

A GIS Method for Agricultural Chemical Groundwater Monitoring Well Site Selection

ACSR:

Agricultural Land Use – Crop Frequency – Saturated Soil Residency



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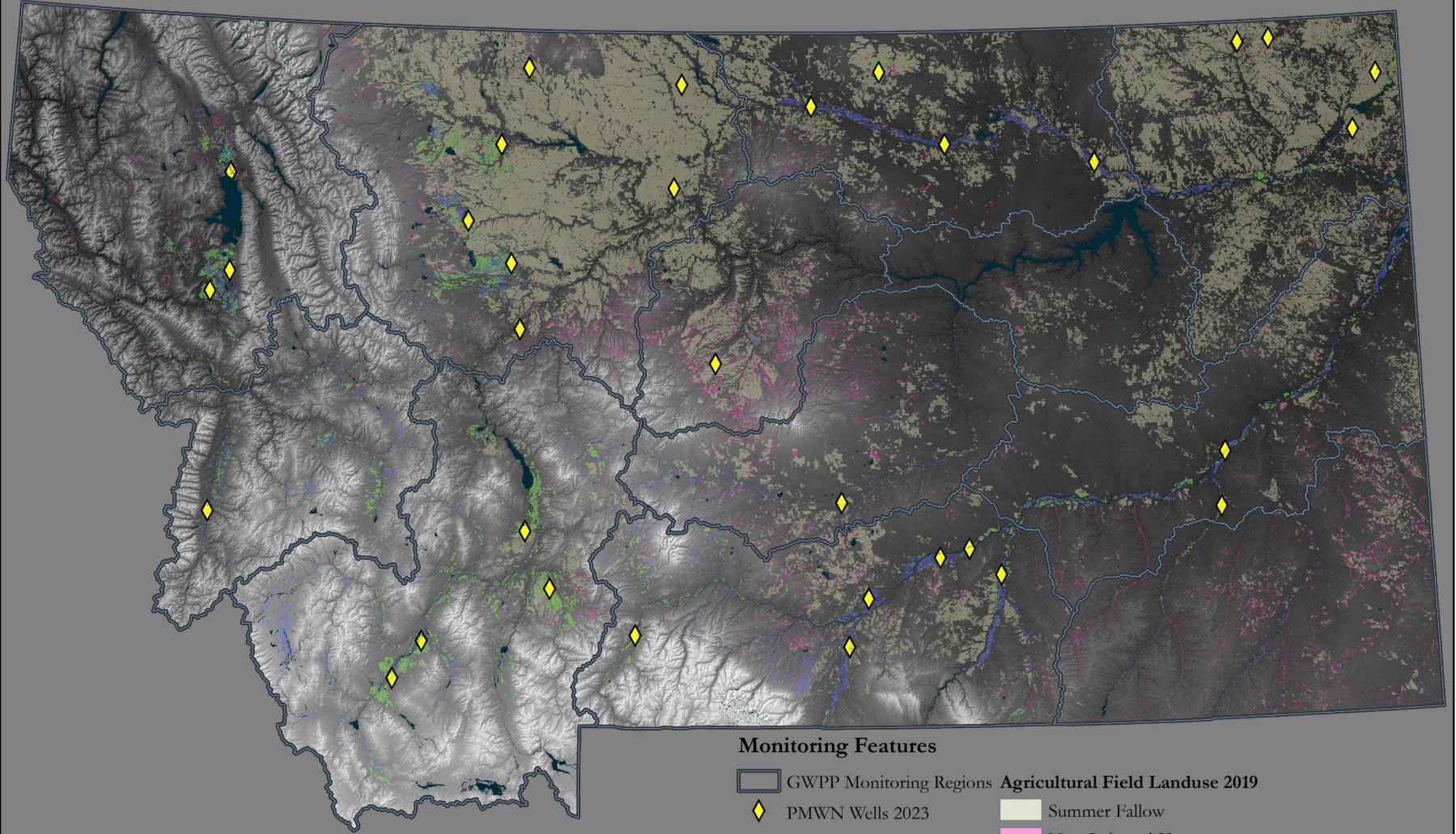








Montana Groundwater Protection Program Permanent Monitoring Network

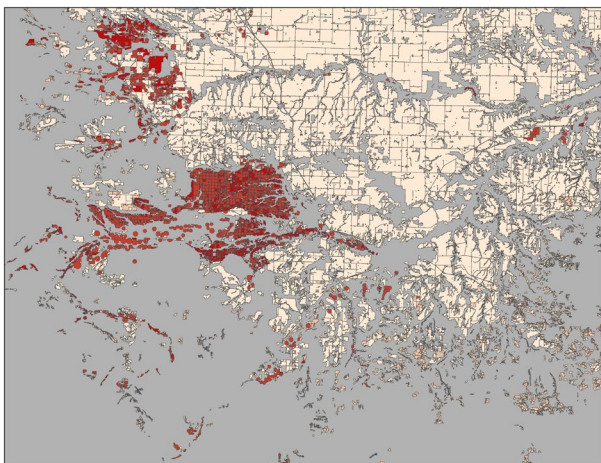


Monitoring Features

- | | |
|-------------------------|--|
| GWPP Monitoring Regions | Agricultural Field Landuse 2019 |
| PMWN Wells 2023 | Summer Fallow |
| | Non-Irrigated Hay |
| | Continuously Cropped |
| | Specialty Crops |
| | Pivot/ Sprinkler Irrigated |
| | Flood Irrigated |

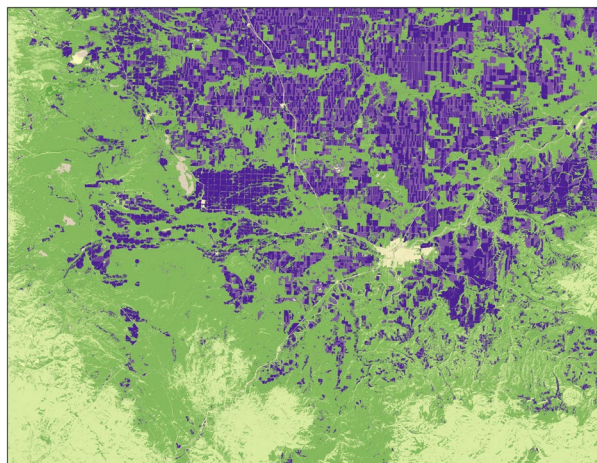
ACSR Land Use Classification Code

Agricultural Land-use, Crop Frequency, Soil Residency Classification					
1st Digit	Agricultural Landuse	2nd & 3rd Digits	Crop Frequency (Years)	4th Digit	Soil Root Zone (<=36in) Residency Time (Hrs)
1	(X) Commercial Land	01	1	1	0.0 - 24
2	(F) Summer Fallow	02	2	2	25 - 48
3	(H) Non-Irrigated Hay	03	3	3	49 - 72
4	(C) Continuously Cropped	04	4	4	73 - 96
5	(S) Specialty Crops	05	5	5	97 - 120
6	(N) Noncommercial Forest Land	06	6	6	121 - 144
7	(T) Forest Land	07	7	7	145 - 168
8	(PS) Pivot/Sprinkler Irrigated	08	8	8	169 - 192
9	(FL) Flood Irrigated	09	9	9	192 <
		10	10		



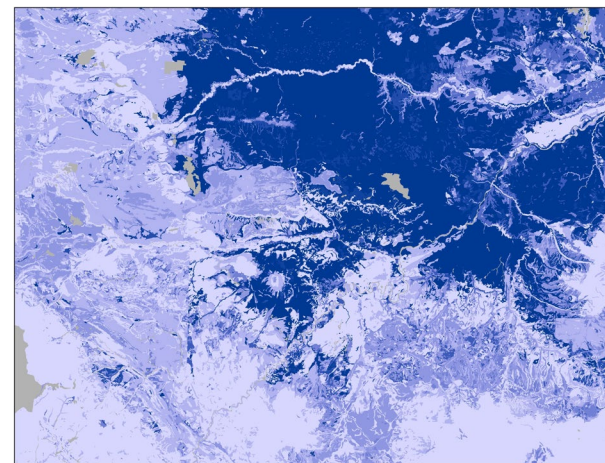
Revenue Final Land Unit (FLU) Classification

The Montana Department of Revenue Final Land Unit Classification (FLU) is a classification of private agricultural land into one of six uses, fallow, hay, grazing, irrigated, continuously cropped and forest, with forest additionally classified as commercial or non-commercial.



