	Year	Subd.	Title	Organization	First Name	Last Name	Funding Amount	Link to Final Report	Soundbite of Results
	FINAL REPORTS ENDING JUNE 30, 2019 (96 Final Reports)								
1	2013	06a	An Aquatic Invasive Species Research Center	U of MN - MAISRC	Nicholas	Phelps	$ 8,700,000	https://www.lccmr.leg.mn/projects/2013-index.html#201306a	This project established the Minnesota Aquatic Invasive Species Research Center (MAISRC) at the University of Minnesota. Through this appropriation, MAISRC has supported 32 subprojects on many of Minnesota's most important aquatic invasive species, significantly advancing our scientific understanding and ability to manage AIS, and engaging thousands of stakeholders and partners.
2	2013	06a-02	AIS Research Center Sub-Project 02: Delaying the Spread of AIS: Monitoring the Abundance and Distribution of AIS Using New Molecular Tools so Techniques to Delay Their Spread can be Implemented	U of MN - MAISRC	Michael	Sadowsky		https://www.lccmr.leg.mn/projects/2013-index.html#201306a	This project evaluated the potential for harnessing natural microbes for use as biocontrol agents against Eurasian watermilfoil and zebra mussels. Several microorganisms were isolated that could be pathogenic to zebra mussels, but none met safety requirements for testing. Eurasian watermilfoil is associated with elevated concentrations of E. coli and human pathogens.
3	2013	06a-03	AIS Research Center Sub-Project 03: Reducig and Controlling AIS: Developing Effective Tools to Attract and Locate Aggregations of Invasive Carp	U of MN - MAISRC	Peter	Sorensen		https://www.lccmr.leg.mn/projects/2013-index.html#201306a	A sound deterrent system that is over 98% effective at stopping invasive carp was developed in the laboratory and versions of it have been installed in two rivers. To complement this deterrent system we developed food and pheromone attractants which, when coupled with DNA measurements, detect carp with extreme sensitivity.
4	2013	06a-04	AIS Research Center Sub-Project 04: Reducing and Controlling AIS: Developing Effective Bio-Control Techniques to Control Common and/or Asian Carp	U of MN - MAISRC	Przemyslaw	Bajer		https://www.lccmr.leg.mn/projects/2013-index.html#201306a	This project found that bluegill sunfish can reduce production of carp fry by 8-fold in shallow lakes. It also found that corn-based food pellets that contain a toxin might be used to selectively target carp with little risk to native fish. Both of these are promising strategies for carp control.
5	2013	06a-07	AIS Research Center Sub-Project 07: Developing Eradication Tools: Exploring whether Native Pathogens can be used to Control AIS	U of MN - MAISRC	Nicholas	Phelps		https://www.lccmr.leg.mn/projects/2013-index.html#201306a	Researchers identified many new and important viruses in Minnesota fish populations, including Koi Herpes Virus, which caused high mortality in common carp and was not detected in native fish species. This virus will be evaluated as a potential biocontrol agent for common carp in the next phase of the project.
6	2013	06a-08	AIS Research Center Sub-Project 08: Implementing Findings: An Applied Ecologist - Extension Specialist Position and Program	U of MN - MAISRC	Daniel	Larkin		https://www.lccmr.leg.mn/projects/2013-index.html#201306a	This project predicted invasion risk, assessed ecological impacts, evaluated control efficacy, and investigated factors limiting post-control recovery of native aquatic plants. This was applied to starry stonewort, Eurasian watermilfoil, and curlyleaf pondweed. This will refine approaches for invasion prevention, reduce populations of established AIS, and restore native species.

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7	2013	06a--09	AIS Research Center Sub-Project 09: Implementing Findings: ImplementinNew Tools for Zebra Mussel Control	U of MN - MAISRC	Michael	McCartney		https://www.lccmr.leg.mn/projects/2013-index.html#201306a	Project completed before sound bite field was created.
8	2013	06a-10	AIS Research Center Sub-Project 10: Implementing Findings: An Extension Educator or Outreach Position	U of MN - MAISRC	Daniel	Larkin		https://www.lccmr.leg.mn/projects/2013-index.html#201306a	We developed the AIS Detectors program to train volunteers to be "eyes on the water" for AIS detection and response. 299 people are certified and have contributed 10,000+ hours of work. The AIS Trackers program has been piloted and will launch next year. This project also launched Starry Trek.
9	2013	06a-12	AIS Research Center Sub-Project 12: Characterizing long-term spiny water flea ecosystem impacts using paleolimnology	U of MN - MAISRC	Donn	Branstrator		https://www.lccmr.leg.mn/projects/2013-index.html#201306a	This project found that spiny waterflea have been present in Lake Mille Lacs and Lake Kabetogama since the 1930s, about 80 years before they were first detected. Evidence shows they were in low abundance until around the year 2000. This tells us that traditional detection methods may be inadequate.
10	2013	06a-14	AIS Research Center Sub-Project 14: Cost-effective Monitoring of Lakes Newly Infested with Zebra mussels	U of MN - MAISRC	John	Fieberg		https://www.lccmr.leg.mn/projects/2013-index.html#201306a	We evaluated five survey designs for estimating zebra mussel density. Double-observer surveys that allow for imperfect detection are optimal for lakes with low density; quadrat counts that assume perfect detection are optimal at higher densities. A training video, data collection worksheets, and an analysis tutorial were made available online.
