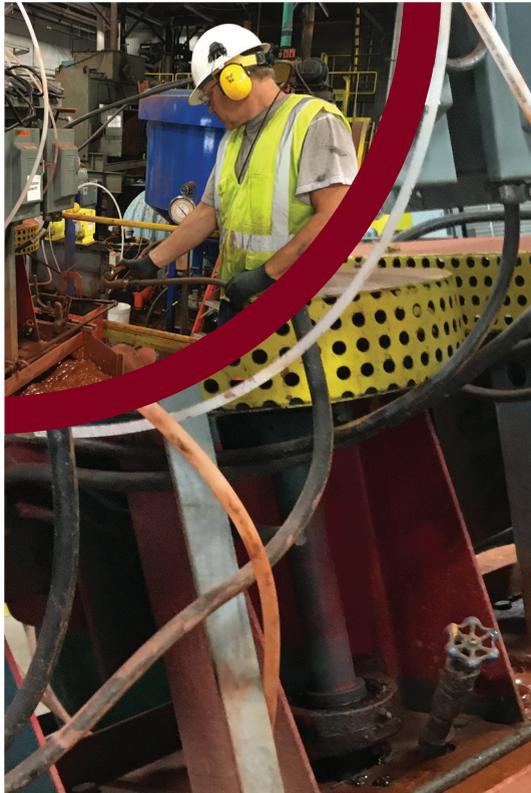


FY18

Natural Resources
Research Institute

HIGHLIGHTS



www.nrri.umn.edu



WELCOME TO NRRI'S ANNUAL HIGHLIGHTS FOR FISCAL YEAR 2018

Thanks to our stakeholders and hardworking research teams, NRRI has had another very busy and successful year.

Our research continues to define challenges, engage collaborators and deliver innovative solutions tied to Minnesota's natural resources. I am particularly pleased with NRRI's strong delivery on the Mining and Water Innovation Initiative - each project team collaborated with industry and businesses partners, fulfilling objectives on time and on budget.

The opportunities ahead are especially exciting. Our research is revealing new metallic products, cutting edge forest management tools, biomass-based energy and polymer composite products and strategies for renewable energy storage. We are also enhancing our capabilities to help developing businesses and entrepreneurs reach success.

Of course, we also face many challenges. First, we must achieve the final increase in state base funding. This will allow us to maintain and develop NRRI's technical capabilities and give our scientists the opportunity to anticipate and prepare for future trends. Large scale technology demonstrations that can reduce risk and attract investment also need continued funding.

This is all some serious heavy lifting. By combining forces with other entities across the state, we can continue to provide research solutions and play to win for Minnesota.

Thank you for your support.

A handwritten signature in black ink, which appears to read "R. T. Weberg". The signature is stylized and fluid, written over a white background.

Rolf T. Weberg
Executive Director, Natural Resources Research institute

RESEARCH HIGHLIGHTS

2016 Legislature Funded Mining & Water Innovation - Results Delivered

Ambitious goals were set to increase Minnesota's competitiveness, enhance the value of its resources and protect water quality. Funding of \$2.6 million in 2016 from the state legislature allowed the following goals to be met in FY 2018:

- Designed a unique simulation process for direct reduced iron that will enhance future high value iron product development in Minnesota.
- Built an online Natural Resources Atlas that holds over 250 layers of data to assist informed natural resource decisions for our stakeholders.
- Developed a new flotation process to get more iron out of Minnesota's currently unmined ore resources.
- Tested biological and electro-chemical methods to remove sulfate and sulfide from industrial wastewater.
- Demonstrated a bench-scale process to solidify dissolved sulfate for removal from municipal wastewater to meet regulatory standards for wild rice.



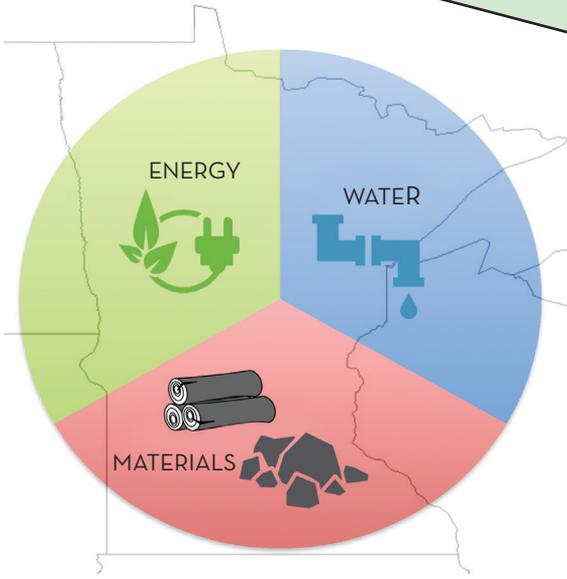
PREPARING FOR THE NEXT 35 YEARS: ROUND ONE OF SUCCESSION PLANNING

An increase in State Special funding in FY 2017 allowed NRRI to hire top talent in the following positions:

- Grants & Contracts Manager
- Business Development & Intellectual Property Manager
- Coleraine Minerals & Energy Labs Director
- Materials Science, Additive Manufacturing & Machining Engineer
- Process Development Engineer
- Quality Six Sigma/LEAN Researcher
- Forest Silviculture Program Leader
- More searches underway to replace retiring personnel and add to skillsets.



