS							
Canada Thistle	N2B	Containment	Noxious	Noxious	Noxious	Noxious	Noxious	Noxious
Cheatgrass	R3			Noxious	Noxious			
Common Buckthorn	N2A			Prohibited Noxious	Noxious			
Common Hound's-tongue	N2B	Containment	Noxious	Noxious	Prohibited	Noxious		Noxious
Common St. John's-wort	N2B		Invasive of Concern	Prohibited Noxious				Noxious
Common Tansy	N2B		Regional Noxious	Noxious	Noxious			Noxious
Common Water Hyacinth	AIS	EDRR						
Curly-leaf Pondweed	N2B/AIS	Containment			Prohibited			
Dalmation Toadflax	N2B	Containment	Noxious	Noxious	Prohibited	Noxious		Noxious
Diffuse Knapweed	N2B	Containment	Noxious	Prohibited Noxious	Prohibited	Noxious		Noxious
Dyer's Woad	N1A	Control		Prohibited Noxious			Watch	Noxious
Eurasian Water-milfoil	N2A/AIS	Control		Prohibited Noxious	Prohibited			
European Common Reed	N1A	Control	Noxious					
Fanwort	AIS	EDRR						
Field Bindweed	N2B	Containment		Noxious	Noxious			Noxious
Flowering-rush	N2A/AIS	Control	Noxious	Prohibited Noxious	Prohibited			
Giant Knotweed	N1B	Control	Noxious	Prohibited Noxious				
Hoary False-alyssum	N2B	Containment	Regional Noxious	Prohibited Noxious	Noxious			
Hydrilla	R3	EDRR						
Japanese Knotweed	N1B	Control	Noxious	Prohibited Noxious				

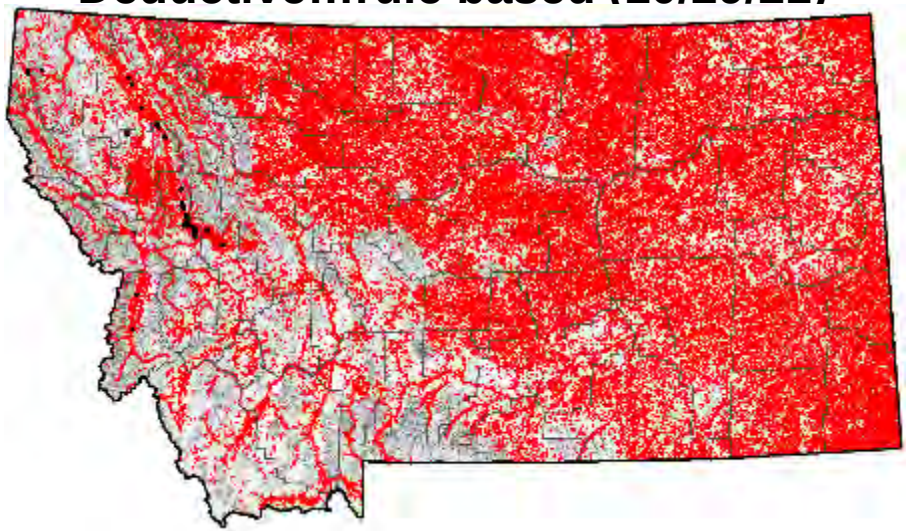
Common Name	MT	ID	B.C.	AB	SK	ND	SD	WY
Kingdevil Hawkweed	N2A							
Leafy Spurge	N2B	Containment	Noxious	Noxious	Noxious	Noxious	Noxious	Noxious
Meadow Hawkweed	N2A	Control		Prohibited Noxious				
Medusahead	N1A			Prohibited Noxious			Watch	Noxious
Orange Hawkweed	N2A	Control	Regional Noxious	Prohibited Noxious			Watch	
Oxeye Daisy	N2B	Containment	Regional Noxious	Noxious	Prohibited			Noxious
Parrot Feather Water-milfoil	R3	Control						
Perennial Pepperweed	N2A	Containment	Regional Noxious	Noxious	Prohibited			Noxious
Purple Loosestrife	N1B	Containment	Noxious	Prohibited Noxious	Noxious	Noxious	Noxious	Noxious
Rush Skeletonweed	N1B	Containment	Noxious	Prohibited Noxious			Watch	
Russian Knapweed	N2B	Control	Regional Noxious	Prohibited Noxious	Noxious	Noxious	Watch	Noxious
Russian Olive	R3							Noxious
Salt Cedar	N2B	Containment		Prohibited Noxious	Prohibited	Noxious	Noxious	Noxious
Scotch Broom	N1B	Control	Invasive of Concern					
Spotted Knapweed	N2B	Containment	Noxious	Prohibited Noxious	Prohibited	Noxious		Noxious
Starry Stonewort	AIS	EDRR						
Sulphur Cinquefoil	N2B		Regional Noxious	Prohibited Noxious				
Tall Buttercup	N2A			Noxious				
Tall Hawkweed	N2A	EDRR						
Tansy Ragwort	N2A	Containment	Noxious	Prohibited Noxious				
Ventenata	N2A		Noxious					Noxious
Whitetop	N2B	Containment	Regional Noxious	Noxious	Noxious		Noxious	Noxious
Yellow Floating Heart	AIS	EDRR			Prohibited			
Yellow Starthistle	N1A	Containment	Noxious	Prohibited Noxious	Prohibited			Noxious
Yellow Toadflax	N2B	Containment	Noxious	Noxious	Noxious	Noxious		Noxious
Yellowflag Iris	N2A/AIS	Containment	Noxious	Prohibited Noxious				

American Water-lily (*Nymphaea odorata*)

Inductive…from data (1/14/21)



Deductive…rule based (10/29/21)



Suitability	Logistic Cutoff	Area in Km²	% of MT
Low	0.0004	3,360	1%
Moderate	0.050	295	<1%
Optimal	0.126	552	<1%

This is a simple rule-based model for aquatic invasive plants that have invaded Montana or have the potential to invade Montana. The rules applied were as follows:

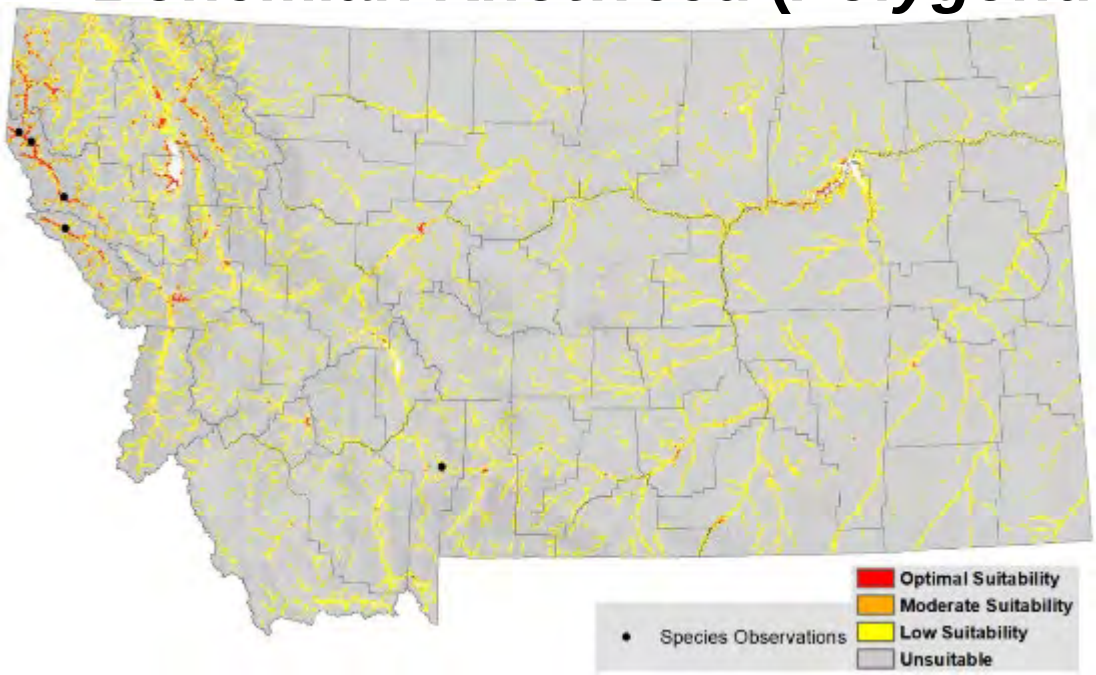
- Include modern National Wetland Inventory mapped wetland areas for palustrine systems with Permanently Flooded or Intermittently Exposed water regimes and lacustrine systems (Limnetic and Littoral) with Permanently Flooded or Intermittently Exposed water regimes
- Include National Hydrography Dataset features for Reservoirs, Lakes, Ponds, Rivers and large Streams
- Exclude the interior limnetic areas of Flathead Lake, Canyon Ferry Reservoir, and Fort Peck
- Exclude any features above 7000 ft (2135 m) in elevation

Blueweed (*Echium vulgare*) (4/9/24)

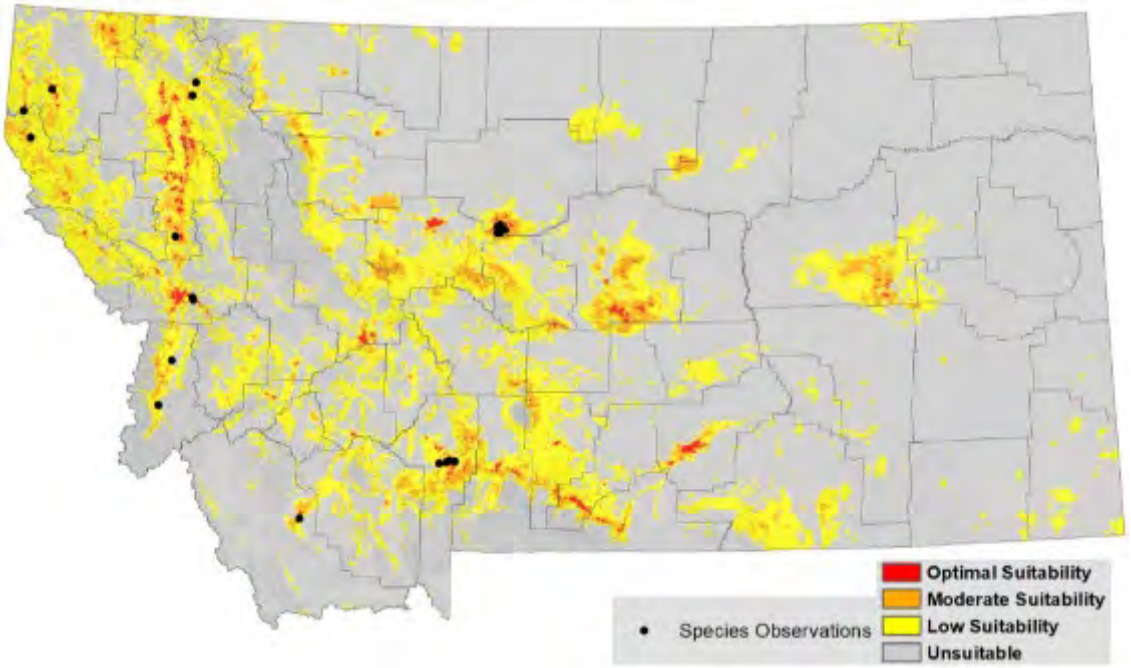
Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.011	36,556	10%
Moderate	0.104	7,607	2%
Optimal	0.264	4,724	1%

N1B

Bohemian Knotweed (*Polygonum x bohemicum*) 4/7/24

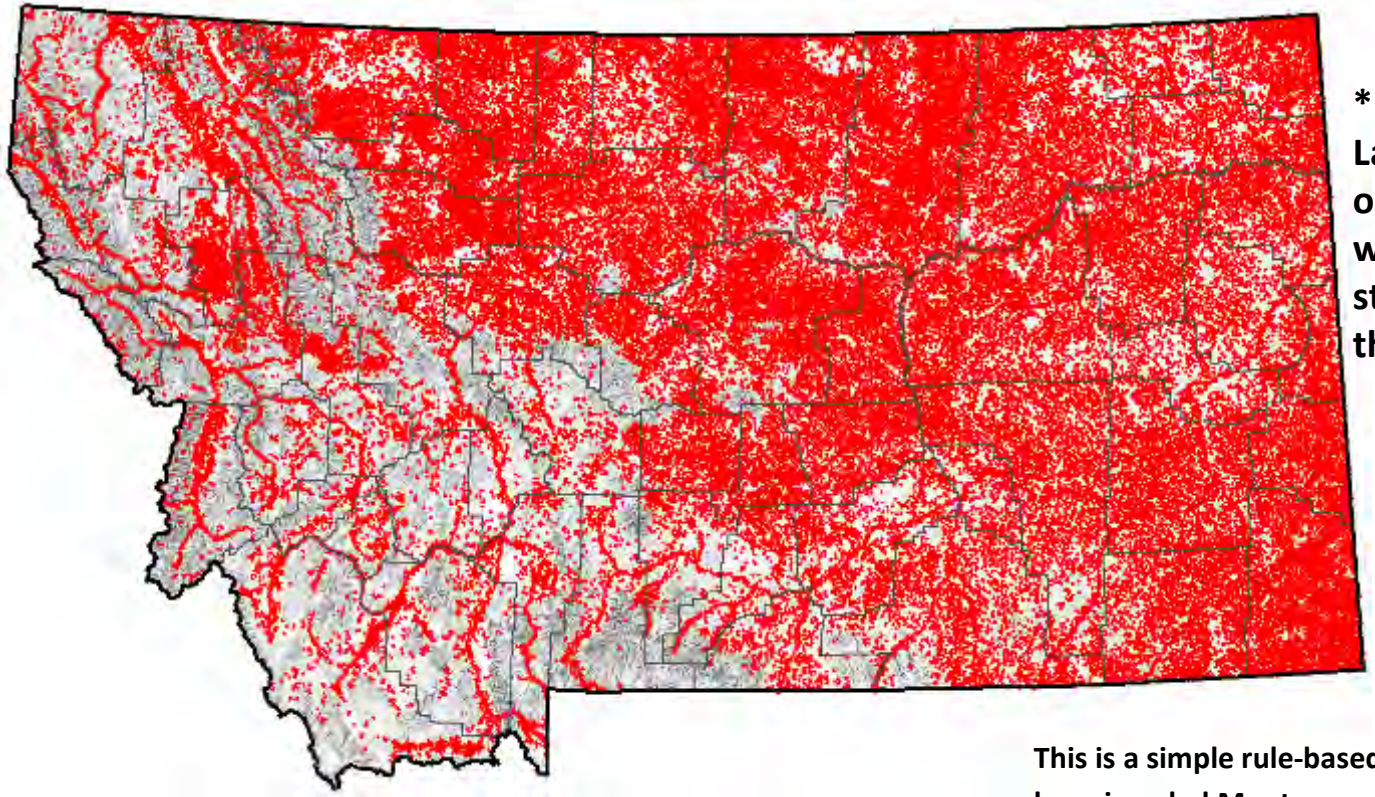


***There are only 5 records that can be used for modeling Polygonum x bohemicum. Despite that limitation, the model to the left seems very reasonable. The model below for the potential distribution of Japanese Knotweed (*Polygonum cuspidatum*) is provided for comparison.**



N1B

Brazilian Waterweed (*Egeria densa*) Deductive (10/29/21)



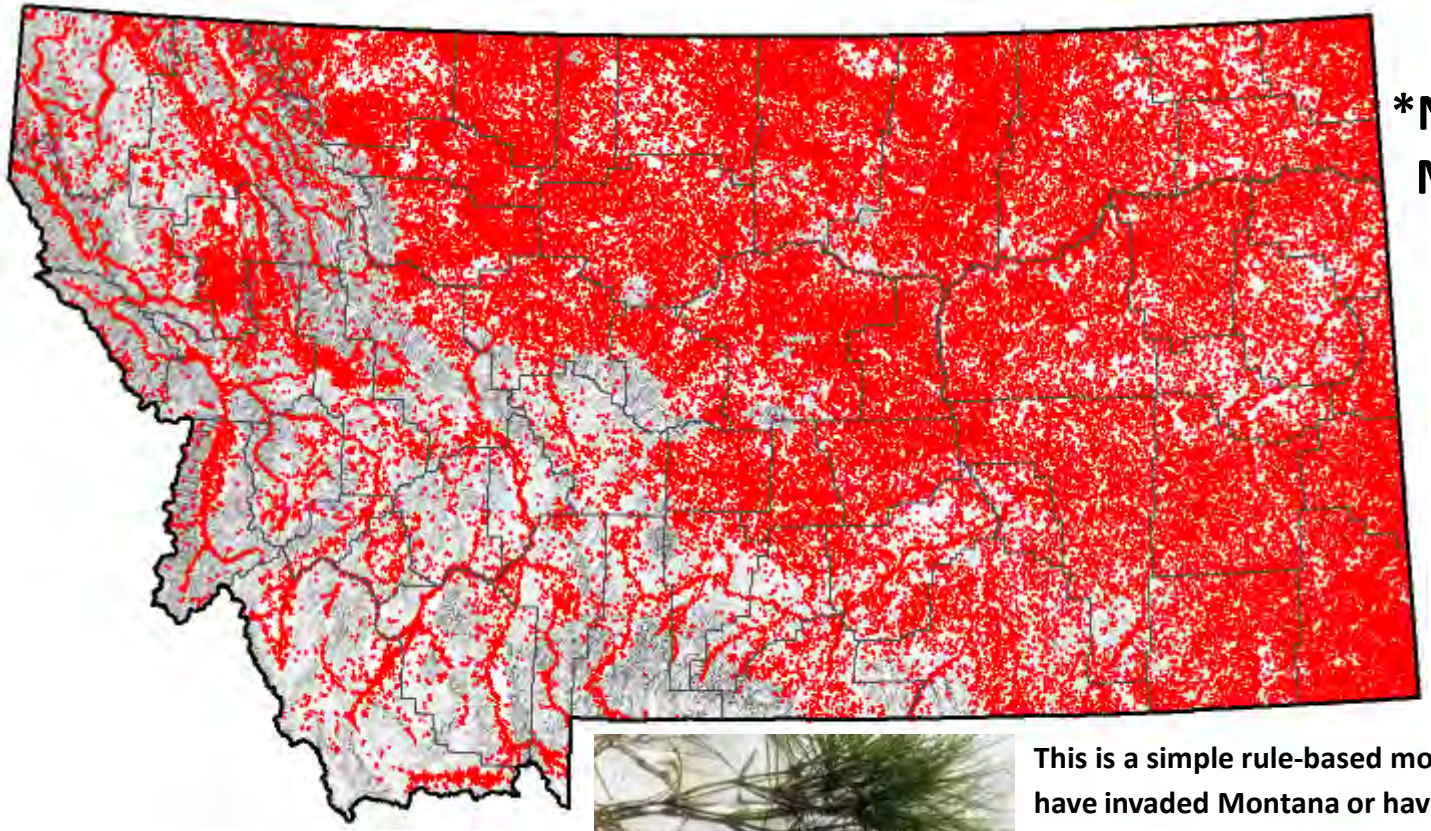
*** Reports from Georgetown Lake in 1973, 1981, & 1982 were only to genus and no specimens were collected. Thus, there is still no documented evidence of this species in Montana.**

This is a simple rule-based model for aquatic invasive plants that have invaded Montana or have the potential to invade Montana. The rules applied were as follows:

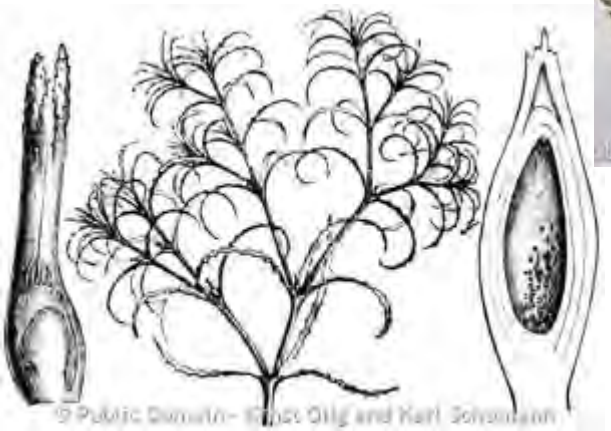
- **Include modern National Wetland Inventory mapped wetland areas for palustrine systems with Permanently Flooded or Intermittently Exposed water regimes and lacustrine systems (Limnetic and Littoral) with Permanently Flooded or Intermittently Exposed water regimes**
- **Include National Hydrography Dataset features for Reservoirs, Lakes, Ponds, Rivers and large Streams**
- **Exclude the interior limnetic areas of Flathead Lake, Canyon Ferry Reservoir, and Fort Peck**
- **Exclude any features above 7000 ft (2135 m) in elevation**

R3

Brittleleaf Naiad (*Najas minor*) Deductive (10/29/21)



***Not documented in Montana to-date.**



This is a simple rule-based model for aquatic invasive plants that have invaded Montana or have the potential to invade Montana. The rules applied were as follows:

- **Include modern National Wetland Inventory mapped wetland areas for palustrine systems with Permanently Flooded or Intermittently Exposed water regimes and lacustrine systems (Limnetic and Littoral) with Permanently Flooded or Intermittently Exposed water regimes**
- **Include National Hydrography Dataset features for Reservoirs, Lakes, Ponds, Rivers and large Streams**
- **Exclude the interior limnetic areas of Flathead Lake, Canyon Ferry Reservoir, and Fort Peck**
- **Exclude any features above 7000 ft (2135 m) in elevation**

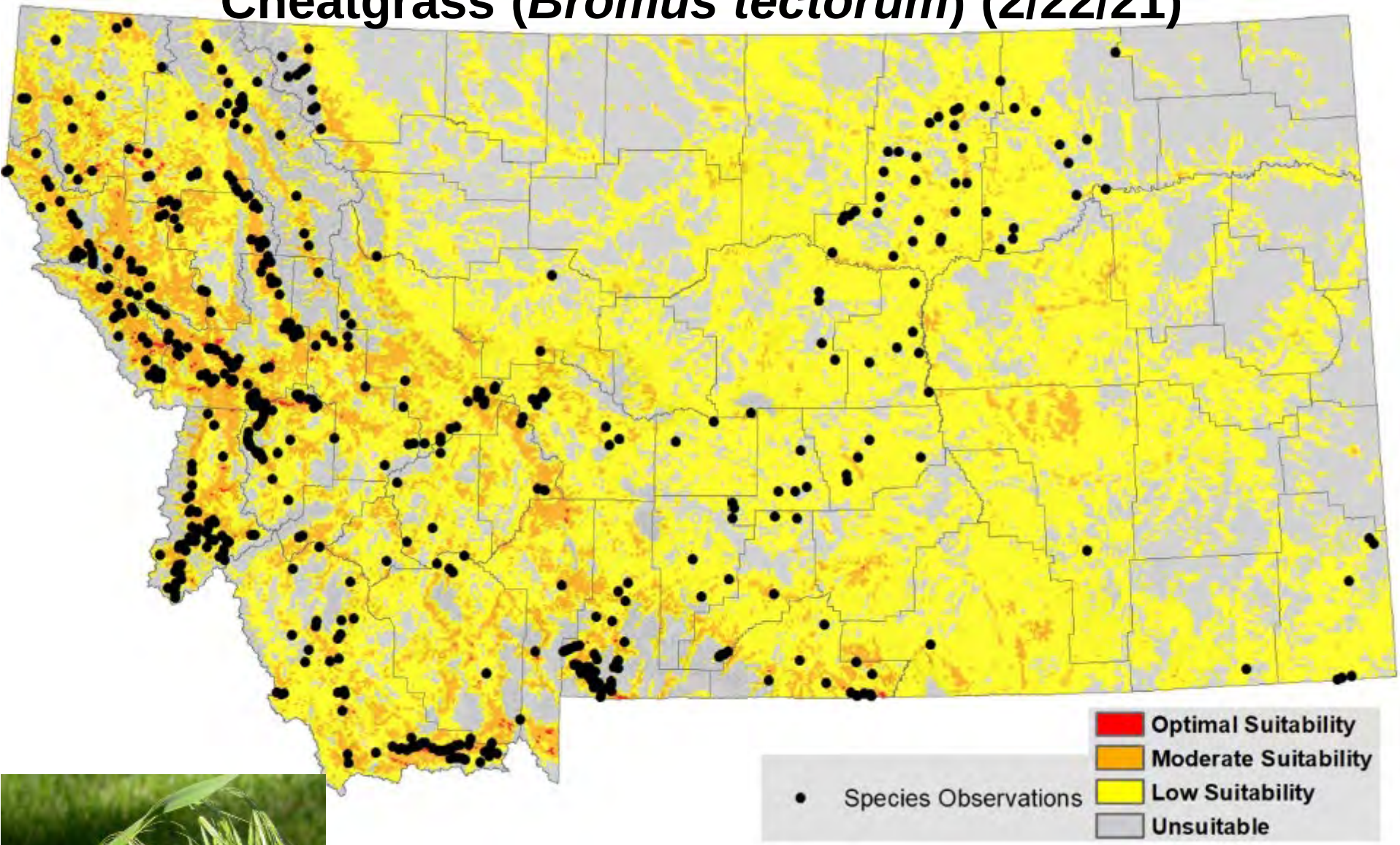
AIS

Canada Thistle (*Cirsium arvense*) (4/29/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.063	253,737	67%
Moderate	0.307	55,783	15%
Optimal	0.742	5,115	1%

N2B

Cheatgrass (*Bromus tectorum*) (2/22/21)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.062	161,034	42%
Moderate	0.280	39,256	10%
Optimal	0.660	6,878	2%

R3

Common Buckthorn (*Rhamnus cathartica*) (6/11/25)

Species Observations

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.013	43,847	12%
Moderate	0.094	5,580	1%
Optimal	0.265	4,311	1%

