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**OPERATIONAL MANAGEMENT
GUIDANCE
FOR
STATE-OWNED FOREST
LANDS**

**Michigan Department of Natural Resources
Forest, Mineral & Fire Management**

IC 4250 (Rev. 08/24/2005))

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EXECUTIVE SUMMARY

Part 525, Sustainable Forestry on State Forestlands, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, requires the Michigan Department of Natural Resources (DNR) to manage the State Forest in a manner that is consistent with the principles of sustainable forestry, and to prepare and implement a management plan that states long-term management objectives and the means of achieving these objectives. Part 525 also requires the DNR to seek and maintain a third party certification of the management of the State Forest that satisfies the sustainable forestry standards of at least one credible certification program. This Operational Management Guidance (Guidance) is intended to help achieve these requirements. The drafting of this document is a joint effort by the DNR Forest, Mineral and Fire Management, Wildlife, and Fisheries Divisions. The final approval authority of this document is the Statewide Council.

The Guidance contains five major sections. Section 1 begins with a discussion of its purpose and use. The Guidance seeks to implement landscape ecosystem management, with a deliberate, multi-level and integrated approach to planning that will provide unity of effort, centralized strategic planning and direction at both State-wide and eco-regional levels, and also facilitates decentralized tactical planning at the Forest Management Unit level. When used with other plans, inventories and projects, it will provide multi-dimensional biological and social data to forest managers, which will help shape management options.

Section 2 of the Guidance document establishes a vision of desired future conditions for the State Forest. When long-term management goals for the State Forest are achieved, the forest will reflect the following desired future conditions:

- *Sustain fundamental ecological processes and functions that, in turn, support representative, diverse, and productive biological assemblages.*
- *Provide for a variety of ecosystem services that help sustain human civilization. Examples include purification of air and water, carbon storage, and moderation of drought and flood conditions.*
- *Provide for a variety of sustainable, human values related to ecosystems and the services they provide; including economic, recreational, and intrinsic values.*

Section 2 also sets forth long-term ecological and social-economic management objectives, the achievement of which will facilitate the vision of desired future conditions and guide our steps towards sustainable, ecosystem-based management of DNR-managed forest lands. These principles are:

- *Principle 1. Practice Sustainable, Ecosystem-based Management.*
 - Sub-Principle 1.1 Conserve Geophysical Processes.*
 - Sub-Principle 1.2 Conserve Biodiversity.*
 - Sub-Principle 1.3 Maintain Biotic Productivity.*
- *Principle 2. Maintain Essential Ecosystem Services.*
- *Principle 3. Sustain Social-Economic Values.*
- *Principle 4. Provide Public Access.*
 - Sub-Principle 4.1 Provide Recreational Opportunities.*
 - Sub-Principle 4.2 Provide Educational Opportunities.*
 - Sub-Principle 4.3 Allow for Cultural Uses.*


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In Section 3, the Guidance document establishes levels of management authority and forest administration at statewide, ecoregional, and Forest Management Unit levels, and then provides a description of the State Forest land management system.

The heart of the Guidance is in Section 4, where management guidance is provided that is intended to facilitate achievement of the long-term strategic principles, and to guide operational decisions regarding the management of the State Forest. It contains specific guidance related to each of the strategic principles. For each principle, a listing of existing resources (such as laws, work instructions, policies and procedures and other guidelines) is also included. Some detailed discussion of background information for each of the strategic principles is provided in Appendix H. The document concludes with Section 5, which describes the monitoring and management review processes that are required for assessing the effectiveness of management plans, and for incorporation of the results of monitoring into the revision and implementation of future management plans and procedures.

Included as Appendices is the text of Part 525, excerpts of the SFC and SFI standards, and a list of existing DNR planning processes and initiatives. Also in the Appendices are a template for ecoregional State Forest management plans, a list of forest certification work instruction, and a list of criteria and indicators for use in sustainable forest management. The planning template, work instructions and criteria and indicators are intended for use by Eco-Teams in the development of ecoregional management plans.

APPROVED BY THE STATE-WIDE COUNCIL:


Chairperson

8-26-05
Date

1. PURPOSE AND USE

1.1 - Part 525, Sustainable Forestry on State Forestlands

In 2004, the State Legislature enacted Part 525, Sustainable Forestry on State Forestlands, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Part 525 is included in Appendix A. As defined by Part 525, sustainable forestry means forestry practices that are designed to meet present and future needs by employing a land stewardship ethic that integrates the reforestation, managing, growing, nurturing, and harvesting of trees for useful products with the conservation of soil, air and water quality, wildlife and fish habitat, and visual qualities. Part 525 requires the DNR to manage the State Forest in a manner that is consistent with the principles of sustainable forestry, and to prepare and implement a management plan that states long-term management objectives and the means of achieving these objectives. This Guidance is intended to fulfill this requirement of Part 525.

1.2 - SFI and FSC Certification Standards

Section 52505 of Part 525 also requires the DNR to seek and maintain a third party certification of the management of the State Forest that satisfies the sustainable forestry standards of at least one credible certification program. Certification itself is required by January 1, 2006. The DNR is seeking forest management certification under two standards:

- The Regional Forest Stewardship Standard for the Lake States-Central Hardwoods Region (USA), as approved by the Forest Stewardship Council (FSC)-US Board on February 7, 2002, and accredited by FSC International on August 5, 2002.
- The Sustainable Forestry Initiative (SFI) 2005-2009 Standard as adopted by the Sustainable Forestry Board, Inc. on January 10, 2005.

Principle 7 of the FSC standard requires a management plan that includes long-term ecological, social and economic goals and objectives, and that describes desired future conditions that will meet the long-term goals and objectives. The desired future conditions in turn determine the silvicultural techniques and management prescriptions that are implemented by Forest Management Units (FMUs) in management of the State Forest. Excerpts of planning principles from the FSC Standards are contained in Appendix B. The certification standards also require strategic, long-term, landscape planning. Thus, another purpose of this Guidance document is to satisfy these certification requirements.

1.3 - Use of this document in the context of other DNR initiatives

There are a broad range of benefits and values that people desire from the natural resource base that are codified in plans, programs, and activities. Natural resources and human needs change over time - the challenge of natural resource management is to adapt and adjust plans and management activities to align with these changes while ensuring continued natural resource health into the future.

To meet these challenges, the DNR has adopted a philosophy of ecosystem management, which is a process that integrates biological, social and economic factors into a comprehensive strategy aimed at protecting and enhancing the sustainability, diversity and productivity of natural resources. The Ecological Society of America described eight elements of ecosystem management that were endorsed by the Statewide Council on September 15, 2000 for planning and managing Michigan's natural resources:

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1. **Sustainability:** Ecosystem management does not focus primarily on deliverables but rather regards intergenerational sustainability as a precondition.
2. **Goals:** Ecosystem management establishes measurable goals that specify future processes and outcomes necessary for sustainability.
3. **Sound Ecological Models and Understanding:** Ecosystem management relies on research performed at all levels of ecological organization.
4. **Complexity and Connectedness:** Ecosystem management recognizes that biological diversity and structural complexity strengthen ecosystems against disturbance and supply the genetic resources necessary to adapt to long-term change.
5. **The Dynamic Character of Ecosystems:** Recognizing that change and evolution are inherent in ecosystem sustainability, ecosystem management avoids attempts to freeze ecosystems in a particular state of configuration.
6. **Context and Scale:** Ecosystem processes operate over a wide range of spatial and temporal scales, and their behavior at any given location is greatly affected by surrounding systems. Thus, there is no single appropriate scale or timeframe for management.
7. **Humans as Ecosystem Components:** Ecosystem management values the active role of humans in achieving sustainable management goals.
8. **Adaptability and Accountability:** Ecosystem management acknowledges that current knowledge and paradigms of ecosystem functions are provisional, incomplete, and subject to change. Management approaches must be viewed as hypotheses to be tested by research and monitoring programs.

To implement landscape ecosystem management, a deliberate, multi-level, and integrated approach to planning is necessary to provide unity of effort, centralized strategic planning and direction at both State-wide and ecoregional levels, and to facilitate execution of decentralized tactical planning. A multi-level, integrated approach is well suited to the multi-tiered organizational structure of the DNR, and assures that ecosystem management will be employed throughout the DNR.

The DNR has myriad plans, programs, and activities that address management of individual or multiple natural resource elements, flora, fauna, watersheds, and/or ecosystems. A list of these planning processes and initiatives is provided in Appendix D. This sustainable forest management guidance provides additional information for managers to make informed operational decisions. It is intended to provide strategic, State-wide principles, which in turn will foster coherence and unity of effort for ecoregional and tactical FMU planning initiatives. In conjunction with short-term management objectives, the Guidance is intended to complement ecoregional planning efforts. The Guidance provides a menu of desired conservation objectives, management guidance and a set of criteria and indicators for sustainable forest management. When used with other plans, inventories and projects, it will give forest managers multi-dimensional biological and social principles with which to weigh management options. The Guidance is expected to change over time as both the resource and human interests and needs change. It can be integrated, as appropriate and applicable, into the DNR's public trust responsibilities and management efforts.

2. VISION AND MISSION FOR DNR-MANAGED FOREST LANDS

2.1 - Vision of Desired Future Conditions for DNR-Managed Forest Lands

The DNR has a vision of the desired future conditions of DNR-managed forest lands that are related to long-term management goals. When these goals are achieved the State Forest will:

- *Sustain fundamental ecological processes and functions that, in turn, support representative, diverse, and productive biological assemblages.*
- *Provide for a variety of ecosystem services that help sustain human civilization. Examples include purification of air and water, carbon storage, and moderation of drought and flood conditions.*
- *Provide for a variety of sustainable human values that are derived from ecosystems; including economic, recreational, and intrinsic values.*

2.2 - Mission for DNR-Managed Forest Lands

In the context of public trust responsibilities that consider interests of all current and future citizens in the State's natural resources, the DNR has adopted the following mission statement:

The Department of Natural Resources is committed to the conservation, protection, management, use, and enjoyment of the State's natural resources for current and future generations.

2.3 - Strategic Principles

With an understanding of the DNR's vision and mission, we can articulate specific long-term management goals. In this context, goals are presented as strategic principles. The DNR sets forth the following strategic principles to guide our steps towards sustainable, ecosystem-based management of DNR-managed forest lands:

2.3.1 - Ecological Principles

- **Principle 1. Practice Sustainable, Ecosystem-based Management.** Resource planning and operations shall be conducted to maintain the long-term integrity, representation, diversity, and productivity of terrestrial and aquatic ecosystems; with recognition of valued human activities and uses derived from these systems. Fundamental processes, functions, and values of ecosystems shall be protected or rehabilitated. In doing so, the following set of sub-principles shall be followed:

Sub-Principle 1.1 - Conserve Geophysical Processes. Resource planning and operations shall emphasize conservation and rehabilitation of geo-physical processes such as soils formation, geomorphic sediment dynamics, carbon dynamics, hydrologic dynamics, and nutrient dynamics. Such processes are the foundation of the habitat conditions required to sustain desired biological assemblages.

Sub-Principle 1.2 - Conserve Biodiversity. Resource planning and operations shall encourage the maintenance of intact, functional landscapes, ecosystems, and communities that will achieve the conservation of representative biological assemblages, including rare species; maintaining statewide biological diversity at ecosystem, species, and genetic levels.

Sub-Principle 1.3 - Maintain Biotic Productivity. Resource planning and operations shall protect, maintain, and rehabilitate ecosystem processes and

habitats to provide sustainable production of desired forest, wildlife, and fishery resources.

2.3.2 - Social-Economic Principles

- **Principle 2. Maintain Essential Ecosystem Services.** – Resource planning and operations shall ensure the variety of ecosystem services that help to sustain life and civilization.
- **Principle 3. Sustaining Social-Economic Values.** – Resource planning and operations shall encourage the efficient and sustainable production of desired forest, mineral, wildlife, and fishery resources to provide a range of social and economic benefits.
- **Principle 4. Provide Public Access.** Resource planning and operations shall protect and preserve the natural, historic, and cultural features of DNR-managed lands to provide public access to these resources. In doing so, the following subset of principles shall be followed:

Sub-Principle 4.1 Provide Recreational Opportunities. Resource planning and operations shall provide for a variety of active and passive recreational opportunities, tailored to specific local ecological and social characteristics.

Sub-Principle 4.2 Provide Educational Opportunities. Resource planning and operations shall provide public educational programs and opportunities that help build public understanding and appreciation for the important processes linking landscapes, ecosystems, habitats, and biological assemblages, and the human values and services derived from these natural systems.

Sub-Principle 4.3 Allow for Cultural Uses. Resource planning and operations shall allow for cultural uses by indigenous peoples and others.

3. FOREST ADMINISTRATION AND AUTHORITY

3.1- Statewide Authorities –

Authority of Divisions and The Statewide Council, Processes And Planning Initiatives

A framework of DNR authority and planning efforts is shown below in Figure 1. The upper layer of the diagram depicts the operational flow of authority within the DNR. The lower layer of the diagram depicts the flow of planning information within the DNR. The linkage between the two layers reflects the authority that divisional staff bring to planning processes through their participation on various teams and committees.

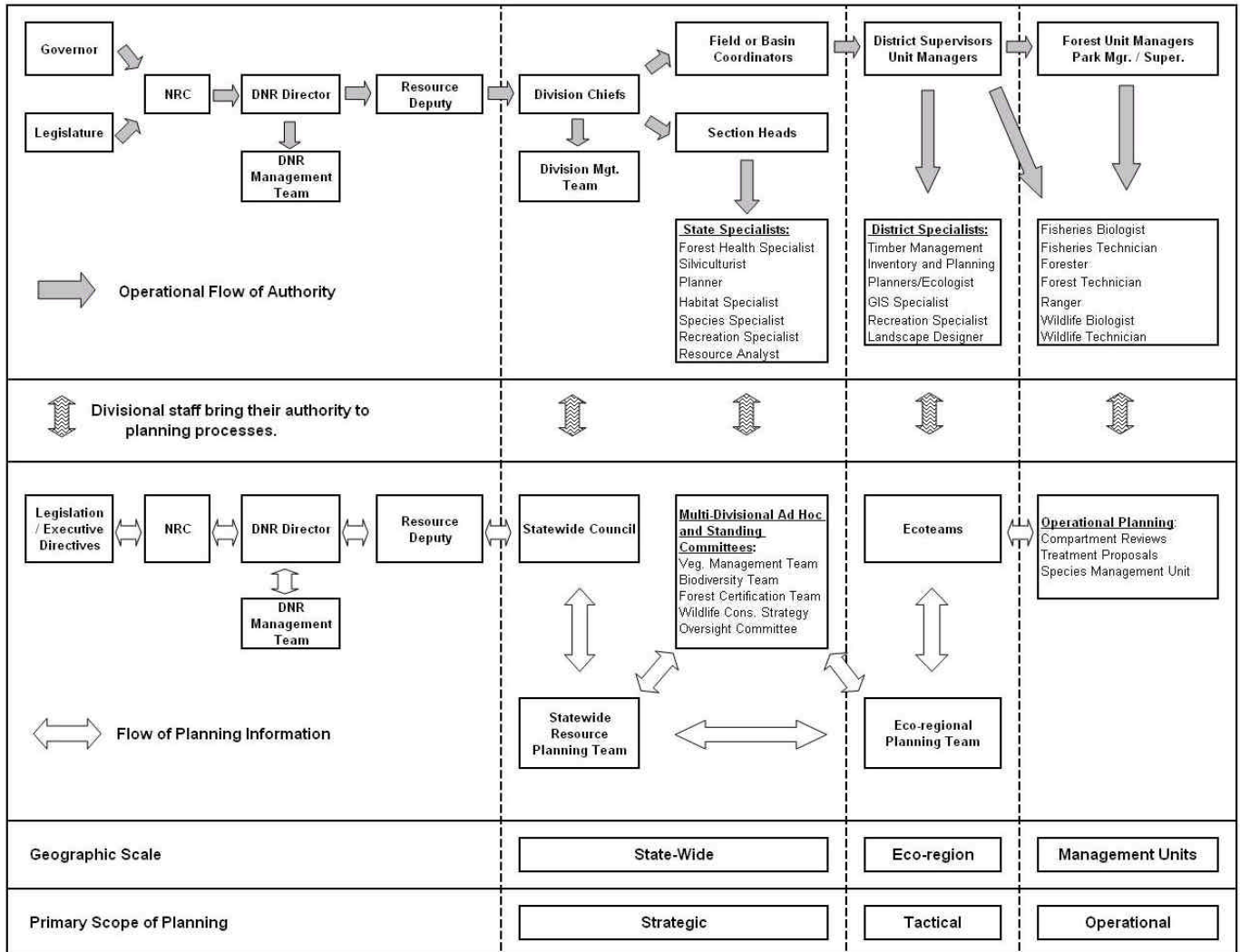


Figure 1. Framework of Michigan DNR Authority and Planning Efforts.

