

U.S FISH & WILDLIFE SERVICE
HURON ISLANDS WILDERNESS
SENEY NATIONAL WILDLIFE REFUGE
REPORT ON WILDERNESS CHARACTER MONITORING



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INTRODUCTION

The Wilderness Act was signed into law on September 3, 1964 by President Johnson. The Act was Congress's response to the evidence that the wild spaces of the United States, which once seemed endless, were in jeopardy due to the industrialization. The purpose of the Wilderness Act was "to establish a National Wilderness Preservation System for the permanent good of the whole people and for other purposes". The Act further states that "...each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the area and shall so administer such area for such other purposes for which it may have been established and also to preserve its wilderness character." The Wilderness Act describes wilderness as having the following qualities:

Untrammeled

Wilderness is "...an area where the earth and its community of life are untrammeled by man..." "... generally appears to have been affected primarily by the forces of nature." – Wilderness Act of 1964

Wilderness is essentially unhindered and free from the actions of modern human control or manipulation.

Natural

Wilderness "...is protected and managed so as to preserve its natural conditions." – Wilderness Act of 1964

Wilderness ecological systems are substantially free from the effects of modern civilization.

Undeveloped

Wilderness is "...an area of undeveloped Federal land. Without permanent improvements or human habitation." and "...where man himself is a visitor who does not remain." – Wilderness Act of 1964

Wilderness retains its primeval character and influence, and is essentially without permanent improvement or modern occupation.

Solitude or Primitive and Unconfined Recreation

Wilderness "...has outstanding opportunities for solitude or primitive and unconfined recreation." – Wilderness Act of 1964

Other Features

Wilderness "...may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value." – Wilderness Act of 1964

Wilderness preserves other tangible features that are of scientific, scenic, or historical value.

From this descriptive language in the Wilderness Act of 1964, an interagency team developed a monitoring framework that incorporates monitoring and preservation of these wilderness qualities and is described in the Forest Service publication, *"Keeping It Wild"*: an interagency strategy to monitor trends in wilderness character across the National Wilderness Preservation System (Landres et al. 2008).

Wilderness Character Monitoring:

- Provides on-the-ground information to assess trends and make defensible decisions
- Provides regional and national information to evaluate policy effectiveness
- Communicates a positive and tangible vision for what wilderness is within the agency and with the public
- Allows managers to understand consequences of decisions and actions in wilderness
- Evaluates and documents effects of actions taken inside the wilderness and effects from threats outside the wilderness
- Provides solid information for planning
- Synthesized data into single, holistic assessment
- Provides legacy information that will endure over time when personnel change
- Guards against legal vulnerability

- Improves on-the-ground wilderness stewardship

This document describes a wilderness character monitoring program for the Huron Islands Wilderness Area and provides baseline data for future trend analysis. This report accompanies and explains the results of the Huron Islands Wilderness character baseline assessment that have been entered into the National Wilderness Character Monitoring Database.

Measures of wilderness character were created that are specifically relevant to the Huron Islands Wilderness. However, every indicator within the framework must be represented by at least one measure, whether it is pertinent to a particular wilderness or not. The purpose of this is to ensure a comprehensive and consistent representation of wilderness status throughout U.S. Fish and Wildlife Service National Wildlife Refuge System lands.

SETTING OF THE HURON ISLANDS WILDERNESS

Geographic Setting

Huron National Wildlife Refuge (NWR) is comprised of the Huron Islands in Lake Superior, is a satellite refuge of Seney NWR and is located approximately 125 highway miles west-northwest of Seney, Michigan. The Refuge is made up of 8 islands situated about 3 miles off the south shore of Lake Superior directly north of the Huron River inlet and about 17 miles east of Portage Entry on the Keweenaw Peninsula. The Huron Islands NWR consists of approximately 147 acres. Acreages for the four largest islands are shown in Table 1.

Table 1. Area of Huron Islands

Island	Acres
West Huron (Lighthouse)	40
East Huron	77
Cattle	12
Gull Rock	15
Unnamed Islands	3
Total Acres	147

The geography presents a unique challenge to management and operation of Huron NWR. The islands are remote and take a considerable amount of time and planning to access. Boat access is required and is dependent on weather, wave height, and requires local knowledge and advanced planning. Lighthouse Island is the only island with a dock, making it easier to access by boat than the other refuge islands.

General Island Geological and Ecological Background

Many ecological disturbances maintain the character of islands in the Upper Great Lakes, including fire, wind, insects and disease, hydrology, and the effects to vegetation by large flocks of nesting colonial waterbirds. Subsequent colonization of islands after major disturbances and successional change over time (including colonization by flora and fauna) spurred the Theory of Island Biogeography by MacArthur and Wilson (1967). Because of geographic isolation and the resulting impact this isolation has had on colonization by species and human use, many of the islands in the Upper Great Lakes have unique plant and animal communities. Not surprisingly, numerous studies have occurred on these islands to describe flora, fauna, and ecological patterns and processes. And to this day, the study and conservation of islands have multiple values for science and society as a whole. Islands of the Upper Great Lakes are, and have always been, dynamic ecosystems unto themselves.

Due to its inland location, northern latitude, and relatively high elevation, the Great Lakes islands refuges are characterized by a relative severe climate. Growing season ranges from 70 to 130 days, with spring freezes common. Extreme temperatures recorded range from -50°F to over 105°F. Snowfall is heavy, with up to 140 inches recorded annually in some localities. Average annual precipitation is relatively uniform across the area, between 28 inches and 32 inches.

Huron NWR consists of pink and gray granite outcroppings of Precambrian age. These islands are upthrusts left after the last Wisconsin Ice Age. Physiographically the islands are similar, varying chiefly in size and elevation. They portray an ecological sequence from the small, bare rock islands (on one end of the continuum) to the mostly forested East Huron (on the other end), covering 77 acres and rising to about 160 feet.

Flora: Four islands of Huron NWR are vegetated; the remaining islands are barren outcrops of granite. Vegetation surveys have documented 157 species of flora. The vegetated islands are generally characterized by shallowly rooted trees and exposed granite. Vegetation is a boreal transition type made up of balsam fir, white pine, red pine, white spruce, red maple, bigtooth aspen, and paper birch. Much of the balsam fir is decadent and contributes to a significant fuel loading on Huron Island. The understory contains cherry species, balsam fir regeneration, Canada yew, various woody shrubs, grasses, and forbs. There are a few areas on East Huron that contain small sphagnum bogs with an occasional black spruce. Only West Huron, East Huron, Cattle and Gull Rock Islands have substantial vegetation.

Fauna: According to evidence, with the exception of the birds on the island, the species on the island represent less than 20 percent of the species found on the adjacent mainland. Most mammals found on the islands probably arrived by crossing the ice during winter and the majority of amphibians and reptiles probably reached the islands by swimming. Amphibians are scarce due to a lack of suitable breeding areas on even the larger islands. Some common species found in the Huron Wilderness include: Eastern Red Bat (*Lasiurus borealis*), Snowshoe Hares (*Lepus americanus*), and the Double Crested Cormorant (*Phalacrocorax auritus*).

History of Establishing the Huron Islands Wilderness

West Huron Island, Huron's second largest island, has a long history of recorded use. During the 1860s, the Huron Islands were well known to those sailing the coastal waters, because they mark the turning point between Marquette and the Keweenaw Bay. After several shipwrecks, a lighthouse was built on the highest elevation of West Huron (Lighthouse Island) in 1868. The lighthouse was home to at least 10 different keepers and several additional assistant keepers during its time of human operation. The U.S. Coast Guard vacated the island in December 1972, thus ending the years of human occupation. Then on September 2, 1975, the Huron Lighthouse was entered in the National Register of Historic Places.

Theodore Roosevelt designated a portion of the Huron Islands as a bird refuge on October 10, 1905 making it the first National Wildlife Refuge in the Fish and Wildlife Service Midwest Region (Region 3). In 1938, Franklin Roosevelt signed an order to enlarge the refuge to include all of the islands in the Huron Island grouping. The Huron Islands were then designated as a Wilderness Area on October 23, 1970 under Public Law 91-504. In 1978, the majority of West Huron Island was transferred to the control of the Fish and Wildlife Service (FWS) and the remaining eleven acres and the lighthouse have been managed by the FWS since 1991.

Refuge Purposes

The purposes of the refuges come from executive orders Congress passed as it established each refuge. There are also specific purposes Congress designated for managing the National Wildlife Refuge System. This Wilderness Character Monitoring plan has been designed with consideration to the establishing legislation and purpose of each refuge.

Huron NWR was established for the following:

" . . . as a refuge and breeding ground for migratory birds and other wildlife . . . " Executive Order 7937 dated

August 2, 1938, President Franklin D. Roosevelt.

“...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. 715d (Migratory Bird Conservation Act).

“...so as to provide protection of these areas...and to ensure...the preservation of their wilderness character....” (Wilderness Act of 1964, Public Law 88-577).

