

Milk Marias Rotating Basin Level 1 Wetland Assessment and Wetland Profiling Methodology

Level 1 wetland assessments are performed in a GIS using readily available digital data and provide information on the landscape context and anthropogenic disturbances that may affect wetland condition. We conducted Level 1 wetland assessments on 1,012 NWI polygons and their corresponding 100 m, 300 m, and 1,000 m buffers. We considered four major attributes as possible sources of anthropogenic disturbances: transportation, hydrology, land cover, and land use. Each attribute was comprised of multiple metrics (Table 1).

Table 1. Data sources for each Level I assessment metric.

| Attribute | Metric | Data Source |
|-------------------------|---|---|
| Transportation | Distance to 4-wheel drive roads | ftp://ftp2.census.gov/geo/tiger/TIGER2009/ |
| | Distance to local roads | ftp://ftp2.census.gov/geo/tiger/TIGER2009/ |
| | Distance to highways | ftp://ftp2.census.gov/geo/tiger/TIGER2009/ |
| Hydrology | Distance to wells | http://nris.state.mt.us/nsdi/nhd/hiresgeo.asp |
| | Distance to canals or ditches | http://nris.state.mt.us/nsdi/nhd/hiresgeo.asp |
| Land Cover | Percent of buffer in crop/agriculture | ftp://nris.mt.gov/MSDI_Landcover.zip |
| | Percent of buffer in hay/pasture | ftp://nris.mt.gov/MSDI_Landcover.zip |
| | Percent of buffer in developed, open space | ftp://nris.mt.gov/MSDI_Landcover.zip |
| | Percent of buffer in low density residential | ftp://nris.mt.gov/MSDI_Landcover.zip |
| | Percent of buffer in medium density residential | ftp://nris.mt.gov/MSDI_Landcover.zip |
| Soils | Soil type | http://nris.mt.gov/nrcs/soils/datapage.asp |
| Climate | Relative effective annual precipitation | http://nris.mt.gov/nrcs/REAP/datapage.asp |
| Wetland characteristics | Wetland polygon size | http://nris.mt.gov/nsdi/nris/shape/nwi_poly.zip |
| | Perimeter to area ratio of wetland polygon | http://nris.mt.gov/nsdi/nris/shape/nwi_poly.zip |
| | Distance to nearest five wetlands | http://nris.mt.gov/nsdi/nris/shape/nwi_poly.zip |

We assigned a rating to each metric based upon its distance from the wetland or wetland buffer perimeter for transportation, hydrology, and land use (Table 2). For land cover, we assigned metric ratings based upon the percent cover of each land cover type within the wetland polygon or wetland buffer. Disturbance ratings increased with either decreasing distance from the disturbance, or increasing percent cover of each land cover type.

Table 2. Level 1 assessment attributes and associated metrics and metric ratings.

| Attribute | Metric | Distance from Perimeter (meters) | Rating | |
|---|---------------------------------------|----------------------------------|----------|---|
| Roads | 4x4, dirt | > 200 | 1 | |
| | | > 100 - 200 | 2 | |
| | | 0 - 100 | 3 | |
| | local, city | >300 | 1 | |
| | | >200-300 | 2 | |
| | | >100-200 | 3 | |
| | | 0-100 | 4 | |
| | | highways | >500 | 1 |
| | | | >300-500 | 2 |
| | >200-300 | | 3 | |
| | Land Cover | medium density residential | >100-200 | 4 |
| | | | 0-100 | 5 |
| <5% | | | 1 | |
| 5%-15% | | | 2 | |
| >15%-20% | | | 3 | |
| low density residential / high use recreation | | >20%-30% | 4 | |
| | | >30% | 5 | |
| | | <=10% | 1 | |
| | | >10%-25% | 2 | |
| developed/open space | | >25%-40% | 3 | |
| | | >40% | 4 | |
| | | <=10% | 1 | |
| | >10%-25% | 2 | | |
| | crop agriculture | >25%-40% | 3 | |
| | | >40% | 4 | |
| | | >25%-40% | 4 | |
| | | >40% | 5 | |
| <=10% | | 1 | | |
| hay pastures | >10%-25% | 2 | | |
| | >25%-40% | 3 | | |
| | >40% | 4 | | |
| | >200 | 1 | | |
| Hydrology | canals, ditches | >100-200 | 2 | |
| | | 0-100 | 3 | |
| | upstream reservoirs (includes cattle) | >1,000 | 1 | |
| | | >500-1,000 | 2 | |

