

Chapter 4. Affected Environment

4.1 Physical Environment

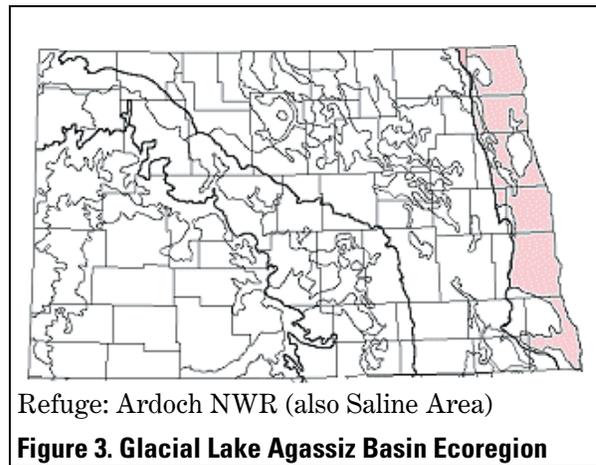
The limited-interest refuges are scattered across North Dakota, primarily east of the Missouri River, from the Canadian border down to South Dakota. Because the refuges cover such a large geographic area, the physical environment and biological resources will be described in terms of the physiographic region or ecoregion in which each refuge or group of refuges is located. Thirteen ecoregions are found in the Program area (figure 5). These ecoregions denote areas of general similarity in ecosystems and the type, quality, and quantity of environmental resources.

The text and graphics in this section are from a project completed in 1998 by the Northern Prairie Wildlife Research Center in Jamestown, North Dakota and titled “Ecoregions of North and South Dakota.”

Ecological regions are distinguished by the patterns of biotic and abiotic phenomena that reflect the differences in ecosystem quality. These phenomena include geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. Each ecoregion and its associated refuge(s) are summarized in tables 6 and 7.

Glacial Lake Agassiz Basin

From the Pembina Escarpment, the view of the Glacial Lake Agassiz Basin (figure 3) is of an extremely flat patchwork of cultivated farmland. Because the Red River of the North has a poorly defined flood plain and very low gradient, flooding can be a problem. Outside of channelized areas in the flood plain, turbid valley streams meander within narrow buffer strips of cottonwood, elm, ash, and willow. Soils range from silty to clayey in texture. Most areas have high water tables and are extremely productive.

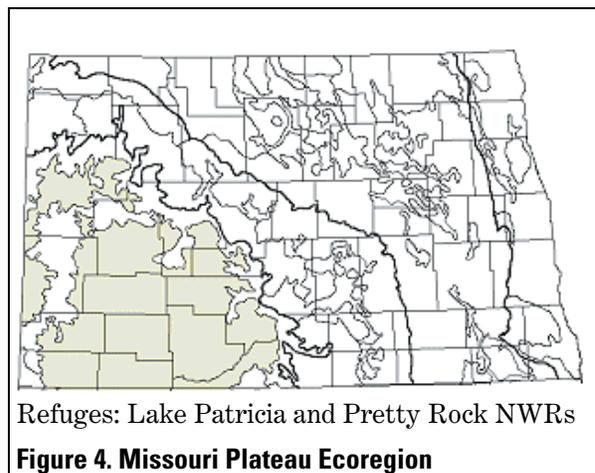


Refuge: Ardoch NWR (also Saline Area)

Figure 3. Glacial Lake Agassiz Basin Ecoregion

Missouri Plateau

On the Missouri Plateau west of the Missouri River (figure 4), the landscape opens up to become the “wide open spaces” of the American West. The topography of this ecoregion was largely unaffected by glaciation and retains its original soils and complex stream drainage pattern. A mosaic of spring wheat, alfalfa, and grazing land covers the shortgrass prairie where herds of bison, pronghorn (antelope), and elk once grazed.



Refuges: Lake Patricia and Pretty Rock NWRs

Figure 4. Missouri Plateau Ecoregion

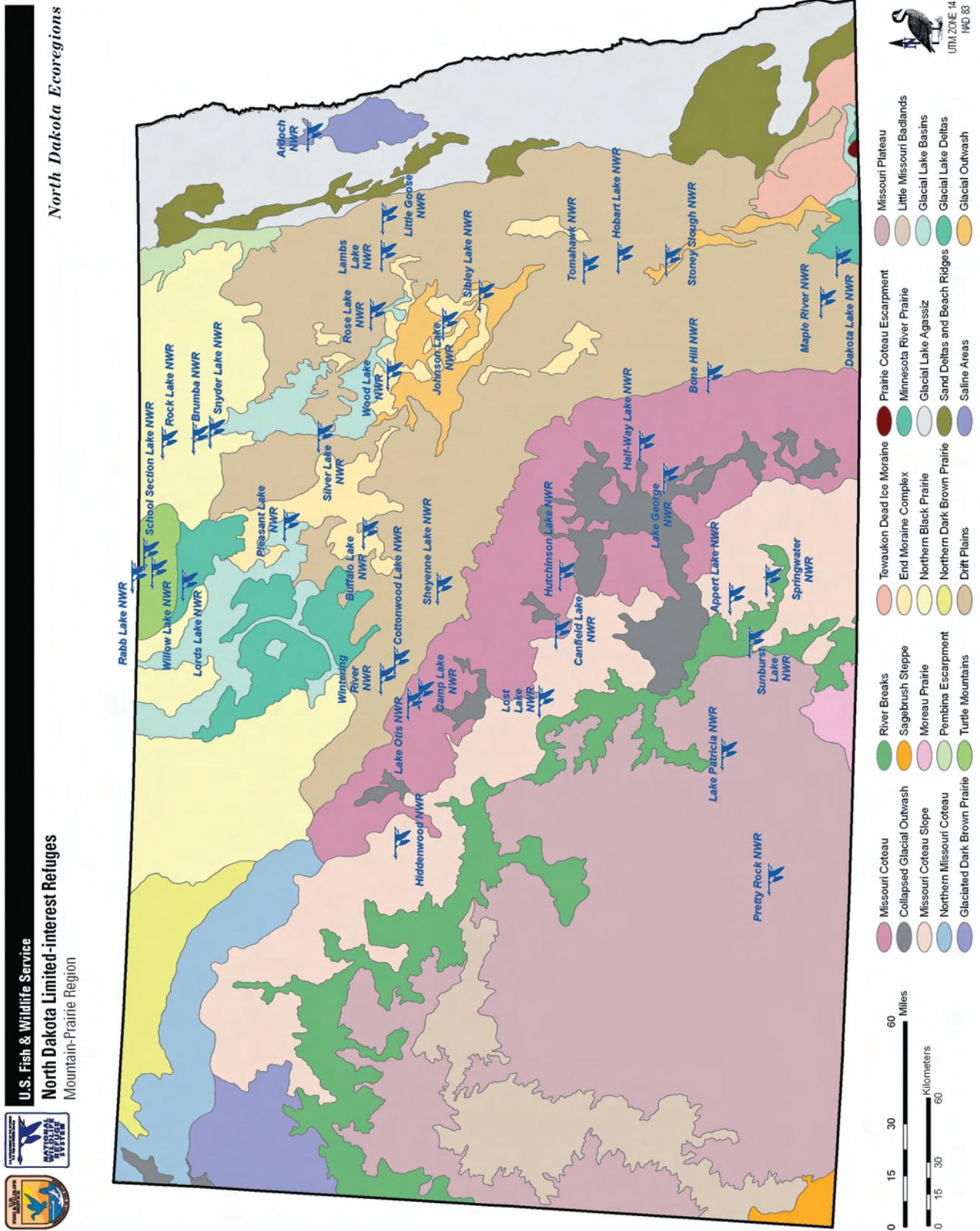
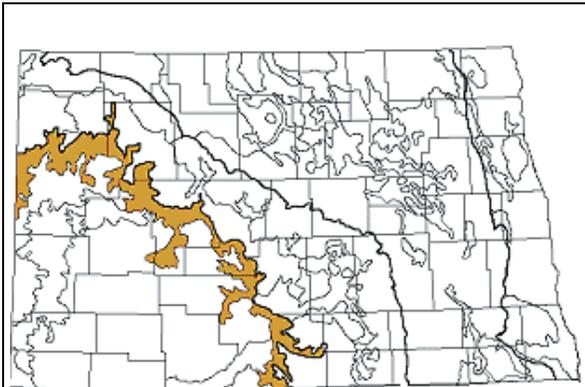


Figure 5. Ecoregion Map

River Breaks

The River Breaks (figure 6) form broken terraces and uplands that descend to the Missouri River and its major tributaries. These terraces have formed particularly in soft, easily erodible strata, such as Pierre shale. The dissected topography, wooded draws, and uncultivated areas provide a haven for wildlife. Riparian gallery forests of cottonwood and green ash persist along major tributaries such as the Moreau and Cheyenne rivers, but have largely been eliminated along the Missouri River by impoundments.

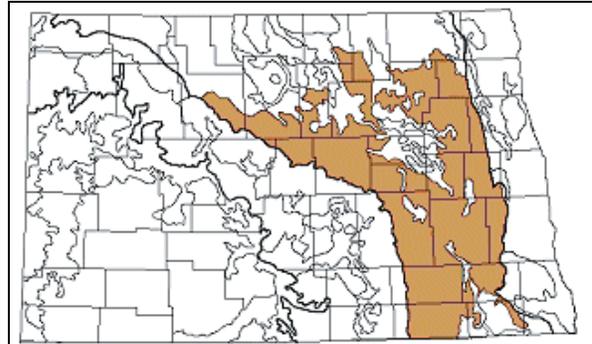


Refuges: Sunburst Lake and Springwater NWRs

Figure 6. River Breaks Ecoregion

Drift Plains

On the Drift Plains (figure 7), the retreating Wisconsin glaciers left a subtle undulating topography and a thick mantle of glacial till. A greater proportion of temporary and seasonal wetlands are found on the Drift Plains than in the Coteau areas, where semipermanent wetlands are numerous. Because of the productive soil and level topography, this ecoregion is almost entirely cultivated, with many wetlands drained or simply tilled and planted. However, valuable waterfowl habitat still remains, concentrated in state and federally sponsored duck production areas. The historic grassland on the Drift Plains was a transitional mix of tallgrass and shortgrass prairie. The prairie grasses have been largely replaced by fields of spring wheat, barley, sunflowers, and alfalfa.

