M.L. 2014 Projects

MN Laws 2014, Chapter 226, Section 2 (beginning July 1, 2014)

MN Laws 2014, Chapter 312, Article 12, Section 8 (beginning July 1, 2014)

For the Minnesota's FY 2014-15 biennium (July 1, 2013 - June 30, 2015), approximately $33.8 million was available each fiscal year (Total = $67,620,000) for funding from the Environment and Natural Resources Trust Fund. In response to the 2014 Request for Proposal, 192 proposals requesting a total of approximately $111 million were received. Through a competitive, multi-step process 94 of these proposals, requesting a total of $58.7 million, were chosen to present to the LCCMR and 71 of those proposals, totaling $29 million, were chosen to receive a recommendation for funding to the 2013 MN Legislature. The Legislature adopted all 71 of these project recommendations and they were signed into law by the Governor on 05/09/14. The Legislature added one additional project and it was signed into law by the Governor on 05/20/14. For 2014 a total of 72 appropriations will be receiving $30,430,000.

NOTE: For all projects, contact us to obtain the most up-to-date work programs for current projects (project updates are required twice each year) or the final reports of completed projects.

When available, we have provided links to web sites related to the project. The sites linked to this page are not created, maintained, or endorsed by the LCCMR office or the Minnesota Legislature.

M.L. 2014, Chapter 226, Section 2 Appropriations
M.L. 2014, Chapter 312, Section 8 Appropriations

MN Laws 2014, Chapter 226, Section 2

Subd. 03 Water Resources

03a	Solar Driven Destruction of Pesticides, Pharmaceuticals, Contaminants in Water - **RESEARCH**
03b	Methods to Protect Beneficial Bacteria from Contaminants to Preserve Water Quality - **RESEARCH**
03c	Triclosan Impacts on Wastewater Treatment - **RESEARCH**
03d	Evaluation of Wasterwater Nitrogen and Estrogen Treatment Options - **RESEARCH**
03e	Antibiotics and Antibiotic Resistance Genes in Minnesota Lakes - **RESEARCH**
03f	Impacts of Estrogen Exposure on Minnesota's Shallow Lake Wildlife - **RESEARCH**
03g	Watershed-Scale Monitoring of Long-Term Best Management Practice Effectiveness - **RESEARCH**
03h	Protection of State's Confined Drinking Water Aquifers - **RESEARCH**
03i	Watershed Water Budgets for Managing Minnesota's Groundwater - **RESEARCH**
03j	Identifying Causes of Exceptionally High Mercury in Fish - **RESEARCH**
03k	Reducing Lake Quality Impairments through Citizen Action
03l	Rainwater Reuse and Valuation Investigation
03m	Measuring Hydrologic Benefits from Glacial Ridge habitat Restoration - **RESEARCH**

Subd. 04 Aquatic and Terrestrial Invasive Species

04a	Blocking Bighead, Silver, and Other Invasive Carp by Optimizing Lock and Dams - **RESEARCH**
04b	Bioacoustics to Detect, Deter and Eliminate Silver Carp - **RESEARCH**

07b Metropolitan Regional Park System Acquisition
07c Mesabi Trail Development - Soudan to Ely Segment
07d Shoreland Acquisition on St. Croix River
07e Martin County Park and Natural Area Acquisition
07f Minnesota River Water Trailhead and Landing in Morton

Subd. 08 Air Quality, Climate Change, and Renewable Energy

08a Solar Cell Materials from Sulfur and Common Metals - **RESEARCH**
08b Innovative Groundwater-Enhanced Geothermal Heat Pump Study
08c Demonstrating Innovative Technologies to Fully Utilize Wastewater Resources - **RESEARCH**
08d Transitioning Minnesota Farms to Local Energy
08e Life Cycle Energy of Renewably Produced Nitrogen Fertilizers
08f Clean Water and Renewable Energy from Beet Processing Wastewater and Manure - **RESEARCH**
08g Next Generation Large-Scale Septic Tank Systems - **RESEARCH**
08h Solar Photovoltaic Installation at Residential Environmental Learning Centers
08i Itasca Community College Woody Biomass Utilization Project Design

Subd. 09 Environmental Education

09a Minnesota Conservation Apprenticeship Academy
09b Youth-led Sustainability Initiatives in 40 Greater Minnesota Communities
09c Urban Environmental Education Engaging Students in Local Resources
09d Diversifying Involvement in the Natural Resources Community
09e Educating Minnesotans about Potential Impacts of Changing Climate
09f Pollinator Education Center at the Minnesota Landscape Arboretum
09g Minnesota Pollinator Partnership
09h Raptor Lab Integrating Online and Outdoor Learning Environments
09i Wolf Management Education

Subd. 10 Administration and Contract Agreement Reimbursement

10a Contract Agreement Reimbursement
10b Legislative Coordinating Commission Legacy Web Site
10c Environment and Natural Resources Trust Fund (ENRTF) Project Records System Upgrade

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MN Laws 2014, Chapter 312, Section 8
Sec. 08 Invasive Terrestrial Plants and Pests Center - **RESEARCH**

Funding Source:
Environment and Natural Resources Trust Fund (TF)

MN Laws 2014, Chapter 226, Section 2

Subd. 03 Water Resources

Solar Driven Destruction of Pesticides, Pharmaceuticals, Contaminants in Water
Subd. 03a $291,000 TF

William Arnold
U of MN
500 Pillsbury Dr SE
Minneapolis, MN 55455

Phone: (612) 625-8582
Email: arnol032@umn.edu
Web: http://personal.ce.umn.edu/~arnold/

RESEARCH

Appropriation Language
$291,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to quantify the solar-driven destruction of contaminants reacting with dissolved organic matter to optimize water treatment methods and guide reuse. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Pesticides, pharmaceuticals, and agricultural nutrients serve important functions in crop production and the treatment of disease. However, these chemicals become pollutants when discharged into surface waters through wastewater, storm water, and agricultural runoff. There are natural processes, though, that help break down and remove these pollutants from water. One such process is the role that sunlight interacting with dissolved organic matter naturally present in surface water from decaying plant materials and algae has in transforming these contaminants. Researchers at the University of Minnesota are using this appropriation to better understand the role this interaction between sunlight and dissolved organic matter has in affecting the fate of water pollutants in order to optimize water treatment methods and guide effective water reuse.

Project due to be completed: 6/30/2017

Methods to Protect Beneficial Bacteria from Contaminants to Preserve Water Quality
Subd. 03b $279,000 TF

Paige Novak
U of MN
122 Civil Engineering Bldg, 500 Pillsbury Dr SE
Minneapolis, MN 55455

Phone: (612) 626-9846
Email: novak010@umn.edu
Web: http://www.cege.umn.edu/directory/faculty-directory/novak.html

RESEARCH

Appropriation Language

$279,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to research how and why bacteria that provide ecological functions humans depend on for water quality are affected by exposure to certain man-made perfluorinated chemicals entering the wastewater treatment system in order to identify methods that can be implemented to protect those bacterial functions from being degraded. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Many types of bacteria perform critical ecological functions, such as cycling carbon and other nutrients, which enable life to exist. In fact, humans harness these types of bacteria in certain engineered systems, such as wastewater treatment plants and landfills, to provide various benefits such as protecting surface waters from excess nitrogen, decomposing solid waste, and treating wastewater. Unfortunately, the environments within these systems where the beneficial bacteria live are also environments that receive a complex array of synthetic chemicals that can negatively affect bacterial function, particularly when present in mixtures. One such class of chemicals that find their way into these systems is perfluorinated chemicals, which research has suggested can cause other co-contaminants to be more toxic to bacteria. Researchers at the University of Minnesota are using this appropriation to research how and why these beneficial bacteria are affected by exposure to perfluorinated chemicals entering the wastewater treatment system in order to help develop and engineer methods to better protect and enhance the important ecological functions these bacteria provide.

Project due to be completed: 6/30/2017

Triclosan Impacts on Wastewater Treatment
Subd. 03c $380,000 TF

Timothy LaPara
U of MN
500 Pillsbury Dr SE
Minneapolis, MN 55455

Phone: (612) 624-6028
Email: lapar001@umn.edu
Web: http://www.cege.umn.edu/directory/faculty-directory/lapara.html

RESEARCH

Appropriation Language
$380,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to assess the role of the commercially used antibacterial agent triclosan in creating antibiotic resistant bacteria during the municipal wastewater treatment process. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
As people use antibiotics and products containing antibacterial substances the bacteria that are resistant to the effects of these products survive and reproduce, thus creating a selection for antibiotic resistant bacteria. Many of these bacteria and the antibacterial substances ultimately make their way into the waste stream and are mixed together and concentrated at wastewater treatment plants, where they interact and can create further selection for organisms with antibiotic resistance to multiple antibacterial substances resulting in what are commonly known as "super bugs". If these antibiotic

resistant organisms are not entirely removed during the wastewater treatment process, these organisms then are released into the environment where they can eventually affect humans and other species. One antimicrobial substance of particular concern is triclosan, which is present in numerous personal care products, because it has been shown to help select for organisms that show antibiotic resistance not just to triclosan but also to a multitude of other antibiotics. Researchers at the University of Minnesota are using this appropriation to improve understanding of the role of triclosan in selecting for antibiotic resistant bacteria during the municipal wastewater treatment process.

Project due to be completed: 6/30/2017

Evaluation of Wasterwater Nitrogen and Estrogen Treatment Options
Subd. 03d $500,000 TF

Paige Novak
U of MN
122 Civil Engineering Bldg, 500 Pillsbury Dr SE
Minneapolis, MN 55455

Phone: (612) 626-9846
Email: novak010@umn.edu
Web: http://www.cege.umn.edu/directory/faculty-directory/novak.html

RESEARCH

Appropriation Language
$500,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to examine the performance of new wastewater contaminant treatment options under Minnesota weather conditions in order to understand how to improve wastewater treatment of nitrogen and estrogenic compounds, decrease costs and energy use, and safeguard aquatic species. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Wastewater treatment plants discharge effluent that contains contaminants of emerging concern, such as estrogens. Estrogens have been shown to cause ecological effects such as fish feminization and fish population collapses. Presently the treatment and discharge of estrogens into the environment via wastewater treatment is not regulated. However, it has been found that the extent of estrogen discharge from wastewater treatment correlates with how and how well nitrogen, which currently is regulated and will likely be more so in the future, is removed during the treatment process. Thus more effective nitrogen removal processes have the potential to also ensure more effective removal of estrogens. Researchers at the University of Minnesota are using this appropriation to determine how different nitrogen removal processes perform under a variety of weather conditions with respect to how well they remove both nitrogen and estrogenic compounds in order to help improve wastewater treatment of nitrogen and estrogenic compounds.

Project due to be completed: 6/30/2017

Antibiotics and Antibiotic Resistance Genes in Minnesota Lakes
Subd. 03e $300,000 TF

William Arnold
U of MN
500 Pillsbury Dr SE
Minneapolis, MN 55455

Phone: (612) 625-8582
Email: arnol032@umn.edu
Web: http://personal.ce.umn.edu/~arnold/

RESEARCH

Appropriation Language
$300,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to quantify the relationship between antibiotics and antibiotic-resistant bacteria in Minnesota lakes to determine if improved wastewater treatment is necessary to protect human and aquatic health. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Through various means, human produced chemicals can make their way into surface waters where they can have adverse effects on the function of ecological communities. Of particular concern are antibiotics and other antimicrobial substances because they have the potential to create increased antibiotic resistance. While there is a background level of naturally occurring antibiotic resistance in the natural world, elevated or persistent levels caused by human activities have the potential to harm human, animal, and overall ecosystem health. Researchers at the University of Minnesota are using this appropriation to quantify and compare the levels within lakes of naturally occurring antibiotic compounds versus those resulting from human actions to delineate the role of each in creating antibiotic resistant bacteria and determine the extent to which improved wastewater treatment could contribute to controlling the amount of antibiotics and antibiotic resistant genes within the environment.

