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1	6/30/2023	2015	06a	----	Minnesota Invasive Terrestrial Plants and Pests Center	U of MN - MITPPC	Robert Venette	$ 5,000,000	The Minnesota Invasive Terrestrial Plants and Pests Center (MITPPC) funded 20 research sub-projects through this appropriation to better protect Minnesota lands from the harmful effects of 14 priority invasive species, such as garlic mustard, soybean aphid, and oak wilt. MITPPC discoveries improved TIS management across Minnesota.
2	6/30/2023	2015	06a-01	----	Subproject 06a-01: Garlic Mustard Biocontrol: Ecological Host Range of Biocontrol Agents	U of MN - MITPPC	Roger Becker	*$ 600,000*	We were integral in the release of Ceutorhynchus scrobicollis in Canada, the first biological control agent for garlic mustard in North America. We moved closer to federal regulatory approval to release C. scrobicollis and C. constrictus in the United States. When achieved, these will offer the first viable control of garlic mustard in Minnesota woodlands.
3	6/30/2023	2015	06a-02	----	Subproject 06a-02: Mountain Pine Beetle, Phase II: Protecting Minnesota	U of MN - MITPPC	Brian Aukema	*$ 444,982*	Repeated surveys did not find mountain pine beetle in Minnesota. Scant few individuals were captured dispersing far from active infestations in western states. We found that local bark beetles and predators do not optimally recognize the insect's chemical signals, however, suggesting that such components of invasion resistance might be low.
4	6/30/2023	2015	06a-03	----	Subproject 06a-03: Biological Control of the Soybean Aphid by Aphelinus Certus	U of MN - MITPPC	George Heimpel	*$ 479,859*	Results of this study indicate that the parasitoid Aphelinus certus provides sufficient mortality of soybean aphids to substantially decrease the need to apply insecticides against this pest.
5	6/30/2023	2015	06a-04	----	Subproject 06a-04: Decreasing Environmental Impacts of Soybean Aphid Management	U of MN - MITPPC	Robert Koch	*$ 570,000*	Management of soybean aphid relies on applications of broad-spectrum insecticides. This work aimed to decrease insecticide use and ameliorate associated environmental impacts through development of aphid-resistant soybean and advancement of remote scouting.
6	6/30/2023	2015	06a-05	----	Subproject 06a-05: Optimizing Tree Injections against Emerald Ash Borer	U of MN - MITPPC	Brian Aukema	*$ 318,927*	Emerald ash borer continues to spread and devastate Minnesota's urban forests, but deploying the right types of insecticides to ash trees in the right ways can offer tree conservation and protection with minimal risk to non-target organisms such as bees that visit flowers and worms that decompose leaves.
7	6/30/2023	2015	06a-06	----	Subproject 06a-06: Distribution and Traits of the Fungal Pathogen Fusarium Virguliforme that Influence Current and Future Risk to Soybean and Other Legumes in Minnesota	U of MN - MITPPC	Dean Malvick and Kathryn Bushley	*$ 383,651*	This project has discovered factors that influence the ability of the fungus Fusarium virguliforme to become established as a destructive pathogen on crops in new areas of Minnesota. The results are foundational to understanding this pathogen and contribute to managing the diseases it causes on soybean and other crops.

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8	6/30/2023	2015	06a-07	----	Subproject 06a-07: Tools to Distinguish Native from Exotic Reed Canary Grass	U of MN - MITPPC	Neil O. Anderson	$ 263,273	This project used genetic techniques to find that most reed canarygrass in Minnesota is native to the state and not from Europe. Plant DNA was extracted from samples of reed canarygrass across the state. Due to this outcome, Tribal and State managers may choose to manage or preserve this species differently.
9	6/30/2023	2015	06a-08	----	Subproject 06a-08: Accurate Detection and Integrated Treatment of Oak Wilt (Ceratocystis fagacearum) in Minnesota	U of MN - MITPPC	Jeannine Cavender-Bares	$ 356,382	This project developed methods and approaches for better detection of oak wilt using spectroscopic technology and documented best practices to prevent spread of the disease.
10	6/30/2023	2015	06a-09	----	Subproject 06a-09: Characterizing Dispersal of Larval Gypsy Moth to Improve Quarantine Regulations	U of MN - MITPPC	Brian Aukema	$ 35,000	We conducted laboratory experiments to determine how host type and food deprivation affected movement of gypsy moth caterpillars. Results indicated risks of larvae crossing a regulatory buffer zone may increase where an outbreak results in complete defoliation of preferred hosts like oaks.
11	6/30/2023	2015	06a-10	----	Subproject 06a-10: Management Strategies for the Invasive Spotted Wing Drosophila	U of MN - MITPPC	Mary Rogers	$ 477,541	Our project developed new cost-effective methods to help growers manage damage and reduce yield loss caused by the invasive Spotted-wing drosophila in small fruit while reducing pesticide use. Additionally, we have gained basic knowledge on the behavior and flight capabilities of this pest that will contribute to future management strategies.
12	6/30/2023	2015	06a-11	----	Subproject 06a-11: Will Future Weather Favor Minnesota's Woody Invaders?	U of MN - MITPPC	Peter Reich	$ 526,000	Our findings tell the story of how exotic honeysuckle and buckthorn have invaded Minnesota forests, how and why new areas are likely to be invaded in the future, and how we may be able to mitigate invasion using native tree species.
13	6/30/2023	2015	06a-12	----	Subproject 06a-12: Developing Robust Identification Assays for Amaranthus Palmeri in Seed Mixture	U of MN - MITPPC	Don Wyse	$ 208,230	This project created a highly reliable test for detecting Palmer Amaranth, in individual plants and pools of seed. The test is expected to be commercially available and will be an important tool for Minnesota farmers, crop consultants, and agronomic specialists. Palmer amaranth can reduce corn and soybean yields by 80-90%.
14	6/30/2023	2015	06a-13	----	Subproject 06a-13: Terrestrial Invasive Species Prioritization	U of MN - MITPPC	Amy Morey	$ 71,461	This project produced written risk evaluations of 77 terrestrial invasive species requested for review by MITPPC stakeholders, and assisted with the 2020 update of the MITPPC prioritization analysis. Thorough review of species allows MITPPC to be dynamic and transparent in how it responds to emerging TIS threats and stakeholder concerns.