The vision statement of Great lakes Island Refuges, as stated in the Great Lakes Islands Comprehensive conservation Plan (2012), is:

Management of Great Lakes islands refuges will reflect the mission of the National Wildlife Refuge System (NWRS, Refuge System) by conserving in perpetuity a rich mosaic of island habitats and enabling nesting and migrating birds and other wildlife of conservation concern in the Great Lakes to thrive here. The refuge islands will serve as a resilient source of evolving habitats and ecosystem processes even as structure and composition are altered due to climate change. With the help of our conservation partners, we will apply sound, scientific principles based on research, studies, and adaptive management strategies to: sustain the long-term health and integrity of Great Lakes habitats; expand community outreach and environmental education and interpretation programs; and motivate visitors to embrace stewardship of natural resources.

RESOURCES AND PROCESS

Documents Consulted

The following is a list of documents used to prepare this report. Information from these documents, along with interviews with refuge staff, was the main sources used to help identify measures and also supplied data for some of the measures.

Documents:

Gravel Island, Green Bay, Harbor Island, Huron Island, and Michigan Island DRAFT Comprehensive Conservation Plan. October 2012. U.S. Fish and Wildlife Service. Electronic PDF.

OGawa, L. (2000). *Huron islands lighthouse property interpretive resources compilation*. Informally published manuscript, Department of Health, Physical Education and Recreation, Northern Michigan University, Marquette, MI. Print.

Petrillo, H., & Corace, R. National Wildlife Refuge System, U.S. Fish and Wildlife Service. (2011). *Rapid ecological assessment of forests in the Laurentian mixed forest-great lakes coastal biological network, midwest region*. Print.

Wilderness Management Plan: Huron and Seney National Wildlife Refuges. U.S. Fish and Wildlife Service. 1978. Electronic PDF.

Wilderness Study Areas: Huron and Seney National Wildlife Refuges. U.S. Fish and Wildlife Service. Print.

Refuge Files:

Minimum Tool Analysis

Special Use Permits

Wilderness Character Monitoring Resources:

Landres et al. 2008. Keeping It Wild: An Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System. US Department of Agriculture, Forest Service: General Technical Report RMRS-GTR-212.

Landres et al. 2009. Technical Guide for Monitoring Selected Conditions Related to Wilderness Character. US Department of Agriculture, Forest Service: General Technical Report WO-80.

Websites:

National Oceanic and Atmospheric Administration (NOAA): National Climatic Data Center
<http://www.ncdc.noaa.gov/cdo-web/datasets/ANNUAL/stations/COOP:478905/detail>

U.S. Census Data
<http://quickfactcensus.gov>

Staff Consulted:

Seney NWR Staff

Mark Vaniman, Complex Manager

Greg McClellan, Deputy Complex Manager

Greg Corace, Forester and Acting Biologist

Process Used for Identifying Measures

Wilderness Character Monitoring requires the identification of quantifiable measures that reflect wilderness character. Changes in the values of these measures over time will be used as an index to evaluate trends in the four primary wilderness qualities: Untrammeled, Natural, Undeveloped, and Opportunities for Solitude and Primitive and Unconfined Recreation. The changes in the values of these measures are supposed to correlate with improvements or degradations to wilderness character.

Sadie O'Dell (Huron NWR) and Carlita Payne (2012 Wilderness Fellow) collaborated on potential measures for all of the Great Lakes Islands Wilderness Areas. Since most of the wilderness islands in the Great Lakes were similar, consistency among the measures that were being identified for most, if not all of the islands, was deemed a priority. Both Carlita and Sadie traveled to Seney NWR during the summer of 2012 to discuss potential wilderness character measures for multiple Great Lakes Wilderness Areas, including the Huron Islands. Individual meetings were held with Mark Vaniman (Refuge Manager), Greg McClellan (Deputy Complex Manager), and Greg Corace (Refuge Forester) to provide them with the essential background information on wilderness character monitoring and discuss potential measures for monitoring wilderness character.

After the initial meetings with Seney NWR staff, the list of potential Huron Wilderness measures was further critiqued and edited until a final collection was created. In November, Steve Zweber was brought on-board for the completion of the Huron Wilderness Character Monitoring Report. Along with resources from Carlita, who had begun work on the report, Steve met with Sadie to collaborate on a data sheets for all measures along with the prioritization of measures worksheet. These documents was sent to Mark Vaniman for completion in late November. Once the remaining information required for the report was collected from Seney staff, work was began on populating the Wilderness Character Monitoring database. The database was completed and uploaded to the Wilderness Fellows Sharepoint site along with this draft report for Huron Wilderness.

MEASURES USED

Untrammelled Quality

The Wilderness Act states that wilderness is “an area where the earth and its community of life are untrammelled by man,” and that “generally appears to have been affected primarily by the forces of nature.” This quality is degraded by modern human activities or actions that control or manipulate the components or processes of ecological systems inside the wilderness. This quality stresses freedom from modern human control or manipulation and is compromised when the wilderness is “manipulated” to sustain or improve another wilderness quality (such as the intentional act of removing an invasive species). Any human action that alters the wilderness is considered trammeling.

The purpose of monitoring the untrammelled quality is to track management decisions and actions rather than track the consequence. Under this quality, actions are recorded to assess trends. An “action” is defined as an act or series of acts that are purposefully taken to manipulate the biophysical environment. Keeping in mind, actions that manipulate the biophysical environment may be taken and degrade the untrammelled quality with the long-term desire to improve another quality. For example, the removal of mute swans from islands in the short-term degrades the untrammelled quality with the long-term goal of improving the natural quality. The effect of the action is accounted for under the natural quality.

Untrammelled Quality				
<i>Wilderness is essentially unhindered and free from modern human control or manipulation.</i>				
Monitoring Question	Indicator	Measure	Data Source	Freq (yr)
What are the trends in actions that control or manipulate the “earth and its community of life” inside wilderness?	Actions authorized by the Federal land manager that manipulate the biophysical environment.	1-1. Number of person-hours spent maintaining trails (Lighthouse Island only)	Refuge Manager, Biological staff	1
		1-2. Number of research, survey, and monitoring projects that manipulate vegetation, soils, and other factors of the abiotic community	Special Use Permits, Biological Staff, Refuge Management	1
		1-3. Number of person-hours spent treating invasive plant species	Forester	1
	Actions NOT authorized by the Federal land manager that manipulate the biophysical environment.	1-4. Number of known incidents of unauthorized actions that influence the biotic and/or abiotic community inside wilderness	Assistant Refuge Manager, Park Ranger, Forester	1

[Measure 1-1] Number of person-hours spent maintaining trails (Lighthouse Island only)

Context: Maintaining trails is one of the authorized manipulations occurring within wilderness that can easily be measured. The maintenance of trails is done in order to provide opportunities for wilderness users to access the Lighthouse Island Wilderness Area. The untrammeled quality is degraded if person-hours spent maintaining trails increases.

Description: Trail maintenance is performed by Refuge staff. Person-hours are calculated by multiplying the number of people and number of hours.

Relevance: Wilderness by definition is land that has been unaltered and remains in a natural state. This measure captures authorized large-scale or significant actions that manipulate the plants, as well as the larger biophysical environment, within wilderness.

Source: Refuge Manger, Biological staff

Data Adequacy: This data is highly adequate because hours are usually recorded and/or the Refuge staff has knowledge of the number of person-hours spent maintaining trails.

Determining Significant Change: Any increase in the number of person hours results in a decrease in the trend for this measure and a decrease in Wilderness Character.

2012 Data Value: 3 person-hours

Comments: Minimum tool analysis may apply to this measure.

[Measure 1-2] Number of research, survey, and monitoring projects that manipulate vegetation, soils, and other factors of the abiotic community on wilderness islands per year

Context: This measure focuses on agency and non-agency actions that represent larger scale manipulations of populations, communities, and disturbance processes rather than smaller scale, localized manipulations. The untrammeled quality is degraded if the number of authorized actions that manipulate the biophysical environment increases.

Description: This measure is a count of the number of research projects and studies that monitor vegetation, soils, and other factors of the abiotic community within wilderness.

Relevance: The Refuge Staff promotes applied research, surveys, and monitoring aimed at addressing ecosystem-, wildlife-, habitat-, and community-based concerns without compromising wildlife and wilderness values. Monitoring and research have many positive implications and often lead to improved management practices. However, some research projects might involve the installation of fencing, flagging, removing or disturbing soil and/or vegetation. The potential impacts can be directly correlated with the number of projects and therefore warrants monitoring.

Source: Special Use Permits, Biological Staff, Refuge Management

Data Adequacy: The quality of scientific data is collected with a high degree of confidence with regard to the number of research projects and studies within wilderness.

Determining Significant Change: Any increase in the number of actions within wilderness would be a significant enough impact to be interpreted as a change in the trend of wilderness character.

2012 Data Value: 0

[Measure 1-3] Number of person-hours spent treating invasive plant species

Context: Treating invasive plant species is one of the authorized manipulations occurring within wilderness that can easily be measured, as there is not a high presence of invasive plant species within the Wilderness Area at this time. The untrammeled quality is degraded if the number of person-hours treating invasive plant species increases. This measure will show a degrading trend due to a purposeful decision to minimize the impacts of invasive plant species on non-invasive native plant communities.

Description: This measure is a count of the number of treatment/removal of invasive plant species. These actions will be done by Refuge staff, which may include removal by hand-pulling, treating with herbicide, etc.

Relevance: This measure captures authorized large-scale or significant actions that manipulate the plants within wilderness.

