J-WAFS Water and Food Grand Challenge Grant

2023 Announcement of Funding Opportunity

1. Executive Summary

J-WAFS seeks to fund one Grand Challenge Grant for an interdisciplinary, collaborative project to address a significant problem in water and food for human use, specifically in the context of climate change. The funding for this opportunity is up to $1.5M over 2-3 years, with an anticipated start date of Sept. 1, 2024 or Jan. 1, 2025. The project development and selection will be a multi-stage process including workshops and required statements of interest due on Dec. 8, 2023, followed by invitation-based submission of concept papers and full proposals.

To ensure you receive further communications related to this funding opportunity, including registration for the kickoff workshops described below, we strongly suggest that you ***sign up for the J-WAFS Grand Challenge email list*** *(please sign up here if you are interested).*

2. About J-WAFS and this Funding Opportunity

J -WAFS catalyzes MIT research, innovation, and technology for ensuring safe and resilient supplies of water and food while reducing environmental impact, to meet the local and global needs of a rapidly expanding and evolving population on a changing planet. At a time when climate change, urbanization, and a growing and evolving global population are collectively putting tremendous stresses on the world's water and food supplies, solutions-oriented research addressing these most basic human needs is essential. The challenges are tremendous, the systems are complex, and the need for research on science, technologies, policies, and the scale-up of solutions is urgent.

In this context, J-WAFS launched a new funding opportunity in 2022 for MIT researchers to address significant "Grand Challenge" problems in water and/or food systems. This announcement kicks off our second call for proposals. We seek to fund a large, integrated project that addresses a significant challenge in the area of water and/or food for human need under climate change. This funding opportunity targets grand challenges in water and food that can leverage multiple existing areas of expertise, programs, and Institute resources. We wish to identify challenges that can benefit from actionable, solutions-oriented research. Examples of "grand challenges" identified in prior J-WAFS workshops and discussions can be found in the addendum. Proposed projects are expected to be substantially more rigorous than a seed grant proposal. Concept papers and full proposals will be subject to extramural peer review.

Cross-disciplinary approaches are highly encouraged. Projects involving collaboration with non-MIT researchers or external stakeholders are encouraged, but the J-WAFS funding itself should primarily support MIT research. Our process over the coming months is aimed at identifying grand challenges related to climate, water, and food for which MIT capabilities can be marshaled, and helping individuals form teams and craft research objectives and strategies to address these challenges. Following workshops and initial statements of interest, concept papers will be invited. Finalist teams will be chosen based on those papers and will be invited to submit full proposals.

We recognize that there is potential overlap with some of the MIT Climate Grand Challenge flagship projects. While we would avoid funding research that is already supported by those Flagship projects, we are open to complementary or synergistic topics. Please contact J-WAFS (see below) if you would like to discuss the eligibility of these or any other topics.

Please note that J-WAFS will issue its annual RFP for seed grants in October. Please do not submit topics that are more appropriate for seed grants to this Grand Challenge RFP.

3. Funding and Eligibility

Teams must be led by a Principal Investigator who meets one of these two eligibility criteria:

- *MIT professor*
- *Member of the MIT research staff with principal investigator privileges (generally senior or principal research scientist, or senior or principal engineer)*

If you have questions about eligibility, contact J-WAFS (see below).

We anticipate funding one 2-3 year project with a total budget of up to $1,500,000 (overhead free). Funding is primarily for use at MIT, although a fraction of the funding may be used outside of MIT via subcontracts to other institutions (subject to overheads) if it is deemed critical to the success of the project.

4. Proposal Process and Timeline

This funding opportunity has a multi-step process, starting with workshops in the fall to explore potential research topics and help teams form. Brief statements of interest describing an impact area, research topic, and approach are due at the beginning of December. Based on these, J-WAFS will invite selected teams to submit concept papers. Following an external review process, two to three final proposals will be invited. The following dates are approximate:

September 2023:	Funding opportunity announced
Oct.-Nov. 2023:	Workshops
Friday, Dec. 8, 2023:	Two-page statements of interest due

Late Dec. 2023:	Invitations to submit concept papers issued
Mid-February 2024:	Team concept papers due
Late March 2024:	Invitations to submit full proposals issued
Late June 2024:	Proposals due
Summer 2024:	Final funding decisions
Sept. 1, 2024 or Jan. 1, 2025:	Research starts

5. Objectives and Review Criteria

Proposals will be evaluated based on the following review criteria:

- **Appropriateness for a Grand Challenge**: The importance of the problem to the human need for water and/or food, scale of the problem, the relevance to climate change, and appropriateness of the research to address the problem.
- **Technical merit**: The research approach is sound and the work plan is well-structured. Proposed methods and techniques are appropriate and the scientific foundation for the work has been demonstrated. The research is innovative and applies new perspectives or methods to the problem.
- **Team strength**: The research team encompasses relevant disciplines and areas of expertise and has a track record of, or plan for, interdisciplinary interaction and collaboration. Team members have demonstrated success in addressing similar research challenges.
- **Feasibility and resources**: The project's objectives are achievable within the proposed timeline and budget. The proposal identifies, and the team has access to, the needed resources (e.g., facilities, equipment, data, etc.).
- **Potential for meaningful outcomes**: The proposal demonstrates a high potential for meaningful outcomes, e.g.:
    - disruptive breakthroughs or innovations;
    - technology commercialization or scale up (through licensing, spinout companies, non-profit initiatives, or other open-access solutions);
    - development of a larger follow-on MIT research effort or new MIT initiative.