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15	6/30/2023	2015	06a-14	----	Subproject 06a-14: Improved Detection and Future Management of Leafy Spurge and Common Tansy using Remote Sensing, Mechanistic Species Distribution Models, and Landscape Genomics	U of MN - MITPPC	David Moller and Ryan Briscoe Runquist	$ 70,812	Cutting-edge deep learning computer models, large scale field experiment, and genomic analyses were used to improve predictions of invasive range expansion for leafy spurge and common tansy. In both species, we found substantial genetic and phenotypic evolution that may impact their invasive risk and change future strategic decision making.
16	6/30/2023	2015	06a-16	----	Subproject 06a-16: Effects of Puccinia species complex on common buckthorn (Rhamnus cathartica)	U of MN - MITPPC	Pablo Olivera Firpo	$ 26,908	Project being completed under ML 2021, First Special Session, Ch 6, Art 5, Sec 2, Subd 6a
17	6/30/2023	2015	06a-17	----	Subproject 06a-17: Studies of entomopathogenic fungi for effective biocontrol of the emerald ash borer, Phase 2	U of MN - MITPPC	Robert Blanchette	$ 33,000	Project being completed under ML 2021, First Special Session, Ch 6, Art 5, Sec 2, Subd 6a
18	6/30/2023	2015	06a-18	----	Subproject 06a-18: Incorporating adaptation into forecasts of range shifts with climate change	U of MN - MITPPC	Ryan Briscoe Runquist	$ 33,000	Project being completed under ML 2021, First Special Session, Ch 6, Art 5, Sec 2, Subd 6a
19	6/30/2023	2015	06a-19	----	Subproject 06a-19: Genetic control of invasive insect species: Phase 3	U of MN - MITPPC	Michael Smanski	$ 50,000	Project being completed under ML 2021, First Special Session, Ch 6, Art 5, Sec 2, Subd 6a
20	6/30/2023	2015	06a-20	----	Subproject 06a-20: Making revegetation as part of buckthorn management feasible in Minnesota	U of MN - MITPPC	Michael Schuster	$ 40,000	Project being completed under ML 2021, First Special Session, Ch 6, Art 5, Sec 2, Subd 6a
21	6/30/2023	2016	06a	----	Minnesota Invasive Terrestrial Plants and Pests Center - Phase III	U of MN - MITPPC	Robert Venette	$ 3,750,000	The Minnesota Invasive Terrestrial Plants and Pests Center (MITPPC) funded 10 research sub-projects through this appropriation to protect Minnesota lands from the harmful effects of 11 priority invasive species such as common buckthorn, emerald ash borer (EAB), and several knotweeds. Results from these projects were featured prominently by local media.
22	6/30/2023	2016	06a-01	----	Subproject 06a-01: Fungi in Ash Trees: Towards Protecting Trees from Emerald Ash	U of MN - MITPPC	Robert Blanchette	$ 500,000	Important new findings have been obtained about the fungi associated with the emerald ash borer (EAB). This knowledge helps better understand the biology and ecology of EAB invasion and provides new biological control agents that can be used to help manage this invasive pest.
23	6/30/2023	2016	06a-02	----	Subproject 06a-02: Understanding the Benefits and Limitations of using Goats for Invasive Plant Control	U of MN - MITPPC	Tiffany Wolf	$ 410,267	Targeted grazing by goats demonstrates some benefits for the control of invasive Rhamnus cathartica and the enhancement of native plant communities. While P. tenuis transmission to goats remains a concern during invasive plant management, co-grazing goats with waterfowl may mitigate this seasonal disease risk.