Project due to be completed: 6/30/2017

Impacts of Estrogen Exposure on Minnesota's Shallow Lake Wildlife
Subd. 03f $136,000 TF

Kurt Illig
St. Thomas University
2115 Summit Ave
St. Paul, MN 55105

Phone: (651) 962-5273
Email: krillig@stthomas.edu
Web: http://www.stthomas.edu/biology/faculty/kurt-r-illig.html

RESEARCH

Appropriation Language
$136,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the University of St. Thomas to use biological samples already gathered from shallow

lakes across Minnesota to determine the environmental estrogen exposure impacts on aquatic wildlife in shallow lakes for enhanced land and lake management. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Endocrine-disrupting contaminants such as environmental estrogens have been found and studied in large lakes and streams and shown to exist at concentrations that have adverse effects on wildlife. However, very little is known about the sources and effects of environmental estrogens in small, shallow lakes. Preliminary data suggests that these compounds are present in shallow lakes and have an effect on the survival and reproduction of wildlife. Researchers at the University of St. Thomas are using this appropriation to determine the extent to which aquatic wildlife in shallow lakes are being exposed to environmental estrogens, the land-use practices that correlate with exposure, and the amount of detrimental impact that exposure creates in order to enhance land and water management practices.

Project due to be completed: 6/30/2017

Watershed-Scale Monitoring of Long-Term Best Management Practice Effectiveness
Subd. 03g $900,000 TF

Daniel Engstrom
Science Museum of Minnesota
St. Croix Watershed Research Station
16910 152nd St N
Marine on St. Croix, MN 55047

Phone: (651) 433-5953
Email: dre@smm.org
Web: http://www.smm.org/scwrs/

RESEARCH

Appropriation Language
$900,000 the second year is from the trust fund to the Science Museum of Minnesota for the St. Croix Watershed Research Station to evaluate the effectiveness of best management practices in reducing sediment and nutrient loads at watershed scales over long time periods. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Minnesota has widespread water quality impairments due to nonpoint-source pollution generated by agricultural, urban, and other human-altered lands. Mitigation of these impairments requires implementing best management practices (BMPs) that are designed to limit soil erosion and nutrient transport from lands to receiving waters. Long-term data sets of water quality and land-use history are needed to tease apart the many factors that affect water quality. In particular, data sets that span periods before and after BMP implementation are needed to determine BMP effectiveness. However, such data sets are lacking because water quality monitoring of our lakes and rivers did not begin until well after humans altered the landscape. To fill this data gap, Researchers at the Science Museum of Minnesota's St. Croix Watershed Research Station are using this appropriation to construct long-term historical water quality records through analysis of lake sediments in order to enable better determination of the effectiveness of BMPs on improving water quality.

Project due to be completed: 6/30/2017

Protection of State's Confined Drinking Water Aquifers
Subd. 03h $394,000 TF

James Stark
US Geological Survey
2280 Woodale Dr
Mounds View, MN 55112

Phone: (763) 783-3230
Email: stark@usgs.gov
Web: http://mn.water.usgs.gov/index.html

RESEARCH

Appropriation Language
$394,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the United States Geological Survey to test methods of defining properties of confined drinking water aquifers in order to improve water management. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
The groundwater contained in confined glacial aquifers provides clean drinking water to many Minnesota residents. An important factor affecting the long-term sustainability of these aquifers is how water infiltrates through clayey deposits of overlying glacial till, which act as barriers to contaminants but also limit water flow and aquifer recharge. Very little is actually known about the properties and infiltration of water through till, which hinders the ability to accurately define the sustainability of these aquifers. The United States Geological Survey is using this appropriation to test methods for assessing and defining the hydrologic properties of glacial till in order to understand the role it plays in the long-term sustainability of groundwater.

Project due to be completed: 6/30/2017

Watershed Water Budgets for Managing Minnesota's Groundwater
Subd. 03i $129,000 TF

David Lorenz
US Geological Survey
2280 Woodale Dr
Mounds View, MN 55112

Phone: (763) 783-3271
Email: lorenz@usgs.gov
Web: http://mn.water.usgs.gov/index.html

RESEARCH

Appropriation Language
$129,000 the second year is from the trust fund to the commissioner of natural resources for an

agreement with the United States Geological Survey to create a pilot study to calculate complete watershed water budgets for two counties in Minnesota for enhanced groundwater management. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Effective groundwater management requires accurate knowledge about the water budget, which is the amount of water stored within the system in aquifers and the amount of water flowing through the overall hydrologic system including water flowing at the surface, water flowing from above ground down into aquifers, and water flowing between aquifers below the surface. While groundwater storage can be generally well understood and there is good knowledge about surface water flow, there is not usually a strong understanding about the water flowing down from the surface to aquifers and below the surface between different aquifers. The United States Geological Survey is using this appropriation to pilot a method intended to better calculate the groundwater flow component of the hydrologic system in order to provide information that will improve knowledge about water sustainability and the interaction between surface and ground water. The method will be piloted in watersheds in St. Louis and Goodhue counties.

Project due to be completed: 6/30/2017

Identifying Causes of Exceptionally High Mercury in Fish
Subd. 03j $743,000 TF

Bruce Monson
Minnesota Pollution Control Agency
520 Lafayette Rd N
St. Paul, MN 55155

Phone: (651) 757-2579
Email: bruce.monson@state.mn.us
Web: http://www.pca.state.mn.us

RESEARCH

Appropriation Language
$743,000 the second year is from the trust fund to the commissioner of the Pollution Control Agency to quantify the probable causes of high mercury levels in fish within the Roseau River and two tributaries of the Red River of the North by comparing mercury movements within watersheds to understand the drivers of mercury biomagnifications in the food web of rivers with similarly high mercury levels and to guide further mercury reduction initiatives. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Most mercury in Minnesota waters is deposited from the atmosphere as a byproduct of burning coal and other compounds. Once in the environment, mercury can convert to a form called methylmercury where it bioaccumulates up the food chain from microscopic plants and animals to fish and then to humans and wildlife that consume the fish. The first step in solving the problem of mercury in fish is reducing the sources of mercury entering waters. Significant efforts are underway to reduce the amount of mercury released from human sources such as smokestacks and wastewater discharge, which will address the majority of the mercury entering the environment. However, there are a percentage of

watersheds where mercury appears to have enhanced concentrations due to factors that are particular to the ecology of a watershed and not mainly driven by the amount of mercury entering the watershed. The Minnesota Pollution Control Agency is using this appropriation to better understand the probable causes of high mercury levels in fish in watersheds where atmospheric deposition alone does not account for the high mercury levels in order to determine what additional measures beyond source reduction can be taken to reduce mercury levels in those watersheds.

Project due to be completed: 6/30/2017

Reducing Lake Quality Impairments through Citizen Action
Subd. 03k $59,000 TF

Alex Gehrig
Freshwater Society
2500 Shadywood Rd
Exelsior, MN 55331

Phone: (952) 314-8134
Email: agehrig@freshwater.org
Web: http://www.freshwater.org

Appropriation Language
$59,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Freshwater Society to train lake associations and other stakeholder groups to develop lake management plans and to implement science-based, citizen-led water quality improvement projects on impaired lakes in west central Minnesota. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Many lakes in Minnesota are classified as "impaired" for aquatic recreation and aquatic life as the result of nonpoint source pollution. These impairments can be addressed by the citizens that live by and have a vested interest in these water bodies, but there is often a lack of knowledge and resources to take effective action. The Freshwater Society is using this appropriation to train citizen groups in lake ecology and management in order to guide them in implementing water quality improvement projects for their local water bodies.

Project due to be completed: 6/30/2017

Rainwater Reuse and Valuation Investigation
Subd. 03l $300,000 TF

Scott Alexander
U of MN
310 Pillsbury Dr
Minneapolis, MN 55455

Phone: (612) 626-4164
Email: alexa017@umn.edu
Web: http://www.esci.umn.edu/orgs/geofluids/people_scott_alexander_home.html

Appropriation Language
$300,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to design, install, and monitor a rainwater reuse system for use in evaporative chiller systems and identify other potential applications for rainwater reuse systems.

Project Overview
Rainfall runoff in urban areas contributes to localized flooding and washes contaminants and excess nutrients downstream affecting water quality. Systems to mitigate these problems can be challenging to implement in urban areas due to existing infrastructure and competing demands for land use. However, one option is to find alternative applications for the excess rainwater and use it replace the potable water that is currently being used for certain purposes. Researchers at the University of Minnesota are using this appropriation to evaluate alternative uses for captured rainwater. In particular the project will design and install a rainwater reuse system for integration into evaporative chiller systems, which are common in large buildings and currently account for a significant portion of summer water usage at these sites, and examine other potential reuses for rainwater, such as for toilet flushing and industrial processes.

Project due to be completed: 6/30/2016

Measuring Hydrologic Benefits from Glacial Ridge habitat Restoration
Subd. 03m $168,000 TF

Myron Jesme
Red Lake Watershed District
100 Pennington Avenue South
Thief River Falls, MN 56701

Phone: (218) 681-5800
Email: jesme@wiktel.com
Web: http://www.redlakewatershed.org/default.html

Tim Cowdery
U.S. Geological Survey
2208 Woodale Dr
Mounds View, MN 55112

Phone: (763) 783-3273
Email: cowdery@usgs.gov
Web: https://sites.google.com/site/largescaleresto/

RESEARCH

Appropriation Language
$168,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Red Lake Watershed District and the United States Geological Survey for completion of the analysis of flooding and water-quality benefits resulting from wetland and prairie restorations at Glacial Ridge National Wildlife Refuge.

Project Overview
Since 2000, a diverse group of partners has been collectively working in northwestern Minnesota on one

of the largest prairie-wetland restorations in the world. Spanning 22,000 acres and adjacent to an additional 16,000 acres of public and private conservation land, the goal of the Glacial Ridge Project has been to demonstrate whether large-scale habitat restoration is a viable way to reduce flooding and improve water quality. Prior to beginning restoration efforts on the project, a comprehensive baseline hydrologic study of the area was completed by the U.S. Geological Survey (USGS). The Red Lake Watershed District and USGS are using this appropriation to complete a post restoration study that will quantify and evaluate the amount of flood reduction, water-quality improvement, and ecosystem-function change that has resulted from the wetland and prairie restoration efforts at Glacial Ridge. This information will be used to guide future restoration efforts throughout the state and beyond.

Project due to be completed: 6/30/2016

Subd. 04 Aquatic and Terrestrial Invasive Species

Blocking Bighead, Silver, and Other Invasive Carp by Optimizing Lock and Dams
Subd. 04a $854,000 TF

Peter Sorensen
U of MN
1980 Folwell Ave
St Paul, MN 55108

Phone: (612) 624-4997
Email: soren003@umn.edu
Web: http://fwcb.cfans.umn.edu/sorensen/

RESEARCH

Appropriation Language
$854,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to collaborate with the United States Army Corps of Engineers to develop ways, including new technologies, to modify the operations of Lock and Dam Numbers 2 to 8 to optimize their ability to impede invasive carp movement into the Minnesota, St. Croix, and Mississippi Rivers. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Invasive carp species, including silver carp and bighead carp, are migrating north up the Mississippi River and pose threats to the native fish and aquatic ecosystems of Minnesota rivers and lakes where they can become established. While individual carp have been found in Minnesota, it is not presently believed that there are established breeding populations in the state. Nevertheless, the only current impediments to the upstream travel of carp into Minnesota waterways are the various lock and dam systems located between the Iowa border and the Twin Cities and these systems do not create a constant barrier to carp passage. Researchers at the University of Minnesota, in cooperation with the U.S. Army Corps of Engineers, are using this appropriation to develop and test ways to modify and optimize the operations of the existing lock and dam systems in order to enhance their ability to deter and block carp passage without detrimentally affecting native fish or current lock and dam function. These efforts have the potential to delay or even prevent statewide invasion by invasive carp in Minnesota via the Mississippi River.

Project due to be completed: 6/30/2017

Bioacoustics to Detect, Deter and Eliminate Silver Carp
Subd. 04b $262,000 TF

Allen Mensinger
U of MN - Duluth
1035 Kirby Dr
Duluth, MN 55812

Phone: (218) 726-7259
Email: amensing@d.umn.edu
Web: http://www.d.umn.edu/biology/faculty/mensinger.html

RESEARCH

Appropriation Language
$262,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota-Duluth to develop bioacoustics technology for detection and early warning systems, capture and elimination methods, and deterrent systems for silver carp. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Silver carp are migrating north up the Mississippi River and pose threats to the native fish and aquatic ecosystems of Minnesota rivers and lakes where they can become established. Additionally, the unique jumping ability of silver carp also places recreational boaters in danger of being injured during collisions with airborne fish. However, it is believed that this jumping ability could potentially be exploited as a weakness to help detect, manage, and control silver carp populations. Researchers at the University of Minnesota - Duluth, in cooperation with the U.S. Geological Survey, are using this appropriation to develop bioacoustics technologies that use sound to stimulate silver carp jumping in order to assist with strategies for detection, capture, and deterrence.

