

MINNESOTA STATEWIDE CONSERVATION AND PRESERVATION PLAN

Brief summaries of DRAFT Recommendations As of May 20, 2008

Minnesota's quality of life and economic vitality depend on clean air and water, abundant fish and wildlife, healthy forests, and access to outdoor recreation. Unfortunately, complex and rapid changes affecting our landscapes and watersheds are leading to degradation and loss of these precious amenities. Such critical environmental issues can no longer be addressed piecemeal. Instead, a wide range of experts must work together to better understand Minnesota's environment, economy and natural resources.

To gain this knowledge and proceed with a feasible action plan, the Legislative Citizens Commission on Minnesota Resources (LCCMR) has funded a partnership of the region's foremost natural resource experts. More than 40 research scientists from the University of Minnesota, staff from private consulting firms Bonestroo and CR Planning, numerous state agency professionals, and representatives from stakeholder groups (ex. Ducks Unlimited, Builders Association of Twin Cities, Minnesota Association of Counties, League of Minnesota Cities, etc.) have worked together on developing the Minnesota Statewide Conservation and Preservation Plan ("Conservation Plan").

With input from the public, the teams are now working to finalize recommendations for the Conservation Plan before delivering the plan to the LCCMR in July 2008. This document contains brief summaries of recommendations that will be considered for the final plan.

Each of the nearly 70 recommendations falls under one of three key areas: Land and Aquatic Habitat Conservation as applied on a landscape level; Energy Production and Use; and Land Use Practices as applied on a site level. These focus areas have the broadest influence on multiple resources and are most amenable to management through policy and investment decisions.

Please review the following summary of recommendations and share your comments via the public forums, or send an e-mail to info@mnconservationplan.net.

LAND AND AQUATIC HABITAT CONSERVATION

A. Maintain or restore critical land habitat. Recommendations include:

1. **Research.** Minnesotans pride themselves on the natural features of the state, but as the climate warms and the population increases, the quality and quantity of these resources will continue to decline. The project team examined spatial data layers in relation to where housing development is most likely to occur; location of road networks; agricultural-bioenergy activity; and land ownership. Minnesota should continue to appropriate a portion of the budget to improving our understanding of fish and wildlife populations, native biological diversity and water quality, and to mitigating the stressors that affect them.

2. **Acquisition – protection of land habitats.** With the exception of deer and a few wildlife species, the outdoor recreation opportunities and success for fishing and hunting in Minnesota have significantly declined in the past 50 years. Land and watershed changes have resulted in degradation of water quality and aquatic habitats in wetlands, streams, rivers and lakes. The project team has identified critical land habitats and ranked those areas by township in 22 ecological subsections. Currently, there are several programs for land acquisition, protection and restoration within the public and private sectors. Minnesota must continue these efforts by implementing a long-term habitat acquisition and protection plan as soon as possible.

B. Maintain/restore critical habitat at the land/water interface. Recommendations include:

3. **Research.** Shoreland developments are changing Minnesota's lake ecosystems. Development pressure is increasing with more dwellings and docks per lake each year, leading to a cumulative effect on fish, wildlife habitats and water quality. In the next 2-20 years, depending on the task, the project team has determined the need for research in near-shore habitat vulnerability. The team also recommends conducting social science on the human behaviors that lead to degradation and loss of near-shore habitat, as well as policies or programs that result in preservation or restoration of such habitats.
4. **Acquisition – critical shoreland habitat.** Aquatic management areas provide a critical foundation for shoreland protection and management, while providing public access to fishing, hunting, recreation and observing wildlife. Over the next 25 years, the project team recommends investment in acquisition of critical shoreland habitat. A holistic approach is needed for shoreline protection, including best management practices, shoreland regulations and incentives, zoning ordinances, conservation development and technical guidance for lakeshore owners.
5. **Acquisition – protection of shallow lake shorelines.** Shallow lakes are extremely sensitive to disturbance and are subject to mixing from wind, motorized boats and fish. Minnesota's shallow lakes are becoming the target of development proposals, leading to degradation of watersheds and shorelines. The project team recommends land protection tools and programs including tax incentives, conservation easements for shoreland protection and restoration, and land acquisition. These programs should target the state's forest, forest-prairie transition, prairie zones, and lakes with outstanding natural resource and wildlife habitat value.
6. **Education.** In order to provide a better understanding of the factors surrounding land and water resources, the state must invest in the consolidation, adaptation and development of educational materials on watershed science principles. In addition, significant efforts are needed to communicate this information to the public. Potential approaches include the development of a "master watershed practitioner," recognition certificates and awards, and college credits for people interested in watershed management work.
7. **Keeping water on the landscape.** The mismanagement of vegetation and soil adversely impacts the natural resources of shoreland areas. Examples include erosion and sedimentation to surface waters; the filling of areas that previously held and filtered surface water runoff; and the clearing of shoreland vegetation that once maintained the scenic vistas of our lakes and streams. Moreover, conversion of the shoreline has adverse impacts on water quality. The project team recommends keeping water on the landscape by expanding perennial vegetation. This can be accomplished through water management changes and policies that protect and conserve critical land areas.