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24	6/30/2023	2016	06a-03	----	Subproject 06a-03: Genetic Control of Invasive Insect Species: Phase I	U of MN - MITPPC	Michael Smanski	$ 295,717	We have demonstrated (in lab cages) a powerful new approach to combat invasive insect pests. Genetically engineered male insects would be released to mate with wild females, who would not have offspring. This can crash a wild population, and it is applicable to any sexually reproducing insect.
25	6/30/2023	2016	06a-04	----	Subproject 06a-04: Dwarf Mistletoe Detection and Management in Minnesota	U of MN - MITPPC	Marcella Windmuller-Campione	$ 455,606	We were able to identify key considerations for the early detection of the invasive American dwarf mistletoe on jack pine, including different detection methods and the need for field-level biology and identification education for foresters and loggers.
26	6/30/2023	2016	06a-05	----	Subproject 06a-05: Developing Spatially Explicit Bio-economic Dispersal Model to Aid with the Management of Brown Marmorated Stink Bug	U of MN - MITPPC	Senait Senay	$ 329,304	We developed a high resolution, spatially explicit, agent-based dispersal model for H. halys and results were published as "Effects of Starvation, Age, and Mating Status on Flight Capacity of Laboratory-Reared Brown Marmorated Stink Bug (Hemiptera: Pentatomidae)" in Environmental Entomology Volume 50, Issue 3, June 2021.
27	6/30/2023	2016	06a-06	----	Subproject 06a-06: Management of Invasive Knotweeds	U of MN - MITPPC	Alan Smith	$ 476,723	Three distinct species of knotweeds and their hybrids were confirmed present from the sampling. Cold tolerance measures indicate all knotweeds have the potential to grow throughout Minnesota and into colder climates. Seed production is inconsistent among populations and dispersal appears to be predominantly asexual and human facilitated. These data predict seed dispersal will become more prevalent, increasing diversity and the probability of resistance to herbicides and other management practices.
28	6/30/2023	2016	06a-07	----	Subproject 06a-07: Building Mechanistic and Process based Species Distribution Models for Common Tansy and Leafy Spurge: from Landscapes to Genomes	U of MN - MITPPC	David Moller and Ryan Briscoe Runquist	$ 351,188	Cutting-edge deep learning computer models, large scale field experiment, and genomic analyses were used to improve predictions of invasive range expansion for leafy spurge and common tansy. In both species, we found substantial genetic and phenotypic evolution that may impact their invasive risk and change future strategic decision making.
29	6/30/2023	2016	06a-08	----	Subproject 06a-08: Using Plants to Control Buckthorn: an Expanded Approach	U of MN - MITPPC	Peter Reich	$ 560,000	Many of Minnesota's forests are degraded by buckthorn invasion. Management is challenging because buckthorn typically returns quickly after removal. We found seeding wild rye grasses (in areas with >10% canopy openness) or densely planting shrubs and trees following initial herbicide application reduced buckthorn re-establishment concurrent with increased native cover.

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30	6/30/2023	2016	06a-09	----	Subproject 06a-09: Genetic control of invasive insects, Phase 2	U of MN - MITPPC	Michael Smanski	$ 55,100	Genetic biocontrol provides a non-toxic approach to control invasive pests. The Smanski lab pioneered a version of this technology for relatives of spotted wing drosophila. They demonstrated the feasibility and robustness of the technology in laboratory environments and explored strategies to ensure environmental safety.
31	6/30/2023	2016	06a-10	----	Subproject 06a-10: Novel Diagnostic Tools for Rapid and Early Detection of Oak Wilt	U of MN - MITPPC	Abdennour Abbas	$ 170,637	Oak wilt is a tree disease that causes major losses to Minnesota's forests, natural resources and economy every year. One of the key solutions to fighting this disease is early detection to enable timely decision making and prevention. The research effort conducted in this project over the last two years led to a successful development of a new technology for oak wilt detection in the field. The technology will soon be used in the field to enable early detection and prevention.
32	6/30/2023	2017	03n	----	Pollinator Research and Outreach	U of MN	Daniel Cariveau	$ 500,000	We installed 20 pollinator plantings in the Minnesota tallgrass prairie regions to study the effectiveness of restorations for conserving native bees. We collected nearly 25,000 native bee specimens from approximately 156 species. We found at least three new state records. We also organized a grower-led field day.
33	6/30/2023	2017	07d	----	District Heating with Renewable Biomass at Camp Ripley Training Center	Department of Military Affairs	Jay Brezinka	$ 1,000,000	The scope of this project was to install a biomass heating plant that would service seven buildings, including mechanical and distribution systems. We received an architect estimate and the base cost for the project in total was $7,122,035. The project was therefore canceled and funds returned to ENRTF.
34	6/30/2023	2017	08k	----	Conservation Reserve Enhancement Program (CREP) Outreach and Implementation	Board of Water and Soil Resources	Dusty VanThuyne	$ 6,000,000	This project assisted farmers and landowners in enrolling in conservation practices on environmentally sensitives lands by enrolling in the MN CREP program. Through this project, locally trusted staff in 49 counties were able to promote the MN CREP program and assist landowners in permanently protecting 29,350 acres.
35	6/30/2023	2017	08l	----	Conservation Reserve Enhancement Program (CREP)	Board of Water and Soil Resources	Sharon Doucette	$ 13,500,000	MN CREP is a federal/state partnership to improve water quality and provide habitat in 54 counties in southern and western Minnesota by establishing buffers, restoring wetlands, and protecting groundwater resources. This $13.5 million ENRTF project leveraged $16.5 million from USDA to restore and protect over 3,900 acres on 74 easements.