The authority of the DNR is derived from the Michigan State Constitution of 1963 Article IV § 52 {Natural Resources (Legislature)}:

“The conservation and development of the natural resources of the state are hereby declared to be of paramount public concern in the interest of the health, safety and general welfare of the people. The legislature shall provide for the protection of the air, water and other natural resources of the state from pollution, impairment and destruction.”

Part 5, Natural Resources and Environmental Protection Act, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, creates a Department of Natural Resources and confers on the Department powers to perform specified duties (MCL 324.501 Sec. 501 (1)).

Department is defined as: *“Department” means the director of the department of natural resources or his or her designee to whom the director delegates a power or duty by written instrument.* [Part 3, Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (MCL 324.301 Sec. 301 (b))].

Section 503 (1) of Part 5 requires that *“The department shall protect and conserve the natural resources of this state; provide and develop facilities for outdoor recreation; prevent the destruction of timber and other forest growth by fire or otherwise; promote the reforestation of forest lands belonging to the state;.....”*

The DNR Director has delegated responsibility and authority to Divisions and operating procedures as follows:

- a. Division and Office Chiefs. The Division and Office Chiefs are responsible to the Deputy Director of the Bureau in which their Division or Office is assigned. As operational program administrators, the Division and Office Chiefs have the responsibility to plan, implement, and evaluate the progress of their Division or Office programs. The responsibility and authority of the Division or Office Chief for program administration extends to all staff within the Division or Office in Lansing and field locations with the exception of specific field personnel assigned to the Deputy Directors for the Regions. [Director’s Letter No. 2, IIF., effective October 1, 1993]
- b. Statewide Council. The Statewide Council (SWC) is a DNR -wide team with the mission to implement ecosystem planning and management in the daily operations of the DNR through creation of operating mechanisms that support a holistic management environment. The council evolved out of the 1997 Joint Venture initiative, which in sought to develop ecosystem management processes, the use of geographic information systems (GIS), and implementation of adaptive and inter-divisional management techniques throughout the DNR. The council consists of the Deputy of the Resource Management Bureau, the Deputy of the Upper Peninsula, the Division Chiefs of the Resource Management Bureau, the Chief of the Office of Human Resources, the Chief of the Office of Communication, and the chairpersons of the Eco-teams.

The SWC is primarily responsible to address resource-based issues that:

1. Involve ecosystem or landscape scale planning efforts or management activities.
2. Cross ecoregional or watershed boundaries.
3. Cross divisional lines.
4. Involve statewide planning and/or major DNR projects.

A Statewide Resource Planning Team, which is comprised of one state specialist from each of the FMFM, Wildlife, Fisheries and Parks and Recreation Divisions, has been formed to assist the SWC in the fulfillment of these responsibilities. The purpose of the planning team is to enhance the consistency, compatibility and coordination of planning efforts between the ecoregional teams, multi-divisional committees and the SWC.

3.2 - Eco-Teams – authority, processes and planning templates

Eco-teams were appointed by the Statewide Council on September 15, 2000. There are currently three Eco-teams, the Northern Lower Peninsula, the Eastern Upper Peninsula, and the Western Upper Peninsula. Eco-teams are charged with duties and responsibilities by the SWC. The following authority was given by the council to the Eco-teams:

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1. Use principles of ecosystem management for planning and managing Michigan's natural resources.
2. Communicate and implement the cultural shift necessary for successful implementation of the Joint Ventures philosophy.
3. Define appropriate geographical boundaries for Ecoregions.
4. Be responsible for resource assessments for Ecoregions.
5. Be responsible for developing resource management plans for Eco-Regions.
6. Operate as self-directed work teams, with management authority as determined by existing laws, policies and Division goals and objectives.
7. Distribute information to keep the DNR and the public informed about Ecoregion activities.
8. Be responsible for identifying training needs.

Eco-Teams are responsible for assembling planning teams tasked with drafting eco-regional landscape management plans. These plans will provide long-term, landscape level direction for planning and operations at the management unit level, and must be consistent with and satisfy the certification requirements for sustainable forest management. Guidance for the development of ecoregional plans is provided in the Forest Certification Work Instruction 1.3 entitled "Ecoregional Plan Development". As described in this instruction, ecoregional plan development will be done in the context of other existing statewide, local and species-specific planning efforts. A template for ecoregion State Forest land management plans is contained in the work instruction and is also provided in Appendix E. A set of criteria and indicators are presented in Appendix F for consideration and use as common indicators by ecoregional planning teams in the development of ecoregional management plans.

Eco-Teams are to submit issues or projects via the Statewide Resource Planning Team to the SWC for review, guidance, resolution, support and approval. The chairpersons of the Eco-teams provide additional linkage to the SWC.

3.3 - Districts and Management Units – authority and processes

Director's Letter No. 2 dated October 1, 1993 delegates authority to field staff:

The responsibility and authority of the Division or Office Chief for program administration extends to all staff within the Division or Office in Lansing and field locations with the exception of specific field personnel assigned to the Deputy Directors for the Regions.

[Director's Letter No. 2, IIF., effective October 1, 1993]

The State Forest is comprised of four Districts and fifteen Forest Management Units (FMUs) that are co-managed by the FMFM and Wildlife Divisions. The Districts are the Eastern Lower Peninsula, the Western Lower Peninsula, the Eastern Upper Peninsula, and the Western Upper Peninsula. The District Supervisors are responsible for all FMU operations, and have a district staff that consists of timber management, recreation, and inventory and planning specialists. They are members of the three Eco-teams, and by themselves provide a linkage between ecoregional and FMU planning and operations. However, it is important that District Supervisors integrate their district staff and selected FMU staff into the ecoregional planning process in order to provide a sufficient knowledge base and other intrinsic resources to the planning effort.

Operational management of the State Forest is largely conducted at the FMU level. Forests at the FMU level are managed at the compartment and stand level on a rotating 10-year basis, as described in greater detail in Section 3.4.

3.4 - DNR State Forest Land Management System

The key concept in the application of ecosystem management at the stand and compartment level is that FMU operations are integrally related to larger landscape and ecoregional considerations. It is important that local operational decisions are not made in a vacuum, but take into account landscape level concepts that are consistent with and support ecoregional and statewide goals and objectives.

Policies and procedures for operational management have been supplemented by Forest Certification Work Instructions. These are written to allow the DNR to meet the requirements of sustainable forest management, as defined in the SFI and FSC certification standards. A complete list of these work instructions is provided in Appendix G. The following sub-set of work instructions is directly pertinent to and is required to be used by field staff in the course of daily forest operations:

Work Area Group 1 – Plan, Monitor and Review

- 1.4 Biodiversity Management on State Forest Lands
- 1.5 Social Impact Considerations and Public Involvement Processes
- 1.6 Forest Management Unit Analyses

Work Area Group 2 – Forest Regeneration and Chemical Use

- 2.1 Reforestation
- 2.2 Use of Pesticides and Other Chemicals on State Forest Lands
- 2.3 Integrated Pest Management and Forest Health

Work Area Group 3 – Best Management Practices (BMPs)

- 3.1 Forest Operations
- 3.2 Best Management Practices
- 3.3 Road Closures

Work Area Group 6 – Education and Recreation

- 6.1 Implementing Public Informational and Educational Opportunities on State Forests
- 6.2 Integrating Public Recreational Opportunities with Management on State Forest Lands

Work Area Group 7 – Integrated Implementation and Contracting

- 7.1 Timber Sale Preparation and Administration Procedures
- 7.2 Legal Compliance and Administration of Contracts

Work Area Group 9 – Tribal issues

- 9.1 Collaboration with Tribes in regard to management of State Forest Land.

At the Forest Management Unit (FMU) level, the State Forest is comprised of compartments, which are blocks of land that are 1,000-3,000 acres in size. The inventory process divides compartments into stands, generally ranging in size from 10-100 acres. Compartments are grouped by years-of-entry (Y.O.E.). Each year-of-entry contains approximately 10 percent of the compartments in a FMU. At the end of ten years, all of the compartments, and hence a whole FMU, will have been inventoried and reviewed.

The inventory and decision making process applied to compartments is governed by DNR Policy and Procedure No. 441, Operations Inventory and Compartment Review Procedures, dated January 19, 2000, which directs that inventory operations and associated compartment reviews be conducted using the “Operations Inventory Field Manual”.

As of 2005, the State Forest system is in the process of converting to a new inventory system and enterprise GIS decision making environment known as, “Integrated Forest Monitoring

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Assessment and Prescription” (IFMAP). The IFMAP is designed to better facilitate multi-scaled, ecosystem-based decision making.

Operations Inventory (O.I.) locates and identifies physical, biological, economic, and social information on each unit of land. It provides information for day-to-day operations relating to resource management issues such as timber, wildlife, forest recreation, water quality, reforestation, and land use. The O.I. system requires information that describes the composition of the stand, site factors, and a management prescription that supports State and Ecoregion goals and objectives for desired future conditions. In this process of integrated planning, it is critical that State-wide and landscape level ecosystem considerations be incorporated in the development of management unit goals and objectives upon which compartment and stand prescriptions are then based, as this is the means by which ecosystem-based management is achieved. Stand prescriptions are finalized in a public open house and a multi-disciplinary compartment review to ensure a public and DNR-wide consensus for compartment and management unit goals.

4. - OPERATIONAL FOREST MANAGEMENT GUIDANCE

Management of our natural resources is becoming ever more complex, with multiple and seemingly diametrically opposed ecological and social-economic interests competing for primacy in consultative planning processes. This section contains management guidelines that are intended to facilitate achievement of the long-term strategic principles, the vision of desired future conditions, and to help guide operational decisions regarding the management of the State Forest. This section will not prescribe how decisions are to be made or how issues are to be weighed, but simply presents guidelines that will enable field staff to work in concert for the achievement of common goals.

The objective of this Guidance is to engender the incorporation of landscape level considerations into ecoregional, compartment, and stand level operations. The Guidance is intended to provide direction and continuity in the drafting of ecoregional management plans. It will also provide direction to the compartment review process, where considerations regarding the sustenance of ecological and social-economic issues are balanced, and decisions on management objectives and prescriptions are formulated for forest stands and compartments. There is no universal guidance or direction that can be given to help weigh competing demands for social needs, economic forest resources, and ecological goals. However, it is important to recognize that it is sometimes appropriate for one interest to receive greater consideration than the others in the achievement of specific management objectives. An excellent example of this is found in the management of Kirtland's Warbler habitat, where ecological interests are given primacy, but social and economic forest resource interests are also taken into account in management plans for these sites. The key in this regard is to give due diligence to all competing interests, to account for the probable impacts to the subservient interests and to document all considerations in the decision making process. The ability to assess probable impacts will continually improve as our knowledge of these interests grows through monitoring processes.

Each section is comprised of specific guidelines related to the subject principle. For each principle, a listing of existing resources (such as laws, work instructions, policies and procedures and other guidelines) is provided. Linkage is also made to criteria and indicators, which provide a means of monitoring and understanding the consequences of earlier management decisions and providing feedback into the decision making process. Some detailed discussion of background information for each of the strategic principles is provided in Appendix H.

The Guidance is intended to supplement other operational management resources, such as State Forest Management Plans, Silvicultural Guidelines, Conservation Area Management Guidance, Best Management Guides, and Certification Work Instructions. For example, additional goals and guidance pertaining to landscape management of specific forest types and special resource areas is contained in the State Forest Management Plan, in State Silvicultural Guidelines, and in Conservation Area Management Guidance.

4.1 - Ecological Guidance

4.1.1 - Principle 1. - Sustainable Ecosystem-based Management

Sub-Principle 1.1 - Conservation of Geophysical Processes

a. Guidelines:

1. Management prescriptions should seek to retain soil organic matter content, nutrient retention and cycling by retaining plant litter upon the floor of forest stands.

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2. Management should use soil maps to identify wet soils that are vulnerable to compaction and rutting, and avoid actions (such as harvesting during wet seasons) that will cause excessive soil disturbance. Wetland areas should be flagged and buffered from vehicle traffic.
 3. Management prescriptions should incorporate water quality best management practices (BMPs) for riparian management zones, that minimize or eliminate skidding and access roads, log landings and stream crossings in these areas.
 4. BMP-related problems must be immediately identified, reported and remedied via positive corrective actions.
 5. Management prescriptions should follow BMP guidelines for slope and buffer widths that limit soil disturbance and biomass removal on high gradient sites (>10% slope) where the potential for soil erosion and sedimentation into aquatic systems is high. Management activity should be avoided in areas with >50% slope.
 6. Forest management prescriptions should strive to balance the retention of forest litter, large woody debris and snags with a reduction of excessive fuels loads that can contribute to catastrophic stand fires, which result in the loss of biomass and the alteration of carbon balances.
 7. Management prescriptions should maintain and restore forest canopy cover over stream corridors (riparian management zones) and incorporate water quality best management practices (BMPs) to limit soil disturbance and biomass removal on high gradient sites where the potential for soil erosion and sedimentation into aquatic systems is high.
 8. Forest management should strive to maintain and restore functional wetland habitats (including muskeg, bogs and vernal pools) within the matrix of the forest landscape.
- b. Criteria and Indicators for Soil Conservation:
A set of Criteria and Indicators for use in monitoring and assessing soil conservation are contained in Appendix F.
- c. List of Resources:
1. Water Quality Management Practices on Forest Land, Michigan Department of Natural Resources, 1994.
 2. Guidebook of Best Management Practices for Michigan Watersheds, Michigan Department of Environmental Quality, 1992 (Revised in 1997).
 3. DNR Policy and Procedures No. 512, Annual Fire Plan, dated December 13, 1999.
 4. DNR Policy and Procedures No.521, Forest Fire Law, dated June 16, 1981.
 5. DNR Forest Certification Work Instruction 3.1 – Forest Operations.
 6. DNR Forest Certification Work Instruction 3.2 – Best Management Practices Non-Conformance Reporting Instructions.
 7. DNR Forest Certification Work Instruction 3.3 – Road Closures.
 8. Evaluating Riparian Management Zones on State Lands - Approved Interim Guidelines, dated April 2004.
 9. Fisheries Division Policy and Procedure 02.01.001 – Wetland Alteration, dated April 22, 2005.

10. Fisheries Division Policy and Procedure 02.01.007 – Stream Crossings, dated April 22, 2005.
11. Fisheries Division Policy and Procedure 02.02.011 – Riparian Vegetation, dated April 22, 2005.
12. Fisheries Division Policy and Procedure 02.02.012 – Sediment Traps and In-Stream Detention Basins, dated April 22, 2005.

Sub-Principle 1.2 - Conservation of Biodiversity

a. Guidelines:

1. Forest management should conserve biological diversity and its associated values, water resources, soils and fragile ecosystems, and intact, high quality and functional landscapes [Ecological Reference Areas (ERAs), High Conservation Value Areas (HCVAs), and Special Conservation Areas (SCAs)]. These areas should be managed using the Conservation Area Management Guidance document.
2. In already fragmented landscapes, forest managers should maximize habitat connectivity to the extent possible at the landscape level, by creating habitat corridors and protecting riparian management zones, by maintaining variability in the size and patterns of harvests, and through restoration plantings.
3. To prevent further fragmentation of currently intact forest areas, the number and length of new roads and skid trails should be minimized.
4. On roads where there is a high potential for damage to natural resources, vehicle access should be restricted. Roads no longer required for access or management purposes and not part of a designated recreational ORV trail system, should be considered for closure in order to mitigate forest fragmentation.
5. Managers need to recognize and identify remaining intact and ecologically functional landscape ecosystems and areas of high ecosystem diversity, and, where possible, take positive action to prevent or reverse degradation or fragmentation of these resources. Forest managers should identify and refer potential biodiversity areas to the State Biodiversity Conservation Planning Team for consideration as a High Conservation Value Area under the Biodiversity Conservation Planning Process.
6. Identified habitats for State and Federally threatened and endangered (T&E) species should be maintained. Restoration of degraded T&E habitat should be considered in management plans when such potential areas are identified. Where identification of a community type indicates the likely presence of T&E species, new surveys should be conducted prior to development of management plans or the implementation of management prescriptions. Locations of newly discovered species should be reported to the Michigan Natural Features Inventory.
7. In forested ecosystems, the application of silvicultural prescriptions that maintain or foster spatial and temporal diversity and complexity of stand structure (such as large mature and declining trees, snags and large woody debris, multiple canopy layers, irregular tree spacing and gaps) should be used where possible to most effectively maintain community and species diversity.
8. When even-aged management is employed, live trees and native vegetation should be retained within a harvested unit in a proportion and configuration that is

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consistent with the size of the unit and the characteristic natural disturbance regime for the community type. Exceptions are allowed when retention at a lower level is necessary for purposes of restoration (such as oak and pine barrens), or to maintain specific community types (such as dry-mesic northern forests, and dry northern forests).