8. **Restoration and rehabilitation – shallow lakes.** Most shallow lakes in Minnesota are currently in the turbid water state. This is due to increased flows of water and nutrients from intensively drained and cultivated landscapes, and abundant populations of invasive fish that result from increased connectivity (i.e. ditches) and persist due to lack of natural winterkill. Other threats include housing development and inappropriate surface uses. Funding is needed to purchase conservation easements around shallow lakes to restore their lakesheds and to prevent development. Funding is also needed to install invasive fish barriers and water control structures.
9. **Restoration and rehabilitation – wetlands.** Minnesota should also invest in the restoration of drained wetlands and converted wetland-associated uplands for wildlife habitat and water quality benefits. This work should consider the need to compensate landowners for restoring these lands above the fair market value of the land, since most sites are not for sale and high crop prices deter conversion of land from agriculture to other uses. The state should also consider the utility of allowing land to remain in private ownership via easements.

C. Maintain or restore critical in-water habitat. Recommendations include:

10. **Research.** Groundwater is an indispensable, albeit hidden supply source for many water-based ecosystems, and it is vital to understand how much we have, where we can find it, its quality, how it moves, and many other factors. Therefore, the state needs to make a major investment in the collection and assessment of groundwater information and its connection to surface waters. This need exists at both site-specific and hydrologic-systems scales. Each scale is fundamental to sustainable water and ecosystem management.
11. **Policy.** In order to improve water quality and aquatic habitats, the state should invest in a comprehensive review and analysis of existing Minnesota statutes related to drainage. In turn, they should make recommendations to the Legislature that remove barriers and better facilitate the restoration of critical wetlands.
12. **Restoration and rehabilitation.** In-lake habitat is critical for fish, wildlife and water quality. Accordingly, we must reduce the number of Minnesota lakes in a turbid water state, and restore some of the 500-plus drained shallow lakes. The state should accelerate efforts to restore and improve shallow lake habitat in priority watersheds. A program to restore the natural features of lakeshores should also be developed, and watershed protection efforts should be initiated with a special commitment.
13. **Evaluation and understanding.** Effective water quality protection and restoration will require additional monitoring, research and evaluation of water and land responses to climate change, among other catalysts. While much is known within various scales, responses across scales are not understood as fully. Research is needed to build the capacity of resource managers, so they can better understand and evaluate the many factors at work in the water resources of the state.

D. Outdoor recreation recommendation:

14. **Improve connectivity of and access to outdoor recreation areas.** Connectivity and access will enhance opportunities for environmental productivity, as well as recreational opportunities for the diverse generations and ethnic groups that Minnesota represents. Accordingly, the state should prioritize the acquisition, protection and restoration of natural resources that support outdoor recreation. The state should focus on shoreland; large, contiguous land areas; threatened habitat areas; rapidly growing areas; and areas where land use changes may limit future opportunities.

