

GBCP TARGETS

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		KEY ECOLOGICAL ATTRIBUTE	INDICATOR	CRITICAL ECOSYSTEM FUNCTION CONNECTION	GOAL
LANDSCAPE CONTEXT	COASTAL WETLANDS	Connectivity among communities and ecosystems	Free ground and surface water movement throughout the coastal wetland complexes	Aquatic Connectivity	
		Hydrologic regime (timing, duration, frequency, extent)	Water level fluctuations (seasonality, duration, location, etc.) over time	Aquatic Connectivity	
		Landscape pattern (mosaic): areal dispersion of spawning wetlands throughout coastal system	Wetland mapping		
		Water Chemistry	Adequate oxygen levels and low concentrations of toxins		
CONDITION	COASTAL WETLANDS	Sediment transport	Depth of sediment deposited in coastal wetlands over time	Water Quality	
		Species composition/dominance	Absence of invasive species and persistent populations of keystone native species	Biodiversity	
		Structure of vegetation	Date of stand origin and size/distribution of dominant species		
		Connectivity	Northern Pike		
		Water Quality	Levels of phosphorous	Water Quality	
		Presence of early successional wetland types (grass/sedge dominated)	Aerial photography mapping with ground verification		
SIZE	COASTAL WETLANDS	Size/extent of characteristic communities/ecosystems	Areal extent of various coastal wetland communities/ecosystems	Water Quality	
		Population size and Dynamics	Sufficient recruitment of young and number of spawning adults		



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LANDSCAPE CONTEXT	Connectivity among communities and ecosystems	Species dispersal over time at a site (e.g. the pattern of plant recolonization after disturbance, seasonal spawning movement of fish)	Nearshore Productivity	
	Water level fluctuations	Lake Michigan Water Level	Aquatic Connectivity	
	Landscape pattern (mosaic) & Structure	Presence/absence of nest predation		
	Winter and migratory habitat (Outside of GB)	Sufficient number of returning healthy breeding adults		
CONDITION	Species composition/dominance	Presence of keystone species and lack of invasive species damage to high quality sites	Biodiversity	Perch, bass, walleye
		Native Aquatic Plant Community		Wild Celery
	Alterations	Habitat loss		Dredging, sedimentation
	Perturbations	Invasive species	Biodiversity	
	Water clarity/light penetration	Nutrient levels, algal blooms, secchi disc	Water Quality	
	Adequate breeding habitat	Long-term population levels of colonial nesting birds are within a range that sustains their presences and does not degrade other conservation targets		
	Adequate food resources	Sufficient number of healthy breeding adults		
Population structure & recruitment	Levels of contaminants in bird eggs and young			
SIZE	Size/extent of the various littoral zone communities	Aereal extent of the various littoral zone communities	Nearshore Productivity	

LITTORAL ZONE COMMUNITY (SHORELINE, ISLANDS, & REEFS)



KEY ECOLOGICAL ATTRIBUTE

INDICATOR

CRITICAL ECOSYSTEM FUNCTION CONNECTION

GOAL

LANDSCAPE CONTEXT

Connectivity with Lake Michigan

Benthic community → Current Measurements

Water Chemistry

Benthic community → Levels of phosphorus and/or other eutrophying agents in the water column and oxygen at the substrate/water interface

Landscape pattern (mosaic) & structure

Distance between quality migratory habitat

Adequate habitat for community dynamics

Benthic community → Size, location, water depth, and diversity of substrate types native to Green Bay

Fish habitat

Ciscoe spawning reefs

Perturbations

Invasive species

Biodiversity

Zebra mussels

Water Quality

Dissolved Oxygen Level

Water Quality

Maintain viable dissolved oxygen level (> 3mg/ml) in benthic zone

Sedimentation

Water Quality

Mayflies (Hexagenia) →

Water Quality

Whitefish →

Mudpuppies →

Lake Sturgeon →

Trophic Structure

Benthic Community → Level of contaminants/toxins and presence of keystone species (e.g. burrowing mayfly, fingernail clams)

