

Appendix E – Michigan Core set of Statewide Criteria and Indicators

All ecoteams will use the below core set of Criteria and Indicators (C&I) in Ecoregional Resource Plans. Ecoteams may not delete core metrics, however, reflecting the unique character and values of their regions they may develop additional indicators and metrics for use in their ecoregional management plans. If an ecoteam adds metrics, lead division(s) for completing the metrics must be identified. The lead division(s) will be responsible for coordinating the collection and analysis of data; obtaining the funding for staff time, materials, services, or contracts needed to measure the metric; reporting the metric by a self-defined deadline; and updating the metric at a self-defined frequency.

The core set of C&I will be evaluated for revision in accordance with the plan review and revision requirements provided in Chapter 6, whereby the DNR may seek to add additional metrics or to remove metrics that do not provide an effective measure of an indicator. Proposed additions or removals of metrics will be reviewed by the Statewide Resource Planning Team (SRPT) to obtain consensus of the resource divisions. Within this context, the lead division(s) for a metric will have the option to alter the metric to make it practical, technologically feasible, cost effective, or scientifically defensible. Prior to adopting a metric for inclusion, the lead division(s) will: describe the purpose and primary use of the metric; define and set boundaries for the metric; identify the unit(s) of measure that will be reported; set the date for when the completed metric will be reported; set the frequency at which the metric will be updated; and determine the tier level. Metrics will be included in the core or ecoregional sets upon approval by the Statewide Council.

The extent, scope, and limits of criteria & indicator metrics will be clearly defined in all Ecoregional Resource Plans and any other plans or guidance documents that discuss these metrics. The scope of the core set of statewide criteria & indicator metrics include:

1. gathering information on a statewide basis (where applicable) from a variety of existing data sources;
2. providing information on a statewide basis and may be broken down by ecoregion where applicable and where the robustness of the data is not compromised;
3. gathering information related to all land ownerships, whether state-owned, public, corporate, or private lands;
4. application to any and all land cover community types; and
5. use for monitoring purposes by the ecoteams, divisions, and DNR workgroups, as needed.

Data are not currently available for the effective measurement of all metrics. The core C&I metrics have been categorized into tiers based upon the availability of data and the frequency with which the DNR can commit to measure specific metrics (Table E1). The measurement of metrics may also be subject to DNR workforce and budgetary constraints, whereby the DNR has the option to cease collecting, analyzing, or reporting a metric due to changes in priorities, funding, availability of data, or scientific understanding. There are four tiers of metric measurement:

Tier 1: Metrics for which the DNR or others have **databases available**, and that are measured with short periodicity. Data collected more frequently than on a yearly basis will be reported annually. Examples include: USGS hydrologic data from stream gages, acres and volumes of forest timber, lake and stream surveys for status and trends.

Tier 2: Metrics for which the DNR or others have databases available, but which are measured at a **longer periodicity (every 5-10 years)**. Metrics will be reported when updated data become available. These could be items that are contracted out to Universities as graduate student research. Examples include: Forest Inventory Analysis (FIA) data, large lake surveys, stock-recruitment relationships of specific fish stocks.

Tier 3: Metrics for which the DNR or others have the means to measure, but the data sources are **inconsistent and only partially available**. The DNR will be responsible for reporting only that portion of the data that are currently available. Examples include: resource inventories and population distribution and trends.

Tier 4: Metrics that the DNR **would like to measure, but does not currently have the means to do so**. The DNR will not measure these metrics until data sources or funding become available. These metrics would likely be measured or assembled by a contractor, University, or special project within the DNR. Examples include: large scale genetic or population investigations.

The core set of criteria, indicators and metrics are as follows:

CRITERION 1 Conservation of Biological Diversity

Biological diversity, or biodiversity, is the variability among living organisms and the ecological systems of which they are a part. Biodiversity can be measured at the landscape, ecosystem, species and genetic levels. Each level of biodiversity has three components: 1) Compositional diversity -the number of elements within a system; 2) Structural diversity -the variety of patterns within a system; and 3) Functional diversity -the number of ecological processes within a system. The conservation of biodiversity ensures that all ecosystems maintain their integrity, continue to be productive and are able to adapt to changing conditions.

INDICATOR 1.1 The extent of uncommon or rare natural features.

Identification and recognition of uncommon geological sites, plant and animal species, and ecological communities can make a difference between success and failure at sustaining our heritage and protection of natural systems over the long run.

METRIC 1.1.1 *Percent and extent of rare natural communities relative to historical conditions.*

METRIC 1.1.2 *Percent and extent of uncommon geophysical features relative to historical conditions.*

METRIC 1.1.3 *Percent and extent of uncommon hydro-physical features relative to historical conditions e.g. aquifers, artesian wells, springs, waterfalls, recharge zones.*

INDICATOR 1.2 The extent of landscape and ecosystem diversity.

The number of patches, their characteristics, size, shape and connectivity determines the complexity of landscapes. Ecosystem diversity is the kind and number of ecosystems in an area. Landscape diversity is the variety of ecosystems across a landscape, and reflects the patterns of association of ecosystems with one another and the recurrence of these patterns in a given landscape. The impacts

of change in landscapes are expressed through shifts in ecosystem diversity.