USDA CropScape - Cropland Data Layer

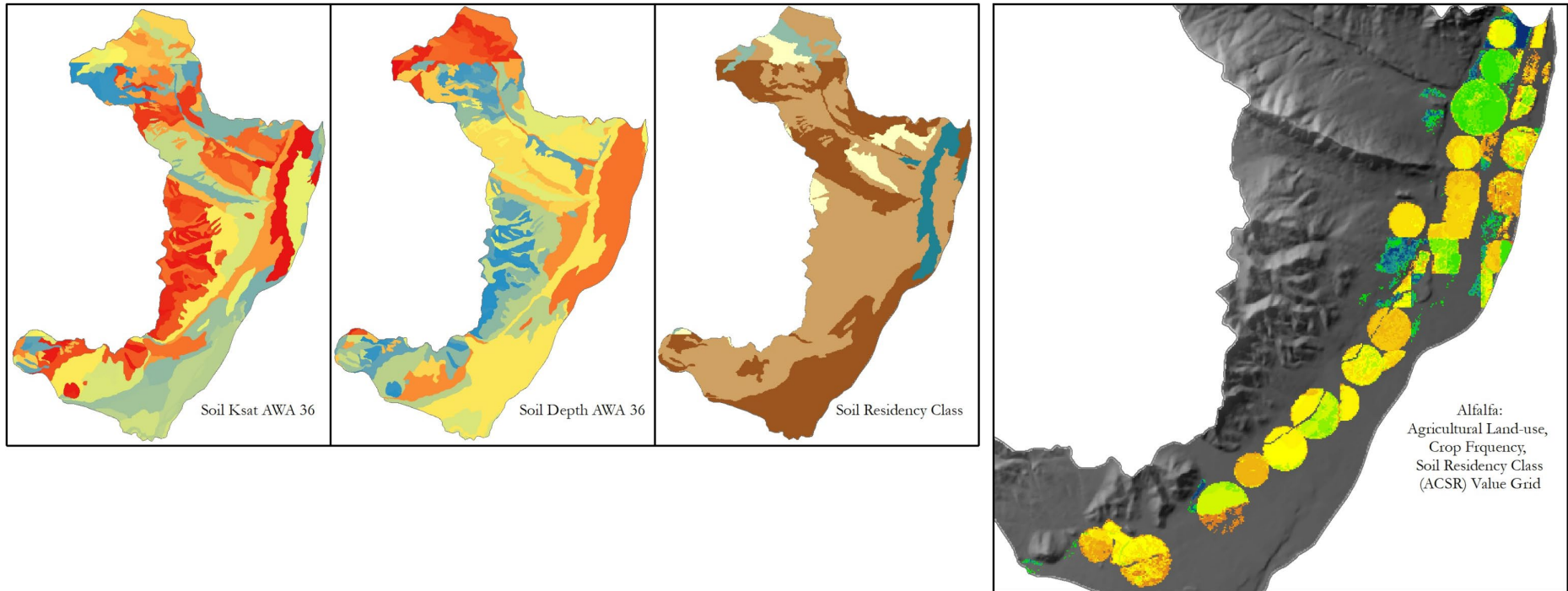
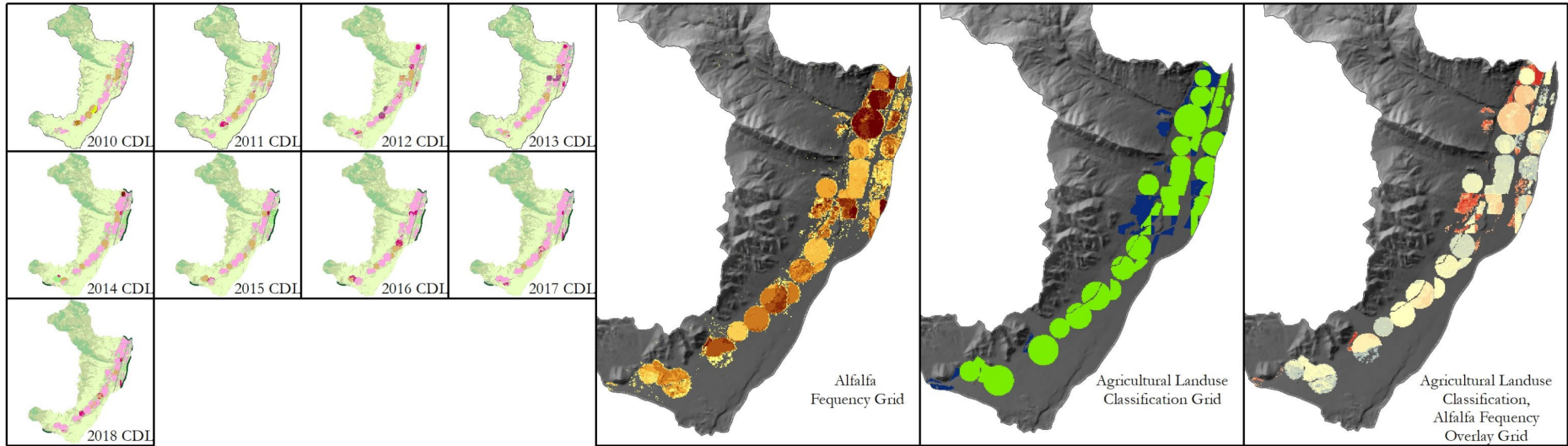
The Cropland Data Layer (CDL), hosted on CropScape, provides a raster, geo-referenced, crop-specific land cover map for the continental United States.

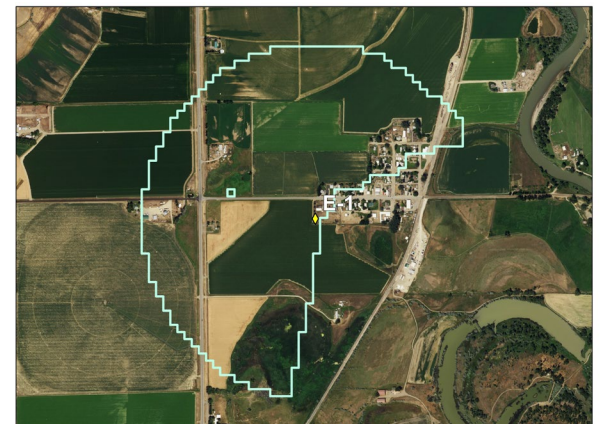
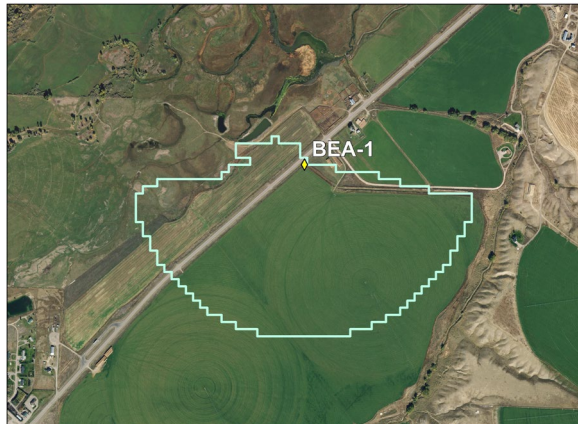
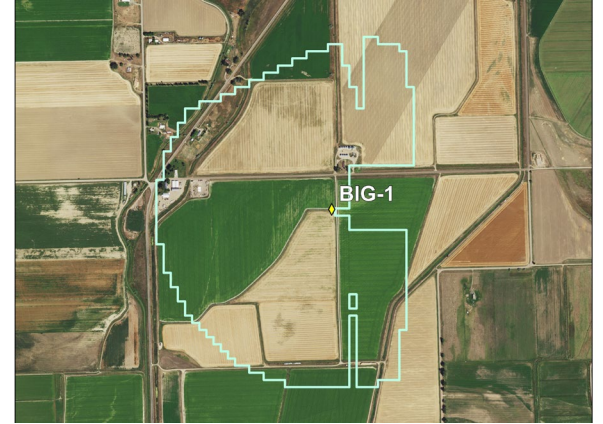
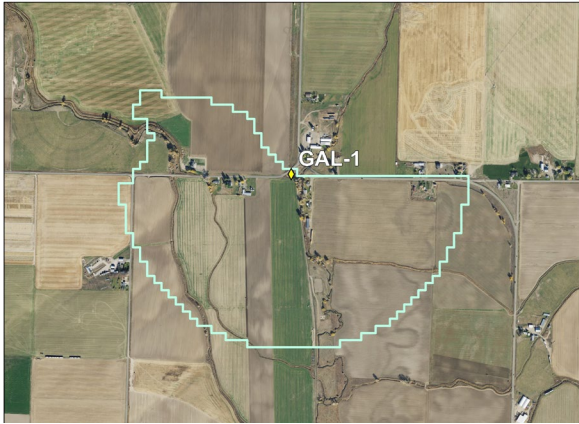


USDA Soil Survey Geographic Database

The SSURGO database contains information about soil as collected by the National Cooperative Soil Survey over the course of a century. The information can be displayed in tables or as maps and is available for most areas in the United States and the Territories, Commonwealths, and Island Nations served by the USDA-NRCS. The information was gathered by walking over the land and observing the soil. Many soil samples were analyzed in laboratories.

