Assessment of Northern Shoveler Habitats in Richland County, North Dakota and Roberts County, South Dakota: an Analysis of Wetland Size and Cultivated Croplands In Relation to Hydrologic Soil Groups

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Abstract

The Prairie Pothole Region (PPR) is home to over 50% of the migratory waterfowl in the North America because of the abundance of temporary and permanent wetlands available for nesting and feeding, but increases in commodity prices and agricultural drainage practices have led to a trend of wetland drainage. The Northern Shoveler is a migratory dabbling duck species that utilizes wetland habitats and cultivated croplands in the PPR for nesting and feeding. Richland County, North Dakota and Roberts County, South Dakota were chosen as the study areas for this research as they both have an abundance of wetlands as well as croplands. This study utilized GIS data to analyze Northern Shoveler wetland habitats in association with hydrologic soil groups (HSG). Habitats with a presence of certain hydrologic soil groups may be at risk of artificial drainage installations due to their proximity to cultivated croplands and soil lacking in natural drainage which may become wet or inundated. Findings show a majority of Northern Shoveler wetland habitats were within or adjacent to cultivated croplands. The results also revealed soil hydrologic groups with high runoff potential and low water transmission rates account for most of the soil within the wetland and cropland habitats.

Introduction

The Northern Shoveler is a dabbling duck species that utilizes the Prairie Pothole Region (PPR) of Canada and the U.S.A during migration seasons. The Shoveler utilizes cultivated croplands and the surrounding habitats within the PPR as nesting, breeding and feeding grounds (Ducks Unlimited, n.d.). The Shoveler may lose these habitats to cropland alteration and expansion. According to Hansen (2006) approximately 15% of wetlands in the nation are located in cropland or pastures. However, often Landowners and operators do not see wetlands as a commodity they can sell or benefit from and they are inclined to alter wetlands for agricultural uses. Johnston (2013) states agricultural practices are the main factor in wetland loss in the PPR in North and South Dakota. The PPR consists of glaciated landscapes ranging from Canada through North and South Dakota as well as parts of Minnesota and Iowa. The region is identified by its depressional wetlands and marshes which range from temporary to permanent (Figure 1).

The PPR is home to over 50% of the migratory waterfowl in North America, but it is estimated that only 40 to 50% of the potholes remain as a result of

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agricultural drainage and alteration (EPA, 2012). Rising commodity prices and demand for specific crops such as corn and soy have also helped to increase alteration and drainage of wetlands for the purpose of conversion to cropland (Johnston, 2013).

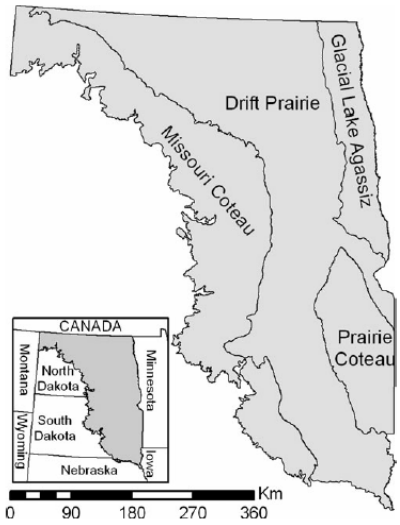

Figure 1. The North and South Dakota PPR with Physiographic regions (Johnston, 2013).

The purpose of this study was to gather data on the types of land cover habitats used by the Northern Shoveler during migrations as well as to perform a more detailed analysis on size and type of wetland habitats in or adjacent to cultivated cropland, and to associate hydrologic soil groups with the land cover habitats. It is thought that small wetlands in or near croplands are the most at risk to alteration or drainage for agriculture. Reynolds, Loesch and Wangler (2007), defined small or shallow wetlands as temporary or seasonal or that are less than one acre in size and defined "At Risk," as partially or wholly embedded in cropland and not enrolled in permanent easements or owned by the U.S. Fish and Wildlife Service. This study analyzed hydrologic soil groups in land cover habitats because it was assumed that habitats in or near agriculture with soil that has high run off potential and restricted water transmission is already drained for agriculture or is likely to have drainage installed in the future. Hydrologic soil groups may provide insight into drainage extents since accurate or widespread drainage data is unavailable (Sugg, 2007).