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36	6/30/2023	2017	09h	----	Tower Trailhead Boat Landing and Habitat Improvement – Phase II	City of Tower	Nancy Larson	$ 600,000	Construction of a trailhead and kiosk, a connecting trail to the Mesabi Trail, and an accessible kayak launch, plus natural habitat development will connect existing recreational and natural resource assets on the East Two River waterway to Lake Vermilion and enhance the outdoor recreation experience for multiple users in northeast Minnesota.
37	6/30/2023	2018	03i	----	Improve Trout-Stream Management by Understanding Variable Winter Thermal Conditions	U of MN	Rebecca Swenson	$ 400,000	Conservation plans are based largely on summer dynamics between fish, food sources, and water temperatures. Yet, winter-emerging aquatic insects, primarily Chironomidae, are a locally abundant and critical resource for trout. This project provides insights about winter air and water temperatures, lifecycles of aquatic insects, and impacts on stream food webs.
38	6/30/2023	2018	05l	----	Increase Diversity in Environmental Careers to Serve Minnesota's Changing Demographics	MN DNR	Mimi Daniel	$ 550,000	The Increasing Diversity in Environmental Careers (IDEC) program fosters the next generation of environmental and natural resources professionals and enthusiasts. From 2019 to 2023, 45 students enrolled in the IDEC program learned about and gained hands-on experience in the environmental/natural resources field. As a result, as these students become professionals, they will bring diversity and innovation to natural resources management and conservation.
39	6/30/2023	2018	09h	----	Protecting North-Central Minnesota Lakes	Crow Wing Soil and Water Conservation District	Andrew Seagren	$ 750,000	A correlation between forestland protection and water quality has been identified. We provided funding to restoration practices on public lands and protected 1,982 acres of private lands via conservation programs. Land protection efforts were guided by atlases that provided a method to prioritize and target high quality parcels.
40	6/30/2023	2018	09i	----	Easement Program for Native Prairie Bank	MN DNR	Judy Schulte	$ 2,000,000	Permanently protected 249 acres of high-quality historically undisturbed native prairie, which house state threatened and special concerns species, Species in Greatest Conservation Need and a wide variety of pollinators. Prairie enhancement (903 acres), outreach, monitoring and research activities were implemented across the state to improve prairie habitat.
41	6/30/2023	2018	09j	----	Minnesota State Trail Development	MN DNR	Kent Skaar	$ 2,500,000	Pending

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42	06/30/2023	2018	09k	----	Minnesota State Parks and State Trails	MN DNR	Shelby Kok	$ 2,500,000	Acquisition of Minnesota State Park and State Trail land provides permanent, effective and consolidated protection and management of pristine natural areas representative of diverse landscapes throughout the entire state of Minnesota for perpetual enjoyment by State Park and Trail users.
43	6/30/2023	2018	09l	----	Scientific and Natural Areas Program	MN DNR	Judy Schulte	$ 3,250,000	Volunteers and contractors with Minnesota DNR completed enhancement activities on over 1,300 acres on 73 Minnesota SNAs. The new 215-acre Little Mantrap Lake SNA with over a mile of undeveloped shoreline, 14 native plant communities and a known population of an extremely rare orchid was protected for all to benefit.
44	6/30/2023	2018	10b	----	Chronic Wasting Disease Targeted Outreach Engaging Culturally-Diverse Hunting Communities	U of MN	Tiffany Wolf	$ 270,468	Our project advances inclusive chronic wasting disease (CWD) management through collaboration with Tribal, southeast Asian, and Amish communities. Insights from surveys and interviews inform culturally-attuned CWD outreach, endorsing thriving deer populations while honoring cultural heritage. Our efforts promote community-engaged CWD response strategies to protect Minnesota deer health and community well-being.
45	6/30/2023	2019	03a	----	Minnesota Biological Survey	MN DNR	Bruce Carlson	$ 1,500,000	The Minnesota Biological Survey (MBS) collects, interprets, and delivers foundational data on native and rare plants, animals, plant communities, and functional landscapes. These data help prioritize actions to conserve, manage, and restore Minnesota's biological diversity and ecological systems.
46	6/30/2023	2019	03e	----	Spruce Grouse as Indicators for Boreal Forest Connectivity	U of MN - Raptor Center	Julia Ponder	$ 350,000	We suggest that forest management to promote dense understory structure in boreal forest may provide climate refugia for various species of early successional forest wildlife. The landscape context should also be considered in forest planning in a changing climate to ensure that landscape connectivity is managed to meet wildlife needs.
47	6/30/2023	2019	03f	----	Understanding Brainworm Transmission to Find Solutions for Minnesota Moose Decline	U of MN	Tiffany Wolf	$ 400,000	We created new knowledge regarding the ecological context of Parelaphostrongylus tenuis transmission that will aid wildlife and forest managers considering management actions as they try to conserve Minnesota's at-risk moose population.