| | | | |
|----------|---------------------------|------------|---|
| | stockponds) | >200-500 | 3 |
| | | 0-200 | 4 |
| | | >200 | 1 |
| | wells | >100-200 | 2 |
| | | 0-100 | 3 |
| | | >1,000 | 1 |
| | resource extraction | >500-1,000 | 2 |
| | | >200-500 | 3 |
| Land Use | | 0-200 | 4 |
| | | >200 | 1 |
| | evidence of livestock use | >100-200 | 2 |
| | | 0-100 | 3 |

Level 1 Data Preparation:

To calculate the percent land cover type for each NWI polygon and its corresponding 100 meter, 300 meter, and 1,000 meter buffers.

1. Create 100 meter, 300 meter, and 1,000 meter buffers for the selected NWI polygons. In ArcToolbox, Analysis Tools → Buffer. Select the setting for 'Side Type' to 'outside only'.
2. Project each buffer layer to the same projection as the ReGAP Land Cover raster layer.
3. To summarize the area of each land cover type within each buffer and for each NWI polygon, use the Thematic Raster Summary tool in Hawth's Tools <http://www.spatialecology.com/index.php>.
4. For the individual NWI polygons, any polygon less than 0.25 acres is too small to run the Thematic Raster Summary tool. You can only run the Thematic Raster Summary tool on those polygons that are at least 0.25 acres. For those polygons smaller than 0.25 acres, create centroids for each small polygon. In Hawth's Tools, Vector Editing Tools → Generate Polygon Centroid Points.
5. To attribute each point with the Land Cover value, Spatial Analyst Tools → Extraction → Extract Values to Points.
6. Join the results of the Thematic Raster Summary to its corresponding layer by attributes based on the PolyFID. Now every polygon has raster values from the Land Cover layer associated with it.
7. Export Data to a new shapefile.
8. Recalculate the NWI_ACRES field. Right click on NWI_ACRES, Calculate Geometry in Acres.

9. Calculate the percent of the acreage of each land cover type for each buffer and each NWI polygon, using the following formula $((30*30)*\text{number of pixels}*.0002471044)$. Then divide land cover acres by NWI acres and multiply by 100 to get percent acreage for each land cover type.

Ancillary Data Layers:

1. Montana Land Cover data ftp://nris.mt.gov/MSDI_Landcover.zip
The Montana Land Cover layer was reclassified using Spatial Analyst in ArcGIS, to give all of the natural vegetation communities the same class value.
2. Roads: <ftp://ftp2.census.gov/geo/tiger/TIGER2008>
 - A. fwd_roads: These are 4-wheel drive roads. MTFCC = S1500 and MTFCC = S1740
 - B. local_roads: These are service roads and rural roads coded as MTFCC = S1400 or S1640.
 - C. highways: These are secondary roads and limited access highways. MTFCC = S1200.
3. High resolution National Hydrography Dataset.

<http://nris.state.mt.us/nsdi/nhd/hiresgeo.asp>

- A. NHD Points: Wells - Ftype = 488
- B. NHD Flowline: Canals and Ditches – Ftype = 336
- C. NHD Waterbody: Reservoirs – Ftype = 436

4. 2005 NAIP Imagery: to add the aerial imagery, follow the instructions below.