Source: Forester

Data Adequacy: This data is highly adequate because the Refuge staff has knowledge of the number of and type of actions taken to manage invasive plant species.

Determining Significant Change: Any increase in the number of actions within wilderness would be a significant enough impact to be interpreted as a change in the trend of wilderness character.

2012 Data Value: 0

[Measure 1-4] Number of known incidents of unauthorized actions that influence the biotic and/or abiotic community inside wilderness

Context: Refuge staff is only aware of unauthorized actions occurring on Lighthouse Island Wilderness that could potentially influence the natural community of life. Although closed to the public, the composition and size of the remaining islands within the Huron Islands Wilderness present challenges to conducting unauthorized actions. Visits to the Wilderness are made approximately twice per year. This includes incidents and actions that are observed by staff or volunteers. Unauthorized or illegal actions can alter natural communities and trammel wilderness. The untrammelled quality is degraded if the number of unauthorized actions that manipulate the biophysical environment increases.

Description: This measure is a count of the number of unauthorized or illegal actions taken that manipulate plants, animals, water, soil, or fire inside wilderness. This measure includes all activities not authorized by the federal land manager that influence the natural environment of the wilderness. Examples of such actions are, but not limited to building camp fires, the introduction of mammalian predators, and seed, plant, or animal harvesting. Each separate action is counted and tallied annually. The sum of all islands is reported in the Wilderness Character Monitoring Database.

Relevance: When actions are permitted within wilderness, there is usually a meaningful purpose behind them (e.g., gaining knowledge and insight or accomplishing management goals). Unauthorized actions typically are indicative of harmful or reckless actions and have adverse effects on the biophysical environment, such as the intentional introduction of exotic species.

Source: Assistant Refuge Manager, Park Ranger, Forester

Data Adequacy: The quality of the data collected for this measure holds a moderate degree of confidence. The number of illegal and/or unauthorized activities occurring within wilderness is difficult to track; it is unrealistic to assume Refuge staff can be aware of all unauthorized actions taking place inside wilderness. An increase in monitoring/enforcement presence on the wilderness islands may result in a higher detection of unauthorized actions.

Determining Significant Change: Any increase in the number of actions within wilderness, results in a decrease in the trend for this measure and a decrease in wilderness character.

2012 Data Value: 0

Natural Quality

The Wilderness Act states that wilderness is “protected and managed so as to preserve its natural conditions.” This quality calls for the protection of native species communities and the structure and function of ecological systems within wilderness, and should be managed so they are substantially free from the effects of modern civilization.

While the untrammeled quality monitors the actions that manipulate or control wilderness ecological systems, the natural quality tracks the effects of these and other actions on the community of life in wilderness.

Natural Quality				
<i>Wilderness ecological systems are substantially free from the effects of modern civilization</i>				
Monitoring Question	Indicator	Measure	Data Source	Freq (yr)
What are the trends in terrestrial, aquatic, and atmospheric natural resources inside wilderness?	Plant and animal species and communities	2-1. Percent boreal transition land cover on wilderness islands	Forester	N/A
		2-2. Presence of whitetail deer (<i>Odocoileus virginianus</i>) on wilderness islands	Forester	1
		2-3. Index of the percent of wilderness acres that are occupied by invasive plant species	Forester	1
	Physical Resources	2-4, 2-5, 2-6, 2-7. Air quality	FWS NWRS Branch of Air Quality	5
What are the trends in terrestrial, aquatic, and atmospheric natural processes inside wilderness?	Biophysical Processes	2-8, 2-9, 2-10. Climate change measures	National Climactic Data Center	5

[Measure 2-1] Percent boreal transition land cover on wilderness islands

Context: The goal of the tracking the percent of boreal transition land cover on the Huron Islands is to increase understanding of existing conditions of the refuge forest and facilitate future monitoring and management.

Description: The percent of boreal transition land cover on wilderness islands will be monitored using the FWS Rapid Ecological Assessment of Forests in the Laurentian Mixed Forest-Great Lakes Coastal Biological Network Field Manual.

Relevance: This measure is relevant to the associated indicator because it tracks the transition in plant species and communities on the Huron Islands.

Source: Forester

Data Adequacy: Data will be recorded with a high degree of confidence using an established list of metrics that can be calculated based on field measurements.

Determining Significant Change: TBD

2012 Data Value: TBD

Notes: This measure will not be satisfied until next year, all data collection will begin in 2013.

[Measure 2-2] Presence of whitetail deer (*Odocoileus virginianus*) on wilderness islands

Context: Presence of whitetail deer on islands is often a concern for Refuge Managers. Islands are highly vulnerable and without proper monitoring, challenges such as over browsing by deer threaten important island habitat. Great Lakes islands such as Plum and Harbor Islands presently require additional management efforts due to their own deer populations. In order to maintain the fragile island ecosystem surveillance monitoring is conducted by the Refuge staff on all islands with the exception of the barren rock islands. There are currently no whitetail deer on the Huron Islands, the presence of whitetail deer would degrade the natural quality.

Description: This measure tracks the trend of white-tailed deer presence within wilderness. The number of animals counted is summed and reported in the Wilderness Character Monitoring Database annually.

Relevance: This measure is relevant to the indicator because it tracks trends in the abundance of selected wildlife species that are of concern.

Source: Forester

Data Adequacy: A simple record of the presence/absence of this species on each wilderness island makes for high confidence in the quality of the data.

Determining Significant Change: Any change in this data would be a significant enough impact to be interpreted as a change in trend of wilderness character.

2012 Data Value: 0

[Measure 2-3] Index of the percent of wilderness acreage that is occupied by invasive plant species

Context: At present, invasive plant, distribution in wilderness is very low. However, increases in non-native plants possess the ability to shift native flora composition if not carefully monitored and managed. This can often result in a loss of biodiversity, which can be detrimental to the entire wilderness ecosystem. If the percentage of wilderness containing non-native plant species increases, the natural quality will be degraded.

Description: Each wilderness island is scored by the estimated percent of wilderness acreage that is occupied by invasive plant species. Values are assigned according to the table below. Scores for each wilderness island are summed to generate a total score for the entire wilderness. This sum is reported in the Wilderness Character Monitoring Database.

Table 2. Index for scoring approx. invasive plant abundance

Estimated Percent of the wilderness which invasive plants are found	Score
None=0%	0
Very Low (or Spot) = <1%	1
Low = 1-5%	2
Moderate = 5-20%	3
High = 20-35%	4
Very High = 35-65%	5
Extreme = >65%	6

Relevance: This measure is relevant to the indicator because it monitors invasive plant species that affect the natural quality of wilderness.

Source: Forester

Data Adequacy: All wilderness islands were visited by refuge biologist to assess invasive exotic plant distribution. Since the percentage of the distribution of invasive plants on each wilderness island is estimated, confidence in the quality of the data is moderate within the coverage categories assigned for this measure.

Determining Significant Change: Any increase in the in the baseline value is a decrease in this indicator of the natural quality of wilderness character. A decrease in the in the baseline value is an increase in this indicator of the natural quality of wilderness character.

2012 Data Value: 1

[Measure 2-4, 2-5, 2-6, 2-7] Air quality

Context: Air quality, while largely beyond the control of refuge management, is an important aspect of wilderness character. Ozone and its precursor emissions (nitrogen oxides and volatile organic compounds) can travel long distances, resulting in elevated ozone levels in wilderness. The concentration of sulfur and nitrogen in rain and snow is a major contributor to acid deposition, adversely affecting algae, aquatic invertebrates, amphibians, fish, soil microorganisms, plants, and trees. A significant decrease in any air quality metric will indicate an improving trend in the natural quality.

Description: Air quality data is not monitored by the Huron Islands NWR staff; however, data is available from other agency monitoring programs and will be compiled on all Wilderness Areas by the National Wildlife Refuge System’s Natural Resource Program Center (Fort Collins, CO). This measure is made up of four air quality parameters (1) ozone air pollution, (2) total nitrogen wet deposition, (3) total sulfur wet deposition, and (4) visibility. The values are presented as a 5 year average. Wilderness areas where we do not have air quality monitors in close proximity, such as the case with the Huron Islands Wilderness, values have been interpolated between monitors. Conditions of the air quality related value are based on the following:

- Ozone:
 - < 60 ppb - Good
 - 61-75 - Moderate
 - > 76 - Significant Concern
- Visibility:
 - < 2 dV - Good
 - 2-8 - Moderate
 - > 8 - Significant Concern
- Total-N and S:
 - <1 kg/ha - Good
 - 1-3 - Moderate
 - > 3 - Significant Concern

Relevance: This measure is relevant to the indicator in that it addresses effects on a physical resource and contributes to an evaluation and understanding of the natural quality.

Source: FWS NWRS Branch of Air Quality

Data Adequacy: Air quality data collected by the FWS NWRS Branch of Air Quality is used to determine the quality of air for the Huron Islands Wilderness Area. Since most monitors are not in close proximity to the Huron Island Wilderness, values have been interpolated between monitors. Interpolated data have been assigned a medium confidence level.

Determining Significant Change: The baseline data are presented as 5-year averages for the years 2005-2009, which are the most recent years for which the Branch of Air Quality has complete datasets for all values. For those measures with a medium confidence, a trend for the natural quality is not assessed. However, we can still track whether the numerical value for the indicator is increasing or decreasing over the averaging periods. Any increase or decrease resulting in a change in the “condition” of the data value according to the scoring range will be considered significant.