Project due to be completed: 6/30/2017

Northwest Minnesota Regional Aquatic Invasive Species Prevention Pilot
Subd. 04c $219,000 TF

Joe Courneya
Red River Basin Commission
119 5th Street S #209
Moorhead, MN 56561

Phone: (218) 790-0706
Email: joe@redriverbasincommission.org
Web: http://www.redriverbasincommission.org

Appropriation Language
$219,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Red River Basin Commission to develop aquatic invasive species prevention strategies on a watershed scale and develop materials to sustain watershed scale decision-making and

implementation. This initiative must be coordinated with the Department of Natural Resources and outdoor heritage fund activities for locally based invasive species control. Specific reporting and analysis of outcomes and findings of this alternative approach must be provided to enable duplication in other regions of the state.

Project Overview
Aquatic invasive species are a threat to the ecology and the recreational and economic viability of Minnesota's water resources. When an invasion is confined to a distinct lake or wetland, local government units will implement localized plans to address invasions. However, when a water body crosses jurisdictions, such as with river systems, to be effective a more coordinated, regional approach is necessary that is more attuned with the natural pathways for invasive species. The Red River Basin Commission is using this appropriation to pilot an effort to develop processes for addressing invasive species at a watershed scale using partnerships between local government units working collectively rather than individually. The pilot is intended to create a model for invasive species prevention that can be applied in other parts of the state.

Project due to be completed: 6/30/2016

Biosurveillance and Biocontrol of Emerald Ash Borer - Phase 2
Subd. 04d $447,000 TF

Monika Chandler
Minnesota Department of Agriculture
625 Robert St N
St Paul, MN 55155

Phone: (651) 201-6537
Email: Monika.Chandler@state.mn.us
Web: http://www.mda.state.mn.us/plants/pestmanagement/eab/eabbiocontrol.aspx

Appropriation Language
$447,000 the second year is from the trust fund to the commissioner of agriculture in cooperation with the University of Minnesota to continue to monitor ash tree and emerald ash borer populations and expand the biological control implementation for emerald ash borer management. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
The Emerald Ash Borer (EAB) is an invasive insect that has been decimating ash trees throughout the Great Lake states and is currently advancing into Minnesota where it threatens the nearly 1 billion ash trees that occur throughout the state - the second most in any state. Loss of these trees would devastate ecosystems throughout Minnesota and have major economic impacts for the forest products industry as well as through the costs associated with treatment, removal, and replacement of lost trees. Biological control - the use of a natural enemy of a species from its native habitat to help with control of that species - is currently the only promising long-term management strategy for EAB. The Minnesota Department of Agriculture is using this appropriation to continue to implement and assess the effectiveness of a biocontrol method for EAB in Minnesota that involves the use of tiny, stingless wasps that are parasitoids of EAB.

Project due to be completed: 6/30/2017

Mountain Pine Beetle Invasive Threat to Minnesota's Pines
Subd. 04e $250,000 TF

Subd. 04e1 $175,000 TF
Brian Aukema
U of MN
1980 Folwell Avenue
St Paul, MN 55108

Phone: (612) 625-5299
Email: brianaukema@umn.edu
Web: http://www.forest-insects.umn.edu/index2.html

Subd. 04e2 $75,000 TF
Mark Abrahamson
Minnesota Department of Agriculture
625 Robert St N
St Paul, MN 55108

Phone: (651) 201-6505
Email: mark.abrahamson@state.mn.us
Web: http://www.mda.state.mn.us/home.aspx

Appropriation Language
$175,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota and $75,000 the second year is from the trust fund to the commissioner of agriculture to survey for the presence and characterize the potential risk of the invasive mountain pine beetle to Minnesota's pine forests to inform early detection and rapid response. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Native to the western United States and Canada, mountain pine beetle is considered the most devastating forest insect in North America. Trees usually die as a result of infestation and an unprecedented outbreak in the west is currently decimating pine forests there. While mountain pine beetle is not presently believed to reside in Minnesota, there are risks posed by an expanding species range resulting from warming climate and the potential for accidental introduction via lumber imports from infested areas. It is estimated that Minnesota currently has about 200 million trees that would be susceptible to mountain pine beetle if it should become established here and loss of those trees would threaten wildlife habitat, water quality protection, and recreation. Researchers at the University of Minnesota and the Minnesota Department of Agriculture are using this appropriation to survey state locations for the presence of mountain pine beetle and to characterize the risk posed by the insect to Minnesota pine species. If detected early enough isolated populations of mountain pine beetle may be possible to control and a better understanding of how Minnesota's particular pine species might react to the insect would guide future management response strategies.

Project due to be completed: 6/30/2017

Brown Marmorated Stink Bug Monitoring and Biocontrol Evaluation
Subd. 04f $266,000 TF

Subd. 04f1 $167,000 TF

Robert Koch
U of MN
1980 Folwell Avenue
St Paul, MN 55108

Phone: (612) 624-6771
Email: koch0125@umn.edu
Web: http://www.entomology.umn.edu/People/GradFaculty/Koch/index.htm

Subd. 04f2 $99,000 TF

Mark Abrahamson
Minnesota Department of Agriculture
625 Robert St N
St Paul, MN 55108

Phone: (651) 201-6505
Email: mark.abrahamson@state.mn.us
Web: http://www.mda.state.mn.us/plants/insects/stinkbug.aspx

Appropriation Language
$99,000 the second year is from the trust fund to the commissioner of agriculture and $167,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to monitor for brown marmorated stink bugs to identify problem areas, target biocontrol efforts, and evaluate the suitability of candidate biological control agents for use in Minnesota. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Brown marmorated stink bug is a terrestrial invasive species in Minnesota that was first discovered in 2010 and has been expanding its range since. It is a generalist plant pest that attacks more than 300 species of plants in natural, agricultural, and horticultural settings and is known for its unpleasant odor, large numbers, and propensity for home invasion. Proactive management approaches are available and in development that can be used to slow and potentially control brown marmorated stink bug populations. Researchers at the Minnesota Department of Agriculture and the University of Minnesota are using this appropriation to establish a state framework for monitoring and biological control of brown marmorated stink bug; efforts will focus on identifying new infestations and potential problem locations and evaluating and implementing biological control options.

Project due to be completed: 6/30/2017

Subd. 05 Foundational Natural Resource Data and Information

Update Statewide Land Cover Use Map
Subd. 05a $300,000 TF

Joseph Knight
U of MN
1530 Cleveland Ave N
St. Paul, MN 55108

Phone: (612) 625-5354
Email: jknight@umn.edu
Web: http://land.umn.edu/

Appropriation Language
$300,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to update Minnesota's land cover data at moderate spatial resolution statewide and at high resolution for selected areas, distribute products, and provide training. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Land and water conservation efforts require accurate information about land cover and land use. Minnesota's land cover and land use data has not been updated since 2000 and so does not reflect changes since that time resulting from growth and development, agricultural production, or landscape cover. Researchers at the University of Minnesota are using this appropriation to conduct a statewide update and enhancement of land cover and land use data and make it freely available online for use by government and non-government organizations involved in land and water conservation.

Project due to be completed: 6/30/2017

State Spring Inventory for Resource Management and Protection
Subd. 05b $200,000 TF

Jan Falteisek
MN DNR
500 Lafayette Rd
St. Paul, MN 55155

Phone: (651) 259-5665
Email: jan.falteisek@state.mn.us
Web: http://mndnr.gov

Appropriation Language
$200,000 the second year is from the trust fund to the commissioner of natural resources to develop necessary protocols, processes, and definitions of springs along with limited field testing of inventory procedures in priority areas to enable a systematic inventory of springs statewide needed to maintain spring flows and protect groundwater-dependent resources. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Natural springs occur throughout Minnesota and provide critical services for the state, such as creating trout streams and cool water fisheries, sustaining base flows in streams, creating unique ecological habitats, and maintaining the integrity of aquatic ecosystems against invasive species. In order to protect springs and the groundwater-dependent resources that depend on them, though, it is important to understand spring locations and status - information that is currently lacking in many areas of the state. The Department of Natural Resources is using this appropriation to establish a foundation and plan to systematically inventory, assess, and monitor spring resources throughout the state.

Project due to be completed: 6/30/2017

Drainage Records Modernization and Statewide Geographic Information System Database
Subd. 05c $230,000 TF

Allan Kean
Board of Water and Soil Resources
520 Lafayette Rd N
St Paul, MN 55155

Phone: (651) 297-2907
Email: al.kean@state.mn.us
Web: http://www.bwsr.state.mn.us/

Appropriation Language
$230,000 the second year is from the trust fund to the Board of Water and Soil Resources to develop a template and Web-based geographic information system (GIS) database portal to facilitate statewide modernization of public drainage records under Minnesota Statutes, chapter 103E, and integrate new specifications into existing drainage records modernization guidelines. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
There are currently more than 21,000 miles of drainage ditches and many thousands of miles of subsurface tile located throughout Minnesota and overseen by over 100 different local drainage authorities. Historically public records of these drainage systems have been maintained primarily in hard copy following differing protocols depending on local requirements. However, this antiquated approach limits the usability and accessibility of public drainage records creating various challenges for drainage management efforts. Modernizing drainage records involves creating and cataloguing electronic copies of the records. While many drainage authorizes have begun at least some level of modernization, there is still much work to be done. The Board of Water and Soil Resources is using this appropriation to establish a standardized information system to house public drainage records in a consistent manner that integrates the data with overall statewide GIS data. The system will facilitate increased accessibility and usability to drainage records and benefit water planning, modeling, and management efforts.

Project due to be completed: 6/30/2017

Restoring Forest Inventory Data
Subd. 05d $100,000 TF

Alan Ek
U of MN
2004 Folwell Ave
St Paul, MN 55108

Phone: (612) 624-3400
Email: aek@umn.edu
Web: http://www.forestry.umn.edu/People/Ek/index.htm

Appropriation Language
$100,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to obtain and restore statewide forest inventories of 1935, 1953, and 1966 to link with more recent data to improve understanding of historical forest trends and enhance long-term ecological monitoring.

Project Overview
Long-term forest plot datasets are helpful for understanding the changing conditions and ecology of forestland over time. The USDA Forest Service produced statewide forest inventories in 1935, 1953, 1962, 1977, 1990, 2003, 2008, and 2013. Unfortunately, only the data from 1977 to the present is currently easily accessible and available in full. Researchers at the University of Minnesota are using this appropriations to locate and restore important information from the 1935, 1953, and 1962 surveys and link it to the more recent data from 1977 and later to generate more detailed understandings of changes in Minnesota's forests over time. Compiling this data will be useful for examining forests in terms of climate change implications for resilience and adaptability, carbon sequestration potential, habitat and biodiversity change, and overall forest health.

Project due to be completed: 6/30/2016

Assessing Species Vulnerability to Climate Change Using Phenology
Subd. 05e $175,000 TF

Rebecca Montgomery
U of MN
1530 Cleveland Ave N
St. Paul, MN 55108

Phone: (612) 624-7249
Email: rebeccam@umn.edu
Web: http://wordpress.cfans.umn.edu/ecophys/

Appropriation Language
$175,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to compile and use historical datasets to assess change over time in the ecology of Minnesota species, identify vulnerable species, and inform management strategies for climate change. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
There is a critical need to understand how our natural resources are already responding to climate change in order to develop tools for projecting natural resource responses into the future and to devise plans for actions that can be taken in reaction to observed and predicted changes. Phenology - the timing of seasonal biological events such as budburst, flowering, bird migration, and leaf coloring - provides a tested indicator of climate change response by plants and animals. A rich source of phenology datasets exists independently throughout the state, but these datasets are not compiled in a centralized manner. Furthermore, ongoing collection of phenology data is a cost efficient task that, done in an organized manner, can continue to provide valuable long-term evidence of climate change response. Researchers at the University of Minnesota are using this appropriation to compile and analyze historical phenology datasets and to establish a statewide network to collect future phenology data. This information will be helpful in identifying plant and animal species vulnerable to climate change and enhancing adaptive management strategies, such as for maintaining forest productivity, supporting plant pollination and reproduction, and supporting efforts to maintain the integrity of wildlife and fisheries populations.