Study Area

This study covers wetland and cropland habitats of the Northern Shoveler in eastern North Dakota and eastern South Dakota USA. The Northern Shoveler was chosen as it is a common summer migratory species and historically is known to respond to changes in wetland density (Austin, 2002). Richland County, North Dakota and Roberts County, South Dakota were chosen for the wetland geography as well as abundance of cropland. The eastern region of South Dakota has the highest waterfowl densities and is characterized by natural basins dominated by glacial deposits with poor drainage (Figure 2) (Brewster, Gates, and Flake, 1976).

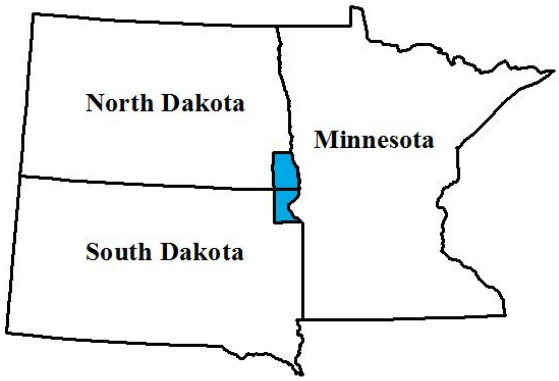

Figure 2. Map of the study area showing Richland County, ND and Roberts County, SD in blue.

Methods

Northern Shoveler summer season distribution data were obtained from the United States Geological Survey (USGS)

Gap Analysis Program species data website. The data represented areas where the species are predicted or known to occur based on habitat associations. Species distribution data was in raster format and the data represented distributions for either summer, winter or both. For this study, only the summer data was used as this is the only season when the Shoveler is present in the Midwestern states. In ArcMap the *Extract by Mask* tool was used to create land cover habitats. The Northern Shoveler distribution data were used as a mask to extract GAP land cover data from areas that had Shoveler occurrences. The output resulted in a spatial representation of Northern Shoveler land cover habitats.

Gridded Soil Survey (gSSURGO) was used to assign hydrologic soil groups to land covers. The gSSURGO data were obtained from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). The data were obtained for the States of North Dakota and South Dakota and the gSSURGO polygon data were used. The gSSURGO polygon layer was joined to *Muaggatt*, a standalone file geodatabase table and stands for map unit aggregate attribute. Muaggatt contained the Hydrologic Group Dominant Condition field as well as other data (USDA, NRCS, 2014). The gSSURGO polygon data were clipped to the shape of the counties and each soil hydrologic group was separated from the master file and exported into separate layers: A, AD, B, BD, C, CD and D (Table 1). There were dual groups which were placed in group D due to the presence of a water table within 24 inches of the surface soil, but were also assigned a different group if they could be adequately drained. The first letter represented the drained group while the second letter represented the undrained group, example AD means that the soil is assigned to group D but can be considered group A if the soil is adequately drained (USDA, NRCS 2007). Including dual soil hydrologic groups is important as farm operators may take them into consideration with the purpose of draining them to a group that is favorable for cultivation.

Table 1. Definitions of the hydrologic soil groups.

Soil Hydrologic Group Definitions	
A	Low runoff potential, transmits water easily through soil
AD	A represents drained group, D is undrained group
B	Relatively low runoff potential, water transmission is unrestricted
BD	B represents drained group, D is undrained group
C	Moderately high runoff potential, water transmission is somewhat restricted
CD	C represents drained group, D is undrained group
D	High runoff potential, water transmission is restricted

The soil polygons were separated into seven hydrologic soil groups: A, B, C, D, A/D, B/D and C/D. The polygons were converted to raster and then converted back to polygon and were not smoothed. The Northern Shoveler land cover habitat raster was extracted from all seven separate hydrologic soil group extents to determine what kind of habitats existed in the soil areas (Table 2). The output data was added to the Northern Shoveler habitat raster attribute table by cell counts and converted to acreages. Ten ecological systems resulted in the hydrologic soil groups and land cover extraction. The ecological systems definitions were as follows (USGS, GAP, 2011): Western Great Plains Depressional Wetland Systems are defined by isolated and open

wetlands in lowland and upland depressions in the Great Plains. Eastern Great Plains Tallgrass Aspen Parkland is defined by tallgrass, wet and brush prairie

Table 2. Total amount of soil hydrologic groups in acreages per ecological system. Table is sorted from least area to largest area.