Paradise Valley: Lower Trail Creek ACSR Construction



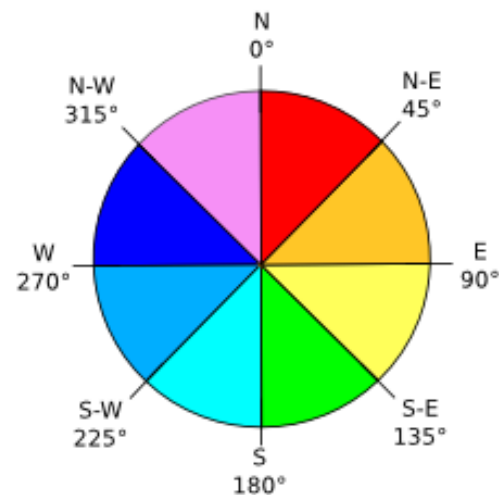


Well Confluence Sampling Areas

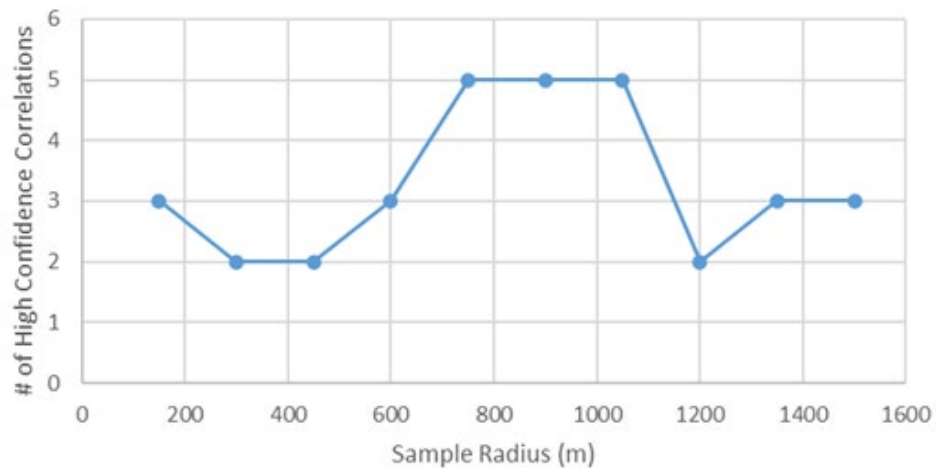
Dynamic Moving Window – “Sampling Confluence”

Cell		Columns									
		0	1	2	3	4	5	6	7	8	
Rows	Reference	col-4	col-3	col-2	col-1	col	col+1	col+2	col+3	col+4	
	row-4					4	7	11			
	1		12	8	4	3	4	8	12		
	2	13	9	5	2	2	2	5	9	13	
	3	10	6	3	1	1	1	3	6	10	
	4	row	4	3	2	1	[row,col]	1	2	3	4
	5	row+1	10	6	3	1	1	1	3	6	10
	6	row+2	13	9	5	2	2	2	5	9	13
	7	row+3		12	8	4	3	4	8	12	
8	row+4			11	7	4	7	11			

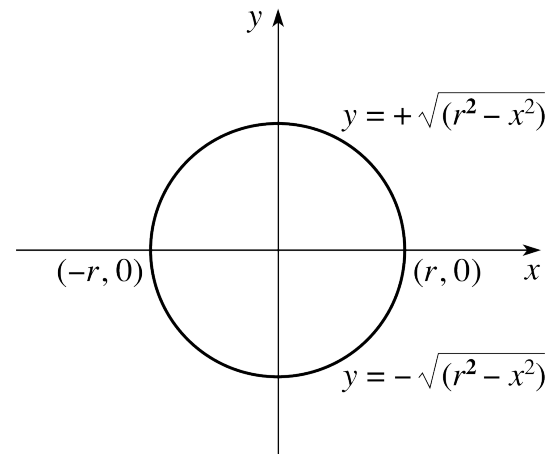
Aspect and Elevation



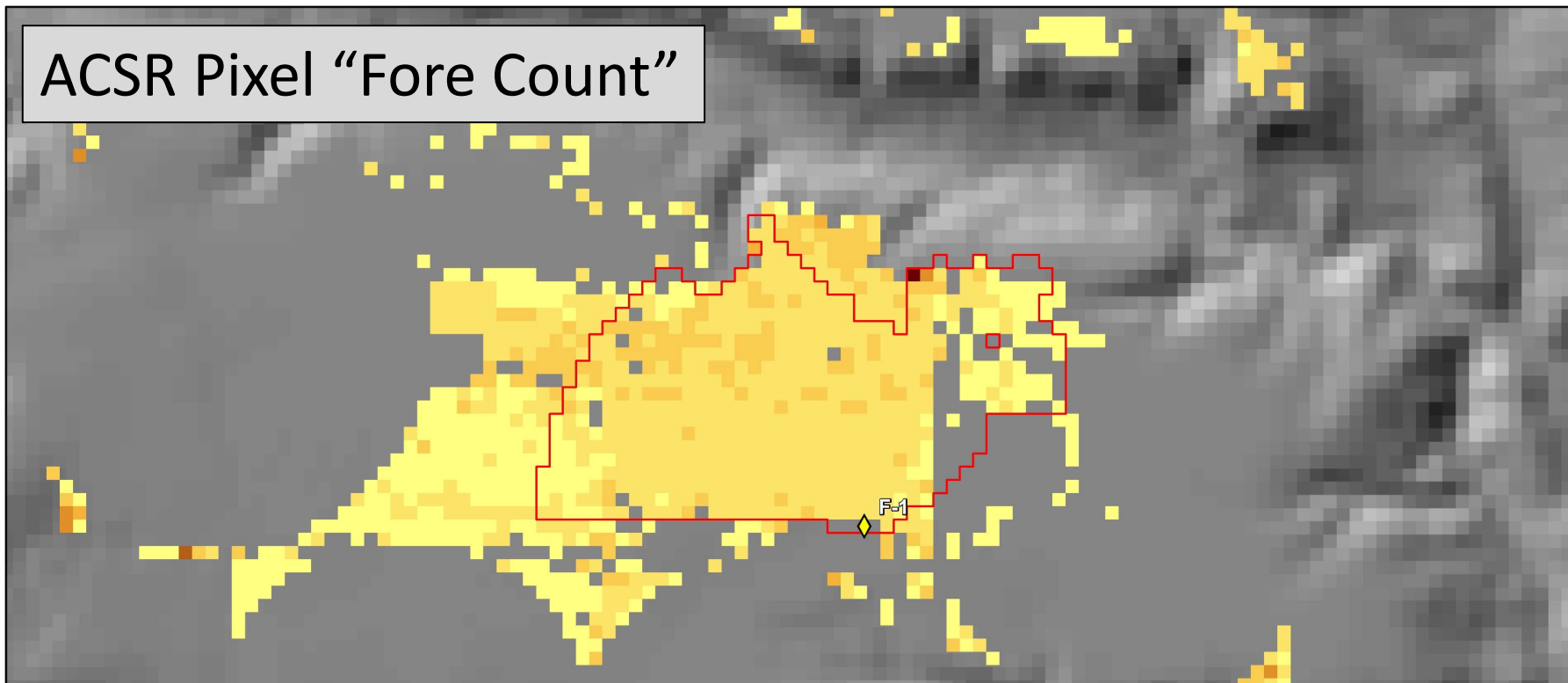
Optimal Sampling Confluence Radius



Programable Sampling Radius



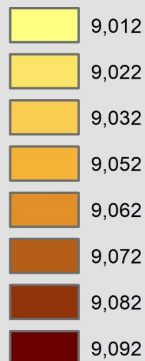
ACSR Pixel "Fore Count"