Instructions for ArcMap 9.x http://nris.mt.gov/nsdi/orthophotos/raster_svc.asp

1. Start ArcMap and click on the "Add Data" button. This will open the Add Data window.
2. Click on the "Look in:" drop-down list and select "GIS Servers".
3. Double-click on Add ArcIMS Server. This will open the Add ArcIMS Server window.
4. Type **http://maps.nris.mt.gov** in the "URL of server" box of the WWW Connection window.
5. Click on the button next to "Just the following service(s)", then click on the "Get List" button. Click the check box next to **raster_svc** and click the OK button.
6. Your Add Data window should now include "maps.nris.mt.gov". Double click on this, and the window should then show the raster_svc. Double click on it to add it to your map.

Wetland Profiling Methodology

List of Wetland Metrics for Subwatershed Wetland Profiling

1. Sum of wetlands (% of subwatershed)
2. Percent of Wetlands providing: (% of wetlands)
 - a. water storage
 - b. streamflow maintenance
 - c. groundwater recharge
 - d. nutrient cycling
 - e. sediment retention
 - f. shoreline stabilization
 - g. native plant community maintenance
 - h. terrestrial habitat
 - i. aquatic habitat
 - j. conservation of wetland biodiversity
3. Percent of isolated wetlands (% of wetlands)
4. Percent of rare wetland types (fens P__B and forested wetlands PFO_) (% of wetlands)
5. Percent of altered wetlands (impounded/diked - h or excavated -x) (% of wetlands)

1. In ArcMap add the following layers:

- 6th Code Hydrologic Units (HUC)
- Wetland polygons with Hydrogeomorphic-type (HGM) code and functions

There are ten Hydrogeomorphic (HGM) functions as listed above. The functions are ranked 1, 2, or 3. A rank of '3' indicates those wetlands with the highest functioning ability. Function is determined by a combination of the wetland attribute and the HGM-type code. A table with the wetland and HGM-type code combinations and corresponding function ranks was created by MTNHP staff to join to the wetland mapping layer.

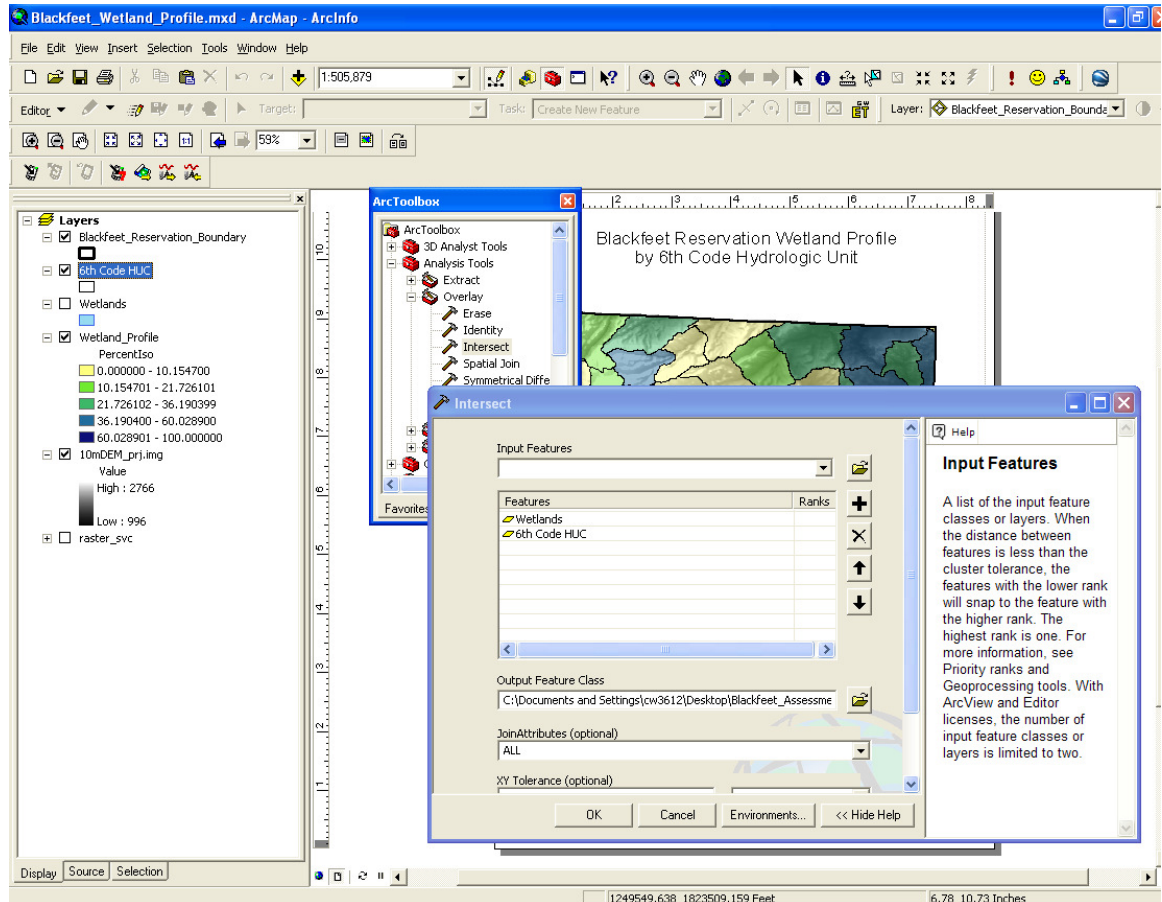
2. To the 6th Code HUC layer add the following fields:

- 6th Code HUC acres
- 6th Code HUC hectares
- Percent Wetland Acres
- Percent water storage
- Percent streamflow maintenance
- Percent groundwater recharge
- Percent nutrient cycling
- Percent sediment retention
- Percent shoreline stabilization
- Percent native plant community maintenance
- Percent terrestrial habitat
- Percent aquatic habitat
- Percent conservation of wetland biodiversity
- Percent Isolated Wetlands
- Percent Rare Wetlands
- Percent Altered Wetlands (impounded/diked/excavated)

(To add a field: open the 6th code HUC table. Click on the options button. Click on the “Add Field...” option. Type in the “Name” of the field and select “Float” as the field “Type.” Click OK.)

3. First calculate the sum of wetlands (percent of subwatershed):

a. Intersect the Wetlands with HGM and functions with the 6th Code HUCs clipped to the project area. An ‘Intersect’ will add the 6th Code HUC ID, Code, and Name fields to the NWI layer.



b. Recalculate the number of acres for the wetlands.

(Right Click on the NWI Acres field and Select “Calculate Geometry”. Select “Area” as the Property and Units as “Acres”. Click OK.)

c. Summarize the total acres of wetlands by 6th Code HUC:

(Right Click on the 6th Code HUC Code field and Select “Summarize”. Click on Sum under the NWI Acres field. Specify output table. Click OK)