  Given the urgency of climate change and its impact on food and water security, the proposal should demonstrate potential for large-scale impact in a relevant time scale by addressing scalability, technoeconomic feasibility, and pathway to realize actual real-world impact. This should include appropriate interaction with relevant stakeholders (in formulating and conducting research, disseminating results, and/or implementing or scaling outcomes).
- **Communication and dissemination**: The proposal includes a clear plan to disseminate research findings (including to the scientific community as well as policymakers and the public as relevant).

- **Evaluation plan**: The proposal (1) includes specific milestones and appropriate metrics to assess the research progress during the project, and (2) defines measures that may be used to assess the real-world impact of the project beyond its conclusion. Depending on the proposal, metrics may relate to, e.g., technical milestones, data to be generated, model accuracy, patents or intellectual property, technology transfer, environmental/societal/economic impact, public engagement, knowledge dissemination, and effectiveness of collaboration and stakeholder involvement.

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6. Workshops and Topics of Interest

J-WAFS will schedule and host one or more workshops in October/November 2023. These workshops will feature invited speakers to provide context for "grand challenges" in water and food at the intersection of climate change, promote mutual understanding of problems and brainstorming of potential solutions through discussion, and facilitate team-building through interactions at the workshops and mutual sharing of contacts of MIT community members interested in water and food.

The workshops will be open to MIT PIs, post-docs, research staff, and graduate students, with sign-up requested for participation. Scheduling will be announced through email, in the J-WAFS newsletter, and on our website. To make sure you are notified, please sign up for the Grand Challenge RFP email list here.

The preliminary workshop topics will be:

Water and Climate: *Address water scarcity, water quality, and sustainability of water systems in the context of climate change.*

Water, as a fundamental resource for human survival and development, plays a central role in shaping societies, economies, and ecosystems. However, the availability, distribution, and quality of water resources are increasingly being disrupted by the interrelated impacts of climate change and overuse. As global temperatures rise, weather patterns become unpredictable, sea levels rise, and freshwater sources are depleted, the strains on water security grow substantially.

The challenges that lie at the nexus of water resources and climate change are complex. Changes in precipitation patterns can lead to water scarcity in some regions while causing devastating floods that contaminate water supply in others. Over-withdrawals of groundwater or rising sea levels can lead to salt water intrusion and other shifts in hydrological cycles that have direct implications for human populations, agriculture, and the overall ecological balance. Rising temperatures contribute to accelerated evaporation rates, intensifying drought conditions and potentially depleting water reservoirs. Additionally, changes in snowpack and glacier melt patterns

affect the timing and volume of river flows, posing challenges to water management systems that rely on predictable water supply patterns. The intersection of water needs and climate challenges has emerged as a critical area of concern, necessitating a combination of innovative technologies and environmentally resilient strategies to meet human need. Research can support the development of sustainable water management practices, innovative technologies for water conservation and purification, policy frameworks for equitable water distribution, and strategies to enhance the resilience of communities facing climate-related water challenges.

Food Systems and Climate: *Improve the productivity, resilience, and sustainability of the world's food and agriculture systems in the face of climate change and extreme weather events*.

The global food system stands at a critical juncture, deeply intertwined with the pressing challenges posed by climate change. Food systems are inherently complex, involving interactions across agriculture, transportation and supply chains, processing and packaging, retail, and waste management. The convergence of a rapidly changing climate, an expanding global population, and mass migration has put immense pressure on these systems, highlighting their vulnerabilities and the urgent need for sustainable solutions.

The effects of climate change on food systems are multifaceted and widespread. Rising temperatures, erratic precipitation patterns, and extreme weather events disrupt agricultural productivity and jeopardize food security. Crop yields and quality are threatened as changing climatic conditions create new challenges for water management, pest management, and soil fertility. Additionally, the increased frequency of heatwaves, droughts, and floods can lead to crop failures and reduced nutritional value of produce, affecting farmer livelihoods as well as consumers. Beyond the direct effects on agriculture, the food supply chain's intricate web is also susceptible to climate-related disruptions, affecting transportation networks, storage facilities, and food processing industries. Furthermore, the food system itself contributes significantly to climate change through emissions from agricultural practices, transportation, and food waste. The intricate relationship between the food system and climate change requires comprehensive and innovative strategies to mitigate its adverse effects while ensuring sustainable and resilient food production and distribution.

Research for Impact: *Discuss stakeholder engagement and socioeconomic, political, and other factors relevant to realizing meaningful impact.*

Addressing challenges through robust implementation approaches that take socioeconomic, organizational, and political, factors into account is key to the adoption and scale-up of effective technologies, practices, and actions that can address climate/food/water challenges. Scaling successful localized initiatives, pilot projects, or prototypes into strategies and technologies with broader reach and impact is critical if we are to transform our water and food systems. Participants will discuss how research that aims to realize socioeconomic impact can be formulated in collaboration with stakeholders who understand real-world needs and constraints, and how research can best be steered towards actionable outcomes.