9. Guidance documents such as The Red Pine Project and Mesic Conifer Restoration of State Land should be used in incorporating biodiversity needs into plantation management plans.
 10. Plantations may be re-established on existing plantation sites. Forest conversion to plantations is prohibited, except in circumstances where conversion: 1) involves a very limited portion of the FMU; 2) does not involve a HCVA; and 3) enables substantial, long-term conservation benefits across the FMU. Forest management activities for wildlife habitat restoration (Kirtland's Warbler habitat, creation of openings, savannahs and wetlands) are not considered conversions.
 11. The ratio of monotypic plantations to natural and semi-natural forests, as well as their scale and spatial distribution, must maintain and/or restore the landscape to a condition that includes a diversity of community types, wildlife habitats, and ecological functions similar to a mosaic of stands within the natural landscape. Wildlife corridors, streamside zones and a mosaic of stands of different ages and rotation periods should be used in the layout of a plantation.
 12. On currently forested land within each ecoregion, plantation management is limited to 15% of the total area of a landscape unit. Where areas of forest and/or plantation are restored to natural and semi-natural conditions, they must be chosen through a landscape analysis that focuses on enhancing ecological integrity and habitat connectivity.
 13. When land is converted from non-forest uses (i.e. abandoned agricultural fields, and savannahs) to forest plantation uses, the minimum percentage of the total area that must be maintained as and/or restored to natural and semi-natural forest cover is as follows:
 - for 100 acres or less, at least 10 percent.
 - for 101 to 1,000 acres, at least 15 percent.
 - for 1,001 to 10,000 acres, at least 20 percent.
 - for > 10,000 acres, at least 25 percent.
 14. Forest management should judiciously use prescribed fire in order to maintain and restore species biodiversity in fire adapted ecosystems.
 15. Forest management should strive to preserve viable pools of wild genetic stock, and to utilize a variety of genetically diverse and regionally adapted seed stock for reforestation and afforestation purposes.
- b. Criteria and Indicators for Biodiversity:
A set of Criteria and Indicators for use in monitoring and assessing biodiversity are contained in Appendix F.
- c. List of Resources:
1. Part 351 Wilderness and Natural Areas
 2. Part 355 Biological Diversity Conservation

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3. DNR Forest Certification Work Instruction 1.4 – Biodiversity Management on State Forest Lands.
4. DNR Forest Certification Work Instruction 7.1 – Timber Sale Preparation and Administration Procedures.
5. DNR Forest Certification Work Instruction 2.1 – Reforestation.
6. DNR Forest Certification Work Instruction 3.3 – Road Closures.
7. DNR Policy and Procedures No. 241, Reforestation, dated October 26, 1999.
8. DNR Policy and Procedures No. 243, Tree Improvement, dated October 26, 1999.
9. DNR Policy and Procedures No. 572, Wildfires in State Natural Areas, dated March 15, 2001.
10. DNR Policy and Procedures No. 581, Prescribed Burning, date unknown.
11. DNR Guidelines for Managing Dead Wood to Enhance Biological Diversity on State Forest Lands, dated April 17, 1996.
12. Conservation Area Management Guidance.
13. Biodiversity Conservation Planning Process, dated April, 2005
14. FMFM GIS Biodiversity Information Layer
15. MNFI Species and Community Abstracts
16. 1985 Kirtland's Warbler Recovery Plan – guidance on management of jack pine (*Pinus banksiana*).
17. Draft Michigan Off-Road Vehicle(ORV) Plan 2005

Sub-Principle 1.3 - Maintenance of Biotic Productivity

a. Guidelines:

1. The compartment review process should include an assessment of current conditions to include:
 - Common vegetation, animals and their habitats
 - Unique, vulnerable, rare and threatened plant communities
 - Sensitive, threatened and endangered species and their habitats
 - Water and fishery resources
 - Soil resources
 - Natural disturbance regimes
 - Potential successional pathways, as identified using the Kotar Habitat Type Classification System.

The current ecological conditions supported by these factors should be compared with both historical conditions and desired future conditions within a landscape context, and this assessment should be used to develop management options and silvicultural practices that will achieve long-term desired future conditions and maintenance of the ecological functions and productivity of the forest.

2. Forest management should consider that landform, localized climate, soils, topographic aspect, growth-limiting nutrient factors, localized precipitation rates and forest canopy cover can create micro-climates that possess different hydrologic properties and support different forest communities across the forest landscape. The Kotar Habitat Type Classification System can be used to assist in determining site suitability when considering which tree species are best adapted to specific sites and local hydrologic conditions.
3. Projections and sustainability of harvest levels should be based upon inventory growth and regeneration data, site index models, and desired future conditions. Once desired conditions of species composition and age-class structure have been achieved, harvest and growth records should demonstrate that the volume harvested during any 10-year span does not exceed the net growth accumulated over that same period.
4. Forest management should strive to ensure that ecological functions and values are maintained intact, enhanced or restored at the forest and stand level. Ecological functions include forest regeneration and succession, and natural carbon, nutrient, and hydrologic cycles that affect the productivity of both forest and aquatic ecosystems. Ecological values include large mature and declining trees, shade trees for aquatic systems, snags for den and nest trees, den logs, terrestrial coarse dead wood, tip-up mounds and nurse logs, aquatic large woody debris, soil organic matter, and minimal sediment input and adequate organic energy input into aquatic systems.
5. The control and eradication of non-native plants should be considered in forest management prescriptions. The planting of native species is preferred over non-native tree species (which should be minimized and only planted after research documentation that they pose minimal ecological risk).
6. Forest management plans should implement control measures to minimize the erosion of soil and organic matter, and the resultant loss in site productivity.
7. Where forest stands that are primarily managed for fiber production, forest management rotations should seek to maximize the rate of biomass production with rotation lengths as recommended in silvicultural guidelines (dependent upon the tree species, site indexes and production goals – i.e. pulpwood vs. sawlog management objectives).
8. Forest management should promote healthy and productive forest conditions to minimize susceptibility to damaging disturbance. Silvicultural systems and prescriptions should be used to lower natural susceptibility and vulnerability of stands to fire, insect and disease outbreaks. Endemic levels of native pest populations should be tolerated before intensive control measures are implemented. Integrated pest management techniques should be utilized, and pesticides should be applied only in circumstances of severe pest infestation. If disease infestation or fire/windthrow disturbance mortality is extensive, then salvage operations are appropriate within the limits necessary for the maintenance of nutrient cycles and diversity of stand structure. Where non-native agents threaten the health and functioning of native ecosystems more immediate and proactive controls are appropriate.
9. Populations of ungulates should be managed to limit detrimental impacts upon natural and artificial forest regeneration, to ensure the retention of endemic species and species that are difficult to regenerate, and to prevent changes in the species composition of forests as a result of selective browsing.

b. Criteria and Indicators for the Maintenance of Biotic Productivity:

A set of Criteria and Indicators for use in monitoring and assessing biotic productivity are contained in Appendix F.

c. List of Resources:

1. State of Michigan Revised Silvics Guide
2. State Forest Silvicultural Guidelines
3. DNR Forest Certification Work Instruction 2.3 – Integrated Pest Management and Forest Health.
4. The Red Pine Project: Draft Guidelines for Red Pine Management based on Ecosystem Management Principles for State Forestland in Michigan, dated January 6, 2004.
5. A Process for Implementing Mesic Conifer Restoration on State Land, Western Upper Peninsula, Michigan, dated April 16, 2004.
6. DNR Policy and Procedures No. 591, Forest Pest Management, dated June 14, 1988.
7. DNR Policy and Procedures No. 593, Gypsy Moth Management Policy, dated June 14, 1988.
8. DNR Guidelines for Managing Dead Wood to Enhance Biological Diversity on State Forest Lands, dated April 17, 1996.
9. A Guide to Forest Communities and Habitat Types of Michigan (Burger and Kotar, 2003).

4.2 - Social-Economic Guidance

4.2.1 - Principle 2. Maintenance of Essential Ecosystem Services

a. Guidelines:

1. To assist in the maintenance of water quality, nutrient cycles, and habitat, riparian management zone guidelines should be applied to buffer stream corridors.
2. The primary management objective for wetlands should be to maintain water quality benefits.
3. Forest management prescriptions should promote the generation and maintenance of soil through the formation and preservation of soil organic matter in the form of detritus, and should avoid practices that erode or remove topsoil (O and A soil horizons).
4. Forest management efforts that promote prompt reforestation and manage for late successional forests should be used to provide carbon sequestration service to the biosphere.
5. Forest management should promote the regeneration and maintenance of a variety of vegetative habitats that support a wide assemblage of plant and animal communities throughout the forested landscape.

b. Criteria and Indicators for the Maintenance of Essential Ecosystem Services:

A set of Criteria and Indicators for use in monitoring and assessing the maintenance of essential ecosystem services are contained in Appendix F.

c. List of Resources:

1. Water Quality Management Practices on Forest Land, Michigan Department of Natural Resources, 1994.
2. Guidebook of Best Management Practices for Michigan Watersheds, Michigan Department of Environmental Quality, 1992 (Revised in 1997).
3. DNR Forest Certification Work Instruction 3.2 – Best Management Practices Non-Conformance Reporting Instructions.

4.2.2 - Principle 3. Sustaining Social-Economic Values

a. Guidelines:

1. Forest management operations should encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits, while taking into account environmental, social, and operational costs of production, and ensuring the investments necessary to maintain the ecological productivity of the forest.
2. Forest management should strive to strengthen and diversify local economies by supporting diversified forest uses and products. This should be accomplished efficiently and without compromising forest composition, structure, or ecological function.
3. In line with efficient and ecologically-sound management and in collaboration with partners, forest policy and procedures should encourage multiple uses of forests and, where economically competitive, local processing of forest products.
4. Diversity of public participation should be sought to measure and assess the social impacts of forest management. These processes range from routine FMU open houses, ongoing open compartment reviews through episodic and direct meetings by FMU staff with a wide array of stakeholders, focus groups and citizen advisory committees.
5. The rate of harvest of forest products should not exceed levels that can be biologically sustained. The sustainability of harvest levels is based upon growth and regeneration data, site index potentials and growth models, and limits are modified by desired future conditions of the forest.
6. For the purposes of providing a consistent supply of fiber, forest management should strive to achieve balanced age and size class distributions of forest stands across the landscape (excluding ERAs, HCVA's and SCAs).

b. Criteria and Indicators for Sustaining Social-Economic Values:

A set of Criteria and Indicators for use in monitoring and assessing social-economic values are contained in Appendix F.

c. List of Resources

1. DNR Forest Certification Work Instruction 1.5 – Social Impact Considerations and Public Involvement Processes.
2. DNR Forest Certification Work Instruction 1.6 – Forest Management Unit Analysis.
3. DNR Forest Certification Work Instruction 1.7 – State Forest Timber Harvest Trends.
4. DNR Forest Certification Work Instruction 6.2 – Integrating Public Recreational Opportunities with Management on State Forest Lands.

4.2.3 - Principle 4. Provision of Public Access

Sub-Principle 4.1 - Recreational Opportunities

a. Guidelines:

1. Communication among DNR personnel and external interests is critical and should be used to ensure that development, enhancement, or reductions of recreational facilities are integrated and compatible with other forest operations. Ongoing attention needs to be given to levels and changes in recreational demands, noted in compartment reviews, and communicated up the chain of command and to recreation program staff.
2. Diversity of public participation should be involved in the process of recreational planning and management. Means of involvement range from routine FMU open houses, ongoing open compartment reviews through episodic and direct meetings by FMU staff with a wide array of stakeholders, focus groups and citizen advisory committees.
3. Boundary signs should be in place in order to clarify the limits of recreation sites to prevent trespass upon private properties.
4. Customary use areas (e.g. wild fruit and mushroom habitats) should be considered in management plans.
5. Where visual aesthetics are a concern (i.e. for scenic areas or vistas) aesthetic considerations should be given to harvesting patterns, road placement, and landing designs.
6. The average size of clearcut harvests should not exceed 120 acres. Regeneration in clearcut stands should be at least 3-years old, or 5-feet high at desired stocking levels before adjacent stands are clearcut. Harvests in response to disease infestations or natural disturbances, or for special management areas (such as Kirtland's Warbler habitat) are exceptions to these requirements.

b. Criteria and Indicators for Recreational Opportunities:

A set of Criteria and Indicators for use in monitoring and assessing recreational opportunities are contained in Appendix F.

c. List of Resources:

1. DNR Forest Certification Work Instruction 6.2 – Integrating Public Recreational Opportunities with Management on State Forest Lands.
2. Off-Road Vehicle (ORV) Trail and Route Maintenance Handbook (IC-1991).
3. Draft Michigan Off-Road Vehicle(ORV) Plan 2005
4. 2003-2007 State Comprehensive Outdoor Recreation Plan

Sub-Principle 4.2 - Educational Opportunities

a. Guidelines:

1. Natural heritage data from the State Historic Preservation Office and the Michigan Natural Features Inventory can be used for identifying and protecting sites that possess unique historical, archeological, geological or ecological qualities. Such information may be confidential in nature, and is not always appropriate for public disclosure. Where the integrity of the site will not be compromised by public disclosure, such areas may present educational opportunities.

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2. Interpretive signs, trails and other similar educational tools should be considered in forest management plans. Cooperative projects with local conservation organizations should be explored. Where maintenance of existing educational facilities is limited by resources, cooperative management or expansion of these facilities may be appropriate in lieu of the creation of new facilities.
 3. Where there is no conflict with operational management plans, the conduct of basic scientific research on State Forest lands should be encouraged. Such research may be conducted by DNR research staff, or may be conducted in cooperation with public or private university staff and/or students, Federal government agencies, or other private or non-profit organizations.
 4. In addition to maintaining and distributing appropriate written informational brochures and publications, web pages should be used to provide information and links to other information sources.
- b. Criteria and Indicators for Educational Opportunities:
A set of Criteria and Indicators for use in monitoring and assessing educational opportunities are contained in Appendix F.
- c. List of Resources:
1. DNR Forest Certification Work Instruction 6.1 –Implementing Public Information and Educational Opportunities on State Forests.
 2. NRC Policy 1005 – Public Involvement in Activities of the Department.
 3. OI Manual, Chapter 7 – Compartment Reviews.

Sub-Principle 4.3 - Cultural Uses

- a. Guidelines:
1. State Forest planning should consider tribal rights reserved by treaty, spiritual and cultural values and practices, archaeological and heritage resources, and adjacent tribal or trust lands.
 2. Tribal Historical Preservation Officers (THPO) should be notified of any activities involving Federal funding, which may affect tribal archeological sites or tribal cultural property.
 3. Natural heritage data from the State Historic Preservation Office, should be notified of all compartment review plans or other activities that may affect tribal sites of historical significance.
 4. Native American Nations should be invited to all FMU open houses and notified of all compartment reviews for the purpose of identifying and protecting sites that possess unique cultural, historical, religious or ceremonial significance.
 5. Sites of archeological, historical or cultural interests are confidential in nature and should be protected from public disclosure, since they are exempt from the Freedom of Information Act.
 6. Forest managers should invite the participation of concerned groups in collaborative planning and implementation of forest management activities, so that cultural and historic sites may be protected from damage or interference.

b. Criteria and Indicators for Cultural Uses:

A set of Criteria and Indicators for use in monitoring and assessing cultural uses are contained in Appendix F.

c. List of Resources:

1. DNR Forest Certification Work Instruction 1.5 – Social Impact Considerations and Public Involvement Processes.
2. DNR Forest Certification Work Instruction 9.1 – Collaboration with Tribes in regard to management of State Forest Lands.

5. - MONITORING AND REVIEW PROCESSES

5.1 - Management Review Process

The DNR State Forest management review process is described in the Forest Certification Work Instruction 1.2 - Management Review Process for continual improvement in the management of forest resources. The work instruction describes internal audit schedules, annual Forest Certification Surveillance Audits, Field Management Reviews, and procedures for implementing improvements.