ENERGY PRODUCTION AND USE

A. Promote alternative energy production strategies. Recommendations include:

15. **Invest in research and demonstration projects on a landscape scale.** Energy crops are expected to play a major role in development of biomass resources for next-generation biofuels or carbon-neutral electricity. The project team recommends coordinated research and policy experimentation to develop and refine renewable energy production systems. The efforts should focus on biomass farming that emphasizes perennial biomass crops. This initiative has potential to improve environmental quality and support economic revitalization in rural Minnesota.
16. **Develop policies and incentives to encourage perennial crop production for biofuels.** Currently, there is little economic incentive for farmers to grow energy crops in Minnesota. This contrasts with subsidies for other crops that are provided from federal sources today. The project team recommends that the state develop firm policies that would incentivize the growth of energy crops on conservation lands and marginal farmlands, while also reflecting environmental and ecological needs for animal habitat and water resource conservation.
17. **Develop coordinated laws, policies and procedures for governmental entities.** A wide array of initiatives are required to meet both goals of protecting Minnesota's environment and meeting society's energy demands. Multiple state agencies will be involved under many laws and programs. All these initiatives should pull in the same direction and not be at odds with one another. The project team recommends that the state support coordination on these issues across agencies as allowed under current state law. The multiple agencies, laws, and programs should be coordinated and streamlined toward the goal of maximizing state investments. Progress on coordination and streamlining should be assessed and progress across issues should be tracked.
18. **Invest in data collection to support the assessment process.** Minnesota needs a comprehensive approach to monitoring the cumulative impact of its energy production on the environment. Data collection to support the monitoring and assessment of energy production should cover every step of the process. At present, many of the data needs are incomplete or lacking entirely. Minnesota should fund data collection in locations around the state.
19. **Invest in research to determine sustainable removal rates of corn stover and to establish incentives and Best Management Practices (BMPs).** There is an ongoing debate among researchers and practitioners regarding how much corn stover may be removed from a field for biofuels or animal feed processing, without negative impacts on soil carbon and erosion rates. If negative impacts of corn stover removal may be mitigated through farmer practice, the state should encourage adoption of these BMPs.
20. **Invest in research to review thermal flow maps for Minnesota.** Using geothermal energy can tap potential lost each day from the natural heat conducted from the earth's interior to the earth's surface, which is then radiated to space. Experts from the Minnesota Geological Survey and their counterparts at the Natural Resources Research Institute should critique the existing heat flow map for Minnesota. Once the state's geothermal power development potential is assessed, funding should be made available to study the potential adoption of Organic Rankine Cycle (ORC) engines for industrial applications.

21. **Invest in applied research to reduce energy and water consumption and emissions in ethanol plants.** A criticism of Minnesota corn-based ethanol plants is the small net gain of energy output from the energy expended to produce ethanol. Criticism has also focused on the high water resource needs that accompany current production techniques. Current production methods also lead to significant co-product generation of carbon dioxide. The project team recommends funding for applied research and demonstration of ways to reduce water consumption and energy use and reduce carbon dioxide emissions at corn-based ethanol plants.
22. **Invest in research to determine the life cycle impacts of renewable energy production systems.** This recommendation aims to inform Minnesota's renewable energy development through data collection and analysis. The project team recommends that energy policy and incentives at the state level take a "systems view," accounting for the resource benefits and impacts associated with each stage of energy production, transport, consumption and associated waste processing.
23. **Invest in research and demonstration projects to develop, and incentives to promote, combined wind power/biomass, wind power/natural gas, and biomass/coal co-firing electricity projects.** Biomass gasification is an alternative that can supplement wind energy. Converting wind power to hydrogen and ammonia allows for better storage of energy and creates byproducts that can reduce our reliance on imported liquid fuels. Combined wind/biomass systems are needed for electricity production even during low wind speeds.
24. **Invest in farm and forest preservation efforts to prevent fragmentation due to development guided by productivity and environmental vulnerability research.** Farm and forest fragmentation is a serious threat to wildlife habitat and ecosystem biodiversity. Expansion of urban and agricultural areas often produces fragmentation of forests, and urban expansion reduces the land resource available for producing food, feed, fiber and fuel. Strategies and policies are needed to protect farms and forests, and prevent fragmentation.
25. **Invest in research and enact policies to protect existing native prairies from genetic contamination by buffering them with neighboring plantings of perennial energy crops.** Existing native prairies are a rare and declining habitat worthy of protection. Expansion of perennial biofuels crops into areas adjacent to natural prairies could threaten their existence by genetic contamination. Research is needed to determine what buffer widths and types of perennial crops can be used to minimize the risk of genetic contamination.
26. **Invest in efforts to develop sufficient seed or seedling stocks for large-scale plantings of native prairie grasses and other perennial crops.** If perennial crops are to become a significant component of biofuels production in Minnesota, sufficient genetic stock for large-scale plantings will be necessary. Seed and seedling stocks would need to be built up over 3-5 years and maintained while perennial biofuels are grown in Minnesota.