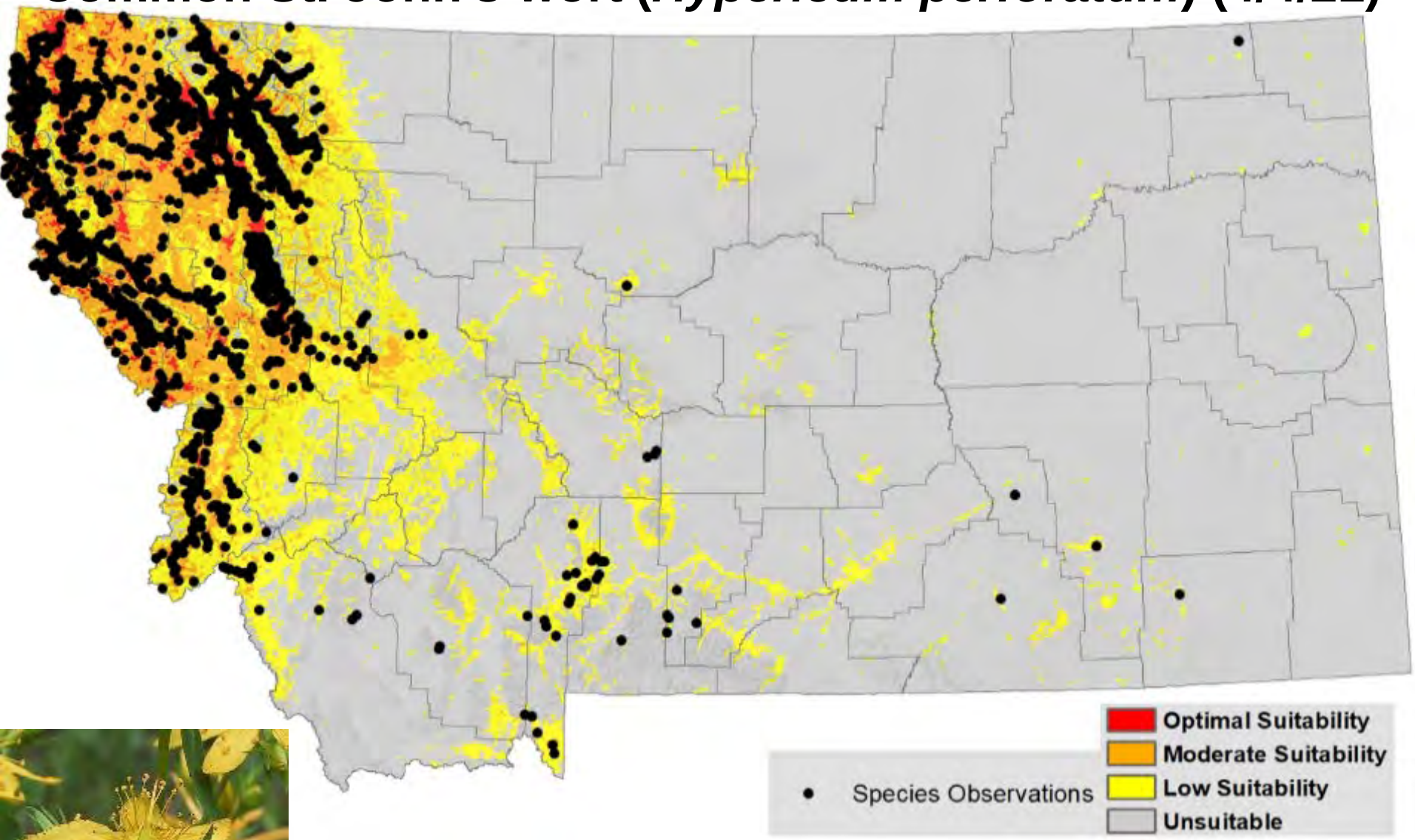
N2A

Common Hound's-tongue (*Cynoglossum officinale*) (3/24/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.059	97,706	26%
Moderate	0.212	61,322	16%
Optimal	0.614	10,120	3%

N2B

Common St. John's-wort (*Hypericum perforatum*) (4/4/21)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.027	42,768	11%
Moderate	0.154	23,712	6%
Optimal	0.411	10,660	3%

N2B

Common Tansy (*Tanacetum vulgare*) (4/15/21)

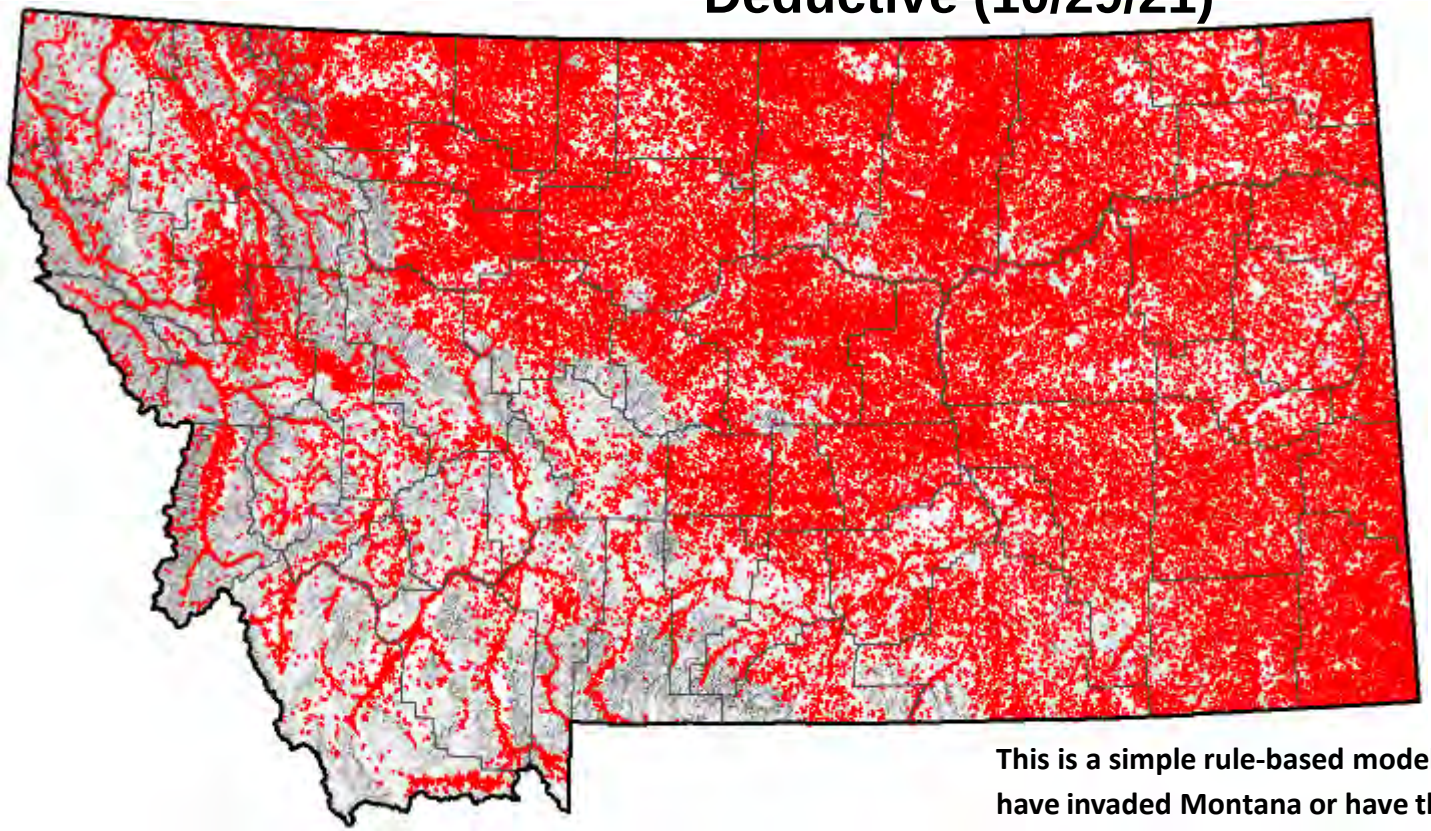
Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.029	70,715	19%
Moderate	0.149	26,538	7%
Optimal	0.423	9,638	3%

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable
Species Observations

N2B

Common Water Hyacinth (*Eichhornia crassipes*)

Deductive (10/29/21)



***Not documented in Montana to-date.**

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AIS

Curly-leaf Pondweed (*Potamogeton crispus*) (6/11/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.002	40,977	11%
Moderate	0.103	3,670	<1%
Optimal	0.238	3,530	<1%

N2B/AIS

Dalmatian Toadflax (*Linaria dalmatica*) (3/26/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.048	110,643	29%
Moderate	0.175	42,841	11%
Optimal	0.521	10,130	3%

N2B

Dalmation Toadflax Stem-boring Weevil (*Mecinus janthiniformis*)

(8/20/18)

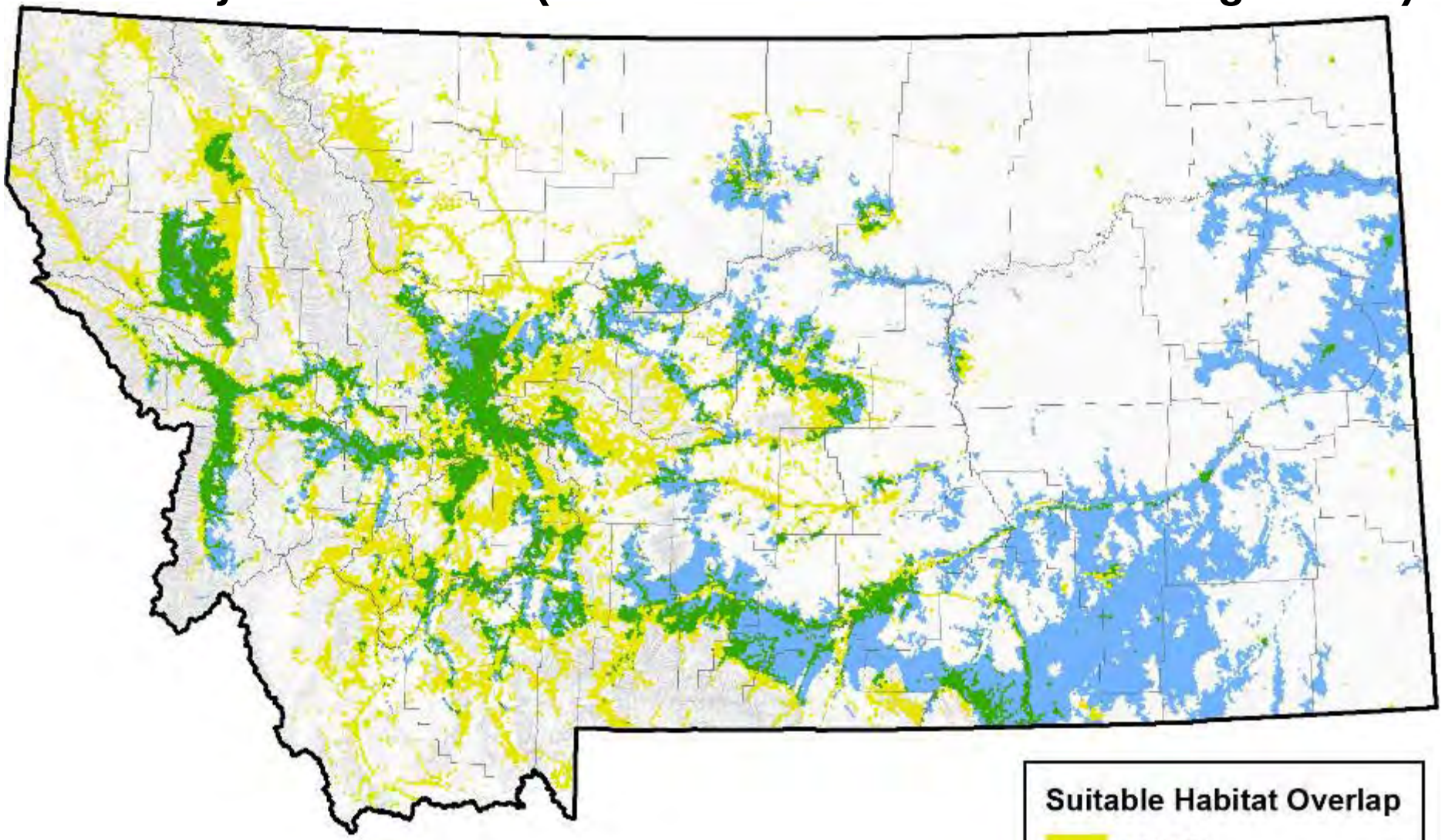
Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.048	179,606	47%
Moderate	0.324	62,501	16%
Optimal	0.732	5,448	1%

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

Biocontrol

Overlay of Dalmatian Toadflax and its Biocontrol

Mecinus janthiniformis (Dalmatian Toadflax Stem-boring Weevil)



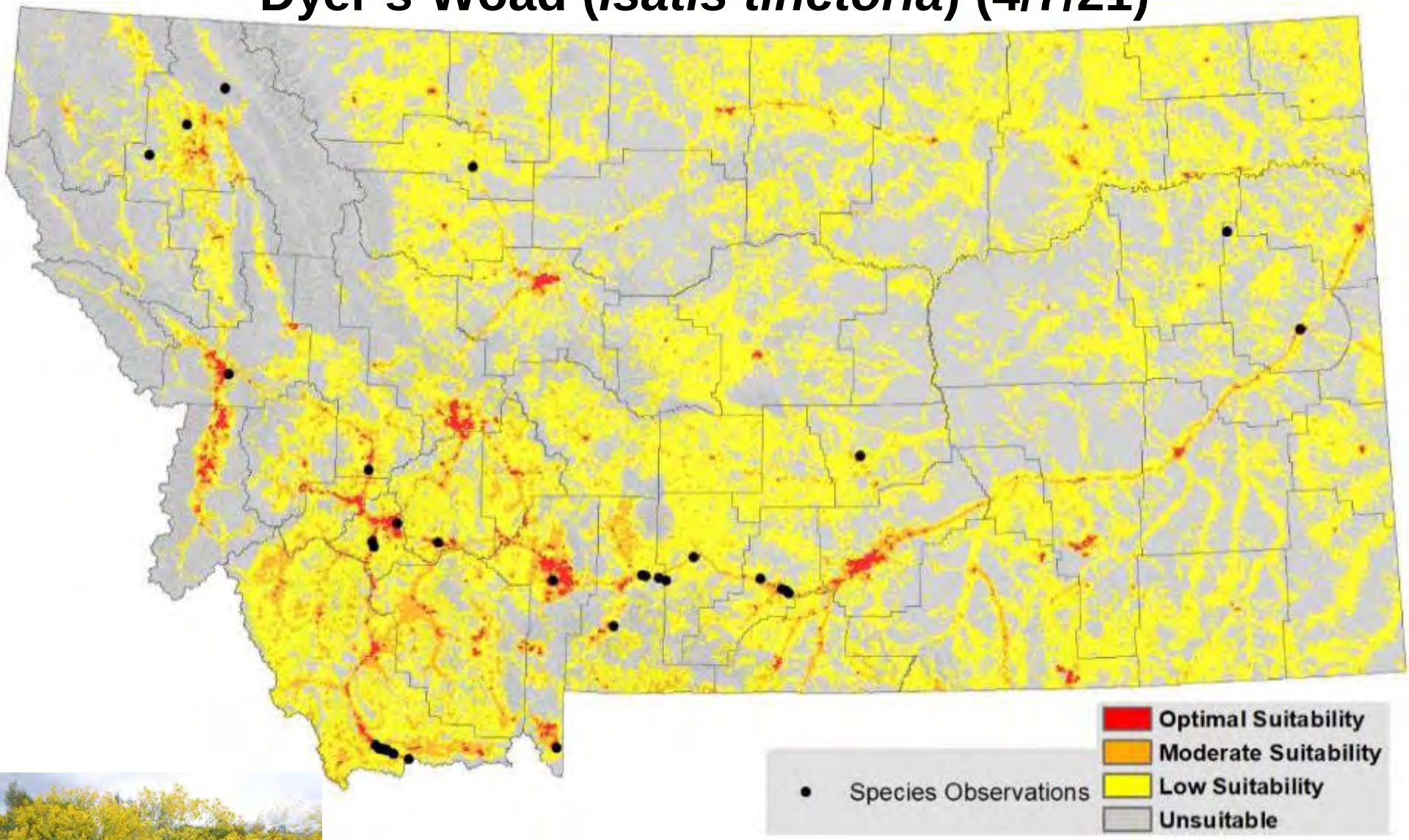
Moderate and optimal suitability for both Dalmation Toadflax and Dalmation Toadflax Stem-boring Weevil. Green areas indicate model support for most effective releases of the biocontrol.

Diffuse Knapweed (*Centaurea diffusa*) (6/11/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.024	101,327	27%
Moderate	0.126	30,797	8%
Optimal	0.514	4,733	1%

N2B

Dyer's Woad (*Isatis tinctoria*) (4/7/21)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.018	117,956	31%
Moderate	0.111	13,878	4%
Optimal	0.310	6,065	2%

N1A

Eurasian Water-milfoil (*Myriophyllum spicatum*) (4/16/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.0004	9,508	2%
Moderate	0.046	1,190	<1%
Optimal	0.144	1,748	<1%

N2A/AIS

European Common Reed (*Phragmites australis ssp. australis*)

*Model should be regarded as exploratory due to observation data limitations.

Species Observations

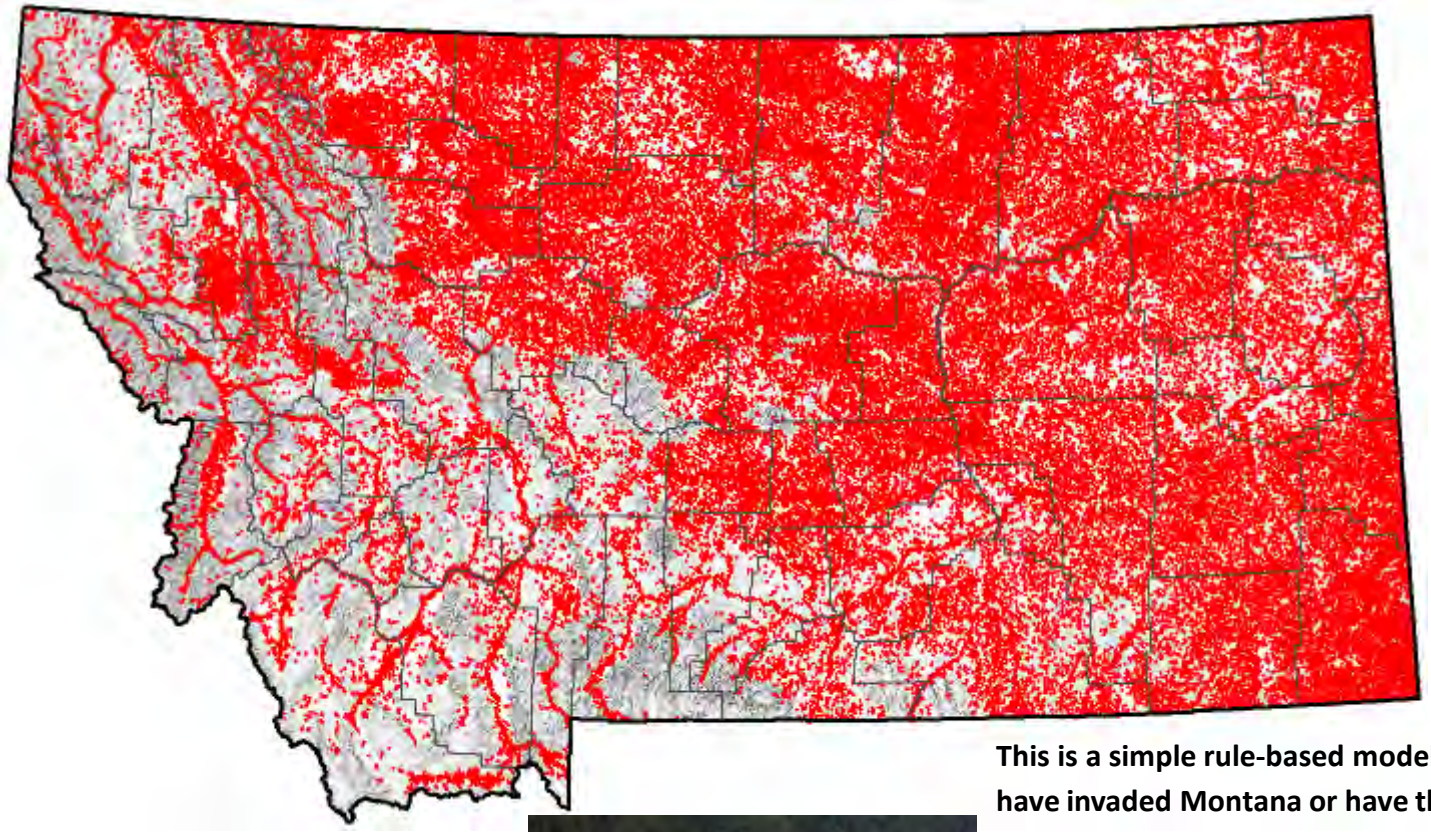
Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.018	30,062	8%
Moderate	0.058	36,200	10%
Optimal	0.318	5,350	1%

Modeled (5/8/25)

N1A

Fanwort (*Cabomba caroliniana*) Deductive (10/29/21)



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Field Bindweed (*Convolvulus arvensis*) (4/3/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.023	109,211	29%
Moderate	0.131	21,023	6%
Optimal	0.374	8,873	2%

N2B

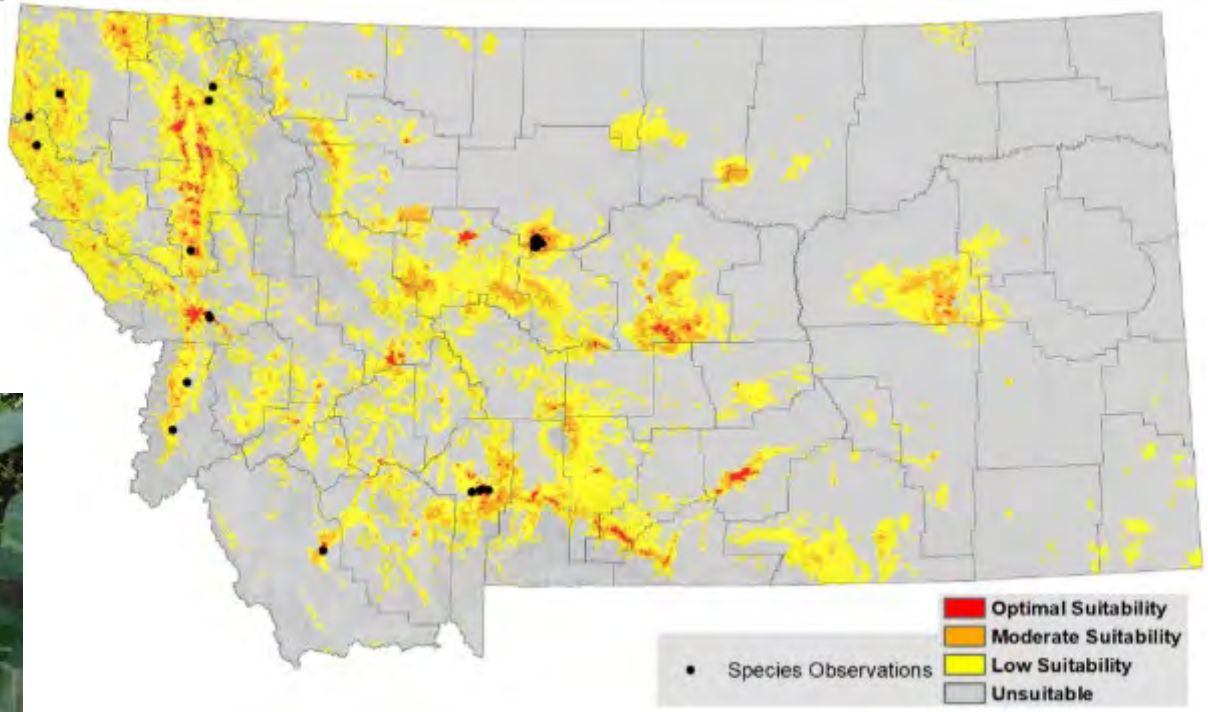
Flowering-rush (*Butomus umbellatus*) (2/23/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.0003	3,002	<1%
Moderate	0.040	217	<1%
Optimal	0.097	434	<1%

N2A/AIS

Giant Knotweed (*Polygonum sachalinense*)

***None of the 30 records shown in the map at the left for this species have precise location information. The model below for Japanese Knotweed (*Polygonum cuspidatum*) is provided as a proxy for the potential distribution of *Polygonum sachalinense*.**



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.018	51,513	14%
Moderate	0.141	11,931	3%
Optimal	0.451	3,469	1%

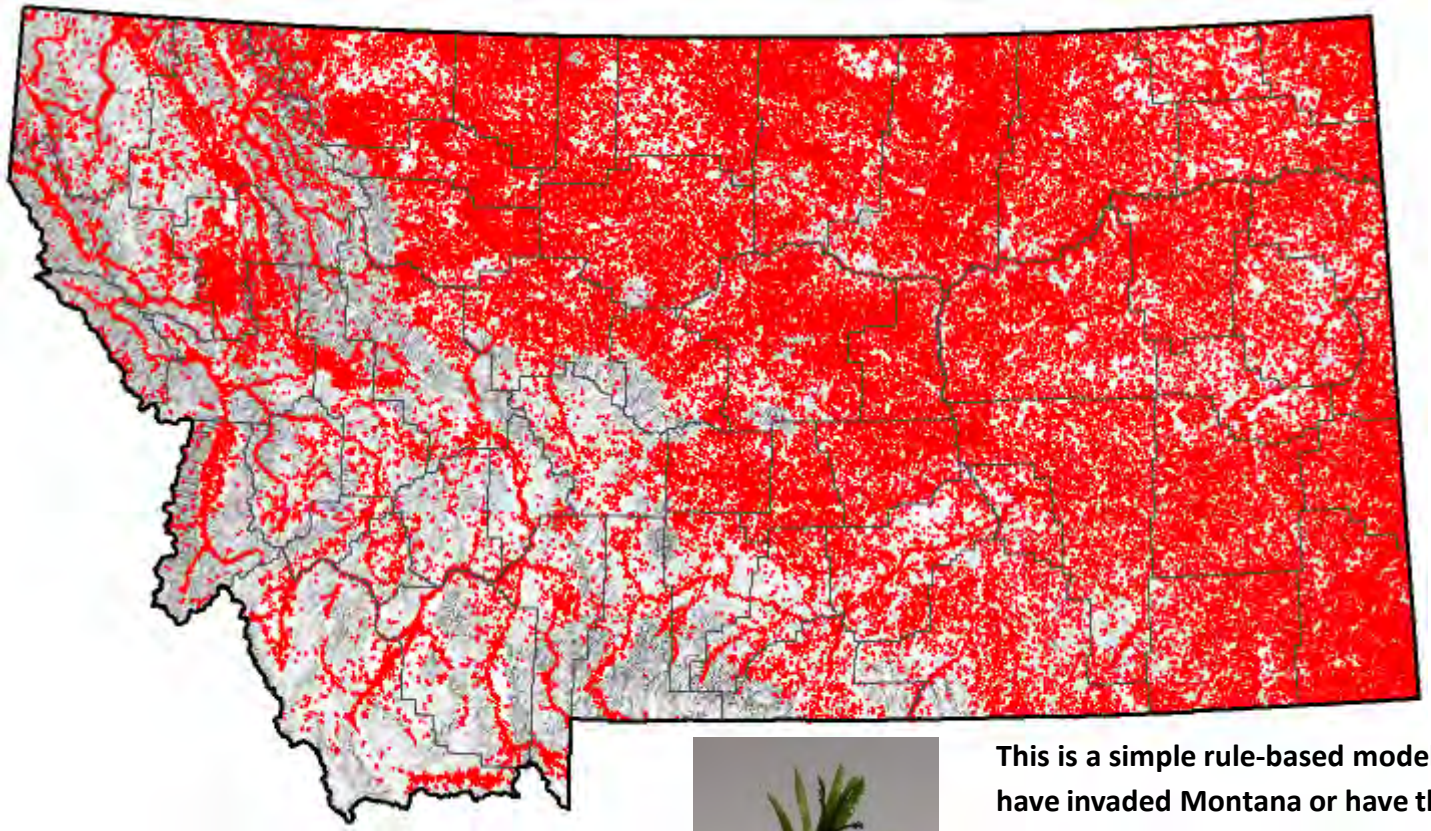
N1B

Hoary False-alyssum (*Berteroa incana*) (4/8/24)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.014	70,852	19%
Moderate	0.115	16,267	4%
Optimal	0.340	7,642	2%

N2B

Hydrilla (*Hydrilla verticillata*) Deductive (10/29/21)



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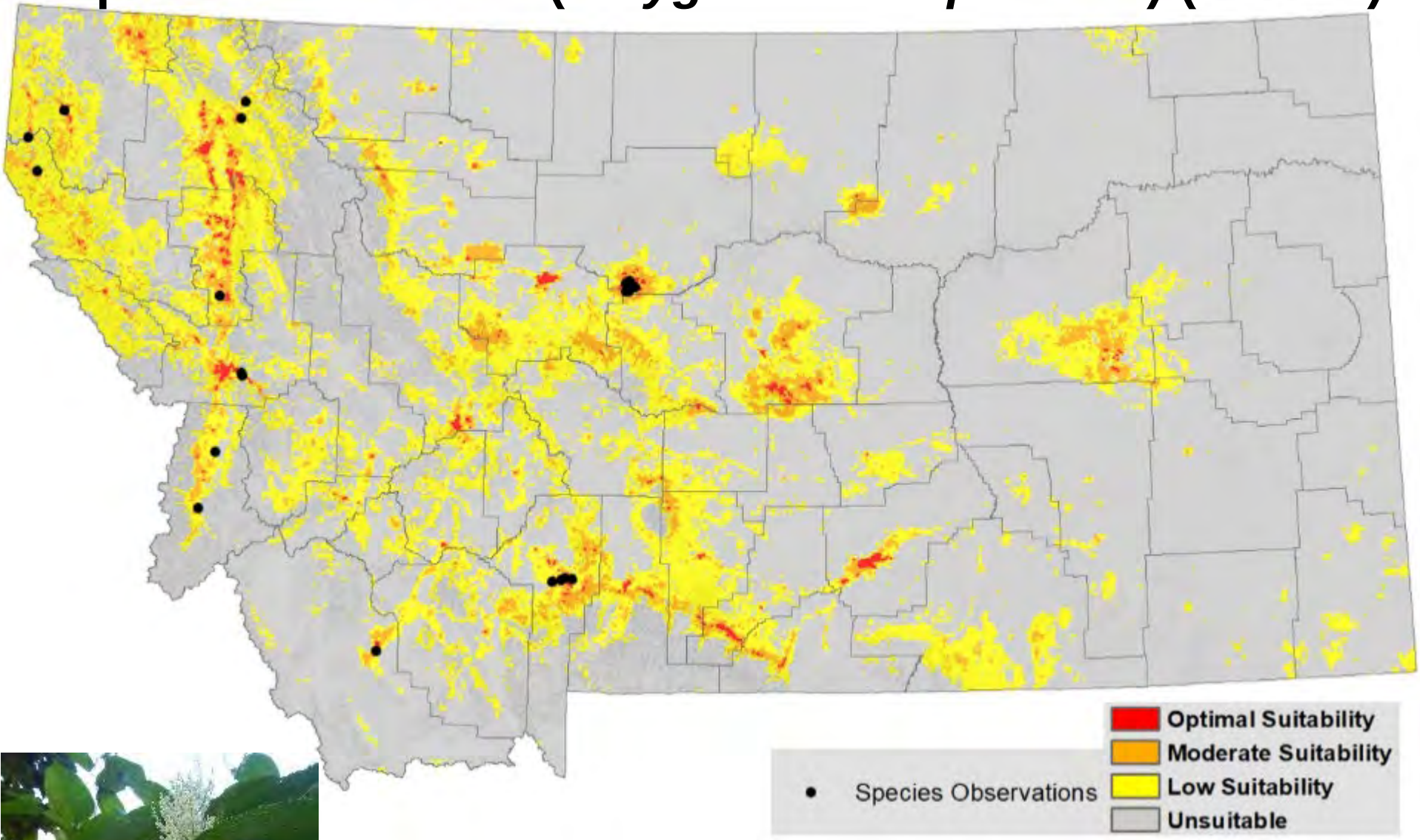
R3

Japanese Knotweed (*Polygonum cuspidatum*) (4/13/21)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.018	51,513	14%
Moderate	0.141	11,931	3%
Optimal	0.451	3,469	1%

N1B

Kingdevil Hawkweed (*Hieracium praealtum*) (5/2/23)

*Model should be regarded as exploratory due to observation data limitations.