METRIC 1.2.1 *Percent and extent of vegetation types relative to historical conditions.*

METRIC 1.2.2 *Number of natural community types.*

METRIC 1.2.3 *Distribution of natural community types.*

METRIC 1.2.4 *Percentage, area and representativeness of vegetation types in designated protected areas of natural and scientific interest.*

METRIC 1.2.5 *Level of fragmentation, connectivity, shape, size and spatial distribution of vegetation types.*

INDICATOR 1.3 The extent of species population diversity.

Species diversity refers to the number and relative abundance of species found in an area. The impacts of change in ecosystems are expressed through shifts in species biodiversity.

METRIC 1.3.1 *Distribution, dispersion and population trends of focal species.*

METRIC 1.3.2 *Absolute and relative abundance of vegetation types and their importance as habitat for focal species.*

METRIC 1.3.3 *Trends in habitat of focal species.*

METRIC 1.3.4 *Species classified as threatened, endangered, rare or vulnerable, their population trends and habitat condition.*

METRIC 1.3.5 *Species richness of plants and animals within representative ecosystems.*

INDICATOR 1.4 The extent of genetic diversity.

Genetic diversity includes the range of genetic characteristics found within a species and among different species.

METRIC 1.4.1 *Proportion of forest area as plantations using native vs. non-native genotypes.*

METRIC 1.4.2 *Proportion of water bodies with native vs. non-native fish-stock genotypes in both inland and Great Lakes waters.*

METRIC 1.4.3 *Proportion of water bodies with fishery sustained by natural reproduction.*

METRIC 1.4.4 *Herbaceous native vs. non-native species plantings on roads, trails, easements, openings, savannas, grasslands and wetlands on managed lands.*

CRITERION 2 Ecosystem Condition and Productivity

Ecosystem condition is a measure of relative freedom from stress and the relative level of physical/biological energy within an ecosystem. Ecosystem productivity refers to the rate of production of biomass (organic matter) within an ecosystem. This results from interactions between plants, animals and micro-organisms or biotic components and abiotic factors such as soil, water and climate. Sustainable productivity is dependent upon the ability of ecosystems to recover from or adapt to both natural and human-induced disturbances. A healthy and diverse ecosystem is more resilient in its ability to respond or adapt to, or to recover from these disturbances in its environment.

INDICATOR 2.1 The scope, scale and intensity of disturbance and stress.

Ecosystems are dynamic and are constantly subject to changes in composition and structure. Many of these changes are adaptations to disturbance. Disturbances generally cause ecosystems to revert to earlier successional stages or establish new patterns of succession. Fundamental to the continued health, vitality and productivity of ecosystems are their ability to adapt to the various stresses placed upon them. Disturbances may be part of natural ecological cycles or the result of human activities. Human-induced stress and disturbance include introduced (exotic) species, prescribed burning, fire suppression, populations out of balance with available habitat, pollution and land-use practices. Natural disturbances include native insects, high wind events, flooding and fire.

METRIC 2.1.1 Area and severity of insect and disease infestation.

METRIC 2.1.2 Area and severity of flooding, drought, wind and fire activity.

METRIC 2.1.3 Presence, extent and number of invasive exotic species.

METRIC 2.1.4 Area and location by county of severe mammalian herbivory.

METRIC 2.1.5 Area and intensity of timber harvest by type.

METRIC 2.1.6 Area and intensity of timber salvage by type.

METRIC 2.1.7 Number and distribution of active and non-restored mineral and non-mineral extraction sites per township.

METRIC 2.1.8 Miles and density of utility corridors and numbers of communication structures.

METRIC 2.1.9 Miles of undeveloped Great Lakes, inland lakes, rivers and stream shoreline.

METRIC 2.1.10 Mean concentration of Chlorophyll A during annual growing season in inland lakes.

METRIC 2.1.11 Miles of streams designated as priority for beaver-trout management per DNR Policy 39.21-20.

INDICATOR 2.2 The extent and change of biomass.

Biomass is the total mass of organic matter in all living organisms within a specific unit area, such as an ecosystem. It is an integrating measure of ecosystem condition, providing a measure of the productivity, health and vitality of all species and habitat types. Evidence that the condition of habitat types is constant or improving indicates that they are being managed in a sustainable way.

METRIC 2.2.1 Volume, net annual growth, mortality and removals by forest type and age class.

INDICATOR 2.3 The extent and type of structure within aquatic ecosystems.

Vegetation and other biotic and abiotic materials provide the physical structure within which most organisms live. Ecosystem structure is the variety of patterns within a system, and includes the presence and arrangement of these physical structures in three-dimensional space. Species richness in some taxa is correlated with ecosystem community structure.

METRIC 2.3.1 Alteration of surface and sub-surface geology of valley segment.

METRIC 2.3.2 Alteration of surface and sub-surface hydrology of valley segment.

METRIC 2.3.3 Number and location of lake and stream restoration projects.

INDICATOR 2.4 The extent and type of structure within upland and wetland ecosystems.

Vegetation and other biotic and abiotic materials provide the physical structure within which most organisms live. Ecosystem structure is the variety of patterns within a system, and includes the presence and arrangement of these physical structures in three-dimensional space. Species richness in some taxa is correlated with ecosystem community structure.

- METRIC** 2.4.1 *Tree size: basal area per acre/hectare for different forest cover types.*
- METRIC** 2.4.2 *Distribution of cliffs, outcrops, sinks and glacial erratics.*
- METRIC** 2.4.3 *Snags per area, Basal area, mean DBH and decay class.*
- METRIC** 2.4.4 *Large woody debris per area, mean DBH and decay class.*
- METRIC** 2.4.5 *Number of vegetative species and structural diversity by age class for forested systems.*

INDICATOR 2.5 The condition of water quality.