11	2013	06a-16	AIS Research Center Sub-Project 16: Sustaining Walleye Populations: Assessing Impacts of AIS	U of MN - MAISRC	Gretchen	Hansen		https://www.lccmr.leg.mn/projects/2013-index.html#201306a	We evaluated the impacts of zebra mussels and spiny waterflea on walleye and yellow perch. Age-0 walleye were >10% smaller at the end of summer following invasion by either AIS, but age-0 yellow perch growth was not consistently affected. Food resources supporting walleye and yellow perch varied among lakes.
12	2013	06a-17	AIS Research Center Sub-Project 17: Building Scientific and Management Capacity to Respond to Invasive Phragmites (common reed) in Minnesota	U of MN - MAISRC	Daniel	Larkin		https://www.lccmr.leg.mn/projects/2013-index.html#201306a	We mapped the distribution of invasive Phragmites, investigated its spread potential, and developed strategies for coordinated response in collaboration with agency staff and other resource managers. Published an action plan outlining how spread could be stopped and reversed; including management recommendations, cost estimates, and region-specific response guidance. Created mnphrag.org.
13	2013	06a-18	AIS Research Center Sub-Project 18: Eurasian and Hybrid Watermilfoil Genotype Distribution in Minnesota	U of MN - MAISRC	Raymond	Newman		https://www.lccmr.leg.mn/projects/2013-index.html#201306a	We determined the distribution of hybrid, Eurasian, and northern watermilfoil in Minnesota and assessed factors related to this distribution. We also assessed genetic variation (diversity) and distribution of specific genotypes and began an assessment of the response of watermilfoil and genotypes to management with herbicides.

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14	2013	06a-19	AIS Research Center Sub-Project 19: Decision-Making Tool for Optimal Management of AIS	U of MN - MAISRC	Nicholas	Phelps		https://www.lccmr.leg.mn/projects/2013-index.html#201306a	We optimized network models for water connectivity and boater movement in Minnesota to predict zebra mussel and Eurasian watermilfoil invasion patterns. We then developed county-based recommendations to prioritize the optimal location of watercraft inspectors. The approach was piloted with Crow Wing, Ramsey, and Stearns Counties, and the results broadly disseminated.
15	2013	06a-21	AIS Research Center Sub-Project 21: Early Detection of Zebra Mussels Using Multibean Sonar	U of MN - MAISRC	Jessica	Kozarek		https://www.lccmr.leg.mn/projects/2013-index.html#201306a	This project tested the utility of a swath mapping system (multibeam sonar) to detect the presence/abundance of zebra mussels. Acoustic backscatter data was collected and machine-learning was used to identify what is present in the substrate. Researchers were able to differentiate by mussel type (native vs. invasive) and density.
16	2013	06a-26	AIS Research Center Sub-Project 26: Updating an invasive and native fish passage model for locks and dams	U of MN - MAISRC	Anvar	Gilmanov		https://www.lccmr.leg.mn/projects/2013-index.html#201306a	This project updated the Computational Fluid Dynamics Agent-Based fish passage model using the field and experimental data through Lock and Dam 2. This new model will better stop invasive Asian carp moving up the Mississippi River in case of blocking or help native fish to swim upstream through navigation dam.
17	2014	06a	Enhancing Pollinator Landscapes	U of MN	Marla	Spivak	$ 864,000	https://www.lccmr.leg.mn/projects/2014-index.html#201406a	There is a large knowledge gap regarding the distribution, floral preferences, and nesting ecology of the more than 400 native bee species in Minnesota. This projected led to an extensive, collaborative network and research team that has generated critical data on the distribution, abundance, floral use, and nesting of native bees.
18	2014	06j	Dredged Sediment for Forest Restoration on Unproductive Minelands	U of MN - Duluth NRRI	Marsha	Patelke	$ 300,000	https://www.lccmr.leg.mn/projects/2014-index.html#201406j	Erie Pier dredge sediment can provide benefits for both state mineland reclamation requirements as well as enhancement of revegetation and restoration of disturbed lands. Evaluation of potential economic advantages from purpose-grown trees was not observed due to the short project length and the slow growth rate of the trees.
19	2014	07b	Metropolitan Regional Park System Acquisition	Metropolitan Council	Emmett	Mullin	$ 1,500,000	https://www.lccmr.leg.mn/projects/2014-index.html#201407b	This project acquired nine properties with high-quality natural resources for the Metropolitan Regional Parks System. This system offers large-scale, natural-resource based recreation opportunities in the metropolitan area for all Minnesotans. The 114 acres protected through this project have a broad range of ecological significance, including wetlands, river bluffs, ravines, shoreline, hardwoods, uplands and floodplains.

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20	2014	Sec 8 - 02	MITPPC #2: Early Detection, Forecasting and Management of Brown Marmorated Stinkbug (Halymorpha halys)	U of MN - MITTPC	William	Hutchison	$ 616,081	https://www.lccmr.leg.mn/projects/2014-index.html#TIS	This project provided new knowledge that will benefit MN agro-ecosystems, via a new App for rapid identification of Midwest stinkbugs, a proactive forecasting model so farmers can anticipate infestations and use less insecticide, a substantially improved trap for monitoring, and quantified faster stinkbug development & egg-lay rates, as influenced by a warming climate.