F-1 Confluence Window

- ◆ Montana_PNT_PMWN_Wells2023
- Montana_SHP_PMWN_ElevationSelectionsAS750

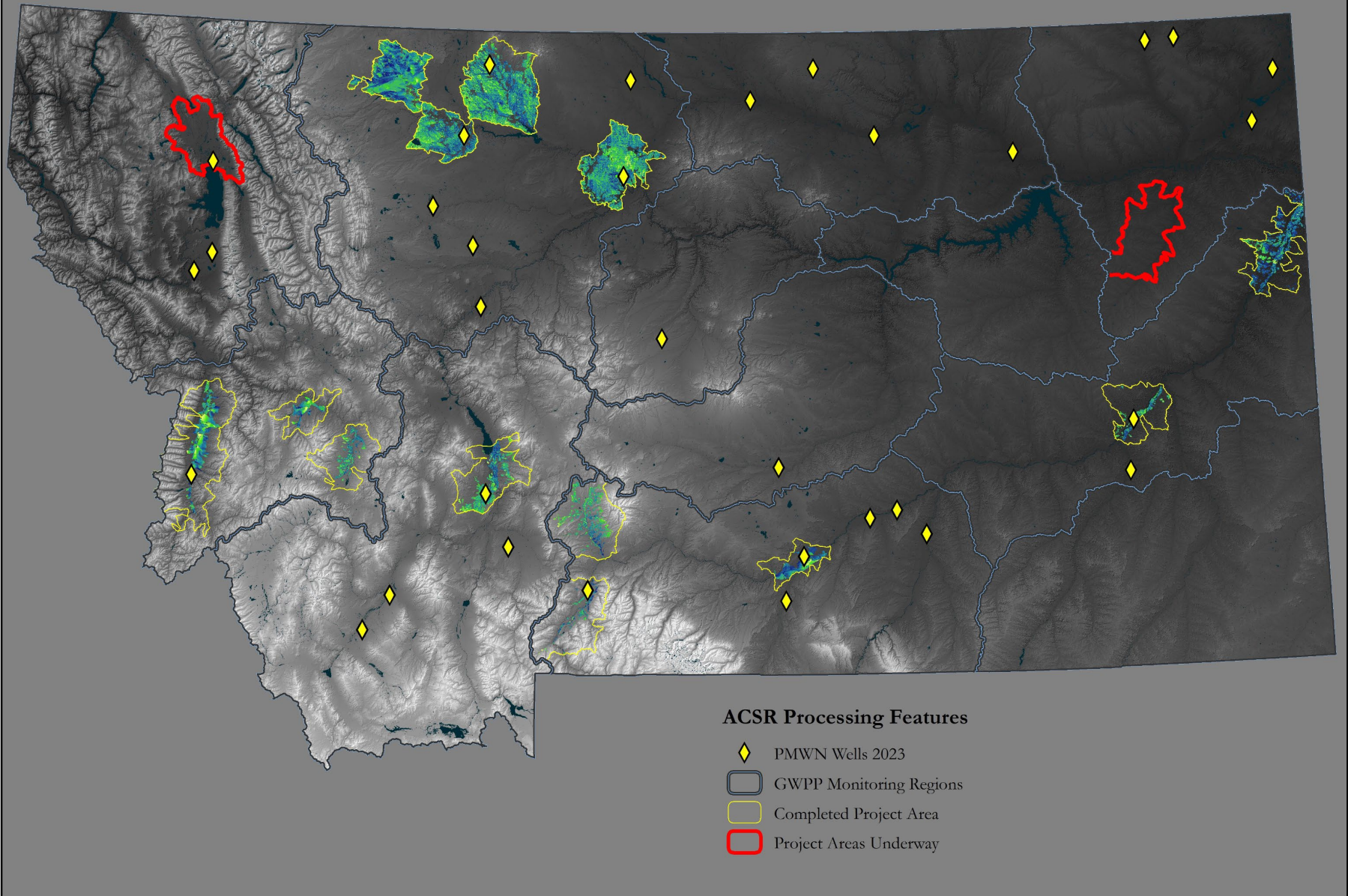
Winter Wheat: ACSR



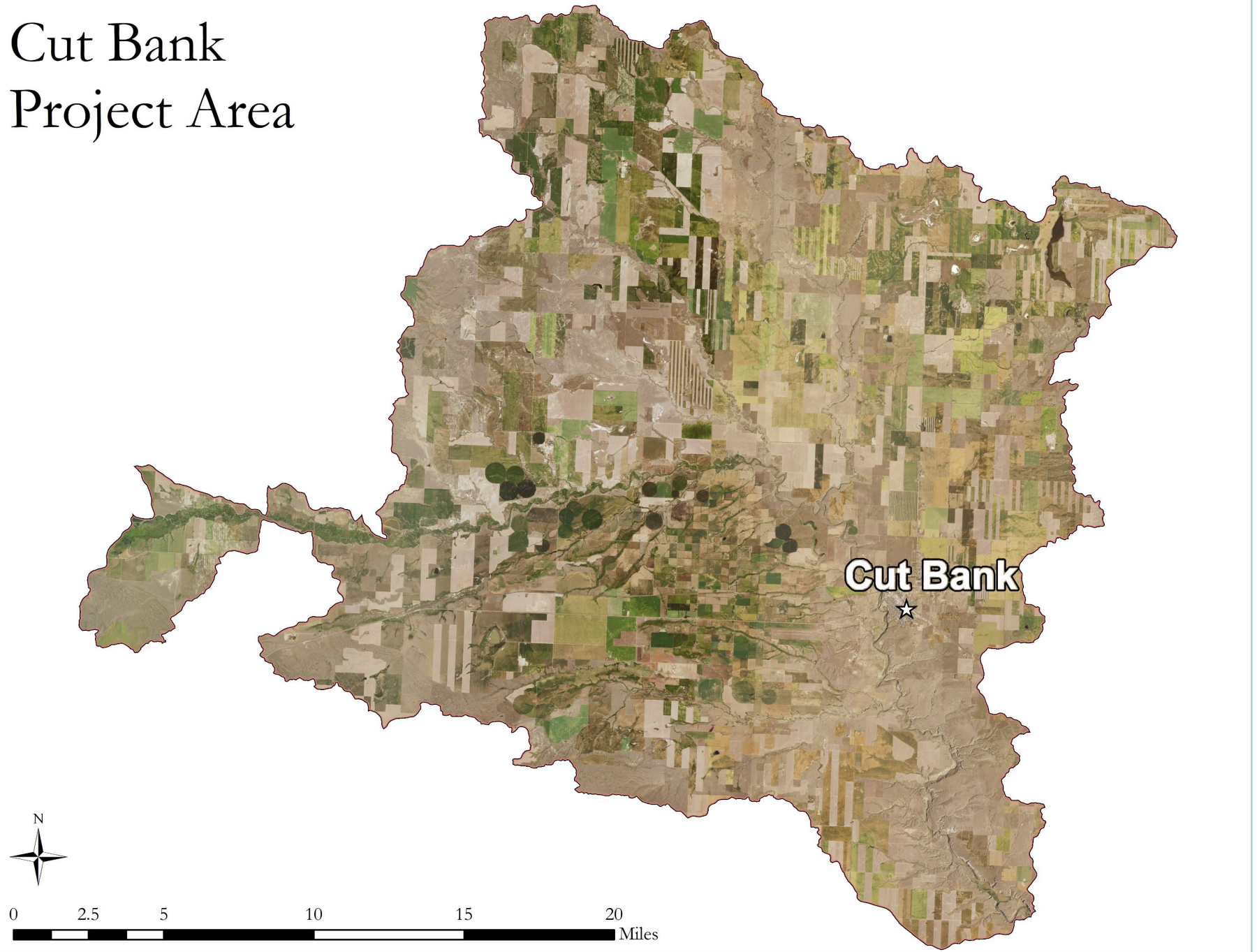
Site_ID	CropType	ACSR	Pixel_Count	Fore_Count	ElevationM	AvgAspect	PctFlat
F-1	Winter_Wheat	9012	89	551	1133	110.5410345	0
F-1	Winter_Wheat	9022	380	462	1133	110.5410345	0
F-1	Winter_Wheat	9032	76	82	1133	110.5410345	0
F-1	Winter_Wheat	9042	4	6	1133	110.5410345	0
F-1	Winter_Wheat	9062	1	2	1133	110.5410345	0
F-1	Winter_Wheat	9092	1	1	1133	110.5410345	0

ACSR 9012 - 9092: Flood Irrigated for 1-9 years on soil with 25-48 hrs of saturated soil residency (30.4 cm AWA soil depth/ 1.836 um/s AWA Ksat = 45.99 hrs)