Long-term productivity and resilience of habitats, and a potable water supply for humans and wildlife, are dependent upon abundant and clean water resources. Management policies that address stream crossings, watershed management and riparian areas help to maintain water flow patterns, water levels and water quality, and ensure that the condition of aquatic ecosystems are maintained and improved.

- METRIC** 2.5.1 *Distribution and acres of lakes and miles of streams of artificial nitrification (nitrates and phosphates).*
- METRIC** 2.5.2 *Pesticide and contaminant residue concentrations in surface water as measured by fish advisories and eagle nesting success.*
- METRIC** 2.5.3 *Percentage of impervious surface in watersheds.*

INDICATOR 2.6 Carbon cycle and greenhouse gas emissions.

The carbon cycle represents an important set of processes linking plant and animal communities with climate change. The release or removal of CO₂ to and from the atmosphere impacts global ecological cycles. Forests, wetlands and water bodies can act as either sinks (a vigorous and growing forest) or sources for atmospheric carbon, depending on whether they are primarily storing carbon or releasing it. Knowledge of the influence of natural disturbances and human intervention on this role can indicate the type of forest practices required for sustainable management.

- METRIC** 2.6.1 *Area of forest permanently, semi-permanently, or temporarily converted to non-forest land use (Also see Indicator 5.3 Land Use).*
- METRIC** 2.6.2 *Changes in carbon pool in vegetative biomass.*
- METRIC** 2.6.3 *Number of wildfire acres and fuels reported by county and township.*
- METRIC** 2.6.4 *Trends in metric tons of greenhouse gas emissions by region or county.*

INDICATOR 2.7 The variance in and type of disruption of hydrological cycles.

Hydrological cycles involve the movement of water from the atmosphere to the surface of the earth in the form of precipitation; from soils to streams to lakes to the atmosphere; and from soil to plants to the atmosphere. Because of their vast area in the state, forests play a major role in Great Lakes hydrological cycles. Changes in forestland cover and management influence the storage and movement of water and the timing of the various components of the hydrological cycle. Forests can influence stream and river hydrographs by regulating the flow of water into wetlands, streams and lakes. Consequently, sustainable forest management plays a crucial role in contributing to the regulation of the hydrological cycle.

- METRIC** 2.7.1 *Number, distribution and acres of impoundments affected by natural and artificial water control structures.*
- METRIC** 2.7.2 *Surface area of lakes and wetlands.*
- METRIC** 2.7.3 *Total flow data for rivers and streams.*

INDICATOR 2.8 The effectiveness of soil conservation.

The long-term productivity and resilience of forests and other habitats are dependent upon the maintenance of appropriate levels of soil oxygen, nutrients, organic matter and water. In order to ensure that terrestrial and aquatic ecosystems are maintained and improved, management policies must be implemented that provide for specific management practices or the protection of sensitive sites.

METRIC 2.8.1 Miles and width of vegetated riparian corridors.

METRIC 2.8.2 Number and location by county of soil erosion and sedimentation BMP violations.

METRIC 2.8.3 Number, location by county, type and funding for soil erosion and sedimentation restoration projects.

METRIC 2.8.4 Trends in soil quality as measured by pH by eco-region.

CRITERION 3 Social/Cultural/Spiritual

Social/Cultural: The Northern Lower and Upper Peninsula Eco-regions in which the State Forest is located are predominantly rural, natural resource rich regions of Michigan with large amounts of public forest land. Current social values rely on tourism, recreation, and resource extraction based on the existing natural resources. Life styles and values of the people of this region are strongly connected to its natural resources. Therefore, sustainability of these natural resources is essential to the social and cultural fabric of the region.

Spiritual: Spiritual values or *existence values* are personal feelings and sentiments that natural resources stir within the human spirit. This criterion is concerned with the continued ability of the resources to provide these values. Because spiritual values are personal in nature and to a large degree intangible, the indicators pertain primarily to ecosystem features of that appeal to the senses or address the ability of people to use those resources.

INDICATOR 3.1 Extent of archaeological and historical sites.

Resource management planning takes into account the identification and protection of known unique or significant Native American and Euro-American social, cultural and or spiritual sites.

METRIC 3.1.1 Number of known archaeological sites. (More weight can be given to sites that are on the National Register of Historic Places. This register includes prehistoric sites as well.)

METRIC 3.1.2. Number (presence, extent, location) of area(s) of historical/cultural significance. (Many times these areas may show no signs of their significance, e.g. a Native American Indian trail corridor where the trail is no longer visible, or a spot at which a meeting or discovery took place.)

INDICATOR 3.2 The extent of undeveloped natural resources.

The existence and maintenance of large undeveloped forests or other similar resources at landscape scales are a significant influence upon social/cultural/spiritual values.

METRIC 3.2.1 Size and distribution of Natural, Wilderness and Wild areas and the allowed use of those areas.

INDICATOR 3.3 The extent and type of aesthetics landscapes.

The visual or aesthetic quality of natural landscapes are a significant influence upon

social/cultural/spiritual values. (Also see metrics under Indicator 2.1.)

METRIC 3.3.1 *Number of designated access opportunities to view scenic vistas and/or wildlife.*

METRIC 3.3.2 *Miles of road by use class, distribution and density*

INDICATOR 3.4 The extent and type of traditional uses for cultural forest products (e.g. berries, syrup, mushrooms, black ash, cattails, etc.).