Species Observations

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

Suitability	Logistic Cutoff	Area in Km²	% of MT
Low	0.050	70,286	18%
Moderate	0.165	35,325	9%
Optimal	0.481	9,607	3%

N2A

Leafy Spurge (*Euphorbia virgata*) (3/26/21)

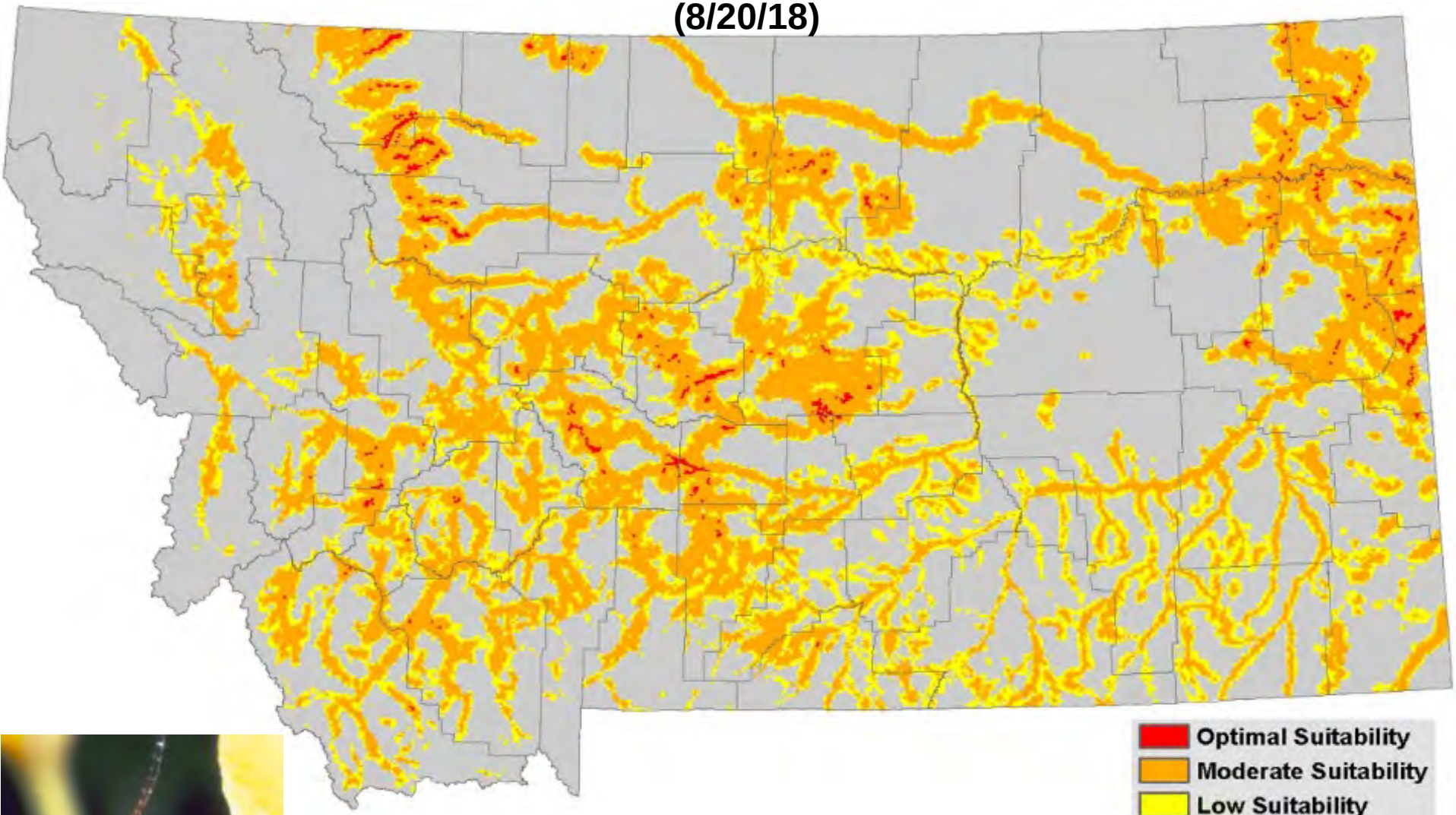
Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable
Species Observations

Suitability	Logistic Cutoff	Area in Km²	% of MT
Low	0.051	223,506	59%
Moderate	0.329	62,408	16%
Optimal	0.754	5,069	1%

N2B

Aphthona lacertosa (Brown-legged Leafy Spurge Flea Beetle)

(8/20/18)

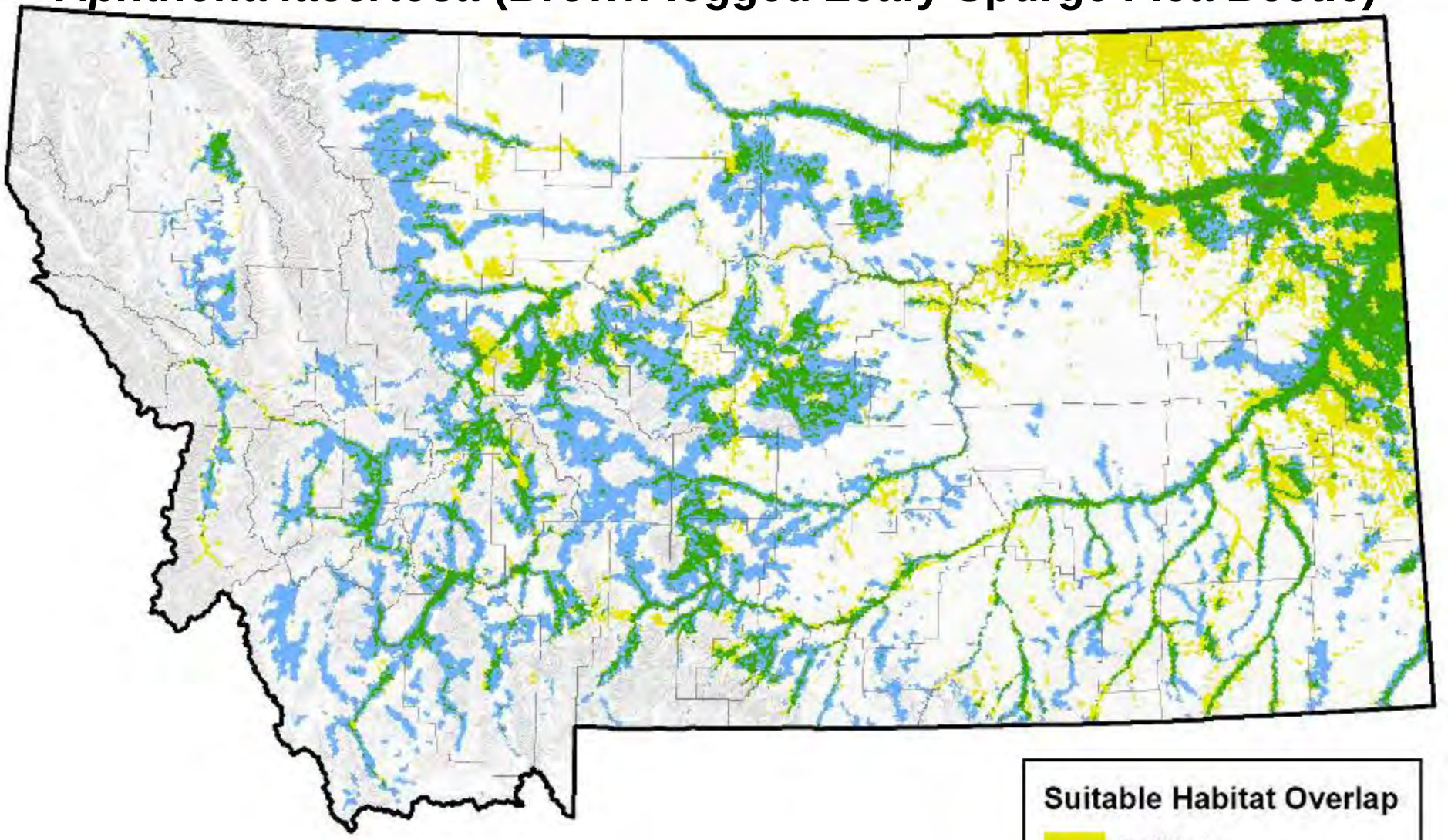


Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.081	46,563	12%
Moderate	0.170	76,981	20%
Optimal	0.695	4,892	1%

Biocontrol

Overlay of Leafy Spurge and its Biocontrol

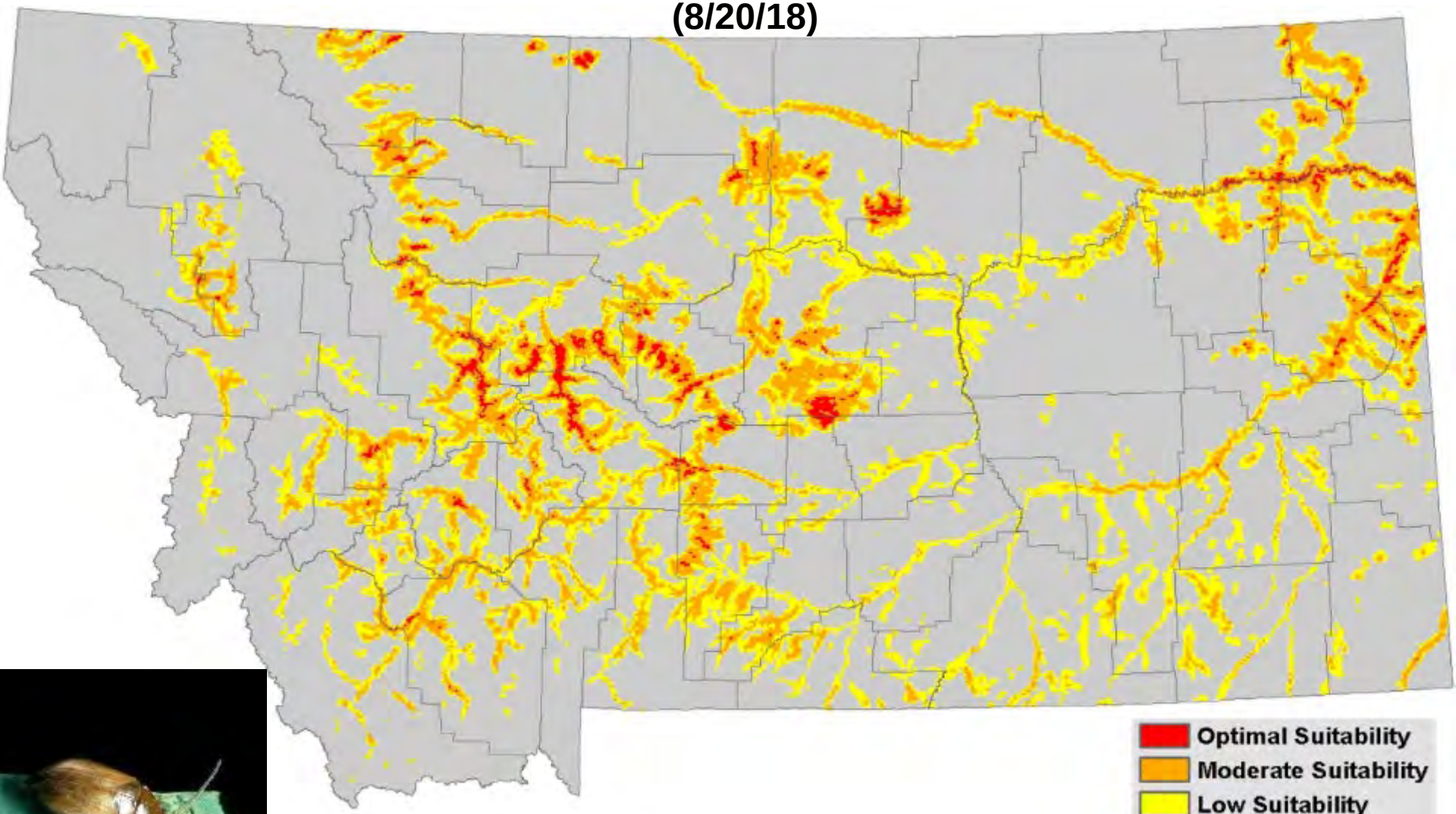
Aphthona lacertosa (Brown-legged Leafy Spurge Flea Beetle)



Moderate and optimal suitability for both Leafy Spurge and Brown-legged Leafy Spurge Flea Beetle. Green areas indicate model support for most effective releases of the biocontrol.

Aphthona nigriscutis (Black Dot Leafy Spurge Flea Beetle)

(8/20/18)

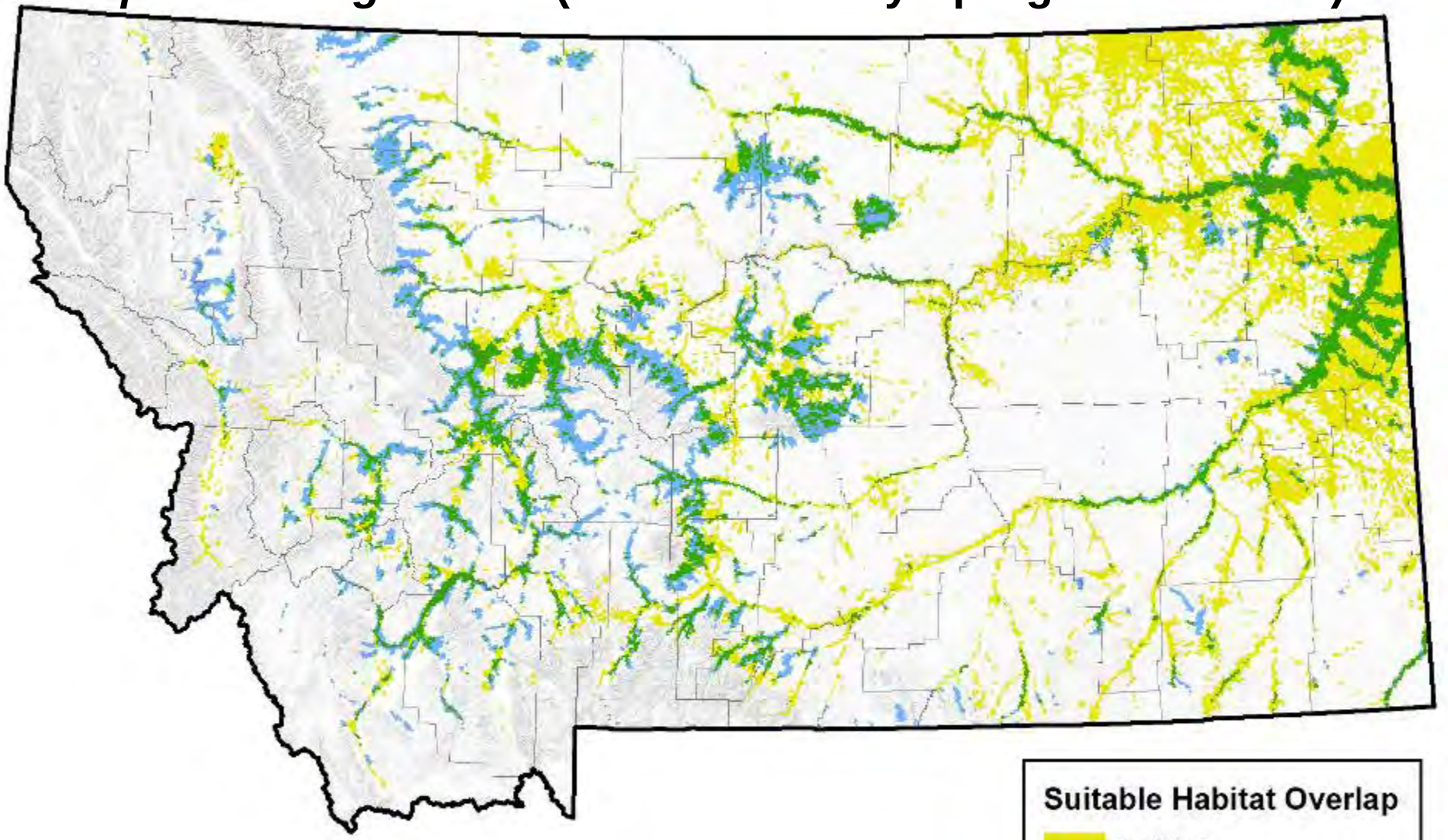


Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.027	41,956	11%
Moderate	0.113	24,408	6%
Optimal	0.458	5,724	2%

Biocontrol

Overlay of Leafy Spurge and its Biocontrol

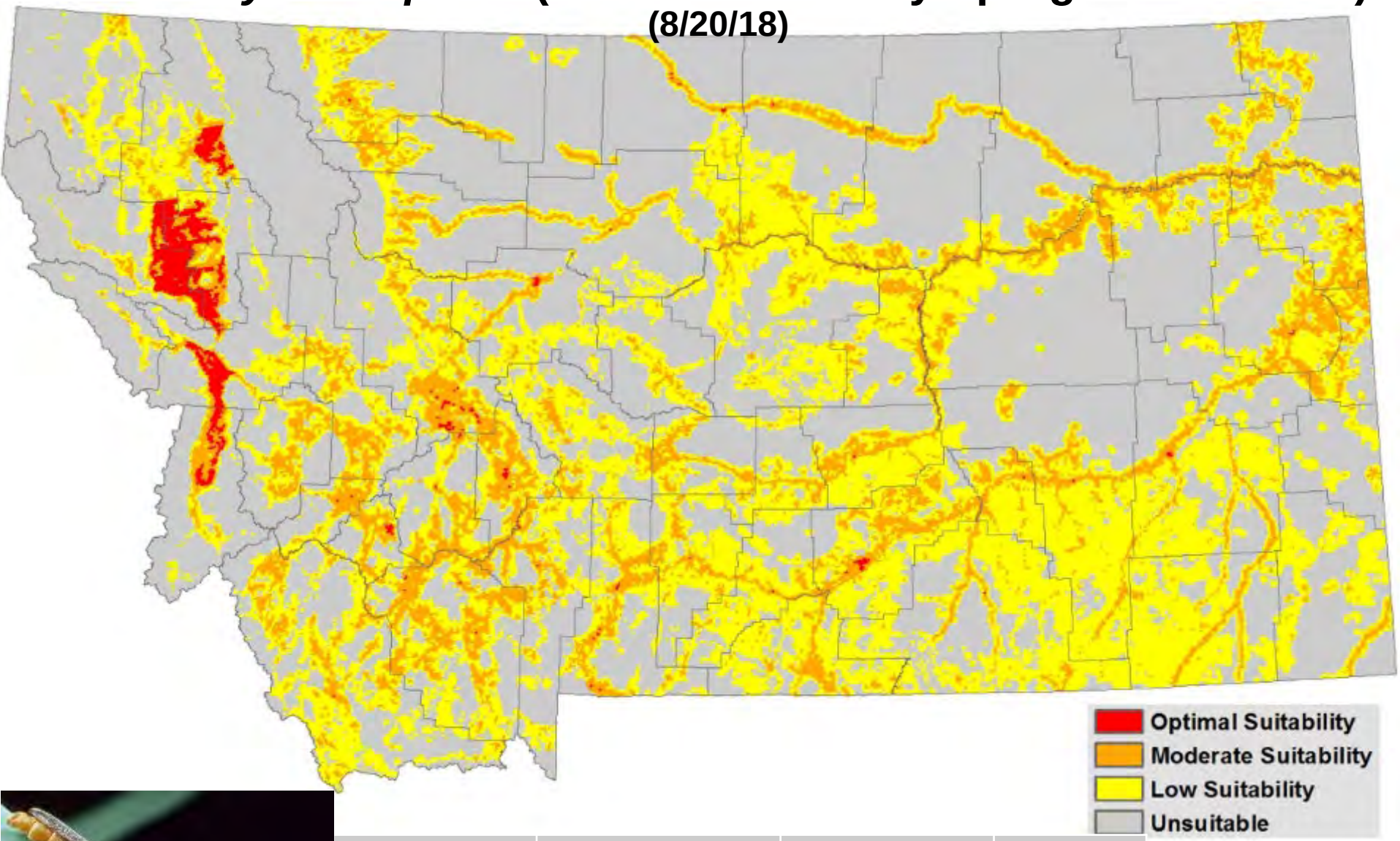
Aphthona nigriscutis (Black Dot Leafy Spurge Flea Beetle)



Moderate and optimal suitability for both Leafy Spurge and Black Dot Leafy Spurge Flea Beetle. Green areas indicate model support for most effective releases of the biocontrol.