B. Promote a healthy rural economy. Recommendations include:

27. **Invest in research and policies regarding "green payments."** Although the Reinvest in Minnesota program pays farmers to enroll their land in conservation easements, the program may be less effective when high commodity prices dissuade farmers from renewing their contracts. A green payment program, on the other hand, would allow farmers to leverage the multiple environmental benefits of removing their land from intensive production. Green payments could be used to promote perennial biofuels crop production on expiring CRP lands, on critical lands in impaired watersheds, on DNR working lands, in Wellhead Protection Areas, or in vulnerable wildlife habitat.

28. **Investigate opportunities to provide tax incentives for renewable energy investors.** Assisting individuals to invest in renewable energy technologies could have a snowball effect that would lead to widespread adoption of these technologies in Minnesota. This would reduce greenhouse gas (GHG) emissions, mercury and other harmful air pollutants from coal-fired plants. It would also reduce water consumption in the electricity generation sector, and could reduce the pressure on land resources to provide biofuels. The state should make it easy and cost-effective for homeowners or businesses to get their electricity from solar, geothermal or wind power sources they install themselves.
29. **Provide incentives and invest in research to determine the costs and opportunities of electricity production for transportation.** Fueling our vehicles predominantly with ethanol would place enormous pressure on the state's land resources, and would take land out of food production and conservation. Therefore, a state goal should be to transition the vehicle fleet away from dependence on fossil fuels and biofuels. Powering vehicles with electricity from renewable sources makes sense from an ecological and sustainability standpoint, but is not yet economically viable. Minnesota should provide incentives and research funding with the goal of creating a robust electric vehicle sector in the state.
30. **Invest in efforts to develop, and research to support, community-based energy platforms for producing electricity, transportation fuels, fertilizer, etc. that are locally/cooperatively owned.** Local communities need to take more responsibility for producing and distributing their own electricity, transportation fuels and fertilizer through locally or cooperatively owned business endeavors. A combination of strategies including wind power, solar power, biomass energy, novel energy storage methods, environmental stewardship and economic development are needed to achieve greater energy sufficiency at the local level.

C. Promote energy conservation efforts. Recommendations include:

31. **Promote policies and incentives that encourage carbon-neutral businesses, homes, communities and other institutions.** Much more could be done to encourage Minnesotans to reduce their carbon footprints, through energy conservation and low-carbon fuel use. Most likely, achieving carbon neutrality will require a portfolio of energy technologies and lowered energy consumption, as seen at the University of Minnesota, Morris (wind, biomass, etc.). Policies and incentives should be targeted to assist individuals, businesses, communities and institutions in developing renewable energy portfolios.
32. **Invest in public education focusing on benefits and strategies for energy conservation.** Individual action is critical in reducing state energy demand, which will lower GHG emissions and reduce pressure on land resources to provide alternative fuels. There is a need to educate the public about lifestyle choices they can make to reduce their energy consumption. Advertising and communications experts should be brought into this effort to disseminate the carbon reduction message in a creative way that reaches the broadest possible segment of the population.
33. **Develop standards and incentives for energy capture from municipal sanitary and solid waste, and minimize landfill options.** An underutilized energy source exists in most communities that could reduce the need for new energy production—namely, municipal solid waste (MSW) products that remain after recycling and reuse options are exhausted. A state mandate should be established that requires the capture of energy units from MSW. Statutory actions should be taken to establish targets for MSW use and minimization of landfill options.