The use of cultural forest products is a form of recreation that originates from historic needs for subsistence. These activities continue to exist for both subsistence and pure recreation. While they do not serve as a significant basis for segments of the state and local economies, they do provide a foundation for traditional social well being. Level of participation and potential resource impacts are also important to consider.

METRIC 3.4.1 *Number of traditional harvest festivals across the state – blueberry, morel mushrooms, thimbleberry etc.*

METRIC 3.4.2 *Number of special use permits, e.g. fire wood, Christmas greens (Lycopodium), seeds, cones.*

METRIC 3.4.3 *Extent of tribal gathering activities, e.g. black ash, bark, berries, medicinal plants, - commercial vs. subsistence.*

METRIC 3.4.4 *Amounts, kinds and impacts of medicinal plant gathering.*

METRIC 3.4.5 *Kinds of and numbers of membership in non-forest product producer organizations.*

CRITERION 4 Outdoor Recreation

The ability to maintain and strengthen the quality of leisure pursuits in the access of resources and amenities while minimizing social or environmental degradation.

INDICATOR 4.1 The type, extent and quality of hunting, trapping and fishing.

Hunting, trapping and fishing are important forms of recreation that originate from historic needs for subsistence. These activities continue to exist for both purposes of subsistence and pure recreation. They serve as a significant basis for large segments of the state and many local economies, as well as for providing a foundation for traditional social well being.

METRIC 4.1.1 *User days per activity.*

METRIC 4.1.2 *Number of animals testing positive for pathogens.*

METRIC 4.1.3 *Population indices for selected species.*

METRIC 4.1.4 *Estimated harvest by selected species.*

METRIC 4.1.5 *Amount and locations by county of Commercial Forest (CF) lands, changes in status.*

METRIC 4.1.6 *Satisfaction of recreational experience for selected programs.*

INDICATOR 4.2 The extent, type and quality of designated trail use – motorized and non-motorized (hiking, ORV, snowmobile, skiing, equestrian).

Trails that are designated for authorized hiking, Off-road Vehicle, snowmobile, skiing and equestrian

uses are significant locations for recreation that form a significant basis for large segments of the state and many local economies, as well as providing a foundation for traditional social well being.

METRIC 4.2.1 *Amount of money and other resources (hours of staff and volunteer time) available for infrastructure and trail maintenance and development.*

METRIC 4.2.2 *User days per activity.*

METRIC 4.2.3 *Miles of trail systems by trail ownership and management type.*

METRIC 4.2.4 *Accident trends per activity per season.*

METRIC 4.2.5 *Satisfaction of recreational experience for selected programs.*

INDICATOR 4.3 Nature Appreciation and Education

One measure for nature appreciation and education is the existence of places where people can interact with natural communities that exist in perpetuity, and where natural processes occur to some degree, such as natural areas, wilderness areas, high conservation value areas and ecological reference areas.

METRIC 4.3.1 *Miles of public Great Lakes, inland lakes and stream shoreline.*

METRIC 4.3.2 *Percentage, area and representativeness of vegetative types in areas of natural and scientific interest.*

METRIC 4.3.3 *Existence and level of nature oriented and eco-tourism activities, e.g. guiding and interpretive services for kayaking, canoeing, birding, elk viewing, wildlife viewing, hunting, fishing, photography, backpacking etc.*

METRIC 4.3.4 *Satisfaction of recreational experience for selected programs.*

INDICATOR 4.4 The extent, type and quality of camping – including dispersed and designated site camping. (Refer also to social economic assessment contract.)

Camping is an important form of recreation that originates from historic needs for shelter while traveling through a natural setting. Camping activities of both forms are a significant basis for large segments of the state and many local economies, as well as providing a foundation for traditional social well being.

METRIC 4.4.1 *Number, type and distribution of campground facilities – rustic, modern, semi-modern, cabin rentals.*

METRIC 4.4.2 *Number of campsites by type in public and private campgrounds.*

METRIC 4.4.3 *User days by campground and campsite.*

METRIC 4.4.4 *Number of dispersed camps per year.*

METRIC 4.4.5 *Satisfaction of recreational experience for selected programs.*

INDICATOR 4.5 The extent, type and quality of water recreation – motorized and non-motorized (including swimming, scuba diving, kayaking, etc.).

Water recreation is an important form of recreation that has roots in historic modes of transportation and for fulfilling needs for exercise and adventure. Both forms of water recreation are a significant basis for large segments of the state and many local economies, as well as providing a foundation for traditional social well being.

- METRIC** 4.5.1 Trends in water activity user days e.g. power/sail boating, jet-skis, canoes, rafting/tubing, kayaking, swimming, snorkeling, fishing, water skiing, boat races, cruise ships, sail boarding, etc.
- METRIC** 4.5.2 Trends in water recreation equipment sales.
- METRIC** 4.5.3 Trends in commercial water recreation operators.
- METRIC** 4.5.4 Number of water access sites and boat slips by type and capacity for watercraft and available amenities.
- METRIC** 4.5.5 Change in status of water body designation and use.
- METRIC** 4.5.6 Satisfaction of recreational experience for selected programs.

INDICATOR 4.6 Public land open to outdoor recreation.

Trends in all land open to outdoor recreation, not just forest land.

- METRIC** 4.6.1 Amount of public land open to outdoor recreation, by agency (e.g. Federal, State, local conservancy and conservation easement lands).