Ecological Systems or Land Use Class	**Total SHG Acres**
Western Great Plains Depressional Wetland System	40.92
Eastern Great Plains Tallgrass Aspen Parkland	581.34
Introduced Upland Vegetation - Perennial Grassland and Forbland	7,278.76
Great Plains Prairie Pothole	19,775.13
Eastern Great Plains Wet Meadow, Prairie and Marsh	27,493.34
Central Tallgrass Prairie	32,257.26
Northern Tallgrass Prairie	35,339.21
Open Water	38,876.18
Pasture/Hay	52,569.03
Cultivated Cropland	189,618.51

as well as aspen-oak woodlands. These areas are normally found in the Glacial Lake Agassiz plain and have loamy to gravel soil textures. Introduced Upland Vegetation is characterized by the presence of introduced perennial forb or grassland species. The Great Plains Prairie Pothole are characterized by closed depressional wetland basins. The Potholes receive irregular water input from surrounding systems which result in differing water levels year to year. Eastern Great Plains Wet Meadow, Prairie and Marsh are located along lakes, streams, creeks and other depressions and characterized by water just below the soil surface to subsurface water a few feet below the soil surface. These areas have textured soils that typically require drainage for use in agriculture. Central Tallgrass Prairie are distinguishable by wildflowers and grasses one to three meters in height located on rich soils. Northern Tallgrass Prairie also has tall grasses similar to the Central Tallgrass Prairie but is found on well drained soils that are not as rich as the Central group. Open Water is lakes, ponds, streams and rivers with soil and vegetation coverages of 25% or less. Pasture/Hay are areas of grasses and legumes or both planted for grazing livestock or hay and seed production. Cultivated Croplands are characterized by areas of annual row crops such as corn and soybeans as well as Perennial orchards and vineyards. Actively tilled land also falls into this group.

The land cover habitat raster extract results were converted to polygons as a method to separate and measure specific habitats. The polygons were not smoothed in the process and retained the original raster shape. The resulting polygons were given a field to mark their soil hydrologic group and merged into one master layer. A flow chart of the polygon to raster to polygon formatting process is shown in Figure 3.

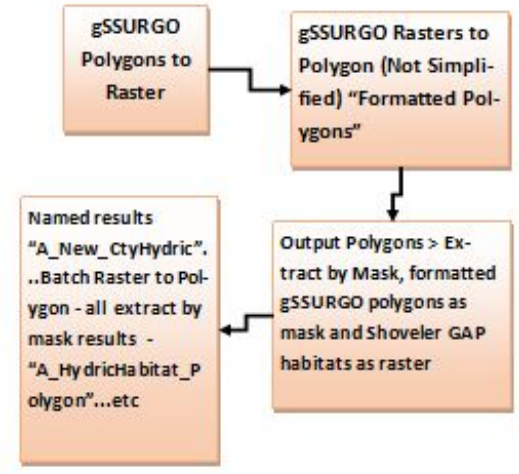

Figure 3. Flowchart of polygon formatting and data extraction process.

A shapefile was created to contain the known water sources: Western Great Plains Depressional Wetland Systems,

Open Water, Great Plains Prairie Pothole and Eastern Great Plains Wet Meadow, Prairie and Marsh. An additional shapefile was created to contain cultivated cropland data. Features were selected from the water sources layer that were within 30 meters of the cultivated cropland layer. The search distance of 30 meters was used because the cell size of raster data was 30 by 30 meters, the study's minimum mapping unit (Figure 4). The raster was not smoothed in the conversion process and the polygons represent the same cell size as the raster file. An 'acres' field was added to the attribute table to determine size and statistics about the wetlands. First the Shape Area field properties had to be changed to allow whole numbers as a raster would. The field calculator was used to add the following formula:

[Shape_Area] / 900 * .222394843

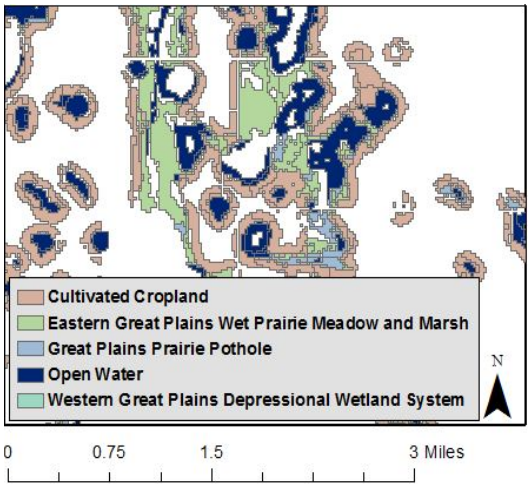

Figure 4. Wetlands within 30 meters of Cultivated Cropland (Brown).