The SWC will conduct an annual management review to evaluate the results of the annual State Forest operations audits. These reviews will evaluate the effectiveness of work instructions and areas of non-conformance, and determine what changes are necessary to continually improve operations. The review will be based upon the following:

1. Internal Audits of FMUs. All fifteen FMUs will receive an initial audit of their operations, and thereafter will receive internal audits on a 3-year cycle with five FMUs being audited per year, in accordance with a schedule to be issued by the DNR Statewide Council.
2. Annual Forest Certification Surveillance Audits will be conducted by certified FSC and SFI auditors.
3. Field Management Reviews of the Annual Forest Certification Audit results will be conducted for the Upper Peninsula and the Northern Lower Peninsula regions to evaluate field operations and DNR programs. A report will be drafted for submission to the SWC, addressing the conformance of DNR operations with the forest certification standards, and providing recommendations for improvement.

The SWC will approve changes necessary to continually improve conformance with work instructions. The DNR Division Chiefs are responsible for implementing approved recommendations.

5.2 - Monitoring Process

Monitoring needs to be well-integrated at the ecoregional level. Monitoring shall be conducted by Forest Management Units and Eco-Teams to assess the condition of the State Forest, the degree to which management objectives have been achieved, deviations from management plans, and the social and environmental impacts of management activities. Utilizing ecoregion-specific criteria and indicators, the following elements of forest management should be monitored:

1. The yield of all forest products harvested.
2. Growth rates, regeneration and condition of the forest.
3. Composition and observed changes in flora and fauna.
4. Environmental and social impacts of harvesting and other operations.
5. Cost, productivity and efficiency of forest management.

Forest Certification Work Instructions 1.6 - Forest Management Unit Analysis, and 1.7 - State Forest Timber Harvest Trends provide additional guidance for monitoring and reporting of these elements.

Results of monitoring and assessment shall be incorporated into the revision and implementation of future ecoregional and FMU management plans. Discrepancies between the results of management activities and expectations of plans and forecasts shall be appraised and considered in subsequent plan revisions.

5.3 - Other Monitoring Processes

An integrated or holistic monitoring process is lacking at a State-wide level, as there are a number of other existing planning processes (Appendix D) that have varying degrees of monitoring components. Some are propelled by the annual budgetary process, including federal grants programs. Others are programmatically driven, such as the annual Timber Sale Preparation Plan of Work process, Ecoregional Plan Criteria and Indicator monitoring, FMU analyses, the Biodiversity Conservation Planning Process, and annual fire plans. Some are ad hoc and project oriented or dependent upon the appointment and perpetuation of various teams.

5.4 Revision Process

Operational components of State-wide and eco-regional management plans will be reviewed and revised as necessary, but at a minimum of every five years. Strategic components of Statewide and eco-regional management plans are to be reviewed and if necessary revised or updated at the completion of each 10-year compartment review cycle, or when other changes in management require revision.

The 10-year planning cycle for compartment reviews is operationally implemented by O.I. and Compartment Review Procedures, as contained in FMD Policy 441 dated January 19, 2000.

6. APPENDICES

APPENDIX A- Part 525, Statewide Forest Resources Plan, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended.

Act No. 125
Public Acts of 2004
Approved by the Governor
May 28, 2004
Filed with the Secretary of State
May 28, 2004
EFFECTIVE DATE: May 28, 2004

**STATE OF MICHIGAN
92ND LEGISLATURE
REGULAR SESSION OF 2004**

Introduced by Reps. Casperson, Stahl, Pastor, Sheen, Walker, Pappageorge, Shackleton, Amos, Nofs, Meyer, Huizenga, Nitz, Palsrok, Palmer, Emmons, LaJoy, Voorhees, Moolenaar, Ward, Bisbee, Hune, Farhat, Mortimer, Hummel, Caswell, Robertson, Shaffer, DeRoche, Julian, Taub, Richardville, Vander Veen, Brandenburg, Acciavatti, Drolet and Bradstreet

ENROLLED HOUSE BILL No. 5554

AN ACT to amend 1994 PA 451, entitled "An act to protect the environment and natural resources of the state; to codify, revise, consolidate, and classify laws relating to the environment and natural resources of the state; to regulate the discharge of certain substances into the environment; to regulate the use of certain lands, waters, and other natural resources of the state; to prescribe the powers and duties of certain state and local agencies and officials; to provide for certain charges, fees, and assessments; to provide certain appropriations; to prescribe penalties and provide remedies; to repeal certain parts of this act on a specific date; and to repeal certain acts and parts of acts," by amending the heading to part 525 and section 52501 (MCL 324.52501), as added by 1995 PA 57, and by adding sections 52502, 52503, 52504, 52505, and 52506.

The People of the State of Michigan enact:
**PART 525 SUSTAINABLE
FORESTRY ON STATE FORESTLANDS**

Sec. 52501. As used in this part:

- (a) "Breast height" means 4.5 feet from highest ground at the base of the tree.
- (b) "Certification" means a process where an independent third party organization assesses and evaluates forest management practices according to the standards of a certification program resulting in an issuance of a certificate of compliance or conformity.
- (c) "Certification program" means a program that develops specific standards that measure whether forest management practices are consistent with principles of sustainable forestry.
- (d) "Conservation" means the wise use of natural resources.

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- (e) “Diameter class specifications” means a classification of trees based on the diameter at breast height.
- (f) “Plan” means the forestry development, conservation, and recreation management plan for state forests as provided for in section 52503.
- (g) “Reforestation” means adequate stocking of forestland is assured by natural seeding, sprouting, suckering, or by planting seeds or seedlings.
- (h) “Residual basal area” means the sum of the cross-sectional area of trees 4 inches or greater in diameter measured at breast height left standing within a stand after a harvest.
- (i) “State Forest” means state land owned or controlled by the department that is designated as State Forest by the director.
- (j) “Sustainable forestry” means forestry practices that are designed to meet present and future needs by employing a land stewardship ethic that integrates the reforestation, managing, growing, nurturing, and harvesting of trees for useful products with the conservation of soil, air and water quality, wildlife and fish habitat, and visual qualities.

Sec. 52502. The department shall manage the State Forest in a manner that is consistent with principles of sustainable forestry and in doing so shall do all of the following:

- (a) Manage forests with consideration of its economic, social, and environmental values by doing all of the following:
 - (i) Broaden the implementation of sustainable forestry by employing an array of economically, environmentally, and socially sound practices in the conservation of forests, using the best scientific information available.
 - (ii) Promote the efficient utilization of forest resources.
 - (iii) Broaden the practice of sustainable forestry by cooperating with forestland owners, wood producers, and consulting foresters.
 - (iv) Plan and manage plantations in accordance with sustainable forestry principles and in a manner that complements the management of and promotes the restoration and conservation of natural forests.
- (b) Conserve and protect forestland by doing all of the following:
 - (i) Ensure long-term forest productivity and conservation of forest resources through prompt reforestation, soil conservation, afforestation, and other measures.
 - (ii) Protect the water quality in streams, lakes, and other waterbodies in a manner consistent with the department’s best management practices for water quality.
 - (iii) Manage the quality and distribution of wildlife habitats and contribute to the conservation of biological diversity by developing and implementing stand and landscape-level measures that promote habitat diversity and the conservation of forest plants and animals including aquatic flora and fauna and unique ecosystems.
 - (iv) Protect forests from wildfire, pests, diseases, and other damaging agents.
 - (v) Manage areas of ecologic, geologic, cultural, or historic significance in a manner that recognizes their special qualities.
 - (vi) Manage activities in high conservation value forests by maintaining or enhancing the attributes that define such forests.
- (c) Communicate to the public by doing all of the following:

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- (i) Publicly report the department's progress in fulfilling its commitment to sustainable forestry.
 - (ii) Provide opportunities for persons to participate in the commitment to sustainable forestry.
 - (iii) Prepare, implement, and keep current a management plan that clearly states the long-term objectives of management and the means of achieving those objectives.
- (d) Monitor forest management by promoting continual improvement in the practice of sustainable forestry and monitoring, measuring, and reporting performance in achieving the commitment to sustainable forestry.
- (e) Consider the local community surrounding State Forestland by doing both of the following:
- (i) Require that forest management plans and operations comply with applicable federal and state laws.
 - (ii) Require that forest management operations maintain or enhance the long-term social and economic well-being of forest workers and local communities.

Sec. 52503.

- (1) The department shall adopt a forestry development, conservation, and recreation management plan for state owned lands owned or controlled by the department. Parks and recreation areas, state game areas, and other wildlife areas on these lands shall be managed according to their primary purpose. The department may update the plan as the department considers necessary or appropriate. The plan and any plan updates shall be consistent with section 52502 and shall be designed to assure a stable, long-term, sustainable timber supply from the State Forest as a whole.
- (2) The plan and any plan updates shall include all of the following:
- (a) An identification of the interests of local communities, outdoor recreation interests, the tourism industry, and the forest products industry.
 - (b) An identification of the annual capability of the State Forest and management goals based on that level of productivity.
 - (c) Methods to promote and encourage the use of the State Forest for outdoor recreation, tourism, and the forest products industry.
 - (d) A landscape management plan for the State Forest incorporating biodiversity conservation goals, indicators, and measures.
 - (e) Standards for sustainable forestry consistent with section 52502.
 - (f) An identification of environmentally sensitive areas.
 - (g) An identification of the need for forest treatments to maintain and sustain healthy, vigorous forest vegetation and quality habitat for wildlife and environmentally sensitive species.

Sec. 52504.

- (1) After the plan is adopted under section 52503, the department shall harvest timber from the State Forest and other state owned lands owned or controlled by the department in compliance with the plan and any plan updates.
- (2) Unless otherwise dedicated by law, proceeds from the sale of timber from the State Forest and other state owned lands owned or controlled by the department shall be forwarded to the

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state treasurer for deposit into the forest development fund established pursuant to section 50507.

Sec. 52505.

(1) The department shall seek and maintain third-party certification that the management of the State Forest and other state owned lands owned or controlled by the department satisfies the sustainable forestry standards of at least 1 credible nonprofit, nongovernmental certification program and this part.

(2) Beginning January 1, 2006, the department shall ensure that the State Forest is certified as provided for in subsection (1).

(3) Beginning the effective date of the amendatory act that added this section, the department shall commence a review and study to determine the appropriateness of certifying parks and recreation areas, state game areas, and other wildlife areas on state owned lands owned or controlled by the department. Not later than 1 year after the effective date of the amendatory act that added this section, the department shall report and recommend to the legislature the appropriateness and feasibility of certifying those lands.

Sec. 52506. By January 1 of each year, the department shall prepare and submit to the commission of natural resources, the standing committees of the senate and the house of representatives with primary jurisdiction over forestry issues, and the senate and house appropriations committees a report that details the following from the previous state fiscal year:

- (a) The number of harvestable acres in the State Forest as determined by the certification program under section 52506.
- (b) The number of acres of the State Forest that were harvested and the number of cords of wood that were harvested from the State Forest.
- (c) The number of acres of state owned lands owned or controlled by the department other than State Forestlands that were harvested and the number of cords of wood that were harvested from those lands.
- (d) Efforts by the department to promote recreational opportunities in the State Forest.
- (e) Information on the public's utilization of the recreational opportunities offered by the State Forest.
- (f) Efforts by the department to promote wildlife habitat in the State Forest.
- (g) The status of the plan and whether the department recommends any changes in the plan.
- (h) Status of certification efforts required in section 52505 and, beginning in 2006, a definitive statement of whether the department is maintaining certification of the entire State Forest.
- (i) A description of any activities that have been undertaken on forest pilot project areas described in section 52511.

Enacting Section 1. This amendatory act does not take effect unless all of the following bills of the 92nd Legislature are enacted into law:

- (a) Senate Bill No. 1023.
- (b) Senate Bill No. 1024.

This act is ordered to take immediate effect.

APPENDIX B. - Excerpts of Planning Principles from the FSC Standards.

**PRINCIPLE 7
MANAGEMENT PLAN**

A management plan appropriate to the scale and intensity of the operations shall be written, implemented, and kept up-to-date. The long-term objectives of management, and the means of achieving them, shall be clearly stated.

7.1. - The management plan and supporting documents shall provide:

- a. Management objectives.**
- b. Description of the forest resources to be managed, environmental limitations, land use and ownership status, socio-economic conditions, and a profile of adjacent lands.**
- c. Description of silvicultural and/or other management system, based on the ecology of the forest in question and information gathered through resource inventories.**
- d. Rationale for rate of annual harvest and species selection.**
- e. Provisions for monitoring of forest growth and dynamics.**
- f. Environmental safeguards based on environmental assessments.**
- g. Plans for the identification and protection of rare, threatened and endangered species.**
- h. Maps describing the forest resource base including protected areas, planned management activities and land ownership.**
- i. Description and justification of harvesting techniques and equipment to be used.**

Applicability Note: The management plan may consist of a variety of documents not necessarily unified into a single planning document but which represents an integrated strategy for managing the forest within the ecological, economic, and social limitations of the land. The plan includes a description and rationale for management elements appropriate to the scale, intensity, and goals of management, and may include:

- Silvicultural systems
- Regeneration strategies
- Maintenance of structural and species diversity
- Pest control (disease, insects, invasive species, and vegetation)
- Soil and water conservation
- Methods and annual rates of harvest, by species and products
- Equipment and personnel needs
- Transportation system
- Fire management
- Prescribed fires
- Wildfires
- Fish and wildlife and their habitats (including non-game species)
- Non-timber forest products
- Methods and annual rates of harvest, by species and products
- Regeneration strategies
- Socioeconomic issues

- Public access and use
- Conservation of historical and cultural resources
- Protection of aesthetic values
- Employee and contractor policies and procedures
- Community relations
- Stakeholder notification
- Public comment process
- For public forests, legal and historic mandates
- American Indian issues
- Protection of legal and customary rights
- Procedures for integrating tribal concerns in forest management
- Management of sites of special significance
- Special management areas
- High Conservation Value Forests
- Riparian management zone
- Set asides of samples of representative existing ecosystems
- Sensitive, rare, threatened, and endangered species protection
- Other protected areas
- Landscape level analyses and strategies

7.1.a. - Management objectives

7.1.a.1. A written management plan is prepared that includes the landowner's short-term and long-term goals and objectives (ecological, social, and economic). The objectives are specific, achievable, and measurable.

7.1.a.2. The management plan describes desired future conditions that will meet the long-term goals and objectives and that determine the silvicultural system(s) and management activities to be used.

7.1.b. - Description of forest resources to be managed, environmental limitations, land use and ownership status, socioeconomic conditions, and profile of adjacent lands

7.1.b.1. The management plan describes the timber, fish and wildlife, harvested nontimber forest products, soils, and non-economic forest resources.

7.1.b.2. The management plan includes descriptions of special management areas; sensitive, rare, threatened, and endangered species and their habitats; and other ecologically sensitive features in the forest.

7.1.b.3. The management plan includes a description of past land uses and incorporates this information into the vision, goals, and objectives.

7.1.b.4. The management plan identifies the legal status of the forest and its resources (e.g., ownership, usufruct rights (see Glossary), treaty rights, easements, deed restrictions, and leasing arrangements).

7.1.b.5. The management plan identifies relevant cultural and socioeconomic issues (e.g., traditional and customary rights of use, access, recreational uses, and employment), conditions (e.g., composition of the workforce, stability of employment, and changes in forest ownership and tenure), and areas of special significance (e.g., ceremonial and archeological sites).

7.1.b.6. The management plan incorporates landscape-level considerations within the ownership and among adjacent and nearby lands, including major bodies of water, critical habitats, and riparian corridors shared with adjacent ownerships.

7.1.c. - Description of silvicultural and/or other management system

7.1.c.1. Silvicultural system(s) and prescriptions are based on the integration of ecological and economic characteristics (e.g., successional processes, soil characteristics, existing species composition and structures, desired future conditions, and market conditions). (see also sub-Criterion 6.3.a)

7.1.c.2. Prescriptions are prepared prior to harvesting, site preparation, pest control, burning, and planting and are available to people who implement the prescriptions.

7.1.d. - Rationale for the rate of annual harvest and species selection

7.1.d.1. Calculations for the harvests of both timber and non-timber products are detailed or referenced in the management plan and are based on net growth, yield, stocking, and regeneration data. (see also 5.6.b)

7.1.d.2. Species selection meets the social and economic goals and objectives of the forest owner or manager and leads to the desired future conditions while maintaining or improving the ecological composition, structures, and functions of the forest.

7.1.d.3. The management plan addresses potentially disruptive effects of pests, storms, droughts, and fires as they relate to allowable cut.