CRITERION 5 Ownership Patterns

The pattern and distribution of ownership and use of lands greatly affects the ability to sustain natural resources. Management options, resource demand and ecological processes are affected by how the land is managed, fragmented, and patterned. Successful sustainable management depends upon the degree of functional connectivity across ownerships, boundaries, and landscapes.

INDICATOR 5.1 The degree of stewardship.

Stewardship is the practice of carefully managing land usage and associated resources to ensure natural systems are maintained or enhanced for use by future generations.

- METRIC** 5.1.1 Number, acres and distribution of Forest Stewardship, Conservation Reserve Program, Qualified Forest Program, American Tree Farm, Commercial Forest and Landowner Incentive Program private land management plans and percent of private ownership with management plans.
- METRIC** 5.1.2 Number of acres and location by county of private land with public conservation easements.
- METRIC** 5.1.3 Number, kinds, acres and by county of conservation easements.
- METRIC** 5.1.4 Number, kinds, and acres by county of cooperative planning “agreements” across ownerships, e.g. Clay Lake Plains Plan, Two Hearted River Watershed Plan, Les Cheneaux Economic Forum, Munuscong Watershed Plan, St. Mary’s River Plan.
- METRIC** 5.1.5 Numbers, acres, and percentage of forested lands certified by county for sustainable forestry by ownership.

INDICATOR 5.2 The extent of accessibility to public lands.

The extent to which a parcel or area of land can be reached and used by people.

- METRIC** 5.2.1 Number by county of access easements to public lands.

METRIC 5.2.2 *Number of acres and location by township of public land without access landlocked by private ownerships.*

METRIC 5.2.3 *Trends in numbers and location by county of barrier free facilities.*

INDICATOR 5.3 The degree of stability of land use.

The stability of land use or large-scale trends in land use can have direct effect upon the landscape resources base from which social/cultural/spiritual values are derived.

METRIC 5.3.1 *Percent of forest land and non-forest land by county.*

METRIC 5.3.2 *Acres of forest land converted to developed land.*

METRIC 5.3.3 *Amount of ownership fragmentation and parcelization of land.*

METRIC 5.3.4. *Number and size of forested parcels added to or removed from the Commercial Forest Program.*

METRIC 5.3.5 *Distribution of forest land ownership by acres.*

METRIC 5.3.6 *Percent change by ownership class.*

CRITERION 6 Economic Health

A wide range of goods and services are derived by and from managing natural resources in the Northern Lower and Upper Peninsulas of Michigan. In addition to the traditional forest products sector, the resource base supports mining, commercial fishing and an ever-growing tourist and recreation industry. These goods and services create jobs and provide economic stability to the region.

INDICATOR 6.1 The extent and trends of local and community economic health.

Trends in planning and investment are important gauges of sustainable natural resource management and in local and community economic health. (Also see social economic assessment contract.)

METRIC 6.1.1 *Number of local economic development plans.*

METRIC 6.1.2 *Trends in job/income/employment/retirement data.*

METRIC 6.1.3 *Contribution of the resource use to gross domestic product (GDP) of all sectors of the economy.*

METRIC 6.1.4 *Diversity of forest economic activity.*

METRIC 6.1.5 *Capital outlay and investment trends.*

INDICATOR 6.2 The extent of non-timber economic benefits of the forest.

The extent of non-timber economic benefits are an important gauge of sustainable natural resource management and in local and community economic health. Also see social and economic assessment contract.

METRIC 6.2.1 *Number of recreation and tourism jobs/economic activity.*

METRIC 6.2.2 *Total expenditures by individuals by select activity.*

METRIC 6.2.3 *Value and jobs/economic activity related to mineral, oil, and gas extraction.*

INDICATOR 6.3 The extent and type of timber and wood products produced.

The extent and type of timber and wood products are important gauges of sustainable natural resource management and in local and community economic health. Also see social and economic assessment contract.

METRIC 6.3.1 *Timber volume, growth and mortality by county.*

METRIC 6.3.2 *Timber harvest by species by county.*

METRIC 6.3.3 *Value and volume of wood products by county.*

METRIC 6.3.4 *Number of jobs/economic activity, e.g. logging, hauling and mills.*

CRITERION 7 Institutional Processes

Institutional processes address the legal and institutional framework for the application of ecosystem management. They address the policies, legislation, regulations and guidelines that drive and direct ecosystem practices; and direct how institutions cooperate with others in the application of ecosystem management. Institutional processes include the quality and quantity of opportunities for public involvement in ecosystem planning leading to resource management decisions.

INDICATOR 7.1 The extent of the legal framework for ecosystem management.

The framework should include the existence and/or application of laws, regulations, policies and guidelines for land management. The framework should also consider and meet legal obligations with respect to duly established Native American treaty rights. (Note the metrics here are very important to the public based on the public meetings that were held).

METRIC 7.1.1 *Presence of and compliance with land management laws and regulations based on continued Forest Certification management review system, Natural Resource Commission(NRC) and other open meetings, and stake holder reports.*

METRIC 7.1.2 *Presence of and compliance with wildlife management laws and regulations.*

METRIC 7.1.3 *Presence of and compliance with recreation laws and regulations.*

METRIC 7.1.4 *Presence of and compliance with fisheries management laws and regulations.*

METRIC 7.1.5 *Presence of and compliance with Native American treaty rights.*

METRIC 7.1.6 *Presence of and compliance with Department and Division policies, procedures and guidelines.*

METRIC 7.1.7 *Number and extent of laws that reference ecosystem management.*

INDICATOR 7.2 The extent of an institutional framework.