34. **Implement policies and incentives to lower energy use of housing stock while monitoring the performance of improvements.** Housing improvements should consist of locally-manufactured building material resources, especially those that use industry byproducts as their primary production feedstock. The project team recommends that the state develop specific policies and incentives to improve construction practices for new residential homes. The University of Minnesota has developed new technologies that present alternative means and methods for achieving vastly improved energy code compliance; these technologies should be further investigated to overcome implementation barriers.
35. **Promote policies and strategies to implement smart meter and smart grid technologies.** Minnesota should implement smart meters to help electricity users gauge their usage, estimate a carbon footprint and conserve energy. The state should also promote policies and strategies toward smart grids, which use advanced, information-based technologies to increase grid efficiency, reliability and flexibility, and to reduce the need for new generating, transmission and distribution facilities.
36. **Develop incentives to encourage the widespread adoption of passive solar and shallow geothermal heat pump systems in new residential and commercial building construction.** The use of alternative heating technologies will allow significant reduction in natural gas, heating oil and electrical energy requirements for the state. In addition, the greenhouse gas impact associated with water and structure heating will be reduced. The project team recommends that policies be established to promote the widespread adoption of passive solar and shallow geothermal heat pump systems in new residential and commercial building construction.

D. With the goal of promoting reductions in mercury deposition, the following ideas are being developed into recommendations:

37. State agencies should work closely with the Environmental Protection Agency to develop mercury reduction strategies and assessment tools for the state, while meeting federal Clean Air and Clean Water Act standards. A strategy should be developed that includes reduction of in-state demand for coal-powered electricity, and addresses mercury deposited in Minnesota from out-of-state sources.
38. Minnesota should develop a strong public education and outreach effort focusing on the health risks associated with mercury pollution and on techniques for reducing mercury loads (including energy conservation and proper disposal of light bulbs) in the environment.
39. The state should be provided with adequate resources to continue to enforce/support existing mercury regulations and programs that lead to reduced emissions of mercury in Minnesota through market restrictions, pollution control techniques and disposal requirements.

LAND USE PRACTICES

A. Agricultural land use practice recommendations include:

40. As much as possible, transition renewable fuel feedstocks to perennial crops.

- A. **Research.** Minnesota agro-eco-regions differ considerably in suitability for perennial species that can serve as feedstocks for biofuels and other products. Growing season length and temperature, precipitation and soil characteristics are important determinants of species suitability. Research is necessary to assist producers in selecting site-specific perennial species for use as cellulosic feedstocks.
- B. **Policy.** Current farm bill commodity programs provide strong incentives for annual row-crop production, primarily corn, as feedstock for ethanol. As technology improves for use of perennial plants as feedstock for ethanol, the incentives should change to encourage their use. The existing state mandate for ethanol blends in gasoline could be amended to gradually decrease the greenhouse gas equivalent of the ethanol produced to fulfill the mandate, which would strongly incentivize a shift to perennial plant feedstock sources.

41. Reduce streambank erosion through reductions in peak flows.

- A. **Research.** There is little research in Minnesota quantifying the relationship between artificial drainage and stream flows. Studies to quantitatively partition the effects of changing precipitation, artificial drainage and changes in land cover have not yet been initiated. The project team recommends an investment in research to determine the quantitative relationship among trends in precipitation, artificial drainage systems and stream hydrology.
- B. **Policy.** There are currently no explicit goals for peak flows or flow reductions. The project team recommends setting research-based goals for peak flow reductions through hydrologic detention, wetland restoration and other measures. There is currently no effective policy regarding mitigation of peak runoff flows originating in rural areas. The team also recommends that the state investigate, analyze and adopt science-based policy that strengthens mitigation of peak flows from artificial drainage systems.
- C. **Protection investment.** Existing wetland restoration programs are not targeted specifically at modifying drainage systems to reduce peak flows. The project team recommends investment in strategically targeted programs for reduction of peak flows through increased water detention in agricultural drainage systems, in-ditch storage and conservation drainage.

42. Reduce upland and gully erosion through soil conservation practices.

- A. **Policy.** Federal farm bill and energy policy and incentives are increasing row-crop production, especially on the sloping soils of Southeast Minnesota where a higher proportion of land had been in pasture and perennial crops. The increased width of tillage, planting and spraying implements has encouraged the elimination of terraces and grassed waterways, increasing delivery of sediment to surface waters. The project team recommends that the state investigate the feasibility of developing or amending policy to phase in outcome-driven, practice-flexible soil and water conservation plans for all farms with potential to deliver sediment and nutrients to water bodies.

B. **Protection investment.** The project team recommends investment in education and incentive programs, leveraging federal, state and local resources when possible, that target land owners in critical sediment source areas.