7.1.e. - Provisions for monitoring forest growth and dynamics (see also Principle 8)

7.1.e.1. The management plan includes a description of procedures to monitor the forest.

7.1.f. - Environmental safeguards based on environmental assessments (see also Criterion 6.1.)

7.1.g. - Plans for the identification and protection of rare, threatened, and endangered species. (see also Criterion 6.3.)

7.1.h. - Maps describing the forest resource base including protected areas, planned management activities, and land ownership.

7.1.h.1. The management plan includes maps of such forest characteristics as: relevant landscape-level factors; property boundaries; roads; areas of timber production; forest types by age class; topography; soils; riparian zones; springs and wetlands; archaeological sites; areas of cultural and customary use; locations of sensitive, rare, threatened, and/or endangered species and their habitats; and designated High Conservation Value Forests.

7.1.i. - Description and justification of harvesting techniques and equipment to be used. (see also Criterion 6.5)

7.1.i.1. Harvesting machinery and techniques are discussed in the management or harvest plan and are specifically matched to forest conditions in order to minimize damage.

7.1.i.2. Conditions for each timber sale are established by a timber sale contract or written harvest prescription and accompanying timber sale map.

7.2. - The management plan shall be periodically revised to incorporate the results of monitoring or new scientific and technical information, as well as to respond to changing environmental, social and economic circumstances.

7.2.a. Operational components of the management plan are reviewed and revised as necessary or at least every 5 years. Components of the long-term (strategic) management plan are revised and updated at the end of the planning period or when other changes in the management require it. (see also Criterion 8.4)

7.3. - Forest workers shall receive adequate training and supervision to ensure proper implementation of the management plans.

7.3.a. The forest owner or manager assures that workers are qualified to implement the management plan (see also Criterion 4.2).

7.3.b. The management plan is understandable, comprehensive, and readily available to field personnel.

7.4. - While respecting the confidentiality of information, forest managers shall make publicly available a summary of the primary elements of the management plan, including those listed in Criterion 7.1.

Applicability Note: Forest owners or managers of private forests may withhold proprietary information (e.g., the nature and extent of their forest resource base, marketing strategies, and other financial information). (see also Criterion 8.5)

7.4.a. A management plan summary that outlines management objectives (from sub-Criterion 7.1.a.), whether on private lands or the land pool under a resource manager, is available to the public at a reasonable fee. Additional elements of the plan may be excluded, to protect the security of environmentally sensitive and/or proprietary information.

7.4.b. Managers of public forests make forestry-related information easily accessible (e.g., available on websites) for public review, including that required by Criterion 7.1.

APPENDIX C. - Excerpts of Planning Objectives from the SFI Standards.

Objective 1. To broaden the implementation of *sustainable forestry* by ensuring long-term harvest levels based on the use of the *best scientific information* available.

Performance Measure 1.1. *Program Participants* shall ensure that long-term harvest levels are sustainable and consistent with appropriate *growth-and-yield models* and written plans.

Indicators:

1. A long-term resource analysis to guide forest management planning at a level appropriate to the size and scale of the operation, including
 - a. a periodic or ongoing forest *inventory*;
 - b. a *land classification* system;
 - c. soils *inventory* and maps, where available;
 - d. access to *growth-and-yield modeling* capabilities;
 - e. up-to-date maps or a *geographic information system (GIS)*;
 - f. recommended sustainable harvest levels; and
 - g. a review of nontimber issues (e.g., pilot projects and economic incentive programs to promote water protection, carbon storage, or *biological diversity conservation*).
2. Documentation of annual harvest trends in relation to the sustainable forest management plan.
3. A forest *inventory* system and a method to calculate growth.
4. Periodic updates of *inventory* and recalculation of planned harvests.
5. Documentation of forest practices (e.g., planting, fertilization, and thinning) consistent with assumptions in harvest plans.

Objective 12. - To broaden the practice of *sustainable forestry* by encouraging the public and forestry community to participate in the commitment to *sustainable forestry* and publicly report progress.

Performance Measure 12.3. *Program Participants* with forest management responsibilities on public lands shall participate in the development of *public land* planning and management processes.

Indicators:

1. Involvement in *public land* planning and management activities with appropriate governmental entities and the public.
2. Appropriate contact with local stakeholders over forest management issues through state, provincial, federal, or independent collaboration.

Objective 13. - To promote continual improvement in the practice of *sustainable forestry* and monitor, measure, and report performance in achieving the commitment to *sustainable forestry*.

Performance Measure 13.1. *Program Participants* shall establish a management review system to examine findings and progress in implementing the SFI Standard, to make appropriate improvements in *programs*, and to inform their employees of changes.

Indicators:

1. System to review commitments, *programs*, and procedures to evaluate effectiveness.
2. System for collecting, reviewing, and reporting information to management regarding progress in achieving SFI Standard *objectives* and *performance measures*.
3. Annual review of progress by management and determination of changes and improvements necessary to continually improve SFI conformance.

APPENDIX D. - Existing DNR Planning Processes and Initiatives.

1. Forest, Mineral and Fire Management Division

Forest Management Planning Guide for the Lake Superior State Forest

The guide provides suggestions on actual requirements of a forest management plan. Processes for establishing terms of reference, consulting the public, and documenting pertinent planning information are provided. Also included is a process for developing a forest description consisting of the history, administrative make-up, socio-economic profile, and condition of the forest. Methods are presented for incorporating publicly-derived criteria of sustainable forest management into broad forest management direction and more specific management objectives, targets and strategies.

The guide specifies processes that can be used to evaluate management alternatives and to determine the ability of each alternative to sustain the forest. Ultimately, the management strategy that, over time, best produces the desired benefits or outcomes, as described through the public consultation process, will be the one used to direct operational planning.

Details are described for operational planning for the recommended 10-year planning period, including values protection planning, silvicultural planning and access planning. Monitoring of activities via publicly-identified indicators is discussed. A section on annual operational planning and monitoring is also presented.

The Red Pine Project

The project produced guidelines for red pine management based on ecosystem management principles for State Forest land in Michigan. As part of guideline development, a web-based Decision Support System (DSS) has been constructed (<http://www.mcgi.state.mi.us/forestHabitatTypes>). The DSS, an intuitive system that can be easily used by decision-makers at all levels, provides resource managers with a set of tools that allow them to efficiently assess and implement red pine management at the stand and landscape level using a forest habitat type classification system developed for northern Michigan.

The red pine project by itself does not address the management of all other forest types. Analyzing other forest and non-forest communities should be undertaken in a systematic manner, using the guidelines and this report as a template, moving the DNR closer to the development of holistic management guidelines for all State Forestland communities. Because this project can be used as a template and many of the results are generally applicable to the assessment of other biological communities (barrens, northern hardwoods, etc.) the development of future guidelines should be streamlined.

Biodiversity Conservation Planning Process

The purpose of the document is to describe the process developed by the Biodiversity Conservation Committee (BCC) to establish a network of functional representative Michigan ecosystems on a portion of Michigan Department of Natural Resources (DNR) administered lands. It also establishes a strategy to conserve biological diversity on all Department administered lands and to cooperate with other landowners to conserve, restore and protect the biological diversity of Michigan. The DNR will manage lands included in this network with conservation of biological diversity as the primary goal. Key elements to this plan are:

- Establish an organizational infrastructure consisting of multiple design teams who will work at statewide, ecoregional and local spatial scales.
- Apply the principles of the Biodiversity Conservation plan consistently throughout the State.

- Select parcels of land for inclusion based on three primary elements as outlined in the Public Advisory Team (PAT) recommendations: 1) ecosystem representation, 2) functionality, and 3) quality and condition.
- Design an integrated public participation process, working cooperatively with individual citizens, conservation and environmental organizations, forest products industry and other state and federal land management agencies.
- Integrate, implement and coordinate with the eco-regional planning process.
- Provide practical and specific guidance for site selection and management that applies the principles of adaptive management.

The proposed process is based on integrating biological and spatial relationships to develop a network of sites and management strategies that conserves and restores some portion of Michigan's biological diversity legacy. As such, the biodiversity conservation process is based on the filtering concept in which the process moves from coarse filters (e.g. Michigan Natural Features Inventory natural community types throughout Michigan) to using fine filters (selecting sites from several to hundreds of acres based on knowledge of local ecology and specific knowledge of species location and habitat).

2. Wildlife Division

WD Strategic Plan

The plan covers all policies and procedures and initiatives:

Strategic Goal #3: Establish an integrated wildlife planning and implementation process that uses a "holistic" management approach based on principles of ecosystem management

- managing to sustain natural resources;
- establishing clear operational goals and objectives;
- recognizing the complexity and interconnectedness of systems;
- incorporating sound ecological models and understanding;
- accommodating the dynamic nature of ecosystems;
- management on multiple spatial and temporal scales;
- integration of human dimensions of ecosystems;
- incorporating principles of adaptive management.

As professionals in applied ecology, we recognize that we cannot manage Michigan's wildlife as a separate entity. Wildlife professionals have long managed habitat as a form of holistic management, but our science and management have expanded the current vision of "holistic" to include ecoregions, landscapes, and ecosystem management.

Natural Areas Program Strategic Plan

The mission of the Natural Areas Program is to identify, establish, maintain and administer a system of high quality, representative, and ecologically viable natural areas in Michigan. The plan recommends to the Division/Bureau Chiefs a common direction for natural areas on Department administered lands and recommends immediate and long-term actions to implement this common direction. Recommendations include:

LONG-TERM ACTIONS

- Commit to ongoing cooperation across the Department. Continue the current arrangement of a formal liaison to the Natural Areas Program within each resource managing Bureau/Division.
- Consider natural area values in joint management efforts, even if there is not a natural area designated.

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- Complete the natural features inventory of all lands and waters in Michigan for identifying new natural areas.
- Provide adequate staffing for natural areas management, including full-time, field-based, Stewardship Ecologists.
- Develop, populate, and continuously update a Geographic Information System (GIS) of natural areas data that will be available to all Department staff through the DNR Spatial Data Library.
- Provide a stable source of funds for natural areas management.
- Develop and implement a stewardship/management plan, based upon a standardized model, for each natural area.
- Develop and implement an ongoing plan for strategic outreach.
- Develop a statewide volunteer stewardship network for natural areas.
- Integrate “State Natural Areas” into the common terminology of the Department, along with “State Parks,” “State Game Areas,” “State Forests” and “State Recreation Areas.”

IMMEDIATE ACTIONS

- Raise the Department’s awareness of State Natural Areas
- Hold an annual meeting of Department resource managers that work with lands or waters directly associated with a State Natural Area.
- Initiate on-site visits with Department resource managers.
- Establish a calendar or timeline of when natural area nominations will be requested and accepted.
- Post boundaries on all State Natural Areas.
- Ensure ecoregional teams integrate natural areas into their planning efforts.
- Complete a biological inventory for each State Natural Area.
- Create limited-term field positions to assist with immediate needs and urgent threats to State Natural Areas.
- Re-initiate a formal dedication process.
- Develop protocol to acquire and manage State lands solely as natural areas, when no other managing unit (State Park, State Forest, State Game Area, etc.) is adjacent or in the general area.
- Use new funding sources to implement the strategic plan, including:
- Conservation and Reinvestment Act (CARA) – federal income from offshore oil & natural gas leases.
- Critical Non-game Wildlife Habitat Fund-Raising Registration Plate.
- Digitize the boundaries of State Natural Areas and make them available electronically.
- Complete an initial assessment of each State Natural Area for immediate management needs.
- Develop a volunteer stewardship network in Southeast Michigan.
- Initiate the unification of mineral rights for dedicated Natural Areas with split ownership (i.e. subsurface rights not State-owned).
- Review boundaries of dedicated Natural Areas for ecological integrity.

Wildlife Conservation Strategy

This strategic plan is one of a set of tools used to guide wildlife conservation in Michigan. The strategy focuses on wildlife (including invertebrates and fish) in the greatest need of conservation, while addressing the full array of wildlife and wildlife related issues in Michigan.

The strategy was cooperatively developed by the four resource divisions of the DNR with participation from stakeholder organizations, conservation groups, universities, technical experts, Federal & local governmental agencies, tribes and other interested individuals.

The DNR is responsible for selecting species that are representative of the different habitat types in Michigan and that are indicative of the diversity and health of our state's wildlife, with a focus on those species determined to be in the greatest need of conservation. Although principally completed, several portions of the strategic plan are still under development. Contracts have been established with Michigan Natural Features Inventory to complete some parts, while feedback and assistance will be requested from stakeholder organizations, technical experts, and interested individuals to complete other parts. The deadline for submittal to and approval by US Fish & Wildlife Service is October 1, 2005.

Candidate Conservation Agreement with Assurances

The purpose of this Agreement is for the DNR and the U.S. Fish and Wildlife Service to implement conservation measures for the Eastern massasauga rattlesnake in the Lower Peninsula of Michigan. The agreement can include non-state partners such as conservancies and non-industrial private landowners as well. The conservation goal of this agreement is to encourage development and protection of suitable Eastern massasauga rattlesnake habitat on non-Federal lands and support the education of the general public to minimize persecution of the species.

The conservation goal will be met by giving the State of Michigan and private landowners incentives to implement conservation measures and providing landowners with funding and regulatory certainty concerning land use restrictions that might otherwise apply should the Eastern massasauga rattlesnake become listed under the federal Endangered Species Act.

Other Wildlife Division Work Groups

- Black Bear Management
- Bovine Tuberculosis Control
- Elk Management
- Furbearer Management
- Moose Management
- Waterfowl Management
- Wild Turkey Management
- Wolf Recovery & Management
- Woodcock Management
- Goose Policy
- Karner Blue Butterfly Habitat Recovery
- Massasauga Rattlesnake Management
- Michigan Bird Conservation Initiative

3. Fisheries Division

The WART Plan

This planning document mandates that the Fisheries Division will implement watershed based management as parallel to terrestrial eco-system management. It establishes a strategy to manage Great Lake Basins and river watersheds as fundamental ecological units, with an emphasis on the use of a landscape ecology approach, and hydrologic processes that influence streams and lakes and fishery management. Two levels of

management are delineated: 1) Great Lakes Basins (4 Basins); and 2) Management Units (sub-units of basins).

Natural Rivers

This program is administered through zoning based planning. It creates long-range comprehensive plans for designated natural river areas that set forth the purposes of the designation, proposed uses of lands and waters, and management measures designed to accomplish the purposes. State land within the designated area is administered and managed in accordance with the plan, and state management of fisheries, streams, waters, wildlife, and boating are required to conform to the plan.

River Assessments

A River Assessment report is a comprehensive review of an entire river watershed, addressing its biological communities and unique resources present. River assessments are used as a knowledge base to help guide resource managers by identifying opportunities and problems within a river watershed and guiding the long-term management vision.

The information contained in an assessment is a compilation of not only river related problems but opportunities as well. The relationship between human influence and river status necessitates public awareness and involvement. The river assessment serves as a tool which can be used to assist the management decision process, and increase public understanding and foster their involvement in management decisions. This cooperative stewardship by professional managers and the public benefits the resource, and ultimately, the future generations of people that will live and recreate within river basins.

4. Parks and Recreation Bureau

Stewardship Planning

Stewardship planning involves both natural and cultural resources. The planning process is undertaken at various levels of detail depending on the needs and resources present in a given park, and the resources available in the Stewardship Program to facilitate or complete planning. The first step in stewardship planning is to complete an inventory of the most significant resources (natural and cultural) that occur in the park. Following completion of an inventory, a management plan is developed containing at a minimum the following information:

1. Conservation targets (i.e., a specific natural community, rare plant species, rare animal species, eagle nest, heron rookery, scenic vista, historic structure, or archaeological site).
2. An analysis of threats to those targets, specific goals and objectives to protect the targets (or abate the threats).
3. A specific implementation plan.

A complete "Stewardship Plan" for a park contains four major components: (1) Inventory of Significant Natural Resources, (2) Natural Resources Management Plan, (3) Inventory of Significant Cultural Resources, and (4) a Cultural Resources Management Plan.