An effective institutional framework is necessary to implement ecosystem management processes effectively.

METRIC 7.2.1 *Trends in public participation processes.*

METRIC 7.2.2 *The number of public advisory committees.*

INDICATOR 7.3 The extent of resources allocated for ecosystem management values.

Sufficiency of resources is necessary to effectively implementation ecosystem management processes.

METRIC 7.3.1 *Resources allocated within the Department for ecosystem management planning*

and monitoring.

METRIC 7.3.2 *Participation in external planning efforts, e.g. National Forest plan revisions.*

METRIC 7.3.3 *Expenditure of resources and dedicated funds for implementation of “on-the-ground” projects.*

METRIC 7.3.4 *Expenditure of resources and dedicated funds for research in ecosystem management.*

Table E1. Tiered C&I Metrics

Core Metric	Tier	Measurement Frequency	Lead Division
1.1.1 Percent and extent of rare natural communities relative to historical conditions.	4	Annually	FMFM (MNFI)
1.1.2 Percent and extent of uncommon geophysical features relative to historical conditions.	4	NA	FMFMD
1.1.3 Percent and extent of uncommon hydro-physical features relative to historical conditions e.g. aquifers, artesian wells, springs, waterfalls, recharge zones.	4	NA	FD
1.2.1 Percent and extent of vegetation types relative to historical conditions.	3	5 Years	FMFMD (MNFI)
1.2.2 Number of natural community types.	1	5 Years	FMFMD (MNFI) FMFMD (BIODIV TEAM)
1.2.3 Distribution of natural community types.	4	NA	
1.2.4 Percentage, area and representativeness of vegetation types in designated protected areas of natural and scientific interest.	3	Annually	FMFMD (WLD, BIODIV TEAM)
1.2.5 Level of fragmentation, connectivity, shape, size and spatial distribution of vegetation types.	4	NA	WLD (MNFI)
1.3.1 Distribution, dispersion and population trends of focal species.	3	Annually	WLD (FD)
1.3.2 Absolute and relative abundance of vegetation types and their importance as habitat for focal species.	3	Annually	WLD (FD)
1.3.3 Trends in habitat of focal species.	3	5 Years	WLD (FD)
1.3.4 Species classified as threatened, endangered, rare or vulnerable, their population trends and habitat condition.	3	2 Years	WLD, FD
1.3.5 Species richness of plants and animals within representative ecosystems.	4	NA	FMFM (WLD, FD, MNFI)
1.4.1 Proportion of forest area as plantations using native vs. non-native genotypes.	3	5 Years	FMFMD
1.4.2 Proportion of water bodies with native vs. non-native fish-stock genotypes in both inland and Great Lakes waters.	1	5 Years	FD
1.4.3 Proportion of water bodies with fishery sustained by natural reproduction.	1	Annually	FD
1.4.4 Herbaceous native vs. non-native species plantings on roads, trails, easements, openings, savannas, grasslands and wetlands on managed lands.	4	5 Years	WLD (FMFMD, PRD)
2.1.1 Area and severity of insect and disease infestation.	1	Annually	FMFMD
2.1.2 Area and severity of flooding, drought, wind and fire activity.	3	5 Years	FMFMD
2.1.3 Presence, extent and number of invasive exotic species.	4	NA	FMFMD (MDA)

Core Metric	Tier	Measurement Frequency	Lead Division
2.1.4 Area and location by county of severe mammalian herbivory.	4	NA	FMFMD
2.1.5 Area and intensity of timber harvest by type.	1	Annually	FMFMD
2.1.6 Area and intensity of timber salvage by type.	2	Annually	FMFMD
2.1.7 Number and distribution of active and non-restored mineral and non-mineral extraction sites per township.	2	5 Years	FMFMD
2.1.8 Miles and density of utility corridors and numbers of communication structures.	3	10 Years	FMFMD (OLAF)
2.1.9 Miles of undeveloped Great Lakes, inland lakes, rivers and stream shoreline.	3	10 Years	FD
2.1.10 Mean concentration of Chlorophyll A during annual growing season in inland lakes.	1	Annually	FD
2.1.11 Miles of streams designated as priority for beaver-trout management per DNR Policy 39.21-20.	4	NA	FD (WLD)
2.2.1 Volume, net annual growth, mortality and removals by forest type and age class.	1	Annually	FMFMD
2.3.1 Alteration of surface and sub-surface geology of valley segment.	2	10 Years	FD
2.3.2 Alteration of surface and sub-surface hydrology of valley segment.	1	As Necessary	FD
2.3.3 Number and location of lake and stream restoration projects.	2	As Necessary	FD
2.4.1 Tree size: basal area per acre/hectare for different forest cover types.	1	Annually	FMFMD
2.4.2. Distribution of cliffs, outcrops, sinks and glacial erratics.	3	5 Years	FMFMD
2.4.3 Snags per area, Basal area, mean DBH and decay class.	3	Annually	FMFMD
2.4.4 Large woody debris per area, mean DBH and decay class.	4	NA	FMFMD
2.4.5 Number of vegetative species and structural diversity by age class for forested systems.	1	Annually	FMFMD
2.5.1 Distribution and acres of lakes and miles of streams of artificial nitrification (nitrates and phosphates).	1	Annually	FD
2.5.2 Pesticide and contaminant residue concentrations in surface water as measured by fish advisories and eagle nesting success.	1	Annually	FD
2.5.3 Percentage of impervious surface in watersheds.	2	10 Years	FD
2.6.1 Area of forest permanently, semi-permanently, or temporarily converted to non-forest land use (Also see Indicator 5.3 Land Use).	2	5 years	FMFMD
2.6.2 Changes in carbon pool in vegetative biomass.	2	5 years	FMFMD
2.6.3 Number of wildfire acres reported by county and township.	3	Annually	FMFMD