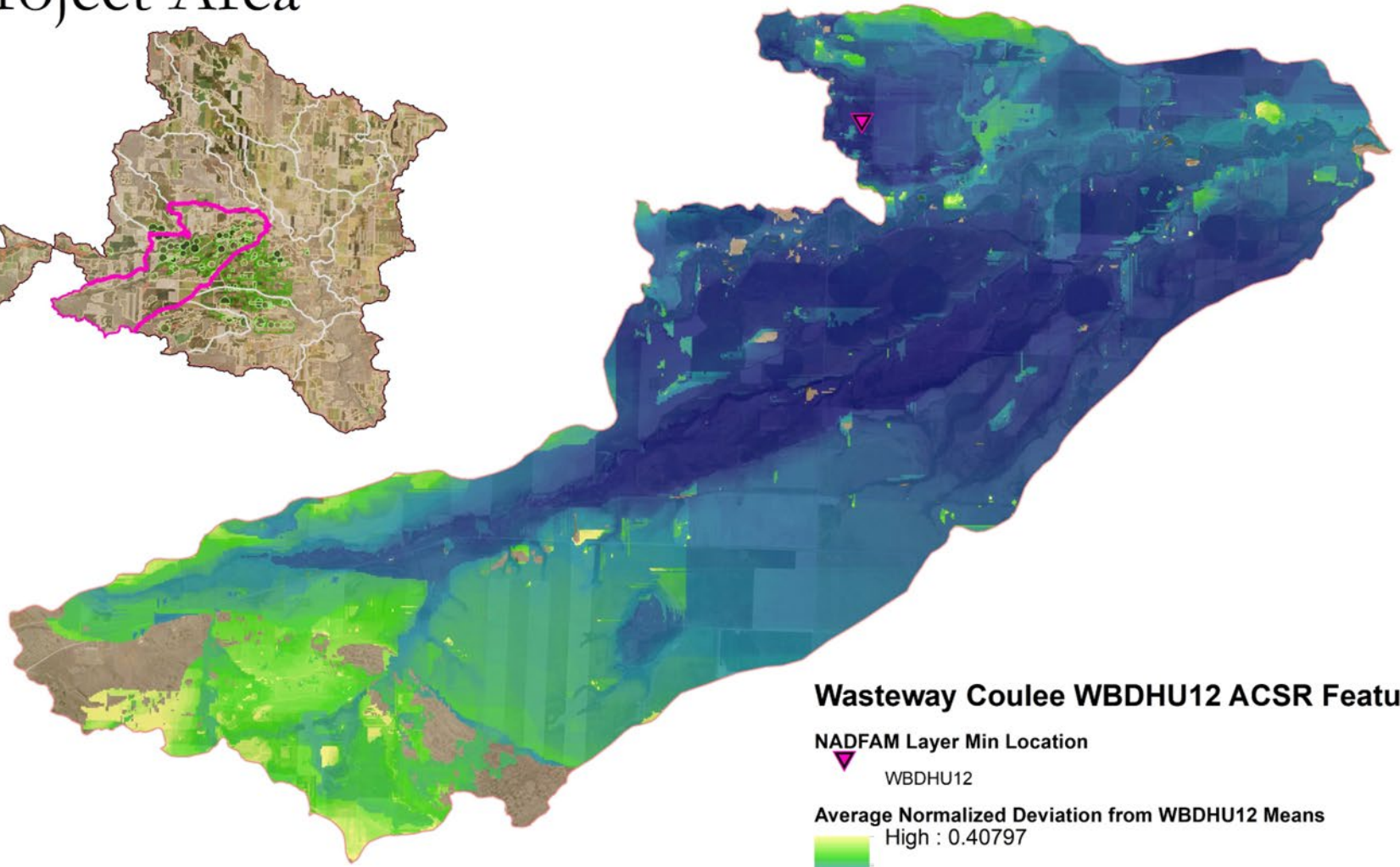
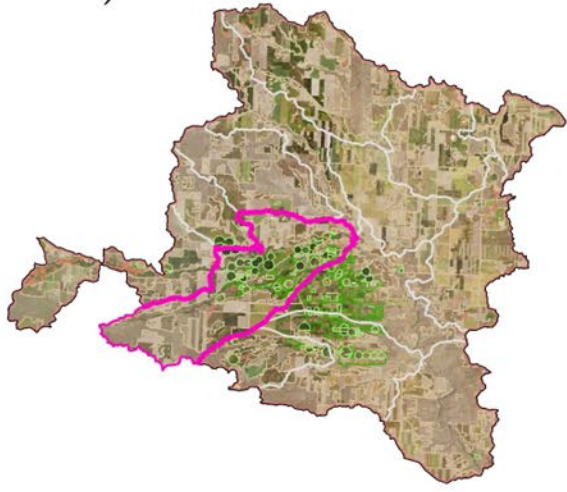
Montana ACSR Analysis



Cut Bank Project Area

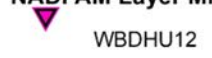


Cut Bank Project Area



Wasteway Coulee WBDHU12 ACSR Features

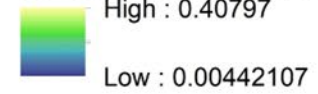
NADFAM Layer Min Location



WBDHU12

Average Normalized Deviation from WBDHU12 Means

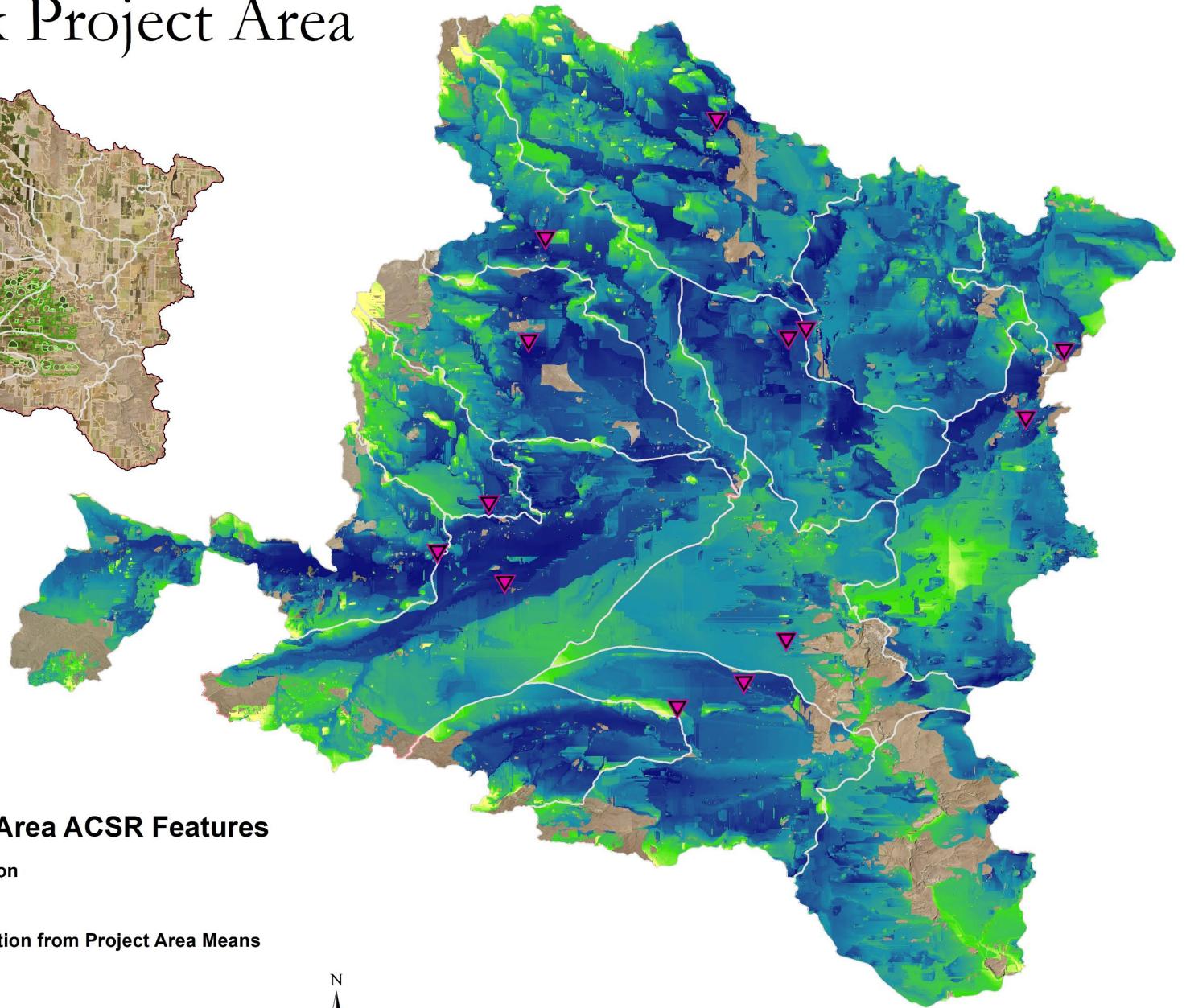
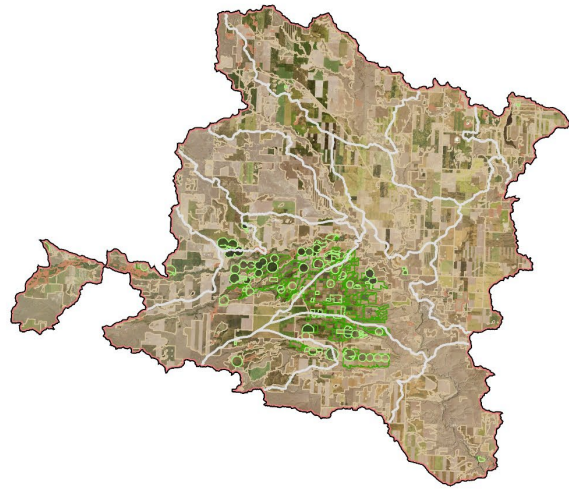
High : 0.40797