Oberea erythrocephala (Red-headed Leafy Spurge Stem Borer)

(8/20/18)

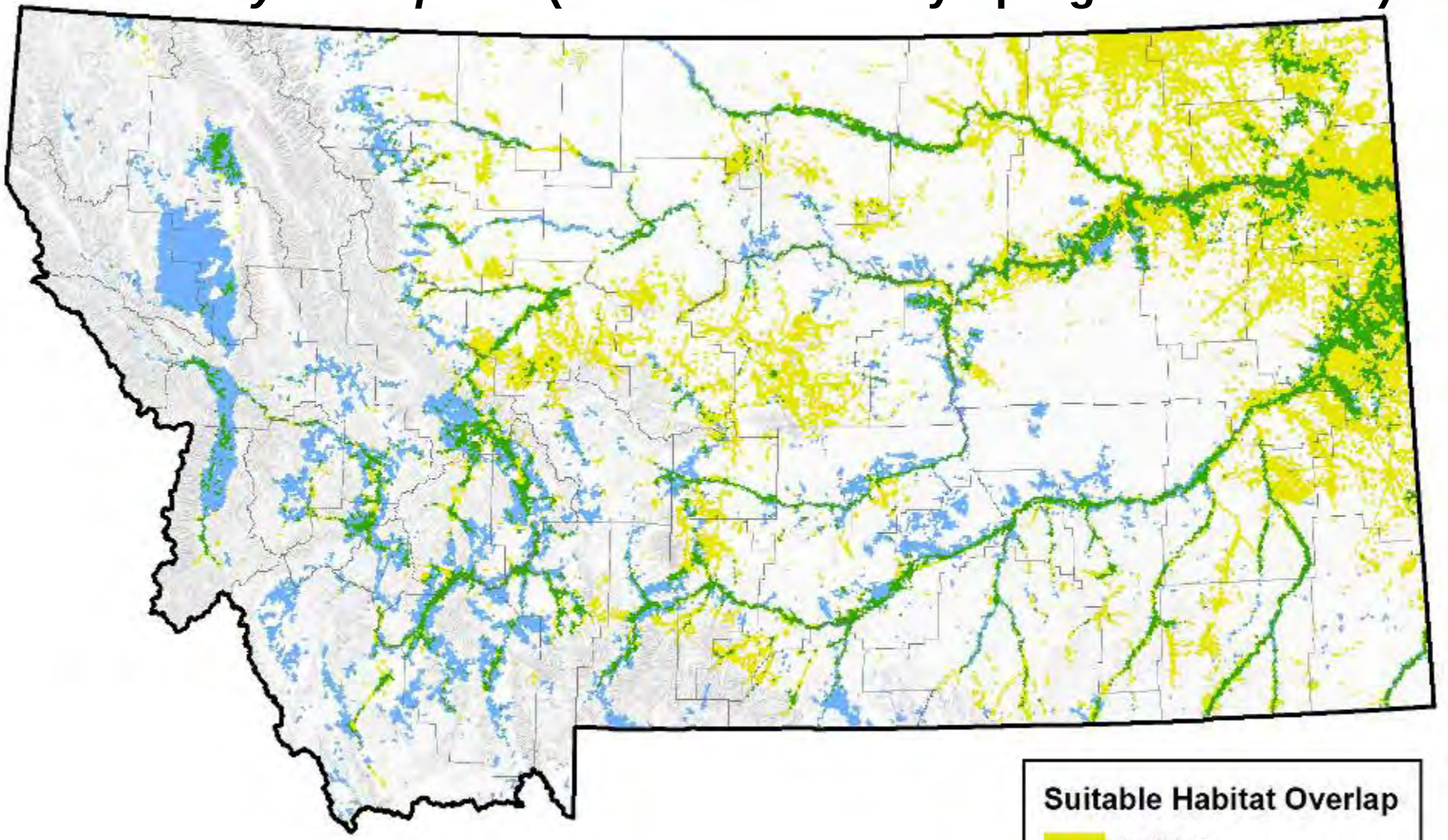


Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.050	96,316	25%
Moderate	0.150	34,117	9%
Optimal	0.492	7,302	2%

Biocontrol

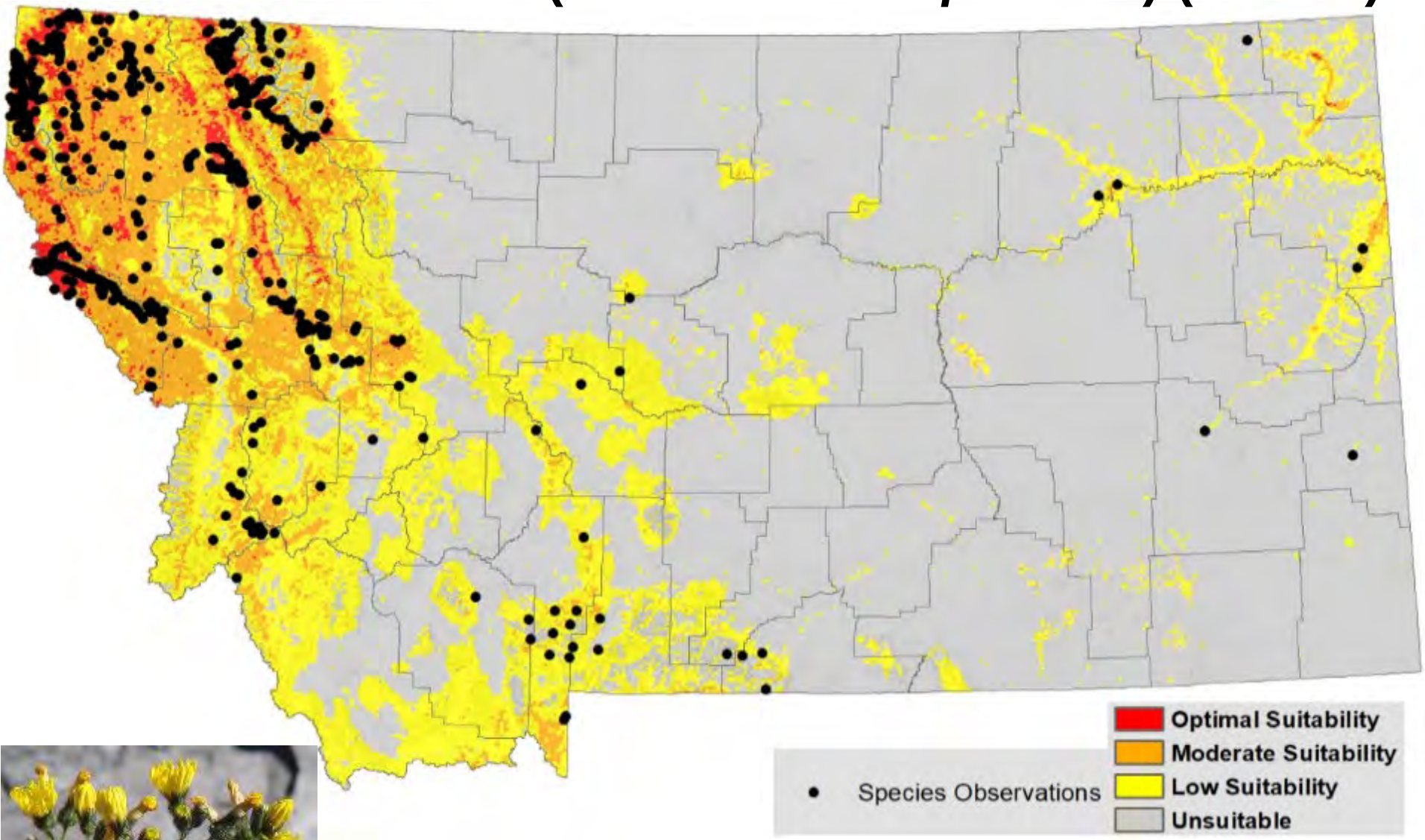
Overlay of Leafy Spurge and its Biocontrol

Oberea erythrocephala (Red-headed Leafy Spurge Stem Borer)



Moderate and optimal suitability for both Leafy Spurge and Red-headed Leafy Spurge Stem Borer. Green areas indicate model support for most effective releases of the biocontrol.

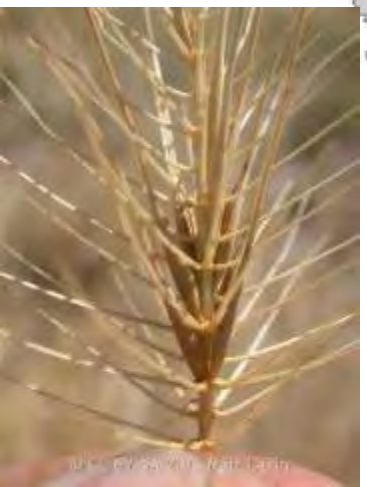
Meadow Hawkweed (*Hieracium caespitosum*) (4/10/21)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.019	66,298	17%
Moderate	0.140	29,390	8%
Optimal	0.427	10,655	3%

N2B

Medusahead (*Taeniatherum caput-medusae*) (6/28/22)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.006	32,115	8%
Moderate	0.200	2,501	<1%
Optimal	0.406	1,265	<1%

N1A

Orange Hawkweed (*Hieracium aurantiacum*) (4/11/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.025	47,731	13%
Moderate	0.149	20,868	5%
Optimal	0.414	10,874	3%

N2A

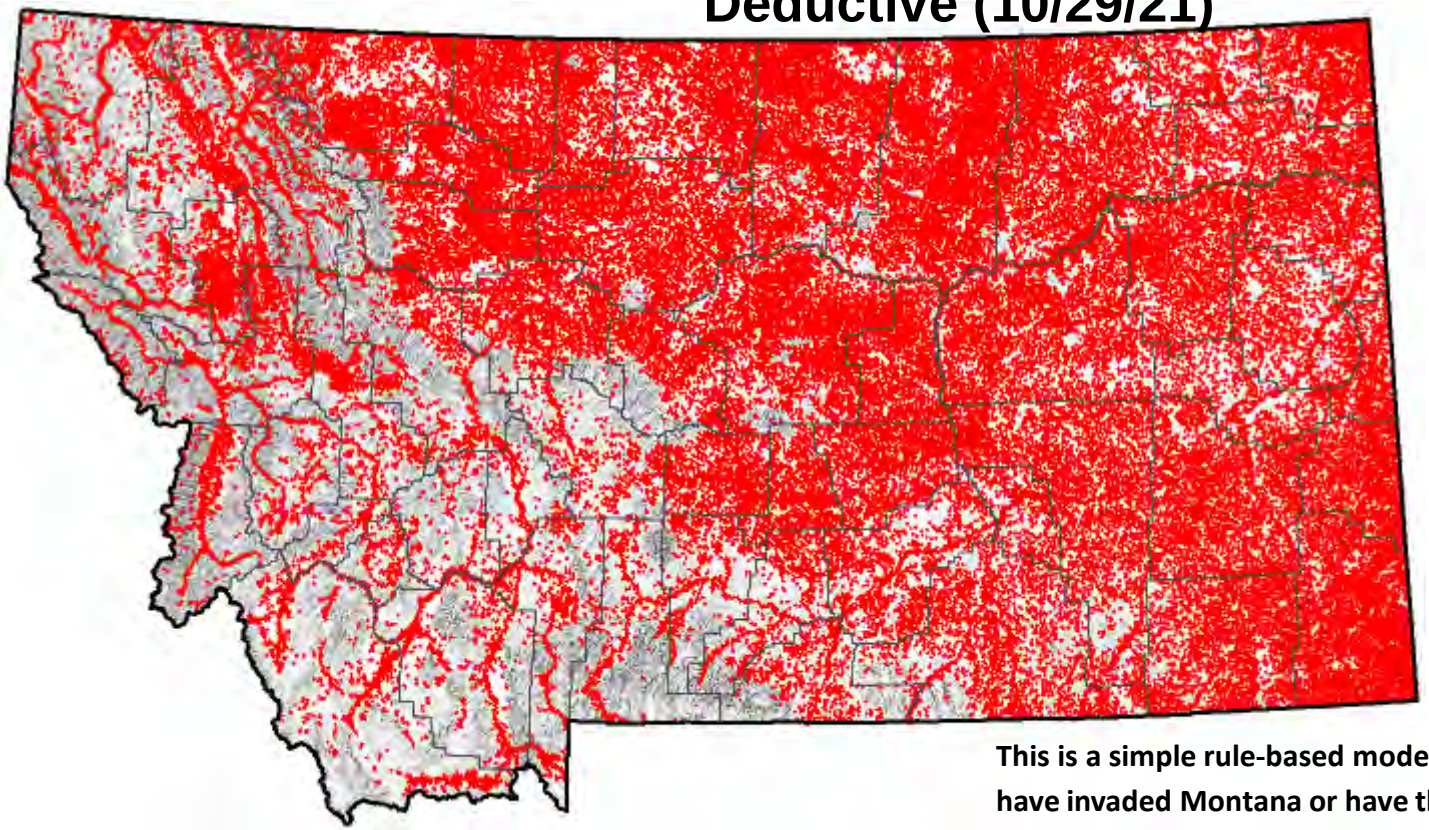
Oxeye Daisy (*Leucanthemum vulgare*) (4/7/21)

Suitability	Logistic Cutoff	Area in Km²	% of MT
Low	0.031	61,451	16%
Moderate	0.170	31,966	8%
Optimal	0.456	10,800	3%

N2B

Parrot Feather Water-milfoil (*Myriophyllum aquaticum*)

Deductive (10/29/21)



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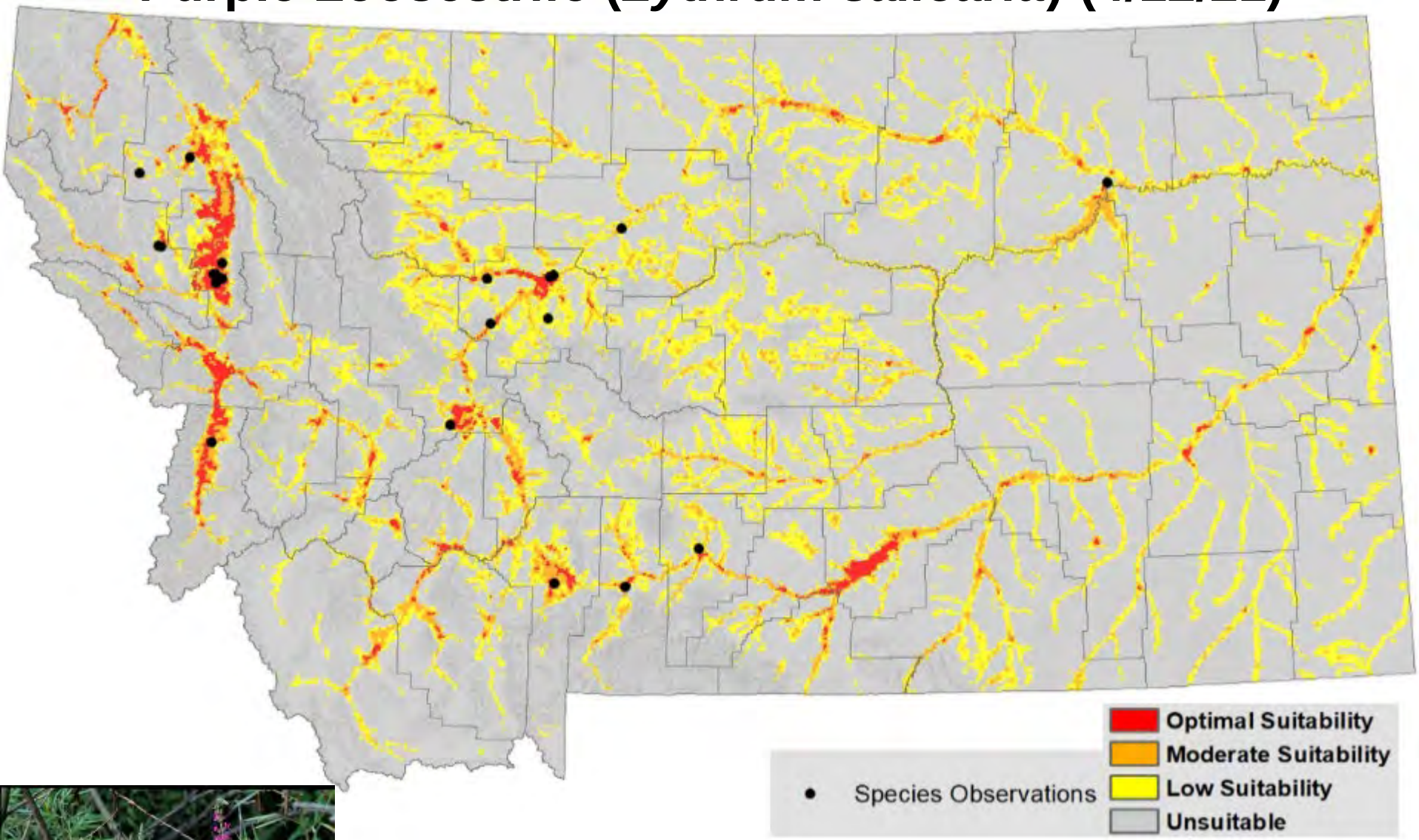
R3

Perennial Pepperweed (*Lepidium latifolium*) (5/14/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.001	33,064	9%
Moderate	0.056	2,023	<1%
Optimal	0.184	1,719	<1%

N2A

Purple Loosestrife (*Lythrum salicaria*) (4/12/21)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.015	35,817	9%
Moderate	0.095	11,860	3%
Optimal	0.276	6,471	2%

N1B

Rush Skeletonweed (*Chondrilla juncea*) (6/11/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.017	48,697	13%
Moderate	0.113	9,100	2%
Optimal	0.309	7,395	2%

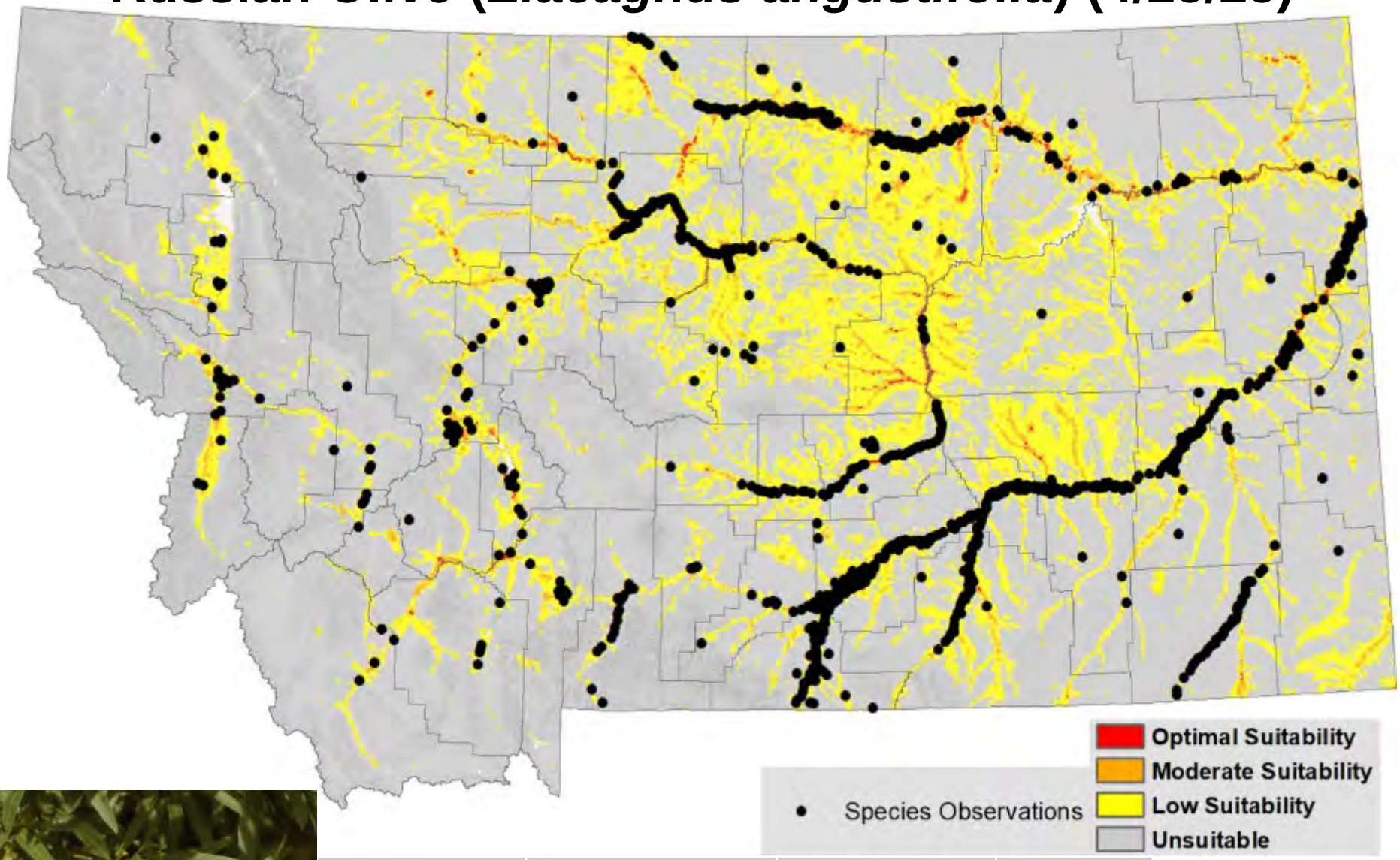
N1B

Russian Knapweed (*Acroptilon repens*) (2/18/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.007	89,906	24%
Moderate	0.060	24,770	7%
Optimal	0.438	3,011	1%

N2B

Russian Olive (*Elaeagnus angustifolia*) (4/25/25)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.007	57,113	15%
Moderate	0.098	6,759	2%
Optimal	0.263	4,891	1%

R3

Salt Cedar (*Tamarix ramosissima*) (4/25/25)

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable
Species Observations

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.005	79,549	21%
Moderate	0.108	7,433	2%
Optimal	0.286	5,054	1%

N2B

Scotch Broom (*Cytisus scoparius*) (4/7/24)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.018	52,467	14%
Moderate	0.101	13,004	3%
Optimal	0.259	7,303	2%

N1B

Spotted Knapweed (*Centaurea stoebe*) (8/1/20)

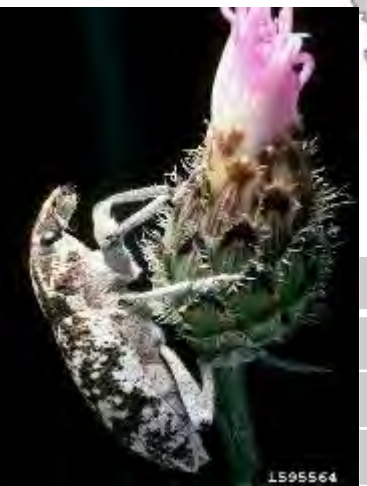
Species Observations

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.082	151,051	40%
Moderate	0.237	82,399	22%
Optimal	0.723	6,717	2%

N2B

Knapweed Root Weevil (*Cyphocleonus achates*) 8/20/18)



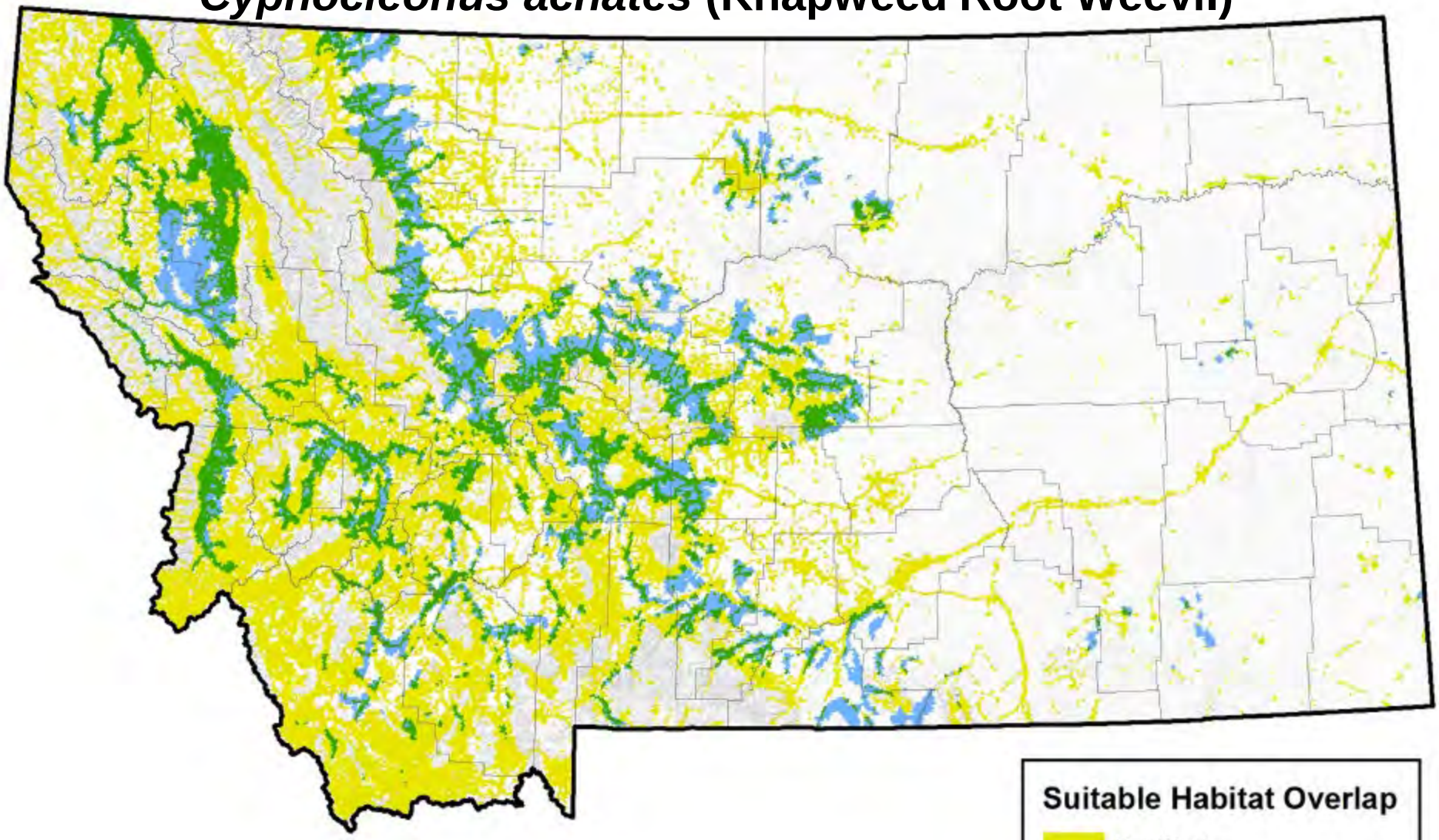
Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.031	47,427	12%
Moderate	0.134	31,241	8%
Optimal	0.172	6,263	2%

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

Biocontrol

Overlay of Spotted Knapweed and its Biocontrol

Cyphocleonus achates (Knapweed Root Weevil)



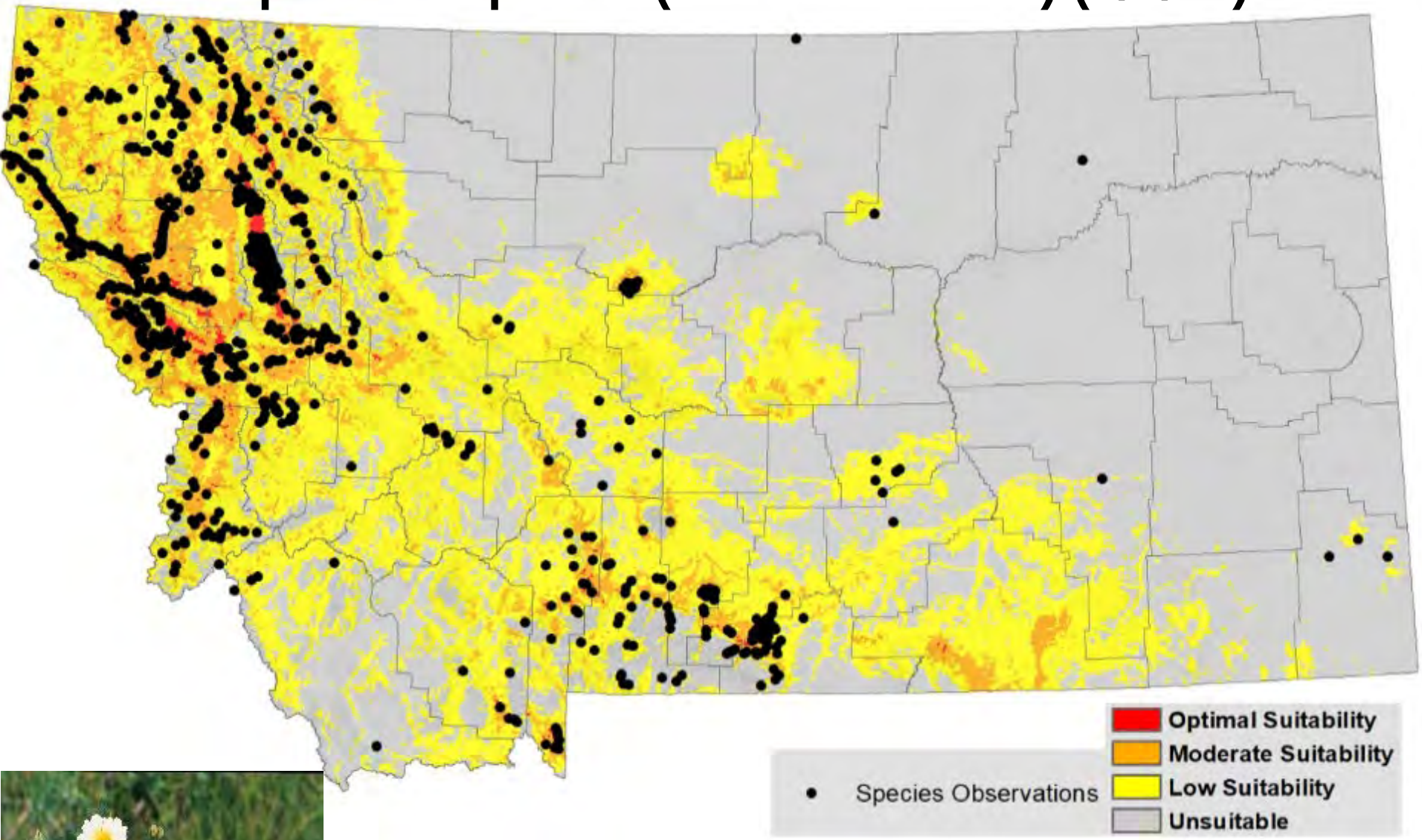
Moderate and optimal suitability for both Spotted Knapweed and Knapweed Root Weevil. Green areas indicate model support for most effective releases of the biocontrol.