21	2014	Sec 8 - 03	MITPPC #3: Climate Change and Range Expansion of Invasive Plants	U of MN - MITTPC	David	Moeller	$ 206,335	https://www.lccmr.leg.mn/projects/2014-index.html#TIS	This project provided maps to describe the climate suitability and invasion risk for ten invasive species in Minnesota now and in the future. These findings can be used to guide management decisions about surveillance and eradication efforts for these species.
22	2014	Sec 8 - 04	MITPPC #4: Cover It Up! Using Plants to Control Buckthorn	U of MN - MITTPC	Peter	Reich	$ 327,000	https://www.lccmr.leg.mn/projects/2014-index.html#TIS	Buckthorn degrades the health of Minnesota forests. Efforts to control buckthorn generally yield only short-term benefits, since buckthorn quickly returns. We found that densely establishing native plants that have leaves early in the spring and late in the fall can shade out buckthorn and reduce the need for repeated management.
23	2015	03b	County Geologic Atlases - Part B	MN DNR	Jim	Berg	$ 2,000,000	https://www.lccmr.leg.mn/projects/2015-index.html#201503b	A geologic atlas provides essential information for management of Minnesota's groundwater by identifying key areas to protect and ensure sustainable use. Accomplishments include completions of: Anoka (2016), Nicollet (2016), Sibley (2017), Renville (2017), Sherburne (2017), Clay (2018), Wright (2018), and Washington (2019), and progress toward completion of 15 other atlases.
24	2015	03h	Reintroduction and Interpretation of Bison in Minnesota State Parks	MN DNR	Edward	Quinn	$ 600,000	https://www.lccmr.leg.mn/projects/2015-index.html#201503h	Project completed before sound bite field was created.
25	2015	03m	Turtle Population Dynamics in an Urban Lake	St. Thomas University	Jennifer	McGuire	$ 250,000	https://www.lccmr.leg.mn/projects/2015-index.html#201503m	We collected and analyzed four years of water quality and habitat parameters in an urban lake. Conditional effects on turtle population dynamics were evaluated in three species using genetic and demographic data. Management and conservation recommendations were made to protect and enhance turtle populations and overall health of urban lakes.

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26	2015	04a	Understanding Water Scarcity, Threats, and Values to Improve Management	U of MN - Humphrey School of Public Affairs	Bonnie	Keeler	$ 234,000	https://www.lccmr.leg.mn/projects/2015-index.html#201504a	We used advanced techniques to create the best available foundational climate change projections for Minnesota. Results show consistent or increased annual precipitation, but changing timing of rainfall, more intense rain events, and longer dry spells. We project winters with several fewer weeks of frost, and summers with significantly more days above 95°F.
27	2015	04g	Using Hydroacoustics to Monitor Sediment in Minnesota Rivers	US Geological Survey	Jeffrey	Ziegeweid	$ 455,000	https://www.lccmr.leg.mn/projects/2015-index.html#201504g	Project completed before sound bite field was created.
28	2015	04h	Assessment of Irrigation Efficiencies in Benton County	Benton Soil and Water Conservation District	Gerry	Maciej	$ 431,000	https://www.lccmr.leg.mn/projects/2015-index.html#201504h	Project completed before sound bite field was created.
29	2015	06c	Biological Control of Canada Thistle	U of MN	Roger	Becker	$ 300,000	https://www.lccmr.leg.mn/projects/2015-index.html#201506c	Project completed before sound bite field was created.
30	2015	06d	Preventing a New Disease of Pines in Minnesota	U of MN	Robert	Blanchette	$ 371,000	https://www.lccmr.leg.mn/projects/2015-index.html#201506d	Heterobasidion root disease is a serious new pathogen of red and white pine that has been found in southeastern Minnesota. New diagnostic tools were developed, tested and successfully diagnosed samples with the pathogen. Selection of native fungi antagonistic to this pathogen were found and their biocontrol potential has been evaluated.
31	2015	07a	Renewable and Sustainable Fertilizers Produced Locally	U of MN	Alon	McCormick	$ 1,000,000	https://www.lccmr.leg.mn/projects/2015-index.html#201507a	We can reduce the environmental impact of Minnesota farms, and provide practical assistance to them as well, by producing ammonia locally with renewable wind energy. This project demonstrated a new UMN technology that can make this economically feasible for Minnesota corn and small grain farms and coops. It also explored another technology that may find use in hydroponics.
32	2015	08h	Improving Community Forests Through Citizen Engagement	MN DNR	Valerie	McClannahan	$ 800,000	https://www.lccmr.leg.mn/projects/2015-index.html#201508h	Twenty communities utilized funds to plant trees and purchase tools for volunteers to maintain planted trees. Communities implemented citizen engagement plans by hosting volunteer planting events, utilizing citizens for small tree pruning, monitoring the health of community trees, and conducting community tree inventory hours garnering a total of 10,518 volunteer.

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33	2015	09c	SNA Acquisition, Restoration, Enhancement and Public Engagement	MN DNR	Ann	Pierce	$ 4,000,000	https://www.lccmr.leg.mn/projects/2015-index.html#201509c	Minnesota's most unique, intact ecosystems that house state threatened and special concern species were permanently protected as state Scientific and Natural Areas (519.3 acres). Habitat restoration (45 acres), enhancement (1,858 acres) and a variety of outreach, engaging citizens in ecological recreation, stewardship, and education activities, took place across the state.