2009 Data Value:

Table 3. Air quality data and related condition.

Air quality metric	2009 value	Condition
Ozone air pollution	68.6 ppb	Moderate
Total nitrogen wet deposition	4.6 kg/ha	Significant Concern
Total sulfur wet deposition	2.2 kg/ha	Moderate
Visibility	5.0 dV	Moderate

[Measure 2-8, 2-9, 2-10] Climate Change Measures

Context: Over the 20th century, the northern portion of the Midwest, including the Upper Great Lakes, has warmed by almost 4°F (2°C), while the southern portion, along the Ohio River valley, has cooled by about 1°F (0.5°C). During the 21st century, models project that temperatures will increase throughout the Midwest and at a greater rate than has been observed in the 20th century. Even over the northern portion of the region, where warming has been the largest, an accelerated warming trend is projected for the 21st century, with temperatures increasing by 5 to 10°F (3 to 6°C). The average minimum temperature is likely to increase as much as 1 to 2°F (0.5 to 1°C) more than the maximum temperature.

As water temperatures in lakes increase, major changes in Great Lakes ecosystems will very likely occur, such as a shift from cold-water fish species (e.g., trout) to warmer water species, (e.g., bass and catfish). Warmer water is also likely to create an environment more susceptible to invasions by non-native species. Changes in bird populations have already been linked to increasing temperatures and more changes are likely in the future.

Annual precipitation has increased, with many of the changes quite substantial, including as much as 10 to 20 percent increases over the 20th century. Much of the precipitation has resulted from an increased rise in the number of days with heavy and very heavy precipitation events. Precipitation is likely to continue its upward trend, at a slightly accelerated rate; 10 to 30 percent increases are projected across much of the region. Despite the increases in precipitation, increases in temperature and other meteorological factors are likely to lead to a substantial increase in evaporation, causing a soil moisture deficit, reduction in lake and river levels, and more drought-like conditions in much of the region.

Precipitation patterns are likely to have measureable impacts on Great Lakes Island ecosystems. Despite the projected increase in precipitation, increased evaporation due to higher summer air temperatures is likely to lead to reduced levels in the Great Lakes. In addition, the projected increase in very heavy precipitation events will likely lead to increased flash flooding and worsen agricultural and other non-point source pollution as more frequent heavy rains wash pollutants into rivers and the Great Lakes. This, coupled with warmer lake temperatures, is likely to stimulate the growth of algae, depleting the water of oxygen to the detriment of other living things.

Description: The Huron Islands Wilderness does not have Remote Area Weather Stations (RAWS) but, weather conditions for the wilderness islands are very similar to temperatures recorded at weather monitoring stations operated by the National Oceanic and Atmospheric Administration (NOAA) that are in close proximity to the wilderness islands. The weather data recorded at these weather-monitoring stations tracks the data pertinent for this measure. Each measure utilizes data recorded from NOAA weather stations: Hancock Houghton CO Airport, Ahmeek 1 SW, and Jacobsville. These measures are: mean summer temperature, mean winter temperature, and total annual precipitation. Summer was defined as the months of June, July, and August. Winter was defined as the months of December, January, and February. Mean summer and winter temperatures were calculated for each year. These seasonal means were then averaged over a five-year time interval. Since the year changes in the middle of the winter season, mean winter temperatures for any given year were calculated using data from December of the previous year and data from January and February of the target year. Total precipitation was calculated for each year and then these totals were averaged over a five-year time interval.

Relevance: Wilderness is set aside to preserve its natural conditions, but climate change has undeniable repercussions for natural system functioning. Attempting to monitor climate change and its widespread effects on wildlife is a national priority for many organizations, but there is no set protocol for how to do this in a cohesive manner. While the weather data measures described here are admittedly simplified proxies for representing climate change, they are an efficient means for Refuge staff to gather data directly linked to climate change and weather patterns.

Source: National Weather Service Station Annual Data Reports. Temperature values can be found using the following URL and searching for the corresponding weather monitoring station. <http://lwf.ncdc.noaa.gov/land-based-station-data/find-station>

Data Adequacy: Data are collected with a high degree of confidence from NOAA however; since the data is interpolated from the nearest weather station the Data Adequacy assigned is moderate.

Determining Significant Change: The baseline data is presented as a five-year average for the years 2007-2011. The mean annual temperature is likely to fluctuate by several degrees every monitoring period. A significant change value is not as important as tracking temperature values to see if the overall mean annual temperature is increasing or decreasing in the region.

2012 Data Value:

Table 4. Five-year means for winter temperatures, summer temperatures, and total precipitation for the Huron Islands Wilderness.

Unit	Winter	2007	2008	2009	2010	2011	5 Yr. Mean
Huron Wilderness	December (prv. yr.)	26.7	19.8	14.5	19.1	20.2	
	January	19.1	18.2	9.7	18.9	14	
	February	15	10.9	14.8	20.1	17.2	
Average Winter Mean Temp. for Huron Islands Wilderness		20.3	16.3	13.0	19.4	17.1	17.2
Unit	Summer	2007	2008	2009	2010	2011	5 Yr Mean
Huron Wilderness	June	61.9	58.9	56.8	na	56.4	
	July	66	63.8	59.9	68.4	68	
	August	64.2	64.2	61.6	68.1	65.3	
Average Summer Mean Temp. for Huron Islands Wilderness		64.0	62.3	59.4	68.3	63.2	63.5
		2007	2008	2009	2010	2011	5 Yr Mean
Total Precipitation for Huron Islands Wilderness		29.1	17.4	23.2	23.4	30.7	24.8

Undeveloped Quality

The Wilderness Act states that wilderness is “an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation,” “where man himself is a visitor who does not remain” and “with the imprint of man’s work substantially unnoticeable.” This quality is degraded by the presence of structures, installations, habitations, and by the use of motor vehicles, motorized equipment or mechanical transport that increases people’s ability to occupy or modify the environment.

Under this quality, non-recreational developments such as refuge boundary signs, area closed signs, concrete slabs, and markers and/or debris left over from past research studies.

Undeveloped Quality				
<i>Wilderness retains its primeval character and influence, and is essentially without permanent improvement or modern human occupation.</i>				
Monitoring Question	Indicator	Measure	Data Source	Freq (yr)
What are the trends in non-recreational development and mechanization inside wilderness?	Non-recreational installations, structures, developments	3-1. Count of non-recreational structures, installations, and developments	Refuge Manager, Forester, Park Ranger	5
	Inholdings	3-2. Acres of inholdings	Refuge staff	10
What are the trends in mechanization inside wilderness?	Use of motorized vehicles, motorized equipment, or mechanical transport	3-3. Index of administrative mechanical transport, motorized equipment, and motor vehicle use on wilderness islands	Refuge Biologist, Refuge Manager	1

[Measure 3-1]: Count of non-recreational structures, installations, and developments

Context: Few developments exist in the Huron Islands Wilderness, aside from Lighthouse Island, and it is likely that no new developments will be added. However, any research authorized on the islands brings the potential for new installations or structures. This measure currently accounts for Lighthouse Island developments such as the boat dock, lighthouse, and other historic buildings. Any additions to the current number of non-recreational structures will degrade the undeveloped quality of the wilderness.

Description: Each development in wilderness is counted. The development type and location is noted, but only a count of developments is reported in the Wilderness Character Monitoring Database.

Relevance: This measure is relevant to the indicator because it directly tracks all development on the wilderness islands.

Source: Refuge Manager, Forester, Park Ranger

Data Adequacy: All wilderness islands were visited to assess for structure presence. A simple count of these structures makes for high confidence in the quality of the data.

Determining Significant Change: Any additional development in wilderness would be a significant enough impact to be interpreted as a change in the trend of wilderness character.

2012 Data Value: 8

Note: Data will be reevaluated every five years, but it is unlikely that data will ever change. Therefore, this measure will likely always report a stable trend.

[Measure 3-2]: Acres of inholdings

Context: There are no private or public inholdings within the Huron Islands Wilderness. This is unlikely to change given that the entire wilderness is under the control of the federal government and protected under the Wilderness Act of 1964. This measure is included to fulfill the national reporting guidelines.

Description: Inholdings are private or other federal or state agency lands entirely within the wilderness boundary. This measure is a sum of the total area (in acres) of any inholding(s) located within wilderness. In general, the undeveloped quality would be degraded if the acreage of inholdings increases.

Relevance: This measure is relevant to the indicator because it tracks the trends in private properties immediately within the wilderness.

Source: Refuge staff

Data Adequacy: Data adequacy is high since these properties are documented. All relevant refuge records were considered.

Determining Significant change: There were zero acres of inholdings in 2012. This is the baseline recording for the wilderness monitoring plan. Any change in this data would be significant enough impact to be interpreted as a change in trend of wilderness character.