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48	6/30/2023	2019	03h	----	Accelerated Aggregate Resource Mapping	MN DNR	Heather Arends	$ 700,000	Minnesota Department of Natural Resources completed and distributed aggregate maps for the following four counties: Sibley, Swift, Redwood, and Kandiyohi. Maps assist governments in planning and conserving of competing resources. Knowing where aggregates are located, supports resilient communities and informed land use decision-making.
49	6/30/2023	2019	03k	----	Implementing Conservation Plans for Avian Species of Concern	Audubon Minnesota	Alexandra Wardwell	$ 124,000	Audubon established benchmark survey sites, to guide future conservation activities within Important Bird Areas, for three species of conservation concern: Black Tern, Common Tern and Yellow Rail. Audubon established these important benchmark survey locations for these species, while also working closely to build increase collaboration and communication with many partners.
50	6/30/2023	2019	03l	----	Mapping Aquatic Habitats for Moose	U of MN	Joseph Bump	$ 199,000	This project mapped key water habitats used by moose in northern Minnesota, assessed relationship of moose to aquatic plant and fish diversity, and developed research & educational materials about moose ecology and conservation. The primary outcome is a better understanding of important moose habitat in Minnesota.
51	6/30/2023	2019	03s	----	Native Bee Survey	MN DNR	Jessica Petersen	$ 600,000	This project greatly expanded the conservation status of bees in the Laurentian Mixed Forest. We identified 255 species from 9,000 specimens. We made five new state records including one new record for the United States, many new county records, and new plant associations. From these data we will build a list of species in need of conservation.
52	6/30/2023	2019	03t	----	Diagnostic Test for Chronic Wasting Disease	U of MN	Peter Larsen	$ 1,804,000	We invented the world's first portable 24-hour CWD test (Minnesota-QuIC) and a 4-hour microfluidic CWD test. These tests will undergo USDA validation and will be made available to agencies tasked with controlling the spread of CWD. Our innovative CWD outreach activities and products reached over 28,000 Minnesotans.
53	6/30/2023	2019	04a	----	Determining Influence of Insecticides on Algal Blooms	U of MN	William Arnold	$ 350,000	Neonicotinoid and fipronil insecticides are present in lakes, rivers, springs, and shallow groundwater across Minnesota often at concentrations exceeding chronic toxicity thresholds for aquatic invertebrates. The compounds were detected in wastewater, stormwater, and rain/snow, indicating multiple sources to Minnesota waters. No clear association with algal blooms was found.

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54	6/30/2023	2019	04b	----	Benign Design: Environmental Studies Leading to Sustainable Pharmaceuticals	U of MN	William Arnold	$ 415,000	Insight into how fluorinated pesticides and pharmaceuticals present in Minnesota's waters degrade when exposed to sunlight was gained. Some compounds degrade to non-toxic fluoride, while others lead to fluorinated byproducts that may continue to impact the environment. The knowledge was used to help design new medically relevant fluorinated molecules.
55	6/30/2023	2019	04e	----	Improving Nitrogen Removal in Greater Minnesota Wastewater Treatment Ponds	U of MN	Paige Novak	$ 325,000	Inadequately treated wastewater in rural communities contributes to environmental/human health issues. We studied how to improve rural wastewater treatment pond performance. Our results suggested that manually increasing oxygen supply when temperatures are greater than 10°C should improve ammonia biodegradation; if temporary, total nitrogen removal should be possible, improving rural water quality.
56	6/30/2023	2019	04f	----	Improving Drinking Water for Minnesotans through Pollution Prevention	U of MN	Raymond Hozalski	$ 345,000	This project comprehensively studied the spatio-temporal occurrence of N-nitrosodimethylamine (NDMA, a potent carcinogen) precursors in the Crow River watershed as well as treatment approaches for NDMA precursor removal. The project results will aid in evaluation and mitigation of potential risks from NDMA formation during disinfection of drinking water with chloramines.
57	6/30/2023	2019	04g	----	Protecting Minnesota Waters by Removing Contaminants from Wastewater	U of MN	Matt Simcik	$ 250,000	It is possible to drive microplastics and some PFAS into the biosolids of a wastewater treatment plant using stabilized powdered activated carbon. However, the amount required may make the technology cost prohibitive, and may affect the operation of the plant. Further improvements may bring costs down and enable unencumbered operation.
58	6/30/2023	2019	04h	----	Reducing Municipal Wastewater Mercury Pollution to Lake Superior	Minnesota Pollution Control Agency	Scott Kyser	$ 250,000	This study identifies wastewater treatment technologies and mechanisms that municipalities can use to treat mercury to low-levels. Cost-effective wastewater technologies that treat solids can be leveraged to also treat mercury to low-levels and this information can be used to reduce discharged mercury which protects the environment and human health.
59	6/30/2023	2019	04j	----	Transformation of Plastic Waste into Valued Resource	U of MN	Brett Barney	$ 225,000	Our project identified prominent strains within microbial communities obtained from Minnesota waters that are able to degrade problem plastics such as polyethylene. In many cases, individual microbial strains were isolated and sequenced to provide a blueprint of strain features that enable this ability to degrade plastics.