43. **Enable improved design and targeting of conservation through improved and timely data collection and distribution.**

A. **Data collection investment:** The project team recommends investing in statewide high-resolution digital elevation data and associated high-resolution watershed delineation; statewide updated land cover data; maps of the artificial drainage network; and a long-term program monitoring the effectiveness of BMPs on critical source areas. The state should also invest in an annual crop residue survey of sloping lands near streams; a periodic detailed survey of benchmark sampling sites to determine trends in soil erosion; and periodic remote sensing by aircraft and/or satellite for land cover and other attributes.

44. **Increase protection of important agricultural lands in local land use planning.**

A. **Policy.** Counties, townships and other communities containing productive agricultural land would be encouraged to conduct land-use suitability modeling and mapping and to implement programs that effectively constrain non-farm development in areas of identified priority agricultural land. In addition, a one-time, multi-day event would be held to bring together Minnesotans with national experts to explore ways that agricultural land can be preserved for the long term.

B. **Investment.** The project team recommends the development of technical assistance and outreach materials and tools for ongoing support to local governments. These could include GIS mapping and analysis tools; best practices on building community support, funding identification and program design; implementation issues, such as land appraisals, easements and easement compliance; and federal Farm and Ranchland Protection Program requirements.

B. Urban land use practice recommendations include:

45. **Ensure protection of water resources in urban areas by evaluating and improving current programs.**

A. **Establish a credit system for stormwater and Low-Impact Development (LID) BMPs.**

Various stormwater regulatory programs have the potential to significantly improve water quality in a large number of water bodies throughout Minnesota. However, their implementation is inhibited by the absence of a meaningful credit system for stormwater and LID BMPs. The project team recommends the development of a credit system that would address and provide incentive toward a wide range of BMPs.

B. **Simplify modeling for Total Maximum Daily Load (TMDL) compliance.** Cities need a relatively simple stormwater modeling system to estimate their current loading for a range of pollutants and the changes to their loading if various BMPs are implemented on portions of the land in their jurisdiction. The project team recommends the development of a model that could be used by all cities and other landowners with low technical knowledge and manageable input requirements.

C. **Monitor TMDL BMP implementation.** There is a widely-recognized need for more information about the effectiveness of BMPs. The project team recommends a program of detailed BMP

monitoring in selected watersheds with TMDL studies and implementation plans. In addition to monitoring the water body itself, this program would involve monitoring throughout the watershed.

46. Establish a more effective and coordinated land planning process.

- A. **Conservation-based planning.** One of the greatest threats to our state's natural resources is the expansion of our urban areas. Conservation-based community planning addresses the threats of urban expansion by enabling communities to develop in a more compact, efficient manner, while creating a permanent green infrastructure. The project team recommends providing pilot project funding for select communities who wish to develop conservation-based plans, as well as instituting a new policy for enhanced integration of our land use decisions.
- B. **Land use, development and investment guide.** Minnesota spends billions of dollars each year on infrastructure, regulation, and local government and business assistance. Yet, the state gives little thought to how these dollars come together on the land and in communities. Now more than ever, a statewide land use, development and investment guide is vital, given the intense competition for land and resources and the scarcity of state funds, coupled with the uncertainties introduced by climate change.
- C. **Invest in a pilot planning project along a Minnesota corridor that focuses on integrating "gray infrastructure" with existing "green infrastructure."** Over the next 20 years, growth in the Twin Cities will increase by 1 million-plus people. To accommodate the burden on our transportation system, new roads, bridges and transit facilities will be required. Unfortunately, gray infrastructure (transit facilities, roads, bridges) is often developed at the expense of green infrastructure (natural resources, parkways, protected land). This proposal involves establishing a pilot project to create a model for a more effective and coordinated land planning process.

47. Establish funding sources and tools for Minnesota communities seeking to prepare and implement conservation-based comprehensive plans.