34	2015	09d	Native Prairie Stewardship and Prairie Bank Easement Acquisition	MN DNR	Judy	Schulte	$ 3,325,000	https://www.lccmr.leg.mn/projects/2015-index.html#201509d	Permanently protected 1,107 acres of high-quality historically undisturbed native prairie, which house state and federally threatened species, state special concerns species, Species in Greatest Conservation Need and a wide variety of pollinators. Prairie enhancement (1,130 acres), outreach, monitoring and research activities were implemented across the state to improve prairie habitat.
35	2015	09f	Metro Conservation Corridors Phase VIII - Strategic Lands Protection	The Trust for Public Land	Robert	McGillivray	$ 750,000	https://www.lccmr.leg.mn/projects/2015-index.html#201509f	The Trust for Public Land protected approximately 20 acres as an addition to the Minnesota DNR Crystal Spring SNA in Washington County. This strategic property will provide significantly safer public access to the SNA and contains high quality native plant communities and several rare species of birds and plants.
36	2015	09g	Metro Conservation Corridors Phase VIII - Priority Expansion of Minnesota Valley National Wildlife Refuge	Minnesota Valley National Wildlife Refuge Trust Inc	Deborah	Loon	$ 500,000	https://www.lccmr.leg.mn/projects/2015-index.html#201509g	Minnesota Valley Trust was unable to bring any of the potential acquisitions to completion by the grant deadline. The funds are returned to the ENRTF.
37	2016	03b	Native Bee Surveys in Minnesota Prairie and Forest Habitats	MN DNR	Jessica	Petersen	$ 600,000	https://www.lccmr.leg.mn/projects/2016-index.html#201603b	Wild bees were surveyed in the prairie-forest region of Minnesota, in 38 counties, expanding the state list of bee species to 470. Two bee identification workshops were held in collaboration with partners. Information regarding the distribution and diversity of wild bees in Minnesota was disseminated.
38	2016	03d	Statewide Monitoring Network for Changing Habitats in Minnesota	MN DNR	Hannah	Texler	$ 500,000	https://www.lccmr.leg.mn/projects/2016-index.html#201603d	We developed the new Ecological Monitoring Network and established the first 125 plots that will be used to monitor change in native vegetation across the state. We also resampled 88 relevé vegetation plots and found significant changes in prairies and forests over the last 20 to 40 years.
39	2016	03e	Completing National Wetland Inventory Update for Minnesota	MN DNR	Steve	Kloiber	$ 1,500,000	https://www.lccmr.leg.mn/projects/2016-index.html#201603e	Completing the statewide update of the National Wetland Inventory (NWI) was a key objective of the strategy to ensure healthy wetlands and clean water for Minnesota. These data are used by government, private industry and non-profit organizations for land use planning, wetland conservation, wetland permitting and environmental impact assessment.

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40	2016	03f	Assessment Tool for Understanding Vegetation Growth Impacts on Groundwater Recharge	U of MN	Gene-Hua (Crystal)	Ng	$ 212,000	https://www.lccmr.leg.mn/projects/2016-index.html#201603f	Year-to-year variations in vegetation can impact recharge over short periods (annual, seasonal, or monthly). Accounting for this will be especially important for predicting future recharge as vegetation responds to increasing and more variable temperatures. Groundwater recharge in the water-limited western part of Minnesota is most sensitive to the impacts of changing temperature and vegetation.
41	2016	03g	Sentinel Lakes Monitoring and Data Synthesis – Phase III	MN DNR	Melissa	Treml	$ 401,000	https://www.lccmr.leg.mn/projects/2016-index.html#201603g	The Sentinel Lakes Program has described large ecological changes such as changing water temperatures, impacts from zebra mussels and spiny water flea, and impacts due to land use and will continue to benefit Minnesota's natural resource managers and constituents by identifying changes and understanding their impacts.
42	2016	03h	State Spring Inventory for Resource Management and Protection - Phase II	MN DNR	Jim	Berg	$ 370,000	https://www.lccmr.leg.mn/projects/2016-index.html#201603h	The Minnesota Spring Inventory currently holds approximately 6,900 features. Fieldwork during this funding period added an additional 900 field verified spring locations. Approximately 800 additional locations were also added to the inventory through file searches and online citizen submittals with a DNR-created application.
43	2016	03i	Enhancing Understanding of Minnesota River Aquatic Ecosystem	MN DNR	Tony	Sindt	$ 500,000	https://www.lccmr.leg.mn/projects/2016-index.html#201603i	Project completed before sound bite field was created.
44	2016	03j	Improving Brook Trout Stream Habitat through Beaver Management	Minnesota State University - Bemidji	Andrew	Hafs	$ 225,000	https://www.lccmr.leg.mn/projects/2016-index.html#201603j	Along the North Shore there was no measurable effect of beaver on brook trout habitat downstream of beaver ponds, however, 9 of 21 beaver ponds were unsuitable largely due to limited dissolved oxygen. Beaver populations recovered to previous levels by the 1990s and appear to have stabilized since that time.
45	2016	03k	Evaluate Temperature, Streamflow, and Hydrogeology Impact on Brook Trout Habitat	Minnesota Geological Survey	Bob	Tipping	$ 115,000	https://www.lccmr.leg.mn/projects/2016-index.html#201603k	Detailed stream temperature profiles combined with fish inventories show links the between hydrogeologic setting and brook trout distribution and abundance. Results demonstrate how geologic maps of southeastern Minnesota, funded in large part by the ENRTF, can be used to manage trout populations dependent on base flow to streams.