2.6.4 Trends in metric tons of greenhouse gas emissions by region or county.	2	10 Years	FMFMD (DEQ)
Core Metric	Tier	Measurement Frequency	Lead Division
2.7.1 Number, distribution and acres of impoundments with artificial water control structures.	3	10 Years	FD (WLD)
2.7.2 Surface area of lakes and wetlands.	2	10 years	FD
2.7.3 Total flow data for rivers and streams.	1	Annually	FD
2.8.1 Miles and width of vegetated riparian corridors.	4	NA	FMFMD
2.8.2 Number and location by county of soil erosion and sedimentation BMP violations.	1	Annually	FMFMD
2.8.3 Number, location by county, type and funding for soil erosion and sedimentation restoration projects.	1	Annually	FD
2.8.4 Trends in soil quality as measured by pH by eco-region	4	NA	FMFMD
3.1.1 Number of known archaeological sites. (More weight can be given to sites that are on the National Register of Historic Places. This register includes prehistoric sites as well.)	3	5 Years	FMFMD (SHPO)
3.1.2. Number (presence, extent, location) of area(s) of historical/cultural significance. (Many times these areas may show no signs of their significance, e.g. a Native American Indian trail corridor where the trail is no longer visible, or a spot at which a meeting or discovery took place.)	3	10 Years	FMFMD (SHPO)
3.2.1 Size and distribution of Natural, Wilderness and Wild areas and the allowed use of those areas.	1	Annually	FMFMD (WLD)
3.3.1 Number of designated access opportunities to view scenic vistas and/or wildlife.	3	10 Years	FMFMD (WLD, PRD)
3.3.2 Miles of road by use class, distribution and density	1	Annually	FMFMD
3.4.1 Number of traditional harvest festivals across the state – blueberry, morel mushrooms, thimbleberry etc.	2	5 Years	FMFMD (MEDC)
3.4.2 Number of special use permits, e.g. fire wood, Christmas greens (Lycopodium), seeds, cones.	1	Annually	FMFMD (WLD)
3.4.3 Extent of tribal gathering activities, e.g. black ash, bark, berries, medicinal plants, - commercial vs. subsistence.	4	NA	FMFMD (WLD)
3.4.4 Amounts, kinds and impacts of medicinal plant gathering.	4	NA	FMFMD
3.4.5 Kinds of and numbers of membership in non-forest product producer organizations.	4	NA	FMFMD
4.1.1 User days per activity.	1	Annually	WLD (FD)
4.1.2 Proportion or number of animals testing positive for pathogens, or number of diseases or pathogens for which there are active surveillance programs.	1	Annually	WLD (FD)
4.1.3 Population indices for selected species.	4	NA	WLD (FD)
4.1.4 Estimated harvest by selected species.	4	NA	WLD (FD)

4.1.5 Amount and locations by county of Commercial Forest (CF) lands, changes in status.	1	Annually	FMFMD
Core Metric	Tier	Measurement Frequency	Lead Division
4.1.6 Satisfaction of recreational experience for selected programs.	3	Annually	WLD, FD (LED)
4.2.1 Amount of money and other resources (hours of staff and volunteer time) available for infrastructure and trail maintenance and development.	1	Annually	FMFMD (PRD, WLD)
4.2.2 User days per activity.	3	10 Years	FMFMD (PRD, WLD)
4.2.3 Miles of trail systems by trail ownership and management type.	1	Annually	FMFMD (PRD)
4.2.4 Accident trends per activity per season.	1	Annually	LED
4.2.5 Satisfaction of recreational experience for selected programs.	4	NA	FMFMD (PRD, WLD, LED)
4.3.1 Miles of public Great Lakes, inland lakes and stream shoreline.	3	10 Years	FD
4.3.2 Percentage, area and representativeness of vegetative types in areas of natural and scientific interest.	3	5 Years	FMFMD (WLD, BIODIV TEAM)
4.3.3 Existence and level of nature oriented and eco-tourism activities, e.g. guiding and interpretive services for kayaking, canoeing, birding, elk viewing, wildlife viewing, hunting, fishing, photography, backpacking etc.	4	NA	FMFMD (MEDC)
4.3.4 Satisfaction of recreational experience for selected programs.	4	NA	Office of Communications
4.4.1 Number, type and distribution of campground facilities – rustic, modern, semi-modern, cabin rentals.	1	Annually	FMFMD (PRD)
4.4.2 Number of campsites by type in public and private campgrounds.	1	Annually	FMFMD (PRD, DEQ)
4.4.3 User days by campground and campsite.	1	Annually	FMFMD (PRD)
4.4.4. Number of dispersed camps per year.	1	Annually	FMFMD
4.4.5 Satisfaction of recreational experience for selected programs.	4	NA	FMFMD, PRD (WLD, LED)
4.5.1 Trends in water activity user days e.g. power/sail boating, jet-skis, canoes, rafting/tubing, kayaking, swimming, snorkeling, fishing, water skiing, boat races, cruise ships, sail boarding, etc.	3	10 Years	LED (MSU)
4.5.2 Trends in water recreation equipment sales and registrations.	1	Annually	PRD
4.5.3 Trends in commercial water recreation operators.	4	NA	LED
4.5.4 Number of water access sites and boat slips by type and capacity for watercraft and available amenities.	1	Annually	PRD
4.5.5 Change in status of water body designation and use.	2	5 Years	LED