LEADING MINNESOTA INTO THE ECONOMY OF THE FUTURE



Mission:

NRRI's mission is to deliver research solutions to balance our economy, resources and environment for resilient communities.

What drives a strong economy? How can Minnesota get the most value from its resources?

NRRI research partners across disciplines and industries at the intersection of an economy built on natural resources. From defining resources to understanding environmental impact and developing high value products, NRRI looks at what's ahead.

NRRI'S INTEGRATED RESEARCH PORTFOLIO:

- Minerals & Water Resources: Defining the state's mineral opportunities while understanding and protecting water resources and mitigating impacts.
- Renewable Energy Management: Demonstrating innovative energy sources and energy storage opportunities.
- Forest Resources, Materials Development & Bioeconomy: Informing forest management for industry and wildlife while driving innovation and opportunities for biomass resources.
- Business Opportunities: Offering NRRI's unique technical expertise to spur innovations from the entrepreneurial scale to large industrial challenges.

DELIVERING SOLUTIONS



INFORMATION

- NRRI launched online, interactive Breeding Bird Atlas with Audubon Minnesota.
- Verified efficacy of ballast water clean-up technologies at ports around the globe.
- Defined ore resources for Hwy. 53 reroute to expand mining opportunities and allow state highway infrastructure changes.
- Informed forest management policies to protect habitat of threatened bat species.

INNOVATION

- Delivered results in the Mining & Water Initiative. (Read more on page 3)
- Demonstrated promise in waste taconite rock as a unique road repair product.
- Applied drone and digital imaging technologies to precisely identify quantity, quality and accessibility of forest resources.
- Expanded unique expertise and equipment to densify a range of materials into durable, solid biofuels.
- Piloted technologies that convert wet waste biomass resources into valuable energy products.

COLLABORATION

- Minnesota company wins “International Bio-based Product of the Year” award for oil absorbant product developed at NRRI that uses agricultural waste.
- Six Sigma/LEAN efficiency project helps local printing company save time and money.
- Wood waste is turned into a power source as NRRI teams up with local manufacturing company to save money and meet sustainability goals.
- Local wood products company works with NRRI on product development and pivots plan for better economic return.
- MN Department of Transportation and NRRI develop a GIS-based sulfide mineral risk assessment model for building roads.
- Lucinda Johnson was appointed in December 2017 to serve on the Environmental Protection Agency’s Board of Scientific Counselors.



FY18 BY THE NUMBERS

INNOVATION

- 15** Invention Disclosures Submitted
- 10** Active Commercial Licenses
- 2** Patents Filed
- 1** Business Startup



ENGAGEMENT

- 598** People Toured Duluth & Coleraine Facilities
- 3** Public Open Houses
- 129** Presentations & Invited Talks
- 39** Conference Participation
- 39** Public Service/Committees Served

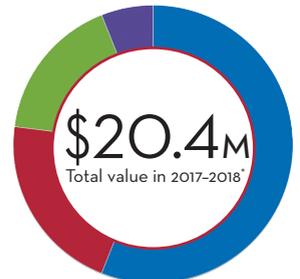
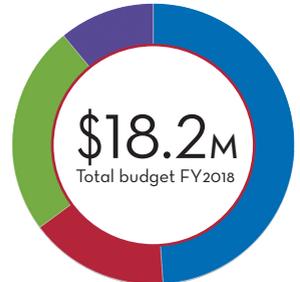
DELIVERY

- 76** Industry Service Contracts
- 48** Grants Submitted
- 25** Peer-Reviewed Papers Published
- 49** Technical & Confidential Reports Published
- 40** College Students Trained & Employed
- 3** Business Assistance Fund Projects

OPERATING BUDGET FOR FY 2018

- Contracts & Competitive Grants • 49%
- Coleraine Lab Support • 16%
- State Base Funding • 24%
- University Funding • 11%

- Federal • 56%
- State • 21%
- Industry • 17%
- Other • 6%



* The total value for grants and external sales uses all years of funding for multi-year projects. the total value represents the cumulative value of externally-funded research activity between July 2017 and June 2018.