APPENDIX E. - Ecoregion State Forest Land Management Plan Template

1. Understanding the Ecoregion Forest Plan
 - a. Purpose & Use of the plan
 - b. Relationship to the State-wide Guidance Document and Organization of this Plan
 - c. Use of Criteria & Indicators
 - d. Plan Communications & Implementation
 - e. Location of the Ecoregion and boundaries of Division management units
2. Forest History
3. Current Forest Condition
 - a. General Land Cover and Forest Resource Base
 - b. Forest Health
 - c. Wildlife Conditions
 - d. Water and Fisheries Conditions
 - e. Socioeconomic Context
4. Eco-region Management Direction
 - a. Definition of terms
 - ? Desired Future Conditions
 - Goals
 - Objectives
 - Standards
 - Guidelines
 - b. Governmental and Stakeholder Relations
 - Tribal
 - c. Desired Future Conditions, Goals & Objectives, Indicators & Metrics
 - i. Special Resource Areas (See Section 5 below)
 - ii. Recreation Management
 - Lake Access Sites
 - Motorized & Non-Motorized Trails
 - Campgrounds
 - Scenery Management
 - Rivers & Streams
 - iii. Vegetation Management
 - Biodiversity
 - Forest Products (timber & nontimber)
 - Wildlife
 - Fisheries
 - Rare Communities
 - iv. Watershed Management
 - Soil Resources
 - Riparian Areas & Wetlands
 - v. Species of Greatest Conservation Need
 - Federal T & E Species
 - State T & E Species
 - Species of Special Concern
 - vi. Land Use Management
 - Easements
 - Special Use Permits
 - vii. Minerals & Geology

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- Oil & Gas Development
 - Metallic & Non-Metallic Mineral Development
 - Unique Geologic Formations
 - viii. Forest Pest Management
 - Insects
 - Disease
 - Invasive Species
 - ix. Fire Management
 - Fuel Management
 - Prescribed Fire
 - Fire Prevention
 - Fire Suppression
 - x. Land Ownership
 - Acquisition and Disposal
 - Boundary Designation (Signage)
 - xi. Transportation System
 - Road Maintenance
 - Road Closure
 - xii. Law Enforcement
 - Contract Enforcement
 - Illegal Activities (ORV use, Illegal Harvests)
 - Trespass
5. Special Resource Area Management Direction- Maps, Standards and Guidelines
- Introduction
- a. Natural Areas
 - b. Rare Communities (Including ERAs, HCVAs, SCAs, and Critical Habitats for Rare Flora and Fauna)
 - c. Major Bodies of Water and Riparian Management Zones
 - d. Old Growth & Biodiversity Stewardship Areas
 - e. Dispersed Recreation Areas
 - f. Large Landscape Level Forests
 - g. Habitat Corridors
 - h. Natural Rivers
 - i. Ecologically Sensitive Areas
 - i. Critical Dunes
 - ii. Springs and Wetlands
 - j. Archaeological Sites
 - k. Cultural and Customary Use Areas
 - l. Visual Management Areas
 - m. Concentrated Recreation Areas
 - n. Soil Limited Areas
 - o. Restricted Access Areas (Slope)
 - p. Restrictive Ownership Patterns
 - q. Mineral Resource Areas
 - r. Road Closure Areas

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6. Implementation, Monitoring, Review & Revision
 - ? Relationship to Management Review System
7. Appendices
8. Glossary

APPENDIX F. - Criteria and Indicators for Sustainable Forest Management

Following the Rio Earth Summit in 1993, the United States became one of the first countries to commit to a national goal of sustainable forest management. Building on the Forest Principles adopted at the Earth Summit, different groups of countries joined together to discuss and reach consensus on ways to assess national progress toward the sustainable management of forest resources. Nine international Criteria and Indicator (C&I) processes are now ongoing, involving approximately 150 countries and covering nearly all the world's forested area.

The United States participates in one of these processes—the Montreal Process. Representatives of the USDA Forest Service, the National Association of State Foresters, and many domestic nongovernmental organizations participated with the U.S. Department of State in discussions that led to a nonbinding agreement in 1995 on a set of C&I for the conservation and sustainable management of temperate and boreal forests. The C&I are comprised of 7 criteria and 66 indicators that characterize essential components of sustainable forest management. They provide an accepted framework for gathering data necessary for discussing the importance, status, and sustainability of forest management. The criteria define categories of capacities or processes that are essential to sustainable forest management, while the indicators provide the means for measuring or describing various aspects of the criteria. Criteria 1 through 6 address biological diversity, the productive capacity of the forest, the health of the ecosystem, soil and water resources, global carbon cycles, and social and economic benefits that come from the forests. Criterion 7 addresses the legal, institutional, and economic framework for supporting forest conservation and sustainable management. Half of the indicators measure economic, social, or institutional concerns. It is important to emphasize that no single criterion or indicator alone is an adequate measure of sustainability. All criteria should be considered together to provide a more complete picture of the status of forests and their management.

The C&I will change over time. They will be reviewed and refined, collectively by all the Montreal Process countries, to reflect experience gained with their use, new research findings, advances in technology, and public understanding of forests.

Indicators provide "gauges" to monitor how a system operates or functions. Any single indicator by itself provides limited information about the system as a whole. A complex system, such as a forest, requires many different indicators to monitor the system. The many different values held by people about the environmental, social, and economic spheres of forests also require a large and diverse set of indicators to depict the many facets of forests and forest management.

The following set of C&I have been adapted from the Montreal Process for the conservation and sustainable management of temperate and boreal forests. They are presented here for informational purposes. Some of the indicators have been selected by ecoregional planning teams for use in their ecoregional plans. They are similar to C & I that have been adopted by the U.S. Forest Service. A common set of indicators has several advantages: 1) Promotion of linkages across multiple scales of planning and assessment, from State-wide to ecoregional to FMU levels; 2) Facilitation of communication by improving the ability to compare, develop and share resource data and information across administrative and jurisdictional (e.g. State and Federal) boundaries; and 3) Identification of cumulative effects of management upon ecological, social and economic systems at different geographic and temporal scales. The information derived from monitoring changes in common indicators can contribute to an improved public understanding of the State Forest system, an improved understanding of the consequences of earlier decisions, and lead to informed decision making process for the sustainable management of forests.

Criterion 1. Conservation of Biological Diversity

Indicators of ecosystem diversity:

1. Extent of area by forested ecosystem type relative to total forest area.
2. Extent of area by forested ecosystem type and by age-class or successional stage.
3. Extent of area by forested ecosystem type in protected Ecological Reference Areas (ERAs).
4. Extent of areas by forested ecosystem type in protected areas as defined by age-class or successional stage.
5. Fragmentation of forests.

Indicators of species diversity:

6. Number of native forest species.
7. The percentage of forest species at risk (threatened, rare, vulnerable, endangered, or extinct) as determined by legislation or scientific assessment.

Indicators of genetic diversity:

8. Percent of forest species that occupy a small portion of their former range.
9. Population levels of representative species from diverse habitats monitored across their range.

Criterion 2. Maintenance of Productive Capacity of Forest Ecosystems

10. Area of forest land and net area of forest land available for timber production.
11. Total growing stock volume and growth of both merchantable and non-merchantable tree species on forest land available for timber production in relation to productive capacity as determined by management objectives.
12. The area and growing stock of plantations of native and exotic species.
13. Annual removal of wood volume compared to the volume determined to be sustainable.
14. Annual amount of non-timber forest products (e.g., fur bearers, berries, mushrooms, game) compared to the amount determined to be sustainable.

Criterion 3. Maintenance of Forest Ecosystem Health and Vitality

15. Area and percent of forest land affected by insects, disease, fire, and windstorm, beyond the range of reference conditions.
16. Area and percent of forest land subjected to levels of specific air pollutants (e.g., sulfates, nitrate, ozone) that may cause negative impacts on the forest ecosystem.
17. Area and percent of forest land with diminished biological components indicative of changes in fundamental ecological processes (e.g., soil nutrient and carbon cycling).

Criterion 4. Conservation and Maintenance of Soil and Water Resources

Protected Areas

18. Area and percent of forest land managed primarily for protection of soil and water resources (e.g., floodplains, wetlands, and riparian management zones).

Soils

19. Area and percent of forest land with significant soil erosion.
20. Area and percent of forest land with significantly diminished soil organic matter and/or changes in other soil nutrient cycles.
21. Area and percent of forest land with significant change in soil physical properties (such as compaction) resulting from human activities.

22. Area and percent of forest land with a significant accumulation of persistent toxic substances.

Aquatic Productivity

23. Length and percent of streams in which significant changes in flow and/or timing have deviated significantly from the historic range of variability.
24. Area and percent of water bodies in forest areas (e.g., stream kilometers, lake hectares) with significant variance of biological diversity from the historic range of variability.
25. Area and percent of water bodies in forest areas (e.g., stream kilometers, lake hectares) with significant variation from the historic range of variability in pH, dissolved oxygen, levels of chemicals (electrical conductivity), sedimentation, or temperature change.

Criterion 5. - Maintenance of Forest Contributions to Global Carbon Cycles

26. Total forest ecosystem biomass and carbon pool, and if appropriate, by forest type, age-class, and successional stages.
27. Contribution of forest ecosystems to the total global carbon budget (standing biomass, coarse woody debris, peat, and soil carbon).
28. Contribution of forest products to the global carbon budget.

Criterion 6. - Maintenance and Enhancement of Long-Term Multiple Socioeconomic Benefits.

Indicators of Production and Consumption

29. Value and volume of wood and wood products production, including value added through downstream processing.
30. Value and quantities of production of non-wood forest products.
31. Supply and consumption of wood and wood products, including consumption per capita.
32. Value of wood and non-wood products production as a percentage of Gross Domestic Product.
33. Degree of recycling of forest products.
34. Supply and consumption/use of non-wood products.

Indicators of Recreation and Tourism

35. Area and percent of forest land managed for general recreation and tourism in relation to the total area of forest land.
36. Number and type of facilities available for general recreation and tourism in relation to population and forest area.
37. Number of visitor days attributed to recreation and tourism in relation to population and forest area.

Investment in the Forest Sector

38. Value of investment, including investment in forest growth, forest health management, planted forests, wood processing, recreation, and tourism.
39. Level of expenditure on research and development and on education.
40. Extension and use of new and improved technologies.
41. Rates of return on investment.

Cultural, Social, and Spiritual Needs and Values

42. Area and percent of forest land managed in relation to the total area of forest land to protect the range of cultural, social, and spiritual needs and values.
43. Non-consumptive use forest values.

Employment and Community Needs

44. Direct and indirect employment in the forest sector and the forest sector employment as a proportion of total employment.
45. Average wage rates and injury rates in major employment categories within the forest sector.
46. The viability and resilience to changing economic conditions of forest-dependent communities, including indigenous communities.
47. Area of the forest used for subsistence purposes by indigenous communities.

Criterion 7. - Legal, Institutional and Economic Framework for Forest Conservation and Sustainable Management.

Extent to Which the Legal Framework (Laws, Regulations, and Guidelines) Supports the Conservation and Sustainable Management of Forests, Including the Extent to Which It:

48. Clarifies property rights, provides for appropriate land tenure arrangements, recognizes customary and traditional rights of indigenous people, and provides a means of resolving property disputes by due process.
49. Provides for periodic forest-related planning, assessment, and policy review that recognizes the range of forest values, including coordination with relevant sectors.
50. Provides opportunities for public participation in public policy and decision-making related to forests and public access to information.
51. Encourages best practice codes for forest management.
52. Provides for the management of forests to conserve special environmental, cultural, social, and/or scientific values.

Extent to Which the Institutional Framework Supports the Conservation and Sustainable Management of Forests, Including the Capacity to:

53. Provide for public involvement activities and public education, awareness, and extension programs, and make available forest-related information.
54. Undertake and implement periodic forest-related planning, assessment, and policy review, including cross-sectoral planning and coordination.
55. Develop and maintain human resource skills across relevant disciplines.
56. Develop and maintain efficient physical infrastructure to facilitate the supply of forest products and services and to support forest management.
57. Enforce laws, regulations, and guidelines.

Extent to Which the Economic Framework (Economic Policies and Measures) Supports the Conservation and Sustainable Management of Forests Through:

58. Extent to which investment, taxation, regulatory and trade policies recognize the long-term nature of public investments and permit the free-flow of capital to meet societies long-term demands for market and non-market forest products and services.

Capacity to Measure and Monitor Changes in the Conservation and Sustainable Management of Forests

59. Availability of up-to-date data, statistics, and other information important to measuring or describing indicators associated with criteria 1 through 7.
60. Scope, frequency, and statistical reliability of forest inventories, assessments, monitoring, and other relevant information.
61. Compatibility with other countries in measuring, monitoring, and reporting on indicators.

Capacity to Conduct and Apply Research and Development Aimed at Improving Forest Management and Delivery of Forest Goods and Services

62. Development of scientific understanding of forest ecosystem characteristics and functions.
63. Development of methodologies to measure and integrate environmental and social costs and benefits into markets and public policies, and to reflect forest-related depletion or replenishment in national accounting systems.
64. New technologies and the capacity to assess the socioeconomic consequences associated with the introduction of new technologies.
65. Enhancement of the ability to predict impacts of human intervention on forests
66. Ability to predict effects on forests of possible climate change.

APPENDIX G. - List of DNR Forest Certification Work Instructions (8-09-05)

Work Area Group 1 - Plan, Monitor, and Review

- 1.1 Strategic Framework for Sustainable Management of State Forest Land
- 1.2 Management Review Process for Continual Improvement in the Management of Forest Resources
- 1.3 Ecoregional Plan Development
- 1.4 Biodiversity Management on State Forest Lands
- 1.5 Social Impact Considerations and Public Involvement Processes
- 1.6 Forest Management Unit Analyses
- 1.7 State Forest Timber Harvest Trends

Work Area Group 2 - Forest Regeneration and Chemical Use

- 2.1 Reforestation
- 2.2 Use of Pesticides and Other Chemicals on State Forest Lands
- 2.3 Integrated Pest Management and Forest Health

Work Area Group 3 - Best Management Practices

- 3.1 Forest Operations
- 3.2 Best Management Practices Non-Conformance Reporting Instructions
- 3.3 Road Closures

Work Area Group 4 – Deleted and integrated with WAG 7

Work Area Group 5 - Research

- 5.1 Coordinated Natural Resource Management Research

Work Area Group 6 - Education and Recreation

6. Implementing Public Informational and Educational Opportunities on State Forests
- 6.2 Integrating Public Recreational Opportunities with Management on State Forest Lands
- 6.3 SFI Involvement and the Michigan State Implementation Committee

Work Area Group 7 - Integrated Implementation and Contracting

- 7.1 Timber Sale Preparation and Administration Procedures
- 7.2 Legal Compliance and Administration of Contracts

Work Area Group 8 - Training

- 8.1 MDNR Staff Training for State Forest Management

Work Area Group 9 - Tribal Issues

- 9.1 Collaboration with Tribes in regard to management of State Forest Land

APPENDIX H. - Background Information for Operational Guidance.

4.1 - Ecological Guidance

4.1.1 - Principle 1. Sustainable Ecosystem-based Management

Sub-Principle 1.1 - Conservation of Geophysical Processes

Soil Formation and Conservation

The amount of organic matter stored in mineral soil reflects the long-term balance between plant litter and the rate at which decomposing organisms return it to the atmosphere as carbon dioxide (Barnes et al., 1998).

Soil erosion following disturbance and biomass removal on high gradient sites can result in high losses of soil organic matter and compromise and impair natural soil formation processes.

Geomorphic Sediment Dynamics

Improper construction and maintenance of access roads, stream crossings, and the removal of biomass on moderate to high gradient sites can result in a detrimental imbalance of sediment dynamics in aquatic habitats.

Carbon Cycling

Factors such as climate and soil nutrient availability and disturbance influence the productivity of plants, and the cycling and storage of carbon in forest ecosystems. Because plants are largely constructed of carbon (47 percent), the production of biomass in forest ecosystems and the extent to which forests are altered by harvesting or conversion to other vegetative types has a substantial influence on the pattern in which carbon is cycled and stored at local, regional and global scales (Barnes et al., 1998). Biomass is located in the above and below-ground tissues of plants, woody debris, the forest floor, the mineral soil, and in the tissues of decomposing organisms. Energy input into aquatic systems is in part dependent upon carbon deposition in the form of detritus and large woody debris from both terrestrial and wetland communities.

Natural fire and wind disturbance regimes, and silvicultural emulations thereof, alter the carbon balance of forest ecosystems by oxidizing biomass to carbon dioxide, causing a reduction in total ecosystem biomass and the productivity of the forest.

Hydrologic Cycling

The climate of Michigan provides most precipitation in the form of rain and snow, with orographic lifting and surface cooling producing lake-effect snowfalls in major portions of the state. Water is returned to the atmosphere by evaporation and evapotranspiration, with continental evapotranspiration accounting for 70 percent of the water returned. The amounts of water evaporated or transpired vary with atmospheric humidity, the water holding capacity of the soil, and the availability of water in the soil. It is the water holding capacity of soil that largely determines the amount of water that is available for plant growth.

Springs and wetlands are critical components of the hydrologic cycle by providing sources of water for stable base flows in streams, rivers, ponds and lakes.