46	2016	03l	Restoration of Elk to Northeastern Minnesota	U of MN	James	Forester	$ 300,000	https://www.lccmr.leg.mn/projects/2016-index.html#201603l	This study examined the feasibility of restoring elk to northeastern Minnesota. It provides information for determining where elk restoration will be successful, should it occur. Results show that habitat suitability and landowner support are not limiting factors for restoring elk to northeastern Minnesota.

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47	2016	03m	Game and Nongame Bird Pesticide Exposure	U of MN - Raptor Center	Julia	Ponder	$ 349,000	https://www.lccmr.leg.mn/projects/2016-index.html#201603m	We documented neurobehavioral abnormalities in chickens from neonicotinoid exposure at doses compatible with what wild birds might ingest, as well as the availability of neonicotinoid-treated seeds on the agricultural landscape. We also identified changes in gene expression associated with exposure that may be useful in developing a non-lethal test for exposure.
48	2016	03n	Evaluating Insecticide Exposure Risk for Grassland Wildlife on Public Lands	MN DNR	Nicole	Davros	$ 250,000	https://www.lccmr.leg.mn/projects/2016-index.html#201603n	Insecticide drift from soybean aphid spraying occurred in grasslands and was greatest along field edges, but wind direction, air temperature, and grassland vegetation structure also played a role. We will work with natural resource professionals and agricultural groups to develop recommendations for reducing impacts of spray drift on grasslands to protect and conserve declining wildlife in Minnesota.
49	2016	03o	Development of Innovative Cost-Saving Methodology for Forest Inventory	MN DNR	Dennis	Kepler	$ 800,000	https://www.lccmr.leg.mn/projects/2016-index.html#201603o	The MNDNR's Resource Assessment Program studied using light detection and ranging (LiDAR) technology to innovate how forest inventory is conducted. The study found that using LiDAR can cut costs by as much as 55%, enables the collection of this valuable information across all lands, and makes data available much faster.
50	2016	03p	Evaluation of Tree Retention Guidelines Pertaining to Wildlife	U of MN - Duluth NRRI	Gerald	Niemi	$ 232,000	https://www.lccmr.leg.mn/projects/2016-index.html#201603p	There is a positive relationship between tree retention and wildlife diversity. Trees retained in a clumped configuration are most beneficial for small mammal communities, maintain bird diversity over time, and significantly increase the relative abundance of several breeding bird species post-harvest.
51	2016	03q	Determine Impacts on Wildlife From Emerald Ash Borer Infection of Black Ash Forests	U of MN - Duluth NRRI	Gerald	Niemi	$ 334,000	https://www.lccmr.leg.mn/projects/2016-index.html#201603q	Black ash wetlands are high in biodiversity and support unique wildlife communities. EAB will fundamentally alter ecosystem structure, causing wildlife communities to shift from forest dependent species to open-canopy and wetland associated species. Management strategies that focus on diversifying tree composition (e.g., via planting) will maintain long-term forest cover and help maintain wildlife diversity.

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52	2016	04a	Tracking and Preventing Harmful Algal Blooms	Science Museum of Minnesota	Daniel	Engstrom	$ 500,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604a	This project provides comprehensive data on the prevalence and toxicity of Harmful Algal Blooms (HABs) in Minnesota lakes today and in the past. By combining these data with updated modeling techniques, we provide a framework for predicting the timing and composition of HABs that can be tailored to individual lakes.
53	2016	04b	Assessing the Increasing Harmful Algal Blooms in Minnesota Lakes	U of MN - St. Anthony Falls Laboratory	Miki	Hondzo	$ 270,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604b	We designed a cyanobacterial profiler to record and display continuous data on physical and micro-algal conditions in lakes over the Internet. The data revealed an approximate seven days time-lag between the maximal cyanobacterial biomass and toxin concentrations. Spreadsheet-type models were developed for predicting cyanobacterial biomass and toxin concentration in lakes.
54	2016	04c	Restoring Native Mussels in Streams and Lakes	MN DNR	Mike	Davis	$ 600,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604c	Reestablishing historical mussel assemblages through laboratory propagation began in 2016 at the MNDNR Center for Aquatic Mollusk Programs (CAMP). Since then, CAMP has produced 1,332,592 juvenile mussels from 11 species in three watersheds. Now thousands of sub-adult mussels are awaiting their release to restore and enhance our native rivers.
55	2016	04d	Assessing Techniques for Eliminating Contaminants to Protect Native Fish and Mussels	St. Thomas University	Kristine	Wammer	$ 287,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604d	This project assessed whether UV treatment will effectively remove toxicity attributable to commonly reported wastewater contaminants: polycyclic musks. Several adverse biological effects were observed for these contaminants, but only at concentrations higher than typically observed in Minnesota waters. These effects are mostly reduced or eliminated upon exposure to UV light.
56	2016	04e	Assessing Neonicotinoid Insecticide Effects on Aquatic and Soil Communities	U of MN	William	Arnold	$ 400,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604e	The processes of hydrolysis and photolysis are relatively slow for neonicotinoid insecticides, with half-lives of years for hydrolysis and hours to days for photolysis. On surfaces, the photolysis rate is dependent on the surface the commercial formulation. The reaction products formed were non-toxic to mosquito larvae.
57	2016	04f	Bacterial Assessment of Groundwater Supplies Used for Drinking Water	U of MN	Raymond	Hozalski	$ 299,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604f	Sixteen groundwater systems throughout Minnesota were sampled and found to be largely free of bacteria that cause gastrointestinal infections but may contain "opportunistic" bacteria (i.e., *Legionella*) that can cause lung infections. Deep wells and/or chlorine disinfection are recommended for minimizing the risk of exposure to disease-causing bacteria via groundwater supplies.

