

APPENDIX J

Draft Eastern Upper Peninsula Ecological Indicators Prepared by the EUP Eco-Team

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Criterion Conservation of Biological Diversity

Indicator Landscape and Ecosystem Diversity

Proposed Metric:

- Percentage and extent of vegetation types relative to historical conditions (at varying scales)
- Richness and evenness of ecosystems or vegetation types (by age class for forested systems)
- Richness and evenness of landforms or soil types and index of topographic heterogeneity.
- Percentage, area, and representativeness of vegetation types in designated protected areas of natural and scientific interest
- Level of fragmentation, connectivity, shape, size and spatial distribution of vegetation types
- Connectivity of landforms and/or soil types
- Number, area and distribution of unusual or rare vegetation types

Indicator Species Population Diversity

Proposed Metric:

- Absolute and relative abundance of vegetation types and importance value for special interest species.
- Distribution, dispersion and Population trends of special interest species
- Changes in habitat of special interest species
- Species classified as threatened, endangered, rare or vulnerable and their population sizes and habitat condition
- Number of known species that occupy a smaller portion of their former range and the number of known species that occupy a larger portion of their former range
- Species richness of all plants, animals and fungi within representative ecosystems
- Proportion of forest area as plantations using native vs. non-native genotypes (just plants)
- Proportion of water bodies using native vs. non-native fish stock genotypes
- Proportion of water bodies with sustainable fisheries produced by stocked vs. natural reproduction.
- Proportion of openings on managed lands planted to native-non-native species

Criterion Ecosystem Condition and Productivity

Indicator Incidence of Disturbance and Stress

Proposed Metric:

- Area and severity of forest stressor (insects and fungus)
- Area and severity of wind and fire activity
- Presence, extent and number of invasive exotic species
- Area and severity of mammalian herbivory
- Area and intensity of timber harvest
- Land clearing/urban sprawl

Indicator Ecosystem Resilience

Proposed Metric:

- Area by vegetation type and age class
- Area successfully regenerated by vegetation type
- Ecological function, activity and responses to perturbation within "protected areas"
- Relative abundance of top carnivores
- Density of mammalian herbivores
- Ratio of exotic invasive plant species to native plant species in natural vegetative communities
- Presence of spring ephemerals

Indicator Biomass

Proposed Metric:

- Mean annual increment by forest type and age class
- Net annual growth by forest type and age class for the EUP
- Biomass volumes of standing flora.

Indicator Ecosystem Structure Forested Ecosystems

Proposed Metric:

- Number of super canopy trees
- Snags per area, basal area, mean DBH and decay class
- Cavities per area by size class
- Coarse woody debris per area, mean DBH and decay class
- Number of vertical vegetation layers per area

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- Number and size of tree fall gaps, harvest gaps and maintained wildlife openings per area in northern hardwood ecosystems
- Tree size: basal area per acre/hectare for different forested communities
- Distribution of cliffs, outcrops, sinks and glacial erratics
- Ratio of open water to emergent vegetation in wetlands
- Surface and sub-surface geology of valley segment
- Number of vertical vegetation layers by valley segment
- Surface and sub-surface hydrology of valley segment
- Coarse woody debris per area, mean DBH and decay class
- Bathymetric shape of lake
- Aquatic plant abundance and distribution

Criterion Water and Soil Conservation

Indicator Water quality

Proposed Metric:

- Percent of rural/urban land managed for water conservation (watershed quality)
- Water chemistry (pH, dissolved O², water conductivity, turbidity and water temperatures) and volume flow
- Fecal coliform
- Nutrients (nitrates and phosphates)
- Fish species diversity
- Benthic species diversity
- Number of water crossings per unit area
- Pesticide residue concentrations in surface water
- Area of wetlands
- Surface withdrawals by volume
- Ground water recharge zones
- Ground Water elevations
- Quality of drinking water
- Total water wells abandoned due to man-made contaminants
- Sub-surface withdrawals by volume

Indicator Soil Conservation

Proposed Metric:

- Area of lands managed for soil conservation (reflects the fragility of the soil on some sites)
- Soil stability and productivity (pH, soil faunal and fungal activity, soil erosion, degradation indices)
- Area of vegetated riparian corridors

Criterion Ecological Cycles

Indicator Carbon cycle

Proposed Metric:

- Area of forest permanently, semi-permanently, or temporarily converted to non-forest land use
- Carbon pool in forest products
- Carbon pools in soils
- Amount of fuels consumed
- Fuelwood consumption/atmospheric

Indicator Hydrological Cycle

Proposed Metric:

- Number, distribution and acres of impoundments affected by natural and artificial water control structures
- Surface area of lakes and wetlands; total flow data for rivers and streams
- Changes in Great Lakes water levels
- Annual precipitation
- Groundwater withdrawals
- Great Lakes water withdrawals
- Acres of artificially created surface

Criterion Uncommon or Rare Natural Features

Indicator Uncommon or rare vegetation types

Proposed Metric:

- Type, area, distribution and quality of uncommon or rare vegetation types. Size and distribution of uncommon or rare habitat types
- Type, area, distribution and representativeness of uncommon or rare vegetation types and their protection status, i.e. protected areas Natural areas, Old growth, Wild and Scenic Rivers, State Parks
- Type, area and distribution of uncommon or rare vegetation types under formal management
- Availability of unique fisheries habitat to support natural reproduction
- Miles of undeveloped Great Lakes shoreline, inland lakes and water courses

Indicator Uncommon or rare species

Proposed Metric:

- Population levels, habitat distribution and changes over time of selected uncommon or rare species (species will need to be selected)
- Number of species classified as threatened, endangered, rare or vulnerable relative to the total number of known species by taxa

Indicator Geophysical and Hydro-physical Features

Proposed Metric:

- Number, location and protection status of physical features and landforms (karsts, dunes, rock outcrops, eskers, drumlins, morains, fossil beds)
- Number of unique water features: aquifers, artesian wells, springs, waterfalls, recharge zones

Criterion Social / Cultural

Indicator Stability of land use

Proposed Metric:

- Percentage of lands that are under large-scale [need to define] alterations [as compared to what] by vegetative type
- Area of lands under restoration [as compared to what] by vegetative type
- Amount of change of ownership
- Amount of ownership fragmentation and parcelization of land
- Traditional non-profit uses for cultural forest products (e.g.berries, syrup, mushrooms, black ash, cattails, etc.)
- Number and size of forested parcels that have been added to or removed from the Commercial Forest Program

Indicator Place for nature and scientific study

Proposed Metric:

- Area and vegetation types in areas of natural and scientific interest
- Number of educational and recreational opportunities
- Presence of natural features, plant species and wildlife species important to the identity of area

Indicator Archaeology and History: Extent to which resource management planning takes into account the protection of unique or significant Native American, Euro American, social, cultural and or spiritual sites.

Proposed Metric:

- Archaeological Site Potential.
- Presence of a known archaeological site (more weight can be given to sites that are on the National Register of Historic Places, this register includes prehistoric sites)
- Presence of an area(s) of Historical/Cultural Significance
- Presence of spiritual/ceremonial activities

Indicator Presence of local planning efforts for the sustainability of natural resources and communities

Proposed Metric:

- Percent of townships addressing sustainability of natural resources and communities.
- Percent of counties addressing sustainability of natural resources and communities.
- Presence of regional or watershed area planning efforts

Criterion Spiritual

Indicator Undeveloped Natural Resources

Proposed Metric:

- Size and distribution of natural and 'special management' areas and allowed use of those areas
- Road and motorized trail density
- Density and distribution of dwellings and commercial structures
- Measure / monitor distribution of undeveloped areas in populated areas

Indicator Aesthetics

Proposed Metric:

- Area and distribution of "secluded" natural resources.
- Presence of litter or trash dumped on public land
- Number of designated access opportunities to view scenic vistas and/or wildlife
- Miles of road by use class, distribution and density in EUP
- Visual management
- Emotional/intrinsic values (Are my needs being met?)

Criterion Recreation

Indicator Hunting, Trapping and Fishing

Proposed Metric:

- User days/activity
- Satisfaction levels
- Population health by species
- Population density by species
- Harvest number by species
- Number and distribution of shooting ranges
- Amount of Commercial Forest (CF) lands, changes in status
- Law Enforcement activity- number of warnings, summons, arrests per activity
- Number of safety training opportunities per activity
- Accident trends per activity per season

Indicator Designated Trail –motorized and non-motorized (hiking, ORV, snowmobile, skiing, equestrian)

Proposed Metric:

- Infrastructure and resources available for trail maintenance
- User days per activity
- Miles of trail systems by trail ownership and management type
- Percentage of stream and wetland crossings complying with BMPs, laws and policies.
- Number of safety training opportunities per activity
- Accident trends per activity per season

Indicator Nature Appreciation and Education

Proposed Metric:

- Area of EUP by vegetation type, age class and ownership
- Miles of public Great Lakes shoreline, inland lakes and water courses
- Percentage, area and representativeness of vegetative types in areas of natural and scientific interest
- User days/activity
- Number of unique species observation opportunities
- Eco-tour opportunities

Indicator Special Scenic Sites

Proposed Metric:

- Size and distribution of natural and 'special' areas and their allowed use
- Miles of designated scenic routes
- Number of designated viewing areas

Indicator Camping – Includes dispersed and designated sites

Proposed Metric:

- Number, type and distribution of campground facilities- rustic, modern, semi-modern, cabins
- Number of campsites by type in campgrounds
- User days by campground and campsite
- Number of dispersed camps per year

- Environmental impact of camping. Benchmarks: -Soil erosion from human use -Trash presence- Carrying capacity of facility vs. overuse

Indicator Water Recreation – motorized and non-motorized (including swimming, scuba diving, kayaking, etc.)

Proposed Metric:

- User days per activity (power/sail boating, jet-skis, canoes, rafting/tubing, kayaking, swimming, snorkeling, fishing, water skiing, boat races, cruise ships, sail boarding, etc)
- Number of water access sites and boat slips by type and capacity for watercraft and available amenities
- Change in status of water body designation and use
- Number of safety training opportunities per activity
- Accident trends per activity per season

Indicator Diversity of recreational opportunities: the availability of different ways for people to recreate on the landscape

Proposed Metric:

- Availability of recreational activities by type i.e. lakes, rivers, forest, parks
- Universal (barrier free) access to facilities
- Quality and satisfaction of recreational experience
- Seasonally adjusted number of participants

Criterion Ownership Patterns

Indicator Ownership types (the distribution and area of land by owner)

Proposed Metric:

- Percent of public and private land in EUP
- Changes in ownership by acres
- Distribution of ownership in the EUP by acres

Indicator Stewardship

Proposed Metric:

- Number, acres and distribution of private land management plans and percent of private ownership with management plans
- Miles of Great Lakes shoreline, inland lakes and water courses under special management
- Number and location of conservation easements in EUP
- Number of cooperative planning “agreements” across ownerships in EUP
- Land use patterns across all ownerships

Indicator Accessibility

Proposed Metric:

- Percent of public and private land in the EUP
- Number and location of easements across public lands
- Number and location of easements across private lands
- Number of acres of public land without access (landlocked by private ownerships)
- Number of acres of private land enrolled in the Commercial Forest Program (CF)
- Existence of a road maintenance plan and expenditures by agency
- Miles of road by use class, distribution and density in the EUP

Criterion Economic Health

Indicator Local and community economic health and trends

Proposed Metric:

- Number of local economic development plans in the EUP Eco-Region
- Describe job/income / employment / retirement data
- Contribution of the resource use to gross domestic product (GDP) of all sectors of the economy
- Diversity of forest economic activity
- Measure change in the tax base
- Capital outlay and investment trends

Indicator Non-timber economic benefits

Proposed Metric:

- Number of jobs/economic activity
- User days/activity

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- Motel occupancy rates
- Mean and median travel spending per person per day per activity
- Total expenditures by individuals per activity in EUP

Indicator Timber and Wood Products

Proposed Metric:

- Timber volume, growth and mortality
- Timber harvest by species
- Legal and physical accessibility. Limit on timber availability for reasons of policy, legality, management decisions and physical access
- Wood product summary
- Determine ratio of harvest to growth by volume, species and products
- Net difference between growth and harvest by species
- Number of jobs/economic activity
- Wood budget

Criterion Institutional Processes

Indicator Legal Framework for Ecosystem Management

Proposed Metric:

- Land management laws and regulations
- Wildlife management laws and regulations
- Recreation laws and regulations
- Fisheries management laws and regulations
- Native American treaty rights
- Department & Division Policies and Procedures
- Compliance with land management laws, regulations, policies and guidelines (LRPGs).

Indicator Institutional Framework

Proposed Metric:

- Public participation in the design of decision-making processes
- Public participation in decision-making processes
- Public participation in implementation of decisions and monitoring

Indicator Balance between different values

Proposed Metric:

- Amount of management effort/interest put into different values
- Annual evaluation and reporting of the eco-system management effort in maintaining the values on the landscape and appropriate adjustments made
- Application and effectiveness of dispute resolution guidelines/policy

Indicator Resources allocated for ecosystem management values

Proposed Metric:

- Resources allocated within the Department for ecosystem management planning, implementation and monitoring.
- Participation in external planning efforts (e.g. National Forest Plan revisions)
- Expenditure of resources and dedicated funds for "on the ground" projects