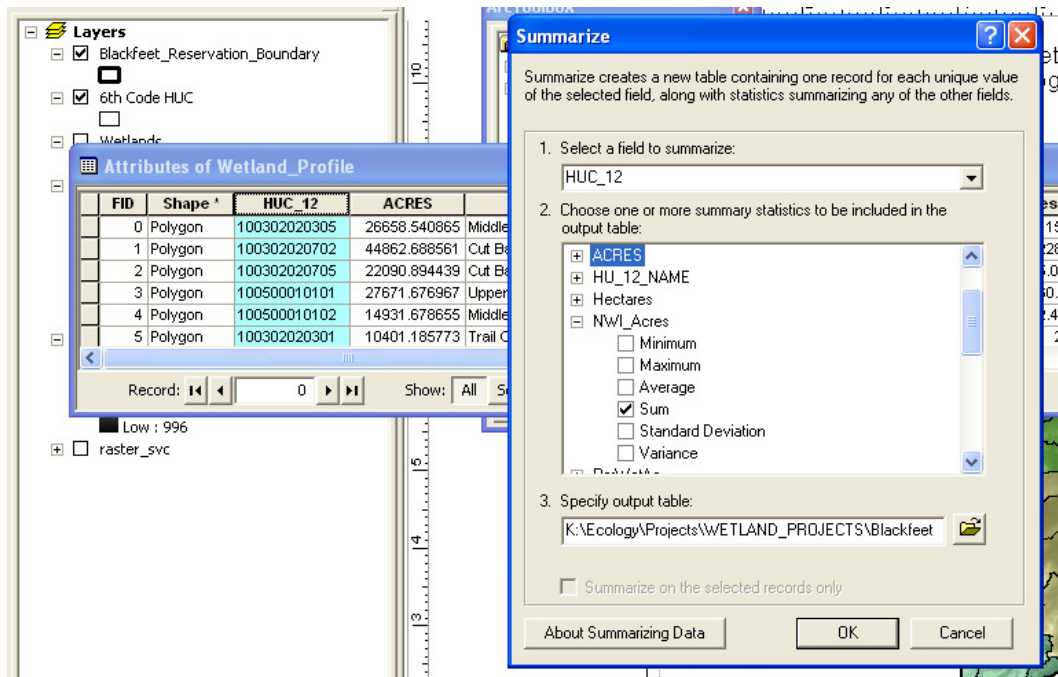
d. Join the new table to the 6th Code HUC layer by the Code field.

e. Use the Field Calculator to add the Sum of NWI acres to the NWI Acres field in the 6th Code HUC layer.

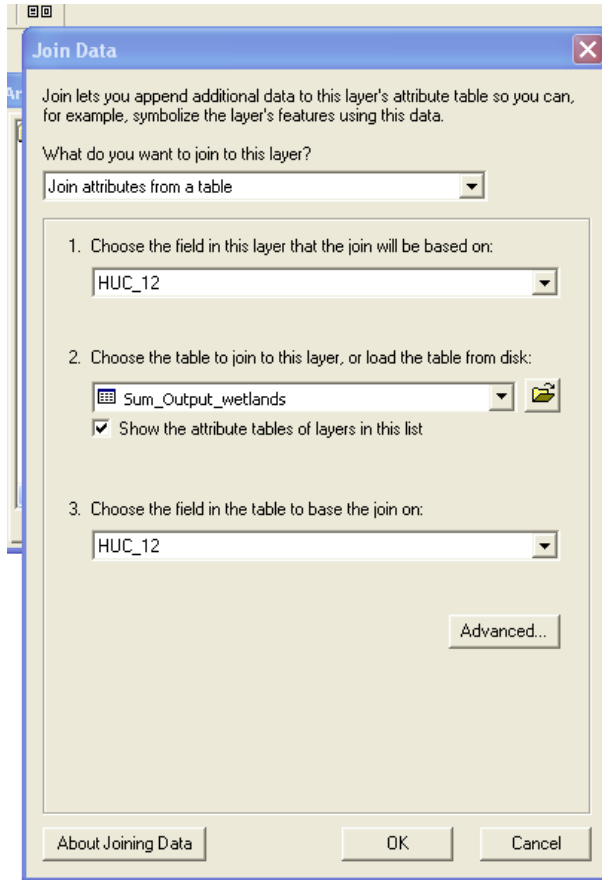
f. Use the Field Calculator to calculate the percent of wetlands by 6th Code HUC. Right Click on the Percent Wetland Acres field and Select Field Calculator.

