

YRERFS GIS WORKFLOW AND MODELING PROCESS

Presenter Name

Presenter Title

Duty Location

Date of Presentation



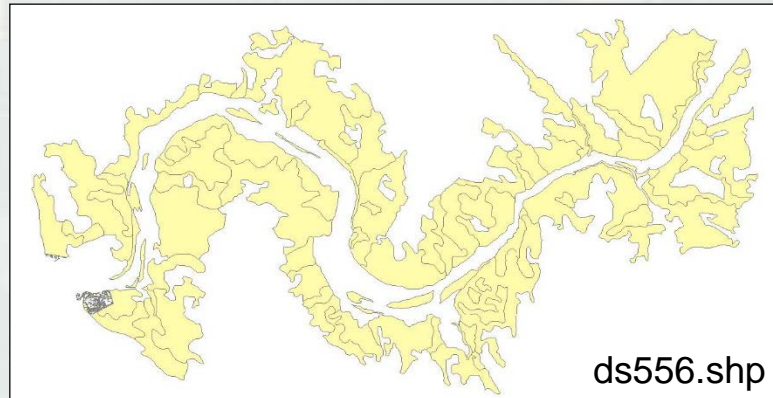
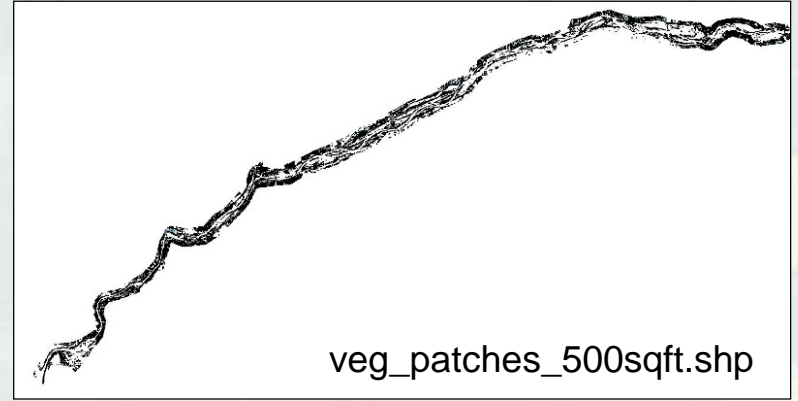
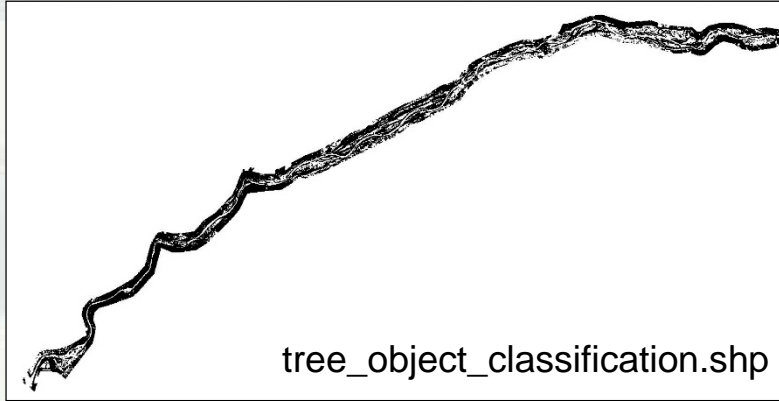
YRERFS Yellow Warbler Riparian Scrub Shrub (RSS) Habitat Determination



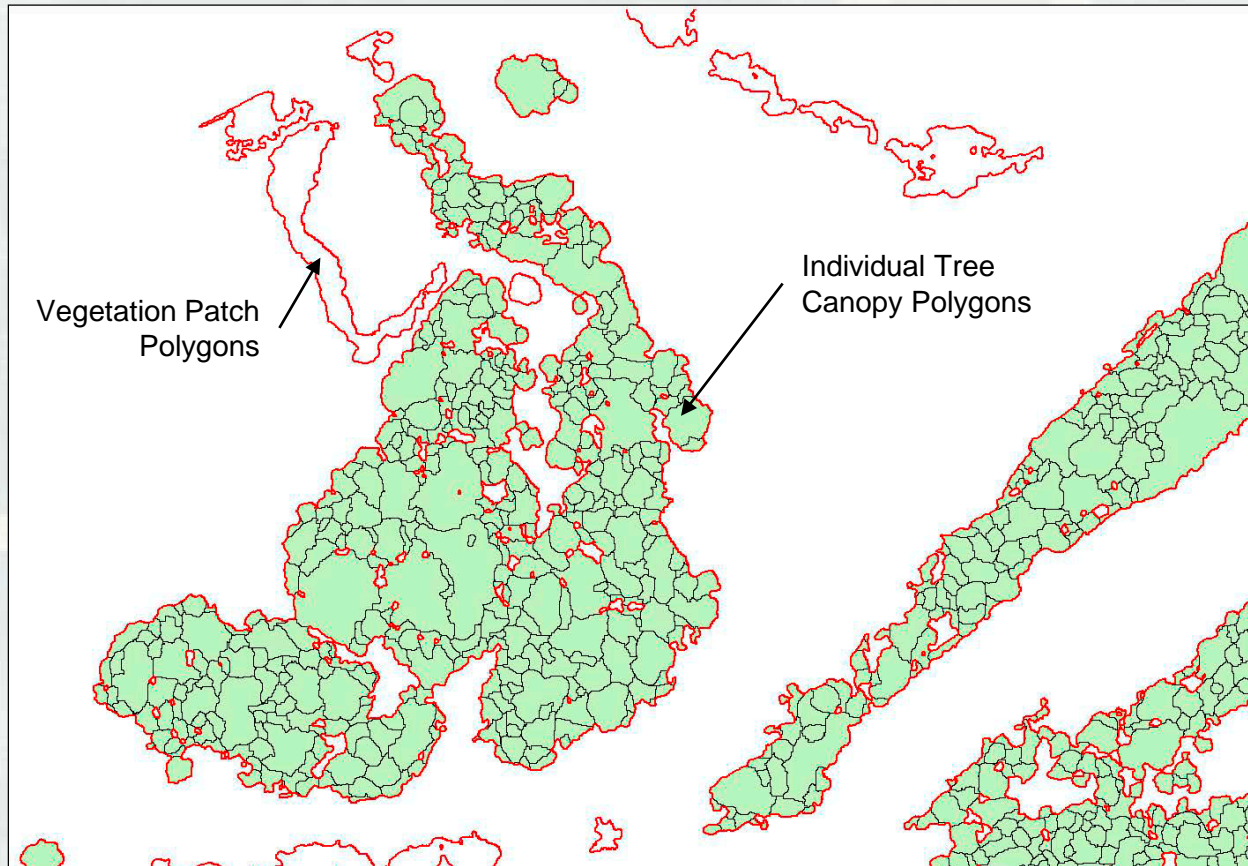
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Original Data Sets