2012 Data Value: 0

[Measure 3-3] Index of administrative mechanical transport, motorized equipment, and motor vehicle use on wilderness islands

Context: The Wilderness Act discusses three forms of mechanization that degrades wilderness character: motor vehicles (aircraft and motorboats are included here), motorized equipment, and mechanical transport. Agency policies restrict the use of motorized equipment and mechanical transport, requiring authorization for such uses when deemed necessary. Motorized boats are used to access Huron Islands Wilderness, and with the exception of Lighthouse Island, they do not technically enter the wilderness, which starts at the mean high water mark. Mechanical transport or motorized equipment have rarely been used in the Huron Islands Wilderness except when such equipment was deemed the minimal tool necessary to accomplish refuge goals and to protect the wilderness resource. For example, using a battery powered drill to install refuge boundary signs in bedrock.

Description: This single measure tracks the status and trends of all motorized and mechanized use authorized by the refuge staff in the wilderness. Not all equipment types have the same level of impact level associated with them. To account for these differences, an inherent weighting system has been assigned to each equipment type based on its perceived impact to social and biophysical resources, as shown in the table below. A “low” level of impact is a mechanical use that causes a small impact to the social environment and little or no impact to the biophysical environment (i.e., hand-held motorized equipment, battery power tool, or wheelbarrow). A “moderate” level of impact is a mechanized use that causes a large impact to the social environment (i.e., chainsaw, generator). A “high” level of impact is a mechanized use that causes a large impact to the social environment and biophysical environment (i.e., helicopter). A total use level value will be calculated for each motorized/mechanized use by multiplying the inherent weight of each type of equipment by the amount of actual use, as shown in the table below. The resulting products for each motorized/mechanized use are summed to generate a total score for the entire wilderness. This sum is reported to the Wilderness Character Monitoring Database.

Table 5. Index of administrative mechanical transport and motorized equipment in wilderness

Equipment Type	Inherent Weight	Amount of Use	Use Weight
Battery-powered tool	1	One piece, 1 day	1
Wheelbarrow	1	Multiple pieces, 1 day	2
Chain saw	2	One piece, multiple days	2
Generator	2	Multiple pieces, multiple days	3

Definitions

Mechanical Transport: Any contrivance for moving people or material in or over land, water, or air, having moving parts that provides a mechanical advantage to the user, and that is powered by a living or non-

motorized power source. This includes, but is not limited to, hang gliders, parachutes, bicycles, game carriers, carts, and wagons. It does not include wheelchairs when used as a necessary medical appliance. It also does not include rafts, kayaks, canoes, or similar primitive devices without moving parts.

Motorized Equipment: Machines that are not used for transportation, but powered by a motor, engine, or other nonliving power source. This includes, but is not limited to, such machines as chain saws and generators. It does not include small battery or gas powered hand-carried devices such as shavers, wristwatches, flashlights, cameras, stoves, or other similar small equipment.

Motor vehicles: Machines used to transport people or material across or over land, water, or air, and which are powered by the use of a motor, engine, or other nonliving power source. This includes, but is not limited to ATVs, motor boats, and aircraft that either land or drop-off or pick-up people or material (i.e., not aircraft that merely fly over the wilderness).

Relevance: This measure is relevant because it tracks the actual use of motor vehicles, motorized equipment, or mechanical transport within wilderness.

Source: Refuge Biologist, Refuge Manager

Data Adequacy: The quality of the data was collected with a moderate to high degree of confidence. For 2012, data came from interviews with refuge staff. Data sheets for accurate recording of administrative mechanical and motorized uses have been developed and will be utilized for future record keeping; stored in the Wilderness folder on the shared drive (S:\). This data will be reported in the Wilderness Monitoring Database annually.

Determining Significant Change: It should be noted that the specific weights are subjectively determined. Best professional judgment was used when assigning weights. An increase in the baseline value degrades the undeveloped quality -- any change is a significant change since the Wilderness Act prohibits the use of motorized equipment, and mechanical transport.

2012 Data Value:

Table 6. 2012 baseline data – Huron Islands Wilderness

Equipment Type	Inherent Weight	Amount of Use	Use Weight	Total Weight (Inherent x Use)	Comments
Battery Powered	1	1 X 1	1	1	Repair board – next to wilderness

Solitude or Primitive and Unconfined Recreation Quality

The Wilderness Act states that, wilderness has “outstanding opportunities for solitude or a primitive and unconfined type of recreation.” This quality is about the opportunity for visitors to experience wilderness; it is not directly about visitor experience per se. Factors that reduce these opportunities, and therefore degrade this quality, include visitor encounters, signs of modern civilization, recreation facilities, and management restrictions on visitor behavior.

Recreation-focused developments such as trails, campsites, shelters, or toilets are included under the solitude or primitive and unconfined recreation quality because of the strong connection to recreational experiences. The distinction between non-recreational and recreation physical development is made to avoid double-counting recreational developments under both qualities.

Solitude or Primitive and Unconfined Recreation Quality				
<i>Wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation.</i>				
Monitoring Question	Indicator	Measure	Data Source	Freq (yr)
What are the trends in outstanding opportunities for solitude inside wilderness?	Remoteness from sights and sounds of people inside the wilderness	4-1. Amount of visitor use	Park Ranger, Refuge Manager	
	Remoteness from occupied and modified areas outside of the wilderness	4-2. Number of potential adult wilderness users residing in the service area	U.S. Census Data	
	Facilities that decrease self-reliant recreation	4-3. Miles of agency-provided trails	Refuge Manager	
		4-4. Number of agency-provided recreation facilities	Refuge Manager, CCP	
	Management restrictions on visitor behavior	4-5. Index of restrictions on visitor behavior	Refuge Manager, CCP	

[Measure 4-1] Amount of visitor use

Context: Visitor use in the Huron Wilderness is confined to Lighthouse Island, the only island in the archipelago open to the public and has a dock available for visitor use. Visitor use is only permitted during daylight hours and usually occurs from March-November. It is presumed that a majority of the visitors are visiting the island because of the lighthouse and old USCG station. The Service currently estimates that Lighthouse Island receives one hundred visitors per year on average. A Visitor Use Plan is necessary to determine the appropriate interpretive infrastructure needed, the appropriate level of visitation that the island can support, and to build the infrastructure to support that use. An increase in the amount of visitor use beyond island capacity, once this amount is established, will result in a degrading trend in opportunity for solitude or primitive and unconfined recreation.

Description: Although actual uses usage of the island is unknown, an estimate was made by refuge staff for the 2012 baseline value. The Boathouse building currently contains a tablet for visitor sign-in, however this most likely does not account for all visitors. Due to all remaining islands being closed to the public, visitor use is recorded In Special Use Permits.

Relevance: This measure is relevant to the indicator because it tracks the amount of visitor use and therefore the amount of actual or potential recreation use that diminishes opportunities for solitude.

Source: Refuge Manager, Park Ranger

Data Adequacy: The quality of the data was collected with a low to moderate degree of confidence.

Determining Significant change: Significant change cannot be determined until a visitor Use Plan is established.
2012 Data Value: 75

[Measure 4-2] Number of potential adult wilderness users residing in the service area

Context: This measure aims to account for potential wilderness users residing in nearby cities and towns. The Huron Islands are secluded given their location of 3 miles off shore; making adjacent property a non-issue. However, if population density increases in nearby areas, visitor activity has the potential to increase. A large increase in population near the Huron Islands will result in the solitude or primitive and unconfined recreation quality being degraded.

Description: The service area is defined as the four neighboring counties to the wilderness area. These counties include Marquette, Baraga, Houghton, and Keweenaw. Total population according to latest U.S census data for the four counties was totaled and reported in the Wilderness Character Monitoring database.

Relevance: This measure aims to capture the potential influence of occupied and modified areas outside wilderness based on the population density.

Source: <http://quickfactcensus.gov>; Info found at pg. 196 of Forest Service Tech Guide

Data Adequacy: Data adequacy is high for this measure.

Determining Significant change: A 5% or more increase or decrease will be considered significant.

2011 Data Value: 115, 313

[Measure 4-3]: Miles of agency-provided trails

Context: This measure is explicit to the Lighthouse Island and accounts for the concrete pathways that were constructed before wilderness designation. Agency-provided trails degrade opportunities for primitive and unconfined recreations. A decrease in the length of trail would indicate an improvement in the solitude or primitive and unconfined recreation quality for the Huron Wilderness. Seney NWR staff currently maintains trails so it is likely that this measure will be reported as a stable trend.

Description: All concrete trails are located on Lighthouse Island and are remnants of when lighthouse attendants and their assistants lived on the island. This measure accounts for the total length of these trails, which are unlikely to change in the near future.

Relevance: This measure is relevant to the indicator because it tracks changes in an agency-provided facility that decreases self-reliant recreation.

Source: Refuge Manager

Data Adequacy: The quality of the data was collected with a high degree of confidence using geographic information systems technology.

Determining Significant change: Any change in the length of agency-provided trails will be considered significant.

2012 Data Value: 0.6

[Measure 4-4]: Number of agency-provided recreational facilities

Context: The data value produced by this measure serves to quantify the presence of recreational facilities within the wilderness. The Huron Islands Wilderness currently has few recreational facilities within it, and therefore makes an ideal contribution to the quality of solitude or primitive and unconfined recreation. The only island that contains recreational facilities is Lighthouse Island.

Description: This measure is a simple count of all recreational facilities on the Huron Islands, not including the concrete pathways on Lighthouse Island. Examples of agency-provided recreational facilities include boat docks and interpretive signs.