Project due to be completed: 6/30/2017

Minnesota Breeding Bird Atlas - Final Phase
Subd. 05f $300,000 TF

Mark Martell
Audubon Minnesota
2357 Ventura Dr, Ste 106
St. Paul, MN 55125

Phone: (651) 739-9332 x15
Email: mmartell@audubon.org
Web: http://www.mnbba.org/

Appropriation Language
$300,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Audobon Minnesota to complete a statewide survey of Minnesota's breeding bird distributions through final analysis, preparation, and dissemination of information collected on an ongoing basis since 2008 on breeding birds in the state. The completed atlas must be available for download from the Internet free of charge. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
A state Breeding Bird Atlas is a comprehensive systematic field survey of the occurrence, distribution, diversity, and breeding status of bird species within every region of a state. Atlases are mainly used to set conservation priorities, develop conservation plans, and guide habitat protection, restoration, and management efforts - in addition to being useful for recreational bird watching. Minnesota is one of only seven states in the country that has yet to complete a Breeding Bird Atlas. Audubon Minnesota and the Natural Resources Research Institute at the University of Minnesota - Duluth will use this appropriation to complete the Minnesota Breeding Bird Atlas. This phase involves analyzing and synthesizing over 350,000 observations collected since this effort began in 2008 and producing and disseminating related information products.

Project due to be completed: 6/30/2017

Assessing Contaminants in Minnesota's Loons and Pelicans - Phase 2
Subd. 05g $260,000 TF

Carrol Henderson
MN DNR
500 Lafayette Rd, Box 25
St. Paul, MN 55155

Phone: (651) 259-5104
Email: carrol.henderson@state.mn.us
Web: http://www.dnr.state.mn.us

Appropriation Language
$260,000 the second year is from the trust fund to the commissioner of natural resources to continue to assess the potential impact of petroleum, dispersants, and heavy metal contaminants from the Deepwater Horizon oil spill in the Gulf of Mexico on the wintering habitat of Minnesota's common loons and white pelicans using radiotelemetry, geolocators, and contaminant analysis.

Project Overview
Over a three-month period in 2010, approximately five million barrels of oil was spilled into the Gulf of Mexico causing extensive damage to marine and wildlife habitats and resulting in significant losses in fish and wildlife populations. A number of Minnesota's migratory bird species spend parts of their lives in the areas impacted by the spill and impacts on their populations in the state could become evident over time. Impacts could be from immediate losses of birds that were present at the time of the spill or from cumulative negative effects resulting from contamination of the food chain by petroleum chemicals and the dispersants used on the oil. The two Minnesota species that are potentially most vulnerable are the common loon and the American white pelican; some of their young would have been present in the Gulf at the time of the spill and their behavior and feeding patterns put them at greater risk of exposure to chemicals from the spill persisting in the environment. The Minnesota Department of Natural Resources is using this appropriation to continue efforts aimed at determining whether or not common loon or American white pelican populations in Minnesota have been impacted by the Gulf oil spill. Phase one revealed that there were population losses following the spill and that a significant percentage of Minnesota loons and pelicans have been exposed to oil and dispersant contaminants, which may be having long-term effects by causing changes in behavior, migratory abilities, reproductive success, or longevity. Any impacts documented will be critical for receiving remediation funds from the Federal Natural Resource Damage Assessment (NRDA) process currently underway, and those funds could be used to help restore the populations of these two species.

Project due to be completed: 6/30/2016

Sandhill Crane Populations and Management in Minnesota
Subd. 05h $250,000 TF

David Andersen
U of MN
200 Hodson Hall, 1980 Folwell Ave
St. Paul, MN 55108

Phone: (612) 626-1222
Email: dea@umn.edu
Web: http://fwcb.cfans.umn.edu/Faculty/Andersen/index.htm

RESEARCH

Appropriation Language
$250,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to delineate population boundaries, habitat use relative to crop depredation, and migration patterns and survival of Minnesota's two populations of sandhill cranes, Mid-continent and Eastern. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Sandhill cranes have expanded their range in Minnesota and elsewhere and as populations have expanded several states, including Minnesota, have initiated sandhill crane hunting seasons and other states are considering doing the same. Partially this is in response to increasing complaints of crop degradation by sandhill cranes. Despite expanding populations, though, sandhill cranes remain a species of management concern and current information on population distribution and migration patterns of

sandhill cranes in Minnesota is insufficient for projecting the impact of hunting or for making informed management decisions. Researchers at the University of Minnesota are using this appropriation to conduct a survey to better understand population distributions, movement patterns, habitat usage, and survival of sandhill cranes in Minnesota in order to inform harvest and management strategies that will minimize conflict with agricultural interests.

Project due to be completed: 6/30/2017

Wild Bee Pollinator Surveys in Prairie-Grassland Habitats
Subd. 05i $370,000 TF

Gerda Nordquist
MN DNR
500 Lafayette Rd
St. Paul, MN 55155

Phone: (651) 259-5124
Email: gerda.nordquist@state.mn.us
Web: http://www.dnr.state.mn.us

Appropriation Language
$370,000 the second year is from the trust fund to the commissioner of natural resources to assess the current status and distribution of wild bee pollinators in prairie-grassland habitats of Minnesota.

Project Overview
Wild bees are important for their pollination services and for their contribution to species diversity; for example, many prairie-grassland plant species require pollinators for seed production. However, while the importance of plant-pollinator interactions is well recognized, there are large gaps in our knowledge of Minnesota's wild bees. The only statewide list of bee species was published in 1919 and it reported only 88 species, whereas it is currently estimated that there are approximately 350-400 native bee species in the state. The Minnesota Department of Natural Resources is using this appropriation to conduct field surveys throughout the prairie-grassland region of MN to document the diversity and distribution of wild bees and related vegetation diversity and quality in order to assess the current status of wild bees and provide a baseline for comparing to past and future data. This information will be used to refine conservation and management decisions to enhance bee pollinator populations and prairie-grassland habitat. Future efforts could further expand knowledge by extending surveys into forested and forest-transition regions of the state.

Project due to be completed: 6/30/2016

Imperiled Prairie Butterfly Conservation, Research and Breeding Program
Subd. 05j $625,000 TF

Subd. 05j1 $380,000 TF
Erik Runquist
Minnesota Zoological Garden
13000 Zoo Blvd
Apple Valley, MN 55124

Phone: (952) 431-9200

Email: erik.runquist@state.mn.us
Web: http://www.mnzoo.org

Subd. 05j2 $245,000 TF
Robert Dana
MN DNR
500 Lafayette Rd Box 32
St. Paul, MN 55155

Phone: (952) 431-9200
Email: robert.dana@state.mn.us
Web: http://www.dnr.state.mn.us

RESEARCH

Appropriation Language
$380,000 the second year is from the trust fund to the Minnesota Zoological Garden and $245,000 the second year is from the trust fund to the commissioner of natural resources to prevent the extirpation and possible extinction of imperiled native Minnesota butterfly species through breeding, genetics and mortality research, inventory, monitoring, and public education. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
With only 1% of Minnesota's native prairie remaining, many prairie plant and animal species have dramatically declined. Of the 12 butterfly species native to Minnesota prairies, two species, the Poweshiek skipperling and the Dakota skipper, have already largely disappeared from the state and are proposed for listing under the U.S. Endangered Species Act despite being historically among the most common prairie butterflies and having their historic ranges concentrated in Minnesota. The Minnesota Zoo and the Minnesota Department of Natural Resources are using this appropriation to conduct efforts aimed at preventing the extirpation and possible extinction of these butterfly species in Minnesota. Efforts will include expansion of both a butterfly research and conservation breeding program and ongoing butterfly survey and monitoring programs. Because of the ecological role of butterflies as pollinators and a food source for wildlife, analysis should also reveal important information about the greater prairie ecosystem and guide actions to be taken to protect it.

Project due to be completed: 6/30/2017

Conserving Minnesota's Native Freshwater Mussels
Subd. 05k $350,000 TF

Jessica Kozarek
U of MN
2 3rd Avenue SE
Minneapolis, MN 55414

Phone: (612) 624-4679
Email: jkozarek@umn.edu
Web: http://www.safl.umn.edu

RESEARCH

Appropriation Language
$350,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota in cooperation with Macalester College to document native freshwater mussel abundance and distribution, quantify environmental conditions necessary to conserve Minnesota's native freshwater mussels, and conduct outreach to local organizations and the public. This appropriation is available until June 30, 2018, by which time the project must be completed and final products delivered.

Project Overview
Though they are a relatively unnoticed group of species, native freshwater mussels are a critical part of river ecosystems because they provide a variety of important functions including improved water clarity, enhanced streambed stability, reduced downstream transport of contaminants, and creation of habitat for other aquatic life. However, mussel populations in Minnesota have declined in recent decades as a result of habitat destruction, pollution, land-use change, over-harvesting, and the introduction of exotic species. Researchers at the University of Minnesota are using this appropriation to conduct surveying and analysis to better understand mussel abundance, distribution, and interactions with habitats in order to guide efforts to preserve and restore native mussel populations and maintain the ecosystem services they provide.

Project due to be completed: 6/30/2018

Impacts of Forest Quality on Declining Minnesota Moose
Subd. 05l $300,000 TF

James Forester
U of MN
1980 Folwell Ave
St. Paul, MN 55108

Phone: (612) 626-6721
Email: jdforest@umn.edu
Web: http://fwcb.cfans.umn.edu/forester/index.html

RESEARCH

Appropriation Language
$300,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota in cooperation with the Department of Natural Resources to link regional patterns of moose abundance through time to the distribution of food and cover and determine if this distribution affects the diet and survival of individual moose. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Moose, one of Minnesota's prized wildlife species, are dying at much higher rates in Minnesota than elsewhere in North America. Recently observed increases in mortality rates amongst some moose in northeastern Minnesota have led to concern that the population there may be entering a decline like that seen in the northwestern part of the state, where moose populations fell from over 4,000 to fewer than 100 in less than 20 years. Additionally the specific causes of increased mortality amongst individual moose remain under investigation. Scientists at the University of Minnesota are using this appropriation to examine the role of habitat quality and landscape change and how it impacts moose diet, body

condition, and mortality risk, specifically the role of forest age, structure, and composition in distribution of food and cover. Knowledge gained will be used by federal, state, and local natural resource agencies to identify appropriate management and habitat needs and actions that can be taken to help slow or prevent continued population declines in northeastern Minnesota of this iconic, keystone species.

Project due to be completed: 6/30/2017

Moose Decline and Air Temperatures in Northeastern Minnesota
Subd. 05m $600,000 TF

Mike Larson
MN DNR
1201 E Hwy 2
Grand Rapids, MN 55744

Phone: (218) 999-7933
Email: michael.larson@state.mn.us
Web: http://www.dnr.state.mn.us/moose/index.html

RESEARCH

Appropriation Language
$600,000 the second year is from the trust fund to the commissioner of natural resources in cooperation with the University of Minnesota to study the physiology and behavior of adult moose and effects of female condition on calf production and survival to determine the impact of air temperature on moose population performance and decline. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Moose, one of Minnesota's prized wildlife species, are dying at much higher rates in Minnesota than elsewhere in North America. Recently observed increases in mortality rates amongst some moose in northeastern Minnesota have led to concern that the population there may be entering a decline like that seen in the northwestern part of the state, where moose populations fell from over 4,000 to fewer than 100 in less than 20 years. Additionally the specific causes of increased mortality amongst individual moose remain under investigation. Scientists at the Minnesota Department of Natural Resources are using this appropriation to help understand how air temperature affects moose habitat use and behavior, reproductive success, and survival in order to determine if, when, and how moose are able to successfully modulate internal body temperature. Knowledge gained will be used by federal, state, and local natural resource agencies to identify appropriate management and habitat needs and actions that can be taken to help slow or prevent continued population declines in northeastern Minnesota of this iconic, keystone species.

Project due to be completed: 6/30/2017

Expansion of Minnesota Wildflowers Online Botanical Reference
Subd. 05n $150,000 TF

Katy Chayka
MN Wildflowers Information
1590 Long Lake Rd

New Brighton, MN 55112

Phone: (651) 399-4064
Email: kchayka@c-net.us
Web: http://www.minnesotawildflowers.info/

Appropriation Language
$150,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Minnesota Wildflowers Information to accelerate field work for surveying and imaging of plant species and publication of species profiles to a plant identification reference Web site available to the public and land managers. Images acquired and information compiled using these funds are for purposes of public information available on a Web site. If the organization is no longer able to maintain the Web site, the organization shall work with the state and the University of Minnesota Bell Museum of Natural History to ensure the materials remain publicly available on the Web. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
The average Minnesotan and even most natural resource managers are not skilled in plant identification, yet the ability to positively identify plants is crucial to a number of conservation activities, including identifying areas that need protection, recognizing new or existing invasive species, monitoring restoration projects, and delineating wetlands. The Minnesota Wildflowers project attempts to fill this need with a free web-based field guide ultimately aimed at providing profiles for each of the over 2,100 vascular plant species in Minnesota. Minnesota Wildflowers Information is using this appropriation to continue to update and expand the information contained on its online field guide by doubling the number of new species profiled. Information will be freely available to the public, students, and natural resource professionals as a learning reference and to assist in plant identification.