7. Statement of Interest Requirements

Following the workshops, J-WAFS will solicit initial statements of interest to identify grand challenges and corresponding research projects of interest to members of the MIT community. These will not be by invitation, but may be limited to a subset of grand challenge topics identified during the workshops. Statements of interest should identify a water or food security challenge and provide a brief explanation of the proposed project, the expertise needed to address the problem, how it fits this RFP, and the intended outcomes. In addition, submitters should include a list of PIs and team members and provide descriptions of their roles on the project, and also identify any additional disciplines or related areas of expertise (whether at MIT or external) that might be needed to complete the team. Please use the Statement of Interest template available here.

There is no limit on the number of statements that a single PI may participate in.

Submission process: Please fill out the webform and upload your Statement of Interest here: https://webportalapp.com/webform/jwafs_grandchallenge_soi

Due date: Friday, December 8, 2023

8. Contacts

Please direct questions about topics, eligibility, process, etc. to:

Rohit Karnik, Associate Director, J-WAFS, karnik@mit.edu
Renee Robins, Executive Director, J-WAFS, rrobins@mit.edu

Addendum 1: Past Awards

2022 RFP Enhanced photosynthesis in crops (EPiC)

Addendum 2: Grand Challenge Examples

NOTE: *These are examples and not a list of topics or challenges we are looking for, and this list is not meant to be exclusive of other potential topics. Many of these topics are interrelated, reflecting the nature of water and food grand challenges.*

Some General Grand Challenge areas:

(1) Adapt to climate change

1. Predict the impact of climate change on food production and water resources
2. Adapt to water scarcity (policy, technology, practice)
3. Develop drought or heat tolerant plants
4. Manage for extreme events & compound events (early warning systems, technology adoption)
5. Protect farmers livelihood through insurance, other risk management tools, and economic policies

(2) General crop/food productivity/yield improvements/access to food

1. Protect and revitalize soils
2. Manage the nutrient cycle
3. Improve fertilizer access/use/alternatives to improve productivity
4. Reduce food waste
5. Sustainable dietary choices
6. Supply chain/cold supply technology
7. Change farming practice (no-till, precision ag, etc)
8. Manage pests/diseases exacerbated by climate change
9. Improve fisheries management and aquaculture productivity
10. Advance indoor/urban ag, cellular ag, other novel approaches to produce food/protein

(3) Reduce GHGs from agriculture & food systems

1. Reduce CO_2 from fertilizer production and other energy-intensive farming activities
2. Reduce methane from cattle, rice farming
3. Soil carbon sequestration in farming

Some examples of challenges in water and food at the nexus of climate change:

- Salinity intrusion in coastal areas such as Bangladesh threatens food production and livelihoods.
- Food production uses a major fraction of the world's freshwater supply and a considerable amount of land (but not sea), which are limited resources that may not be able to fulfill the needs of a growing population.
- Crop yields are expected to decrease as a result of climate change.
- The melting of Himalayan glaciers threatens the supply of freshwater for millions of people.
- Degradation of soils and desertification affects agricultural productivity and livelihoods.
- Agricultural yield in many areas is limited by poor soil, lack of fertilizers, pests/diseases, lack of labor, and other factors.
- Climate change and extreme weather events result in loss of crops.
- Cost and other factors limit access to nutritious food especially for the poorest and most vulnerable.
- The production, use, and disposal of essential elements for crops (especially N, P) is wasteful and harmful to the environment.
- Food production (especially beef and rice) contributes significantly to climate change.
- Seafood production is affected by climate change and overfishing, reducing food supply and adversely impacting fishing communities.
- Translating climate change predictions into actions that could be taken at multiple levels to adapt and mitigate adverse impacts is difficult.
- Food waste and inequitable distribution and access to food exerts a higher strain on resources while depriving some of essential nutrition.
- Socioeconomic and other factors sometimes favor unhealthy food habits, overconsumption, waste, and unsustainable food choices.
- Difficulty in monitoring of crop and soil health in an actionable manner causes lower yield for smallholder farmers.
- Water systems are threatened by climate change, contamination, and overuse.
- Climate change results in changing availability of water resources, forcing societies to adapt.

Addendum 3: Background Reading

Below are a few web resources that describe various aspects of the climate-food-water nexus and various general and specific challenges:

https://resourcewatch.org/dashboards/food
https://resourcewatch.org/dashboards/water
https://www.fao.org/3/i5188e/I5188E.pdf
https://www.nature.org/en-us/what-we-do/our-priorities/provide-food-and-water-sustainably/food-and-water-stories/climate-friendly-food-faqs-regenerative-ag-101/
https://siwi.org/why-water/water-climate/
https://www.un.org/en/chronicle/article/coming-grips-water-security-face-climate-change
https://agricultureandfoodsecurity.biomedcentral.com/articles/10.1186/2048-7010-1-10