Relevance: This measure is relevant to the associated indicator, monitoring question, and quality in that it addresses facilities that decrease self-reliant recreation, and contributes to an evaluation and understanding of the solitude or primitive and unconfined recreation quality of wilderness.

Source: Refuge Manager, CCP

Data Adequacy: The quality of the data was collected with a high degree of confidence, given the size of the Huron Islands it is easy to account for all recreational facilities.

Determining Significant change: Any change in the number of recreational facilities will be considered a significant change.

2012 Data Value: 2

[Measure 4-5] Index of management restrictions on visitor behavior

Context: Based on the Wilderness Act of 1964, and reinforced through the operational definitions proposed by this monitoring program, outlets for primitive and unconfined recreation represent a major contributing quality to the overall character of wilderness. Management of wilderness includes the creation and enforcement of visitor use/behavior restrictions, which ultimately affect the quality of a visitor’s recreational experience. This measure indicates the scope of management restrictions for the Huron Island Wilderness that function beyond the limitations determined for all wilderness areas by the Wilderness Act. An increase in the management restrictions index indicates an improving trend for the solitude and unconfined recreation quality.

Description: Table 7, sourced from the Forest Service’s Technical Guide for Monitoring Selected Conditions Related to Wilderness Character, contains a list of management restrictions placed on visitor behavior, as well as scores assigned based on the degree of restriction, and the significance of their impact on opportunities for primitive and unconfined recreation. When scoring the restrictions of a given wilderness, a geographical weight is also applied: 1 = restriction applies only to a portion of the wilderness; 2 = restriction applies throughout entire wilderness. Based on the stipulations of management policy within a given monitoring period, the wilderness will be scored, and the total score will serve as the data value. Table7 illustrates this scoring process for the Huron Islands Wilderness based on management restrictions in place at the time of this report. An increase in the management restrictions index indicates an improving trend for the solitude and unconfined recreation quality.

Relevance: This measure is relevant to the associated indicator in that it addresses management restrictions on visitor behavior, which contributes to enhanced solitude, and contributes to an evaluation and understanding of the solitude or primitive and unconfined quality of wilderness.

Source: Refuge Manager, CCP

Data Adequacy: Data adequacy is high since all management restrictions on the Huron Islands NWR are listed in the CCP and have been confirmed by refuge staff.

Determining Significant Change: Any change in the number and/or weight of specific management restrictions on any of the Huron Islands will be considered significant.

2012 Data Value:

Table 7. Index of management restrictions for the Huron Islands Wilderness

Category	Type of Restriction	Score	Geographic Weight (1= subarea, 2= entire wilderness)	Index Score
Small game hunting during state season	No restrictions	0		
	Permitted but restricted	1		
	Not permitted	2	2	4
Fishing	No restriction	0		
	Permitted but restricted	1		
	Prohibited	2	2	4
Fees	No fees	0	0	0
	Fees charged of selected user type	1		
	Fees charged of all visitors	2		
Permits for general use	No permit or registration	0	-	0
	Voluntary self-registration	1		
	Mandatory; non-limiting registration	2		
	Mandatory; use limited	3		
Human waste	No regulation	0		

	Pack out required	1	1	1
Length of stay	No restrictions	0		
	Length of stay limited	1	1	1
Group size limit	No restrictions	0	-	0
	Group size limits in place	1		
Horseback riding/domesticated animals	No restrictions	0		
	Permitted but restricted	1		
	Prohibited	2	2	4
Camping	No restrictions	0		
	Permit required	1		
	Prohibited	2	2	4

Total Score = 18

Other Features Quality

The Wilderness Act states that, wilderness “...may also contain ecological, geological, or other features of scientific, education, scenic, or historical value.” This quality is the indicators and measures of other features which must be identified separately for each wilderness, and do not readily fit within one of the other qualities. Wilderness preserves other features that are of scientific, educational, scenic, or historical value. Factors that degrade this quality include vandalism, and unauthorized removal of geological, paleontological or cultural resources.

Other Features Quality				
<i>Wilderness “...may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.”</i>				
Monitoring Question	Indicator	Measure	Data Source	Freq (yr)
What are the trends in loss of geological and cultural resources?	Loss of statutorily protected cultural resources	5-1. Index of disturbances to cultural resources (Lighthouse Island only)	Refuge Staff	1
	Loss of paleontological or geological resources	5-2. Number of unauthorized removals of paleontological or geological resources	Refuge Staff	1

[Measure 5-1] Index of disturbances to cultural resources (Lighthouse Island only)

Context: On September 2, 1975 the Huron Islands Lighthouse was entered in the National Register of Historic Places, which requires that the property be managed in a specific way for the preservation of this historic site. Lighthouse Island is home to the historic lighthouse and is the only island that allows visitors. Although visitor use is relatively light, the lighthouse and many of the other structures on Lighthouse Island have been subject to vandalism. The lighthouse has also been damage by water and severe weather, rendering it in need of restoration. In September 2000, The Huron Lighthouse Preservation Association took over responsibilities for the buildings maintenance. Any increase in the amount and severity of disturbances to the cultural resources on Lighthouse Island would degrade the other features quality.

Definition: This measure is a count of the number of disturbances to statutorily protected cultural resources inside wilderness. Disturbances may include vandalism, construction, damage from wildlife, etc. Disturbances are weighted on the level of severity and a total value is reported for assessing a trend in the wilderness character.

Relevance: Recording the number of disturbances to cultural resources is directly linked to the indicator “Loss of statutorily protected cultural resources”. Many wilderness areas across the U.S. hold statutorily protected

cultural resources. These cultural resources may be protected by law or agency policy. While cultural resources are often manmade structures, they are irreplaceable relics of a time when human history was intertwined with nature. They reflect the primeval character of wilderness and have often been in place for hundreds of years. They are a crucial part of human history and the wilderness' history as well. It is therefore important to monitor the degradation or disturbance of these resources, which may be caused by authorized, unauthorized, or natural means.

Source: Refuge staff

Data Adequacy: Data adequacy is high, although visitation by refuge staff is infrequent. Vandalism and overall disturbances to buildings on Lighthouse Island is easily monitored.

Determining Significant Change: Any change in this measure will be considered significant.

2012 Data Value:

Table 8. 2012 index of disturbances to cultural resources

Disturbance	Number of resources disturbed	Severity (low = 1, high = 3)	Total	Comments
Minor vandalism	2	1	3	Windows damaged to gain access to lighthouse and barracks, lighthouse window covered in 2012

[Measure 5-2] Number of unauthorized removals of paleontological or geological resources

Context: This is not a concern for the Huron Islands Wilderness, as there are no known paleontological or geological resources within the wilderness. It is included to fulfill the national reporting guidelines.

Definition: This measure will be a count of the known removals of paleontological or geological resources.

Relevance: This measure is relevant to the indicator because it accounts for losses of paleontological or geological resources, and contributes to an evaluation and understanding of the other features quality of wilderness.

Source: Refuge staff

Data Adequacy: Data adequacy for this measure is moderate and likely to remain that way unless a stronger presence of monitoring/enforcement is performed on the Huron Islands.

Determining Significant Change: Any change in this measure will be considered significant.

2012 Data Value: TBD

Notes: This measure was not entered into the Wilderness Character Monitoring database due to the unavailability of a proper category for entry. It has been included to satisfy the indicator and will eventually be added to the database when the next application version is released.

DROPPED MEASURES

Table 9. Dropped measures and reasons for rejection.

UNTRAMMELED QUALITY		
INDICATOR	MEASURE	REASON NOT USED
Authorized actions that manipulate biophysical environment	Number of actions to manage fire	Data not available; not feasible for Refuge to monitor (staff & Island visit constraints).
NATURAL QUALITY		
INDICATOR	MEASURE	REASON NOT USED
Plant and animal species and communities	Population dynamics of selected native species	Data not available; low relevance to assessing wilderness character.
	Extirpated native species	Data not available; low relevance to assessing wilderness character.
Physical Processes	Presence and amount of contaminants	Data not available; not feasible for Refuge to monitor.
Biophysical Processes	Pathways for invasives	Data not available; low relevance to assessing wilderness character (all Islands except Lighthouse Island); not feasible for Refuge to monitor on Lighthouse Island (staff & Island visit constraints).
UNDEVELOPED QUALITY		
INDICATOR	MEASURE	REASON NOT USED
Use of motor vehicles, motorized equipment, or mechanical transport	Guide and private (non-commercial and non-administrative) aircraft and helicopter landings	Data not available; low relevance to assessing wilderness character.
SOLITUDE or PRIMITIVE and UNCONFINED RECREATION QUALITY		
INDICATOR	MEASURE	REASON NOT USED
Remoteness from sights and sounds of people inside the wilderness	Number of wilderness acres where man-made structures are visible	Data not available; low relevance to assessing wilderness character (all Islands except Lighthouse Island); not feasible for Refuge to monitor on Lighthouse Island (staff & Island visit constraints).
	Night sky light pollution	Data not available; not feasible for the Refuge to monitor. (all Islands are closed to the public except Lighthouse Island; public visits to Lighthouse Island is restricted to daylight hours only).
Remoteness from occupied and modified areas outside the wilderness	Index of the degree of accumulated trash and debris on the wilderness island	Data not available; low relevance to assessing wilderness character (all Islands except Lighthouse Island); not feasible for Refuge to monitor on Lighthouse Island (staff & Island visit constraints).
OTHER FEATURES		
INDICATOR	MEASURE	REASON NOT USED
Loss of statutorily protected cultural resources	Number of unauthorized removals of cultural resources	This measure was not used because there are no protected cultural resources within the wilderness boundary.