Since the Shape Area field is represented in area, and raster cells and the converted polygon cells each represent 900 square meters (30 by 30 meter cells) the values of the polygon, the Shape Area field had to be divided by 900 to determine how many cells would be counted if the layer were a raster. That count was then multiplied by the acre equivalence of one cell (.222394843) to derive a count of how many acres were in each polygon. This process was unnecessary for rasters as the count was already present in its own field. The equation to find acres with a raster file was as follows (U.S. Forest Service, 2011):

[Count] * .222394843

Results

The USGS GAP Northern Shoveler summer season species distribution data were used as an overlay to identify and extract GAP land cover habitats utilized by the Shoveler. Cultivated Cropland had the highest number of Shoveler occurrences whereas Western Great Plains Depressional Wetland Systems had the fewest number of occurrences and Great Plains Prairie Pothole was the next smallest habitat. Once the Shoveler habitat occurrences were associated with the land cover data it was overlain with the hydrologic soil groups and extracted from the polygons (Table 3).

Table 3. Total acres per hydrologic soil group.

Hydric Groups in Shoveler County Level Ecological Systems	Total Acre Counts by Hydric Groups
A	28,358.01
A/D	24,438.30
B	70,419.10
B/D	30,490.33
C	164,207.68
C/D	81,207.03
D	4,709.21

Acreages were determined for each hydrologic soil group found in wetland and cropland polygons.

Group C with moderately high runoff potential, dominated the landscape with 164,207.68 acres of the Shoveler habitats. Hydrologic group D which was far below the other groups had 4,709.21 acres. For ecological systems, Cultivated Cropland had the greatest amount of hydric acres at 189,618.51. Cultivated Cropland's greatest amount of hydric soil was found in group C at 92,365.69 acres. The total of the hydrologic soil acreage was 403,829.67. Table 4 shows acres per hydrologic soil group per ecological system. The land cover habitat was converted from a raster to polygons and was not smoothed to keep the original raster shape. The values that suggested the ecological systems were wetlands were removed into a separate layer. The wetlands removed were: Great Plains Prairie Pothole, Open Water, Eastern Great Plains Wet Prairie Meadow and Marsh and Western Great Plains Depressional Wetland Systems. Cultivated Cropland was also removed and added to its own layer. A query was made to find wetlands that were within 30 meters of Cultivated Cropland. A select by location analysis in ArcMap will return entire intact polygons and will not edit a polygon in any way. For this study, if only the west side of a wetland was within 30 meters of Cultivated Cropland, the entire wetland polygon was counted as being within 30 meters of Cultivated Cropland. Total acreage for wetlands within 30 meters of Cultivated Cropland was 55,672.77 with the smallest wetland at .22 acres which is the size of one raster cell. The largest wetland was 1.678.86 acres and the mean was 1.61 acres. Western Great Plains Depressional Wetland System had the smallest number of wetlands with the acreage at 26.24 and the mean size at .31 acres. Eastern Great Plains Wet Prairie Meadow and Marsh was the second smallest group for total number of wetlands but had a total of

Table 4. Total number of hydrologic soil group acres per soil group and ecological system.

Ecological System or Land Use Class	**A**	**A/D**	**B**	**B/D**	**C**	**C/D**	**D**	**Total Acres**
Eastern Great Plains Tallgrass Aspen Parkland	1.56	4.23	150.12	0.67	280.88	131.44	12.45	581.34
Centrall Tallgrass Prairie	634.05	10.67	3562.32	3512.06	20997.85	3536.08	4.23	32257.26
Northern Tallgrass Prairie	3625.48	3046.59	6811.29	5600.79	11025.67	5109.08	120.32	35339.21
Eastern Great Plains Wet Prairie, Meadow and Marsh	4300.00	3811.18	1887.47	4922.93	4544.86	7952.62	74.28	27493.34
Great Plains Prairie Pothole	608.92	1456.46	1629.93	2134.77	6086.28	7563.20	295.56	19775.13
Great Plains Depressional Wetland System	0.00	2.22	4.23	3.11	23.57	5.56	2.22	40.92
Cultivated Cropland	9810.28	8823.96	40667.34	5855.43	92365.69	28259.49	3836.31	189618.51
Pasture/ Hay	5518.95	2897.36	12229.05	7154.00	20824.39	3678.19	267.10	52569.03
Introduced Upland Veg. Perennial Grassland and Forbland	3112.64	606.03	803.51	141.67	1912.37	687.87	14.68	7278.76
Open Water	746.13	3779.60	2673.85	1164.90	6146.10	24283.52	82.06	38876.18