Project due to be completed: 6/30/2017

Subd. 06 Methods to Protect, Restore, and Enhance Land, Water, and Habitat

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Enhancing Pollinator Landscapes
Subd. 06a $864,000 TF

Marla Spivak
U of MN
219 Hodson Hall, 1980 Folwell Ave
St. Paul, MN 55108

Phone: (612) 624-4798
Email: spiva001@umn.edu
Web: http://beelab.umn.edu/

Appropriation Language
$864,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to identify sources of nectar and pollen for native pollinators and honey bees and coordinate ongoing and future efforts to enhance pollinator habitat and opportunities for pollinator nesting and foraging. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Pollinators play a key role in ecosystem function and in agriculture, including thousands of native plants and more than one hundred U.S. crops that either need or benefit from pollinators. However, pollinators are in dramatic decline in Minnesota and throughout the country. The causes of the decline are not completely understood, but identified factors include loss of nesting sites, fewer flowers, increased disease, and increased pesticide use. Fortunately, there are known actions that can be taken to help counteract some of these factors. Researchers at the University of Minnesota are using this appropriation to conduct efforts aimed at increasing reliable supplies of nectar and pollen for pollinators by surveying for existing populations, identifying plants that contribute the most resources to pollinator production and survival, and identifying areas where pollinators nest and overwinter. Information will be used to develop maps, demonstration sites, best management strategies, and long term plans for sustaining pollinators that will assist private landowners and public land managers in efforts to enhance landscapes for the benefit of pollinators.

Project due to be completed: 6/30/2017

Understanding Systemic Insecticides as Protection Strategy for Bees
Subd. 06b $326,000 TF

Vera Krischik
U of MN
1980 Folwell Ave, #219
St. Paul, MN 55108

Phone: (612) 625-7044
Email: krisc001@umn.edu
Web: http://www.entomology.umn.edu/cues

RESEARCH

Appropriation Language
$326,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to continue research on how native bee and honey bee colonies are impacted by systemic, neonicotinyl insecticides in pollen and nectar of plants growing in fields and landscapes. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
A class of insecticides known as systemic neonicotinyl insecticides has been identified as a potential factor in recently observed declines in pollinators, including the phenomenon amongst honeybees known as Colony Collapse Disorder. Previous research examining the effects of neonicotinyl insecticides on lab colonies of bumblebees found that exposure to these insecticides at various levels increased queen bee mortality and detrimentally altered bee behavior and production. Researchers at the University of Minnesota are using this appropriation to continue this research aimed at quantifying levels of insecticide residues in pollen and nectar of plants treated with systemic insecticides to determine how exposure to these residues affects bee colony health. This phase expands the research to conduct studies in the field in a natural setting.

Project due to be completed: 6/30/2017

Prairie Sustainability through Seed Storage, Beneficial Microbes, and Adaptation
Subd. 06c $600,000 TF

Ruth Shaw
U of MN
450 McNamara Alumni Ctr, 200 Oak St SE
Minneapolis, MN 55455-2070

Phone: (612) 624-7206
Email: shawx016@umn.edu
Web: http://www.cbs.umn.edu/explore/departments/eeb/faculty-research/directory/ruth-g-shaw

RESEARCH

Appropriation Language
$600,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to collect and preserve germplasm of plants throughout Minnesota's prairie region, study the microbial effects that promote plant health, analyze local adaptation, and evaluate the adaptive capacity of prairie plant populations. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Healthy prairies contribute numerous benefits, such as providing habitat for wildlife and pollinators, maintaining and improving water quality, stabilizing roadsides, and providing a sustainable source of materials for bioenergy production and other products. Since European settlement the once vast expanses of Minnesota prairie covering 18 million acres have been reduced to small remnants totaling about 235,000 acres. With this decline has also come a drastic reduction in the genetic diversity of the various species typical of Minnesota prairies. This has resulted in inbreeding of remnant species populations, which reduces the robustness of plants and can result in yet further population decline. Researchers at the University of Minnesota are using this appropriation for efforts aimed at protecting the long-term health and sustainability of remaining prairie in the state by collecting prairie plant genetic material for long-term preservation, collecting and studying microbes that promote prairie plant health, and examining the capacity for prairie plants to adapt to changing conditions. Information and resources derived from this effort will contribute to improving restoration techniques and ensuring healthy prairies into the future.

Project due to be completed: 6/30/2017

Northeast Minnesota White Cedar Restoration - Phase 2
Subd. 06d $335,000 TF

Dale Krystosek
Board of Water and Soil Resources
403 4th Street NW, Suite 200
Bemidji, MN 56601

Phone: (218) 755-2603
Email: dale.krystosek@state.mn.us
Web: http://www.bwsr.state.mn.us/

Appropriation Language
$335,000 the second year is from the trust fund to the Board of Water and Soil Resources to continue an assessment of the decline of northern white cedar plant communities in northeast Minnesota, demonstrate restoration techniques, and provide cedar restoration training to local units of government. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Northern white cedar wetland plant communities provide unique ecological, economic, and wetland functions, including high value timber, long-term carbon storage, winter refuge for deer and other wildlife, wildlife habitat, and thermal buffering for brook trout streams. However, these plant communities have been declining in Minnesota for decades mostly as a result of development impacts. The Minnesota Board of Water and Soil Resources is using this appropriation to continue efforts aimed at improving the quantity and quality of white cedar wetland plant communities in Minnesota. Efforts will include assessing existing white cedar communities to prioritize sites for restoration and then providing training and demonstration of restoration and re-vegetation techniques for local natural resource managers.

Project due to be completed: 6/30/2017

Southeast Minnesota Watershed Protection Plan
Subd. 06e $200,000 TF

Richard Biske
The Nature Conservancy
PO Box 405
Preston, MN 55965

Phone: (507) 765-2450
Email: rbiske@tnc.org
Web: http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/minnesota/

Appropriation Language
$200,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with The Nature Conservancy to provide a framework and plans for the protection and stewardship of unimpaired waters in southeast Minnesota. The result will be a template for watershed protection in Minnesota. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Oftentimes water conservation efforts are directed toward impaired waters. However, it is much more cost-effective to protect habitat and water resources before they become degraded. The Nature Conservancy is using this appropriation to create a broader, long-term, watershed-based framework for proactively protecting habitat and water resources in southeast MN, specifically the Cannon River and Zumbro River watersheds, before they become degraded. Information will help guide efforts for assessing and prioritizing conservation efforts in southeast MN and provide a framework for other watersheds in the state to replicate.

Project due to be completed: 6/30/2017

Upland and Shoreline Restoration in Greater Metropolitan Area
Subd. 06f $300,000 TF

Wiley Buck
Great River Greening
35 W Water St, Ste 201
St Paul, MN 55107

Phone: (651) 665-9500
Email: wbuck@greatrivergreening.org
Web: http://www.greatrivergreening.org

Appropriation Language
$300,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Great River Greening to restore and enhance upland, shoreline, and approximately 150 acres of forests, woodlands, savanna, and prairie and to provide related educational opportunities for volunteers in the greater metropolitan area. A list of proposed restorations and enhancements must be provided as part of the required work plan. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Though many parts of the Twin Cities metropolitan area are urbanized, there are also has large areas of natural lands that continue to serve as important habitat for fish, wildlife, and plant communities. However, pressure on these remaining lands continues to intensify as population and development pressures increase. This appropriation continues the efforts of the Metro Conservation Corridors (MeCC) partnership, an ongoing effort by a partnership of state and non-profit organizations, to conduct strategic and coordinated land conservation activities that build connections between remaining high quality natural areas in the greater Twin Cities metropolitan area and ensures their benefits are available for future generations. Great River Greening is using this appropriation to restore approximately 150 acres of permanently protected forest, woodland, savanna, and prairie habitat while engaging hundreds of volunteers in the stewardship of the metropolitan area's remaining natural areas.

Project due to be completed: 6/30/2017

Prairie, Forest, and Savanna Restoration in Greater Metropolitan Area
Subd. 06g $200,000 TF

Tom Lewanski
Friends of the Mississippi River
360 N Robert St, Ste 400
St Paul, MN 55101

Phone: (651) 222-2193 x1
Email: tlewanski@fmr.org
Web: http://www.fmr.org

Appropriation Language
$200,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Friends of the Mississippi River to restore approximately 150 acres of prairie, forests, and oak savanna in the greater metropolitan area. A list of proposed restorations and enhancements

must be provided as part of the required work plan. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Though many parts of the Twin Cities metropolitan area are urbanized, there are also has large areas of natural lands that continue to serve as important habitat for fish, wildlife, and plant communities. However, pressure on these remaining lands continues to intensify as population and development pressures increase. This appropriation continues the efforts of the Metro Conservation Corridors (MeCC) partnership, an ongoing effort by a partnership of state and non-profit organizations, to conduct strategic and coordinated land conservation activities that build connections between remaining high quality natural areas in the greater Twin Cities metropolitan area and ensures their benefits are available for future generations. Friends of the Mississippi River is using this appropriation to restore approximately 150 acres of permanently protected prairie, forest, and oak savanna habitat in the metropolitan area.

Project due to be completed: 6/30/2017

Nutrient Capture Through Water Management and Biomass Harvesting
Subd. 06h $300,000 TF

Jeff Lewis
Red River Basin Commission
119 5th Street S, PO Box 66
Moorhead, MN 56561

Phone: (218) 291-0422
Email: jeff@redriverbasincommission.org
Web: http://www.redriverbasincommission.org

Appropriation Language
$300,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Red River Basin Commission to evaluate the potential capture of excess nutrients using cattails grown and harvested within shallow flood reservoirs for bioenergy use. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Excess nutrients are among the most common impairments of water resources in the Red River Basin, as well as the rest of Minnesota. About 80% of the land use in the Red River Basin is for agricultural cropland and over 90% of phosphorus and nitrogen found in rivers and streams in the area originate from nonpoint sources, such as cropland. Excess nutrients are also one of the most difficult impairments to correct. The Red River Basin Commission is attempting to help correct this problem by using this appropriation to develop and evaluate an innovative, multipurpose method to use cattails and other vegetation within existing flood storage reservoirs to capture and reduce nutrient loads from runoff originating from mostly non-point sources and then use the harvested vegetation for purposes including bioenergy production and fertilizer. If effective this technique could be implemented in multiple locations in the Red River Basin and in other agricultural regions of the state to assist in reducing nutrient loads in waterways.

Project due to be completed: 6/30/2017

Cattail Management for Wetland Wildlife and Bioenergy Potential
Subd. 06i $74,000 TF

Daniel Svedarsky
U of MN
Northwest Experiment Station
Crookston, MN 56716

Phone: (218) 281-8129
Email: dsvedars@mail.crk.umn.edu
Web: http://www3.crk.umn.edu/faculty/S/WDaniel_Svedarsky.htm

Appropriation Language
$74,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Northwest Research and Outreach Center in Crookston to evaluate different management techniques for cattail control and related wildlife impacts in northwest Minnesota and to assess the use of cattails as a biofuel feedstock.

Project Overview
On many public lands in northwest Minnesota, cattail growth has far exceeded the distribution recommended for optimum wetland wildlife habitat and a need for cattail control has become recognized. Cattails have also recently been demonstrated to have bioenergy potential. Researchers at the University of Minnesota in Crookston are using this appropriation to evaluate cattail management and harvesting techniques in various northwest Minnesota habitats as a means of reducing an increasing overabundance of exotic cattails in wetlands, which are degrading wildlife habitat, while providing a value-added feedstock for sustainable bioenergy in the region.

Project due to be completed: 6/30/2016

Dredged Sediment for Forest Restoration on Unproductive Minelands
Subd. 06j $300,000 TF

Tom Levar
U of MN - NRRI
5013 Miller Trunk Hwy
Duluth, MN 55811

Phone: (218) 720-4333
Email: tlevar@d.umn.edu
Web: http://www.nrri.umn.edu

Appropriation Language
$300,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota-Duluth for the Natural Resources Research Institute to restore up to 136 acres of unproductive mine stockpile while improving the treatment of municipal sewage and biosolids near Virginia using clean Erie Pier dredged sediment and managed forestry techniques. This appropriation is available until June 30, 2018, by which time the project must be completed and final products delivered.