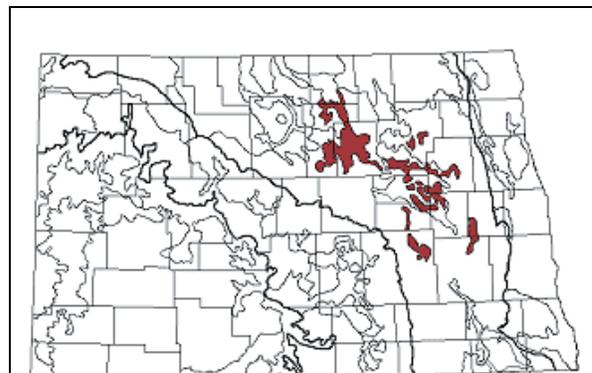


Refuges: Bone Hill (also Missouri Coteau), Buffalo Lake (also End Moraine Complex), Dakota Lake (also Glacial Lake Delta), Maple River, Hobart Lake, Tomahawk, Rose Lake, Lambs Lake, Little Goose, Wintering River, Cottonwood Lake, Sheyenne Lake, and Stoney Slough NWRs (also Glacial Outwash)

Figure 7. Drift Plains Ecoregion

End Moraine Complex

The End Moraine Complex (figure 8) is a concentration of glacial features in east central North Dakota. Blue Mountain and Devils Lake Mountain are composed of blocks of surficial material scraped off and thrust up by the continental glacier at the south end of the Devils Lake basin. In the western part of the ecoregion, patches of stagnation moraine similar to the Missouri Coteau have high wetland densities. On the moraines south of Devils Lake basin, favorable precipitation, aspect, and slightly higher elevations result in wooded lake margins and morainal ridges.

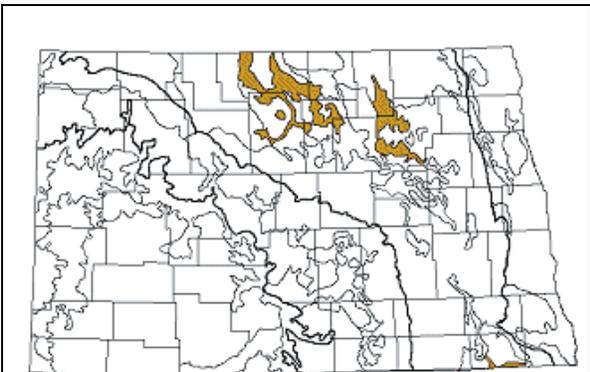


Refuges: Buffalo Lake (also Drift Plains), Johnson Lake (also Glacial Outwash), and Wood Lake NWRs

Figure 8. End Moraine Complex Ecoregion

Glacial Lake Basins

The Glacial Lake Basins (figure 9) were once occupied by Lake Souris, Devils Lake, and Lake Dakota. These proglacial lakes were formed when major stream or river drainages were blocked by glacial ice during the Pleistocene. The smooth topography of the Glacial Lake Basins, even flatter than the surrounding Drift Plains, resulted from the slow buildup of water-laid sediments. The level, deep soils on the lake plains are intensively cultivated. In the north, the primary crops are spring wheat, other small grains, and sunflowers; in the Lake Dakota basin of South Dakota, corn and soybeans are more prevalent.

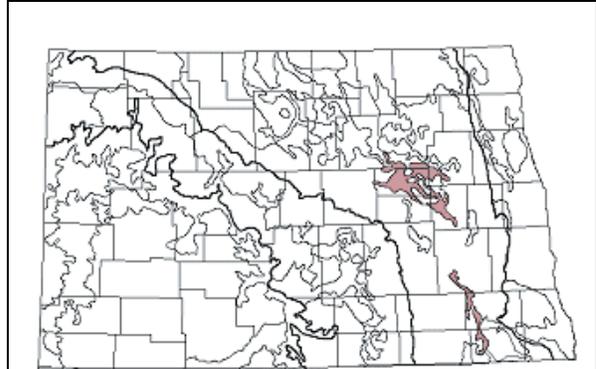


Refuges: Pleasant Lake, Dakota Lake (also Drift Plains), Silver Lake, Rock Lake and Brumba (both also in Northern Black Prairie), and Snyder Lake NWRs

Figure 9. Glacial Lake Basins Ecoregion

Glacial Outwash

The disjunct areas of Glacial Outwash (figure 10) differ from outwash areas on the Missouri Coteau in that they generally have a smoother topography. The soils are highly permeable with low water holding capacity. Areas of excessive soil permeability have a poor to fair potential for dryland crop production. Some areas are used for irrigated agriculture. The risk for blowing soil in droughty areas is reduced by retaining native range grasses like little bluestem, needle-and-thread grass, and green needlegrass.

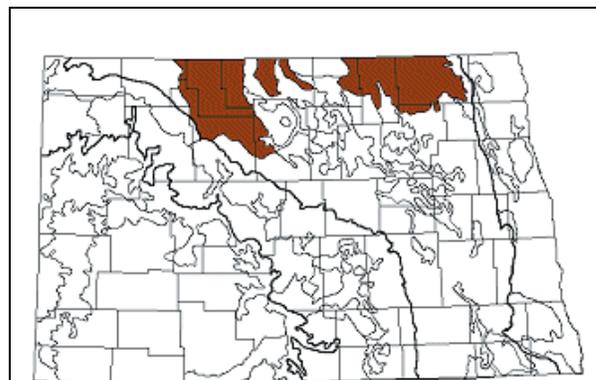


Refuges: Sibley Lake, Johnson Lake (also End Moraine Complex), and Stoney Slough NWRs (also Drift Plains)

Figure 10. Glacial Outwash Ecoregion

Northern Black Prairie

The Northern Black Prairie (figure 11) represents a broad phenological transition zone marking the introduction from the north of a boreal influence in climate. Aspen and birch appear in wooded areas, willows grow on wetland perimeters, and rough fescue, common to the Rocky Mountain foothills, becomes evident in grassland associations. This ecoregion has the shortest growing season and the lowest January temperatures of any other ecoregion in the Dakotas. Most of the area is used for growing small grains, with durum wheat being a major crop.

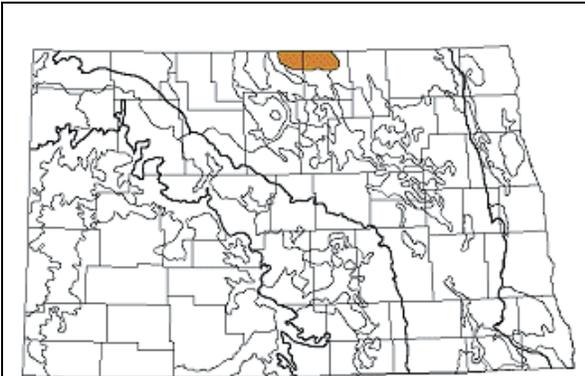


Refuges: Rock Lake and Brumba NWRs (both also in Glacial Lake Basins)

Figure 11. Northern Black Prairie Ecoregion

Turtle Mountains

The undulating landscape and abundant wetlands of the Turtle Mountains (figure 12) are similar to the Missouri Coteau. However, the Turtle Mountains contain larger, deeper, and more numerous lakes. Additionally, this ecoregion receives about 10 inches more precipitation than the surrounding Drift Plains; thus, it supports a forest cover of aspen, birch, burr oak, elm, and ash. The forest soils are erodible and poorly suited for cropland, though there is some clearing for pastureland.

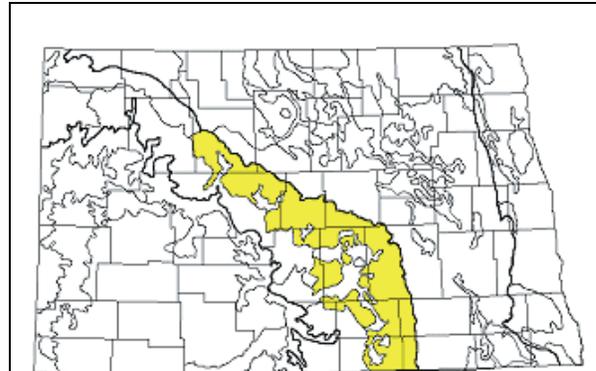


Refuges: Rabb Lake, Willow Lake, and School Section Lake NWRs

Figure 12. Turtle Mountains Ecoregion

Missouri Coteau

Like closely spaced ocean swells, the rolling hummocks of the Missouri Coteau (figure 13) enclose countless wetland depressions or potholes. During its slow retreat, the Wisconsin glacier stalled on the Missouri escarpment for thousands of years, melting slowly beneath a mantle of sediment to create the characteristic pothole topography of the Coteau. The wetlands of the Missouri Coteau and the neighboring prairie pothole regions are the major WPAs in North America. Land use on the Coteau is a mix of tilled agriculture in flatter areas and grazing land on steeper slopes.

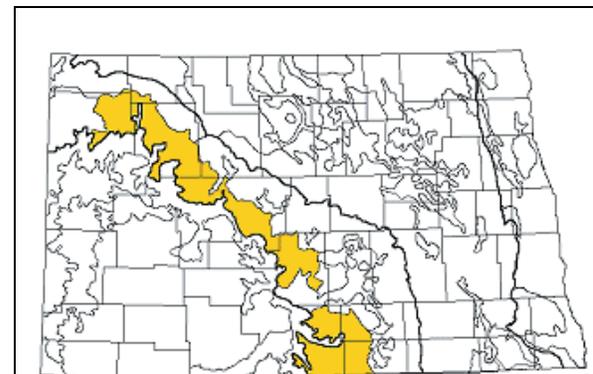


Refuges: Half Way Lake, Lake George, Hutchinson Lake, Canfield Lake, Camp Lake, Lake Otis, and Bone Hill NWRs (also Drift Plains)

Figure 13. Missouri Coteau Ecoregion

Missouri Coteau Slope

The Missouri Coteau Slope ecoregion (figure 14) declines in elevation from the Missouri Coteau to the Missouri River. Unlike the Missouri Coteau where there is a paucity of streams, the Missouri Coteau Slope has a simple drainage pattern and fewer wetland depressions. Due to the level to gently rolling topography, there is more cropland than on the Missouri Coteau. Cattle graze on the steeper land that occurs along drainages.