- A. **Fund the creation of a user-friendly carbon calculator for communities.** If all Minnesota communities could easily understand the effect that local land use decisions have on green house gas emissions, they would be able to test alternatives and make better decisions. The net effect of the widespread use of such a tool could be very significant for our resources. Therefore, the project team recommends funding the creation of a user-friendly carbon calculator for communities.
- B. **Invest in a Conservation Catalyst Fund.** Current research shows that corridors of conserved natural systems perform better in multiple ways. Many communities are planning to establish multi-purpose greenway corridors. Unfortunately, many local governments lack the combination of regulations and funding sources to acquire and maintain these corridors. The project team recommends creating a Conservation Catalyst Fund. The fund would provide grants to communities that have adopted excellent greenway corridor plans but are unable to complete a key linkage in their system.
- C. **Provide communities with the tools necessary for developing and implementing conservation-based comprehensive plans.** Scenario planning is one important tool of conservation-based comprehensive plans. These scenario plans allow citizens and decision-makers to see the consequences of various development patterns. Strategic planning initiatives

should be supported that use scenarios to provide citizens and public officials with choices in how their community can develop over time. Funding should also be made available for technical assistance and resources for communities that wish to make changes to their planning, zoning, and codes.

- D. **Provide communities with support and technical assistance through a Minnesota Community Enterprise Partnership.** Most harm to natural resources results from noble attempts to meet other needs such as energy, transportation and housing. To encourage a more holistic approach to conservation and development, the project team recommends that Minnesota support a community enterprise partnership. The enterprise would encourage and empower agencies to combine resources to help implement planned, innovative activities in ways that simultaneously enhance environmental quality, economic vitality and quality of life.
- E. **Establish a statewide grant program to build capacity to conserve water quality, natural lands and parks.** Local governments and nonprofit conservation organizations can be key agents in implementing a statewide conservation and preservation plan. Providing funding and incentives to local entities can increase their ability to protect natural resources. The project team recommends establishing a statewide grant program that would increase local capacity to conserve water quality, natural lands and parks, and reflect the state's conservation priorities.
- F. **Support state agencies to provide conservation and development assistance to growth communities.** Projected increases in population pose imminent threats to Minnesota's unprotected natural habitats and serious land availability issues for developing communities. The project team recommends providing incentives for communities to develop in ways that conserve natural resources. Incentives could include natural resources information, data and analysis; technical assistance; training workshops; site and community design; and mentoring opportunities.

48. **Invest in generating base data and information necessary to support decisions or tools.**

- A. **Update land cover databases and remote sensing capabilities.** Land and watershed management relies on characterizations that are up-to-date and reflect changes from past inventories. As land and water characteristics change quickly, periodic updating of the information on five-year cycles will improve evaluation of management actions. The project team recommends that investments should include: updating statewide land cover and lake quality data; and acquisition of aerial remote sensing capabilities to obtain near-real time updating of critical land cover/land use information.
- B. **Develop data in areas vulnerable to development or conversion of land cover.** Accurate information about the type and quality of natural resources is essential to making sound planning decisions. The Minnesota Land Cover Classification System (MLCCS) is a powerful tool that provides high-quality data necessary for planning. Unfortunately, current MLCCS data is severely lacking in most of the state. The project team recommends that Minnesota promote and fund the completion of such data in select regions, with a priority emphasis on areas vulnerable to near-term land cover conversion, including growth corridors and areas at high risk for natural resource extraction.
- C. **Develop statewide Light Detection and Ranging (LiDAR) database.** Accurate digital topographic information is essential to predicting water flows and soil erosion. The project team

recommends investing in high-resolution digital topographic (elevation) data. The elevation data would be obtained using LiDAR with a laser scanner mounted on light aircraft.

C. Transportation practice recommendations include:

49. **Integrate streamlined environmental transportation project review.** The project team recommends that the state streamline project planning protocols through coordination across state, metropolitan and county/local transportation, land use and conservation decision-making responsibilities. The state should create a cross-consultative forum and an environmental team to lead federally-and state-mandated impact assessment.
50. **Reduce per capita vehicle miles of travel.** The project team recommends that the state incorporate Transportation Demand Management strategies in planning and project design. This would enhance local intermodal access in support of density and land use mix and resource conservation. The state should give priority to qualified transit and other non-motorized system fiscal investments in the State Transportation Improvement Program for regions that integrate local resource planning and performance standard-based design for compact development.
51. **Align transportation planning across agencies and across projects.** The project team recommends that Minnesota Department of Transportation (MnDOT) surface transportation planning be aligned with and other large-scale regional projects (such as commuter rail, regional parks, and urban area expansion). This alignment should occur in concert with other state agencies and plans. The planning integration would be accomplished in consultation with relevant agencies, and centered on critical resource protection issues.
52. **Develop research programs on habitat fragmentation.** Many species are impacted by bridging, culverts, road width, pavement and shoulder treatments. The same species often benefit from grade-separated crossings or vegetated edge design and management. To determine the pending impacts, the project team recommends that research on best conservation practices for Minnesota's prime terrestrial and aquatic habitats, as well as species in greatest conservation need, should be embedded into the statewide and district office transportation planning.
53. **Reduce non-point source pollution to surface and ground waters.** The project team recommends that the state establish watershed databases on non-point source pollutants by land use/land cover types. The state should also establish transportation design, planning and management practices according to contaminant, land cover, slope, soils, stream segment, overland distances (buffers) to surface waters, and relationship to groundwater and biotic resources (especially aquatic habitat).