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58	2016	04g	Understanding Bedrock Fracture Flow to Improve Groundwater Quality	U of MN - MN Geological Survey	Anthony	Runkel	$ 183,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604g	The principle outcome is improved understanding of how groundwater flows in fractured rock, which will lead to more effective remediation of contamination, improved strategies to protect unimpacted groundwater and address water quantity issues. These outcomes are relevant to much of southeastern and northeastern Minnesota where aquifers are dominated by fractured bedrock.
59	2016	04i	Assessment of Surface Water Quality With Satellite Sensors	U of MN	Jacques	Finlay	$ 345,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604i	This project developed methods to measure key water quality parameters across the state's waterbodies using satellite imagery. Current ground-based sampling has limited ability to measure status and trends in water quality across our lakes and rivers. Our innovative methods can routinely measure major water quality indicators in Minnesota's 10,000+ lakes.
60	2016	04j	Development of Innovative Sensor Technologies for Water Monitoring	U of MN	Tianhong	Cui	$ 509,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604j	This project developed very tiny, cheap, fast, accurate sensors and sensor networks to monitor pollutants including phosphate, nitrate, mercury, and chlorine in Minnesota's waters. The team successfully conducted field tests at Mississippi River, Minnesota River, Minnehaha Creek and Calhoun Lake in Minnesota.
61	2016	04k	Wastewater Treatment Process Improvements	U of MN	Timothy	LaPara	$ 398,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604k	This project demonstrated that specific microbial populations can be quantified in near real-time at full-scale municipal wastewater treatment facilities. Knowledge of quantities of these microbial populations should enable wastewater treatment plant operators and engineers to better optimize treatment performance, thereby improving surface water quality throughout the State of Minnesota.
62	2016	04l	Membrane-Based Process for Decentralized Drinking Water Production	U of MN	Santiago	Romero-Vargas Castrillón	$ 199,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604l	The main outcome of this project is a novel surface modification protocol for water treatment membranes. We showed that graphene oxide coatings, known to exhibit antibacterial properties, improve the efficiency with which the membranes remove micropollutants, such as N-nitrosodimethylamine (NDMA), which are common in Minnesota surface waters.
63	2016	04m	Analyzing Alternative for Muncipal Wastewater Treatment	Minnesota Pollution Control Agency	Scott	Kyser	$ 180,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604m	Project completed before sound bite field was created.

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64	2016	04n	Understanding Impacts of Salt Usage on Minnesota Lakes, Rivers, and Groundwater	U of MN	John	Gulliver	$ 497,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604n	This project developed a statewide chloride budget demonstrating the relative impacts of fertilizers, water softening, livestock waste, and road salt on Minnesota's water resources. Experiments and field cores demonstrated the complexity of chloride transport through Minnesota's soils. Together these results illustrate that chloride must be carefully managed in Minnesota.
65	2016	04o	Microbes for Salt and Metal Removal	U of MN	Daniel	Bond	$ 596,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604o	New bacteria and fungi were discovered residing in the Soudan Iron Mine and other contaminated areas of Minnesota that demonstrate an ability to self-power salt-removing reactors or bind toxic metals in passive filtration devices.
66	2016	04p	Engineered Biofilter for Sulfate and Metal Removal from Mine Waters	U of MN	Sebastian	Behrens	$ 440,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604p	In this project we produced and evaluated the heavy metal absorption properties of a new sorbent material made from pyrolyzed waste biomass. The developed material improves copper and nickel removal from water and constitutes an efficient, low-cost alternative to conventional sorbent materials for heavy metal removal from affected waters in Minnesota.
67	2016	04q	Developing Biosponge Technology for Removal of Nitrates from Minnesota Waters	U of MN	Lawrence	Wackett	$ 198,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604q	The project developed methods for detecting and removing nitrate from Minnesota waters. Nitrate comes from nitrogen fertilizer that runs into water. Removing nitrate in Minnesota water treatment plants is expensive. We developed methods to inexpensively detect and lower nitrate levels on land and in water.
68	2016	04u	Assessing Effectiveness of Wetland Restorations for Improved Water Quality	U of MN	Jacques	Finlay	$ 420,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604u	Wetland restorations are vital for achieving water quality improvement in Minnesota. Assessment of common wetland restoration techniques across 58 wetlands demonstrated the importance of removing accumulated sediment, time since restoration, and hydrology to restoration outcomes. Benefits to native plants and nutrient removal are likely worth the extra cost of sediment removal, but continued management is necessary to maintain them following restoration.
69	2016	04v	Integrating Targeted Watershed Planning Tools with Citizen Involvement	Minnesota State University, Mankato - Water Resources Center	Kimberly	Musser	$ 169,000	https://www.lccmr.leg.mn/projects/2016-index.html#201604v	The Water Resources Center at Minnesota State University, Mankato used geographic information system (GIS) prioritization and modeling tools to develop pollution reduction strategies in five priority subwatersheds in the Le Sueur River watershed and promoted implementation of the reduction strategies through citizen involvement and outreach.

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70	2016	05a	Minnesota Conservation Apprentice Academy	Board of Water and Soil Resources	Jenny	Gieseke	$ 433,000	https://www.lccmr.leg.mn/projects/2016-index.html#201605a	Project completed before sound bite field was created.