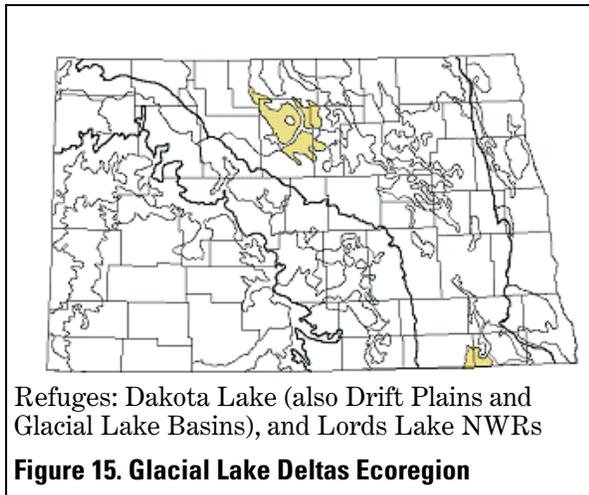


Refuges: Appert Lake, Lost Lake, and Hiddenwood NWRs

Figure 14. Missouri Coteau Slope Ecoregion

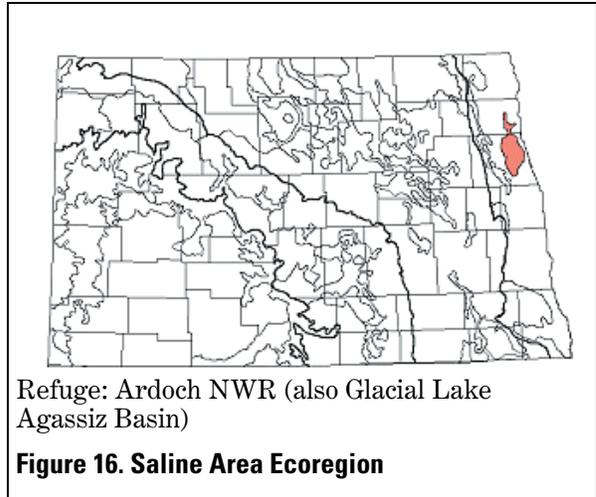
Glacial Lake Deltas

The Glacial Lake Deltas (figure 15) were deposited by rivers entering glacial lake basins (e.g., Glacial Lake Souris, Devils Lake, and Lake Dakota). The heaviest sediments, mostly sand and fine gravel, formed delta fans at the river inlets. As the lake floors were exposed during withdrawal of the glacial ice, wind reworked the sand in some areas into dunes. In contrast to the highly productive, intensively tilled glacial lake plains, the dunes in the delta areas have a thin vegetative cover and a high risk for wind erosion. These areas are used mainly for grazing or irrigated agriculture.



Saline Area

In the Saline Area (figure 16) of the Lake Agassiz basin, salty artesian groundwater flows to the surface through glacial till and lacustrine sediments from the underlying beds of Cretaceous sandstone. The regional boundary of the Saline Area delineates an area where salt effects are most evident. Other saline areas occur along the tributaries of the Park, Forest, and Turtle rivers in northeast North Dakota. Salt-affected soils in the saline area reduce crop productivity. Many areas are not suitable for farming, but are used for range or wildlife habitat.



Collapsed Glacial Outwash

Areas of Collapsed Glacial Outwash (figure 17) formed from gravel and sand deposited by glacial meltwater and precipitation runoff over stagnant ice. Many large, shallow lakes are found in these areas; lakes and wetlands tend to be slightly to very alkaline depending upon the flowpath of groundwater moving through the permeable outwash deposits. They attract birds preferring large areas of open water, such as white pelicans, black terns, and Forster’s terns, as well as those living in brackish water, such as avocets and tundra swans.

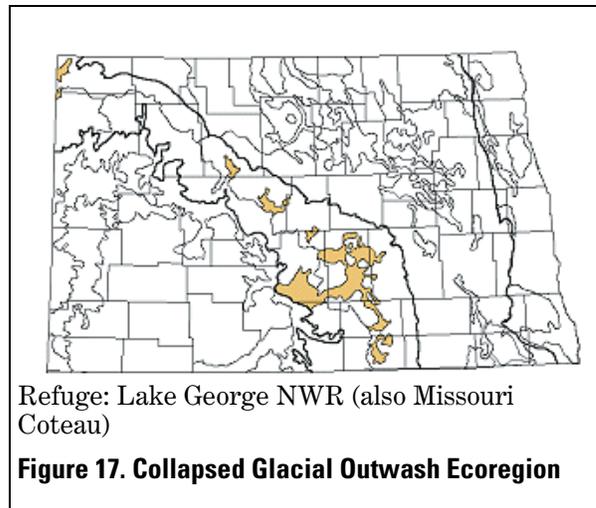


Table 6. Physiography of the ecoregions in which the limited-interest refuges reside

<i>Ecoregion</i>	<i>Area (mile²)</i>	<i>Elevation/ Local Relief (feet)</i>	<i>Geology</i>	<i>Soil Order (Great Groups)</i>	<i>Common Soil Series</i>	<i>Potential Natural Vegetation</i>	<i>Land Use and Land Cover</i>	<i>Limited-interest Refuges in Ecoregion</i>
Glacial Lake Agassiz Basin	5,137	790–1,200/1–50 Extremely flat glacial lake plain. Streams and rivers sluggish, meandering, and highly turbid with large sediment loads. Ditching and channelization common.	Tertiary sandstone, shale and some coal. Ludlow, Cannonball, Slope, Bullion Creek, and Sentinel Butte Formations.	Mollisols (Haploborolls, Calciborolls, Argiborolls, Natriborolls)	Vebar, Chama, Amor, Williams, Rhoades, Belfield, Cabba, Flasher, Reeder, Regent, Parshall, Golva, Zahl	Blue grama, wheatgrass/needlegrass association, little bluestem, prairie sandreed	Dryland farming and cattle grazing. Spring wheat a predominant crop with acreage of barley, oats, and sunflowers, native areas consist of mixed grasses.	Ardoch NWR (also Saline)
Missouri Plateau	20,000	1,750–3,300/50–500 Unglaciated. Moderately dissected level to rolling plains with isolated sandstone buttes.	Same as above	Entisols (Ustorthents, Ustipsammments)	Same as above	Same as above	Same as above	Lake Patricia and Pretty Rock NWRs
River Breaks	10,517	1,300–2,700/200–500 Unglaciated. Highly dissected hills and uplands bordering major rivers and associated alluvial plains.	Tertiary sandstone and shale.	Mollisols (Calciborolls, Haploborolls) Entisols (Ustorthents, Ustipsammments, Flavaquents) Aridisols (Natragids) Vertisols (Haplusterts) Inceptisols (Ustochrepts)	Sansarc, Opal, Bullock, Cabba, Amor, Flasher, Vebar, Temvik, Mandan, Cherry, Chama, Zahl, Lallie, McKeen	Blue grama, western wheatgrass, buffalograss, and some bluestem. Juniper and deciduous tress on north-facing slopes. cottonwood gallery forests on the flood plain	Steep slopes restrict land use to cattle grazing. Land cover is mostly rangeland and native grasses. Remnant woodlands in draws and on existing alluvial flats.	Sunburst Lake (also Missouri Coteau Slope) and Springwater NWRs

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Drift Plains	15,609	1,080–2,000/0–200 Glaciated. Generally flat, with occasional “washboard” undulations. High concentrations of temporary and seasonal wetlands. Simple drainage pattern.	Glacial till over Cretaceous Pierre Shale and Fox Hills Formations	Mollisols (Haploborolls, Calciaquolls, Natriborolls, Calciborolls, Argiaquolls)	Barnes, Svea, Buse, Hamerly, Cresbard, Parnell	Western wheatgrass, big and little bluestem, switchgrass, and indiangrass	Extensively tilled to spring wheat and other small grains, sunflowers, and alfalfa	Bone Hill (also Missouri Coteau), Dakota Lake (also Glacial Lake Delta and Basins), Hobart Lake, Tomahawk, Silver Lake (also Glacial Lake Basins), Rose Lake, Lambs Lake, Little Goose, Stoney Slough (also Glacial Outwash), Cottonwood Lake, Sheyenne Lake, Maple River, Buffalo Lake (also End Moraine Complex) and Wintering River NWRs
End Moraine Complex	1,518	1,450–1,790/20–170 Glaciated. A diverse area of hummocky stagnation moraine, parallel end moraine ridges, and other glacial features such as eskers, kames and thrust ridges.	Wisconsin glacial till and outwash	Mollisols (Haploborolls, Argiborolls, Calciborolls, Calciaquolls)	Hemdal, Emrick, Esmond, Barnes, Buse, Bottineau, Aastad, Edgeley, Hamerly	Tallgrass/ Midgrass prairie; western wheatgrass, green needlegrass, big and bluestem, blue grama. Forest vegetation of burr oak and aspen associated with Devils Lake.	Mixed range and cropland depending up slope and presence of rocks in soil. Spring wheat, oats, barley, flax, and hay.	Buffalo Lake NWR (and Drift Plains) Johnson Lake NWR (also Glacial Outwash) Wood Lake NWR

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Glacial Lake Basins	3,584	1,300–1,585/0–30 Glaciated. Very level glacial lake floors. Low wetland density.	Glacial lake deposits	Mollisols (Calcicquolls, Endoaquolls, Haploborolls, Natriborolls)	Hegne, Fargo, Bearden, Overly, Embden, Gardena, Glyndon, Great Bend, Aberdeen	Western wheatgrass, needle-and-thread grass, blue grama, green needlegrass.	Extensively tilled for durum and spring wheat, sunflowers, and flax. Corn and soybeans south.	Pleasant Lake, Dakota Lake (also Drift Plains and Glacial Lake Deltas), Silver Lake (also Drift Plains), Rock Lake and Brumba (both also in Northern Black Prairie), and Snyder Lake NWRs
Glacial Outwash	890	1,300–1,550/0–50 Glaciated. Flat to slightly rolling. Ancient channel depressions, relict lakes.	Sand and plane-bedded gravel, sediments of glacial meltwater rivers	Mollisols (Haploborolls, Natraquolls) Entisols (Udipsammments)	Brantford, Claire, Totten, Renshaw, Arvilla, Fordville, Sioux	Little bluestem, needle-and-thread grass, blue grama, prairie junegrass. Elm, ash, burr oak in river bottoms.	Cattle grazing on droughtiest soils. Tillable land produces wheat, oats, barley, rye, and alfalfa.	Johnson Lake (also End Moraine Complex), Stoney Slough (also Drift Plains) and Sibley Lake NWRs
Northern Black Prairie	5,040	1,500–1,970/5–200 Glaciated. Generally flat, with occasional “washboard” undulations. High concentrations of temporary and seasonal wetlands. Simple drainage pattern.	Glacial till over Cretaceous Pierre Shale and Tertiary Ft. Union Formation.	Mollisols (Haploborolls, Natriborolls, Calcicquolls, Calciborolls, Argiaquolls)	Barnes, Svea, Cresbard, Hamerly, Buse, Parnell	Northern prairie: western wheatgrass, green needlegrass, little bluestem, blue grama, and rough fescue.	Extensively tilled to durum and spring wheat, other small grains, sunflowers and alfalfa.	Rock Lake and Brumba Lake NWRs (both also in Glacial Lake Basins)