D. Forestry land practice recommendations include:

54. **Provide incentives for sustainable forestry.** The project team recommends that the state provide incentives to landowners and forest managers for the sustainable management of forest land, including tax relief, payments for conservation easements, and other economic tools.
55. **Assess tools for forest land protection.** The team recommends that Minnesota assess how conservation easements relate to other forest land protection tools. The state should also produce a report card assessing the effectiveness of all forest land protection tools.
56. **Protect large blocks of forest land.** The team recommends that the state focus protection efforts on large blocks of forest land. In determining areas to protect, Minnesota should connect the identification to key indicator species and utilize an ecosystem/biodiversity perspective. In order to

address climate change and invasive species, the state should also expand and connect already protected areas.

57. **Establish state leadership on natural resources and land use.** Parcelization is a problem for the forest industry and forest habitat. When lands are zoned for smaller parcels, they are developed and forest resources decline. Based on guidance from the state, each county should create a natural resource-based land use plan to identify areas of forest land needed to maintain habitat, water quality, and economic health. State leadership would also involve funding the collection and distribution of data necessary for the county-level process.
58. **Connect best management practices to biomass harvesting.** The project team recommends that Minnesota educate landowners, loggers and forest managers on biomass harvesting best management practices. The master logger certification program is an example of useful outreach.
59. **Assess and improve sustainable forestry best management practices.** The state should support continuous improvement of best sustainable forestry management practices through monitoring. The current sustainable forestry guidelines contain some level of uncertainty so additional research and monitoring is necessary. Minnesota should also increase funding for education of best management practices for both the public and the logging industry.
60. **Fulfill the Scientific and Natural Areas (SNAs) mandate.** The project team recommends this measure in order to expand resiliency to climate change. Minnesota should create five SNAs per native plant community, including forests, in order to hedge our bets against climate change.
61. **Expand the supply of, and demand for, sustainably harvested wood.** Minnesota should educate consumers on certified wood to increase the market, as well as subsidize certification of loggers and automatically certify Sustainable Forest Incentive Act (SFIA) enrolled lands.
62. **Promote collective/cooperative management of forestlands at a landscape level.** Minnesota should promote landscape-scale management of forestlands in order to increase the multiple benefits of forests (timber, air quality, carbon sinks, water quality, etc.). The project team recommends supporting the Minnesota Forest Resources Council efforts on this topic.
63. **Increase our understanding of invasive species.** We do not currently know if management impacts susceptibility to invasive species. In addition, we do not fully understand the effect of climate change on invasives. The state needs to develop a comprehensive inventory of invasive species' geographic extents. Inventories should be strategically targeted in order to know where to focus efforts. The Ecological Classification System (ECS) field guide and management protocols should also be expanded.
64. **Create deer exclusion pilot projects in every ecological subsection.** Minnesota has made huge investments in white pine regeneration, but white pine and many other plant species are threatened by deer impacts. Deer control has economic and environmental benefits. The purpose of these pilot projects would be to gain a better understanding of the impact of deer on forest biodiversity, and to understand how forest ecosystems will respond to climate change. The projects should include low-deer and no-deer reserves.
65. **Support the use of fire to increase forest health and biodiversity.** Use of fire is a management strategy currently accepted for certain plant community classifications. The project team recommends utilizing fire in pine and oak forests to encourage regeneration. This would result in an overall

improvement in habitat quality benefiting multiple species. Fire as a BMP could be used in conjunction with biomass harvested for energy production.