Nutrient Cycling

The supply of nutrients is controlled by physiological activities of plants and soil microorganisms and geochemical processes in the soil. Nutrient input into natural ecosystems come from mineral weathering, atmospheric deposition, and from biological fixation of atmospheric nitrogen into the soil. Nutrient losses from ecosystems are from harvesting, gaseous losses and leaching into aquatic systems. Unlike agricultural ecosystems where chemical fertilizers are widely used, the rate at which nutrients are cycled in forest ecosystems is controlled by the physiological activities

of plants and soil microorganisms, and their requirements for growth-limiting nutrients, such as nitrogen (Barnes et al., 1998). The production of plant litter above and below the soil surface eventually returns nutrients to the forest floor and mineral soil, where soil microorganisms decompose the litter by incorporating nutrients and carbon into their biomass and releasing excess nutrients into soil solution, where they can again be absorbed by plant roots.

Differences in soil parent material give rise to differences in soil nitrogen availability, which is thought to control the productivity of many boreal and temperate forests (Barnes et al., 1998). Landform is a significant factor in controlling nutrient cycling, and local ecosystems upon different landforms have different patterns of nitrogen cycling, with nitrogen mineralization increasing on a gradient of xeric to mesic landforms (Zak et al., 1986). Biomass removal also has effects upon nutrient cycles since soil nitrogen availability is controlled by the decomposition of plant litter by soil microorganisms, which can in turn effect the growth of forests. As decomposition increases the organic matter content of mineral soil, the mineralization and cycling of nitrogen generally increases (Marion and Black, 1988).

Sub-Principle 1.2 - Conservation of Biodiversity

Maintenance of Intact and Functional Landscapes, Ecosystems and Communities

The conservation of forest biodiversity requires the maintenance of intact and functional landscapes, ecosystems and communities. Intact and functional landscape forests are comprised of a mosaic of ecosystem and community patches in a contiguous matrix that are often connected by gradual transitional boundaries (dependent upon landform and natural disturbance regimes). In contrast, the commonly disturbed landscape of most areas of the state are comprised of fragmented forests with abrupt transitional boundaries, which are caused by a reduction in total forest area, conversion of natural forests to biotically simplified or even-aged plantations, and by isolation by roads, agriculture and development into progressively smaller patches. This unnatural forest fragmentation causes a degradation of functional landscapes and ecosystems by reducing ecosystem diversity and causing a concomitant loss of habitat heterogeneity that provides a diversity of flora and fauna (Barnes et al., 1998).

The recognition and consideration of Ecological Reference Areas (ERAs), High Conservation Value Areas (HCVAs) and Special Conservation Areas (SCAs) in forest lands can help to maintain intact and functional landscapes, ecosystems and communities, especially when they are embodied by or are a part of relatively large landscape level forest matrices.

Regional and Local Ecosystem Diversity – Richness and spatial distribution

In every regional and local setting, the nature and patterns of ecosystems and communities and the biodiversity contained therein are strongly related to geological processes, landform, climate, soil, and disturbance regimes, and reflect their diversity and heterogeneity.

In general, heterogeneity promotes diversity at all scales, and extreme conditions tend to constrain diversity. A heterogeneous pattern of ecosystems or their components (climate, physiography, soil, hydrology) and heterogeneous disturbance regimes and stand structures tend to promote biodiversity. In contrast, the most extreme physical conditions of temperature, water, soil reaction, and combinations thereof tend to limit biodiversity (Barnes et al., 1998).

Levels of high biodiversity are associated with areas of high ecosystem diversity (Pearsall, 1995). Such areas of high ecosystem diversity can be identified on landscape level maps. It is then possible to conserve biodiversity by identifying and managing areas of high ecosystem diversity.

Species Diversity – Richness and spatial distribution

Species diversity is related to composition, age and structural complexity within and among forest stands and communities. Specifically, the diversity of forest fauna may be affected by the

compositional diversity of forest stands, structural and age differences within and among communities, the diversity of canopy layers, and stem distribution within and among stands.

Fire and windthrow disturbance can also affect species diversity. The return intervals, size and intensity of disturbance can have a tremendous impact upon diversity. In general, low species diversity occurs at both very low and very high frequencies of disturbance, and the highest diversity of species occurs at intermediate frequencies of disturbance (Huston, 1994). The intensity of fire disturbance is a particularly important factor. Frequent and less severe fire disturbances are necessary for the maintenance of diversity and structure of herbaceous vegetation in prairie and savanna ecosystems (Curtis, 1959). Conversely, rare but very severe fire disturbance can cause a decrease in diversity.

Endemic, rare and endangered species often contribute to regional species diversity, and are often indicative of uncommon or rare communities. It is difficult to retain these species outside of the context of the natural ecosystem in which they have evolved. They can be retained using an ecosystem approach to conservation of biodiversity.

Genetic/Population Diversity – Richness and spatial distribution

Genetic diversity is necessary for maintaining viable populations of species. Species diversity and genetic diversity within species has been greatly influenced by human activities that affect the evolutionary processes of extinction, selection, drift, gene flow and mutation. Habitat alternation, environmental deterioration, and domestication of forest species may lead to reduced biodiversity (Ledig, 1992). Opportunities for genetic improvement of species depend upon the degree of variability in wild populations. Widespread and regionally distributed species maintain the most genetic diversity, whereas endemic woody species contain the least (Barnes et al., 1998).

Forest fragmentation can result in large changes in population sizes and can simplify age structure, which can impact the genetic diversity of forest species.

Sub-Principle 1.3 - Maintenance of Biotic Productivity

Geographic differences in productivity are strongly correlated with climatic variation in temperature and precipitation. The amount of water available for transpiration sets the upper bounds on plant carbon gain, and is responsible for the differences in productivity among ecosystems from different climatic regions (Barnes et al., 1998).

Forest plantations can contribute to meeting the demand for wood fiber, and they can complement the management of, reduce pressures on, and promote the protection, restoration and conservation of natural forests. The productivity of forest plantations should be balanced with needs and concerns for maintaining biodiversity. Guidance documents such as The Red Pine Project and Mesic Conifer Restoration of State Land can be useful in incorporating biodiversity needs into plantation management plans.

Consideration should be given to the effects of past harvesting, burning, windthrow and insect/disease disturbance in forest stands. Following events such as harvesting or natural disturbance that remove forest vegetation, biomass is sharply reduced to near zero in areas of clearcut or catastrophic disturbance. Biomass then increases as a new forest ecosystem matures. For an idealized forest (Barnes et al., 1998) where natural succession is allowed to proceed, both net primary productivity (NPP) and biomass accumulation increase rapidly during the first 20 to 25 years of forest stand development, and approach maximum values after approximately 50 years. Thereafter NPP begins to decline, and the rate of biomass accumulation slows until total ecosystem biomass reaches a relatively constant state after about 75 years of stand age. After approximately 130 years of stand age net ecosystem productivity declines to zero, when gross primary productivity equals carbon losses from respiration. These productivity estimates vary for different community and soil types, and are available in silvicultural guides for individual tree species.

Where over-population of mammalian herbivores is present, detrimental impacts upon natural and artificial forest regeneration can be significant. Hemlock (*Tsuga Canadensis*), white cedar (*Thuja occidentalis*), yellow birch (*Betula alleghaniensis*), and Canada yew (*Taxus canadensis*) are preferred browse species that decrease in abundance when subjected to light to moderate deer browsing (Stoeckeler et al., 1957). Studies indicate that species richness of tree seedlings begins to decline at deer densities of 4 deer/km², and that species richness and abundance of shrubs and herbaceous vegetation declines between 4 and 8 deer/km² (Tilghman, 1989; deCalesta, 1992). Changes in the species composition of forests can occur as a result of selective browsing, with displacement of conifers (hemlock, white cedar and Canada yew) by hardwoods (Frelich and Lorimer, 1985; Alverson et al., 1988). In 1985 Frelich and Lorimer estimated that if no action was taken to control browsing in portions of the Porcupine Mountains Wilderness Park where it is currently the major dominant species, hemlock will become only a minor component of the forest in less than 150 years. Tilghman (1989), deCalesta (1994), and Healy (1997) suggest that when the forest management objective is sustaining biodiversity, the relative deer density should be one-third (or 4 deer/km²) of the relative deer density associated with maximum sustained yield of deer for hunter harvest.

Soil erosion following disturbance and biomass removal on high gradient sites can result in high losses of soil organic matter and a subsequent decrease in site productivity.

Native insects and disease can cause a loss of stand productivity or mortality. Invasive non-native species can have a competitive advantage over native plant species, and in the absence of natural controls can displace native plants from their habitat. Common buckthorn (*Rhamnus cathartica*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), garlic mustard (*Alliaria petiolata*) and purple loosestrife (*Lythrum salicaria*) are some of the most commonly encountered non-native, invasive plants in the Great Lakes region.

4.2 - Social-Economic Guidance

4.2.1 - Principle 2. Maintenance of Essential Ecosystem Services

Society critically depends upon many functions from the environment. These can be described or classified in many ways. Examples of the functions include that the environment provides a storehouse of raw materials, sources of power, a disposal sink for residuals, the life support system for all flora and fauna, a source of beauty, and space for occupancy. The Ecological Society of America has defined ecosystem services as the processes by which the environment produces resources such as clean water, timber, habitat, and pollination of plants. Society is dependent upon naturally functioning ecosystems to provide these multiple services to the biosphere. The following ecosystem services will be discussed in this document: 1) the maintenance of atmospheric quality; 2) the maintenance of water quality; 3) the generation and maintenance of soil; 4) the decomposition and recycling of nutrients; 5) carbon sequestration; and 6) maintenance and regeneration of habitat. Each service is discussed in greater detail below.

Maintenance of atmospheric quality

Forest ecosystems contribute to the global biosphere the service of producing oxygen as a byproduct of photosynthesis. However, the O₂ content in the atmosphere today is largely a result of long term accumulations and is a rather stable component of the atmosphere, with a mean residence time on the order of 10,000 years (Schlesinger, 1991).

Following harvesting, when the forest floor is exposed to greater solar radiation, soils become warmer and wetter, resulting in increased rates of organic matter decomposition and loss of carbon as CO₂ to the atmosphere. As discussed further in the below sections on nutrient cycling and carbon sequestration, large amounts of carbon in the form of organic matter can accumulate in the soil of cool temperate forests, where decomposition rates are relatively slow when compared to rates in warmer climates (Vogt et al., 1986).

Maintenance of water quality

Forested lands slow the rate of sediment transport, as a measure of mechanical weathering of rock and soil, by a factor of four (Gregor, 1970), which help to maintain the quality and sediment balance of aquatic ecosystems. Wetlands serve biological and chemical oxidation basins, cleansing water that is released as base flow into streams and lakes.

Generation and maintenance of soil

Plants contribute to the mechanical weathering of rock by the splitting action of root growth into rock crevasses. Plant roots and decomposing soil organic matter also release CO₂ (which forms carbonic acid) and other organic acids into the soil, the reactions of which cause the dominant form of chemical weathering of rock and soil. Thus, living organisms have a controlling influence over the geochemical process of terrestrial rock weathering and soil creation.

Forested lands contribute to the improvement and maintenance of soil by the continual contribution of organic matter in the form of litter and root detritus, which is decomposed by microbial actions and accumulated as humus in the soil profile. In most cases, the mass of humus in the soil profile exceeds the combined content of organic matter in the forest floor and aboveground biomass (Schlesinger, 1977).

Erosion or removal of topsoil in the O (organic) and A (zone of organic matter accumulation into the mineral matrix) soil horizons, have the potential to greatly reduce the nutrient capital of accumulated soil organic matter in forest ecosystems (Barnes et al., 1998), often to the detriment of aquatic systems that are the receivers of eroded sediment. The loss of these horizons can interrupt microbial decomposition processes and reduce rates of nutrient mineralization, resulting in a degradation of soil fertility and mitigate the beneficial ecosystem service provided by nutrient cycling.

Decomposition and recycling of nutrients

Since decomposition rates in cool temperate forests are relatively slow when compared to warmer climates, large amounts of organic matter and nutrients can accumulate in the soil of these forests. For example, approximately 90 percent of total ecosystem nitrogen is contained in the forest floor and mineral soil of temperate forests (Barnes et al., 1998). Soil microorganisms assimilate the organic matter of detritus into their cells, and the amount of energy (carbon) that microorganisms gain from plant litter governs the processes of decomposition and the recycling of nutrients. In fact, the carbon balance of terrestrial ecosystems exerts a substantial influence on the cycling and storage of nutrients, as well as upon nutrient retention and loss (Barnes et al., 1998). Large quantities of nutrients circulate between trees, the forest floor and mineral soil on an annual basis, and in intact forest ecosystems only a small proportion of these nutrients are lost to the hydrologic cycle (leaching) or the atmosphere (gaseous losses).

Nutrients can be lost from nutrient cycles from the harvest of biomass. Where the post-harvest forest floor is exposed to greater solar radiation, soils become warmer and wetter, resulting in increased rates of decomposition and loss of carbon. Lower rates of nutrient uptake (dependent upon the density of remaining overstory trees) in concert with a greater supply of nutrients from organic matter decomposition can lead to the loss of nutrients from forest ecosystems.

When precipitation exceeds evapotranspiration, the movement of water through the soil profile results in the leaching of nutrients from the rooting zone of trees where it eventually enters into groundwater and aquatic stream and lake systems, thus linking the nutrient cycles of terrestrial and aquatic ecosystems. Research by Vitousek and Reiners (1975) has shown that nitrate loss through groundwater in late-successional forests is over 6 times as great as losses from mid-successional forests, reflecting a decline in ecosystem biomass where the loss of limiting nutrients exceed their input.

Water saturation in poorly drained soils inhibits nitrification of ammonia in these soils, limiting nitrogen losses through groundwater in these systems. However, nitrogen is lost from these anaerobic soils in gaseous form to the atmosphere through the process of denitrification.

Carbon sequestration

Carbon accumulation in soil organic matter is a beneficial ecosystem service for fertility purposes. However, the current understanding of the sinks of the global carbon cycle is incomplete, and is currently the subject of much debate. Moreover, the significance of the role of carbon sequestration by reforestation versus the role of the oceans in the global carbon cycle is uncertain. Regardless of this uncertainty, research shows that reforestation has been a sink for atmospheric carbon in the southeastern United States during the past century (Delcourt and Harris, 1980), and it is likely that the reforestation of the northern Great Lakes region has provided a similar service over the same period. Old-growth forests can accumulate over twice the amount of carbon and biomass (in stems, roots and coarse woody debris) and soil organic matter than second-growth forests accumulate (Harmon et al., 1990), and can thereby make a proportionally greater contribution to carbon sequestration services.

Rising atmospheric carbon dioxide concentrations and projected changes in global climate have the potential to alter the geographic distribution of forests and the rate at which they sequester carbon from the atmosphere. In the northern hemisphere, a northward shift in the distribution of productive forests may increase the rate of carbon storage by Net Primary Production in areas such as Michigan, but this may be offset by a decline of biomass and NPP in other regions (Soloman and Tharp, 1985; Pastor and Post, 1988), and increasing rates of CO₂ emissions from warming tundra and boreal regions (Billings et al., 1982). Although changes in the distribution of vegetation and in ecosystem function due to climatic change do not appear responsible for much of the increase in atmospheric CO₂ over the past century, they are potentially important factors to consider for the future (Esser, 1987).

For areas covered by the last continental glaciation, the total accumulation of carbon in soil organic matter represents the net ecosystem production for the last 10,000 years, and accounts for about 25% of the carbon contained in all soils of the world (Schlesinger, 1991). During the present Holocene period (beginning 10,000 years ago) soil organic matter has accumulated at a rate that is too small to be a significant sink that can effectively counterbalance human releases of CO₂ to the atmosphere (Billings et al., 1982, 1984).

Maintenance and Regeneration of Habitat

Habitat has different connotations that pertain to different species. The term is widely used to describe the vegetative communities that provide shelter and food for organisms. Conversely, the habitat for vegetation is defined by a complex of abiotic site factors, such as climate (comprised of temperature and moisture gradients), physiography (such as landform, parent material, aspect and slope), and soils (comprised of texture, drainage and nutrient content gradients), and biotic factors (such as associated plants, animals, and microorganisms). Ecosystems are comprised of these abiotic and biotic components. In ecosystem management the term site (the habitat supporting plants) is used to describe the physical environment of landscape ecosystems.