15,489.13 acres and a mean size of 2.10 acres. Open Water had the largest sum of acres out of all groups at 29,072.79, but did not have the highest total number of wetlands between the four groups. Open Water had a mean size of 2.37 acres. The Great Plains Prairie Pothole had the highest total number of wetlands and a total acreage of 11,084.60. The largest wetland was 177.92 acres and the mean size was .75. All groups had the smallest wetland starting at .22 acres.

The Wetlands within 30 m of the cropland polygon layer were used to clip each of the seven hydrologic soil polygons to determine the soil group of each wetland and cropland areas. Eastern Great Plains Wet Prairie Meadow and Marsh had the largest area of hydrologic soil in group CD at 5,832.30 acres. Great Plains Prairie Pothole had largest areas in group C at 3,883.24 acres. Western Great Plains Depressional Wetland Systems had the highest area in group C with 13.79 acres. Soil group CD covered the largest area in the Open Water ecological system at 18,598.44 acres and, Cultivated Croplands had group C with the largest coverage of hydrologic soil groups at 92,365.69 acres.

Discussion

The first task of the Northern Shoveler habitat analysis was to determine general acreage numbers per habitat and to determine hydrologic soil groups of those habitats. Cultivated Cropland had the greatest acreage in hydrologic soil groups with 189,618.51 acres. The four wetland categories together had a total of 86,185.56 acres in hydrologic soil groups.

The second task of the analysis was to determine wetlands that were within or adjacent to croplands. 30,512.79 acres were removed from the analysis after a select by location query was executed. The select by location query found 55,672.77 acres of wetlands that were within or adjacent to croplands (Table 5a and 5b). Before the selection was made the data revealed the average size of total wetlands utilized by the Northern Shoveler to be 1.27 acres. After the selection and removal of some wetlands the average went up to 1.61 acres.

Great Plains Depressional Wetland Systems had the smallest average size of wetlands at .31 acres. Great Plains Prairie Pothole had an average size of .75 acres, Eastern Great Plains Wet Prairie Meadow and Marsh had an average of 2.10 acres and Open Water had the highest average at 2.37 acres. Statistics for cultivated cropland produced a minimum of .22 acres (a single raster cell), maximum of 486.38 acres, total of 189,618.51 acres and an average of 4.29 acres.

The hydrologic soil groups in the Eastern Great Plains Wet Prairie, Meadow and Marsh had relatively large standard deviations from the mean, specifically in dual soil groups BD and CD. An interesting pattern observed in this class was the variation between the maximum acre counts of dual groups and single hydrologic soil groups. Single hydrologic soil group maximums did not reach 100 acres while dual group maximums reached 1,678.86 acres. The frequency distribution graphs show a majority of soil groups in the .22 acre small wetland size for groups A, B, C and D but, also show some variations in larger wetland sizes. The dual soil groups also show a majority of hydrologic soil groups in the .22 acre small wetland size but also show presence in larger wetland areas. The only soil group that fell below one acre in the standard deviation of the mean was group D.

This is important as these soils are likely to be candidates for artificial

Table 5a. Hydrologic Soil group acres and means for the resulting study area, a merge of the Wetlands within 30m and Cultivated Cropland datasets.

422 - Eastern Great Plains Wet Prairie, Meadow and Marsh		
Hydric Group	Total Acres	Mean Acres
A	1501.83	1.58
AD	1807.63	1.93
B	1018.12	0.95
BD	3106.63	3.22
C	2207.94	1.12
CD	5832.30	3.95
D	14.68	0.70
424 - Great Plains Prairie Pothole		
Hydric Group	Total Acres	Mean Acres
A	303.12	0.73
AD	784.16	0.75
B	1019.90	0.65
BD	1031.02	1.07
C	3883.24	0.73
CD	3868.56	0.72
D	194.60	1.57
426 - Western Great Plains Depressional Wetland System		
Hydric Group	Total Acres	Mean Acres
A	0.00	0.00
AD	0.89	0.44
B	4.00	0.29
BD	2.45	0.41
C	13.79	0.30
CD	3.78	0.34
D	1.33	0.22

drainage because they have favorable water table levels when drained that are conducive to agriculture, specifically in the dual soil groups BD and CD. Adequately drained means the water table

Table 5b. Hydrologic Soil group acres and means for Open Water and Cultivated Cropland in the resulting study area.