CONCLUSIONS

The Huron Islands Wilderness is a unique unit in the National Wilderness Preservation System with an interesting past. The history of the islands as a landmark for sailors, particularly West Huron, is an attraction for visitors and the very reason the island is accessible for the public. This island is in need of the greatest monitoring effort, which is why measure exclusive to West Huron Island were created for this report. Aside from West Huron, the islands remain much as they were when first placed under protective status, except for natural ecological changes over time.

The wilderness character monitoring described in this report has taken into account many of the issues unique to the Huron Islands Wilderness. The plan responds to all nationally required wilderness character indicators, while taking care to include only measures that are actually relevant within the unique set of conditions at the Michigan Islands Wilderness. Additionally, these selected measures have been identified as priorities and feasible for Refuge staff to monitor over time.

The Huron Islands Wilderness requires relatively few management actions. However, if the resources were available, higher enforcement of management restrictions would most likely have a positive influence on the wilderness character. Seven out of the eight islands will remain closed to public visitation to protect the sensitive nature of the islands and bird species utilizing the islands as nesting sites. In most cases, the refuge is collecting data for research and observation rather than direct management. I suspect that the quality of the Huron Islands Wilderness will not degrade significantly in the immediate or near distant future. It is more likely that the implementation of the wilderness character monitoring plan will result in improved wilderness stewardship and improvement of wilderness character.

APPENDIX A: PRIORITY RANKING OF MEASURES

In each row, write the potential measure in the left column under the appropriate indicator. Add or delete rows as needed. Use the criteria and ranking guide below to create an overall score for each measure. If the combined score for criteria A and B is ≤ 2 , STOP and do not score criteria C and D. Those measures with the highest overall scores should be the highest priority for assessing trends in wilderness character.

A. Level of significance (the measure is highly relevant to the quality and indicator of wilderness character, and is highly useful for managing the wilderness):

High = 3 points, Medium = 2 points, Low = 1 point

B. Level of vulnerability (measures an attribute of wilderness character that currently is at risk, or might likely be at risk over 10-15 years): High = 3 points, Medium = 2 points, Low = 1 point

High = 3 points, Medium = 2 points, Low = 1 point

C. Degree of reliability (the measure can be monitored accurately with a high degree of confidence, and would yield the same result if measured by different people at different times):

High = 3 points, Medium = 2 points, Low = 1 point

D. Degree of feasibility (the measure is related to an existing effort or could be monitored without significant additional effort):

High = 1 point, Low = 0 point (if 0 is given, do not use)

POTENTIAL MEASURE	Criteria for Prioritizing Potential Measures				OVERALL SCORE
	A. Significance	B. Vulnerability	C. Reliability	D. Feasibility	
UNTRAMMELED QUALITY					
Indicator: Authorized actions that manipulate the biophysical environment Measure: Number of person hours spent maintaining trails	1	2	3	1	7
Indicator: Authorized actions that manipulate the biophysical environment Measure: Number of person hours treating non-native plant species	2	1	2	1	6
Indicator: Authorized actions that manipulate the biophysical environment Measure: Number of research, survey, and monitoring projects (agency and non-agency included) that manipulate vegetation, soils, and other factors of the abiotic community on wilderness islands	3	2	1	1	7
Indicator: Unauthorized actions that manipulate the biophysical environment Measure: Number of known incidents of unauthorized actions that influence the biological and/or abiotic community on wilderness islands	1	3	1	1	6
NATURAL QUALITY					

Indicator: Plant and animal species and communities Measure: Percent of boreal transition land cover type on wilderness islands	n/a	n/a	n/a	n/a	n/a
Indicator: Plant and animal species and communities Measure: Percentage of wilderness acreage occupied by invasive exotic plant species	1	2	1	1	5
Indicator: Plant and animal species and communities Measure: Presence or absence of white-tailed deer	1	2	1	1	5
Indicator: Physical resources Measure: Air quality measures	2	1	2	1	6
Indicator: Biophysical processes Measure: Climate change measures	2	1	2	1	6
UNDEVELOPED QUALITY					
Indicator: Non-recreational structures, installations, or developments Measure: Count of non-recreational structures, installations, and developments (<i>Lighthouse, accessory buildings, power poles, bridges, refuge entrance sign</i>)	1	2	3	1	7
Indicator: Inholdings Measure: Acres of inholdings within wilderness	3	1	3	1	8
Indicator: Use of motor vehicles, motorized equipment, or mechanical transport Measure: Index of administrative mechanical transport and motorized equipment use in wilderness	2	1	3	1	7
SOLITUDE OR PRIMITIVE AND UNCONFINED RECREATION QUALITY					
Indicator: Remoteness from sights and sounds of people inside the wilderness Measure: Number of visitors to wilderness islands, including staff, permitted volunteers to maintain lighthouse	2	2	1	1	6
Indicator: Remoteness from occupied and modified areas outside the wilderness Measure: Number of potential adult wilderness users residing in the service area	1	2	1	1	5
Indicator: Facilities that decrease self-reliant recreation Measure: Miles of agency provided trails	3	2	1	1	7
Indicator: Facilities that decrease self-reliant recreation Measure: Number of agency provided recreation facilities (dock, interpretive signs, and everything other than trails)	3	2	3	1	9

Indicator: Management restrictions on visitor behavior Measure: Index of restrictions on visitor behavior	3	2	1	1	6
Other Features Quality (if applicable)					
Indicator: Loss of statutorily protected cultural resources Measure: Number and severity of disturbances to cultural resources	1	2	3	1	7
Indicator: Loss of paleontological or geological resources Measure: Number of unauthorized removals paleontological or geological resources	1	2	3	1	7

APPENDIX B: SUMMARY OF EFFORT REQUIRED FOR WILDERNESS CHARACTER MONITORING

Quality	Indicator	Measure	Were data gathered from office paper files, computer files, or field work (professional judgment is an option)?	Time you spent gathering data for each measure (in whole hours)
Untrammeled	Authorized actions	Number of person-hours spent maintaining trails - HURON (LIGHTHOUSE) ISLAND ONLY	professional judgment (discussions w/staff)	1
Untrammeled	Authorized actions	Number of research, survey, and monitoring projects that manipulate vegetation, soils, and other factors of the abiotic community on wilderness islands per year	paper files, CCP, professional judgment (discussions w/staff)	2
Untrammeled	Authorized actions	Number of person-hours spent treating invasive plant species	professional judgment (discussions w/staff)	1
Untrammeled	Unauthorized actions	Number of known incidents of unauthorized actions that influence the biotic and/or abiotic community inside wilderness	professional judgment (discussions w/staff)	1

Natural	Plant and animal species	Percent boreal transition land cover on wilderness islands	N/A	0
Natural	Plant and animal species	Index of the percent of wilderness acreage that is occupied by invasive plant species	professional judgment (discussions w/staff)	1
Natural	Plant and animal species	Presence of whitetail deer (<i>Odocoileus virginianus</i>) on wilderness islands	professional judgment (discussions w/staff)	1
Natural	Physical resources	Air quality Measures	I&M	1
Natural	Biophysical processes	Climate Change Measures	NOAA	1
Undeveloped	Non-recreational structures, installations, and developments	Count of non-recreational structures, installations, developments	paper files, professional judgment (discussions w/staff)	2
Undeveloped	Inholdings	Acres of inholdings	Paper files, professional judgment (discussions w/staff)	0
Undeveloped	Use of motorized or mechanical	Index of administrative mechanical transport, motorized equipment, and motor vehicle use on wilderness islands	paper files, professional judgment (discussions w/staff)	1
Solitude +	Remoteness from inside	Amount of visitors use	paper files, professional judgment (discussions w/staff)	1
Solitude +	Remoteness from outside	Number of adult wilderness users residing in the service area	U.S Census data	0

Solitude +	Facilities that decrease self-reliant recreation	Miles of agency-provided trails	paper files, professional judgment (discussions w/staff)	1
Solitude +	Mgmt restrictions on visitor behavior	Index of management restrictions on visitor behavior	paper files, professional judgment (discussions w/staff)	1
Other Features	Loss of cultural resources	Number and severity of disturbances to cultural resources	paper files, professional judgment (discussions w/staff)	0
Other Features	Loss of paleontological or geological resources	Number of unauthorized removals of paleontological or geological resources	professional judgment (discussions w/staff)	0

Title of staff involved in identifying, prioritizing, and selecting measures	Staff time to identify, prioritize, and select measures (in whole hrs)
Wildlife Biologist	40
Refuge Manager	8
Deputy Refuge Manger	4

Combined time spent to identify, prioritize, and select all the measures (in whole hours)	Combined time spent to learn how to enter data into the WCM database application (in whole hours)	Combined time spent to enter all data into the WCM database application (in whole hours)	Combined time spent on other tasks directly related to WCM (e.g., reading CCP, giving presentations, talking with staff) (in whole hours)	Combined time spent doing other Refuge tasks not directly related to WCM (in whole hours)
100	10	8	190	0