Starry Stonewort (*Nitellopsis obtusa*)

***Not documented in Montana to-date.**

AIS

Sulphur Cinquefoil (*Potentilla recta*) (4/1/21)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.033	96,142	25%
Moderate	0.228	25,754	7%
Optimal	0.508	7,903	2%

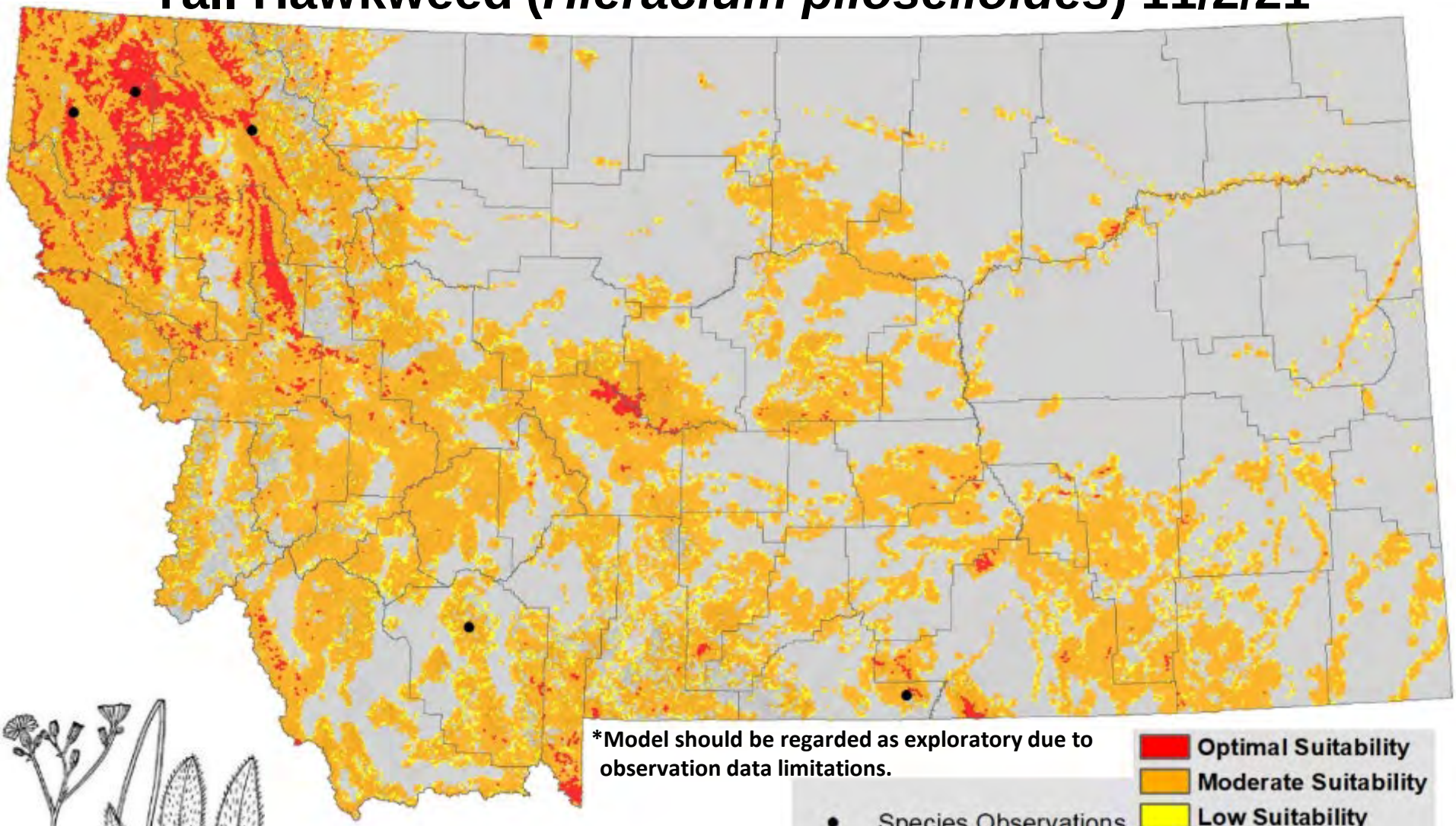
N2B

Tall Buttercup (*Ranunculus acris*) (6/11/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.015	53,977	14%
Moderate	0.106	17,141	5%
Optimal	0.325	7,658	2%

N2B

Tall Hawkweed (*Hieracium piloselloides*) 11/2/21



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.081	14,665	4%
Moderate	0.113	99,586	26%
Optimal	0.461	20,453	5%

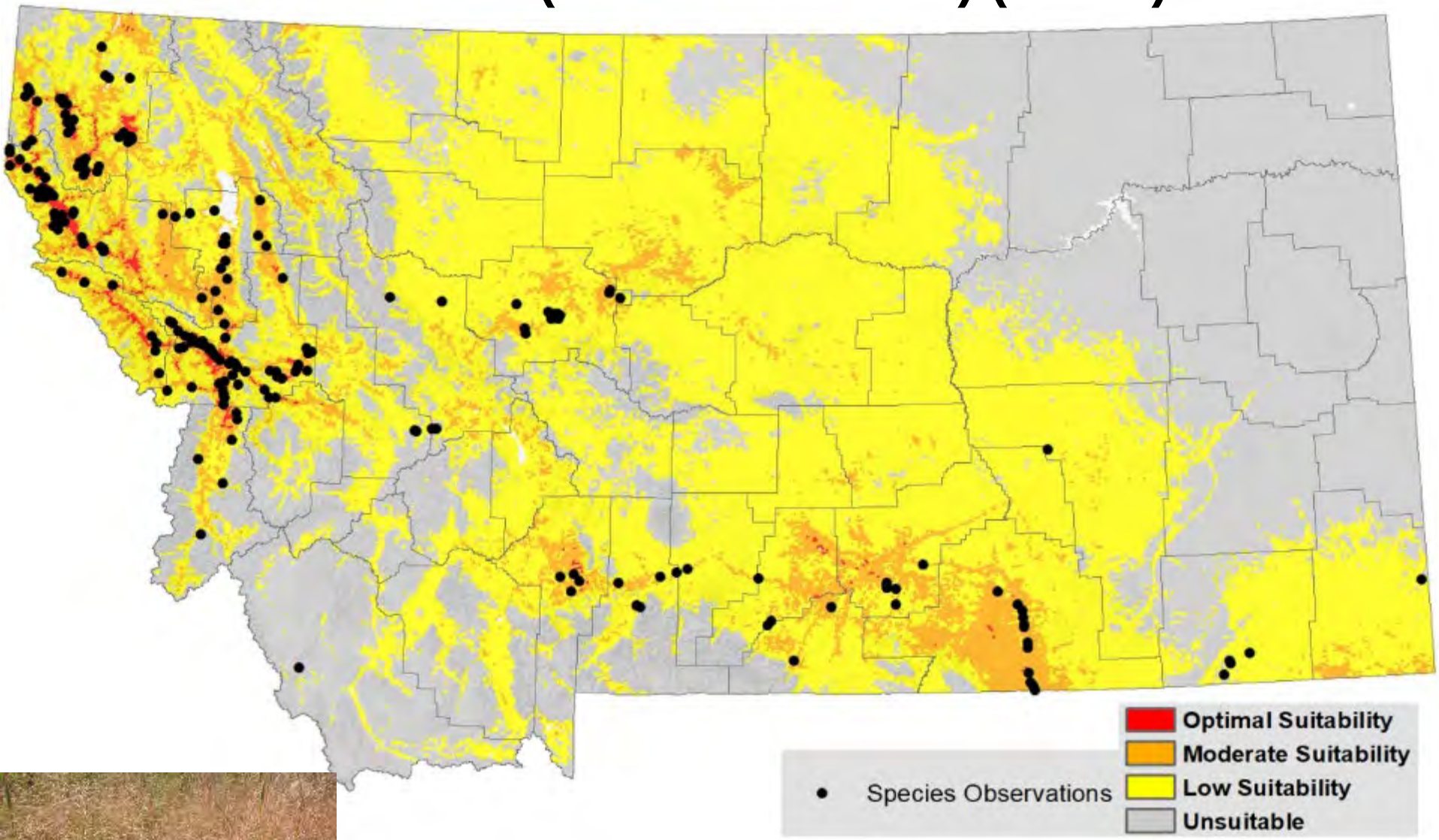
N2A

Tansy Ragwort (*Senecio jacobaea*) (4/6/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.004	19,514	5%
Moderate	0.062	3,954	1%
Optimal	0.194	3,713	1%

N2A

Ventenata (*Ventenata dubia*) (4/5/24)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.028	170,204	45%
Moderate	0.261	26,247	7%
Optimal	0.589	5,870	2%

N2A

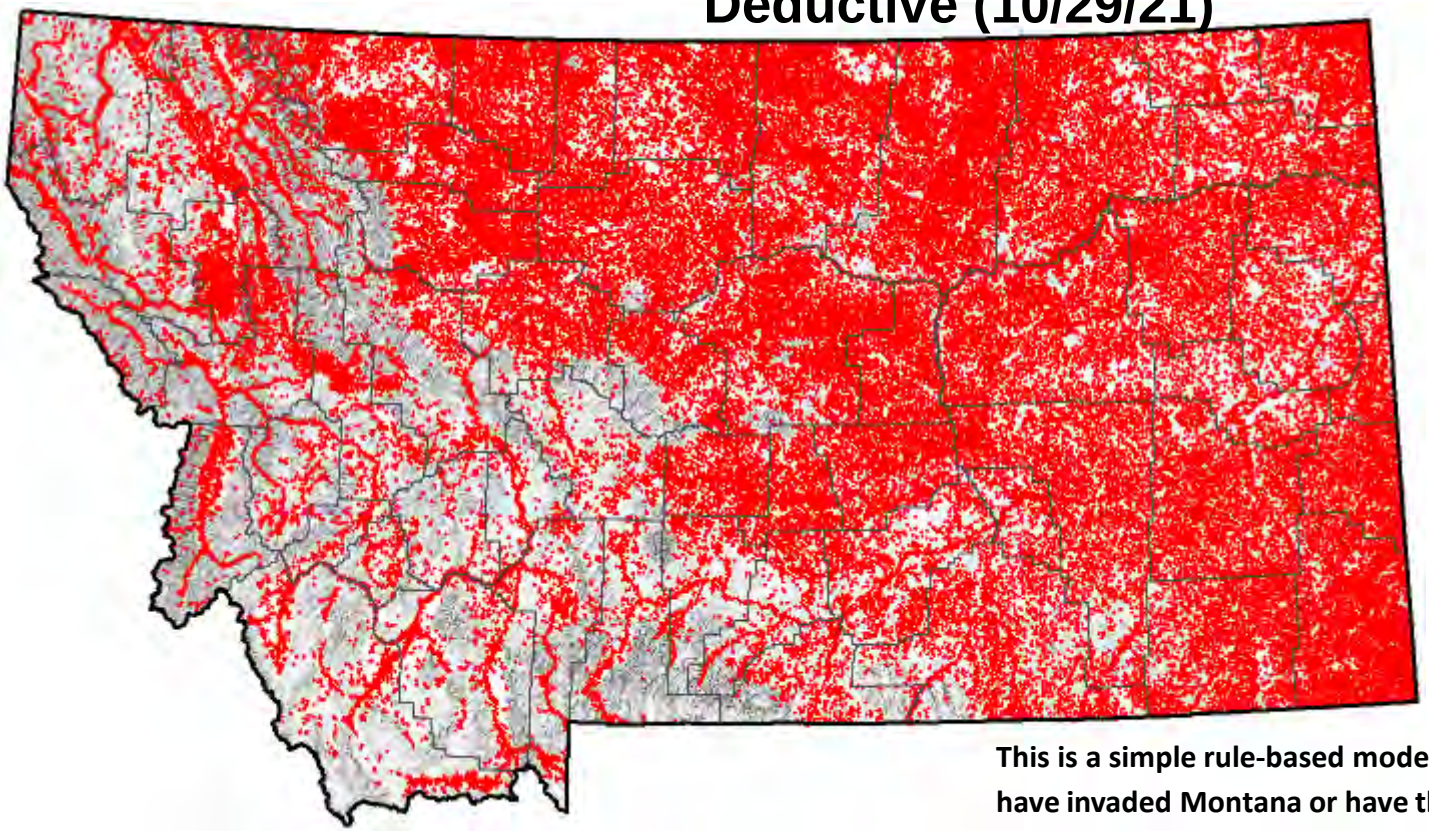
Whitetop (*Lepidium draba*) (2/19/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.018	100,547	26%
Moderate	0.137	22,091	6%
Optimal	0.388	8,728	2%

N2B

Yellow Floating Heart (*Nymphoides peltata*)

Deductive (10/29/21)



***Not documented in Montana to-date.**

This is a simple rule-based model for aquatic invasive plants that have invaded Montana or have the potential to invade Montana. The rules applied were as follows:

- **Include modern National Wetland Inventory mapped wetland areas for palustrine systems with Permanently Flooded or Intermittently Exposed water regimes and lacustrine systems (Limnetic and Littoral) with Permanently Flooded or Intermittently Exposed water regimes**
- **Include National Hydrography Dataset features for Reservoirs, Lakes, Ponds, Rivers and large Streams**
- **Exclude the interior limnetic areas of Flathead Lake, Canyon Ferry Reservoir, and Fort Peck**
- **Exclude any features above 7000 ft (2135 m) in elevation**

AIS

Yellow Starthistle (*Centaurea solstitialis*) (6/9/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.026	42,615	11%
Moderate	0.121	15,755	4%
Optimal	0.333	10,084	3%

N1A

Yellow Toadflax (*Linaria vulgaris*) (4/14/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.015	79,283	21%
Moderate	0.116	26,712	7%
Optimal	0.380	9,023	2%

N2B

Yellow Toadflax Stem-boring Weavel (*Mecinus janthinus*)

(7/27/18)

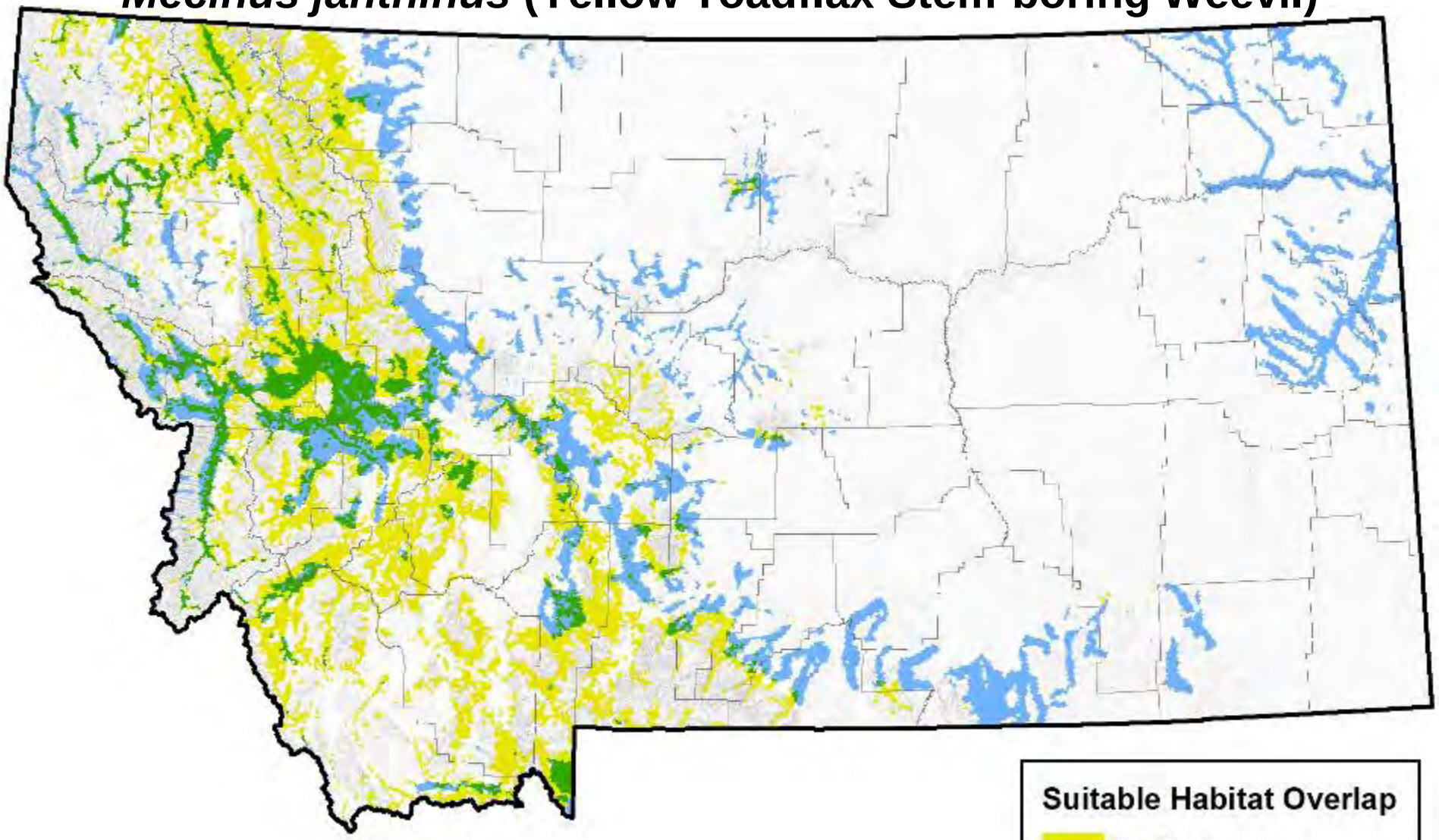
Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.021	52,632	14%
Moderate	0.071	20,881	5%
Optimal	0.172	14,168	4%

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

Biocontrol

Overlay of Yellow Toadflax and its Biocontrol

Mecinus janthinus (Yellow Toadflax Stem-boring Weevil)



Moderate and optimal suitability for both Yellow Toadflax and Yellow Toadflax Stem-boring Weevil. Green areas indicate model support for most effective releases of the biocontrol.

Yellowflag Iris (*Iris pseudacorus*) (2/23/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.013	35,532	9%
Moderate	0.104	7,276	2%
Optimal	0.269	6,100	2%

N2A/AIS

County-listed Noxious Weeds

Models can be viewed in the Single Species Overview Task in Map Viewer with agency-level sign in at:
https://mtnhp.org/mapviewer

Model write ups are available for download at:
https://mtnhp.org/models/

You can request geodatabases of model outputs at:
https://nris.mt.gov/reqapp/userMain.asp

Status listings highlighted in yellow have changed since the 2023 version of this presentation.

Common Name	MT	ID	B.C.	AB	SK	ND	SD	WY
Black Henbane	County	Control	Invasive of Concern	Noxious	Noxious			Noxious
Bladder Campion	County		Regionally Noxious	Noxious				
Bladder-vetch	County							
Bull Thistle	County		Invasive of Concern		Noxious			
Chicory	County		Invasive of Concern					
Common Blue-mustard	County							
Common Bugloss	County		Regional Noxious					
Common Burdock	County		Regional Noxious	Noxious	Noxious			Noxious
Common Caraway	County							
Common Crupina	County	Control	Noxious	Prohibited Noxious	Prohibited		Watch	
Common Kochia	County		Regionally Noxious		Noxious			
Common Matrimony Vine	County							
Common Mullein	County			Noxious				Noxious
Common Teasel	County		Invasive of Concern					
Common Wormwood	County				Noxious	Noxious	Noxious	
Creeping Bellflower	County			Noxious				
Curly Dock	County							
Cypress Spurge	County				Noxious			
Dwarf Snapdragon	County					Lincoln		
Field Scabious	County		Regional Noxious	Noxious	Prohibited			
Field Sowthistle	County	Control	Noxious	Noxious	Noxious		Noxious	Noxious
Garlic Mustard	County		Noxious	Prohibited Noxious	Prohibited			
Germander Speedwell	County							
Gypsy-weed	County							
Halogeton	County			Prohibited Noxious	Prohibited			

Common Name	MT	ID	B.C.	AB	SK	ND	SD	WY
Mayweed	County							
Meadow Goat's-beard	County		Invasive of Concern		Nuisance			
Meadow Knapweed	County		Regional Noxious	Prohibited Noxious				
Musk Thistle	County	Control	Invasive of Concern	Prohibited Noxious	Noxious	Noxious		Noxious
Myrtle Spurge	County							
Pacific Mosquito Fern	County							
Poison Hemlock	County	Containment	Invasive of Concern		Prohibited			
Prickly Lettuce	County				Noxious			
Puncture-vine	County	Containment	Regional Noxious	Prohibited Noxious	Prohibited			
Russian Thistle	County		Regional Noxious		Nuisance			
Scentless Chamomile	County		Noxious	Noxious	Noxious			
Scotch Thistle	County	Containment	Regional Noxious					Noxious
Sheep Sorrel	County							
Spiny Plumeless-thistle	County	Containment	Regional Noxious	Prohibited Noxious				Noxious
Spotted Cat's-ear	County							
Tall Baby's-breath	County		Invasive of Concern	Prohibited Noxious	Noxious			
Tall Tumble-mustard	County							
Urban Spurge	County							
Wood Sage	County							
Yellow Mignonette	County							

Black Henbane (*Hyoscyamus niger*) (4/6/24)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.025	78,031	21%
Moderate	0.138	29,509	8%
Optimal	0.429	10,084	3%

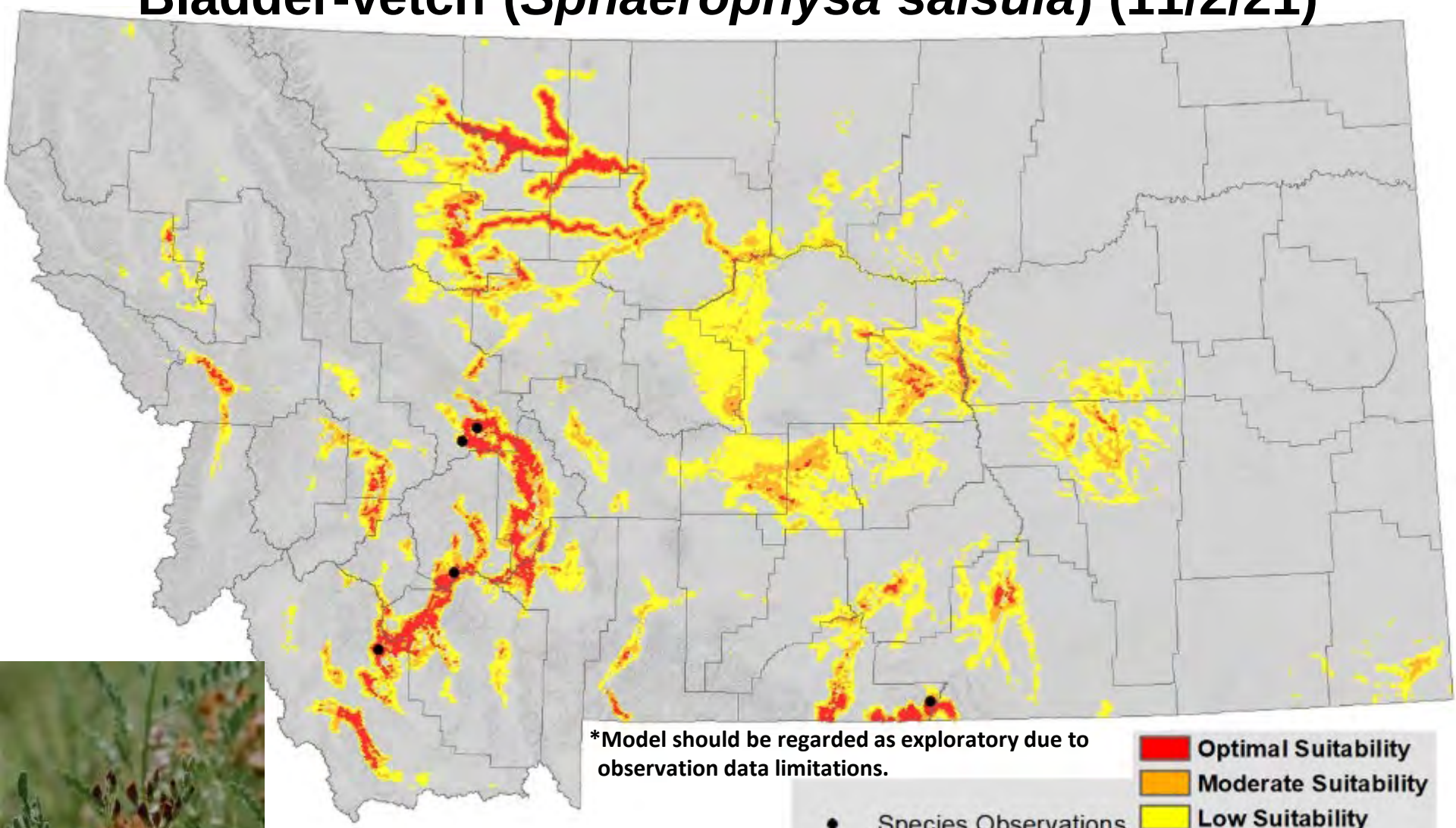
15 Counties

Bladder Campion (*Silene latifolia*) (6/9/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.018	51,395	14%
Moderate	0.097	19,983	5%
Optimal	0.334	7,715	2%

2 Counties

Bladder-vetch (*Sphaerophysa salsula*) (11/2/21)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.010	31,450	8%
Moderate	0.071	8,248	2%
Optimal	0.179	6,518	2%

2 Counties

Bull Thistle (*Cirsium vulgare*) (2/2/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.041	132,015	35%
Moderate	0.272	38,835	10%
Optimal	0.646	7,433	2%

Species Observations

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

2 Counties

Chicory (*Cichorium intybus*) (5/2/23)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.024	103,891	27%
Moderate	0.165	34,628	9%
Optimal	0.471	9,056	2%

1 County

Common Blue-mustard (*Chorispora tenella*) (4/8/24)

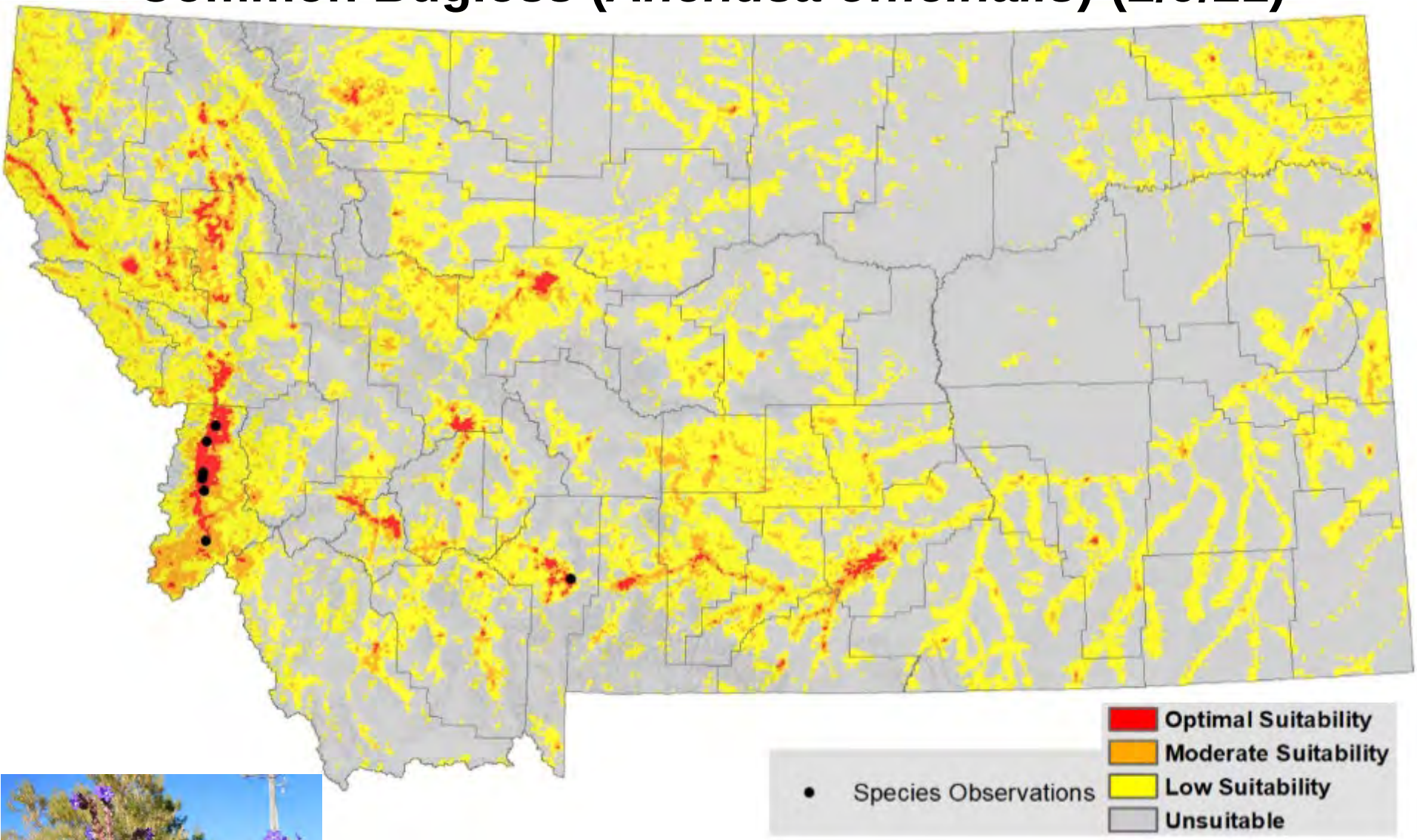
Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.056	134,740	35%
Moderate	0.276	43,523	11%
Optimal	0.644	6,409	2%