Depending upon chance, past history, and upon changing environmental conditions within a site, various types of forest communities may develop upon that particular site (Barnes et al., 1998). This is abundantly evident when comparing past vegetative communities with those of present Michigan, where historic logging, widespread fires, a warming climate and the influence of human civilization have combined to produce the present landscape communities of the State. The resilience of ecosystems to regenerate and maintain vegetative communities through natural successive pathways following severe disturbance is a tremendous service to the landscape of the State.

4.2.2 - Principle 3. Sustain Social-Economic Values

Social sustainability is of value in its own right. It plays a paramount role in the progress toward sustainability, since it is ultimately people that determine economic and environmental well-being (Magis, 2005). Sustainable forest management assumes a systems perspective in which society, the environment and the economy are components. The system of forest sustainability can only remain viable to the extent that each of these components function properly and are themselves sustainable (Harris, 2000). In many areas of the State the maintenance of quality of life, economic development and employment are dependent upon the provision of natural resources from the environmental component. Social sustainability in turn relies upon economic development as a means to make qualitative improvements in human well being (Magis, 2005), and is influenced by the degree to which inequalities are reduced (Polese and Stren, 2000).

Four main categories form the context in which social sustainability must be considered.

1. Cultural, spiritual and community values
2. Community vitality, well-being, social capital and capacity for adaptation.
3. Public participation.
4. Legal frameworks and community sustainability.

Cultural, spiritual and community values with respect to natural resources shift over time and space. Sometimes, natural resources play a determining role in shaping the identity of a locality, for example in the case of a wilderness or coastal area. At other times and places natural resources may be looked upon as assets for economic development. In modern, urbanized settings, where many people are employed in so-called service sectors, natural resource issues may not be of immediate concern. This attitude may persist despite the population's material dependency upon natural resources, the important aesthetic and environmental services provided by natural resources, and the population's desire to recreate in natural settings. Other values issues include a shift from a representative to a participatory democracy, with an attendant emphasis on collaboration and partnership. These trends are indicative of a society that has increasing expectations for more control over natural resources (Leefers, et al., 2003).

Measures of community well-being have been identified in studies of forest-dependent communities. They include per capita income, percentages of families below the poverty line and on welfare, average education, infant mortality, and racial and ethnic diversity (Fortmann et al., 2002; Kusal and Fortmann, 1991; McDonough et al., 1999; McDonough et al., 2002). Physical infrastructure, human capital and civic responsiveness are several key characteristics of the capacity of a community to adapt to change (USDA, 1993).

Measures of legal framework and community sustainability include the existence of land use policies, such as zoning ordinances, master plans and land use studies. Besides migration data, more economically-oriented measures of community sustainability include trends in employment, diversity of industry, and capital investment. Industry diversity lends itself to resilient economies, much as biodiversity lends itself to healthy ecosystems.

Societal changes have the potential to influence the way people interact with forests and their expectations for forest management (Caplow, 1991; Cetron and Davies, 2001; Cornish et al., 2000; National Academy of Sciences, 2000; Vasievich, 1999). Examples of societal changes include demographic trends in diversity and age of the population, dynamic changes in information technology, and evolving views on water and land use.

There are two major ways in which social-economic issues are considered in the context of the management of State Forest lands:

1. Directly through assessments and measurements of social impacts or of related social-economic variables, and

2. Indirectly through collaboration/input processes that enable participation and the expression of values and interests. This includes DNR participation in external discussions, evaluations, and planning efforts, that often inform others of DNR activities and intents.

Assessments and measurements of social-economic variables range from stand and compartment-level assessments of access, aesthetics, and uses through state-level needs for recreational infrastructure, and the competitiveness of our natural resource industries. In the economic context of natural resource management there are five primary sectors:

1. Timber and forest products industry
2. Oil and natural Gas
3. Metallic and non-metallic mineral extraction
4. Recreation and Tourism (i.e. boating, camping, angling, hunting and snowmobiling)
5. Real estate development and seasonal homeowners

The competitiveness and resilience of these sectors to forces of change in the economy and in society in general shape demands upon forest lands. Thus, forest management sustainability can be greatly influenced by social-economic forces.

Public participation methods have evolved from a primary focus upon public hearings to more participatory methods of public collaboration such as citizen advisory committees and focus groups (Leefers et al., 2003). It is essential to identify groups that have vested social-economic interests in State Forest planning and management. Interest groups that are important for public participation include statewide recreation and other user organizations, tribal governments, county and local units of government, resource conservation districts, watershed councils, non-governmental organizations, environmental and conservation interests, and industry.

4.2.3 - Principle 4. Provision of Public Access

Sub-Principle 4.1 Recreational Opportunities

Recreational activities and the provision of opportunities for them are vital to the communities in and around DNR lands. In particular, there are a wide variety of dispersed recreational opportunities on State Forest lands which are influenced through the compartment review process, the eco-regional planning process, and FMFM and Wildlife Division habitat and recreation programs. Primary among these are hunting, trapping, fishing, primitive camping, hiking and trail riding, birding, scenic tours, wild fruit and mushroom gathering, boating, snowmobiling, biking and off-road vehicle use.

Ownership patterns and surrounding land uses are important factors in determining the feasibility and prudence of each recreational opportunity.

Coordination with interest groups is necessary in the planning and management of recreational opportunities on State Forest lands. Interest groups that are important for public participation include statewide recreation and other user organizations, tribal governments, county and local units of government, resource conservation districts, watershed councils, non-governmental organizations, environmental and conservation interests.

The visual impact of harvesting and other forest operations is often readily visible to the public, and can alter their perceptions and views of DNR management of the forest resource. Likewise, the impacts of recreation users on the forest resource can alter the views of managers of the resource. Good two-way communication is vital to convey concerns with respect to impacts and the basis for management practices.

The use of citizen volunteers for activities such as campground, trails and other facility maintenance can be an important method of improving recreational opportunities.

Sub-Principle 4.2 - Educational Opportunities

Citizen involvement in State Forest activities ensures that the DNR is meeting community and user needs, and creates interest and a sense of ownership in these activities. The relationships that State Forest Districts and FMUs have with their communities and other organizations are important for generating public support for the forests, and creating additional potential relationships and resources for forest management activities. These relationships include public participation, partnerships with schools and community organizations, volunteers, and forest educational activities.

Dispersed recreational facilities such as trails can present an opportunity for education regarding the ecology of the forest community in which it is located. Interpretive nature trails and interpretive signs for exceptional geological or ecological features are particularly appropriate for non-staffed facilities.

Areas where public visibility and awareness of forest management prescriptions are present can present an opportunity for education regarding the purpose and intent of the prescription. The use of interpretive signs along roads adjacent to treated forest stands are a common tool.

The State Forest can provide an acceptable setting for the conduct of basic scientific research.

Sub-Principle 4.3 - Cultural Uses

Native American tribes are independent, sovereign nations, and the State of Michigan does not exercise any authority or control over tribal reservation or trust lands.

The treaties of 1836, 1837 and 1842 govern tribal hunting, fishing and gathering rights in on Federal lands in Michigan.

Both known and unknown areas of cultural, archeological, historical, religious and ceremonial significance and areas of customary use may be present upon State Forest Lands.

7. GLOSSARY OF TERMS

Afforestation: The establishment of a forest or stand in an area where the preceding vegetation or land use was not forest.

Biodiversity: The spectrum of life forms and the ecological processes that support and sustain them. Biological diversity occurs at four interacting levels: genetic, species, community, and ecosystem. The variety of living organisms considered at all levels of organization, from genetics through species, to higher taxonomic levels, also; the term encompasses the variety of habitats and ecosystems supporting the organisms, as well as the processes occurring within those systems.

Biomass: The dry mass of living organisms and dead organic matter contained in a defined area.

Community: An assemblage of species living together in a particular area, at a particular time, in a prescribed habitat. Communities usually bear the name of their dominant plant species, but include all the microbes, plants, and animals living in association with the dominant plant species at a given time. A grouping of organisms which exist in the same general place and have mutual interactions.

Compartment: Blocks of State Forestland that range from 1500 to 3000 acres in size. The size of a compartment is designed to facilitate systematic examination and treatment on a regular basis.

Conserve, Conserving and Conservation: **1.** Management of a renewable natural resource with the objective of sustaining its productivity in perpetuity while providing for human use compatible with the sustainability of the resource; **2.** The process and measures for restoring natural biological diversity through management efforts, in order to protect, restore, and enhance as much of the variety of native plant and animal species and communities as possible in quantities and distributions that provide for the continued existence and normal functioning of native species and communities, including the viability of populations throughout the natural geographic distributions of native species and communities.

Ecological Reference Areas (ERAs): Areas that serve as models of ecological reference within the state and may be located on any forest land ownership. They are high quality examples of functioning ecosystems that are primarily influenced by natural ecological processes. ERAs are defined as areas that have a natural community classification Global or State Rank of G1, G2, G3, S1, S2, S3 and an Element Occurrence (EO) Rank A or B.¹ The initial set of ERAs in is based on MNFI's current list of known high quality natural community sites (See Conservation Area Management Guidance). Additional ERAs will be identified through the Biodiversity Conservation planning process.

Ecology: The study of organisms or groups of organisms to their environment, both biotic and abiotic. A study of their linkages.

Ecosystem: A dynamic and natural complex of living organisms interacting with each other and with their associated nonliving elements in the environment.

Ecosystem Diversity: The distinctive assemblages of species and ecological processes that occur in difference physical settings of the biosphere.

Ecosystem management: A process that integrates physical, chemical, biological, and ecological principles, along with economic and social factors, into a comprehensive strategy aimed at protecting and enhancing sustainability, diversity, and productivity of a system.

Ecoregions: 1) Areas of relatively homogeneous ecological systems. Ecoregions are usually based on patterns of land use, topography, present and potential natural vegetation and soils. Ecoregion designations are used by resource managers to develop logical, regional strategies for land

¹ Natural Community Rank and Element Occurrence in Michigan are determined by Michigan Natural Features Inventory using the internationally recognized heritage methodology.

acquisition and management; **2)** Geographic areas established by the DNR, containing similar ecological patterns and processes whose political boundaries closely align with natural Ecoregions, that were established for organizing and administering assessment, planning, facilitating, and updating of regional ecosystem management activities. Four ecoregions were established: Western Upper Peninsula, Eastern Upper Peninsula, Northern Lower Peninsula, and Southern Lower Peninsula. These four ecoregions apply to all Divisions.

Eco-Team: A team of DNR employees composed of District and Management Unit Supervisors along with additional support personnel from each division that are mandated to accomplish regional ecosystem planning, assessment, and monitoring utilizing ecosystem management principles.

Edaphic: Related to or caused by particular soil conditions.

Endangered Species: Any plant or animal species defined through the Endangered Species Act of 1976 as being in danger of extinction throughout all or a significant portion of its range, and published in the Federal Register. A species facing imminent extinction or extirpation.

Forest: An ecosystem characterized by a more or less dense and extensive tree cover, often consisting of stands varying in characteristics such as species composition, structure, age class, and associated processes, and commonly including meadows, streams, fish, and wildlife. A plant community or predominantly trees and other woody vegetation growing more or less closely together, its related flora and fauna, and the values attributed to it.

Forest Type: A classification of forestland based on the species forming a plurality of live tree stocking.

Genetic Diversity: The differences in genetic composition within and among populations of a given species.

Geographic Information Systems or Science (GIS): A system designed for the collection, storage, and analysis of objects and phenomena where geographic location is an important characteristic. The study of this system is Geographic Information Science.

Habitat: The place where an organism lives and its surrounding environment including its biotic and abiotic components. Habitat includes everything an organism needs to survive.

Habitat Type System: A classification that uses the floristic composition of plant community (understory species as well as trees) as an integrated indicator of those environmental factors that affect species reproduction, growth, competition, and therefore, community development.

High Conservation Value Areas (HCVAs): Areas (including ERAs) that have been recognized for their contribution to specific conservation objectives or attributes through a recognized DNR process such as legislation, administrative rule, Director's and Natural Resource Commission Orders but not including the Open House/Compartment Review process. Examples of recognized processes include Dedicated Natural, Wilderness or Wild Areas, Natural Rivers, and Kirtland's Warbler plan.

Landscape: An area composed of adjacent and interacting ecosystems that are related because of geology, land forms, soils climate, biota, and human influences.

Landscape Scale: The appropriate spatial or temporal scale for planning, analysis, and improvement of management activities to achieve ecosystem management objectives.

Monitoring: The daily, seasonal, annual or longer-term collection and analysis of environmental and social data.

Net Ecosystem Production: The annual rate of biomass accumulation in live plants, live animals and soil organic matter.

Net Primary Productivity (NPP): The difference between gross primary production and plant respiration. $NPP = GPP - R_A$, where R_A = total plant respiration.

Old-growth Forest: The late successional stage of forest development, characterized by specific structural conditions such as multi-aged and multi-layered climax dominant trees, large snags, downed logs and coarse woody debris, and a developed and often patchy understory.

Orographic Lifting: The lifting of moist air over a geographic barrier, such as a mountain range, which results in the condensation and precipitation of the moisture from the air.

Poletimber: A live tree of commercial species at least 5.0 inches DBH., but smaller than sawtimber size. Harvested poletimber is sometimes referred to as cordwood.

Public: A group of people sharing a common interest or common characteristic: i.e. snowmobile groups, or residents of a county.

Pulpwood: Roundwood, whole-tree chips, or wood residues that are used for the production of wood pulp.

Rare Species: Species that have a limited range, or a limited number of individuals. This could include species found in very low numbers throughout their range, or species that may have rather large local populations, but only a handful of total populations.

Resource assessment: The determination of the significance, importance, or value of a resource or a set of resources.

Special Concern Species: Species that have a limited range, or a limited number of individuals so much so they are on the verge of becoming threatened or endangered.

Special Conservation Areas (SCAs): Special Conservation Areas are areas of State Forest land that have had one or more conservation objectives, interests, or elements identified. The type and strength of recognition will vary depending on the process used to identify the conservation value. Some SCA designations will have the force of law, (such as areas identified in Land Use Orders of the Director), some will be by cooperative agreement (such as National Natural Landmarks with the National Park Service), some will be by department process or agreement (such as deer yards, POG, and riparian buffers), and some will be identified by an external group or organization (such as Audubon's Important Bird Areas).

Sawtimber: A live tree of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs 8 feet or longer and meeting regional specifications for freedom from defect. Softwoods must be at least 9.0 inches DBH and hardwoods must be at least 11.0 inches DBH.

Site Index: A numerical indicator of site quality based on tree height at a specified age used as coordinates for interpolating site index from a specially prepared set of graphed curves for a given species of tree.

Spatial Scale: The geographical size of a community, ecosystem, or study. Spatial scale can range from a microsite such as an underside of a leaf on the forest floor, to a forest, to a larger landscape. Operationally, spatial scale refers to the geographic extent at which certain processes operate within the environment. This could be the scale at which nutrients recycle in a wetland to the patterns of deer migration in the Upper Peninsula.

Species: A group of individuals that can interbreed successfully with one another, but not with members of other groups. Plants and animals are identified as belonging to a given species based on similar morphological, genetic, and biochemical characteristics.

Species Diversity: The richness and variety of native species in an area. It includes not only the number of species in the area, but also their relative abundance and spatial distribution. Species richness is one component of species diversity, but not the only determinant.

Stakeholder: Individuals or groups impacted by and/or having an interest in the management of Michigan's natural resources and DNR programs. These would include Native American Nations, other State and local government agencies, academic institutions, the scientific community, nongovernmental entities including environmental, agricultural, and conservation organizations, trade groups, commercial interests, and private landowners and citizens.

Statewide Council (SWC): A team composed of all the DNR land-managing Division chiefs and some administrative division chiefs who meet periodically to plan and discuss policy, coordination, cooperation, and implementation of Department programs that concern ecosystem management.

Succession: The natural change in vegetation over time in the absence of disturbance or the artificial change in vegetation due to natural or human-caused disturbance.

Sustainable/Sustainability: Maintenance of healthy, functioning ecosystems capable of providing goods, services, and processes upon which human welfare ultimately depends. Also implied is the idea that the actions of the current generation will not diminish the resources and opportunities available to future generations.

Temporal scale: The time required to complete a study, a life history event or ecological process. Temporal scale can vary from a few seconds for biochemical reactions to thousands of years for ecosystem development. Operationally, temporal scale refers to the time extent certain processes operate in the environment. (The apparent spatial-operational scale of an ecological process will often change as the temporal-observational scale changes in the same process).

Threatened species: A plant or animal species likely to become endangered throughout all or a significant portion of its range within the foreseeable future.

Usufruct: The right to use property not owned by the owner, with the proviso that the condition or quality is not degraded by its use.

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