Project Overview
Mine stockpiles are unproductive due to soil deficiencies of organic matter, nutrients, and soil organisms, which are essential to supporting healthy plant growth, diversity, and succession. Waste products, including biosolids, composts, and dredged materials, have the potential to be used to address some of these deficiencies and make the lands productive again. Researchers at the Natural Resources Research Institute at the University of Minnesota in Duluth are using this appropriation to demonstrate and evaluate methods for using dredged sediment and treated biosolids as a substrate for restoring up to 136 acres of unproductive minelands to productive forestland. If effective this technique could be applied more broadly to minelands in Minnesota and elsewhere with potential benefits including production of materials for the biofuels and forest products industries, increased wildlife habitat, restoration of unproductive lands, and re-utilization of waste products.

Project due to be completed: 6/30/2018

Expansion of Greenhouse Production
Subd. 06k $176,000 TF

Lana Fralich
City of Silver Bay
7 Davis Dr
Silver Bay, MN 55614

Phone: (218) 226-4408
Email: lanaf@silverbay.com
Web: http://www.d.umn.edu/cscd/victusfarm/

Appropriation Language
$176,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Silver Bay to expand and enhance a city-owned greenhouse facility to increase system production for locally grown food on a year-round basis and reduce water usage.

Project Overview
New and innovatively designed greenhouse facilities have the potential to provide sustainable food, fuel, and other products year round by utilizing ecological processes and other practices to integrate production of fish, plants, and algae in a low input, self-sustainable system. The City of Silver Bay and researchers at the University of Minnesota - Duluth are using this appropriation to expand and enhance a demonstration greenhouse facility. Refined techniques developed at the facility have the potential to be transferred and replicated at similar facilities throughout the state.

Project due to be completed: 6/30/2016

Subd. 07 Land Acquisition, Habitat, and Recreation

Scientific and Natural Area Acquisition, Restoration, Improvement and Citizen Engagement
Subd. 07a $2,540,000 TF

Peggy Booth
MN DNR
500 Lafayette Rd, Box 25
St. Paul, MN 55155

Phone: (651) 259-5088
Email: peggy.booth@state.mn.us
Web: http://www.dnr.state.mn.us/snas/index.html

Appropriation Language
$2,540,000 the second year is from the trust fund to the commissioner of natural resources to acquire lands with high-quality native plant communities and rare features to be established as scientific and natural areas as provided in Minnesota Statutes, section 86A.05, subdivision 5, restore and improve parts of scientific and natural areas, and provide technical assistance and outreach. A list of proposed acquisitions must be provided as part of the required work program. Land acquired with this appropriation must be sufficiently improved to meet at least minimum management standards, as determined by the commissioner of natural resources. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Minnesota's Scientific and Natural Areas (SNA) Program is an effort to preserve and perpetuate the state's ecological diversity and ensure that no single rare feature is lost from any region of the state. This includes landforms, fossil remains, plant and animal communities, rare and endangered species, and other unique biotic or geological features. These sites play an important role in scientific study, public education, and outdoor recreation. The Minnesota Department of Natural Resources is using this appropriation to permanently protect approximately 240 acres of high quality habitat with rare species and unique natural resources of statewide significance; to restore approximately 770 acres of existing SNAs to conserve the rare features they protect; and to monitor existing SNAs to gauge, improve, and verify that site specific conservation values are protected and achieved. The project includes engagement activities for local communities to help build a network of people to be involved with their local SNAs.

Project due to be completed: 6/30/2017

Metropolitan Regional Park System Acquisition
Subd. 07b $1,500,000 TF

Arne Stefferud
Metropolitan Council
390 N Robert St
St. Paul, MN 55101

Phone: (651) 602-1360
Email: arne.stefferud@metc.state.mn.us
Web: http://www.metrocouncil.org/Parks.aspx

Appropriation Language
$1,500,000 the second year is from the trust fund to the Metropolitan Council for grants for the acquisition of lands within the approved park unit boundaries of the metropolitan regional park system. This appropriation may not be used for the purchase of habitable residential structures. A list of proposed fee title and easement acquisitions must be provided as part of the required work program. This appropriation must be matched by at least 40 percent of nonstate money that must be committed by December 31, 2014, or the appropriation cancels. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
The Twin Cities area is host to a nationally renowned system of regional parks and trails that provides numerous outdoor recreational opportunities for the public while preserving green space for wildlife habitat and other natural resource benefits. Currently the regional parks and trails system consists of 51 parks and park reserves containing more than 54,000 acres, more than 300 miles of interconnected trails, and has more than 46 million visits each year. Through an existing grant program, the Metropolitan Council is using this appropriation to partner with local metropolitan communities to partially finance the acquisition of approximately 200 acres to be added to existing metropolitan regional parks. Priority will be given to lands with shoreland, lands that provide important natural resource connections, and lands containing unique natural resources.

Project due to be completed: 6/30/2017

Mesabi Trail Development - Soudan to Ely Segment
Subd. 07c $1,000,000 TF

Bob Manzoline
St. Louis & Lake Counties Regional Railroad Authority
111 Station Rd
Eveleth, MN 55734

Phone: (218) 744-2653
Email: bmanzoline@rrauth.com
Web: http://www.mesabitrail.com/

Appropriation Language
$1,000,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with St. Louis and Lake Counties Regional Rail Authority for the right-of-way acquisition, design, and construction of segments of the Mesabi Trail totaling approximately 11 miles east of Soudan towards Ely. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Running through the Iron Range of northeastern Minnesota, the Mesabi Trail provides a recreational and alternate transportation corridor for hikers, bikers, skiers, and horseback riders, as well as some designated snow snowmobile use areas. When completed the trail will include 145 paved miles extending from the Mississippi River in Grand Rapids to the Boundary Waters Canoe Area in Ely - 115 miles have been finished to date. The St. Louis and Lake Counties Regional Railroad Authority are using this appropriation to develop 11 miles of trail segments near Vermilion State Park.

Project due to be completed: 6/30/2017

Shoreland Acquisition on St. Croix River
Subd. 07d $1,250,000 TF

June Mathiowetz
Washington County
14949 62nd Street N
Stillwater, MN 55082

Phone: (651) 430-6016
Email: june.mathiowetz@co.washington.mn.us
Web: http://www.co.washington.mn.us

Appropriation Language
$1,250,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Washington County to purchase 15 acres, encompassing 3,500 feet of St. Croix shoreland paralleling Brown's Creek State Trail in the city of Stillwater. The county will transfer the parcel to the city of Stillwater. This appropriation is contingent on the expenditure of at least $2,500,000 of nonstate match.

Project Overview
The St. Croix River is one of the most pristine, large river ecosystems remaining in the upper Mississippi River System. Washington County, in partnership with the City of Stillwater, is using this appropriation to acquire 15 acres containing 3,500 feet of St. Croix River shoreline just north of downtown Stillwater and parallel to the Brown's Creek State Trail. The land will be turned into a local nature park for trail users, river users, tourists, and area residents with passive recreation including fishing, boat launching, walking, and picnicking.

Project due to be completed: 6/30/2016

Martin County Park and Natural Area Acquisition
Subd. 07e $435,000 TF

Rich Perrine
Martin County Soil and Water Conservation District
923 N State St, Ste 110
Fairmont, MN 56031

Phone: (507) 235-6680
Email: richard.perrine@mn.nacdnet.net
Web: http://www.martinswcd.net

Appropriation Language
$435,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Fox Lake Conservation League, Inc. and Martin County to acquire approximately 40 acres in Martin County, including a ten-acre prairie remnant to be owned and managed by Martin County as part of its park system. A vegetation management plan must be developed and implemented and public access must be provided to the native prairie remnant. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
After years of discussions, some of the most diverse riparian, mesic, and dry hillside native prairie containing the only identified remnant population of Prairie Bush Clover in Martin County is available for permanent protection. Martin County is using this appropriation to acquire and permanently protect approximately 40 acres, including 10 acres of remnant prairie. The land will be turned into a county park providing recreational opportunities for local residents and educational opportunities for area students.

Project due to be completed: 6/30/2017

Minnesota River Water Trailhead and Landing in Morton
Subd. 07f $198,000 TF

Carl Colwell
City of Morton
PO Box 127
Morton, MN 56270

Phone: (507) 697-6912
Email: mortoncityhall@mchsi.com
Web: http://www.mortonmn.com

Appropriation Language
$198,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the city of Morton to transform a municipal parcel from a compost site into a Minnesota River water trailhead and landing and to design and build interpretative trails around the landing complex. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Morton, Minnesota is home to many unique natural, cultural, and historic sites, including sites from the US-Dakota War and some of the oldest exposed rock, called Morton Gneiss, on the planet. The City of Morton is using this appropriation to develop a municipal site along the Minnesota River in Morton to be converted into a public canoe landing and campground and a trail connection between the Minnesota River State Water Tail and natural and cultural sites in the area including the Morton Outcrop Scientific and Natural Area. The project will provide increased recreational opportunities and amenities for users and provide a natural classroom for students to learn about the river.

Project due to be completed: 6/30/2017

Subd. 08 Air Quality, Climate Change, and Renewable Energy

Solar Cell Materials from Sulfur and Common Metals
Subd. 08a $494,000 TF

Lee Penn
U of MN
207 Pleasant St SE
Minneapolis, MN 55455

Phone: (612) 626-4680
Email: rleepenn@umn.edu
Web: http://www.chem.umn.edu/groups/penn/

RESEARCH

Appropriation Language
$494,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota

to develop solar cell materials using nontoxic and common metals combined with sulfur. This appropriation is subject to Minnesota Statutes, section 116P.10. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Sustainable energy production is a major challenge facing our society. Solar energy is renewable and is a viable and attractive option. However, there are obstacles to widespread use. Current technology is expensive, making it difficult for businesses and homeowners to implement, and solar cells are commonly made using toxic and rare elements or using processes that require large amounts of energy. To become commonplace, solar cells must be inexpensive and robust, and they must be made of abundant, cheap, nontoxic materials. Researchers at the University of Minnesota are using this appropriation to develop and test an innovative, more energy and time-efficient method for producing thin film solar cells made of sulfur and common metals instead of the more toxic and rare elements currently used in most cases.

Project due to be completed: 6/30/2017

Innovative Groundwater-Enhanced Geothermal Heat Pump Study
Subd. 08b $196,000 TF

Martin Saar
U of MN
310 Pillsbury Dr SE
Minneapolis, MN 55455

Phone: (952) 457 8959
Email: rando035@umn.edu
Web: http://www.esci.umn.edu/orgs/geofluids/

Appropriation Language
$196,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to analyze and validate a new geothermal pump method and technology that will reduce heat pump costs and improve performance and predictability. This appropriation is subject to Minnesota Statutes, section 116P.10.

Project Overview
Space and water heating and cooling consume 48% of all energy used in an average U.S. residence, and usually that energy is supplied by natural gas or fossil-fuel derived electricity. Geothermal heat pumps can reduce energy requirements for heating and cooling by up to 75%. However, traditional geothermal heat pumps are expensive and their performance is difficult to predict before installation. Researchers at the University of Minnesota are using this appropriation to develop, test, and demonstrate a novel geothermal heat pump technology that utilizes the heat exchange of groundwater flow to be more efficient, less space intensive, and less costly than current conventional geothermal systems. The technology has the potential to make geothermal heat pump systems have a faster payback period, resulting in more widespread use, and give geothermal a larger role in renewable energy production.

Project due to be completed: 6/30/2016

Demonstrating Innovative Technologies to Fully Utilize Wastewater Resources
Subd. 08c $1,000,000 TF

Roger Ruan
U of MN
1390 Eckles Ave
St Paul, MN 55108

Phone: (612) 625-1710
Email: ruanx001@umn.edu
Web: http://biorefining.cfans.umn.edu/bioenergy-bioproducts-cluster/

RESEARCH

Appropriation Language
$1,000,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to demonstrate innovative technologies to utilize and treat wastewater streams for conversion of treatment by-products to biofuels. This appropriation is subject to Minnesota Statutes, section 116P.10. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Each year Minnesota municipal wastewater treatment plants generate large amounts of oily scum, concentrated liquid called centrate, and sludge. These waste streams are disposed of either in landfills or by burning or subjected to additional treatment. However, new technologies have shown potential to capture resource values from these waste products while lowering the treatment costs for these waste streams. Researchers at the University of Minnesota are using this appropriation to demonstrate the feasibility and effectiveness of several technologies that implemented together in a wastewater treatment system could improve wastewater treatment while generating valuable biofuel byproducts. Expected benefits of the technologies include reduced landfill contributions, reduced fossil fuel use, cost savings and revenue generation for wastewater treatment plants, and reduced air and water pollution.