Species Observations

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

2 Counties

Common Bugloss (*Anchusa officinalis*) (2/9/21)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.037	102,198	27%
Moderate	0.192	16,853	4%
Optimal	0.444	4,466	1%

2 Counties

Common Burdock (*Arctium minus*) (5/2/23)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.020	105,028	28%
Moderate	0.112	34,830	9%
Optimal	0.393	8,017	2%

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable
Species Observations

10 Counties

Common Caraway (*Carum carvi*) (5/6/21)

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable
Species Observations

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.042	59,418	16%
Moderate	0.181	32,933	9%
Optimal	0.562	6,103	2%

1 County

Common Crupina (*Crupina vulgaris*) (1/16/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.001	55,509	15%
Moderate	0.070	1,509	<1%
Optimal	0.175	1,437	<1%

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable
Species Observations

1 County

Common Kochia (*Kochia scoparia*) (4/29/23)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.011	60,074	16%
Moderate	0.077	19,105	5%
Optimal	0.309	5,914	2%

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable
Species Observations

5 Counties

Common Matrimony Vine (*Lycium barbarum*) (4/6/24)

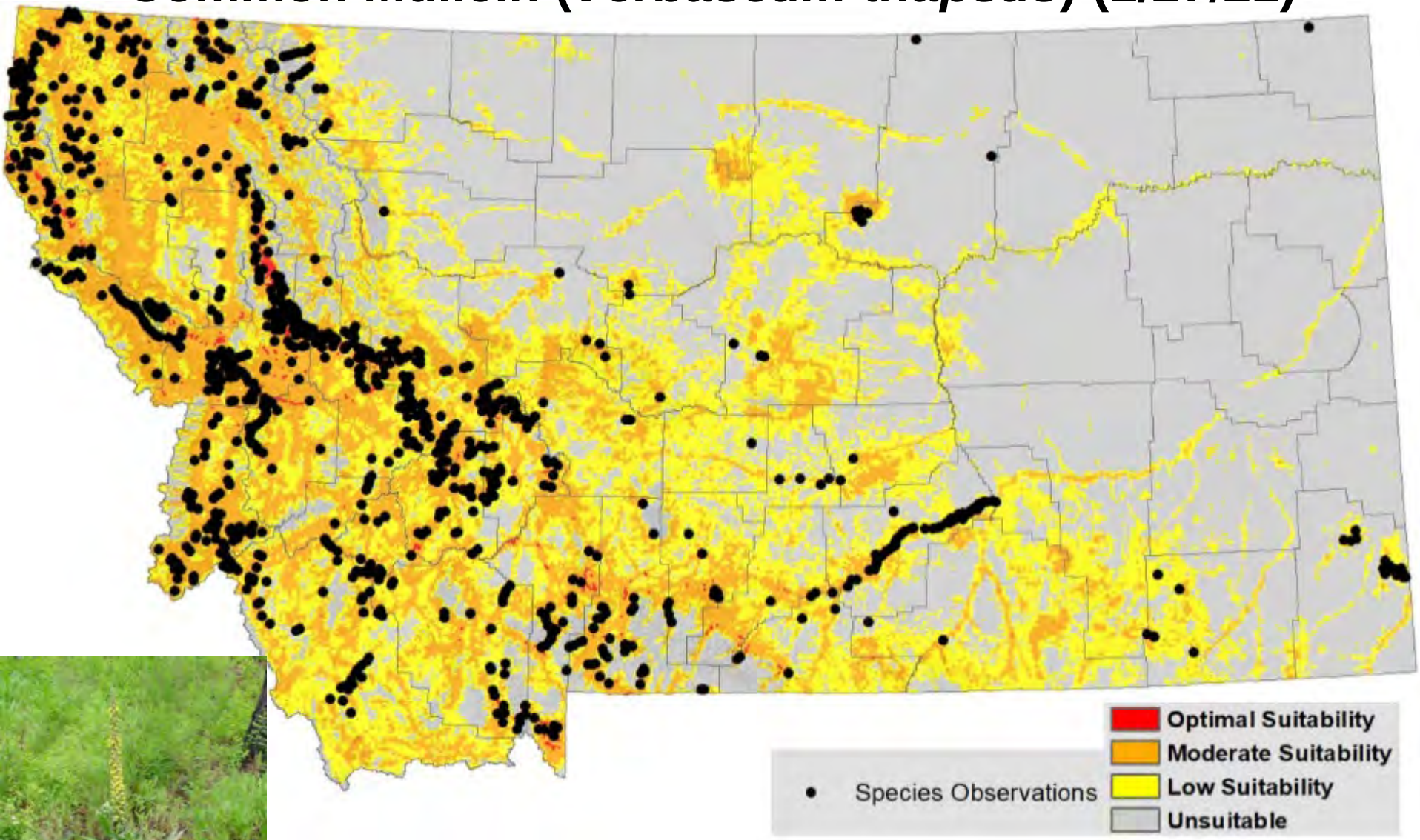
*Model should be regarded as exploratory due to observation data limitations.

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable
Species Observations

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.018	78,906	21%
Moderate	0.156	9,022	2%
Optimal	0.430	2,038	<1%

1 County

Common Mullein (*Verbascum thapsus*) (1/27/21)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.066	87,823	23%
Moderate	0.222	62,441	16%
Optimal	0.635	10,052	3%

12 Counties

Common Teasel (*Dipsacus fullonum*) (6/10/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.005	70,661	19%
Moderate	0.110	6,768	2%
Optimal	0.283	4,508	1%

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable
Species Observations

3 Counties

Common Wormwood (*Artemisia absinthium*) (6/30/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.027	156,427	41%
Moderate	0.203	28,192	7%
Optimal	0.590	6,772	2%

5 Counties

Creeping Bellflower (*Campanula rapunculoides*) (6/5/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.007	58,263	15%
Moderate	0.099	4,431	1%
Optimal	0.250	3,126	1%

1 County

Curly Dock (*Rumex crispus*) (4/6/24)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.043	135,786	36%
Moderate	0.222	52,429	14%
Optimal	0.680	5,581	1%

1 County

Cypress Spurge (*Euphorbia cyparissias*) (5/6/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.046	67,741	18%
Moderate	0.190	31,774	8%
Optimal	0.499	6,343	2%

1 County

Dwarf Snapdragon (*Chaenorhinum minus*) (4/6/24)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.077	91,006	24%
Moderate	0.185	75,620	20%
Optimal	0.521	7,304	2%

1 County

Field Scabious (*Knautia arvensis*) (5/2/23)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.009	37,381	10%
Moderate	0.104	4,970	1%
Optimal	0.248	3,828	1%

Species Observations

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

6 Counties

Field Sowthistle (*Sonchus arvensis*) (6/9/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.038	138,652	36%
Moderate	0.190	52,104	14%
Optimal	0.670	4,774	1%

6 Counties

Garlic Mustard (*Alliaria petiolata*) 4/9/24

*Model should be regarded as exploratory due to observation data limitations.

Species Observations

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.019	62,391	16%
Moderate	0.185	12,789	3%
Optimal	0.449	1,564	<1%

1 County

Germander Speedwell (*Veronica chamaedrys*) (5/3/23)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.021	47,274	12%
Moderate	0.079	16,696	4%
Optimal	0.221	9,966	2%

1 County

Gypsy-weed (*Veronica officinalis*) (6/6/25)

Suitability	Logistic Cutoff	Area in Km²	% of MT
Low	0.018	36,046	9%
Moderate	0.115	17,523	5%
Optimal	0.370	9,064	2%

1 County

Halogeton (*Halogeton glomeratus*) (4/29/23)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.036	79,146	21%
Moderate	0.220	23,193	6%
Optimal	0.554	3,793	1%

Species Observations

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

1 County

Mayweed (*Anthemis cotula*) (6/5/25)

*Model should be regarded as exploratory due to observation data limitations.

Species Observations

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.024	55,121	14%
Moderate	0.097	19,741	5%
Optimal	0.264	9,328	2%

1 County

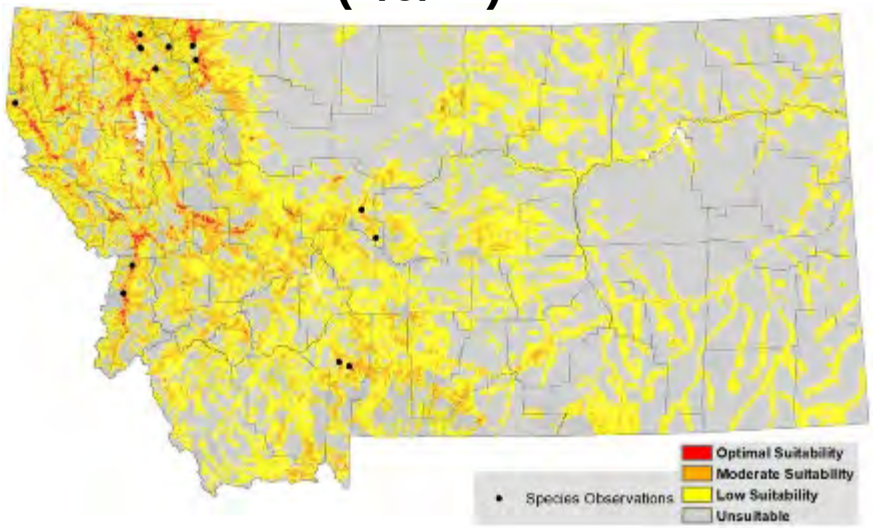
Meadow Goat's-beard (*Tragopogon pratensis*) (5/28/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.036	44,653	12%
Moderate	0.135	32,372	9%
Optimal	0.449	9,280	2%

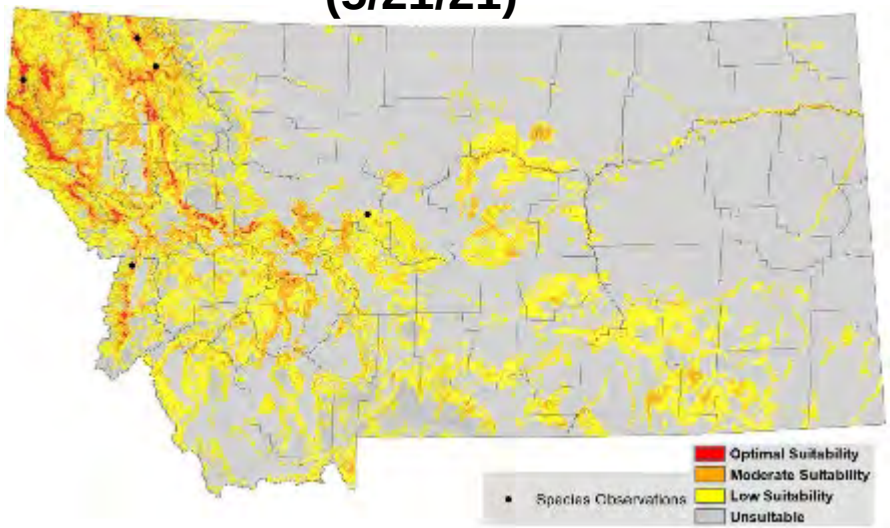
1 County

Meadow Knapweed (*Centaurea x moncktonii*)

Brown Starthistle (*Centaurea jacea*) (4/9/24)



Black Starthistle (*Centaurea nigra*) (5/21/21)



***There is only one location (map below) for *Centaurea x moncktonii* in Montana. As a proxy for potential distribution of Centaurea x moncktonii, model output is provided for Brown Starthistle (*Centaurea jacea*) and Black Starthistle (*Centaurea nigra*) which are also members of the "Centaurea jacea complex" that have been documented in nearby localities.**

1 County

Musk Thistle (*Carduus nutans*) (1/20/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.032	74,272	20%
Moderate	0.167	46,300	12%
Optimal	0.505	10,714	3%

16 Counties

Myrtle Spurge (*Euphorbia myrsinites*)

- County-listed as Noxious by Beaverhead County
- Model not constructed due to lack of records and lack of evidence of escape from horticultural plantings
- Horticultural record in Missoula County

1 County

Pacific Mosquito Fern (*Azolla filiculoides*)

- County-listed as Noxious by Lake County
- Model not constructed due to lack of records

1 County

Poison Hemlock (*Conium maculatum*) (6/10/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.023	111,449	29%
Moderate	0.125	31,484	8%
Optimal	0.412	8,029	2%

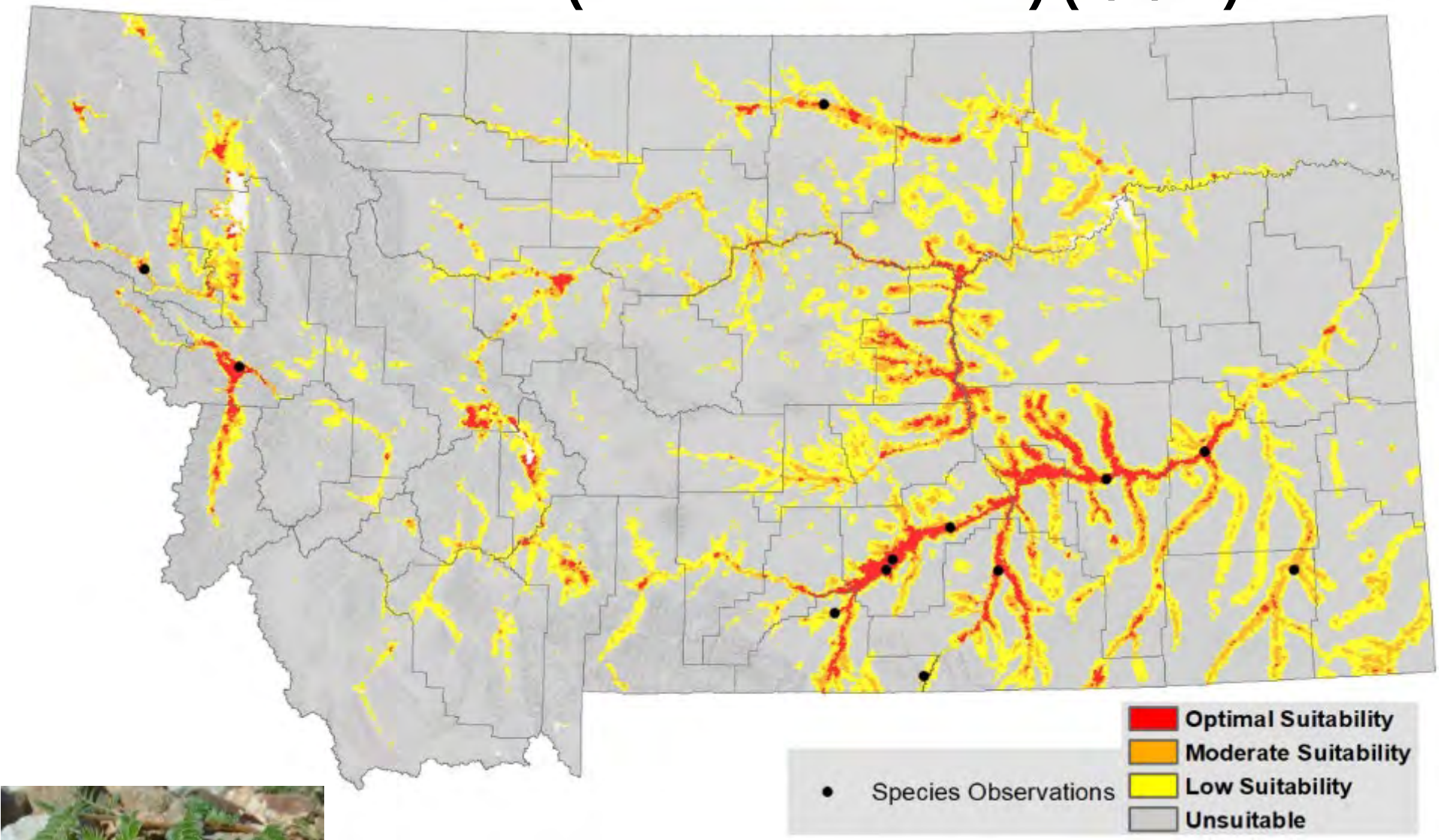
14 Counties

Prickly Lettuce (*Lactuca serriola*) (6/10/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.047	96,455	25%
Moderate	0.226	134,255	35%
Optimal	0.831	846	<1%

2 Counties

Puncture-vine (*Tribulus terrestris*) (4/6/24)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.013	37,907	10%
Moderate	0.092	11,267	3%
Optimal	0.211	7,780	2%

3 Counties

Russian Thistle (*Salsola tragus*) (4/29/23)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.042	107,005	28%
Moderate	0.246	62,111	16%
Optimal	0.671	5,448	1%

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable
Species Observations

1 County

Scentless Chamomile (*Tripleurospermum inodorum*) (4/27/23)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.020	48,004	13%
Moderate	0.075	25,103	7%
Optimal	0.464	3,609	1%

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable
Species Observations

7 Counties

Scotch Thistle (*Onopordum acanthium*) (4/27/23)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.043	137,334	36%
Moderate	0.280	38,870	10%
Optimal	0.647	6,615	2%

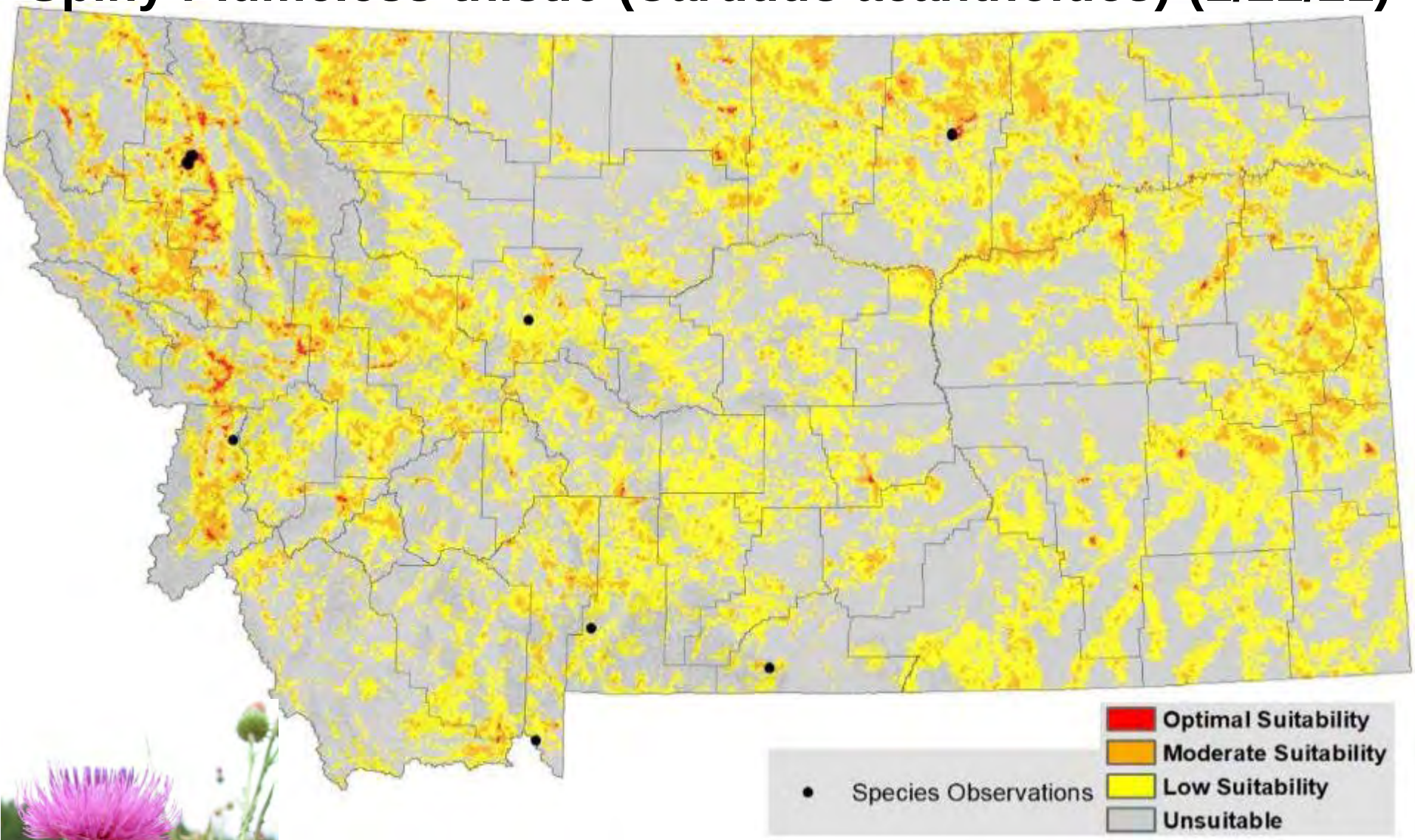
10 Counties

Sheep Sorrel (*Rumex acetosella*) (5/3/24)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.043	103,202	27%
Moderate	0.211	36,674	10%
Optimal	0.606	5,832	2%

1 County

Spiny Plumeless-thistle (*Carduus acanthoides*) (1/21/21)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.050	79,746	21%
Moderate	0.209	32,844	9%
Optimal	0.503	6,049	2%

1 County

Spotted Cat's-ear (*Hypochaeris radicata*) (6/30/25)

*Model should be regarded as exploratory due to observation data limitations.

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable
Species Observations

Suitability	Logistic Cutoff	Area in Km²	% of MT
Low	0.022	41,065	11%
Moderate	0.097	15,614	4%
Optimal	0.246	12,920	3%

1 County

Tall Baby's Breath (*Gypsophila paniculata*) (4/7/24)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.011	139,758	37%
Moderate	0.117	25,577	7%
Optimal	0.485	3,205	<1%

14 Counties

Tall Tumble-mustard (*Sisymbrium altissimum*) (4/8/24)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.069	122,619	32%
Moderate	0.328	105,505	28%
Optimal	0.770	3,316	1%

1 County

Urban Spurge (*Euphorbia agrarian*) (1/28/21)

*Model should be regarded as exploratory due to observation data limitations.

- Species Observations
- Optimal Suitability
- Moderate Suitability
- Low Suitability
- Unsuitable

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.002	20,189	5%
Moderate	0.062	1,291	<1%
Optimal	0.121	1,934	<1%

1 County

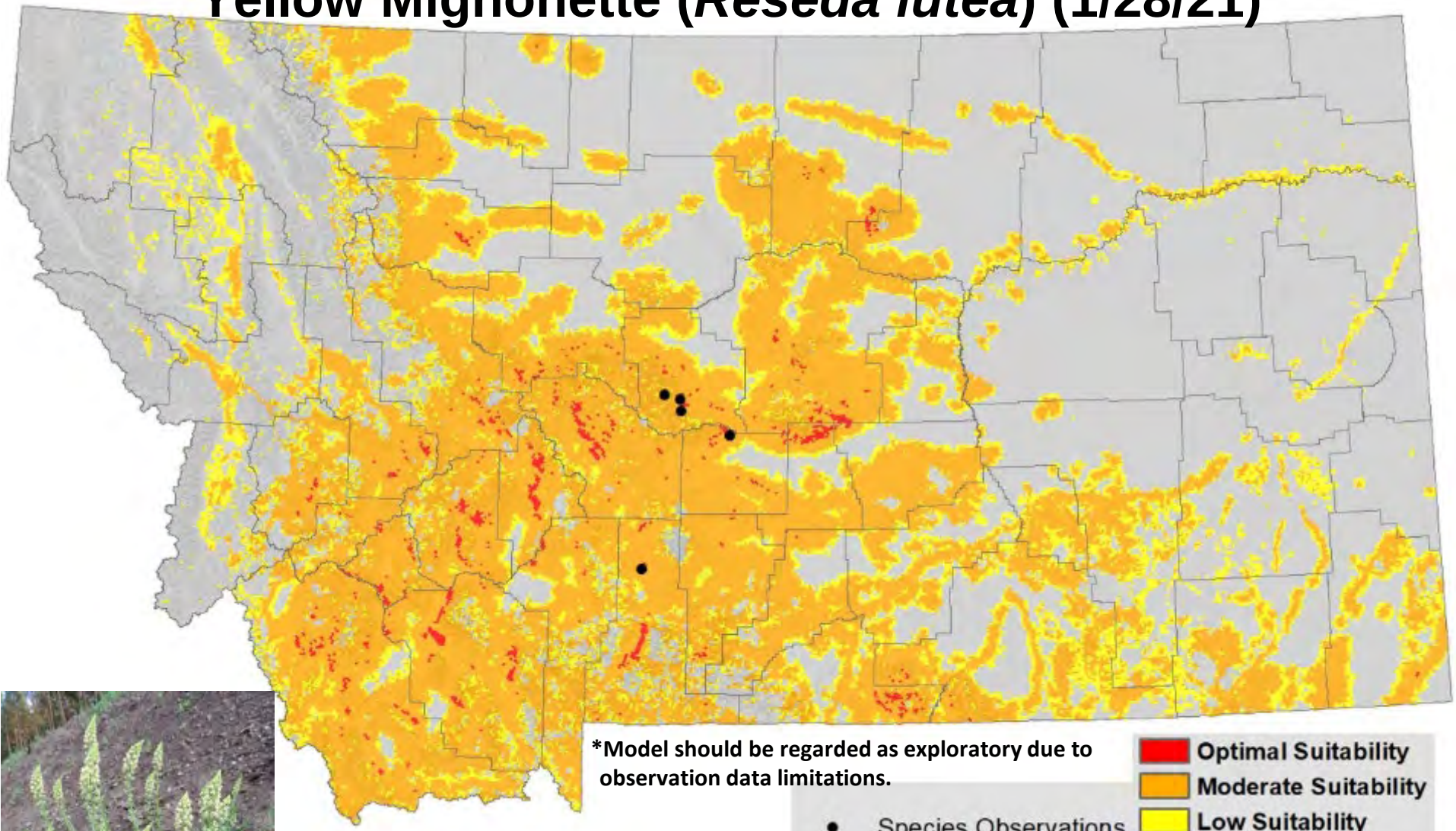
Wood Sage (*Salvia nemorosa*) (5/8/25)

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable
Species Observations

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.090	73,471	19%
Moderate	0.222	71,649	19%
Optimal	0.755	2,626	<1%

1 County

Yellow Mignonette (*Reseda lutea*) (1/28/21)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.078	42,451	11%
Moderate	0.132	103,526	27%
Optimal	0.485	9,723	3%