Three datasets were initially used to produce the base data workflow. The tree object classification and vegetation patch datasets were provided by HDR and the third dataset for the area east of HWY 20 came from the Department of Fish and Wildlife web mapping portal.



Prior to conducting an intersect between the layers several new fields were added to the veg patch layer; unique ID, patch area, and canopy type. Canopy type is determined based on the average height of the patch. A height of greater than 16.5 feet was designated Riparian Forest (RF) and 16.5 feet or less was designated Riparian Scrub Shrub (RSS). Similarly new fields of canopy type and canopy area were added to the tree object layer to determine and label each polygon with an RF or RSS designation based on its height. The layers were then intersected so the tree object layer was connected with the veg patch it fell within and given the corresponding unique ID. Since we are dealing with RSS only for Yellow Warbler habitat, the objects designated RSS were queried out as their own layer to conduct the calculations.



RF tree objects intersected with RF veg patches



Three elements needed to determine HSI for Yellow Warbler:

1. % Canopy Cover: percentage of RSS per unit
2. % Hydrophytic Shrub: percentage of hydrophytic shrub area per patch
3. Average Canopy Height: average height of RSS from 0 to 16.5 feet



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Percent Hydrophytic

- Sum of the canopy area (sqft) for all hydrophytic RSS within each RSS designated veg patch divided by the total patch area (sqft) for that patch.

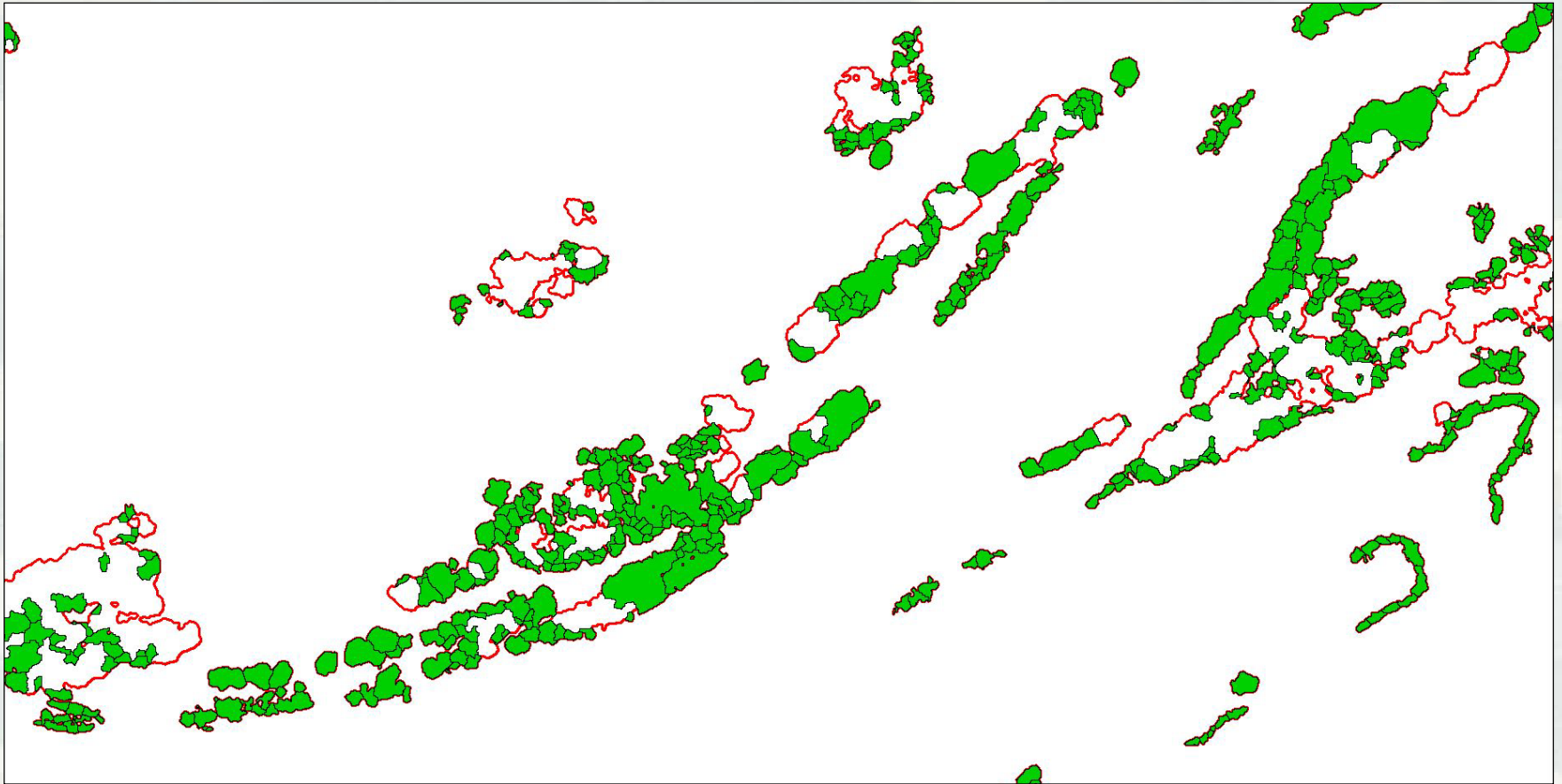
Ex:

Patch #1011 has a total patch area of 22,458.99 sqft and the sum of all the hydrophytic shrubs canopy area within that patch is 15,670.99. thus the percentage of hydrophytic shrubs is 69.77%

$$(15670.99/22458.99) * 100 = 69.77\%$$



Percent Hdyro Layer:



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Percent hydrophytic resulting table should look similar to the one below after all calculations have been done.