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60	6/30/2023	2019	04l	----	Farm-Ready Cover Crops for Protecting Water Quality	Central Lakes College - Ag and Energy Ctr	Keith Olander	$ 741,000	By integrating Kura Clover and Camelina into row crop production we were able to supply producers with data about crop production and water quality impacts to influence adoption. Camelina demonstrates promise when double cropped with soybeans and Kura Clover can be an aggressive nitrogen scavenger and offer opportunities in forage production.
61	6/30/2023	2019	04q	----	Restoring Impaired Lakes through Citizen-Aided Carp Management	Carver County Water Management Organization	Andrew Dickhart	$ 106,000	This project demonstrated new innovative methods of carp management that includes local volunteer residents. The use of baited box nets and an electric guidance system produced an integrated and multi-faceted approach to long term carp management, which we know is important given the longevity of the species.
62	6/30/2023	2019	04r	----	Spring Biological Nitrate Removal to Protect Drinking Water	City of Fairmont	Tyler Cowing	$ 175,000	The city constructed a passive nitrate removal system optimized for spring low temperature treatment and partnered with the University of Minnesota to evaluate this field scale model. The results show that the concept of warming the water for early spring treatment works; however, treatment was hindered by algae growth in the greenhouse.
63	6/30/2023	2019	04s	----	Degrading Chlorinated Industrial Contaminants with Bacteria	U of MN	Paige Novak	$ 150,000	A group of bacteria exist that can “breathe” chlorinated pollutants. Naturally occurring chlorinated compounds are formed when leaves and pine needles break down. We discovered that these naturally occurring compounds can speed the rate at which chlorinated pollutants are degraded when added as an amendment.
64	6/30/2023	2019	05b	----	Connecting Students to the Boundary Waters	Friends of the Boundary Waters Wilderness	Chris Knopf	$ 450,000	This project connected over 6,000 Minnesota students to the wildlife, ecology, and history of the Boundary Waters through online resources, classroom visits, and provided opportunities for students to develop deep connections to the wilderness, leadership, and positive peer relationships through overnight wilderness trips.
65	6/30/2023	2019	06a	----	Building Knowledge and Capacity to Solve AIS Problems	U of MN - MAISRC	Nicholas Phelps	$ 4,000,000	This project continued MAISRC’s work to develop research-based solutions that can reduce the impacts of aquatic invasive species in Minnesota. Through this appropriation, MAISRC has supported 12 subprojects on many of Minnesota’s most important AIS, significantly advanced our scientific understanding and ability to manage AIS, and engaged thousands of stakeholders and partners.

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66	6/30/2023	2019	06a-21.2	----	Subproject 06a-21.2: Field Validation of Mulitbeam Sonar Zebra Mussel Detection (Year 2)	U of MN - MAISRC	Jessica Kozarek	$ 228,764	Invasive mussels are a major threat to Minnesota's aquatic ecosystems, water infrastructure, and recreation. This project tests the feasibility of using multibeam sonar to map mussel habitat and distribution over large areas. This information will greatly enhance monitoring efforts and direct management and treatment efforts.
67	6/30/2023	2019	06a-22.2	----	Subproject 06a-22.2: Assessing and Refining Copper-Based Treatment to Suppress Zebra Mussel populations	U of MN - MAISRC	Diane Waller	$ 249,056	Low-dose copper treatment can greatly reduce zebra mussel settlement at less cost and with less risk to native species compared to eradication treatments using maximum allowable copper concentration. We determined how long a mussel population is suppressed after low-dose copper treatment and the short- and long-term impacts to native species.
68	6/30/2023	2019	06a-23.2	----	Subproject 06a-23.2: AIS and Tourism - A Socio-Economic Assessment	U of MN - MAISRC	Amit Pradhananga	$ 249,088	Minnesota's businesses and visitors to key tourist destinations are concerned about the ecological impacts of aquatic invasive species, and value efforts to manage AIS. While businesses are willing to share information about AIS with customers. Programs to engage businesses in AIS management are needed.
69	6/30/2023	2019	06a-25.2	----	Subproject 06a-25.2: Examining Motivations for Illegal Baitfish Release	U of MN - MAISRC	Nicholas Phelps	$ 74,636	Minnesota anglers care about our fish and aquatic ecosystems, but don't always know the laws and practices they can do to help keep them safe from invasive species. Focused communications emphasizing shared responsibility and social norms around proper bait disposal could reduce illegal release and consequently, AIS introduction risk.
70	6/30/2023	2019	06a-28.2	----	Subproject 06a-28.2: Enzyme-Based Coatings to Suppress Priority AIS	U of MN - MAISRC	Mikael Elias	$ 187,480	Biofouling clumps all submerged structures and is a vector for aquatic invasive species. Current countermeasures are toxic. We work on some eco-friendly, protein products that could advantageously replace these chemicals and preserve our environment.
71	6/30/2023	2019	06a-33	----	Subproject 06a-33: Optimizing eDNA Monitoring for Multiple Aquatic Invasive Species	U of MN - MAISRC	Josh Dumke	$ 436,331	Environmental DNA (eDNA) is a useful tool we can use to survey waterbodies for Aquatic Invasive Species. Understanding how we can use eDNA to detect different AIS will allow us to most efficiently look for existing and new invasive species throughout Minnesota, protecting vulnerable lakes from harmful aquatic invaders.