3 Counties

Weeds Listed in Surrounding States and Provinces of Potential Concern

Alberta

https://www.alberta.ca/provincially-regulated-weeds.aspx#jumplinks-2

https://open.alberta.ca/publications/distribution-of-regulated-weeds-in-alberta

British Columbia

https://bcinvasives.ca/wp-content/uploads/2023/05/Field-Guide-to-Noxious-Weeds-12th-WEB.pdf

Idaho

https://invasivespecies.idaho.gov/plants

https://www.uidaho.edu/-/media/UIdaho-Responsive/Files/Extension/publications/bul/bul0816.pdf?la=en

Montana

https://agr.mt.gov/Topics/N-P/Noxious-Weeds-Pages/Noxious-Weed-Education

North Dakota

https://www.ndda.nd.gov/divisions/plant-industries/noxious-weeds

Saskatchewan

https://publications.saskatchewan.ca/#/products/75172

South Dakota

https://danr.sd.gov/Conservation/PlantIndustry/WeedPest/WeedandPestInfo

Wyoming

https://wyoweed.org/noxious-species/listed-species/state-designated-noxious-weeds

Weeds Listed in Surrounding States and Provinces of Potential Concern

- **Only yellow highlighted species currently have models.**
- **Bolded status listings have changed since the 2023 version of this presentation.**
- **Please let us know if you have a weed or biocontrol species you would like a model developed for!** bmaxell@mt.gov

Models can be viewed in the Single Species Overview Task in Map Viewer with agency-level sign in at: https://mtnhp.org/mapviewer

Model write ups are available for download at: https://mtnhp.org/models/

You can request geodatabases of model outputs at: https://nris.mt.gov/reqapp/userMain.asp

Common Name	MT	ID	B.C.	AB	SK	ND	SD	WY
Autumn-olive				Prohibited Noxious				
Big-head Purple Star-thistle		EDRR						
Big-head Star-thistle				Prohibited Noxious				
Black Starthistle		Control	Regional Noxious	Prohibited Noxious				
Blessed Milk-thistle			Noxious					
Brooms (Tagasaste, Escabon, or Tree Lucerne, or French Broom)		Prohibited genera						
Brown Starthistle			**Invasive of Concern**	Prohibited Noxious				
Buffalo Bur (native to eastern MT)		**Control**						
Bur Chervil			Noxious					
Celandine			**Invasive of Concern**					
Chufa Flatsedge			Noxious	Prohibited Noxious				
Climbing Nightshade			Invasive of Concern					
Clover Dodder			Noxious					
Cogon Satintail		**EDRR**						
Common Dandelion					Nuisance			
Common Frogbit		EDRR						
Common Milkpea		**EDRR**						
Common Sowthistle			Noxious		Noxious			
Cordgrass			**Noxious**					
Corn Mustard			**Regional Noxious**					
Creeping Buttercup			Invasive of Concern					
Dame's Rocket				Noxious	Noxious			
Darnel Ryegrass					Prohibited			
Dwarf Cheeseweed			Invasive of Concern					
European Barberry				Prohibited Noxious	Prohibited			
Fig-root Buttercup			**Invasive of Concern**					

Common Name	MT	ID	B.C.	AB	SK	ND	SD	WY
Giant Foxtail					Prohibited			
Giant Hogweed		EDRR	Noxious	Prohibited Noxious	Prohibited			
Giant Reed			Invasive of Concern					
Giant Salvinia		EDRR						
Globe-podded Whitetop			Regional Noxious	Noxious	Noxious			
Golden Virgin's-bower				Noxious				
Gorse			Noxious					
Greater Burdock			Regional Noxious	Noxious				
Grecian Foxglove							Watch	
Green Bristle Grass			Regional Noxious					
Ground-cherry Nightshade			Invasive of Concern					
Hairy Cupgrass					Prohibited			
Harmal Peganum					Prohibited			
Himalayan Blackberry			Invasive of Concern					
Himalayan Knotweed			Noxious					
Hybrid Knapweed				Prohibited Noxious				
Iberian Starthistle		EDRR						
Japanese Brome				Noxious	Noxious			
Johnson Grass		Control						
Jointed Goatgrass		Containment	Noxious	Prohibited Noxious	Prohibited			
Lenspod Whitetop			Regional Noxious	Noxious	Noxious			
Maiden's-tears			Regional Noxious		Prohibited			
Marsh Thistle				Prohibited Noxious				
Meadow Goat's-beard			Invasive of Concern					
Mediterranean Sage		Control						

Common Name	MT	ID	B.C.	AB	SK	ND	SD	WY
Milium		Containment						
Moor Matgrass		Control						
Mouse-ear Hawkweed			**Invasive of Concern**	Prohibited Noxious				
Narrowleaf Hawksbeard					Noxious			
Night-flowering Catchfly			**Regional Noxious**		Noxious			
Palmer's Amaranth						Noxious		
Persian Ryegrass					Noxious			
Policeman's Helmet		EDRR	Invasive of Concern	Prohibited Noxious				
Purple Flatsedge			**Noxious**					
Quackgrass			**Regional Noxious**		Nuisance			Noxious
Red Odontites				Prohibited Noxious	Prohibited		Watch	
Reed Mannagrass			Noxious					
Running Cheeseweed					Noxious			
Shining Crane's-bill			**Invasive of Concern**					
Short-fringe Star-thistle				Prohibited Noxious				
Skeleton-leaf Bursage								**Noxious**
Slender False Brome			**Invasive of Concern**					
Small Bugloss		Control						
Smallflower Tamarisk				Prohibited Noxious				
Small-seed Alfalfa Dodder			Noxious					
Spiny-leaf Sowthistle					Noxious			
Squarrose Knapweed		EDRR		Prohibited Noxious	Prohibited			
Stork's bill					Noxious			
Syrian Bean-caper		EDRR						
Turkish Thistle		**EDRR**						

Common Name	MT	ID	B.C.	AB	SK	ND	SD	WY
Variable-leaf Water-milfoil		EDRR						
Velvet-leaf			Noxious					
Water Chestnut		EDRR						
Whiplash Hawkweed			**Invasive of Concern**					
White Bryony		Containment						
Wild Chervil			**Regional Noxious**		Prohibited			
Wild Oats			Noxious					
Wild Parsnip			**Invasive of Concern**		Noxious			
Woolly Burdock			Regional Noxious	Noxious				
Yellow Arch-angel			**Invasive of Concern**					
Yellow Devil Hawkweed		EDRR						

Big-head Star-thistle (*Centaurea macrocephala*) (5/29/24)

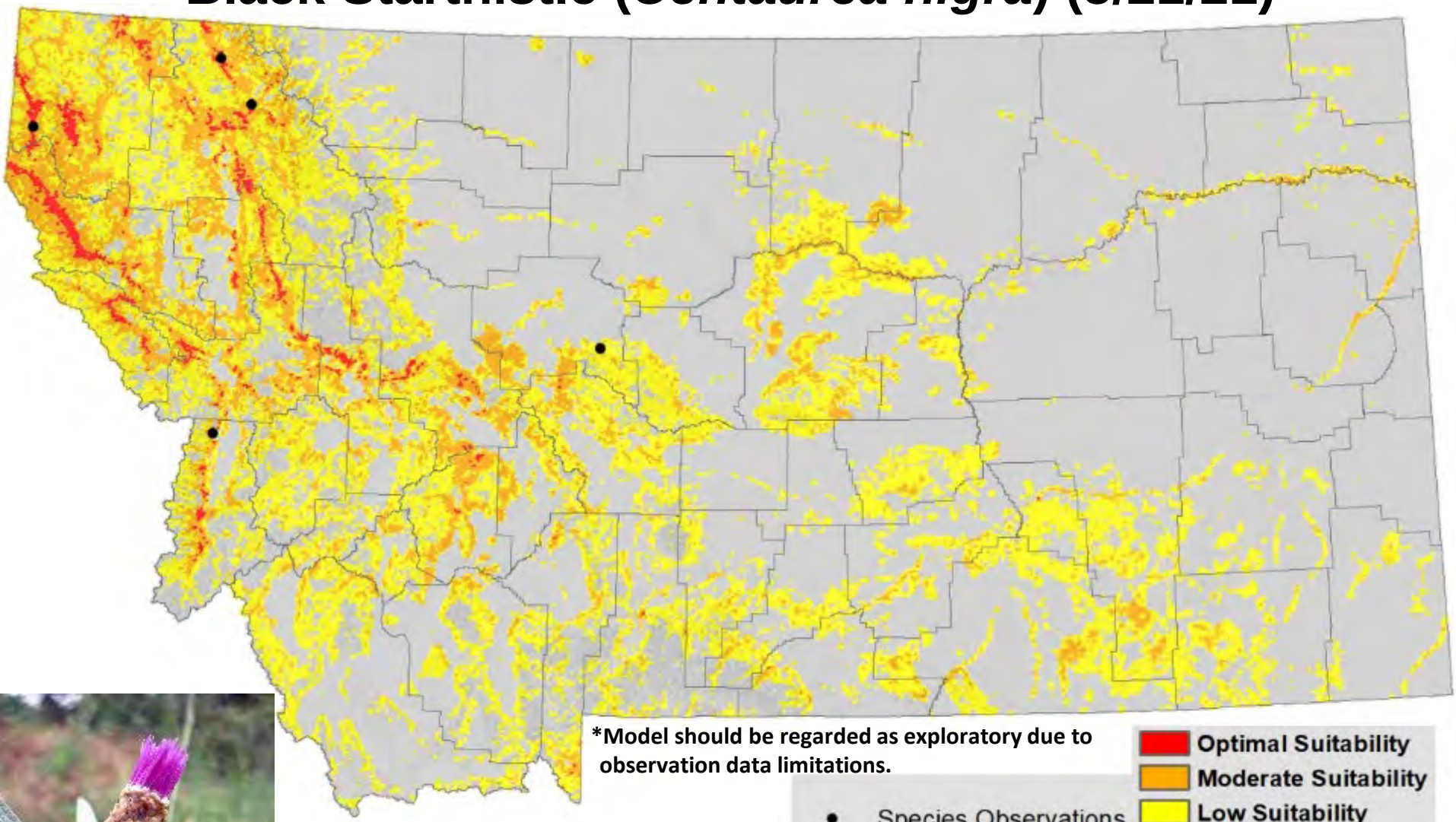
*Model should be regarded as exploratory due to observation data limitations and poor model performance.

Species Observations

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.129	53,932	14%
Moderate	0.252	112,345	30%
Optimal	0.661	3,463	1%

Black Starthistle (*Centaurea nigra*) (5/21/21)



*Model should be regarded as exploratory due to observation data limitations.

Species Observations

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.023	61,062	16%
Moderate	0.107	27,416	7%
Optimal	0.342	5,010	1%

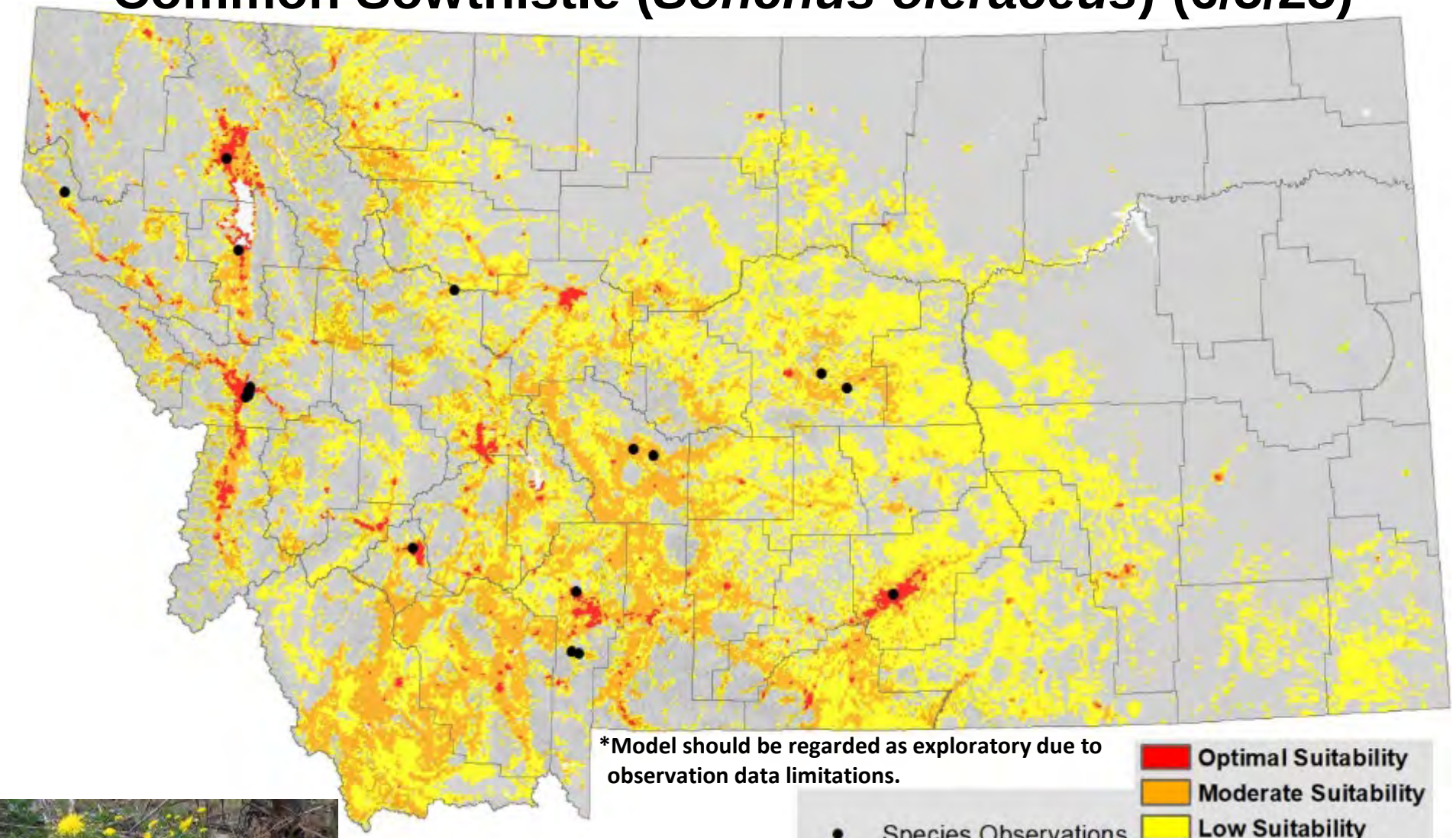
Brown Starthistle (*Centaurea jacea*) (4/9/24)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.062	106,155	28%
Moderate	0.241	27,503	7%
Optimal	0.574	6,519	2%

Climbing Nightshade (*Solanum dulcamara*) (6/17/25)

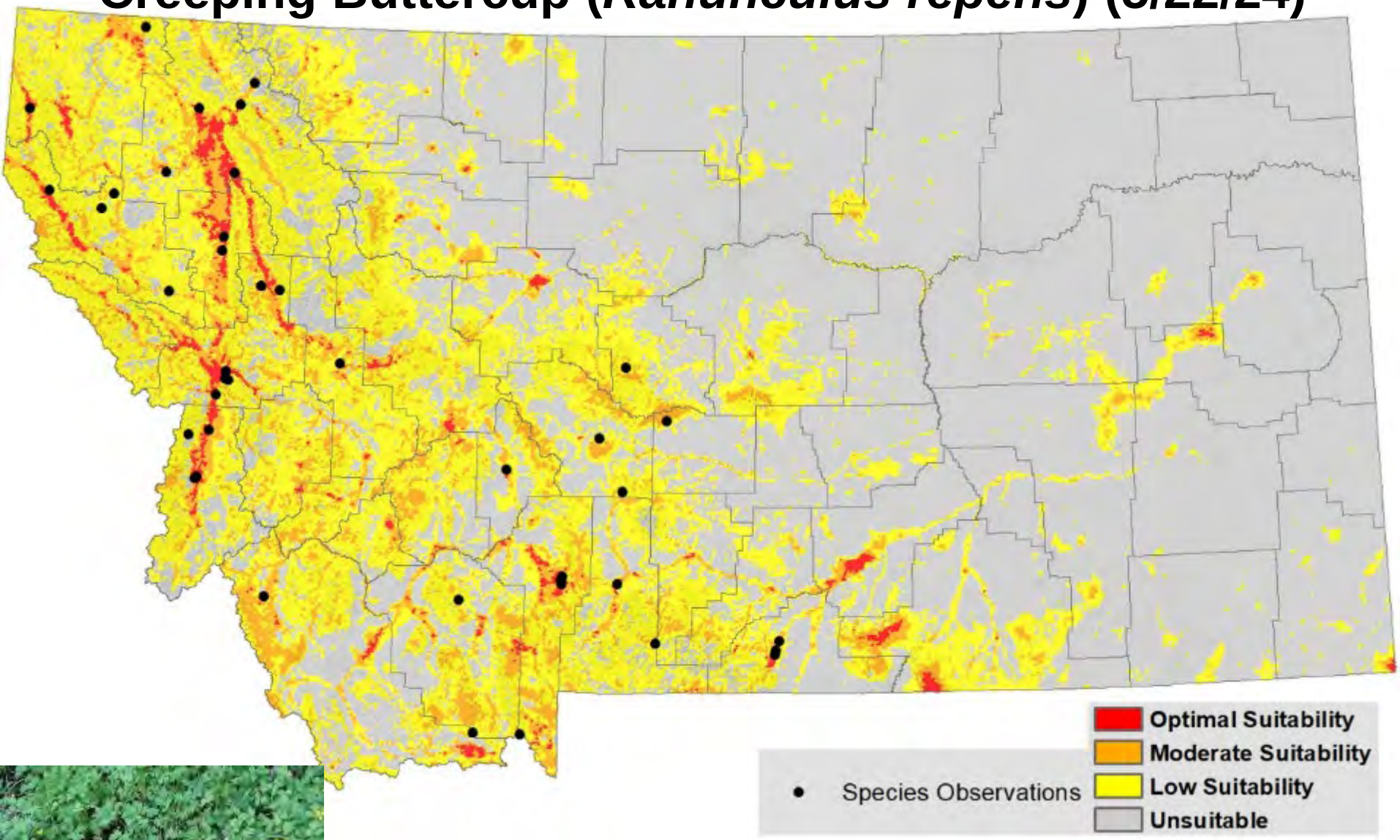
Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.028	81,572	21%
Moderate	0.133	13,173	3%
Optimal	0.348	7,162	2%

Common Sowthistle (*Sonchus oleraceus*) (6/5/25)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.031	57,239	15%
Moderate	0.103	31,579	8%
Optimal	0.305	9,165	2%

Creeping Buttercup (*Ranunculus repens*) (5/22/24)

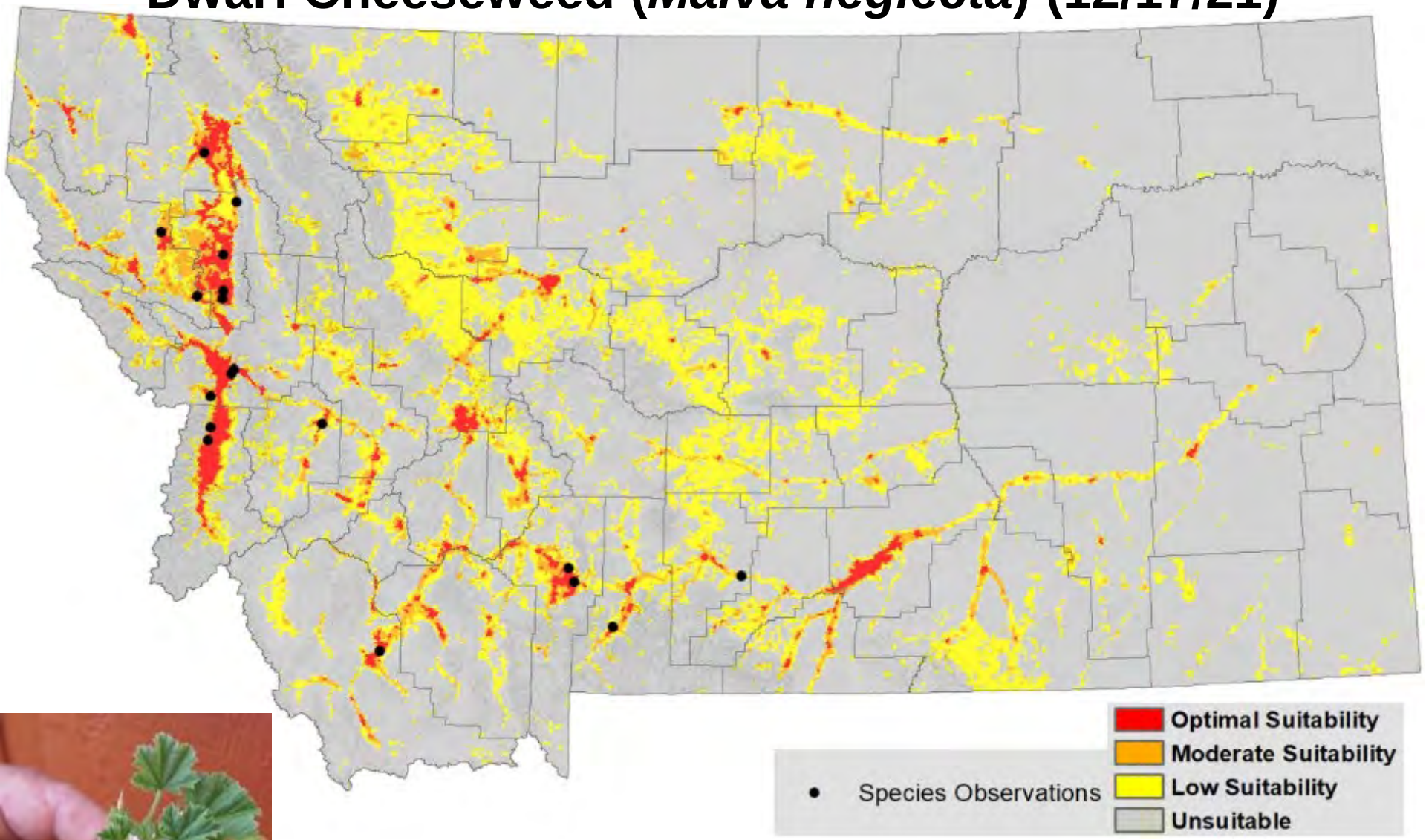


Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.018	76,395	20%
Moderate	0.107	23,674	6%
Optimal	0.356	7,921	2%

Dame's Rocket (*Hesperis matronalis*) (6/30/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.011	51,521	14%
Moderate	0.084	10,644	3%
Optimal	0.258	5,429	1%

Dwarf Cheeseweed (*Malva neglecta*) (12/17/21)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.013	37,835	10%
Moderate	0.076	9,034	2%
Optimal	0.229	6,601	2%

European Barberry (*Berberis vulgaris*) (5/29/24)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.033	66,864	18%
Moderate	0.113	34,543	9%
Optimal	0.425	5,614	1%

Globe-podded Whitetop (*Lepidium appelianum*) (4/8/24)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.018	46,810	12%
Moderate	0.132	11,036	3%
Optimal	0.321	6,612	2%

Greater Burdock (*Arctium lappa*) (4/9/24)

*Model should be regarded as exploratory due to observation data limitations.

Species Observations

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.080	135,468	36%
Moderate	0.287	37,339	10%
Optimal	0.613	5,301	1%

Ground-cherry Nightshade (*Solanum physalifolium*) (11/5/21)

*Model should be regarded as exploratory due to observation data limitations.

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable
Species Observations

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.026	64,711	17%
Moderate	0.081	31,510	8%
Optimal	0.257	8,802	2%

Japanese Brome (*Bromus japonicus*) (6/11/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.033	105,443	28%
Moderate	0.240	116,495	31%
Optimal	0.911	1	<1%

Jointed Goatgrass (*Aegilops cylindrica*) (6/5/25)

*Model should be regarded as exploratory due to observation data limitations.

Species Observations

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.119	86,906	23%
Moderate	0.302	77,157	20%
Optimal	0.708	4,242	1%

Lenspod Whitetop (*Lepidium chalepense*) (5/26/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.038	158,890	42%
Moderate	0.291	40,893	11%
Optimal	0.663	5,482	1%

Maiden's-tears (*Silene vulgaris*) (6/30/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.047	134,342	35%
Moderate	0.237	37,534	10%
Optimal	0.620	6,071	1.6%

Meadow Goat's-beard (*Tragopogon dubius*) (6/11/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.059	116,343	31%
Moderate	0.298	156,761	41%
Optimal	0.999	0	0%

Narrowleaf Hawksbeard (*Crepis tectorum*) (12/21/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.037	96,948	25%
Moderate	0.203	31,558	8%
Optimal	0.620	6,795	2%

Night-flowering Catchfly (*Silene noctiflora*) (12/21/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.031	39,168	10%
Moderate	0.118	27,424	7%
Optimal	0.382	10,966	3%

Persian Ryegrass (*Lolium persicum*)

***Of the 75 records we have for this species, only 1 is mapped precisely enough for use in modeling the species' invasion risk.**

Quackgrass (*Elymus repens*) (1/6/22)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.056	88,947	23%
Moderate	0.174	56,860	15%
Optimal	0.678	5,086	1%

Small Bugloss (*Anchusa arvensis*) (1/6/22)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.052	43,723	11%
Moderate	0.142	59,224	16%
Optimal	0.503	7,942	2%

Small-seed Alfalfa Dodder (*Cuscuta approximata*)

***Of the 15 records we have for this species, only 1 is mapped precisely enough for use in modeling the species' invasion risk.**

Spiny-leaf Sowthistle (*Sonchus asper*) (6/15/21)

*Model should be regarded as exploratory due to observation data limitations.