4.5.6 Satisfaction of recreational experience for selected programs.	4	NA	PRD (FMFMD, LED)
4.6.1 Amount of public land open to outdoor recreation in Michigan, by agency.	1	Annually	FMFMD (PRD, WLD)
Core Metric	Tier	Measurement Frequency	Lead Division
5.1.1 Number, acres and distribution of Forest Stewardship, Conservation Reserve Program, Qualified Forest Program, American Tree Farm, Commercial Forest and Landowner Incentive Program private land management plans and percent of private ownership with management plans.	4	NA	FMFMD (WLD)
5.1.2 Number of acres and location by county of private land with public conservation easements.	3	5 Years	FMFMD (WLD)
5.1.3 Number, kinds, acres and by county of conservation easements.	3	5 Years	FMFMD
5.1.4 Number, kinds, and acres by county of cooperative planning "agreements" across ownerships, e.g. Clay Lake Plains Plan, Two Hearted River Watershed Plan, Les Cheneaux Economic Forum, Munuscong Watershed Plan, St. Mary's River Plan.	2	5 Years	FMFMD
5.1.5 Numbers, acres, and percentage of forested lands certified by county for sustainable forestry by ownership.	4	NA	FMFMD
5.2.1 Number by county of access easements to public lands.	2	5 Years	FMFMD (OLAF)
5.2.2 Number of acres and location by township of public land without access landlocked by private ownerships.	2	10 Years	FMFMD (OLAF)
5.2.3 Trends in numbers and location by county of barrier free facilities.	3	10 Years	FMFMD (PRD)
5.3.1 Percent of forest land and non-forest land by county.	2	10 Years	FMFMD
5.3.2 Acres of forest land converted to developed land.	4	NA	FMFMD
5.3.3 Amount of ownership fragmentation and parcelization of land.	3	10 Years	FMFMD (OLAF)
5.3.4. Number and size of forested parcels added to or removed from the Commercial Forest Program.	1	Annually	FMFMD
5.3.5 Distribution of forest land ownership by acres.	2	10 Years	FMFMD
5.3.6 Percent change by ownership class.	2	10 Years	FMFMD
6.1.1 Number of local economic development plans.	2	10 Years	FMFMD (DLEG)
6.1.2 Trends in job/income/employment/retirement data.	2	10 Years	FMFMD (DLEG)
6.1.3 Contribution of the resource use to gross domestic product (GDP) of all sectors of the economy.	2	10 Years	FMFMD (DLEG)
6.1.4 Diversity of forest economic activity.	2	10 Years	FMFMD (DLEG)
6.1.5 Capital outlay and investment trends.	2	10 Years	FMFMD (DLEG)

6.2.1 Number of recreation and tourism jobs/economic activity.	2	10 Years	FMFMD
6.2.2 Total expenditures by individuals by select activity.	2	10 Years	FMFMD
Core Metric	Tier	Measurement Frequency	Lead Division
6.2.3 Value and jobs/economic activity related to mineral, oil, and gas extraction.	2	10 Years	FMFMD
6.3.1 Timber volume, growth and mortality by county.	2	10 Years	FMFMD
6.3.2 Timber harvest by species by county.	2	10 Years	FMFMD
6.3.3 Value and volume of wood products by county.	2	10 Years	FMFMD
6.3.4 Number of jobs/economic activity, e.g. logging, hauling and mills.	2	10 Years	FMFMD
7.1.1 Presence of and compliance with land management laws and regulations based on continued Forest Certification management review system, Natural Resource Commission(NRC) and other open meetings, and stake holder reports.	1	Annually	FMFMD
7.1.2 Presence of and compliance with wildlife management laws and regulations.	2	5 Years	LED (WLD)
7.1.3 Presence of and compliance with recreation laws and regulations.	2	5 Years	LED (PRD, FMFMD)
7.1.4 Presence of and compliance with fisheries management laws and regulations.	2	5 Years	LED (FD)
7.1.5 Presence of and compliance with Native American treaty rights.	1	Annually	FMFMD
7.1.6 Presence of and compliance with Department and Division policies, procedures and guidelines.	3	5 Years	FMFMD (All DNR)
7.1.7 Number and extent of laws that reference ecosystem management.	2	10 years	FMFMD
7.2.1 Trends in public participation processes.	3	5 Years	FMFMD (All DNR)
7.2.2 The number of public advisory committees.	2	5 Years	FMFMD (All DNR)
7.3.1 Resources allocated within the Department for ecosystem management planning and monitoring.	2	5 Years	FMFMD (All DNR)
7.3.2 Participation in external planning efforts, e.g. National Forest plan revisions.	2	10 Years	FMFMD (All DNR)
7.3.3 Expenditure of resources and dedicated funds for implementation of "on-the-ground" projects.	3	Annually	FMFMD (All DNR)
7.3.4 Expenditure of resources and dedicated funds for research in ecosystem management.	3	Annually	FMFMD (All DNR)

Note: Organizations in parentheses represent contributing sources of data.