OBJECTID	uniq_patch_ID *	cover_type	veg_canopy_mrh_mean_16_5	Max_nDSM	final_pred	veg_canopy_type	canopy_area	shrub_sum_per_patch	patch_area	perc_hydro_per_patch
1	P1011	hydrophytic	RSS	4.360001	ald	shrub	30	15670.999997	22458.999999	69.776036
2	P1011	hydrophytic	RSS	1.739998	wil	shrub	15	15670.999997	22458.999999	69.776036
3	P1011	hydrophytic	RSS	2.530003	wil	shrub	39	15670.999997	22458.999999	69.776036
4	P1011	hydrophytic	RSS	1.789997	wil	shrub	10	15670.999997	22458.999999	69.776036
5	P1011	hydrophytic	RSS	1.480003	wil	shrub	1	15670.999997	22458.999999	69.776036
6	P1011	hydrophytic	RSS	1.640007	wil	shrub	18	15670.999997	22458.999999	69.776036
7	P1011	hydrophytic	RSS	2.309998	eld	shrub	32	15670.999997	22458.999999	69.776036
8	P1011	hydrophytic	RSS	3.41	wil	shrub	103.000001	15670.999997	22458.999999	69.776036
9	P1011	hydrophytic	RSS	1.82	eld	shrub	29	15670.999997	22458.999999	69.776036
10	P1011	hydrophytic	RSS	1.66	wil	shrub	42	15670.999997	22458.999999	69.776036
11	P1011	hydrophytic	RSS	9.700001	wil	shrub	124.999999	15670.999997	22458.999999	69.776036
12	P1011	hydrophytic	RSS	5.709999	wil	shrub	85	15670.999997	22458.999999	69.776036
13	P1011	hydrophytic	RSS	10.579998	eld	shrub	485	15670.999997	22458.999999	69.776036
14	P1011	hydrophytic	RSS	2.529999	wil	shrub	125.999999	15670.999997	22458.999999	69.776036
15	P1011	hydrophytic	RSS	3.770004	wil	shrub	303	15670.999997	22458.999999	69.776036
16	P1011	hydrophytic	RSS	6.27	wil	shrub	234.999999	15670.999997	22458.999999	69.776036
17	P1011	hydrophytic	RSS	3.540001	wil	shrub	259	15670.999997	22458.999999	69.776036
18	P1011	hydrophytic	RSS	3.830002	ald	shrub	81.999999	15670.999997	22458.999999	69.776036
19	P1011	hydrophytic	RSS	6.340004	wil	shrub	355	15670.999997	22458.999999	69.776036
20	P1011	hydrophytic	RSS	8.5	wil	shrub	277	15670.999997	22458.999999	69.776036
21	P1011	hydrophytic	RSS	7.739998	eld	shrub	510.000001	15670.999997	22458.999999	69.776036
22	P1011	hydrophytic	RSS	12.280006	wil	shrub	1367.999999	15670.999997	22458.999999	69.776036
23	P1011	hydrophytic	RSS	9.900002	wil	shrub	202.000001	15670.999997	22458.999999	69.776036
24	P1011	hydrophytic	RSS	5.110001	wil	shrub	176	15670.999997	22458.999999	69.776036
25	P1011	hydrophytic	RSS	5.41	wil	shrub	296.000001	15670.999997	22458.999999	69.776036
26	P1011	hydrophytic	RSS	11	wil	shrub	125.999999	15670.999997	22458.999999	69.776036
27	P1011	hydrophytic	RSS	2.02	wil	shrub	73	15670.999997	22458.999999	69.776036
28	P1011	hydrophytic	RSS	3.489998	wil	shrub	79	15670.999997	22458.999999	69.776036
29	P1011	hydrophytic	RSS	6.540001	wil	shrub	586.000001	15670.999997	22458.999999	69.776036
30	P1011	hydrophytic	RSS	10.079998	eld	shrub	276	15670.999997	22458.999999	69.776036
31	P1011	hydrophytic	RSS	13.140007	wil	shrub	389	15670.999997	22458.999999	69.776036
32	P1011	hydrophytic	RSS	12.379997	wil	shrub	276	15670.999997	22458.999999	69.776036
33	P1011	hydrophytic	RSS	4.510002	wil	shrub	108	15670.999997	22458.999999	69.776036
34	P1011	hydrophytic	RSS	11.460003	wil	shrub	1029	15670.999997	22458.999999	69.776036
35	P1011	hydrophytic	RSS	9.18	wil	shrub	350	15670.999997	22458.999999	69.776036
36	P1011	hydrophytic	RSS	8.189999	wil	shrub	124	15670.999997	22458.999999	69.776036
37	P1011	hydrophytic	RSS	7.010002	wil	shrub	341	15670.999997	22458.999999	69.776036
38	P1011	hydrophytic	RSS	10.920002	wil	shrub	1069	15670.999997	22458.999999	69.776036
39	P1011	hydrophytic	RSS	8.670002	syc	shrub	94	15670.999997	22458.999999	69.776036
40	P1011	hydrophytic	RSS	11.480003	wil	shrub	676	15670.999997	22458.999999	69.776036



Percent Cover:

- Sum of the canopy area (sqft) for all RSS within each Unit (1-9) divided by the area (sqft) of that unit.