Low : 0.00442107



Cut Bank Project Area



Cut Bank Project Area ACSR Features

NADFAM Layer Min Location



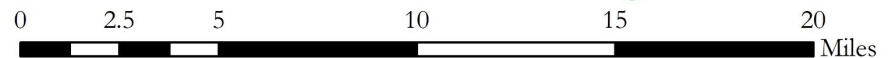
Project Area

Average Normalized Deviation from Project Area Means

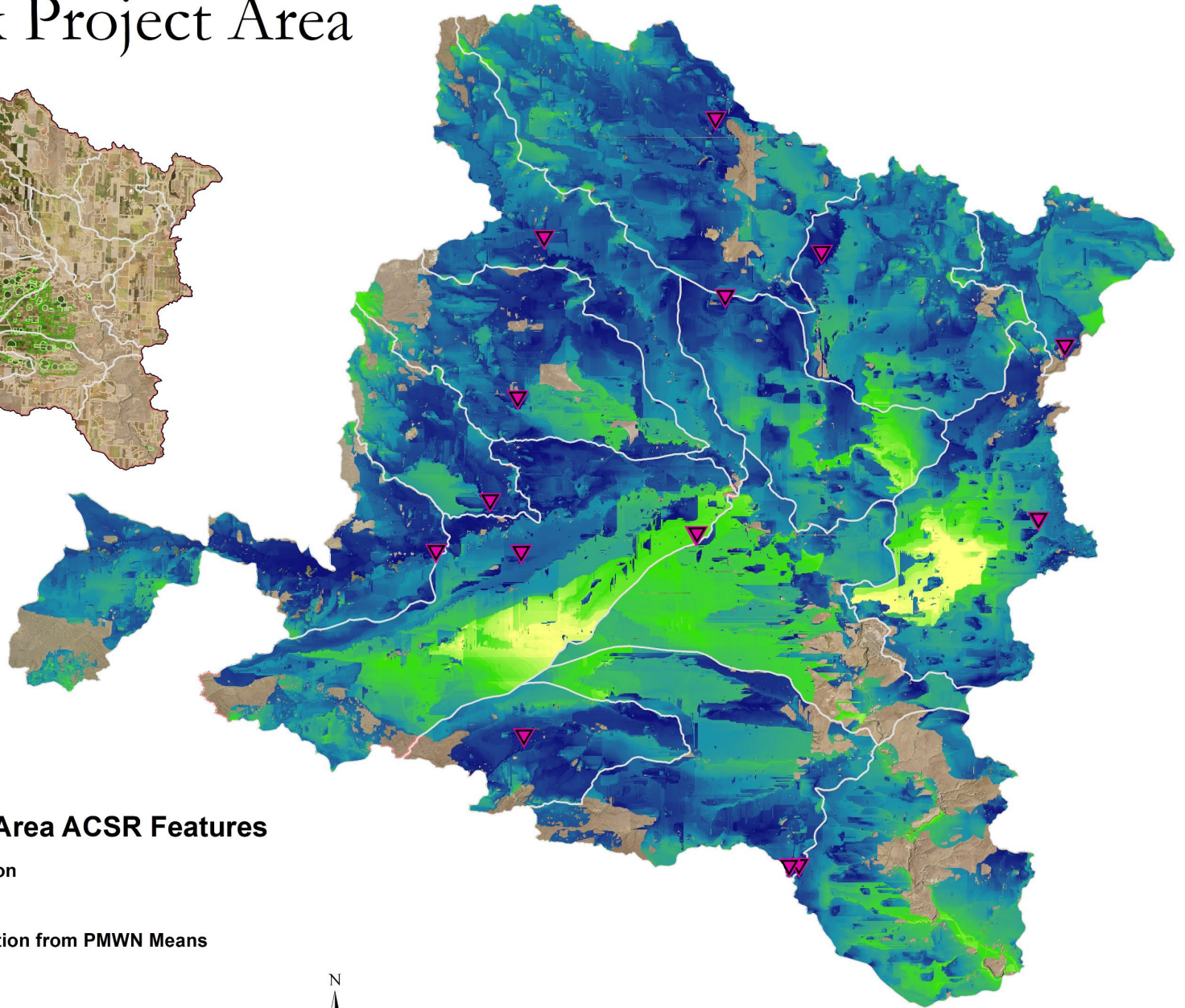
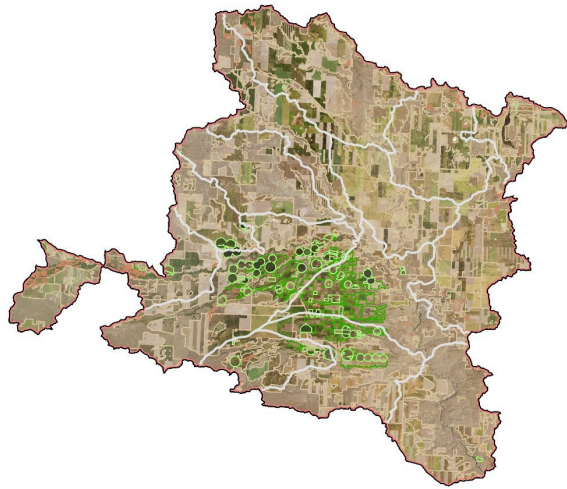


High : 0.369629

Low : 0.00328827

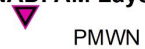


Cut Bank Project Area

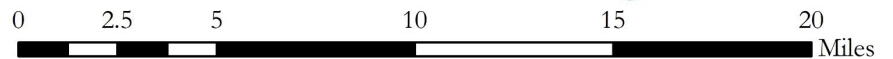
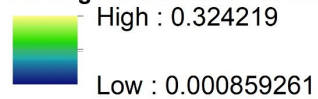


Cut Bank Project Area ACSR Features

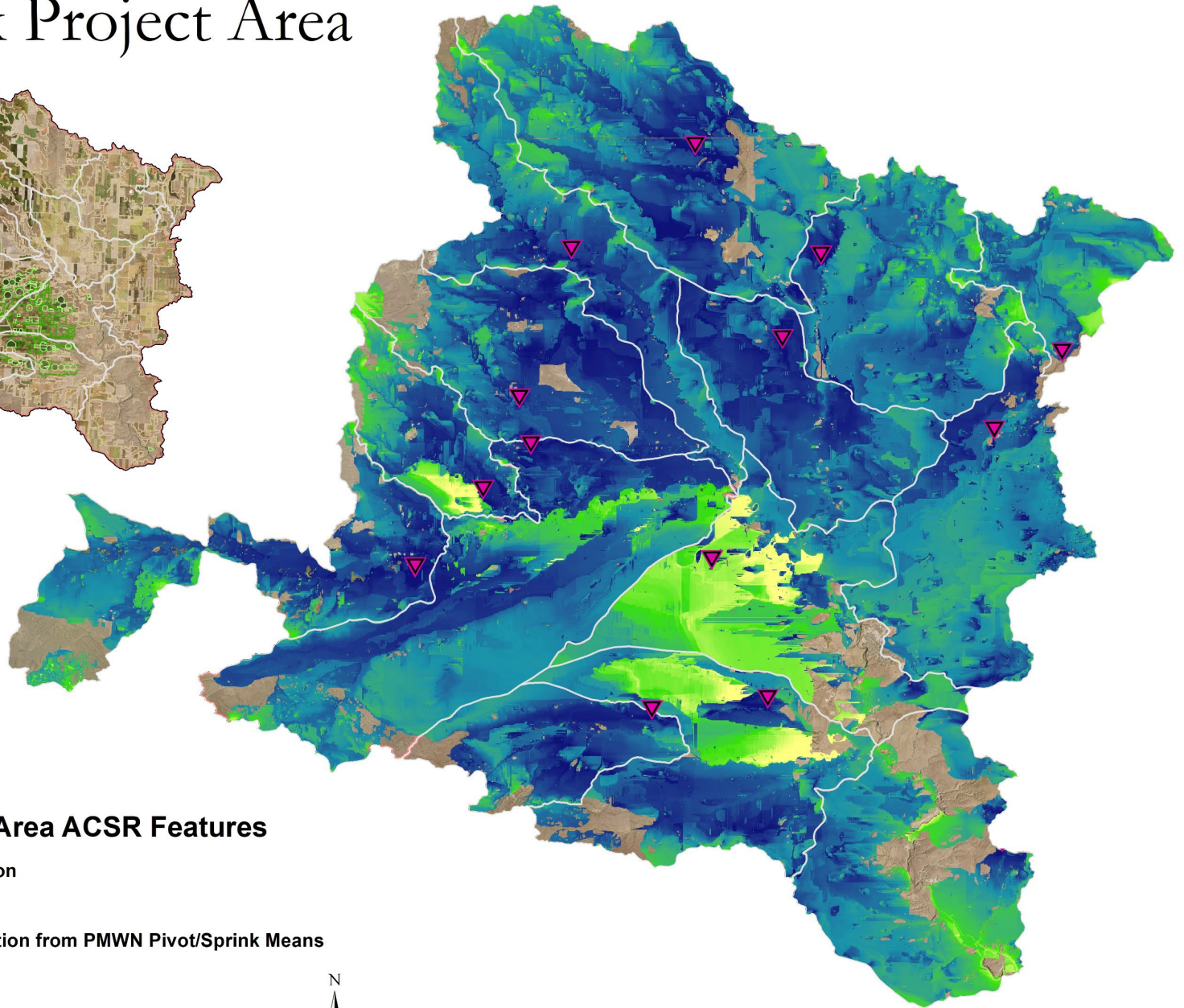
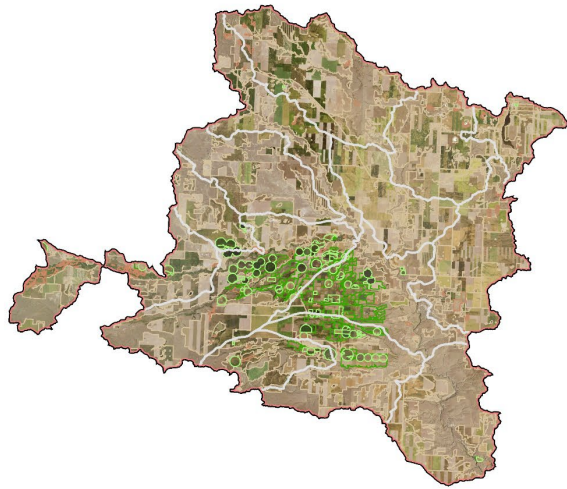
NADFAM Layer Min Location