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Turtle Mountains	409	2,000–2,550/40–180 Glaciated. Platform of hummocky, rolling terrain above surrounding drift plains. Stream network lacking. High concentration of large lakes and wetlands.	Glacial till over Tertiary sandstone and shale.	Mollisols (Haplororolls, Argborolls, Calciborolls) Alfisols (Eutroboralfis)	Bottineau, Buse, Kelvin, Metigoshe	Burr oak dominant on side slopes, aspen on top. Other species present: green ash, paper birch, boxelder, sumac, serviceberry, and snowberry.	Native woodland and pasture clearings. Some hay and small grains on gentler soils.	Rabb Lake, Willow Lake, and School Section Lake NWRs
Missouri Coteau	9,122	1,650–2,100/10–300 Glaciated. Hummocky, rolling stagnation moraine. Stream drainage absent or uncommon. Numerous pothole wetlands between mounds of glacial till.	Thick glacial till over Tertiary sandstone and shale.	Mollisols (Haploborolls, Argiaquolls, Argborolls, Calciborolls)	Barnes, Buse, Parnell, Svea Williams, Bowbells, Zahl	Western wheatgrass, bluestem, needle-and-thread grass, green prairie needlegrass. Prairie cordgrass, northern reedgrass near wetlands.	Cattle grazing on steeper land mixed with tilled agriculture of hay and spring wheat. Native prairie remaining on unbroken rangeland. Wetlands provide wildlife habitat.	Half Way Lake, Lake George (also Collapsed Glacial Outwash), Bone Hill (also Drift Plains), Hutchinson Lake, Camp Lake, Canfield Lake, and Lake Otis NWRs
Missouri Coteau Slope	5,799	1,700–2,450/50–150 Glaciated. Level to gently rolling plain sloping to Missouri River. Sparse drainage pattern; few wetlands.	Wisconsin glacial till over Tertiary sandstone and shale in Cretaceous Pierre Shale.	Mollisols (Haploborolls, Argborolls, Argiaquolls, Calciborolls)	Williams, Max, Zahl, Bowbells, Parnell	Western wheatgrass, needle-and-thread grass, prairie junegrass, green needlegrass.	Mainly tilled agriculture of spring wheat, barley, alfalfa, silage corn. Some grazing on steep and saline or wet areas.	Appert Lake, Sunburst Lake (also River Breaks), Lost Lake, and Hiddenwood NWRs

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Glacial Lake Delta	1,877	1,290–1,595/6–85 Glaciated. Flat sheets of sand and gravel or rolling sand dunes. Paucity of stream channels.	Sand and gravel deposited over glacial lake floor	Mollisols (Haploborolls, Calciaquolls, Endoaquolls) Entisols (Udipsamments, Psammaquents)	Hecla, Ulen, Arvilla, Sioux, Serden, Rosewood, Lohnes, Bantry, Hamar	Prairie sandreed, little bluestem, indiangrass, switchgrass, sand bluestem	Droughty soils mostly used for native pasture. When filled, used for small grains, flax and fall planted rye (north) or small grains, sunflowers, and corn (south).	Dakota Lake (also Glacial Lake Basins and Drift Plains) and Lords Lake NWRs
Saline Area	348	820–870/3–25 Glacial Lake plain with saline ground water welling to the surface.	Silt and clay lacustrine deposits over Cretaceous shale and sandstone	Mollisols (Calcicquolls)	Bearden, Antler, Ojata	Tallgrass prairie, salt tolerant western wheatgrass, saltgrass	Grazing land on strongly saline soils. Where salinity levels are moderate, sunflowers, barley, sugarbeets, and potatoes are grown. Brackish wetland habitat	Ardoch NWR (also Glacial Lake Agassiz Basin)
Collapsed Glacial Outwash	1,771	1,650–2,100/30/120 Glaciated. Irregular plains left by glacial outwash deposited over stagnant ice. Broad, shallow, brackish wetlands and lakes.	Late Wisconsin glacial outwash deposits over Tertiary sandstone and shale and Cretaceous Pierre Shale.	Mollisols (Natraquolls, Haploborolls, Calciaquolls, Haplaquolls, Argiaquolls)	Ruso, Bowdle, Lehr, Wabek, Telfer, Lihen, Sioux, Parshall, Arvilla, Southam, Divide, Harriet	Needlethread, plains muhly, prairie muhly, prairie junegrass, blue grama. Saltgrass in alkaline areas.	Small grains, sunflowers, alfalfa, and corn on deeper soils. Grazing land on shallow soils over gravel. Sand and gravel quarries. Wetlands provide wildlife habitat.	Lake George NWR (also Missouri Coteau)

Source: Bryce et al. 1998.

Table 7. Climate of the ecoregions in which the limited-interest refuges reside

<i>Ecoregion</i>	<i>Area (mile²)</i>	<i>Temperature/ Moisture Regimes</i>	<i>Precipitation</i>	<i>Frost-Free Mean Annual (days)</i>	<i>Mean Temperature January and July min/max (°F)</i>	<i>Limited-interest Refuges in Ecoregion</i>
Glacial Lake Agassiz Basin	5,137	Frigid/Ustic	15-17	95-130	-3/21;55/83	Ardoch NWR (also Saline)
Missouri Plateau	20,000	Frigid/Ustic	15-17	95-130	-3/21;55/83	Lake Patricia and Pretty Rock NWRs
River Breaks	10,517	Frigid/Ustic	16-18	80-125	-3/21;56/87	Sunburst Lake (also Missouri Coteau Slope) and Springwater NWRs
Drift Plains	15,609	Frigid/Udic	17-19	95-125	-5/16;56/83	Bone Hill (also Missouri Coteau), Dakota Lake (also Glacial Lake Delta and Basins), Hobart Lake, Tomahawk, Silver Lake (also Glacial Lake Basins), Rose Lake, Lambs Lake, Little Goose, Stoney Slough (also Glacial Outwash), Cottonwood Lake, Sheyenne Lake, Maple River, Buffalo Lake (also End Moraine Complex) and Wintering River NWRs
End Moraine Complex	1,518	Frigid/Udic	18-20	90-120	-7/13;55/82	Buffalo Lake NWR (and Drift Plains) Johnson Lake NWR (also Glacial Outwash) Wood Lake NWRs
Glacial Lake Basins	3,584	Frigid/Udic	16-19	95-120	-10/10;54/80	Pleasant Lake, Dakota Lake (also Drift Plains and Glacial Lake Deltas), Silver Lake (also Drift Plains), Rock Lake and Brumba (both also in Northern Black Prairie), and Snyder Lake NWRs
Glacial Outwash	890	Frigid/Udic	16-18	110-130	-6/14;55-81	Johnson Lake (also End Moraine Complex), Stoney Slough (also Drift Plains) and Sibley Lake NWRs
Northern Black Prairie	5,040	Frigid/Udic	16-20	95-120	-10/10;54-80	Rock Lake and Brumba Lake NWRs (both also in Glacial Lake Basins)
Turtle Mountains	409	Frigid/ Udic	16-22	95-120	-10/10;53/80	Rabb Lake, Willow Lake, and School Section Lake NWRs

Table 7. Climate of the ecoregions in which the limited-interest refuges reside

<i>Ecoregion</i>	<i>Area (mile²)</i>	<i>Temperature/ Moisture Regimes</i>	<i>Precipitation</i>	<i>Frost-Free Mean Annual (days)</i>	<i>Mean Temperature January and July min/max (°F)</i>	<i>Limited-interest Refuges in Ecoregion</i>
Missouri Coteau	9,122	Frigid/ Udic, Ustic	15–19	110–130	-3/16;57/84	Half Way Lake, Lake George (also Collapsed Glacial Outwash), Bone Hill (also Drift Plains), Hutchinson Lake, Camp Lake, Canfield Lake, and Lake Otis NWRs
Missouri Coteau Slope	5,799	Frigid/ Ustic	15–18	110–130	-2/20;59/86	Appert Lake, Sumburst Lake (also River Breaks), Lost Lake, and Hiddenwood NWRs
Glacial Lake Delta	1,877	Frigid/Udic	16–19 (north) 19–21 (south)	95–120 (north) 120–140 (south)	-10/10;54/80 (north) 4/19;58/85 (south)	Dakota Lake (also Glacial Lake Basins and Drift Plains) and Lords Lake NWRs
Saline Area	348	Frigid/Udic	18–21	95–125	-7/21;56/82	Ardoch NWR (also Glacial Lake Agassiz Basin)
Collapsed Glacial Outwash	1,771	Frigid/Udic, Ustic	15–19	113–130	-2/20;59/86	Lake George NWR (also Missouri Coteau)

Source: Bryce et al. 1998.

Most of the limited-interest refuges have had some form of development or use varying from livestock yards to dozens of recreational cabins (table 8). Currently, 189 landowners reside on these 39 refuges (149 reside on Camp Lake NWR).

Several of the refuges have become popular recreational areas. Many of the refuges had some residential development at the time the limited-interest refuges were acquired, primarily in the form of farmsteads; however, development now includes commercial operations such as a fertilizer plant, recreational facilities, and an elk farm. The limited-interest refuges are scattered across North Dakota, primarily east of the Missouri River, from the Canadian border down to South Dakota.

Travel from the managing station ranges from 15 minutes to two hours. This travel time is relative to the station's ability to conduct regular maintenance and management programs.

4.2 Biological Resources

Most limited-interest refuges are located east of the Missouri River in the area commonly known the "Prairie Pothole Region." The two major categories of habitat types addressed in this CCP are upland (table 9) and wetland (table 10). The only available data relative to these refuges is from the HAPET office in partnership with Ducks Unlimited and the National Wetlands Inventory. To map upland habitat types, the HAPET office used Landsat Thematic Mapper Satellite Imagery (30 meter resolution) using a combination of unsupervised and supervised classification techniques. Image acquisition dates range from May 1992 to September 1996. Thematic Mapper scenes were processed individually and mosaiced to produce a state-wide coverage. The resulting classes of upland habitat are summarized in table 9.

Five separate upland habitat types were mapped using the image classification process: grass/hay/undisturbed, cropland, forest, riparian, and urban. Most uplands within the refuges are classified as cropland, totaling 14,296 acres. The grass/hay/undisturbed habitat type totals 14,060 acres and is used primarily for haying and grazing operations. These areas have the potential to be preserved as native prairie habitat because there is no indication this ground has ever been plowed or

broken. Forested lands total 814 acres, while riparian areas total 96 acres for all refuges. Some refuges encompass sections of small communities, resulting in an urban classification that totals 218 acres.

Currently, the Service only regulates hunting and trapping uses on the 29,483 acres of uplands (see section 2.3).

Wetland mapping was acquired from the National Wetlands Inventory database and interpreted by the HAPET office. Wetland habitat types within the limited-interest refuges include: impoundments; seasonal, temporary, and semi-permanent wetlands; riverine; and lakes. The Service has a water right on each refuge except Lake Otis. Table 11 summarizes those water rights filed with the state of North Dakota.