71	2016	05b	School Forests Outdoor Classrooms	MN DNR	Amy Kay	Kerber	$ 440,000	https://www.lccmr.leg.mn/projects/2016-index.html#201605b	Land management projects were completed on 67 School Forests, 3,314 students engaged in service learning, and 412 school staff and volunteers completed training on projects such as creating trails, building amphitheaters, and removing invasive species. These efforts created healthier, safer, and more accessible outdoor learning spaces, while renewing student interest and use.
72	2016	05d	New Prairie Sportsman Statewide Broadcast Video Project	Pioneer Public Television	Patrick	Moore	$ 300,000	https://www.lccmr.leg.mn/projects/2016-index.html#201605d	Project completed before sound bite field was created.
73	2016	05f	Standards-Based Dakota Indian Land Stewardship Education	Dakota Wicohan	Darlene	St. Clair	$ 197,000	https://www.lccmr.leg.mn/projects/2016-index.html#201605f	A rigorous evaluation of *Mni Sota Mackoce: The Dakota Homelands* , a multi-media, standards-based curriculum about Dakota history and values from Morton-based non-profit Dakota Wicohan, revealed that 1,678 sixth-graders in 14 urban, suburban, and rural schools gained new ways of connecting to and protecting our relative, the land.
74	2016	05h	Master Water Steward Program Expansion	Freshwater Society	Leslie	Yetka	$ 116,000	https://www.lccmr.leg.mn/projects/2016-index.html#201605h	Freshwater's Master Water Steward Program trains community leaders throughout the state to take action to work with local governments to improve the health of our water. This project has helped amplify the availability of this program to community partners with varying needs and unique water challenges, and to effectively communicate the impact of the stewards.
75	2016	06b	Developing Membrane Filtration System to Treat Lake Superior Ballast Water	U of MN	Santiago	Romero-Vargas Castrillón	$ 151,000	https://www.lccmr.leg.mn/projects/2016-index.html#201606b	Project completed before sound bite field was created.
76	2016	06d	Biological Control of White Nose Syndrome in Bats - Phase II	U of MN	Christine	Salomon	$ 452,000	https://www.lccmr.leg.mn/projects/2016-index.html#201606d	This project is focused on bio-control treatments for white nose syndrome (WNS) in bats. We identified microbes that inhibit the fungal pathogen, *Pseudogymnoascus destructans* and also quantified *P. destructans* along cave transects to identify best locations for treatments. This work may provide solutions to help vulnerable populations of Minnesota bats.

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77	2016	06f	Dutch Elm Disease Resistance - Phase II	U of MN	Robert	Blanchette	$ 200,000	https://www.lccmr.leg.mn/projects/2016-index.html#201606f	Dutch elm disease continues to devastate Minnesota's urban and forested elm species. Results from our research provided new data on resistance mechanisms in DED resistance elm selections, we identified, propagated, and screened 46 genotypes in order to increase the diversity of DED resistant elms available and developed enhanced propagation techniques.
78	2016	07b	Waste Heat Recovery with Efficient Thermoelectric Energy Generators	U of MN	Uwe	Kortshagen	$ 400,000	https://www.lccmr.leg.mn/projects/2016-index.html#201607b	The work performed under this project has made important contributions to the scientific community, documented in several scientific papers, and may lead to the production of new thermoelectric materials that convert waste heat into electricity. This has the potential to improve the efficiency of thermal cycles and reduce the energy lost in waste heat, which will ultimately benefit Minnesota citizens and all of humanity.
79	2016	07c	Hydrogen Fuel from Wind-Produced Renewable Ammonia	U of MN - WCROC	William	Northrop	$ 250,000	NOT COMPLETE	NOT COMPLETE
80	2016	07d	Utilization of Dairy Farm Wastewater for Sustainable Production	U of MN - WCROC	Bradley	Heins	$ 475,000	https://www.lccmr.leg.mn/projects/2016-index.html#201607d	The project benefited lakes and streams through the development of novel methods to clean affected waterways through microalgae production and testing. We developed technology that recycled nutrients and added value to nutrients in wastewater from dairy farms in Minnesota that will reduce environmental impact.
81	2016	07e	Solar Energy Utilization for Minnesota Swine Farms – Phase II	U of MN - WCROC	Lee	Johnston	$ 475,000	https://www.lccmr.leg.mn/projects/2016-index.html#201607e	Our project demonstrated that solar-generated electricity used to power a sow cooling system in a swine farrowing system can effectively improve the comfort of sows and reduce the carbon footprint of commercial pork production.
82	2016	08c	Establishment of Permanent Habitat Strips Within Row Crops	Science Museum of Minnesota	Shawn	Schottler	$ 179,000	https://www.lccmr.leg.mn/projects/2016-index.html#201608c	This project successfully demonstrated the establishment of native perennial plantings within row-crops –without removing land from production. These plantings provided significant habitat value to pollinators and reproduction of monarch butterflies. Adapting this technique to create a strip of milkweeds within the outside row of corn/soy fields could offer substantial benefits to monarchs at minimal cost.
83	2016	08e	Controlling Reed Canary Grass to Regenerate Floodplain Forest	Minnesota State Office of National Audubon Society	Luis	Ramirez	$ 218,000	https://www.lccmr.leg.mn/projects/2016-index.html#201608e	Because of this work, we were able to identify best practices to control Reed Canary grass in the floodplain forest. This information has been translated into a supporting decision tools that can be used by landowners and land managers.