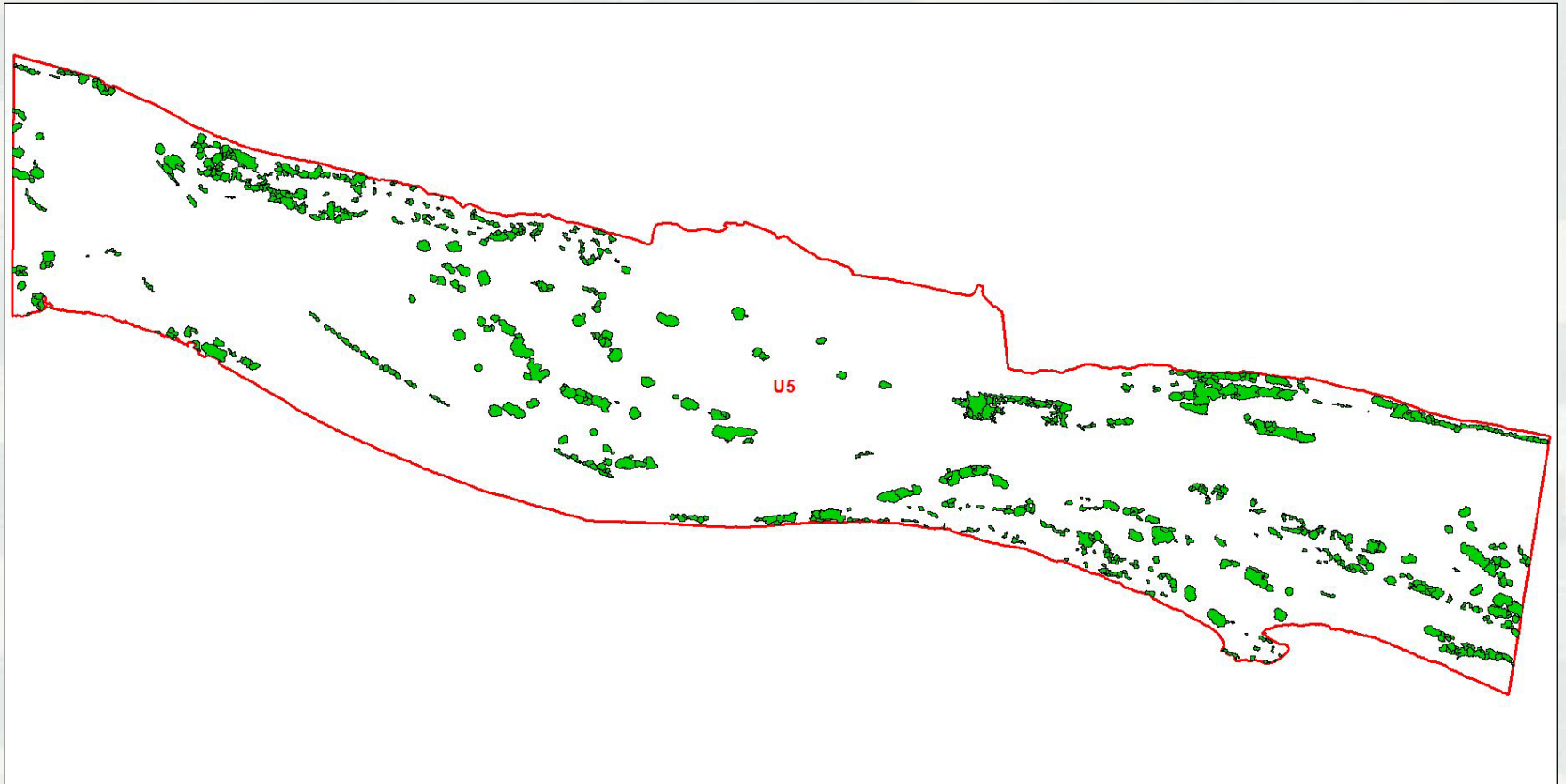
Ex:

Patch #1460 has an RSS canopy total of 927,406.89 sqft and the Unit (#1) has an area of 5,960,601.90 sqft giving a percent cover total of 15.56%

$$(927,406.89/5,960,601.90) * 100 = 15.56\%$$



Percent Cover Layer:



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Percent cover resulting table should look similar to the one below after all calculations have been done:

OBJECTID *	uniq_patch_ID *	canopy_area_sqft	FWOP_hab_type	unit_ID	sum_canopyarea_sqft	unit_area_sqft	perc_cover_per_unit
2755	P1460	124.999999	RSS	U1	927406.897374	5960601.9	15.558947
2756	P1460	98.335794	RSS	U1	927406.897374	5960601.9	15.558947
2757	P1460	607.311242	RSS	U1	927406.897374	5960601.9	15.558947
2758	P1460	277.615582	RSS	U1	927406.897374	5960601.9	15.558947
1799	P1461	98	RSS	U1	927406.897374	5960601.9	15.558947
1864	P1461	418	RSS	U1	927406.897374	5960601.9	15.558947
1865	P1461	73.999999	RSS	U1	927406.897374	5960601.9	15.558947
1866	P1461	30	RSS	U1	927406.897374	5960601.9	15.558947
1691	P1462	2	RSS	U1	927406.897374	5960601.9	15.558947
1796	P1462	20.46464	RSS	U1	927406.897374	5960601.9	15.558947
1797	P1462	1	RSS	U1	927406.897374	5960601.9	15.558947
1798	P1462	12	RSS	U1	927406.897374	5960601.9	15.558947
1863	P1462	29.854741	RSS	U1	927406.897374	5960601.9	15.558947
1793	P1463	302	RSS	U1	927406.897374	5960601.9	15.558947
1794	P1463	75.999999	RSS	U1	927406.897374	5960601.9	15.558947
1795	P1463	16	RSS	U1	927406.897374	5960601.9	15.558947
1860	P1463	86.000001	RSS	U1	927406.897374	5960601.9	15.558947
1861	P1463	256	RSS	U1	927406.897374	5960601.9	15.558947
1862	P1463	52	RSS	U1	927406.897374	5960601.9	15.558947
1891	P1464	90.737638	RSS	U1	927406.897374	5960601.9	15.558947
1690	P1465	50	RSS	U1	927406.897374	5960601.9	15.558947
1790	P1465	52	RSS	U1	927406.897374	5960601.9	15.558947
1791	P1465	32	RSS	U1	927406.897374	5960601.9	15.558947
1792	P1465	34	RSS	U1	927406.897374	5960601.9	15.558947
1859	P1465	187	RSS	U1	927406.897374	5960601.9	15.558947
1894	P1465	161	RSS	U1	927406.897374	5960601.9	15.558947
1895	P1465	234.000001	RSS	U1	927406.897374	5960601.9	15.558947
1689	P1466	29	RSS	U1	927406.897374	5960601.9	15.558947
1788	P1466	61	RSS	U1	927406.897374	5960601.9	15.558947
1789	P1466	2	RSS	U1	927406.897374	5960601.9	15.558947
1858	P1466	378	RSS	U1	927406.897374	5960601.9	15.558947
1870	P1466	418.999999	RSS	U1	927406.897374	5960601.9	15.558947
1871	P1466	143	RSS	U1	927406.897374	5960601.9	15.558947
1682	P1467	22	RSS	U1	927406.897374	5960601.9	15.558947
1683	P1467	6	RSS	U1	927406.897374	5960601.9	15.558947
1684	P1467	2	RSS	U1	927406.897374	5960601.9	15.558947
1685	P1467	15	RSS	U1	927406.897374	5960601.9	15.558947
1686	P1467	30	RSS	U1	927406.897374	5960601.9	15.558947
1687	P1467	23	RSS	U1	927406.897374	5960601.9	15.558947
1688	P1467	8	RSS	U1	927406.897374	5960601.9	15.558947



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Average Height:

- Within the original *veg_patches_500sqft.shp* there is a column labeled *mrh_mean*. This layer is based on the values of that column.

Ex:

Patch #2 mrh_mean equals 10.0074 feet



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Average Height Layer:



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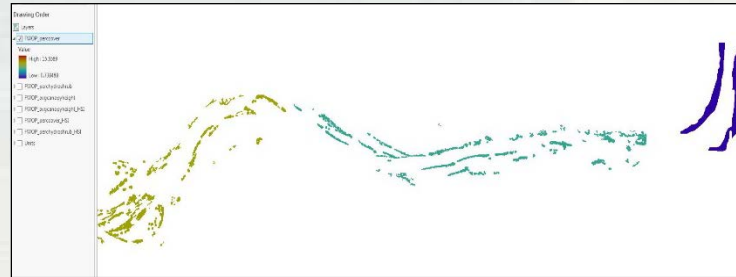
Average height resulting table should look similar to the one below after all calculations have been done:

OBJECTID *	uniq_patch_ID	veg_canopy_mrh_mean_16_5	patch_area	mrh_MEAN
2	P2	RSS	1173	10.0074
3	P3	RSS	1253.000001	9.2399
4	P4	RSS	873	7.42536
5	P5	RSS	1038	8.65874
6	P6	RSS	602.000001	8.98248
7	P7	RSS	1415	9.4933
8	P8	RSS	1046	8.98746
9	P9	RSS	2637	10.024
10	P10	RSS	2937.999999	10.7309
11	P11	RSS	3212.999999	10.677
12	P12	RSS	3156.000001	11.2352
13	P13	RSS	1000.000001	12.6037
14	P14	RSS	3809.000001	11.5473
15	P15	RSS	2879.000001	12.4995
16	P16	RSS	7968	13.3574
17	P17	RSS	552	9.9786
18	P18	RSS	66963.999995	14.6527
19	P19	RSS	76775.999995	11.3317
20	P20	RSS	589.999999	10.2476
21	P21	RSS	757	8.16641
22	P22	RSS	68674.000002	10.3313
23	P23	RSS	124133.000002	11.5152
24	P24	RSS	785.000001	16.3967
28	P28	RSS	38533	10.3815
29	P29	RSS	580	11.6401
30	P30	RSS	738	7.67482
31	P31	RSS	981	7.87983
32	P32	RSS	519.000001	7.74452
33	P33	RSS	727	6.63634
34	P34	RSS	8059.999998	9.26979
36	P36	RSS	531	2.44963
37	P37	RSS	574	6.64849
38	P38	RSS	2192.000001	9.11792
39	P39	RSS	689.000001	5.18902
40	P40	RSS	601.000001	1.66924
41	P41	RSS	3197.000001	10.7447
42	P42	RSS	715	13.073
43	P43	RSS	2069	16.1482
44	P44	RSS	552	15.5906
45	P45	RSS	707	15.4921

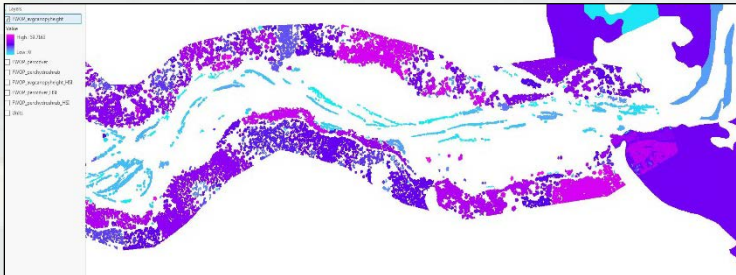


RSS FWOP rasters based on values in each table:

Percent Cover



Average Height



Percent Hydrophytic



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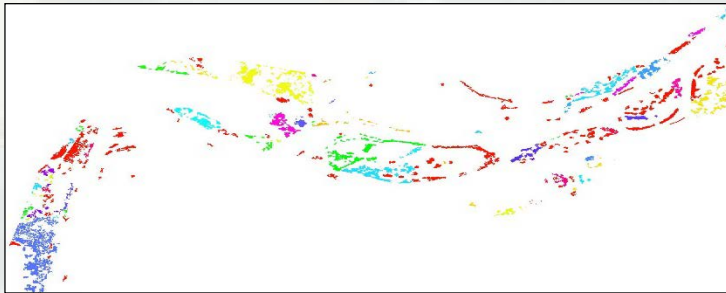
Create a raster of the measures polygon and assign the following values:

Year 1				
Canopy Type (Riparian Scrub-shrub or Riparian Forest)	% Deciduous Shrub Canopy Comprised of Hydrophytic Shrubs (% of hydrophytic shrubs per patch)	Average height of Canopy	% Cover of Shrub canopy (% of polygon area)	Basal Area
RSS	81.3	2	1.5	FWOP
Year 5				
Canopy Type (Riparian Scrub-shrub or Riparian Forest)	% Deciduous Shrub Canopy Comprised of Hydrophytic Shrubs (% of hydrophytic shrubs per patch)	Average height of Canopy	% Cover of Shrub canopy (% of polygon area)	Basal Area
RSS	81.3	9.6	7.5	FWOP
Year 15				
Canopy Type (Riparian Scrub-shrub or Riparian Forest)	% Deciduous Shrub Canopy Comprised of Hydrophytic Shrubs (% of hydrophytic shrubs per patch)	Average height of Canopy	% Cover of Shrub canopy (% of polygon area)	Basal Area
RF	81.3	25.8	22.5	10.1
Year 25				
Canopy Type (Riparian Scrub-shrub or Riparian Forest)	% Deciduous Shrub Canopy Comprised of Hydrophytic Shrubs (% of hydrophytic shrubs per patch)	Average height of Canopy	% Cover of Shrub canopy by Reach	Basal Area
RF	81.3	37.8	37.5	16.8
Year 50				
Canopy Type (Riparian Scrub-shrub or Riparian Forest)	% Deciduous Shrub Canopy Comprised of Hydrophytic Shrubs (% of hydrophytic shrubs per patch)	Average height of Canopy	% Cover of Shrub canopy by Reach	Basal Area
RF	81.3	49.8	75	33.7

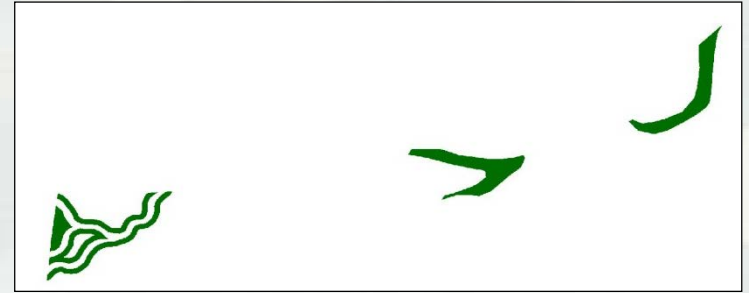


Mosaic: Use *mosaic to new raster* tool to combine the FWOP perc hydro shrub with the measures only raster to create a Future With Project (FWP) raster.

Take that raster and copy it to make one for years 1, 5, 15, 25, & 50. *Note: for years 15, 25 & 50 you will see decreased numbers for RSS because the shrubs will have grown above the 16.5 foot shrub height designation.*



FWOP_percydroshrub: Values of 0 – 100 percent



FWP_yr1_percydroshrub_measuresonly: Value of 81.3%



FWP_yr5_percydroshrub: Values of 0 – 100 percent



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Suitability Index (SI) needs to be determined for FWOP, FWP yrs 1, 5, 15, 25, & 50 using the tables below:

Percent Cover

% cover range	Formula
for % cover from 0 to 60%	$SI = 0.0167(\% \text{ Cover})$
for % cover from 60 to 80%	$SI = 1$
for % cover from 80 to 100%	$SI = -0.05(\% \text{ Cover}) + 5$

Average Height

Average Canopy Height (ft)	Formula
for canopy from 0 to 6.56ft	$SI = 0.1524 \times \text{height}$
for canopy greater than 6.56ft	$SI = 1$