Adequate breeding habitat

Sufficient number of first year birds arriving in fall

Adequate food resources

Aerial extent and abundance of benthic invertebrates

Adequate overwintering habitat

Large number of well-fed diving ducks leaving the wintering grounds

SIZE

Population size and Dynamics

Sufficient recruitment of young and number of spawning adults

Lake Sturgeon

Number of ducks of target species utilizing bay during migration

OFFSHORE COMMUNITY

CONDITION



KEY ECOLOGICAL ATTRIBUTE

INDICATOR

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GOAL

TRIBUTARIES AND STREAMS

LANDSCAPE CONTEXT

CONDITION

SIZE

LANDSCAPE CONTEXT	Connectivity among communities and ecosystems; fish passage; fish spawning, hydrologic regime	Brook Trout → connectivity, pool and riffle habitat, wood	Year Round Habitat
	Watershed land useage	Walleye → Access, good water quality, clean rock for spawning	large dams, shoreline habitat loss, sediment load, improved water quality
	Connectivity among communities and ecosystems	Number of barriers to fish passage in tributary networks, evidence of fish movement throughout the bay and with Lake Michigan	
		Number of barriers to fish passage in tributary networks, evidence of fish movement throughout the bay and with Lake Michigan, and number of low oxygen levels	Lake Sturgeon
	Connectivity with Lake Michigan	Current measurements	Lake Sturgeon
Water Chemistry	Adequate oxygen levels and low concentrations of toxins	Lake Sturgeon	
CONDITION	Water Quality	Benthic invertebrate community, restore native fish	
	Habitat and Structure	Brook Trout → Cold water, constant flow	< 60 degrees, cold in summers, warmer in winter
		Habitat loss → Coarse woody habitat	
	Cold water (?), consistent flow	Walleye → rock 1-6 inches in diameter that is clean, well oxygenated	
		Water clarity	
	Adequate spawning habitat	Number of non-fragmented tributary streams or fragmented streams with appropriate flow regimes; and the number, size, and spatial arrangement of high-quality reefs and shoals	Lake Sturgeon
SIZE		Brook Trout → Stream size	Inland streams < 10 m in width
	Population size and Dynamics	Sufficient recruitment of young and number of spawning adults	Lake Sturgeon
		Walleye → inland streams > 10m in width	



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GRASSLANDS (PASTURELANDS, OLD FIELDS, ETC.)	LANDSCAPE CONTEXT	Availability of food sources, Landscape Pattern, Impact of Pesticides	Pollinators → ???			
		Landscape pattern (mosaic) & Structure	Neotropical migratory birds → Distance between quality migratory habitat			
		Connectivity among communities and ecosystems	Neotropical migratory birds → Barriers between habitat types. (e.g. urban development, water bodies)			
	CONDITION	Water Quality	Sedimentation → ???			
			Upland wetlands (existing & potential)			
		Adequate food resources	Neotropical migratory birds → Extent and abundance of invertebrates and seed sources			
		Structure of vegetation	Size/distribution of dominant habitat types			
		Diverse habitat types	Distribution of different habitat types in the water shed.			
		Adequate food resources; adequate breeding habitat	Pollinators → ???			
	SIZE	Population size	Pollinators → ???			
		Size/extent of the various habitat types	Areal extent of various ecosystems			
		Population size and Dynamics	Number and diversity of neotropical bird species utilizing the watershed during migration			
	FORESTED WETLANDS	L.C.	Connectivity among communities and ecosystems	Free ground and surface water movement throughout forested wetlands and non forested wetlands		
		CONDITION	Structure of vegetation	Date of stand origin and size/distribution of dominant species		
			Species composition/dominance	Absence of invasive species and persistent populations of keystone native species		
SIZE		Size/extent of characteristic communities/ecosystems	Areal extent of various forested wetland communities/ecosystems			



		KEY ECOLOGICAL ATTRIBUTE	INDICATOR	CRITICAL ECOSYSTEM FUNCTION CONNECTION	GOAL
UPLAND FORESTS	LANDSCAPE CONTEXT	Landscape pattern (mosaic) & Structure	Red Shouldered Hawks → Size and distance between nesting habitat of breeding pairs		
	Goshawks → Size and distance between nesting habitat of breeding pairs				
	CONDITION	Structure of vegetation	Red Shouldered Hawks → Date of stand origin and size/distribution of dominant species		
		Species composition/dominance	Red Shouldered Hawks → Absence of invasive species and persistent populations of keystone native species		
		Diverse habitat types	Red Shouldered Hawks → Distribution of upland adjacent to lowland forest types		
		Structure of vegetation	Goshawks → Size and distance between nesting habitat of breeding pairs		
		Species composition/dominance	Goshawks → Absence of invasive species and persistent populations of keystone native species		
	SIZE	Size/extent of characteristic communities/ecosystems	Red Shouldered Hawks → Areal extent of larger intact forest canopy composition		
			Goshawks → Areal extent of larger intact forest canopy composition		