Project due to be completed: 6/30/2017

Transitioning Minnesota Farms to Local Energy
Subd. 08d $500,000 TF

Mike Reese
U of MN
46352 State Hwy 329
Morris, MN 56267

Phone: (320) 589-1711
Email: reesem@morris.umn.edu
Web: http://renewables.morris.umn.edu/

Appropriation Language
$500,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the West Central Research and Outreach Center in Morris to develop clean energy strategies for Minnesota farms in order to reduce fossil fuel energy use and increase local energy production. Any installation of infrastructure or improvements must be at the University of Minnesota West Central Research and Outreach Center. This appropriation is available until June 30, 2017, by which time the

project must be completed and final products delivered.

Project Overview
Production agriculture's dependence on fossil fuel energy carries significant economic and ecological risks. The energy consumed within livestock facilities alone is the equivalent consumption of several large cities, and agriculture currently contributes approximately 14% of the total greenhouse gas emissions in the state. As consumers increasingly demand low carbon footprint products, adoption of clean energy systems in crop and livestock production would position Minnesota's agricultural sector with a competitive advantage. While Minnesota farmers have historically adopted technology to more efficiently use resources and optimize production, implementation of clean energy technologies on farms has been slow to date and farmers continue to opt for conventional fossil-based energy. In response to this, researchers at the University of Minnesota West Central Research and Outreach Center are using this appropriation to develop, test, and evaluate options for clean energy systems for modern swine production facilities and conduct associated outreach to increase adoption of clean energy systems at these facilities.

Project due to be completed: 6/30/2017

Life Cycle Energy of Renewably Produced Nitrogen Fertilizers
Subd. 08e $250,000 TF

Joel Tallaksen
U of MN
46352 State Hwy 329
Morris, MN 56267

Phone: (320) 589-1711
Email: tall0007@umn.edu
Web: http://wcroc.cfans.umn.edu/RenewableEnergy/index.htm

Appropriation Language
$250,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the West Central Research and Outreach Center in Morris to calculate fossil fuel energy savings and greenhouse gas reductions resulting from the use of local renewable energy technologies, including biomass gasification, anaerobic digestion, and hydroelectricity to produce fertilizer. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Minnesota supports over 14 million acres of cropland in grain production. Almost 600,000 tons of synthetic nitrogen fertilizers are needed annually to maintain productivity on this land, which requires the equivalent of 3,000,000 barrels of oil and costs farmers over $400 million dollars per year. This amount of fossil fuel use results in a significant amount of greenhouse gas emissions, while the absence of fossil energy resources in the state means that these synthetic nitrogen fertilizers must be imported into Minnesota from other states and overseas. In response to this, researchers at the University of Minnesota West Central Research and Outreach Center are using this appropriation to conduct modeling and analysis of the viability of options for using different renewable energy technologies that could be implemented in Minnesota for generating nitrogen fertilizer. Findings have the potential to help reduce agricultural energy related production costs and make rural communities more energy independent.

Project due to be completed: 6/30/2017

Clean Water and Renewable Energy from Beet Processing Wastewater and Manure
Subd. 08f $400,000 TF

Xiao Wu
U of MN
35838 120th Street
Waseca, MN 56093

Phone: (507) 837-5625
Email: wuxxx199@umn.edu
Web: http://sroc.cfans.umn.edu

RESEARCH

Appropriation Language
$400,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Southern Research and Outreach Center in Waseca to research the cofermentation of sugar beet processing wastewater and swine manure for hydrogen and methane production and to install and evaluate a pilot-scale system. This appropriation is subject to Minnesota Statutes, section 116P.10. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Minnesota ranks #2 in hog production and #1 in sugar beet production in the U.S., generating about 11 million tons of pig manure and over one million tons of sugar processing wastes annually. Presently there are not cost-effective methods available to deal with these waste streams other than land application, which usually results in nutrient runoff into ground and surface water resources. Better treatment of these waste streams is necessary, but treatment alone is not only expensive but usually fails to capture resource values contained within these waste streams that could be put to other uses. Additionally, these two waste streams together contain complimentary nutrients needed for biological processes such as fermentation and anaerobic digestion. Researchers at the University of Minnesota Southern Research and Outreach Center are using this appropriation to develop, test, and evaluate technologies that utilize these two different agricultural waste streams containing complementary nutrients to produce value-added byproducts in the forms of bioenergy and fertilizer while reducing the negative impact of both waste streams on water quality.

Project due to be completed: 6/30/2017

Next Generation Large-Scale Septic Tank Systems
Subd. 08g $258,000 TF

Bo Hu
U of MN
1390 Eckles Ave
St. Paul, MN 55108

Phone: (612) 625-4215
Email: bhu@umn.edu

Web: http://bohu.cfans.umn.edu/

RESEARCH

Appropriation Language
$258,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to develop a dual utility large-scale septic tank system designed for nutrient recuperation, bioenergy generation, and environmental protection using a bio-electrochemical system. This appropriation is subject to Minnesota Statutes, section 116P.10. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Septic tank systems aim to treat sewage generated by homes and facilities that do not have access to centralized wastewater treatment plants. Currently 25% of the U.S. population relies on these systems as their primary means of wastewater treatment. However, the treatment capabilities of these systems are limited and so byproducts can contribute to degradation of water resources and other environmental problems and the systems emit instead of collect powerful greenhouse gases such as methane. Additionally, the systems are actually an untapped source for recovering nutrients for other uses. Researchers at the University of Minnesota are using this appropriation to develop, test, and evaluate technologies to improve large-scale septic systems to be more effective and capable of capturing valuable nutrients from the waste stream and generating bioenergy. The technologies could be integrated into existing septic tank systems and the information will be helpful to wastewater professionals in designing next generation septic systems.

Project due to be completed: 6/30/2017

Solar Photovoltaic Installation at Residential Environmental Learning Centers
Subd. 08h $150,000 TF

Dale Yerger
The MN Coalition of RELCs
Deep Portage Learning Center
2197 Nature Center Drive NW
Hackensack, MN 56452

Phone: (218) 682-2325
Email: portage@uslink.net
Web: http://www.deep-portage.org

Appropriation Language
$150,000 the second year is from the trust fund to the commissioner of natural resources for agreements with Deep Portage Learning Center to coordinate with Audubon Center of the North Woods; Eagle Bluff Environmental Learning Center; Laurentian Environmental Learning Center; Long Lake Conservation Center; and Wolf Ridge Environmental Learning Center the installation of at least five kilowatt institutional solar arrays at each of the six residential environmental learning centers as a teaching tool. Prior to the installation, the proposed placement of the solar arrays must be submitted to the Legislative-Citizen Commission on Minnesota Resources office to ensure the demonstration of the maximum educational value.

Project Overview

Over the past several years six environmental learning centers located around the state - Audubon Center of the North Woods, Deep Portage Learning Center, Eagle Bluff Environmental Learning Center, Laurentian Environmental Learning Center, Long Lake Conservation Center and Wolf Ridge Environmental Learning Center - have been implementing demonstrations of energy conservation, energy efficiency, and renewable energy on their campuses for use as educational tools for the thousands of students and visitors that come to the centers each year. The six environmental learning centers are using this appropriation to expand their energy demonstration offerings by installing 5-kilowatt solar photovoltaic systems at each of the centers.

Project due to be completed: 6/30/2016

Itasca Community College Woody Biomass Utilization Project Design
Subd. 08i $112,000 TF

Bart Johnson
Itasca Community College
1851 Hwy 169 E
Grand Rapids, MN 55744

Phone: (218) 349-9154
Email: bart.johnson@itascacc.edu
Web: http://www.itascacc.edu

Appropriation Language
$112,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Itasca Community College to develop a final design for installation of a boiler heating system using woody biomass. Students at the college must be involved in the final design process.

Project Overview
Woody biomass energy systems have shown themselves to offer more locally-based, stable energy supplies for some communities. Itasca Community College is using this appropriation to design a renewable energy system based on woody biomass that will serve as a demonstration and educational tool in the region.

Project due to be completed: 6/30/2016

Subd. 09 Environmental Education

Minnesota Conservation Apprenticeship Academy
Subd. 09a $392,000 TF

Jenny Gieseke
Board of Water and Soil Resources
520 Lafayette Rd N
St. Paul, MN 55155

Phone: (507) 381-3131
Email: jenny.gieseke@state.mn.us
Web: http://www.conservationcorps.org/apprentice-academy/

Appropriation Language
$392,000 the second year is from the trust fund to the Board of Water and Soil Resources in cooperation with Conservation Corps Minnesota to continue a program to train and mentor future conservation professionals by providing apprenticeship service opportunities with soil and water conservation districts. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Many of the most experienced conservation practitioners at local soil and water conservation districts throughout the state are nearing retirement, and with their departure will go much of their practical, on-the-ground knowledge, experience, and skills. Meanwhile, college students seeking to be the next generation of conservation practitioners have knowledge of emerging technologies and other innovations that can improve and contribute to current conservation efforts. Through this appropriation the Minnesota Board of Soil and Water Resources will work with the Minnesota Conservation Corps to continue a program that places students in apprenticeship positions with county soil and water conservation district offices throughout the state. This unique program provides an opportunity for interns to gain valuable in-the-field experience from current practitioners while sharing their knowledge with those practitioners about the newest ideas and solutions for meeting today's natural resource challenges.

Project due to be completed: 6/30/2017

Youth-led Sustainability Initiatives in 40 Greater Minnesota Communities
Subd. 09b $350,000 TF

Dave Pederson
Prairie Woods Environmental Learning Ctr
12718 10th Street NE
Spicer, MN 56288

Phone: (320) 354-5894
Email: d.pederson@tds.net
Web: http://www.youthenergysummit.org/

Appropriation Language
$350,000 the second year is from the rust fund to the commissioner of natural resources for an agreement with Prairie Woods Environmental Learning Center and Laurentian Environmental Learning Center to complete over 100 youth-led sustainability action projects in 40 communities in southwest, southeast, central and northeastern Minnesota.

Project Overview
Adoption of renewable energy technologies and energy conservation practices can contribute in a variety of ways to the environmental and economic health of rural Minnesota communities through costs savings and emissions reductions. Engaging and coaching students as the leaders in the process of implementing such practices provides the added benefit of increasing knowledge, teaching about potential career paths, and developing leadership experience. Using this appropriation the Prairie Woods Environmental Learning Center and its partners are expanding an existing program called the Youth Energy Summit (YES!) to engage approximately 650 students in implementing 150 additional youth-led renewable energy and energy conservation projects in over 40 communities in central, northeastern, southwestern, and southeastern Minnesota. These projects will be driven by collaboration

between students, community members, and local businesses and organizations.

Project due to be completed: 6/30/2016

Urban Environmental Education Engaging Students in Local Resources
Subd. 09c $1,093,000 TF

Chad Dayton
Wilderness Inquiry
808 14th Avenue SE
Minneapolis, MN 55414

Phone: (612) 676-9419
Email: chad@wildernessinquiry.org
Web: http://www.wildernessinquiry.org

Appropriation Language
$1,093,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Wilderness Inquiry for a collaborative partnership, including the National Park Service, Minneapolis Public Schools, and St. Paul Public Schools, to establish a metrowide system providing place-based environmental education experiences using existing, but underutilized, outdoor environmental resources serving over 15,000 middle and high school students. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
There has been a sharp decline in participation in outdoor recreation and education amongst youth, particularly in urban areas. Some argue that youth who have meaningful outdoor education experiences are more likely to become engaged in environmental stewardship and invested in outdoor resources as adults. Wilderness Inquiry - in partnership with state and federal agencies, non-profits, and local school districts - is using this appropriation to expand an environmental education and recreation program that provides youth with hands-on educational and recreational experiences centered around the Mississippi River. Funds enable the program to offer experiential, place-based educational experiences to nearly 16,000 additional disadvantaged middle and high school students in Minneapolis, St. Paul, and six greater Minnesota school districts. Experiences will include hiking, canoeing, fishing, aquatic sampling, camping, and conservation-related summer employment.