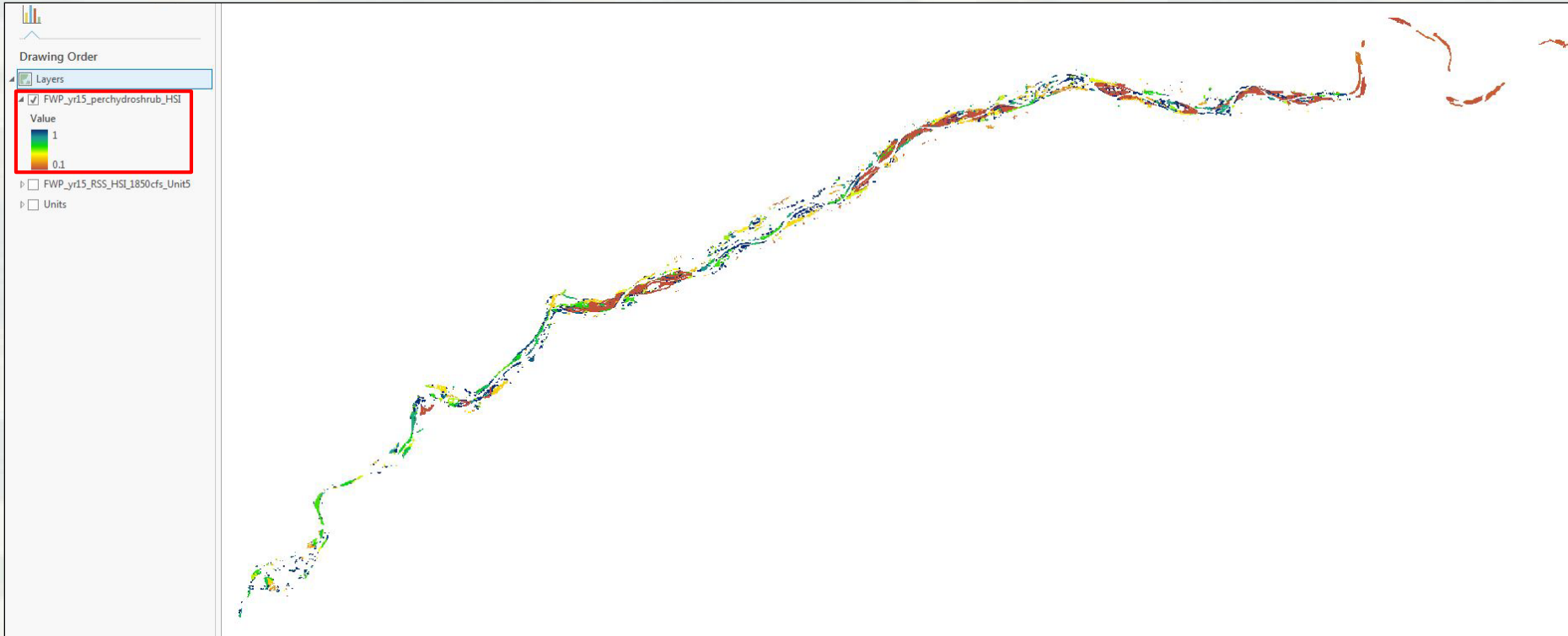
Percent Hydrophytic

% Hydrophytic Cover	Formula
All values	$SI = 0.009(\% \text{ cover hydro}) + 0.1$

Ex. A hydrophytic cover with a percentage of 55.86 would yield an SI value of 0.60. ($SI = 0.009(55.86) + 0.1$)



SI values should be between 0 and 1



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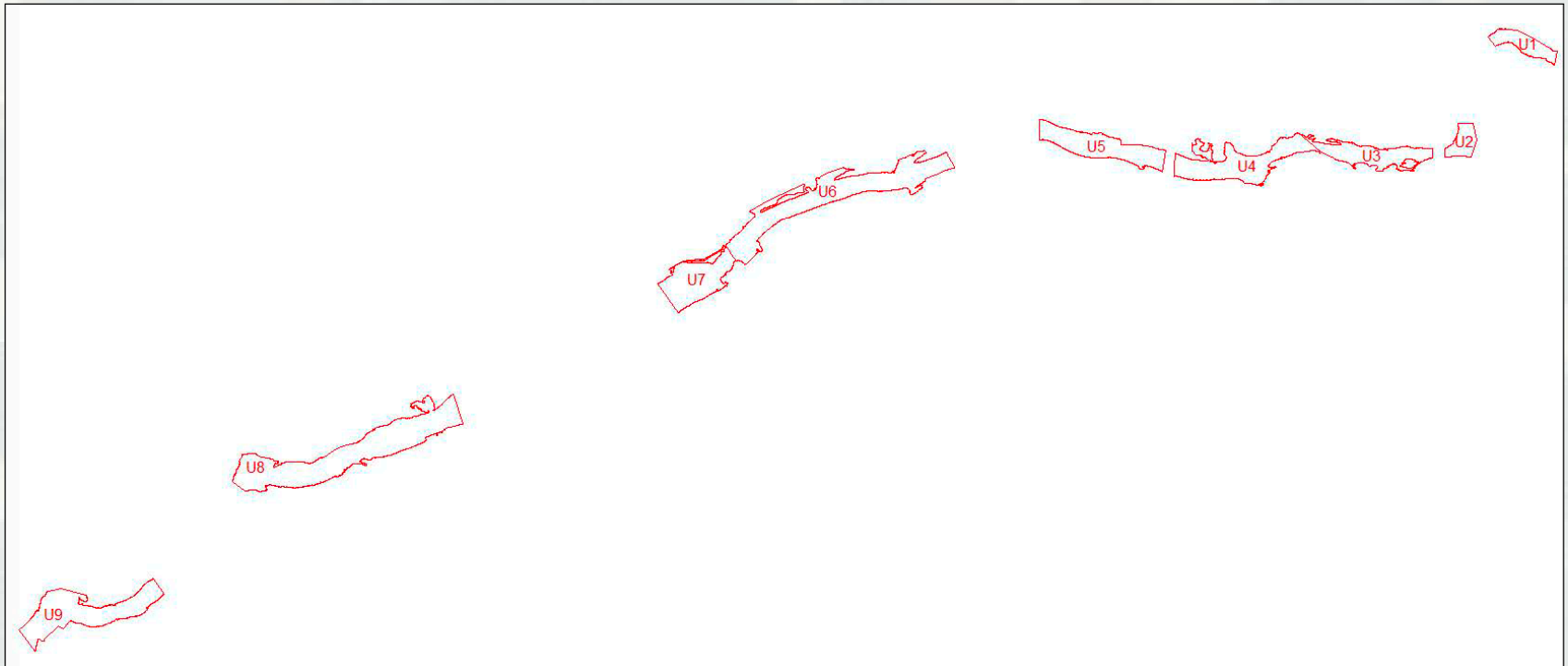
After all SI calculations have been determined those values will be used to determine the HSI values using the following formula:

$$\text{Yellow Warbler AKA Riparian Scrub Shrub HSI RASTER} = (SI_{\%cover} \times SI_{height} \times SI_{\%hydro})^{1/2}$$



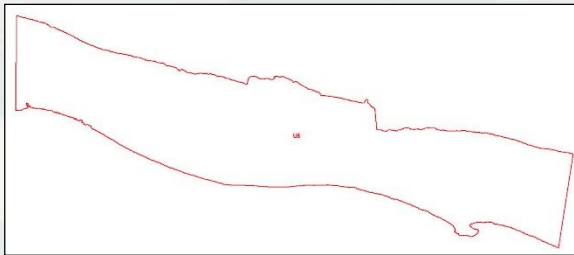
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To refine results of the HSI and make it pertinent to the areas where measures are, a new layer was created to clip out the needed features. The layer, "Units", has a north-south boundary based on the 84,000 cfs flow boundary and an east west boundary of 500 feet off either end of the widest measure in each measure grouping. There are 9 units total.