556 - Cultivated Cropland		
Hydric Group	Total Acres	Mean Acres
A	9810.28	2.93
AD	8823.96	2.84
B	40667.34	4.39
BD	5855.43	1.54
C	92365.69	6.34
CD	28259.49	2.98
D	3836.31	6.43
579 - Open Water		
Hydric Group	Total Acres	Mean Acres
A	483.49	1.60
AD	2873.12	2.18
B	1917.49	0.92
BD	601.36	1.29
C	4528.85	0.89
CD	18598.44	6.25
D	70.05	1.06

can be drained to at least 60 centimeters below the soil surface (USDA, 2007).

Great Plains Prairie Pothole also had large standard deviations with none of the soil groups falling below one acre in deviation. The group had large variations in maximum area between soil groups and dual soil groups. Soil group D had the largest mean and maximum acres but, dual group BD had the largest standard deviation at 6.89 acres from a mean of 1.07 acres. The variability in the standard deviations indicates a range of measurements varying from the mean and suggests that the high standard deviations and high number of small wetlands in the frequency distribution greatly influence results.

The Western Great Plains Depressional Wetland System had small

standard deviations from the mean with no soil groups reaching beyond one acre in standard deviation. All soil groups had very low counts except for group C which had 13.79 acres. Soil group A did not have a presence in this system and like the previous systems the dual groups had a larger standard deviation than groups A, B, C or D. Soil group D had six wetlands all identified at .22 acres, the minimum mapping unit of the study. Soil group D would likely have an artificial drainage system installed if there were enough land to be important to agriculture. This group has a low infiltration rate and a high run off potential, which would cause water to pond in a cropland and make agricultural activities more difficult (Sugg, 2007). This system had a large presence of hydrologic soil groups in small wetlands but there were variations in the frequency distributions, most likely due to low counts within hydrologic soil groups (Figure 6). This was most likely due to small areas small soil means. This system seems to appear only in the north east area of Richland County. Open Water also had large standard deviations. This group had a majority presence in the .22 acre small wetlands but also showed variations in the frequency distribution of each soil group.

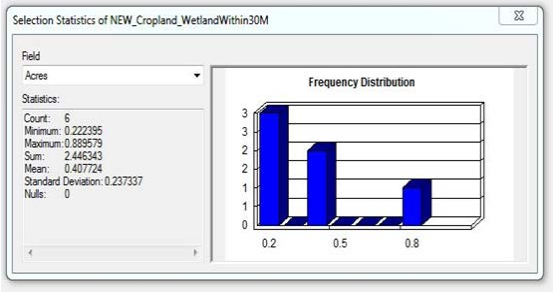

Figure 6. Frequency distribution graph of hydrologic soil group BD in the Western Great Plains Depressional Wetland System.

The final results revealed the highest habitat occurrences for the Shoveler were in Cultivated Croplands, and a large number of the wetland habitats were located within 30 meters of cropland. Wetland habitats averaged in size from .31 acres to 2.37 acres. The mean for all wetlands combined was 1.6 acres indicating the birds are utilizing primarily small wetlands. The mean Cultivated Cropland size for the study area was 4.29 acres.

Eastern Great Plains Wet Prairie, Meadow and Marsh, Great Plains Prairie Pothole and Open Water all had the highest acreage in soil group CD. Western Great Plains Depressional Wetland System and Cultivated Croplands had the greatest acreage in soil group C.

The results show the wetland groups should be classified as soil group D but are classified as dual groups because they allow for situations where if the land was drained it could be altered to group C. The dual groups indicate that group D was assigned due to a presence of a water table within 24 inches of the surface, but saturated conditions may be good for water transmission. It is possible they can be drained to group C. Group C has a moderately high runoff potential when wet and has restricted water transmission potential through soils (USDA, 2007).