The main body of water within the limited-interest refuges was a major focus of the agreement, both from a wildlife preservation and water conservation perspective. Dozens of structures were built in the 1930s to impound and control water. Existing waterbodies, such as lakes and rivers, also were covered by this flowage limited-interest refuge and water right. The Service will regulate the uses that occur on these waters (see section 2.3).

Most of the wetland habitat types within the limited-interest refuges are classified as lakes, totaling 12,867 acres. Impoundment habitat accounts for 3,850 acres, encompassing many other wetland habitat acres due to the characteristics of the impoundment habitats. Impoundment habitats vary from deepwater lakes to seasonal, temporary wetlands. Riverine habitat is limited, totaling 176 acres. These three habitat types are areas in which the Service has the right to control uses and manage for wildlife. Naturally occurring wetland habitats including semi-permanent, temporary, and seasonal wetlands, total 2,436 acres. Information for wetlands on all refuges is provided in table 10. The Service does not control the uses and alterations of any of these naturally occurring wetlands not encumbered by a Service easement. Regulatory authority rests with the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency. As described in section 2.3, it appears from historical documentation that there was never any intent to regulate wetland uses even though these areas are critical habitat to wetland-dependent wildlife.

Most of the limited-interest refuges (30 of 39) have some sort of structure intended to either impound water or allow manipulation of that water for wildlife or flood control. Few of these structures have been updated since they were

originally installed in the 1930s and 1940s. Some are in disrepair, while others are functioning but do not meet the standards for modern water level management practices used to enhance wildlife habitat production.

Table 8. Limited-interest refuge agreements and landowner uses and developments

<i>Refuge</i>	<i>No. of Limited-interest Refuge Agreements</i>	<i>Total Limited-interest Refuge Acres</i>	<i>Travel Time from Managing Station (minutes)</i>	<i>Landowners Residing on Limited-interest Refuge Lands</i>	<i>Landowner Uses and/or Developments</i>
Appert Lake	7	908	20	0	Farming
Ardoch	4	2,389	75	1	3 farmsteads (2 abandoned) and outbuildings
Bone Hill	3	640	30	2	2 residences, fertilizer plant, elk farm
Brumba	12	1,978	65	3	3 farmsteads, farming
Buffalo Lake	7	1,540	80	0	1 recreational cabin
Camp Lake	8	585	60	149	238 cabins, boat docks, beach, livestock, and farming
Canfield Lake	4	310	60	0	Cattle grazing
Cottonwood Lake	7	1,014	80	5	2 farmsteads, 3 residences, 1 mobile trailer, 2 boat docks
Dakota Lake	20	2,800	60	1	2 residences, 1 cabin, boat dock and ramp
Half Way Lake	1	160	30	0	Farming and cattle grazing
Hiddenwood	6	568	80	0	Boat dock and ramp, storage, ball diamond, picnic shelter
Hobart Lake	7	1,831	15	3	3 farmsteads, livestock yard
Hutchinson Lake	2	479	60	0	Cattle grazing
Johnson Lake	7	2,003	60	0	Livestock yard and hay land
Lake George	8	3,090	40	1	1 residence, cattle grazing
Lake Otis	1	320	60	0	Livestock
Lake Patricia	5	800	120	0	Farming, recreation, wildlife habitat (state)
Lambs Lake	11	1,207	60	0	2 abandoned residences, livestock yard
Little Goose	3	288	70	0	None
Lords Lake	10	1,915	45	2	2 farmsteads

Table 8. Limited-interest refuge agreements and landowner uses and developments

<i>Refuge</i>	<i>No. of Limited-interest Refuge Agreements</i>	<i>Total Limited-interest Refuge Acres</i>	<i>Travel Time from Managing Station (minutes)</i>	<i>Landowners Residing on Limited-interest Refuge Lands</i>	<i>Landowner Uses and/or Developments</i>
Lost Lake	5	960	50	0	Cattle grazing
Maple River	4	712	45	0	Cattle grazing and farming
Pleasant Lake	4	898	50	1	1 farmstead, livestock yard
Pretty Rock	2	800	180	1	1 farmstead and livestock yard
Rabb Lake	2	261	65	0	None
Rock Lake	37	5,506	70	3	3 farmsteads, farming and cattle grazing
Rose Lake	2	836	20	1	1 farmstead
School Section Lake	3	297	65	1	1 farmstead, cattle grazing
Sheyenne Lake	7	797	60	0	1 boat dock and ramp, recreation, wildlife habitat (state)
Sibley Lake	9	1,077	60	1	1 farmstead, livestock yard
Silver Lake	17	3,348	50	5	7 farmsteads (2 abandoned), livestock yard and farming
Snyder Lake	6	1,550	60	1	Boat ramp
Springwater	2	640	40	0	Cattle grazing
Stoney Slough	9	880	30	1	1 farmstead, organic farm, cattle grazing, recreation
Sunburst Lake	1	328	60	1	1 farmstead, cattle grazing
Tomahawk	4	440	20	2	2 farmsteads, livestock yard
Willow Lake	17	2,620	60	3	3 farmsteads, farming, cattle grazing
Wintering River	2	239	80	0	Abandoned farmstead
Wood Lake	3	280	25	1	1 farmstead, cattle grazing, farming
Totals/Averages	269	47,294	Average = 58	189	

Table 9. Upland habitat types

<i>Refuge</i>	<i>Upland Habitat Types (acres)</i>					<i>Total Upland Acres</i>
	<i>Grass/Hay/ Undisturbed</i>	<i>Cropland</i>	<i>Forest</i>	<i>Riparian</i>	<i>Urban</i>	
Appert Lake	79.53	742.45	0.00	0.00	0.00	821.98
Ardoch	322.11	945.86	26.47	0.00	0.00	1,294.44
Bone Hill	167.87	405.33	0.00	0.00	0.00	573.20
Brumba	606.18	996.59	19.45	0.00	0.00	1,622.22
Buffalo Lake	719.91	167.34	35.45	33.89	0.00	956.58
Camp Lake	286.62	34.20	0.00	0.00	0.00	320.82
Canfield Lake	89.05	0.23	0.00	1.83	0.00	91.10
Cottonwood Lake	421.01	311.62	0.00	0.00	0.00	732.63
Dakota Lake	555.88	922.60	16.98	18.85	0.00	1,514.30
Half Way Lake	40.96	0.51	0.00	0.00	0.00	41.47
Hiddenwood	91.42	469.79	0.00	0.00	0.00	561.22
Hobart Lake	366.51	505.21	2.22	0.00	0.00	873.51
Hutchinson Lake	91.67	1.43	0.00	8.95	0.00	102.06
Johnson Lake	1,032.49	101.08	2.45	0.00	5.74	1,141.76
Lake George	1,330.75	83.07	0.00	18.52	15.35	1,447.68
Lake Otis	307.87	0.10	0.00	0.00	0.00	307.97
Lake Patricia	N.D. †	N.D.	N.D.	N.D.	N.D.	N.D.
Lambs Lake	75.73	2.87	0.18	0.00	0.00	78.78
Little Goose	39.63	278.40	0.00	0.00	0.00	318.03
Lords Lake	553.15	529.05	21.00	0.00	0.00	1,103.20
Lost Lake	611.77	0.23	0.00	0.00	0.00	612.02
Maple River	166.39	563.78	0.00	0.00	0.00	730.17
Pleasant Lake	433.56	18.56	97.81	0.00	20.94	570.86
Pretty Rock	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Rabb Lake	18.05	0.34	93.68	0.00	0.00	113.63
Rock Lake	1,312.80	2,953.16	30.94	3.29	53.07	4,353.26
Rose Lake	175.65	553.86	0.00	0.00	0.00	729.51
School Section Lake	26.91	5.23	11.00	0.00	0.00	43.14
Sheyenne Lake	187.68	7.48	0.55	7.31	9.12	212.13
Sibley Lake	481.67	16.97	6.01	0.00	0.00	504.64
Silver Lake	559.11	2,061.64	4.00	0.00	113.59	2,738.34
Snyder Lake	664.80	564.22	0.89	0.00	0.00	1,229.91
Springwater	569.26	44.20	6.23	0.00	0.00	619.70
Stoney Slough	114.22	609.76	0.00	0.00	0.00	723.98
Sunburst Lake	321.53	103.97	0.00	2.89	0.00	428.40
Tomahawk	271.76	76.26	0.00	0.00	0.00	348.02
Willow Lake	740.12	69.93	424.81	0.00	0.00	1,234.86
Wintering River	87.76	76.96	3.43	0.00	0.00	168.15
Wood Lake	138.26	71.30	10.41	0.00	0.00	219.97
Total Acres	14,059.66	14,295.61	813.95	95.48	217.81	29,482.51

†N.D. = No landcover data available.

Source: Service 1998.

Table 10. Wetland habitat types

Refuge	Wetlands (acres)			Riverine (acres)	Lake (acres)	NWI Total (acres)	Water Management Structure(s)
	Impoundments (acres)	Seasonal	Semi-permanent				
Appert Lake	71.91	7.43	3.17	0.00	0.00	82.28	Earthen levee
Ardloch	1,091.00	23.4	12.55	9.43	1,143.16	1,189.33	Steel screw gate, 2 spillways
Bone Hill	15.03	15.87	0.82	0.00	43.15	68.95	Earthen dam
Brumba	0.22	57.11	17.02	13.15	97.73	200.94	2 spillways (earthen and sheet pile)
Buffalo Lake	535.65	16.40	7.66	3.08	538.98	582.72	Earthen dam, culvert, masonry spillway
Camp Lake	157.36	2.54	0.52	0.00	143.45	167.55	Earth and rubble dike, concrete spillway, inoperable WCS
Canfield Lake	0.00	11.93	0.00	0.00	204.33	216.25	None
Cottonwood Lake	0.00	35.92	7.68	4.98	232.03	297.48	Ditch, concrete culvert
Dakota Lake	549.65	48.98	80.76	13.16	823.15	1,030.59	Earthen/sheet pile dam with stop log
Half Way Lake	0.00	0.93	0.00	0.00	116.31	117.41	None
Hiddenwood	0.00	1.50	7.52	0.00	121.71	130.72	Culvert
Hobart Lake	63.88	4.34	10.14	0.00	849.79	873.51	None
Hutchinson Lake	0.00	1.74	14.33	0.00	290.94	343.38	None
Johnson Lake	0.00	1.48	0.67	0.00	454.80	458.48	Earthen dam and spillway
Lake George	0.00	28.68	30.64	0.00	1,441.51	1,577.37	2 Earthen dikes, metal spillway
Lake Otis	0.00	12.20	0.11	0.00	6.29	18.60	None
Lake Patricia	316.83	0.00	0.00	0.00	339.86	339.83	Earthen dike, WCS, and spillway
Lambs Lake	111.76	30.81	23.40	0.00	132.47	284.16	Earthen dam and concrete spillway
Little Goose	31.56	0.39	1.11	0.00	38.80	40.30	Earthen dam and spillway, field crossing
Lords Lake	0.00	32.35	5.45	0.00	669.50	789.33	2 ditches and 2 earthen dams
Lost Lake	0.00	10.49	10.26	18.91	165.04	350.42	Dike, diversion ditch, and nesting island, concrete spillway, WCS
Maple River	0.00	19.30	4.01	26.09	0.00	82.31	Earthen dam and sheet pile weir
Pleasant Lake	0.00	7.69	0.00	0.00	471.98	491.58	Fence and masonry water control structure
Pretty Rock	183.13	30.51	0.00	0.00	181.83	212.34	Dike and WCS