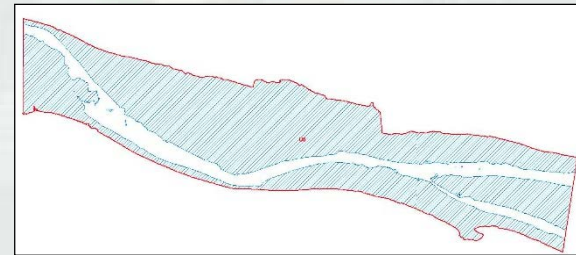


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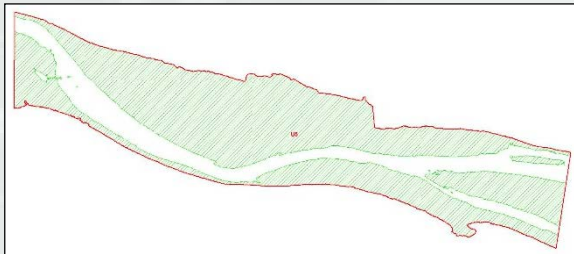
All 9 units were then clipped by three flow boundaries (750, 1850, and 5000 cfs) to get 27 individual polygons that will be used to clip the rasters.



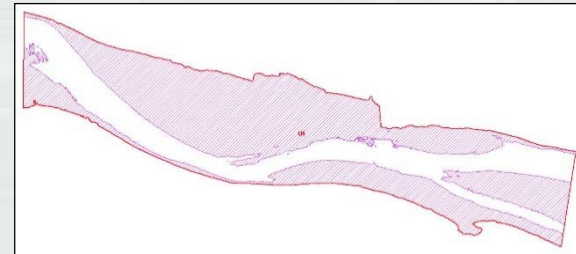
Unit 5



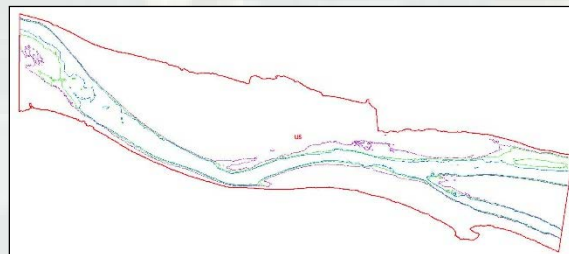
Unit 5: 750 cfs flow boundary clipped out



Unit 5: 1850 cfs flow boundary clipped out



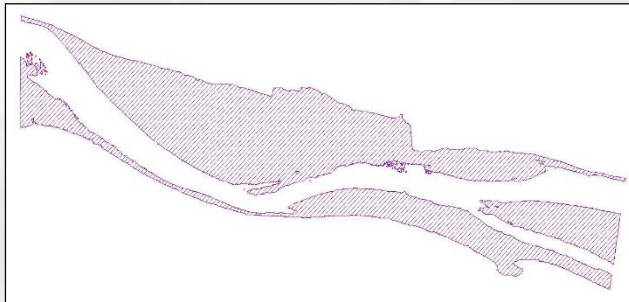
Unit 5: 5000 cfs flow boundary clipped out



Unit 5: all 3 flows to show the difference between them.



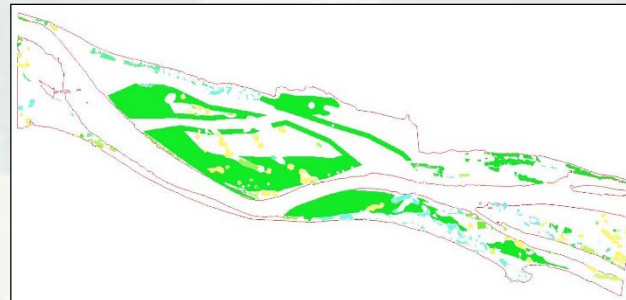
Extract by Mask: to do this you take a unit polygon (unit_5000cfs_unit5 polygon) and use it to mask and HSI raster (FWP_yr25_basalarea_HSI) raster and the resulting output from the process is portions of the input raster bound by the unit mask.



Mask: Unit 5 1850 cfs polygon



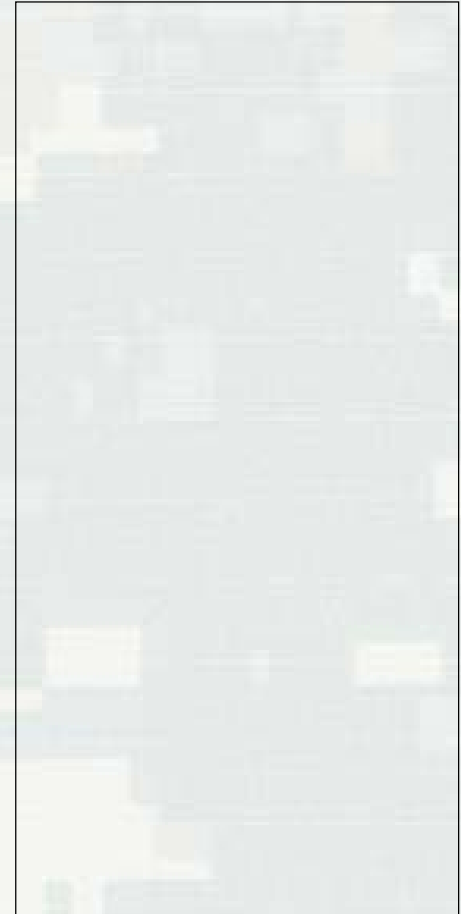
FWP yr5 RSS HSI raster



Result: raster within the bounds of the unit 5 polygon



To calculate actual Habitat Units (end product) need to create a table for each raster. To create a table use the Zonal Statistics tool and input the rasters you want to create a table for.



Once the table is created, create a new field in each raster and call it “Habitat Unit” then use the field calculator tool to determine the total ft² of for each raster.



Use the formula “Sum * 9” where nine is the dimensions of each individual raster cell (3X3) and Sum is the total number of cells.



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