! Priority level Target

GBCP ECOSYSTEM SERVICE FRAMEWORK

ECOSYSTEM SERVICES				AFFECTED STAKEHOLDERS*											
Ecosystem Services and Goods	Ecosystem Service Category	Ecosystem Service Indicators	Human Wellbeing Target	A	OT	MS	T	WRU	NLRU	HT	AN	PU	WWO	ARFC	Other
Aesthetics	Cultural	property values near protected areas	Improved leisure, enhanced connection to nature, and preserved sense of place	2	2	0	0	3	3	2	2	0	0	0	Homeowners 2
Air purification	Regulating	air quality index, asthma-related emergency rooms visits	Improved human health	3	3	3	3	3	3	3	3	3	3	3	
Aquatic Game Species (walleye, whitefish, catfish, pike, smallmouth bass, smelt, chub, whitefish, perch)	Provisioning, cultural	fisheries catch data, economic data	Improved fisheries livelihoods	0	0	0	0	0	1	0	3	0	0	0	
Biodiversity, Genetic	Supporting		Increased resilience of resources	2	2	2	2	1	2	2	2	0	0	0	
Biodiversity, Community types	Supporting, Cultural		Improved leisure choices and quality of life, and preserved sense of place	1	3	2	2	3	3	3	3	0	0	0	
Biodiversity, Species	Supporting, Cultural		Improved leisure choices and quality of life, and preserved sense of place	1	3	1	2	3	3	3	3	0	0	0	
Birds, Backyard*	Cultural, Regulating	e-bird records, visitation information for birding hotspots, bird population data	Preserved sense of place and improved quality of life	2	2	1	1	1	3	2	0	0	0	0	
Birds, Colonial nesting waterbirds	Cultural	bird population data	Preserved sense of place and improved quality of life	0	2	1	1	3	3	1	2	0	0	0	
Birds, Flagship coastal waterbirds (White American Pelican, Great Egret, Great Blue Heron, King Fishers)	Cultural		Preserved sense of place and improved quality of life	0	2	1	1	3	3	1	2	0	0	0	
Birds, Land-based Sport (Ruffed Grouse, Ring-necked Pheasant, American Woodcock, Wild Turkey)	Cultural	harvest data, biologist surveys	Preserved sense of place and improved quality of life	0	2	0	0	0	2	3	0	0	0	0	

* Refer to page 11 for Affected Stakeholder descriptions.

** Birds, Backyard (e.g., Black-capped Chickadee, woodpeckers, Purple Finch, White-breasted Nuthatch, American Goldfinch, Northern Cardinal, Baltimore Oriole, Purple Martin, House Wren, Blue Jay, Eastern Bluebird, Red-winged Blackbird)

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Birds, migratory landbirds, songbirds, shorebirds, waterfowl	Cultural		Preserved sense of place and improved quality of life	2	2	1	1	3	3	1	1	0	0	0	
Birds, Sport Waterfowl species	Cultural, provisioning	harvest data, biologist surveys	Preserved sense of place and improved quality of life	0	2	0	0	3	3	3	2	0	0	0	
Birds, Wintering	Cultural	Presence/abundance	Preserved sense of place and improved quality of life	1	2	1	1	2	3	1	1	0	0	0	
Carbon Sequestration	Regulating		Improved security	3	3	3	3	3	3	3	3	3	3	3	
Climate regulation	Regulating		Improved safety and security	3	3	3	3	3	3	3	3	1	1	1	
Decomposition	Supporting		Improved resilience of resources	3	3	3	3	3	3	3	3	3	3	3	
Disease control	Regulating		Improved safety	3	3	3	3	3	3	3	3	3	3	3	
Energy, Biomass fuels	Regulating		Improved living standards	2	0	0	2	0	0	0	0	0	0	0	biomass industry 3
Energy, Hydropower	Provisioning		Improved living standards	0	0	0	0	0	0	0	0	0	0	0	
Erosion control	Regulating		Improved safety	2	2	1	2	2	2	1	2	2	2	3	
Food, cash crops	Provisioning		Improved agricultural livelihoods	3	3	0	0	0	1	1	0	0	0	0	
Food, Dairy	Provisioning		Improved agricultural livelihoods	3	2	0	0	0	0	0	0	0	1	0	
Food, livestock	Provisioning		Improved agricultural livelihoods	3	3	0	0	0	0	1	0	0	1	0	
Food, White Corn	Provisioning, cultural		Preserved cultural heritage	0	3	0	0	0	0	0	0	0	0	0	
Food, Wild rice	Cultural, Provisioning	presence/absence, abundance	Preserved cultural heritage	0	3	0	0	0	1	2	1	0	0	0	

* Refer to page 11 for Affected Stakeholder descriptions.