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72	6/30/2023	2019	06a-35	----	Subproject 06a-35: Genetic Biocontrol of Invasive Species - Understanding Attitudes and Risk Perceptions	U of MN - MAISRC	David Fulton	$ 209,313	A majority of respondents perceived benefits to genetic biocontrol of AIS and expressed positive attitudes and support for the use of genetic biocontrol of Aquatic Invasive Species in general and specifically for common carp and zebra mussels. However, a majority of respondents also expressed concerns about perceived risks associated with genetic biocontrol.
73	6/30/2023	2019	06a-36	----	Subproject 06a-37: RNA-Interference Screens for Zebra Mussel Biocontrol Target Genes	U of MN - MAISRC	Daryl Gohl	$ 255,979	In this project we began to test RNA interference (RNAi) as a novel form of genetic biocontrol for zebra mussels. While we have not identified robust RNAi phenotypes, this project laid the groundwork for further research into zebra mussel genetic biocontrol by developing new tools and methods.
74	6/30/2023	2019	06a-37	----	Subproject 06a-37: Improving the Efficiency of Watercraft Inspections through Coordination and Cooperation	U of MN - MAISRC	Amy Kinsley	$ 198,241	We developed a series of models that considered state and county-level planning and how county-level collaborations could impact programming efficiency. Our results suggest that watercraft inspection plans involving collaborations between counties that share information about inspection location plans can lead to gains in efficiency when compared to non-collaborative planning.
75	6/30/2023	2019	06a-38	----	Subproject 06a-38: Evaluating Native Phragmites as a Wastewater Treatment Alternative	U of MN - MAISRC	Daniel Larkin	$ 355,122	An obstacle to invasive Phragmites (European common reed) control is its use for dewatering biosolids in wastewater treatment facilities (WWTFs). We assessed the transpiration rates of native and invasive Phragmites to find an optimal WWTF substitute. Our findings confirm invasive Phragmites remove more water than native Phragmites. For some WWTFs, native Phragmites is likely sufficient, while others will need to consider alternative technologies to transition away from invasive Phragmites.
76	6/30/2023	2019	06a-39	----	Subproject 06a-39: Increasing Effectiveness of Bigheaded Carp Deterrents by Carbon Dioxide Integration	U of MN - MAISRC	Allen Mensinger	$ 340,327	Carbon dioxide shows potential to enhance either bubble curtain or acoustic deterrents to prevent the upstream passage of invasive bigheaded carp in the Minnesota's waters.
77	6/30/2023	2019	06a-40	----	Subproject 06a-40: Enhancing Habitat and Diversity in Cattail-Dominated Shorelines	U of MN - MAISRC	Amy Schrank	$ 338,066	Our results suggest that mechanical removal of invasive, hybrid cattails has the potential to restore nearshore lake ecosystems with few negative impacts to other species. Invasive cattail removal increases dissolved oxygen and provides space for native plants to regrow, thereby restoring high quality fish habitat and benefitting lake fish communities.

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78	6/30/2023	2019	06c	----	Noxious Weed Detection and Eradication	Minnesota Department of Agriculture	Mark Abrahamson	$ 1,000,000	This project supported noxious weed management on priority species at both the State and local levels and helped to establish and build support systems that will assist noxious weed management efforts beyond the conclusion of the project.
79	6/30/2023	2019	06d	----	Emerald Ash Borer Response Grants	MN DNR	Emma Schultz	$ 300,000	Minnesota's community forests will lose 2.65 million ash trees due to the impacts of the invasive pest emerald ash borer. These funds were used to administer $300,000 in grants to local units of government for planting ecologically appropriate trees to address ash loss on public land.
80	6/30/2023	2019	07c	----	Sustainable Solar Energy from Agricultural Plant By-Products	U of MN - Morris	Ted Pappenfus	$ 185,000	New materials were developed from agricultural byproducts for use in the fabrication of printed organic solar cells that will lead to a more sustainable, low-cost, renewable energy source in Minnesota.
81	6/30/2023	2019	07d	----	Morris Energy and Environment Community Resilience Plan	City of Morris	Blaine Hill	$ 150,000	This project added capacity in west central MN and Morris to think about sustainability initiatives including clean energy, community resilience, gathering and analyzing building performance data, and community outreach and education focused on MN's changing climate and how it affects west central Minnesotans.
82	6/30/2023	2019	08b	----	Promoting and Restoring Oak Savanna Using Silvopasture	U of MN	Rebecca Montgomery	$ 750,000	We evaluated cattle grazing as an oak savanna restoration tool, compared to prescribed burning and tree thinning. Adaptive targeted grazing reduced overgrown shrubs with minimal impacts on wildlife, water quality, or soil health. We promoted this grazing strategy by developing training workshops, webinars, online resources, and a farmer-to-farmer learning network.
83	6/30/2023	2019	08d	----	Conserving and Monitoring of Minnesota's Rare Arctic Plants	U of MN - Duluth	Briana Gross	$ 135,000	Through three years of genetic and field study, we found that the rare arctic relict plants of Minnesota have retreated northward since the 1900s. They will likely decline into the future, and one species is threatened by an aggressive invasive species. Protection and education are critical to preserve these unique species.