Table 10. Wetland habitat types

Refuge	Impoundments (acres)		Wetlands (acres)			Riverine (acres)	Lake (acres)	NWI Total (acres)	Water Management Structure(s)
	Seasonal	Temporary	Seasonal	Temporary	Semi-permanent				
Rabb Lake	0.00	5.53	0.00	0.00	2.52	3.47	102.13	113.63	None
Rock Lake	0.00	110.14	78.15	109.99	109.99	0.00	831.17	1,129.20	Earthen dike, stop log, and sheet pile spillway
Rose Lake	0.00	28.45	6.74	38.19	38.19	0.00	0.00	73.36	2 earthen dikes and 1 rubble spillway
School Section Lake	0.00	0.00	0.31	0.00	0.00	0.00	312.56	312.56	Earthen dike and spillway
Shenoye Lake	564.35	5.06	1.51	0.00	0.00	0.00	564.30	570.00	Earthen dam and concrete spillway
Sibley Lake	0.00	0.26	6.58	85.41	85.41	0.00	464.95	557.19	None
Silver Lake	0.00	33.26	61.54	36.20	36.20	65.19	428.07	624.26	None
Snyder Lake	0.00	22.18	24.40	27.55	27.55	0.00	243.82	317.95	Sheet pile spillway, earthen dike, stop log
Springwater	2.83	15.25	0.00	9.59	9.59	14.21	0.00	39.05	Earthen dike
Stoney Slough	0.00	57.79	36.40	0.00	0.00	0.00	58.01	152.19	3 water control structures
Sunburst Lake	55.78	3.63	8.40	16.57	16.57	3.25	49.51	81.35	Earthen dike, metal spillway
Tomahawk	63.12	0.57	3.96	14.03	14.03	0.00	65.94	84.49	Earthen dike and spillway
Willow Lake	0.00	81.67	9.47	70.09	70.09	0.65	1,164.78	1,326.65	Stop log structure
Wintering River	0.00	9.20	0.09	67.31	67.31	0.00	0.00	76.57	4 earthen dikes and sheetpile spillway
Wood Lake	35.52	4.00	6.26	7.12	7.12	0.00	40.41	57.78	Masonry water control structure, earthen dike
Total Acres	3,849.57	782.32	484.82	1,169.25	1,169.25	175.57	12,867.03	15,426.06	

WCS = water control structure

Source: Service 2004.

Table 11. Water rights filed with the state of North Dakota

<i>Refuge</i>	<i>Water Storage (acre-feet)</i>	<i>Surface Area (acres)</i>	<i>Refuge</i>	<i>Water Storage (acre-feet)</i>	<i>Surface Area (acres)</i>
Appert Lake	365	103	Lost Lake	52	61
Ardoch	5,347	1,150	Maple River	230	130
Bone Hill	114	38	Pleasant Lake	1,166	480
Brumba	375	150	Pretty Rock	688	201
Buffalo Lake	3,125	862	Rabb Lake	251	98
Camp Lake	706	216	Rock Lake	2,829	695
Canfield Lake	872	218	Rose Lake	225	85
Cottonwood Lake	750	200	School Section Lake	2,098	305
Dakota Lake	3,200	1,600	Sheyenne Lake	628	178
Half Way Lake	90	30	Sibley Lake	1,300	487
Hiddenwood	240	112	Silver Lake	1,530	355
Hobart Lake	778	278	Snyder Lake	564	188
Hutchinson Lake	90	30	Springwater	64	16
Johnson Lake	2,590	740	Stoney Slough	1,685	455
Lake George	102	156	Sunburst Lake	66	33
Lake Otis	0	0	Tomahawk	303	63
Lake Patricia	906	278	Willow Lake	7,200	1,200
Lambs Lake	269	111	Wintering River	103	86
Little Goose	138	44	Wood Lake	100	46
Lords Lake	5,252	778			
			Total Acres	46,391	12,256

Source: Service 2005.

4.3 Cultural Resources

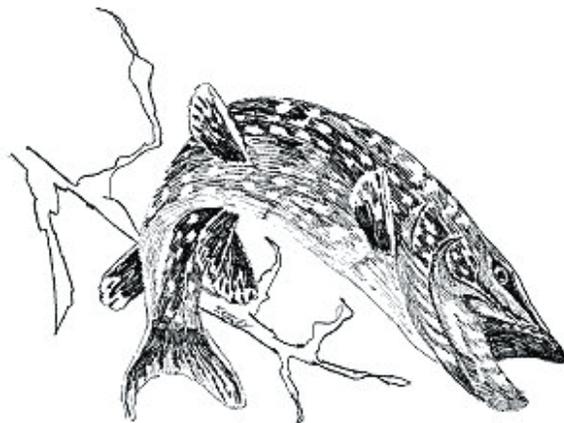
This CCP is not subject to compliance with section 106 of the National Historic Preservation Act. Limited-interest refuges are the rental/lease of non-federally owned land for habitat purposes. The only exception would be if conditions of the agreement specifically identified the protection of cultural resources, which is not the case for the limited-interest refuges.

However, if future federally funded projects on these limited-interest refuges have the potential to affect historic properties, then 106 compliance is necessary.

4.4 Visitor Services

To provide visitor services on the limited-interest refuges, access must be provided by the landowner. If any public activity is allowed, it must be open to the general public. There may be limitations as to the number of participants and seasons of use, but the general public must be given the opportunity to participate because national wildlife refuges are managed by the federal government.

To date, most of the limited-interest refuges have remained closed to all public use. In particular, they historically have been closed to hunting. There has been little public interest in these refuges. Most of these refuges are now posted, but few have entrance signs identifying them by name as is typical on most other national wildlife refuges.



Northern Pike
Tom Kelley/USFWS

During scoping, the state, general public, and some landowners requested opening some refuges to hunting. Increased hunting opportunities and overgrazing by deer and geese, resulting in loss of crops, prompted this request. Trapping has been allowed on a permit-only basis and has become a vital management tool to control unnatural populations of predators that have devastated waterfowl and other grassland nesting birds. Fishing occurs on several refuges and the state has stocked fish in some of the more popular impoundments. Only a few of the refuges have been officially open to public fishing. Numerous requests were made to open these refuges for ice fishing, an extremely popular winter activity in North Dakota.

Other activities such as environmental education and interpretation opportunities, wildlife observation, and photography programs, are nonexistent on the limited-interest refuges. Again, these are private lands so access must be granted by the landowner for an activity to occur. Some landowners expressed interest in establishing environmental education and interpretation programs targeting local schools.

4.5 Socioeconomic Environment

The limited-interest refuges are scattered across a 23-county area with a landbase of 19,970,400 acres. Except for Morton and Grant counties, most counties are located east of the Missouri River. Areas surrounding the limited-interest refuges are typically characterized as rural with an economy and land use based on agriculture. Currently, over 88 percent of the land in these counties is identified as agricultural (table 12).

The state of North Dakota covers 44,156,200 acres. Of this acreage, the Service currently owns 627,116 acres (1.4 percent of the entire state) and has an easement or lease (wetland, grassland, limited-interest) on an additional 1,100,960 acres (3 percent of the entire state). North Dakota ranks 31 in the nation for overall federal land ownership (National Wilderness Institute 1995). Within the 23-county planning area, the Service currently owns 2 percent of the land in national wildlife refuges, WPAs, and National Fish Hatcheries and has various easements on 3.5 percent of lands in this planning area.

Race composition in most of the counties in the Program area is predominantly Caucasian ranging from 50.8 percent (Benson County) to 99.5 percent (Kidder County) (table 13). The next largest group represented is Native American Indian ranging from 0 percent (Emmons) to 48 percent (Benson County). Most of the counties are sparsely populated excluding those with large urban areas such as Grand Forks County and Burleigh County, which encompass the cities of Grand Forks and Bismarck, respectively. Population sizes in 2003 ranged from 2,591 (Kidder County) to 70,937 (Burleigh County). The total population for all counties combined is 296,433, which is 46 percent of North Dakota's 2004 population of 642,200. Population densities range from 1.7/square mile (Grant County) to 42.5/square mile (Burleigh County). Overall, the population of the counties continued to decline between 2000-2003. Population declines ranged from 0.7 percent in Morton County to a decline of 9.9 percent in Sheridan County. Only two counties increased population during this same period: Burleigh County (an increase of 3.3 percent) and Rolette County (an increase of 0.3 percent). The median age varies from 28.9 in Rolette County, to 48.1 in Sheridan County.

The national unemployment rate is 5.0 percent (U.S. Department of Labor 2005). The state of North Dakota's unemployment rate is below the national average at 3.2 percent. The largest employer in the state is the health care and social services (human services) industry employing over 14.1 percent of the state. In 2004, this industry had the largest employment growth in the state (North Dakota Job Service 2004), adding over 1,000 jobs (table 14).

The counties surrounding the limited-interest refuges have an average of 3.1 percent unemployment rate, slightly below the state average. Grant County had the lowest unemployment rate at 1.3 percent, while Rolette County was the highest at 8.2 percent (U.S. Bureau of Census 2000). Human services was the leading industry in 16 of the 23 counties, followed by agriculture (six counties). One county had "entertainment" as the primary industry. The median household income varied between \$23,165 in Grant County to \$41,309 in Burleigh County (U.S. Bureau of Census 2000).