Project due to be completed: 6/30/2017

Diversifying Involvement in the Natural Resources Community
Subd. 09d $500,000 TF

Subd. 09d1 $416,000 TF
Gina Bonsignore
MN DNR
1200 Warner Rd
St. Paul, MN 55106

Phone: (651) 259-5809
Email: regina.bonsignore@state.mn.us
Web: http://www.dnr.state.mn.us/index.html

Subd. 09d2 $84,000 TF

Sue Galatowitsch
U of MN
135 Skok Hall, 2003 Upper Buford Circle
St Paul, MN 55108

Phone: (612) 624-3242
Email: galat001@umn.edu
Web: http://fwcb.cfans.umn.edu/Faculty/Galatowitsch/index.htm

Appropriation Language
$416,000 the second year is from the trust fund to the commissioner of natural resources and $84,000 is to the Board of Regents of the University of Minnesota to increase participation of under-represented communities in the natural resource professions and in outdoor recreation by means of targeted urban outreach and stronger linkages between Department of Natural Resources programs and academic offerings. This initiative must be coordinated with other environmental education appropriations in this subdivision. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Minnesota's natural resource professional workforce is much less diverse than its citizenry and many other professional fields. The benefits of a more diverse workforce are many, including the ability of organizations to increase innovation and creativity, attract higher qualified candidate pools, and ensure services that meet the diverse interests and needs of all citizens. The Department of Natural Resources and the University of Minnesota are using this appropriation to engage diverse urban youth, under-represented in the natural resources community, in natural resources education and developing outdoor recreational skills. Project efforts include connecting youth with close-to-home natural resource recreation and protection issues, a recruitment and retention program to introduce potential career opportunities, support and mentoring for those interested in pursuing natural resources college education and careers, and introductory experiences and internships in natural resources jobs.

Project due to be completed: 6/30/2017

Educating Minnesotans about Potential Impacts of Changing Climate
Subd. 09e $325,000 TF

Kristen Poppleton
Will Steger Foundation
2801 21st Avenue S, Ste 110
Minneapolis, MN 55407

Phone: (612) 278-7147
Email: kristen@willstegerfoundation.org
Web: http://www.willstegerfoundation.org

Appropriation Language
$325,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Will Steger Foundation to plan and conduct forums, workshops, and trainings on Minnesota's changing climate and the potential impacts on ecosystems and natural resources. An

accompanying television program and information spots must be produced for broadcast and use at the forums.

Project Overview
Climate change has and will have profound effects on Minnesota's economy, agriculture, tourism, and natural resources. While climate change is often discussed in the broader contexts of its potential impacts at a national or international level, research has shown that climate change education and behavior change happens more effectively when the issue is made local and relevant. The Will Steger Foundation is using this appropriation to develop and implement efforts aimed at increasing understanding of the potential impacts of climate change for Minnesota and changing related behavioral norms of Minnesotans through the use of stories of individuals' experiences, facilitation of related discussions, and guidance toward additional available resources. Activities include holding public forums and educator workshops around the state, establishment of peer support networks, and the production and broadcast of information spots and a documentary on public television. Approximately 100,000 people are expected to be reached statewide.

Project due to be completed: 6/30/2016

Pollinator Education Center at the Minnesota Landscape Arboretum
Subd. 09f $615,000 TF

Peter Moe
U of MN - MN Landscape Arboretum
3675 Arboretum Dr
Chaska, MN 55318

Phone: (952) 443-1408
Email: moexx004@umn.edu
Web: http://www.arboretum.umn.edu

Appropriation Language
$615,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to develop exhibits for an educational center that will offer hands-on learning experience about the role of pollinators and importance of pollinator habitat. Exhibits must utilize and integrate the best available science pertaining to all pollinator types, particularly native species. Approval of the work plan for this appropriation is contingent upon the organization addressing how it will increase access to the center by youth at no or limited cost.

Project Overview
Pollinators play a key role in ecosystem function and in agriculture, including thousands of native plants and more than one hundred U.S. crops that either need or benefit from pollinators. However, pollinators are in dramatic decline in Minnesota and throughout the country. The causes of the decline are not completely understood, but identified factors include loss of nesting sites, fewer flowers, increased disease, and increased pesticide use. Developing an aware, informed citizenry that understands this issue is one key to finding and implementing solutions to counteract these factors. The Minnesota Landscape Arboretum is using this appropriation to implement educational efforts designed to raise awareness about pollinators, their role in the environment and the economy, and the challenges they currently face due to recent unprecedented decline. Exhibits, programming, and demonstration sites will explore the role of pollinators in plant reproduction, maintaining biodiversity, and supporting agriculture and provide guidance on actions individuals can take, such as with their landscaping choices,

to help pollinators.

Project due to be completed: 6/30/2016

Minnesota Pollinator Partnership
Subd. 09g $100,000 TF

Drew Larsen
Pheasants Forever, Inc.
1783 Buerkle Circle
St. Paul, MN 55110

Phone: (308) 293-1194
Email: dlarsen@pheasantsforever.org
Web: http://www.pheasantsforever.org

Appropriation Language
$100,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Pheasants Forever to complete 40 community pollinator education and habitat projects. This appropriation must be coordinated with appropriations provided by the outdoor heritage fund. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

Project Overview
Pollinators play a key role in ecosystem function and in agriculture, including thousands of native plants and more than one hundred U.S. crops that either need or benefit from pollinators. However, pollinators are in dramatic decline in Minnesota and throughout the country. The causes of the decline are not completely understood, but identified factors include loss of nesting sites, fewer flowers, increased disease, and increased pesticide use. Fortunately, there are known actions that can be taken to help counteract some of these factors, such as adding diversity of flowering plants to the landscape in order to provide nectar and habitat for pollinators. Pheasants Forever is using this appropriation to pilot an education and habitat restoration program in 40 communities around the state that will involve 800 youth and 200 adults in learning about pollinators and their habitat and engaging them in conducting community pollinator projects that establish pollinator foraging habitat on a total of at least 40 acres.

Project due to be completed: 6/30/2017

Raptor Lab Integrating Online and Outdoor Learning Environments
Subd. 09h $186,000 TF

Julia Ponder
U of MN
1920 Fitch Ave
St. Paul, MN 55108

Phone: (612) 624-3431
Email: ponde003@umn.edu
Web: http://www.raptor.cvm.umn.edu/

Appropriation Language

$186,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Raptor Center to develop an environmental education program on raptors for middle schools that integrates outdoor experiences with technology and scientific investigation.

Project Overview
Increasingly many youth are disconnected from the outdoors and the natural world and many of these same youth, nearly 50% in Minnesota, are also not proficient in science. Yet such experiences and knowledge are necessary components for this next generation to understand and participate in solving the complex environmental challenges facing our world. The University of Minnesota's Raptor Center is using this appropriation to develop and implement an online learning environment for 7th and 8th grade students that links outdoor experiential learning with classroom curriculum by engaging students in the design and execution of student-based research projects that utilize real-world data from raptors admitted to the Raptor Center in conjunction with students' outdoor exploration of their local environment. Initially the program will be tested with a minimum of 900 students at five schools in different regions of the state with varying demographics and then made available to schools statewide.

Project due to be completed: 6/30/2016

Wolf Management Education
Subd. 09i $120,000 TF

Darcy Berus
International Wolf Center
3410 Winnetka Ave N Ste 101
Minneapolis, MN 55427

Phone: (763) 560-7374
Email: dberus@wolf.org
Web: http://www.wolf.org

Appropriation Language
$120,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the International Wolf Center for outreach to metro area kindergarten through grade 12 classrooms and nature centers to help children understand wolf management issues.

Project Overview
Wolves are a hot topic in Minnesota, with the public sharply divided on management issues such as wolf hunting. The complexity of the topic lends itself to a lot of misunderstanding and misinformation that is not always helpful to resolving the polarized debate. The International Wolf Center is using this appropriation to help bridge the gap with science-based information by delivering on-site programs to approximately 460 classrooms in the Twin Cities metro area to teach approximately 16,000 students about wolf biology and behavior, the social and political conflicts surrounding wolves, and the overall effects of wildlife habitat loss throughout the state.

Project due to be completed: 6/30/2016

Subd. 10 Administration and Contract Agreement Reimbursement

Contract Agreement Reimbursement
Subd. 10a $135,000 TF

Amanda Graeber
MN DNR
500 Lafayette Rd, Box 10
St. Paul, MN 55155

Phone: (651) 259-5533
Email: amanda.graeber@state.mn.us
Web: http://dnr.state.mn.us/grants/passthrough/index.html

Appropriation Language
$135,000 the second year is from the trust fund to the commissioner of natural resources at the direction of the Legislative-Citizen Commission on Minnesota Resources for expenses incurred for contract agreement reimbursement for the agreements specified in this section. The commissioner shall provide documentation to the Legislative-Citizen Commission on Minnesota Resources on the expenditure of these funds.

Project Overview
Appropriations to non-state entities must be made through a formal contract with a state entity that manages all of the funds for the project on a reimbursement basis. This appropriation to Minnesota's Department of Natural Resources (DNR) funds the expenses incurred by the DNR in contracting, contract management, and expense re-imbursement for most of the Environment and Natural Resources Trust Fund appropriations made to non-state entities, including both new projects funded during the biennium and existing projects funded in previous bienniums.

Project due to be completed: 6/30/2016

Legislative Coordinating Commission Legacy Web Site
Subd. 10b $9,000 TF

Sally Olson
Legislative Coordinating Commission
100 Rev Dr Martin Luther King Jr Blvd, Rm 72
St. Paul, MN 55155

Phone: (651) 296-2963
Email: sally.olson@lcc.leg.mn
Web: http://www.legacy.leg.mn/

Appropriation Language
$9,000 the second year is from the trust fund to the Legislative Coordinating Commission for the Web site required in Minnesota Statutes, section 3.303, subdivision 10.

Project Overview
A website called "Minnesota's Legacy" was created by the Minnesota Legislature to help citizens monitor how dollars from the Legacy Amendment and the Environment and Natural Resources Trust Fund are being invested in the state. This appropriation is being used by the Legislative Coordinating Commission to assist with the administration of the website.

Project due to be completed: 6/30/2016

Environment and Natural Resources Trust Fund (ENRTF) Project Records System Upgrade
Subd. 10c $100,000 TF

Susan Thornton
Legislative-Citizen Commission on Minnesota Resources
100 Rev Dr Martin Luther King Jr Blvd, Rm 65
St. Paul, MN 55155

Phone: (651) 296-6264
Email: susan.thornton@lccmr.leg.mn
Web: http://www.lccmr.leg.mn

Appropriation Language
$100,000 the second year is from the trust fund to the LCCMR for upgrade and modernization of a project records management system.

Project Overview
Per M.S. 116P.09, up to 4% of the amount available for appropriation from the Environment and Natural Resources Trust Fund (ENRTF) for a biennium is available for expenses related to LCCMR administration. These expenses include the LCCMR's project selection and approval process and its ongoing oversight of projects funded by the ENRTF, including both new projects funded during the biennium and existing projects funded in previous bienniums. This appropriation is for the upgrade and modernization of a project records management system.

Project due to be completed: 6/30/2016

MN Laws 2014, Chapter 312, Article 12, Section 8

Invasive Terrestrial Plants and Pests Center
Sec. 08 $1,460,000 TF

Brian Buhr
U of MN
1420 Eckles Ave., 277 Coffey Hall
St. Paul, MN 55108

Phone: (612) 626-7173
Email: bbuhr@umn.edu

Appropriation Language
$490,000 in 2015 is from the environment and natural resources trust fund for the Invasive Terrestrial Plants and Pests Center requested under this act, including a director, graduate students, and necessary supplies. This is a onetime appropriation and is available until June 30, 2022.

$970,000 from the environment and natural resources trust fund appropriated in Laws 2011, First Special Session chapter 2, article 3, section 2, subdivision 9, paragraph (d), Reinvest in Minnesota Wetlands Reserve Acquisition and Restoration Program Partnership, is transferred to the Board of Regents of the University of Minnesota for the Invasive Terrestrial Plants and Pests Center requested

under this act, including a director, graduate students, and necessary supplies and is available until June 30, 2022.

Project Overview
Terrestrial invasive species are species that are not native to a location and that pose critical ecological and economic challenges once they become established in that location. They come in the form of plants, animals, insects, pathogens, and microbes that can cause harm to natural habitat, urban landscapes, and agricultural systems. The problems posed by terrestrial invasive species continue to grow as existing infestations expand and new exotic species arrive, many of which are poorly understood. New ideas and approaches are needed to develop solutions and to stay on top of emerging threats. The University of Minnesota is using this appropriation to help launch a new interdisciplinary Terrestrial Invasive Species Research Center charged with using scientific findings to support policy-making, application, and resource management practices that address the terrestrial invasive species affecting Minnesota. The center will coordinate initiatives focused on prevention of establishment, early detection and rapid response, development of new control methods and technology, integrated pest management, and minimizing non-target impacts of control. Proven tools and techniques developed at the center are intended to be implemented statewide as applicable.

Project due to be completed: 6/30/2022