Species Observations

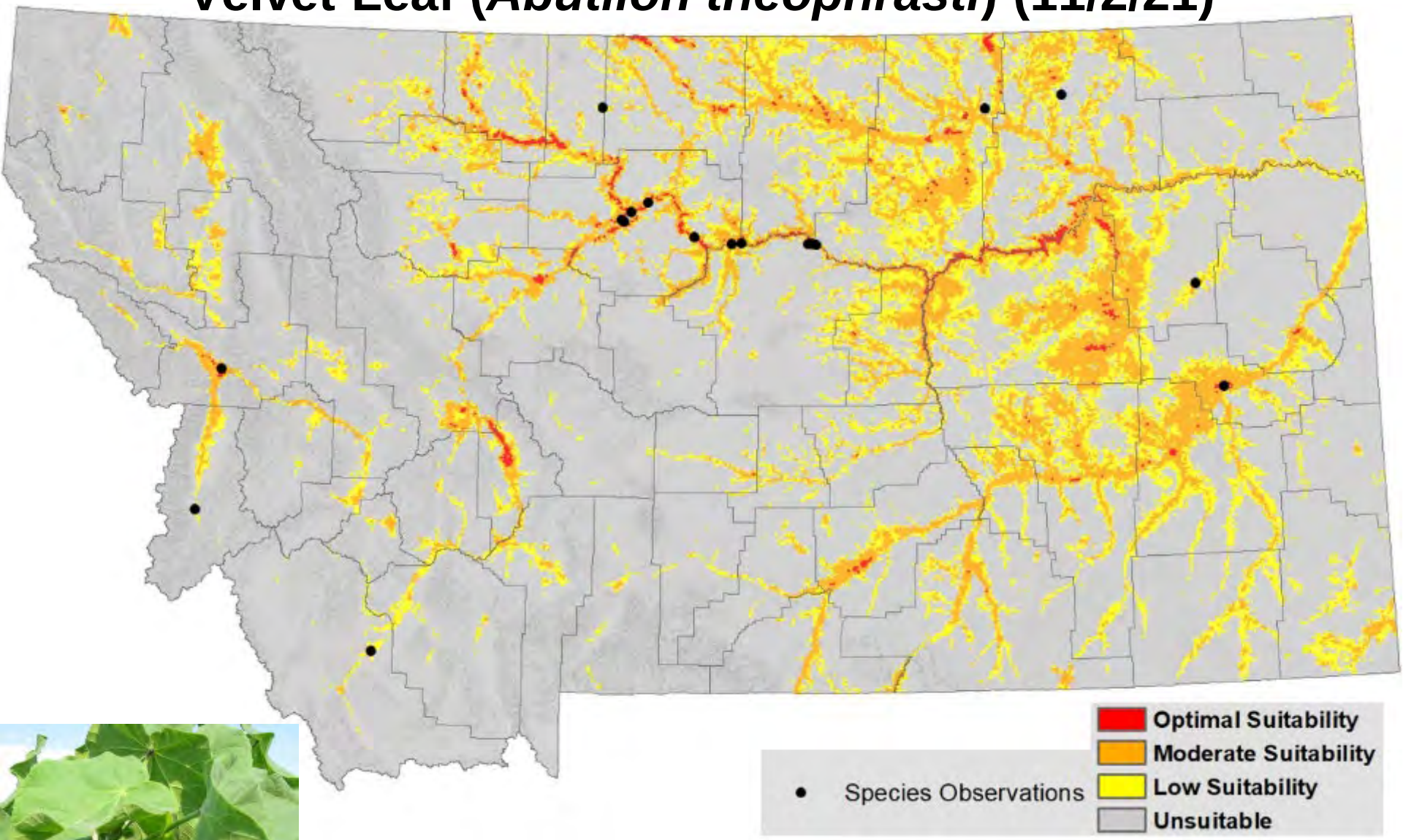
Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.002	16,240	4%
Moderate	0.065	1,149	<1%
Optimal	0.131	1,664	<1%

Stork's Bill (*Erodium cicutarium*) (6/16/25)

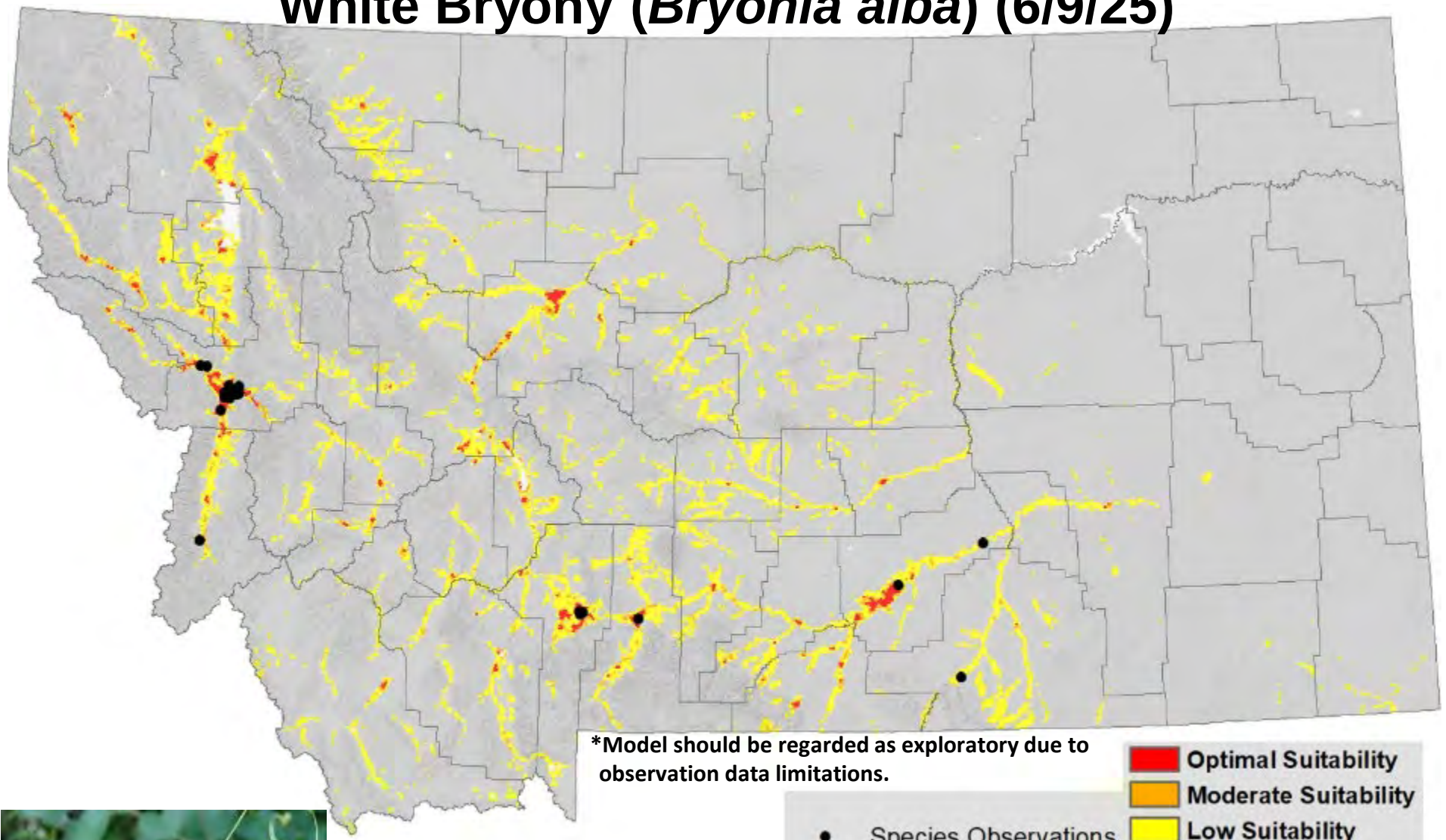
Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.005	48,270	13%
Moderate	0.059	9,869	3%
Optimal	0.245	4,489	1%

Velvet Leaf (*Abutilon theophrasti*) (11/2/21)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.019	32,128	8%
Moderate	0.067	26,206	7%
Optimal	0.440	4,491	1%

White Bryony (*Bryonia alba*) (6/9/25)



Suitability	Logistic Cutoff	Area in Km²	% of MT
Low	0.001	12,893	3%
Moderate	0.052	1,009	<1%
Optimal	0.128	1,278	<1%

Wild Oats (*Avena fatua*) (1/18/22)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.126	83,115	22%
Moderate	0.246	108,850	29%
Optimal	0.870	993	<1%

Wild Parsnip (*Pastinaca sativa*) (1/6/22)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.030	42,950	11%
Moderate	0.090	33,597	9%
Optimal	0.274	12,289	3%

Other Weed Species Modeled

***Please let us know if you have a weed or biocontrol species you would like a model developed for!**
bmaxell@mt.gov

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You can request geodatabases of model outputs at:
https://nris.mt.gov/reqapp/userMain.asp

African Adder's-mouth (*Malcolmia africana*) (5/9/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.031	83,711	22%
Moderate	0.170	20,828	5%
Optimal	0.471	3,690	1%

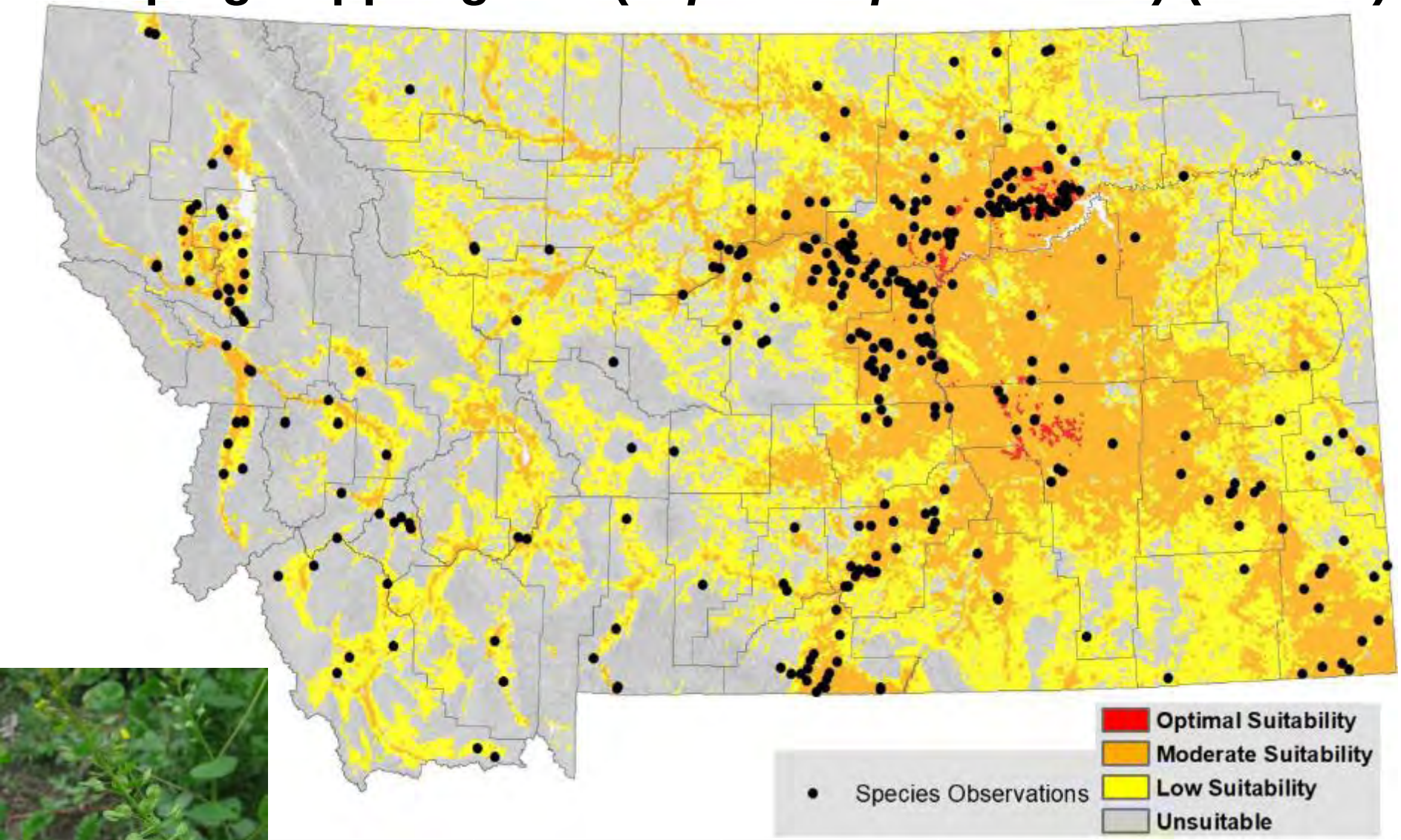
Black Bindweed (*Polygonum convolvulus*) (6/30/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.032	126,953	33%
Moderate	0.257	64,862	17%
Optimal	0.706	5,492	1%

Black Medic (*Medicago lupulina*) (6/12/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.053	155,729	41%
Moderate	0.313	66,983	18%
Optimal	0.717	5,394	1%

Clasping Pepper-grass (*Lepidium perfoliatum*) (6/10/25)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.043	87,522	23%
Moderate	0.177	80,654	21%
Optimal	0.742	3,999	1%

Common Shepherd's Purse (*Capsella bursa-pastoris*) (4/8/24)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.019	72,960	19%
Moderate	0.105	25,789	7%
Optimal	0.372	8,175	2%

Crested Wheatgrass (*Agropyron cristatum*) (6/12/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.055	93,509	25%
Moderate	0.214	122,004	32%
Optimal	0.976	3	<1%

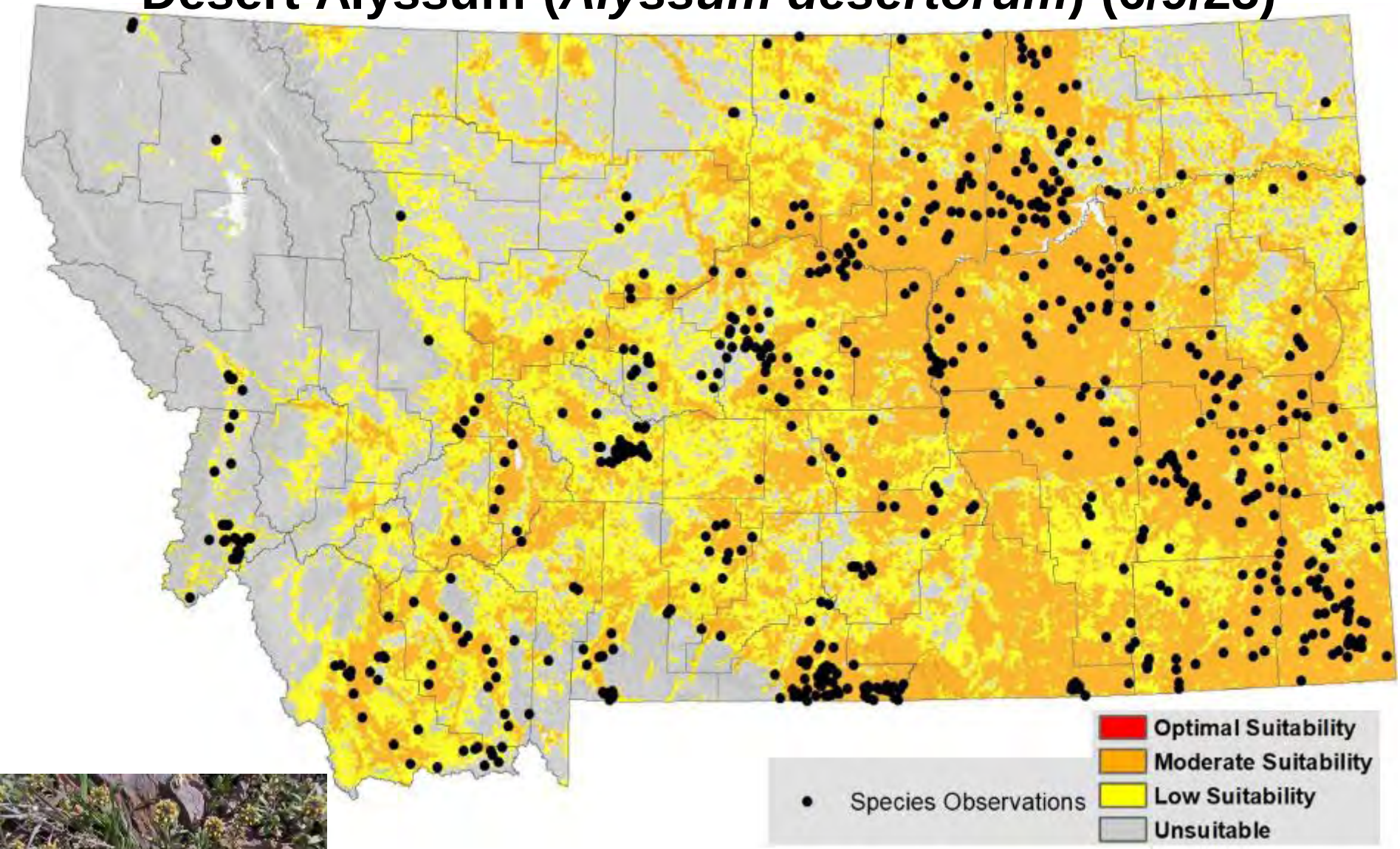
Curveseed Butterwort (*Ranunculus testiculatus*) (5/22/24)

Species Observations

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.069	132,654	35%
Moderate	0.272	35,369	9%
Optimal	0.624	5,187	1%

Desert Alyssum (*Alyssum desertorum*) (6/9/25)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.080	79,630	21%
Moderate	0.231	136,484	36%
Optimal	0.904	315	<1%

Field Fluffweed (*Filago arvensis*) (6/12/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.036	106,123	28%
Moderate	0.220	117,151	31%
Optimal	0.873	14	<1%

Field Pennycress (*Thlaspi arvense*) (4/7/24)

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable
Species Observations

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.091	148,877	39%
Moderate	0.365	82,908	22%
Optimal	0.777	3,534	1%

Field Pepper-grass (*Lepidium campestre*) (5/3/24)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.051	121,245	32%
Moderate	0.242	45,026	12%
Optimal	0.650	6.263	2%

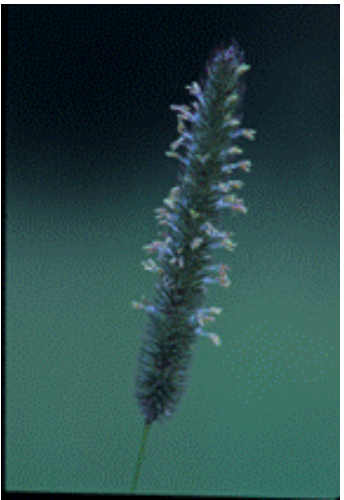
Field Sowthistle variety uliginosus (*Sonchus arvensis ssp. uliginosus*) (5/24/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.036	80,124	21%
Moderate	0.120	40,429	11%
Optimal	0.457	8,089	2%

Knotweed (*Polygonum aviculare*) (4/29/23)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.024	94,591	25%
Moderate	0.145	44,980	12%
Optimal	0.594	4,977	1%

Meadow Timothy (*Phleum pratense*) (6/11/25)

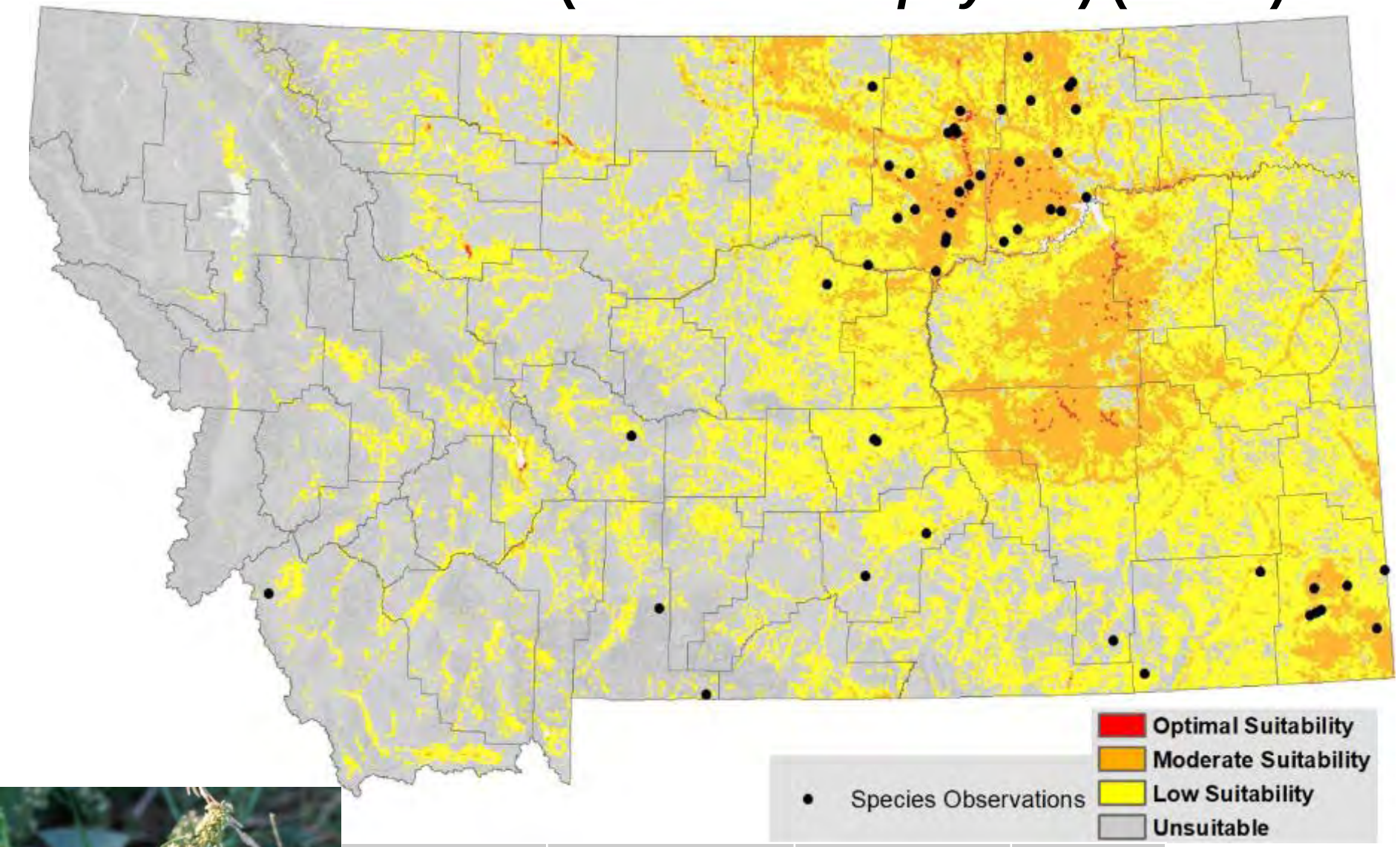


Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.030	99,118	26%
Moderate	0.169	45,469	12%
Optimal	0.540	11,587	3%

Mediterranean Serpent-root (*Scorzonera laciniata*) (4/28/23)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.019	101,688	27%
Moderate	0.159	51,461	14%
Optimal	0.572	8,690	2%

Narrowleaf Dock (*Rumex stenophyllus*) (6/9/25)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.035	81,571	21%
Moderate	0.213	33,224	9%
Optimal	0.615	5,314	1%

Pale Alyssum (*Alyssum alyssoides*) (6/11/25)

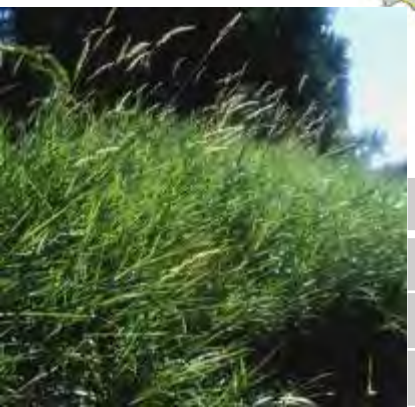
Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable
Species Observations

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.057	139,336	37%
Moderate	0.256	97,880	26%
Optimal	0.989	2.3	<1%

Purple Goat's-beard (*Tragopogon porrifolius*) (6/15/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.069	97,885	26%
Moderate	0.255	62,002	16%
Optimal	0.673	3,583	1%

Reed Canarygrass (*Phalaris arundinacea*) (4/5/24)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.021	66,064	17%
Moderate	0.130	19,851	5%
Optimal	0.391	9,724	3%

Rough Forget-me-not (*Myosotis arvensis*) (6/14/21)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.036	49,839	13%
Moderate	0.166	29,401	8%
Optimal	0.522	7,064	2%

Slender Russian-thistle (*Salsola collina*) (6/30/25)

*Model should be regarded as exploratory due to observation data limitations.

Species Observations

Optimal Suitability
Moderate Suitability
Low Suitability
Unsuitable

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.107	50,240	13%
Moderate	0.231	97,436	26%
Optimal	0.599	12,957	3%

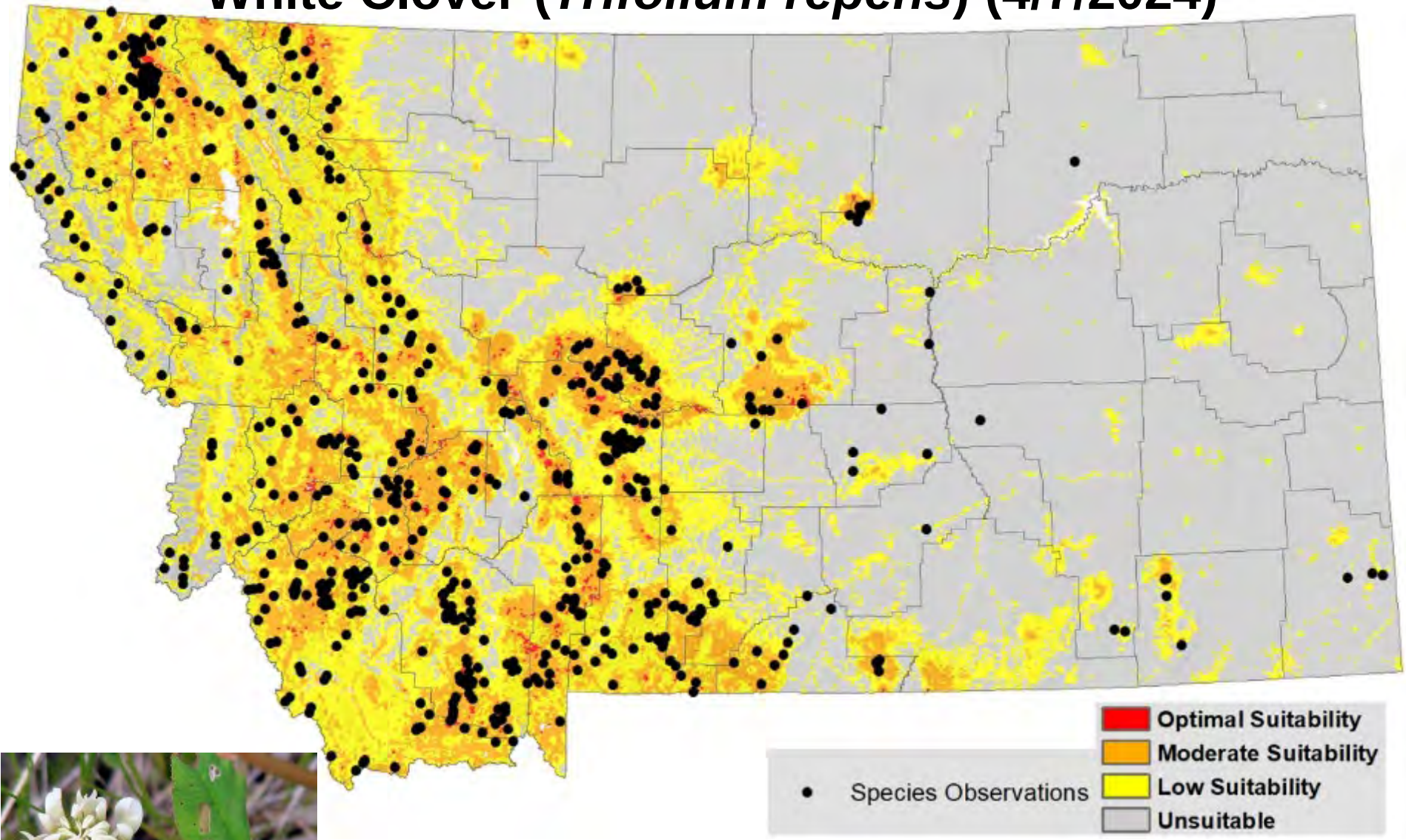
Small Tumble-mustard (*Sisymbrium loeselii*) (6/11/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.033	103,877	27%
Moderate	0.169	50,096	13%
Optimal	0.580	4,324	1%

Small-flowered Forget-me-knot (*Myosotis stricta*) (6/30/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.056	69,647	18%
Moderate	0.166	45,902	12%
Optimal	0.507	10,380	3%

White Clover (*Trifolium repens*) (4/7/2024)



Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.032	79,706	21%
Moderate	0.158	37,522	10%
Optimal	0.475	10,993	3%

White Sweetclover (*Melilotus albus*) (6/5/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.014	88,670	23%
Moderate	0.078	17,316	5%
Optimal	0.301	6,584	2%

Yellow Sweetclover (*Melilotus officinalis*) (6/10/25)

Suitability	Logistic Cutoff	Area in Km^2	% of MT
Low	0.056	91,707	24%
Moderate	0.242	139,602	37%
Optimal	0.829	683	<1%

Questions on Modeling, Model Needs, or Data/Model Access via Map Viewer

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Requests for Model Outputs for Use in GIS

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Botanical and Herbarium Specimen Collection Questions

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