APPENDIX C: SUMMARY OF DATA SOURCE(S) AND DATA COLLECTION PROTOCOLS FOR ALL MEASURES

Measure	Data Source(s) and Collection Protocol
1-1. Number of person-hours spent maintaining trails (Lighthouse Island only)	<p>Data Source(s): Refuge Manger, Biological staff</p> <p>Data Collection Protocol: Trail maintenance is performed by Refuge staff. Person-hours are calculated by multiplying the number of people and number of hours.</p>
1-2. Number of research, survey, and monitoring projects that manipulate vegetation, soils, and other factors of the abiotic community	<p>Data Source(s): Special Use Permits, Biological Staff, Refuge Management</p> <p>Data Collection Protocol: This measure is a count of the number of research projects and studies that monitor vegetation, soils, and other factors of the abiotic community within wilderness.</p>
1-3. Number of person-hours spent treating invasive plant species	<p>Data Source(s): Forester</p> <p>Data Collection Protocol: This measure is a count of the number of treatment/removal of invasive plant species. These actions will be done by Refuge staff, which may include removal by hand-pulling, treating with herbicide, etc.</p>
1-4. Number of known incidents of unauthorized actions that influence the biotic and/or abiotic community inside wilderness	<p>Data Source(s): Assistant Refuge Manager, Park Ranger, Forester</p> <p>Data Collection Protocol: This measure is a count of the number of unauthorized or illegal actions taken that manipulate plants, animals, water, soil, or fire inside wilderness. This measure includes all activities not authorized by the federal land manager that influence the natural environment of the wilderness. Examples of such actions are, but not limited to building camp fires, the introduction of mammalian predators, and seed, plant, or animal harvesting. Each separate action is counted and tallied annually. The sum of all islands is reported in the Wilderness Character Monitoring Database.</p>
2-1. Percent boreal transition land cover on wilderness islands	<p>Data Source(s): Forester</p> <p>Data Collection Protocol: The percent of boreal transition land cover on wilderness islands will be monitored using the FWS Rapid Ecological Assessment of Forests in the Laurentian Mixed Forest-Great Lakes Coastal Biological Network Field Manual.</p>

<p>2-2. Presence of whitetail deer (<i>Odocoileus virginianus</i>) on wilderness islands</p>	<p>Data Source(s): Forester Data Collection Protocol: This measure tracks the trend of white-tailed deer presence within wilderness. The number of animals counted is summed and reported in the Wilderness Character Monitoring Database annually.</p>
<p>2-3. Index of the percent of wilderness acres that are occupied by invasive plant species</p>	<p>Data Source(s): Forester Data Collection Protocol: Each wilderness island is scored by the estimated percent of wilderness acreage that is occupied by invasive plant species. Values are assigned according to the table below. Scores for each wilderness island are summed to generate a total score for the entire wilderness. This sum is reported in the Wilderness Character Monitoring Database.</p>
<p>2-4, 2-5, 2-6, 2-7. Air quality</p>	<p>Data Source(s): FWS NWRS Branch of Air Quality Data Collection Protocol: Air quality data is not monitored by the Huron Islands NWR staff; however, data is available from other agency monitoring programs and will be compiled on all Wilderness Areas by the National Wildlife Refuge System’s Naturals Resource Program Center (Fort Collins, CO). This measure is made up of four air quality parameters (1) ozone air pollution, (2) total nitrogen wet deposition, (3) total sulfur wet deposition, and (4) visibility. The values are presented as a 5 year average. Wilderness areas where we do not have air quality monitors in close proximity, such as the case with the Huron Islands Wilderness, values have been interpolated between monitors.</p>

<p>2-8, 2-9, 2-10. Climate change measures</p>	<p>Data Source(s): National Weather Service Station Annual Data Reports. Temperature values can be found using the following URL and searching for the corresponding weather monitoring station. http://lwf.ncdc.noaa.gov/land-based-station-data/find-station</p> <p>Data Collection Protocol: Each measure utilizes data recorded from NOAA weather stations: Hancock Houghton CO Airport, Ahmeek 1 SW, and Jacobsville. These measures are: mean summer temperature, mean winter temperature, and total annual precipitation. Summer was defined as the months of June, July, and August. Winter was defined as the months of December, January, and February. Mean summer and winter temperatures were calculated for each year. These seasonal means were then averaged over a five-year time interval. Since the year changes in the middle of the winter season, mean winter temperatures for any given year were calculated using data from December of the previous year and data from January and February of the target year. Total precipitation was calculated for each year and then these totals were averaged over a five-year time interval.</p>
<p>3-1. Count of non-recreational structures, installations, and developments</p>	<p>Data Source(s): Refuge Manager, Forester, Park Ranger</p> <p>Data Collection Protocol: Each development in wilderness is counted. The development type and location is noted, but only a count of developments is reported in the Wilderness Character Monitoring Database.</p>
<p>3-2. Acres of inholdings</p>	<p>Data Source(s): Refuge staff</p> <p>Data Collection Protocol: Inholdings are private or other federal or state agency lands entirely within the wilderness boundary. This measure is a sum of the total area (in acres) of any inholding(s) located within wilderness. In general, the undeveloped quality would be degraded if the acreage of inholdings increases.</p>

<p>3-3. Index of administrative mechanical transport, motorized equipment, and motor vehicle use on wilderness islands</p>	<p>Data Source(s): Refuge Biologist, Refuge Manager Data Collection Protocol: This single measure tracks the status and trends of all motorized and mechanized use authorized by the refuge staff in the wilderness. Not all equipment types have the same level of impact level associated with them. To account for these differences, an inherent weighting system has been assigned to each equipment type based on its perceived impact to social and biophysical resources, as shown in the table below. A “low” level of impact is a mechanical use that causes a small impact to the social environment and little or no impact to the biophysical environment (i.e., hand-held motorized equipment, battery power tool, or wheelbarrow). A “moderate” level of impact is a mechanized use that causes a large impact to the social environment (i.e., chainsaw, generator). A “high” level of impact is a mechanized use that causes a large impact to the social environment and biophysical environment (i.e., helicopter). A total use level value will be calculated for each motorized/mechanized use by multiplying the inherent weight of each type of equipment by the amount of actual use, as shown in the table below. The resulting products for each motorized/mechanized use are summed to generate a total score for the entire wilderness. This sum is reported to the Wilderness Character Monitoring Database.</p>
<p>4-1. Amount of visitor use</p>	<p>Data Source(s): Refuge Manager, Park Ranger Data Collection Protocol: Although actual uses usage of the island is unknown, an estimate was made by refuge staff for the 2012 baseline value. The Boathouse building currently contains a tablet for visitor sign-in, however this most likely does not account for all visitors. Due to all remaining islands being closed to the public, visitor use is recorded In Special Use Permits.</p>
<p>4-2. Number of potential adult wilderness users residing in the service area</p>	<p>Data Source(s): http://quickfactcensus.gov; Info found at pg. 196 of Forest Service Tech Guide Data Collection Protocol: The service area is defined as the four neighboring counties to the wilderness area. These counties include Marquette, Baraga, Houghton, and Keweenaw. Total population according to latest U.S census data for the four counties was totaled and reported in the Wilderness Character Monitoring database.</p>

4-3. Miles of agency-provided trails	<p>Data Source(s): Refuge Manager</p> <p>Data Collection Protocol: All concrete trails are located on Lighthouse Island and are remnants of when lighthouse attendants and their assistants lived on the island. This measure accounts for the total length of these trails, which are unlikely to change in the near future.</p>
4-4. Number of agency-provided recreation facilities	<p>Data Source(s): Refuge Manager, CCP</p> <p>Data Collection Protocol: This measure is a simple count of all recreational facilities on the Huron Islands, not including the concrete pathways on Lighthouse Island. Examples of agency-provided recreational facilities include boat docks and interpretive signs.</p>
4-5. Index of restrictions on visitor behavior	<p>Data Source(s): Refuge Manager, CCP</p> <p>Data Collection Protocol: Table 7, sourced from the Forest Service’s <i>Technical Guide for Monitoring Selected Conditions Related to Wilderness Character</i>, contains a list of management restrictions placed on visitor behavior, as well as scores assigned based on the degree of restriction, and the significance of their impact on opportunities for primitive and unconfined recreation. When scoring the restrictions of a given wilderness, a geographical weight is also applied: 1 = restriction applies only to a portion of the wilderness; 2 = restriction applies throughout entire wilderness. Based on the stipulations of management policy within a given monitoring period, the wilderness will be scored, and the total score will serve as the data value. Table 7 illustrates this scoring process for the Mingo Wilderness based on management restrictions in place at the time of this report.</p>
5-1. Index of disturbances to cultural resources (Lighthouse Island only)	<p>Data Source(s): Refuge Staff</p> <p>Data Collection Protocol: This measure is a count of the number of disturbances to statutorily protected cultural resources inside wilderness. Disturbances may include vandalism, construction, damage from wildlife, etc. Disturbances are weighted on the level of severity and a total value is reported for assessing a trend in the wilderness character.</p>
5-2. Number of unauthorized removals of paleontological or geological resources	<p>Data Source(s): Refuge Staff</p> <p>Data Collection Protocol: Calculate the total number of unauthorized removals of paleontological or geological resources in wilderness for the fiscal year.</p>