Average Normalized Deviation from PMWN Means




Cut Bank Project Area




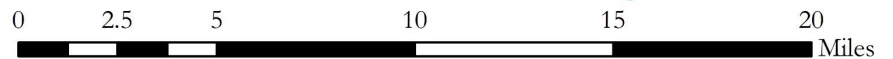
Cut Bank Project Area ACSR Features

NADFAM Layer Min Location

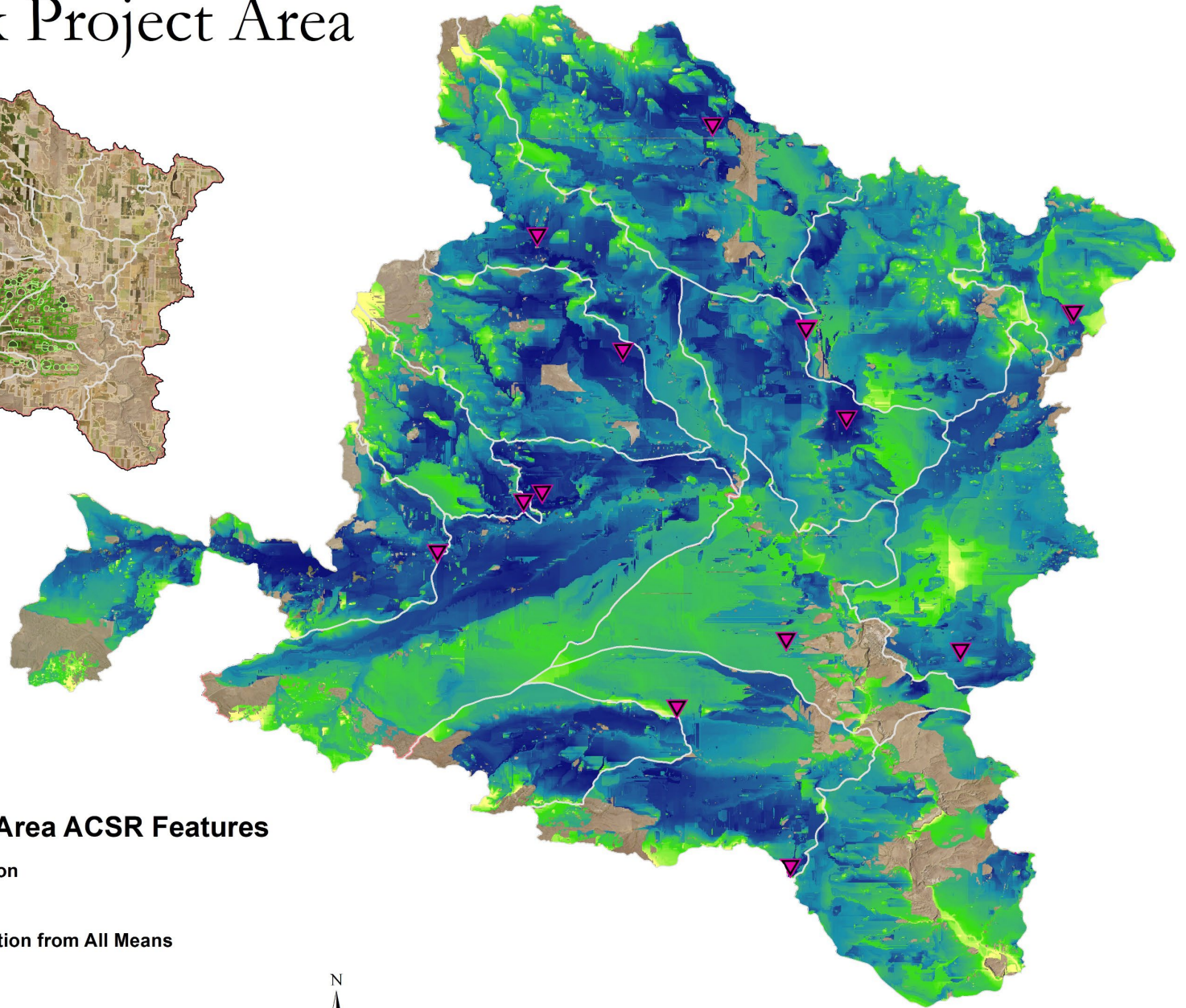
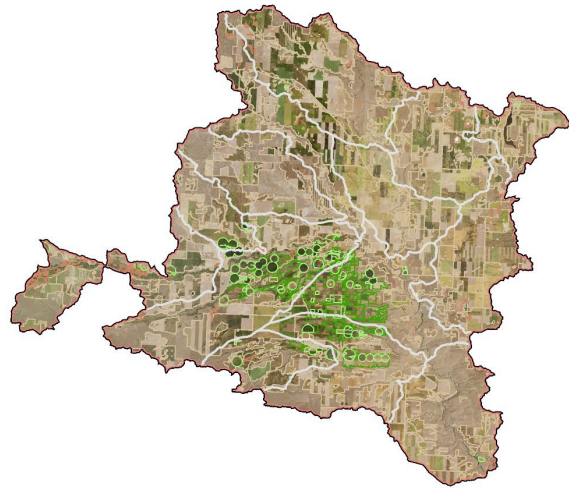
 PMWN_PivSpk