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84	2016	08g	Upland, Wetland, and Shoreline Restoration in Greater Metropolitan Area	Great River Greening	Wiley	Buck	$ 509,000	https://www.lccmr.leg.mn/projects/2016-index.html#201608g	GRG restored/enhanced 340 acres of habitat, through partnerships, in strategic habitat locations throughout the metro with a wide variety of landowners. In the process, we engaged 830 volunteers who participated in deeply engaging, impactful outdoor activities so they and the community better understand, support, and enjoy the ecological restoration/enhancement process.
85	2016	08h	Bluffland Restoration and Monitoring in Winona	Winona State University	Neal	Mundahl	$ 99,000	https://www.lccmr.leg.mn/projects/2016-index.html#201608h	The 40 acres of dry bluff prairies, bur oak savannahs, and mixed oak-basswood forests within Garvin Heights Natural Area were restored by removing invasive plants (MN Conservation Corps, goat grazing), replanted with native species, monitored to assess recovery, enhanced with signage for visitors, and demonstrated with workshops for regional stakeholders.
86	2016	08i	Champlin Mill Pond Shoreland Restoration	City of Champlin	Todd	Tuominen	$ 2,000,000	https://www.lccmr.leg.mn/projects/2016-index.html#201608i	The Mill Pond project restored 42 acres of shoreland and aquatic habitat, including native upland, riparian, and aquatic zones, which will help maintain and enhance sensitive species; sustain game-fish populations and helps to supports migratory and resident wildlife populations. The project reduced erosion, total phosphorus and improved water quality.
87	2016	09a	Scientific and Natural Area Acquisition and Restoration	MN DNR	Ann	Pierce	$ 1,386,000	https://www.lccmr.leg.mn/projects/2016-index.html#201609a	Scientific and Natural Areas (SNAs) are established to protect and perpetuate natural features which possess exceptional scientific/educational value. Through this appropriation, habitat restoration (50 acres) and enhancement (1,522 acres) took place across the state to sustain SNA's unique plant communities and the endangered, threatened, and rare species housed within them.
88	2016	09c	Conservation Easements in the Avon Hills - Phase III	Saint Johns Arboretum and University	John	Geissler	$ 1,300,000	https://www.lccmr.leg.mn/projects/2016-index.html#201609c	Permanently protected 477 acres of forests, grasslands, wetlands, and almost 3 miles of undeveloped shoreline in the Avon Hills of Minnesota through the acquisition of two conservation easements. Provided quality educational programming to over 2000 participants that promoted environmental literacy and illustrated the importance of conservation efforts in central Minnesota.
89	2016	09d	Lincoln Pipestone Rural Water System Acquisition for Wellhead Protection	Lincoln Pipestone Rural Water System	Jason	Overby	$ 1,500,000	https://www.lccmr.leg.mn/projects/2016-index.html#201609d	Project completed before sound bite field was created.

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90	2016	09e	Mesabi Trail Segment from Highway 135 to Town of Embarrass	St. Louis & Lake Counties Regional Railroad Authority	Bob	Manzoline	$ 1,200,000	https://www.lccmr.leg.mn/projects/2016-index.html#201609e	The Mesabi Trail is a project to build a trail from Grand Rapids to Ely. At conclusion of this phase of the project, approximately 120 miles of the trail is complete. In this phase of the project, permitting, acquisition, engineering and construction was completed for a 3.5 mile segment of the trail, including a 0.9 mile floating bridge, From Hwy 135 to Palo Tia Road in Embarrass Township.
91	2016	09f	Tower Historic Harbor Trail Connections	City of Tower	Nancy	Larson	$ 679,000	https://www.lccmr.leg.mn/projects/2016-index.html#201609f	A pedestrian/biking trail was created around Tower's redeveloped historic harbor to connect recreational and natural resource assets to an environmental main street waterway to Lake Vermilion. Boaters can explore the habitat and ecological route through the East Two River channel to Lake Vermilion.
92	2017	04f	Assessment of Water Quality for Reuse	U of MN	Satoshi	Ishii	$ 148,000	https://www.lccmr.leg.mn/projects/2017-index.html#201704f	The outcome of this project will help expand the water reuse in Minnesota, which can reduce demands on groundwater aquifers and improve surface water quality.
93	2017	05d	Expanding Raptor Center Online Education	U of MN - Raptor Center	Julia	Ponder	$ 270,000	https://www.lccmr.leg.mn/projects/2017-index.html#201705d	Expanding Raptor Center Online Education reached 520 teachers in 28 counties throughout Minnesota serving more than 15,000 students with a state-of-the-art education program to engage students in authentic outdoor learning and science to equip and inspire Minnesota's next generation of conservationists.
94	2017	09f	Leech Lake Acquisition	Leech Lake Division of Resource Management	Joseph	Fowler	$ 1,500,000	NOT COMPLETE	NOT COMPLETE
95	2017	09i	Land Acquisition for Voyageurs National Park Crane Lake Visitors Center	Town of Crane Lake	Jim	Janssen	$ 950,000	https://www.lccmr.leg.mn/projects/2017-index.html#201709i	Project completed before sound bite field was created.
96	2017	10a	Contract Agreement Reimbursement	MN DNR	Katherine	Sherman-Hoehn	$ 135,000	https://www.lccmr.leg.mn/projects/2017-index.html#201710a	Project completed before sound bite field was created.