Cultivated Cropland and Western Great Plains Depressional Wetland System had highest soil presence in group C with 92,365.69 acres while group B had the next highest presence at 40,667.34 acres. Group B has relatively low run off potential and unrestricted water transmission which is presumably good for farming. The next largest soil presence in Cultivated Cropland was group CD with 28,259.49 acres. Frequency distributions show .22 acre small wetlands (the study's minimum mapping unit) made up a majority of each ecological system, indicating along with the means that the wetlands in the study area are primarily

small. However, each system also had occurrences of large wetlands. The analysis shows that for this study area there were a large number of small wetlands in proximity to larger cropland areas. The analyses also revealed that cultivated cropland is the largest Northern Shoveler habitat within the study area. The birds may rely on the small wetlands for feeding and utilize the cropland habitats for nesting and breeding. The large acreage of dual hydrologic soil groups in cropland may also indicate that areas of cropland are temporarily ponded during the migratory season which could also be beneficial to the Shoveler habitat. The high presence of soil group C and CD in croplands and the proximity of small wetland habitats could indicate a large potential for agricultural drainage, resulting in alteration of the Shoveler habitat which could affect migratory and breeding patterns.

Limitations and Issues

The data used were large scale raster and polygon data. The polygon data were edited to follow the format of raster data which was based on cell size. This may have caused some discrepancies in the data. For example an ecological system that is big enough to be classified in the land cover data but is still very small would be classified as one cell which is 30 meters by 30 meters. It is possible that any of the values represented by one cell, cultivated croplands or the wetlands, may be smaller than 30 meters by 30 meters but were lost due to the nature of rasterization. In addition, values in raster cells may be smaller than what they are represented as in the raster. It is also possible that values may extend into their neighboring cells but are not the dominant feature of the cell and were not classified. Further analysis could be done utilizing the other major habitats such as Pasture/Hay and the soil groups. The process used here worked well for analyzing Northern Shoveler habitats here but it has not been tested to see if such a process would be applicable for a larger area such as the entire Central Flyway Migratory Route. There are also limitations within the data. The raster to polygon process works well, the land cover raster and formatted land cover polygon data match in total acres, but checking the extracted land cover data with the original dataset had some discrepancies. The hydrologic soil group polygons has no data areas which means not all land cover fell into a soil group. This resulted in the removal of some land cover areas making it difficult to compare to the original land cover (Figure 7). Overall, this study may have been more sensitive in its findings had data with a smaller minimum mapping unit been available.

The study utilized Northern Shoveler data that had known occurrences of birds but also contained probable occurrences based on habitat associations. It is possible that in some areas the Shoveler habitats may be larger or smaller than was used in the study.

Conclusions

The results of this study suggest use of small wetlands by the Northern Shoveler within 30 meters of cultivated cropland. The cropland habitats outnumbered the original total acreage of wetland habitats by 103,492.94 acres and outnumbered the wetlands within 30 meters by 133,945.74 acres. Perhaps the most at risk ecological system is the Great Plains Prairie Pothole where, an integral part of the regional wetland system had an average size of .75 acres but only 40-50% remain undrained

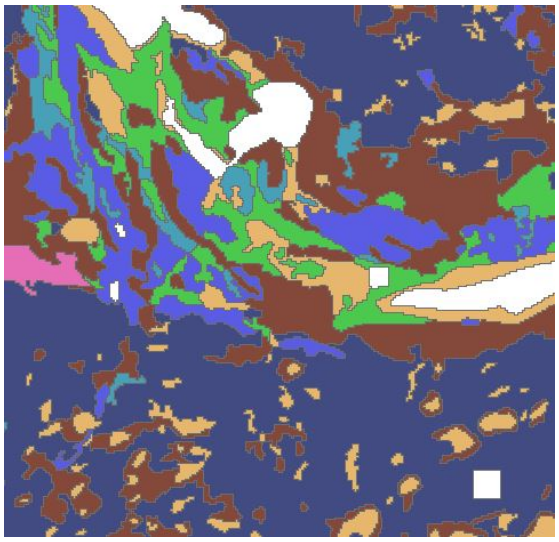

Figure 7. White areas display No Data within the Hydrologic Soil Group polygons.

(GAP, 2011). These small wetlands may be at risk to land cover conversion or inadvertent drying from nearby cropland drainage which would eliminate water transmission from surrounding wet areas. The abundance of hydrologic soil groups with moderate to high runoff potential and restricted or very restricted water movement within the croplands indicate that there is potential for those areas to be drained or altered to accommodate agricultural practices. Altering existing cropland which may provide temporary wetlands would not only result in the loss of cropland habitat but result in the loss of parts or all of the nearby wetland habitat.

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