Average Normalized Deviation from PMWN Pivot/Sprink Means

 High : 0.316895
Low : 0.000857353




Cut Bank Project Area




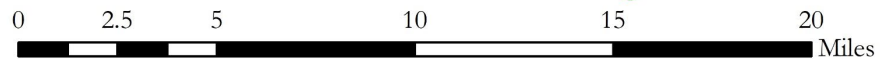
Cut Bank Project Area ACSR Features

NADFAM Layer Min Location

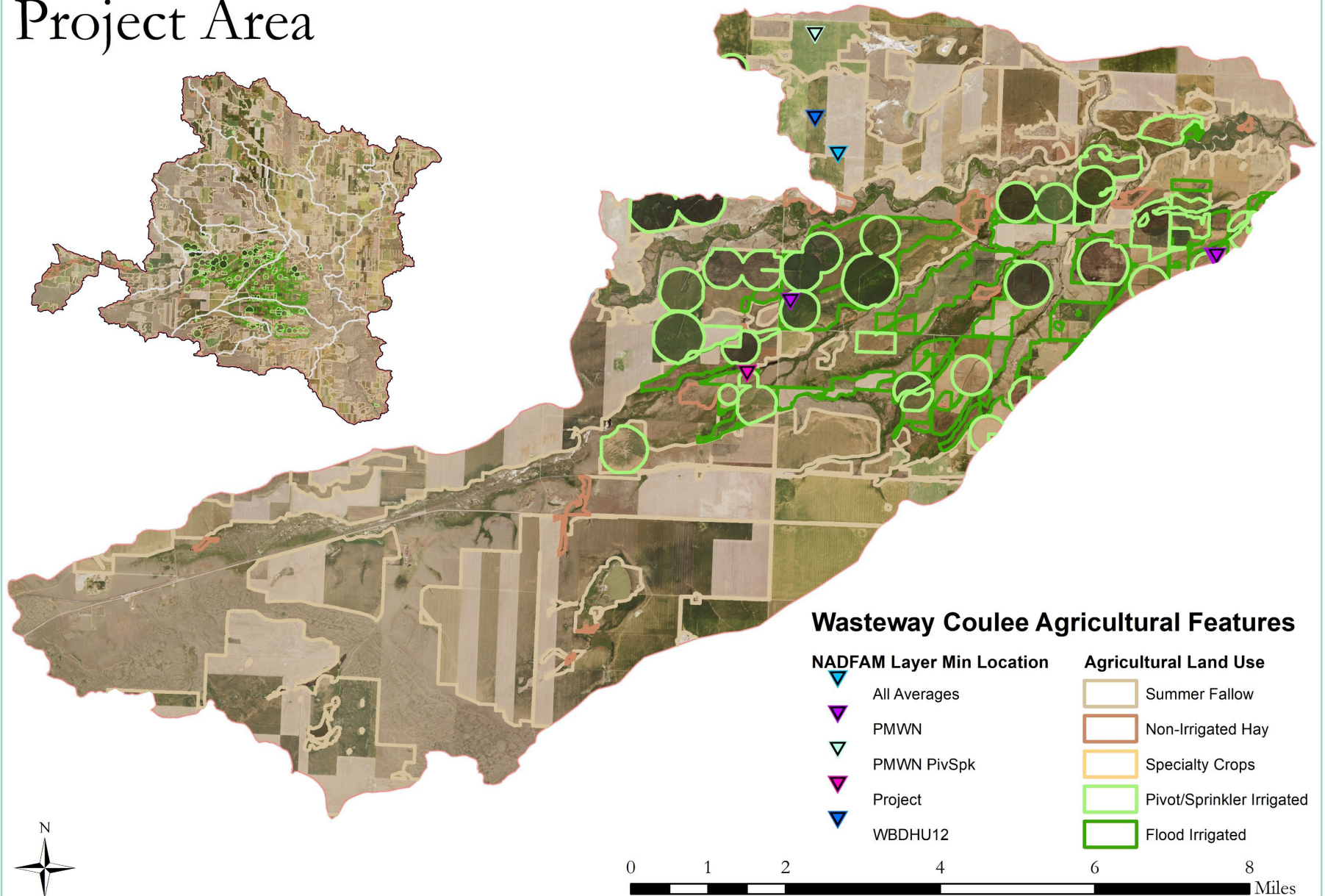
 All_Average

Average Normalized Deviation from All Means

 High : 0.301025
Low : 0.00978088



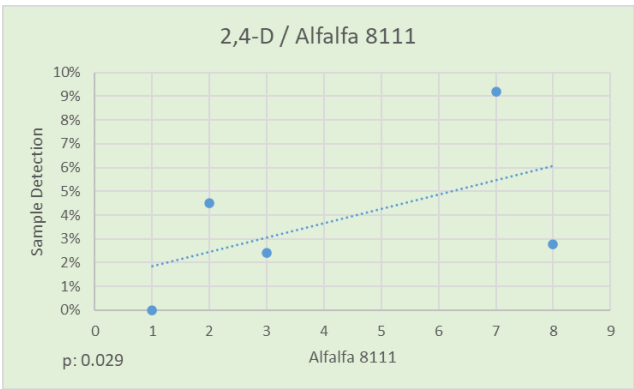
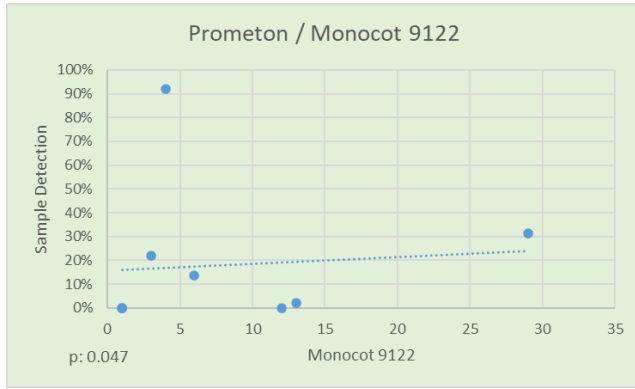
Cut Bank Project Area



Agricultural Chemical Detection Rates, (Samples Collected/ Detected from 2010-2022) and Crop Type ACSR (pixel count) Correlations.

Prometon

Action: Herbicide
Use: Controls most annual, many perennial broadleaf weeds and grasses, generally for a full season or longer.
Chemical Group: Triazine
Mode of Action: Inhibition of photosynthesis at photosystem II.

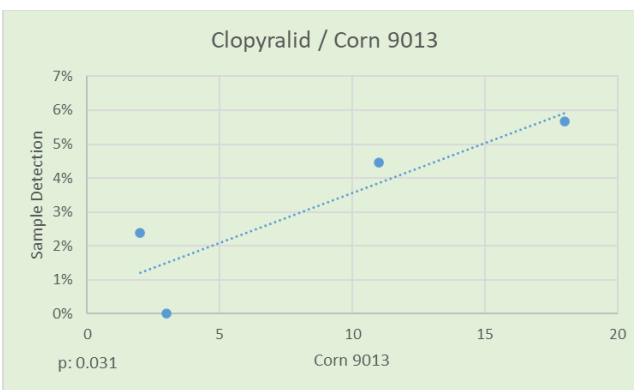
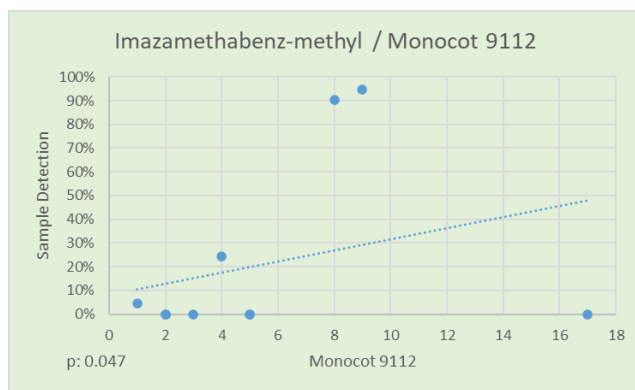


2,4-D

Action: Herbicide
Use: For broadleaf weeds in asparagus, cereals, corn, grasses, hay, sorghum, fallow land, pasture, rangeland, turf...
Chemical Group: Chlorinated phenoxy
Mode of Action: Synthetic Auxin

Imazamethabenz-methyl

Action: Herbicide
Use: For control of wild oat, mustard, and buckwheat in sunflowers, barley, and wheat.
Chemical Group: Imidazolinone
Mode of Action: Inhibition of acetolactate synthase ALS.

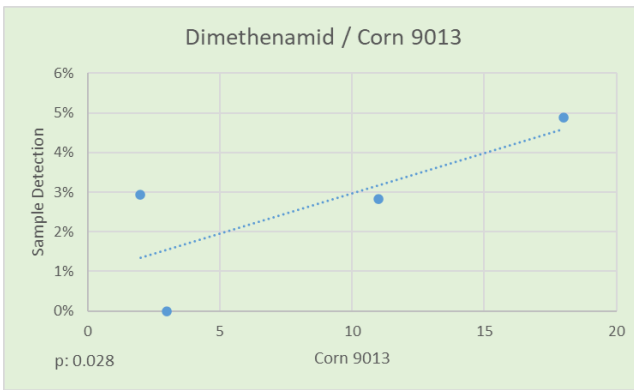
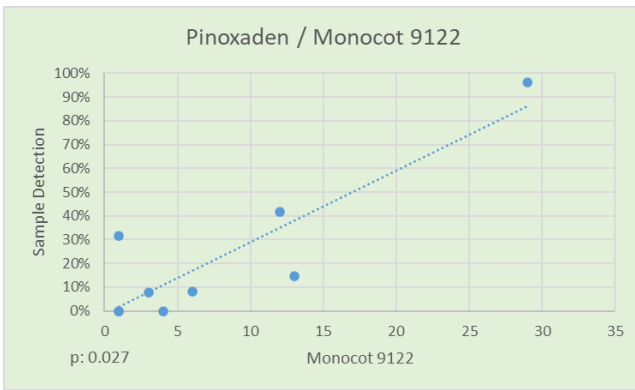


Clopyralid

Action: Herbicide
Use: For broadleaf weeds in barley, oats, wheat, canola, corn ...
Chemical Group: Pyridine carboxylic acid
Mode of Action: Synthetic auxin

Pinoxaden

Action: Herbicide
Use: For use in barley, spring and winter wheat.
Chemical Group: Phenylpyrazoline
Mode of Action: Inhibition of acetyl CoA carboxylase.



Dimethenamid

Action: Herbicide
Use: For use in corn, dry beans, sorghum, soybeans.
Chemical Group: Chloroacetamide
Mode of Action: Inhibition of cell division.

Questions ?