ECOSYSTEM SERVICES				AFFECTED STAKEHOLDERS*											
Ecosystem Services and Goods	Ecosystem Service Category	Ecosystem Service Indicators	Human Wellbeing Target	A	OT	MS	T	WRU	NLRU	HT	AN	PU	WWO	ARFC	Other
Forage species	Cultural, provisioning		Improved leisure and enhanced connection to nature	0	3	0	0	2	3	2	2	0	0	0	
Fresh Water (Drinking Water, Irrigation)	Provisioning		Improved living standards	3	3	3	3	3	3	3	3	3	3	3	
Habitat	Supporting		Improved leisure, hunter/trapper livelihoods, and angler livelihoods	1	2	1	2	3	3	3	3	0	0	2	
Maple Syrup	Provisioning, cultural		Improved maple syrup industry livelihoods	0	0	3	1	0	1	0	0	0	0	0	
Medicinal Plants	Cultural, Provisioning		Improved leisure, enhanced connection to nature, and preserved cultural heritage	0	3	0	0	0	2	0	0	0	0	0	
Minerals	Provisioning		Improved access to resources												
Natural Communities (Forested, Aquatic, Coastal)	Cultural, Regulating		Improved leisure, enhanced connection to nature, and preserved sense of place	1	2	1	2	3	3	3	2	1	1	1	Environmental educators (3), scientific community (2)
Nutrient Cycling	Supporting		Enhanced resilience of resources	1	1	1	1	1	1	1	1	1	1	1	
Nutrient Sinks	Regulating		Improved leisure water-based recreation and angler livelihoods	1	2	0	0	3	1	1	3	2	3	2	
Paper	Provisioning		Improved forest industry livelihoods	0	0	0	2	0	0	0	0	0	0	0	Paper mills 3
Pest control	Regulating		Improved agricultural livelihoods and quality of life	3	3	3	3	3	3	3	3	1	1	1	
Pollination	Regulating		Improved agricultural livelihoods and quality of life	3	3	1	1	1	3	1	1	0	0	0	
Rural Landscapes	Cultural		Preserved sense of place and cultural heritage	3	0	0	0	2	2	2	2	0	0	0	

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Ecosystem Services and Goods	Ecosystem Service Category	Ecosystem Service Indicators	Human Wellbeing Target	A	OT	MS	T	WRU	NLRU	HT	AN	PU	WWO	ARFC	Other
Rural Landscapes	Cultural		Preserved sense of place and cultural heritage	3	0	0	0	2	2	2	2	0	0	0	
Soil health	Regulating		Improved resilience of resources	3	3	3	3	1	1	1	1	1	1	1	
Terrestrial Game Species (Fur bearers, White-tailed Deer)	cultural, provisioning	WiDNR hunting records? Hunter satisfaction surveys?	Improved hunter/trapper livelihoods	0	2	0	0	0	2	3	0	0	0	0	
Timber	Provisioning		Improved forest industry livelihoods	0	2	1	3	0	0	0	0	0	0	0	
Waste processing and detoxification	Regulating		Improved leisure and angler livelihoods	1	1	1	1	3	1	1	3	3	3	2	
Water quality (Good)	Provisioning, Cultural		Improved living standards	2	3	1	1	3	3	1	3	2	3	1	
Water regulation (infiltration ground/surface water)	Regulating	P and TSS loading, acres of healthy soil, acres of wetlands and floodplains	Improved living standards	3	3	2	2	3	3	2	3	3	3	3	
Water regulation (purification ground/surface water)	Regulating	Number of contaminated wells, P and TSS loading, costs of drinking water	Improved living standards	3	3	2	2	3	3	2	3	3	3	3	
Water regulation (storage, regime, flooding)	Regulating	Estimated damages due to a 10, 100 and 500 year flood events	Improved safety	3	3	2	2	3	2	2	3	2	2	3	

* Refer to page 11 for Affected Stakeholder descriptions.

GBCP ECOSYSTEM SERVICE FRAMEWORK AFFECTED STAKEHOLDERS

Affected Stakeholders:

- 0 = No impact on stakeholder group
- 1 = Indirect impact on stakeholder group (supports other services that the group is directly dependent on)
- 2 = Direct impact on stakeholder group, but not total dependence on service
- 3 = Direct dependence on service

A = Agriculture. Organic row crops, non-organic row crops, dairy, beef, poultry, honey, orchards and vineyards, Organic/Local foodists, home/community gardeners.

OT = Oneida Tribe. Subsistence, traditional practices, Tsyunhehkwa Organic farm, Oneida Tribal Farm.

MS = Maple syrup. Wisconsin Maple Syrup Producer's Association, small and large-scale producers, DIY-producers.

T = Timber. Wisconsin County Forests Association, Oconto and Marinette Counties, timber companies, private landowners, county forests.

WRU = Water-based recreational users. Motor boating, kayaking/canoeing, sailing, paddle boarding, swimming, water and jet skiers, water-based businesses.

NLRU = Nature and land-based recreational users. Walkers, hikers, campers, bikers, birders, skiers, snowmobilers, wildlife watchers.

HT = Hunters and Trappers. Deer, turkey, small game, waterfowl, upland bird, furbearers, guides, hunting clubs.

AN = Anglers. commercial, recreational, subsistence, fishing clubs, fishing tournaments)

PU = Public Utilities. Drinking and stormwater.

WWO = Well-water Owners.

ARFC = At-risk flood prone communities.