Table 12. Acres of agricultural and Service-controlled lands by county (% of total land for all listed counties)

County	Land (acres)	Agricultural Lands (acres)		FWS Fee-title (acres)			FmHA Lands [†] (acres)	Wetland Easements (acres)	Grassland Easements (acres)	Limited-interest Refuges in County	Limited-interest Refuge (acres)
				NWR	WPA	NFH					
Barnes	954,880	856,976		246	7,017	110	0	17,342	0	Hobart Lake, Stoney Slough, and Tomahawk	3,151
Benson	883,840	732,870		1,674	7,216	0	1,703	35,195	2,982	Pleasant Lake, Silver Lake (also Rolette), and Wood Lake	4,238
Bottineau	1,068,160	948,475		21,563	2,589	0	471	29,183	0	Lords Lake (also Rolette Co.)	1,462
Burleigh	1,045,120	865,524		11,801	11,256	0	2,187	26,063	12,844	Canfield Lake	310
Dickey	723,840	599,450		0	10,042	0	2,584	26,817	9,333	Dakota Lake and Maple River	3,512
Eddy	403,200	348,786		0	4,657	0	417	11,811	0	Johnson Lake	2,003
Emmons	966,400	838,075		0	3,615	0	309	11,492	0	Springwater, Sunburst Lake, and Appert Lake	1,876
Grand Forks	920,320	755,592		680	6,395	0	0	939	0	Little Goose	288
Grant	1,061,760	1,056,729		0	5,363	0	0	5,821	10,331	Pretty Rock	800
Griggs	453,120	379,022		0	3,228	0	101	16,677	0	Sibley Lake	1,077
Kidder	864,640	794,465		6,609	7,404	0	1,222	63,955	9,887	Hutchinson Lake and Lake George	3,569
Lamoure	734,080	676,966		0	5,435	0	955	13,121	0	Bone Hill	640
McHenry	1,199,360	1,125,831		37,122	5,882	0	2,213	29,131	15,272	Cottonwood Lake and Wintering River	1,253

Table 12. Acres of agricultural and Service-controlled lands by county (% of total land for all listed counties)

County	Land (acres)	Agricultural Lands (acres)		FWS Fee-title (acres)			FmHA Lands [†] (acres)	Wetland Easements (acres)	Grassland Easements (acres)	Limited-interest Refuges in County	Limited-interest Refuge (acres)
		NWR	WPA	NFH	NWR	WPA					
McLean	1,350,400	1,094,748	17,504	12,343	186	73	22,280	7,945	Camp Lake, Hiddenwood, Lake Otis, and Lost Lake	2,433	
Morton	1,232,640	1,276,269	0	0	0	375	0	0	Lake Patricia	800	
Nelson	628,480	531,591	32	3,544	0	439	37,881	0	Lambs Lake, Johnson Lake, and Rose Lake	2,043	
Pierce	651,520	530,623	24	12,750	0	3,906	36,246	1,469	Buffalo Lake	1,540	
Ramsey	758,400	636,109	7,710	9,477	0	386	28,730	0	Silver Lake (also Benson Co.)	313	
Rolette	577,280	507,658	1	5,800	0	361	20,149	0	Rabb Lake, School Section Lake, Lords Lake and Willow Lake	3,616	
Sheridan	622,080	468,745	29,737	22,748	0	726	31,427	11,046	Sheyenne Lake	797	
Stutsman	1,421,440	1,215,190	17,690	28,277	0	1,259	41,927	11,834	Half Way	160	
Towner	656,000	548,774	802	7,241	0	865	24,213	398	Brumba, Rock Lake, and Snyder Lake	9,034	
Walsh	820,480	759,381	308	1,786	0	329	8,758	0	Ardoch	2,389	
Totals	19,997,440	17,547,848	153,503	184,065	396	20,881	539,158	93,341	39 limited-interest refuges	47,304	
Average %		88%	2%	0.1%	2.7%	0.5%					

[†]Farmers Home Administration Lands.
 NWR=national wildlife refuge; WPA=waterfowl production area; NFH=national fish hatchery
 Source: USDA 2002; Service 2005.

Table 13. Demographics of the 23 counties within the planning area

County	Population (2003)	Persons per Square Mile	Population Change (2000–2003)	Median Age	Races (% of population)			
					Caucasian	Black	American Indian	Asian
Barnes	11,093	7.9	-5.9%	40.6	97.9	0.5	0.8	0.2
Benson	6,873	5.0	-1.2%	31.4	50.8	0.1	48.0	0
Bottineau	6,893	4.3	-4.6%	43.4	97.2	0.2	1.5	0.2
Burleigh	70,937	42.5	+3.3%	35.6	95.0	0.3	3.3	0.4
Dickey	5,554	5.1	-4.6%	40.7	97.8	0.1	0.3	0.5
Eddy	2,627	4.4	-5.8%	43.8	96.4	0.1	2.4	0.1
Emmons	4,087	2.9	-7.5%	44.5	99.1	0	0.1	0.2
Grand Forks	64,929	46.0	-2.1%	29.2	93.0	1.4	2.3	1.0
Grant	2,689	1.7	-6.2%	46.5	96.9	0	1.7	0.4
Griggs	2,599	3.9	-6.4%	45.8	99.3	0	0.2	0.1
Kidder	2,591	2.0	-6.4%	44.5	99.5	0.2	0.1	0.1
Lamoure	4,569	4.1	-4.0%	43.3	99.2	0	0.2	0.1
McHenry	5,739	3.2	-4.4%	43.0	98.7	0.1	0.4	0
McLean	9,014	4.4	-4.0%	44.1	92.5	0	5.9	0.1
Morton	25,181	13.1	-0.7%	37.4	95.8	0.2	2.4	0.3
Nelson	3,464	3.8	-7.0%	47.2	98.6	0.1	0.3	0.3
Pierce	4,525	4.6	-4.2%	42.9	98.5	0.1	0.7	0.3
Ramsey	11,746	10.2	-3.7%	39.5	92.3	0.2	5.4	0.3
Rolette	13,760	15.2	+0.4%	28.9	25.1	0.1	73.0	0.1
Sheridan	1,572	1.8	-9.9%	48.1	99.2	0.1	0.4	0
Stutsman	21,388	9.9	-3.0%	39.6	97.5	0.3	0.9	0.4
Towner	2,712	2.8	-7.3%	44.0	97.3	0.1	2.1	0.1
Walsh	11,891	9.7	-5.4%	40.9	94.9	0.3	1.0	0.2

Source: U.S. Bureau of Census 2000.

Table 14. Employment data for counties in the Program area

<i>County</i>	<i>Primary Industry</i>	<i>% Employment</i>	<i>Secondary Industry</i>	<i>% Employment</i>	<i>% Unemployment (2000)</i>	<i>Median Household Income (\$/year)</i>
Barnes	Human Services	27.4	Retail	11.9	2.9	31,166
Benson	Human Services	23.4	Agriculture	15.8	7.4	26,688
Bottineau	Human Services	23.8	Agriculture	16.1	2.7	29,853
Burleigh	Human Services	23.2	Retail	13.0	2.5	41,309
Dickey	Human Services	24.5	Agriculture	17.3	2.5	29,231
Eddy	Human Services	27.4	Agriculture	19.6	2.7	28,642
Emmons	Agriculture	28.0	Human Services	19.8	1.9	26,119
Grand Forks	Human Services	29.8	Retail	13.6	2.9	35,785
Grant	Agriculture	33.5	Human Services	20.1	1.3	23,165
Griggs	Human Services	20.4	Agriculture	16.0	1.9	29,572
Kidder	Agriculture	30.1	Human Services	21.7	2.7	25,389
Lamoure	Agriculture	23.3	Human Services	17.4	1.6	29,707
McHenry	Agriculture	20.5	Human Services	18.9	2.9	27,274
McLean	Human Services	21.5	Agriculture	16.7	3.2	32,337
Morton	Human Services	23.0	Retail	12.4	2.6	37,028
Nelson	Human Services	27.7	Agriculture	16.3	1.8	28,892
Pierce	Human Services	25.1	Agriculture	16.5	2.4	26,524
Ramsey	Human Services	25.9	Retail	15.9	4.5	35,600
Rolette	Human Services	34.7	Entertainment	9.8	8.2	26,232
Sheridan	Agriculture	35.0	Human Services	16.0	3.9	24,450
Stutsman	Human Services	26.8	Manufacturing	11.4	2.2	33,848
Towner	Entertainment	22.1	Agriculture	20.7	1.4	32,740
Walsh	Human Services	27.1	Agriculture	15.1	4.0	33,845

Source: U.S. Bureau of Census 2000.

Chapter 5. Environmental Consequences

5.1 Effects Common to all Alternatives

The following considerations apply to all future actions, regardless of the specific goals, objectives, and strategies that would be used to achieve the vision for the Program.

Landowner Rights

Landowners would always have the right to determine their level of participation, if any, in the activities and projects proposed outside the intent of the current flowage and/or refuge limited-interest refuge agreement (see section 2.3 for discussion).

Landowners would be provided information on available compensated programs for further protecting wildlife habitat, but no response would be required unless the landowner is willing to participate. For a discussion on fee-title actions, see the following information on the Service's land acquisition policy.

The Service would ensure that any activities associated with the Program would not adversely impact adjacent landowners including activities that would detract from the value of their property. Any landowners adjacent to lands owned or managed by the Service would retain all the rights, privileges, and responsibilities of private land ownership.

Service Land Acquisition Policy

The Service acquires lands and interests in lands consistent with legislation or other congressional guidelines and executive orders, for the conservation of fish and wildlife and to provide wildlife-dependent public use for education and recreational purposes. The Service policy is to acquire land only when other protective means, such as zoning and regulation, are not appropriate, available, or effective. When the Service acquires land, it acquires fee title (all property rights) only if lesser property interests (such as conservation easements, leases, or cooperative agreements) are not suitable to achieve resource objectives.

It is Service policy to acquire the minimum interest necessary to reach Program goals and objectives. Any Service acquisition of lands, regardless of the type (easement or fee-title purchase) would be from willing sellers only. Written offers to willing sellers would be based on a professional appraisal of the property using recent sales of comparable properties in the area. Landowners would in no way be coerced into selling their land or any interest in their land. The Service recognizes that every landowner within or adjacent to an existing or proposed national wildlife refuge has the right:

- to retain all privileges and responsibilities of private ownership;
- to sell their land to anyone of their choice;
- not to sell their land;
- to receive a fair market value for any property sought for purchase by the U.S. Fish and Wildlife Service;
- to control access to their land;
- to be heard and to provide input on management plans for neighboring refuge lands;
- to be informed on a regular basis about refuge management activities.

The Refuge Revenue Sharing Act of June 15, 1935, as amended, provides for annual payments to counties or the lowest unit of government that collects and distributes taxes based on acreage and value of national wildlife refuge lands located with the county. The monies for these payments come from two sources: (1) net receipts from the sale of products from national wildlife refuge appropriations; and (2) annual congressional appropriations, as authorized by the 1978 amendment, which were intended to make up the difference between the net receipts from the Refuge Revenue Sharing Fund and the total amount due to local units of government.

Maintenance of Roads and Existing Rights-of-Way

State, county, and townships would retain maintenance obligations for roads and associated rights-of-way under their jurisdiction within refuge boundaries. Existing rights-of-way and terms of other easements would continue to be honored. New rights-of-way and easements would be considered in relation to the existing refuge and/or flowage limited-interest refuge agreements, System regulations, landowner compliance, and likely impacts to wildlife resources.