In the Box add: $(\text{Sum NWI Acres} / \text{Sum 6}^{\text{th}} \text{ Code HUC Acres}) * 100$
** Make sure there are no zeroes in the denominator

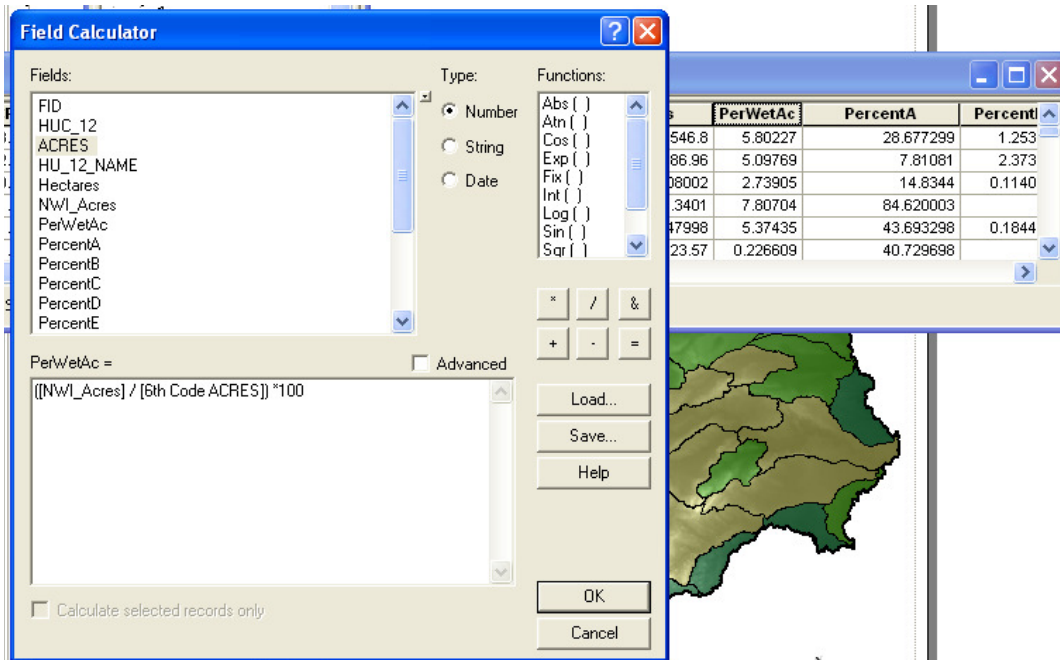
- g. Repeat steps C – F for each of the other metrics.
- To calculate the 10 function metrics FIRST select those wetlands that have a “3” (has highest function) for the metric you are calculating.
For example: In the Select by Attributes window type:
SELECT * FROM NWI layer WHERE:
"WATER_STOR" = 3



Join table to 6th Code HUC layer:



Field Calculator for Sum of wetlands (percent of subwatershed):



Then Summarize, Join, and calculate the percent using the field calculator.
 In the field calculator: (Sum of acres of wetlands with water storage value = 3 / Sum of wetlands acres in each 6th code HUC) * 100
 ** make sure there is no zero in the denominator

For the Isolated Wetlands metric:
 Select the wetlands with "TE" in the HGM code: "HGMCode" LIKE 'TE%'
 Then Summarize by 6th Code HUC; selecting Sum under the NWI Acres
 Join summarized table to 6th Code HUC layer
 Calculate metric: (Sum of Isolated wetlands acres/Total sum of wetlands by 6th Code HUC) * 100

For Rare Wetlands metric:
 Select by Attributes:
 "ATTRIBUTE" LIKE 'PEMB%' OR "ATTRIBUTE" LIKE 'PSSB%' OR "ATTRIBUTE" LIKE 'PFO%'
 Then summarize, join tables, and calculate the metric:
 (Sum of Rare Wetlands acres/Total sum of wetlands by 6th Code HUC) * 100

For Altered Wetlands metric:
 Select by Attributes: "ATTRIBUTE" LIKE '%h' OR "ATTRIBUTE" LIKE '%x'
 Summarize, join tables, and calculate metric:
 (Sum of altered wetlands/Total sum of wetlands by 6th Code HUC) * 100

To symbolize metrics: Open the 6th Code HUC Layer Properties. Select metric of interest in Value Field. Show: Quantities – Graduated colors. Select colors and classification method.