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84	6/30/2023	2019	08e	----	Nongame Wildlife Program Acceleration	MN DNR	Kristin Hall	$ 513,000	Project outcomes for the Nongame Wildlife Program Acceleration project include: 1) improved management and delivery of foundational information on nongame species. 2) new research on declining species and increased status assessment surveys of priority nongame species. 3) increased recreational opportunities through community science, and 4) the creation of a repeatable survey to measure public support for the of the Nongame Wildlife Program.
85	6/30/2023	2019	08f	----	Lawns to Legumes	Board of Water and Soil Resources	Dan Shaw	$ 900,000	The Lawns to Legumes Program is focused on building a movement to support at-risk pollinator species. The project resulted in over 2,300 high diversity residential plantings covering, 4.3 million square feet, and a large numbers of DIY projects across Minnesota inspired and guided by the program.
86	6/30/2023	2019	09b	----	Grants for Local Parks, Trails and Natural Areas	MN DNR	Audrey Mularie	$ 3,000,000	Provide 20 matching grants to local units of government for local parks, acquisition of locally significant natural areas and trails to connect people safety to desirable community locations and regional or state facilities. Park development includes nature-based recreation facilities and does not include playgrounds, sports courts or sport fields.
87	6/30/2023	2019	09h	----	Birch Lake Recreation Area Campground	City of Babbitt	Cathy Bissonette	$ 350,000	The City of Babbitt has completed a new 22-acre campground in the Birch Lake Recreation Area that will include 49 new campsites to accommodate recreational vehicles and tents. The completion of this projects allows area residents and tourists from around the country and Canada to enjoy the unique outdoor experience of Northern Minnesota.
88	6/30/2023	2019	09k	----	Bailey Lake Trail and Fishing Pier	City of Virginia	Britt See-Benes	$ 550,000	The completion of the Baileys Lake Trail and fishing pier provides the community a safe way to enjoy outdoor recreation activities, such as biking, walking, and bird watching, within a city setting. The new pier allows for safe fishing on Baileys Lake without the need for water craft.
89	6/30/2023	2019	09p	----	Rainy Lake Recreational Access and Boat Wash Station	City of Ranier	Sherill Gautreaux	$ 200,000	A new accessible boat launch and accompanying dock was installed. A city owned property was converted into a parking lot for vehicle and trailer parking. A permanent waterless AIS boat wash station and an animal proof receptacle for disposal of bait and boater garbage were also installed.

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90	6/30/2023	2019	09q	----	Historic Bruce Mine Park and Mesabi Trailhead	St. Louis & Lake Counties Regional Railroad Authority	Bob Manzoline	$ 1,000,000	The project entailed redeveloping a former mine site into a trailhead for the Mesabi Trail and provide an interpretative center and park for the Bruce Mine Headframe Historic Site located in Chisholm, MN. A self-guided tour includes an interpretive center and plaques explaining how the relics operated in the past by using the remaining structures including the headframe, railroad track and various structural foundations. The Park serves as a trailhead for the Mesabi Trail providing parking, restrooms and information to travelers and trail users.
91	06/30/2023	2020	11	2020-008	Contract Agreement Reimbursement	MN DNR, Grants Unit	Katherine Sherman-Hoehn	$135,000	This appropriation was used to support the ENRTF contract management program, which ensured that ENRTF grantees expended grant funds in compliance with state law, session law, approved work plans, and Office of Grants Management grants policies.
92	06/30/2023	2020	05b	2020-041	Minnesota Freshwater Quest: Environmental Education On State Waterways	Wilderness Inquiry	Julie Edmiston	$500,000	Wilderness Inquiry's Freshwater Quest engaged 8,833 youth across all regions of Minnesota. Using place-based outdoor environmental education, this project inspired the next generation of stewards of Minnesota's natural resources helping to preserve our state's outdoor economy and the vibrancy and health of our environment and residents.
93	6/30/2023	2020	09v	2020-097	Birch Lake Recreation Area Campground	City of Babbitt	Robecca Jaeger	$350,000	The City of Babbitt has completed a new 22-acre campground in the Birch Lake Recreation Area that will include 49 new campsites to accommodate recreational vehicles and tents. The completion of this project allows area residents and tourists from around the country.
94	06/30/2023	2021	08b	2021-039	Restoring Mussels in Streams and Lakes - Continuation	MN DNR, Ecological and Water Resources Division	Madeline Pletta	$619,000	MDNR Center for Aquatic Mussel Programs reintroduced over 4,400 native mussels into three watersheds in southeast Minnesota, bringing our total number to over 17,000 since 2016. We completed monitoring of mussels and habitat at reintroduction sites. We disseminated information through outreach events, including facility tours, presentations, and newsletters.
95	06/30/2023	2021	08f	2021-084	Restoring Upland Forests for Birds	American Bird Conservancy, Great Lakes Program	John Haben	$193,000	American Bird Conservancy (ABC) restored 12 acres of deciduous forest in partnership with Aitkin, Beltrami and Cass Counties, utilizing science-based BMP's to rejuvenate non-commercial stands for focal wildlife species. The outcomes of this project will be shared on the ABC website.

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96	06/30/2023	2021	10a	2021-027	Contract Agreement Reimbursement	MN DNR, Grants Unit	Katherine Sherman-Hoehn	$135,000	This appropriation was used to support the ENRTF contract management program, which ensured that ENRTF grantees expended grant funds in compliance with state law, session law, approved work plans, and Office of Grants Management grants policies.