Environmental Justice

Environmental justice refers to the principle that all citizens and communities are entitled to:

- equal protection from environmental occupational health or safety hazards;
- equal access to natural resources and;
- equal participation in the environmental and natural resource policy formulation process.

On February 11, 1994, President Clinton issued Executive Order (EO) 12898: “Federal Actions to Address Environmental Justice in Minority Populations and low Income Populations.” The purpose of this Order was to focus attention of federal agencies on human environmental health and to address inequities that may occur in the distribution of costs/benefits, land use patterns, hazardous material transport or facility siting, allocation and consumption of resources, access to information, planning, and decision making, etc.

The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people. The environmental justice strategy of the Service extends this mission by seeking to ensure that all segments of the human population have equal access to America’s fish and wildlife resources, as well as equal access to information that would enable them to participate meaningfully in activities and policy shaping.

Within the spirit and intent of EO 12898, no minority or low income populations would be impacted by any Service action under any alternative.

5.2 Summary of Effects by Alternative

The following section and table 15 provide an analysis of effects resulting from no action (alternative A) and the preferred alternative (alternative B).

Alternative A (No Action)

Existing Program management would be the focus of this alternative. As in the past, there would be no additional staff or funding provided to manage the limited-interest refuges. Any activities conducted on the refuges would continue to be incidental to other funded programs, or funding would be acquired through partnerships with conservation organizations. Hunting on the entire limited-interest refuge and any activities that occur on the water would be controlled by the Service.

There would be continual loss of upland habitats due to development. In particular, native prairie would be permanently lost as land uses change and areas become developed.

Those refuges which contain any high hazard dams would be repaired or replaced to ensure public safety. However, most other water management structures would continue to deteriorate due to lack of available funding. There would be a continued loss of wetland management of impoundments, reducing the production of desirable wetland habitats needed for international migratory bird use. Natural wetlands would remain unprotected, potentially reducing the availability of nutritional food sources and habitats needed for nesting and migratory birds and other wetland-dependent wildlife.

Current visitor services programs such as permit-only trapping, limited hunting and fishing, would continue if they remain compatible and resources are available to manage them. No additional public use activities would be pursued unless the Service was approached by a willing landowner. Additional uses would not be allowed unless it was determined to be compatible with the refuge purposes, and if funding is available to manage the use.

No refuges would be divested, further straining available resources for the Program.

Table 15. Summary of environmental consequences for management alternatives

<i>Issue</i>	<i>Alternative A (Current Management—No Action)</i>	<i>Alternative B (Enhance the North Dakota Limited- interest Program)</i>
Wetland Management	<p><i>Biodiversity:</i> Continued loss of biodiversity due to potential draining or siltation of wetlands.</p> <p><i>Water Level Management:</i> Continued loss of ability to manage impoundments according to modern practices.</p> <p><i>Siltation:</i> No program to actively work with farmers to reduce sedimentation. Wetlands would be lost as silt is deposited by runoff from surrounding agricultural uses.</p> <p><i>Waterfowl:</i> Dominant focus; lack of management and protection of wetlands and nesting habitat. No guarantee of upland cover for nesting and continued loss of wetlands and water level management capabilities due to dilapidating structures; minimal production.</p>	<p><i>Biodiversity:</i> Work with willing landowners to restore and enhance biodiversity through the protection of over 2,500 acres of natural wetlands.</p> <p><i>Water Level Management:</i> Properly manage impoundments for maximum production of waterfowl and other wetland-dependent birds.</p> <p><i>Siltation:</i> Restore upland vegetation and capture and reduce siltation, preserving wetlands.</p> <p><i>Waterfowl:</i> Dominant focus; increase ability to carry out proper water level management, protect natural wetlands, and provide quality nesting cover. Maximize success of nesting waterfowl and brood survival.</p>
Upland Management	<p><i>Biodiversity:</i> No concerted effort to compensate landowners for upland protections. Impact: Continued loss of biodiversity, in particular native prairie, due to upland development and intense farming practices.</p> <p><i>Grassland-dependent Species:</i> No habitat protection of upland vegetation. Little to no habitat available for nesting waterfowl or grassland-dependent birds; minimal production and recruitment.</p> <p><i>Native Prairie:</i> No concerted effort to compensate landowners for native prairie protection. Continued and permanent loss of “true” native prairie habitat.</p>	<p><i>Biodiversity:</i> Work with willing landowners to negotiate added compensations for restoring and enhancing biodiversity through upland habitat protection.</p> <p><i>Grassland-dependent Species:</i> Restore upland nesting bird habitat. Impact: Nesting success of waterfowl and grassland-dependent birds would increase ensuring greater success and survival.</p> <p><i>Native Prairie:</i> Give highest priority to native prairie habitat protection through compensated programs. Potential to protect over 14,000 acres of native prairie.</p>

Table 15. Summary of environmental consequences for management alternatives

<i>Issue</i>	<i>Alternative A (Current Management—No Action)</i>	<i>Alternative B (Enhance the North Dakota Limited- interest Program)</i>
Visitor Services	<p><i>Access:</i> Little to no access would be provided on these privately owned refuges. Few visitor services programs would be provided.</p> <p><i>Hunting:</i> No additional hunting would be permitted due to lack of resources; crop damage issues would not be addressed and this continued refuge status would continue to concentrate harvestable animal populations further damaging crops and costing landowners significant losses each year.</p> <p><i>Trapping:</i> Trapping would continue on a permit-only basis focusing on predator management for the protection of migratory birds.</p> <p><i>Nonconsumptive Uses:</i> No programs would be provided for wildlife viewing and photography, environmental education and interpretation. There would be a continued lack of understanding of the purposes of the Program along with a missed opportunity to further educate the public about the System.</p> <p><i>Natural Resources:</i> No monitoring of the impacts of public disturbance to wildlife.</p> <p><i>Fishing:</i> Additional fishing opportunities would not be actively pursued for the general public.</p>	<p><i>Access:</i> Negotiations with willing landowners to provide access for expanded public use activities and education of visitors about the Program and the System.</p> <p><i>Hunting:</i> Determine compatibility and willingness of landowners to provide access for hunting (except ducks and certain geese species). Crop damage issue addressed while providing increased hunting opportunities for the general public.</p> <p><i>Trapping:</i> Continuing the predator management program while ensuring trappers focus their future efforts on those refuges with habitat desired by nesting waterfowl and grassland birds will improve nesting success and production. The program will also address wildlife damage to water management structures and desirable habitats. Water level management will be enhanced and desirable habitat, such as riparian areas, will be protected. In addition, the trapping program will be reexamined when the International Association of Fish and Wildlife Agencies makes its recommendations for Best Management Practices. Their research and resulting recommendations will only improve this program.</p> <p><i>Nonconsumptive Uses:</i> Determine compatibility and willingness of landowners to provide access for wildlife viewing and photography, environmental education and interpretation, increasing public use while providing a widespread opportunity to educate the public about the Program and the System.</p> <p><i>Natural Resources:</i> Monitor wildlife responses to changes in public uses to determine and modify negative impacts.</p>
Partnerships	<p><i>Landowners:</i> Little to no contact with limited-interest refuge landowners. The Program will never reach its full potential.</p>	<p><i>Landowners:</i> At a minimum, landowners would be provided annual updates on the Program and any opportunities for them to receive compensation for added protections of upland and wetland habitats. Landowners would become true partners in the Program. This would result in a greater chance of success if these landowners are fully engaged. Habitat would be maintained or restored.</p>

Table 15. Summary of environmental consequences for management alternatives

<i>Issue</i>	<i>Alternative A (Current Management—No Action)</i>	<i>Alternative B (Enhance the North Dakota Limited- interest Program)</i>
	<i>Other Partners:</i> Partnerships would be developed incidental to needs and common interests. Loss of potential funds and services	<i>Other Partners:</i> Actively identify and coordinate with potential partners to achieve common goals that enhance and support the Program. Extend existing resources, including funding and knowledge.
Administration	Continued loss of biodiversity and ability to manage impoundments for wildlife.	Ability to partner with willing landowners to address management and maintenance issues and protection of natural resources for migratory birds and other wildlife.
Divestiture	Even though some have no potential to ever support the goals of the System, all refuges would be retained. Program resources would be further strained with little to no gain of wildlife habitat. Integrity of the System would be affected by retaining lands that do not support the goal of the System.	Six refuges would be divested based on loss of habitat and wildlife values due to development or the ability and willingness of the state to continue to manage limited-interest refuge lands as state Wildlife Management Areas. This would support the integrity of the System and ensure the best use of available resources.

Alternative B (Preferred Alternative)

Alternative B would emphasize taking a critical look at the needs and benefits of the limited-interest refuges. Relationships with landowners would be enhanced and programs would be available to willing landowners providing additional compensation and protection for those refuge lands identified as having the most critical habitats.

All refuge water management structures would be evaluated for needed repairs and replacements. Necessary work would be completed by local contractors and supplies would be acquired locally providing economic benefits to the local communities.



Several water management structures need repairs.

Mike Coos/USFWS

Managing stations would plan and initiate water level management programs on these impoundments to ensure maximum production of desirable aquatic plants and invertebrates utilized by nesting and migratory waterbirds, in particular, waterfowl. Maintaining water features on landowners' properties would maintain or increase land value due to the aesthetics and opportunities for wildlife-dependent recreation, such as fishing and birdwatching, a more reliable source of stockwater for livestock.

Landowners would be encouraged to use Best Management Practices (BMPs) for farming operations to reduce siltation and contamination of impoundments and natural wetlands. Managing stations would ensure landowners are provided the necessary BMP information provided by the U.S. Department of Agriculture.

Refuge staff would partner with willing landowners and the NDGF to evaluate many of the refuges for opportunities for public use. Affected landowners would need to provide access to the general public and the Service would monitor impacts to wildlife and landowners. Increased hunting, fishing, and other recreational opportunities would provide an economic benefit to the surrounding areas. Four seasonal law enforcement officers would be recruited for managing

and monitoring these new public uses, while ensuring visitor and landowner safety.

Six refuges would be divested ensuring the existing and added program resources are utilized on those refuges with potential to become national wildlife refuges in more than name only. Refuges with extensive loss of biodiversity that no longer meet their purpose or the goals of National Wildlife Refuge System and those that are currently owned and/or managed by the state (easements revoked), would be

divested. No wildlife habitat would be lost on those areas that would be managed by the NDGF. Recreational opportunities would continue or expand providing quality of life and economic benefits to the local communities. Some refuges would be divested giving all rights back to the landowners or a landowner designated managing interest excluding the water rights, which would be relinquished to the State. The Service would ensure that any water management structures meet federal and state safety standards prior to divestiture and transfer.