**Transformative Strategies for Reducing Excess Nutrients in Waterways**

Modified from https://www.innocentive.com/ar/challenge/9933112

AWARD: **$1,000,000**

**BACKGROUND**

Nutrient pollution is one of America’s most widespread, costly, and challenging environmental problems. Nutrients, including nitrogen and phosphorus, come from a variety of sources, including agri­cultural and urban runoff, sewage treatment plants and septic systems, and fossil fuel combustion. Nitrogen and phosphorus are necessary for crop and plant growth, but excess runoff and leaching can lead to drinking water contamination, harmful algal blooms, and fish kills. These effects of nutrient pollution have significant impacts to human health, recreation, and the economy.

Examples of effects are:

* Freshwater eutrophication (nutrient enrichment of waterways) is estimated to cost the United States at least $2.2 billion annually, with most of the cost attributable to diminished property values and reduced recreational use of water (Dodds *et al.* (2009), *Environ, Sci, Technol*., 43(1), 12-19).
* The U.S. Geological Survey found that nitrates were high in 64 percent of shallow monitoring wells in agricultural and urban areas ([http://water.usgs.gov/nawqa/nutrients/pubs/circ1350/faq.html](http://water.usgs.gov/nawqa/nutrients/pubs/circ1350/faq.html" \t "_blank)).
* The Gulf of Mexico “dead zone,” caused by nutrients draining from the Mississippi River Basin, remains undiminished in size, currently measuring 5,840 square miles ([http://www.noaanews.noaa.gov/stories2013/2013029\_deadzone.html](http://www.noaanews.noaa.gov/stories2013/2013029_deadzone.html" \t "_blank)).

For a review and introduction to the topic:

* General introductions on nutrient pollution - [www.epa.gov/nutrientpollution](http://www.epa.gov/nutrientpollution" \t "_blank)

A review of best practices for nutrient management - [http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/ceap/](http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/ceap/" \t "_blank)

An introduction to the problem, which also includes some steps taken in the specific context of the Chesapeake Bay - [http://www.cbf.org/how-we-save-the-bay/issues/dead-zones/nitrogen-phosphorus](http://www.cbf.org/how-we-save-the-bay/issues/dead-zones/nitrogen-phosphorus" \t "_blank)

* For a closer look at the problem in the Mississippi River Basin and hypoxia in the Gulf of Mexico - [http://toxics.usgs.gov/hypoxia/mississippi/index.html](http://toxics.usgs.gov/hypoxia/mississippi/index.html" \t "_blank)

Progress has been made in this field but there is still considerable scope for improvements, which could potentially address one or more of the various stages in the nutrient cycle, depicted above for the case of nitrogen. Currently technologies that allow for improved management of nutrients do exist (*e.g.* management of nutrients applied to crops; management of nutrient content in livestock and poultry feed; technologies to remove/capture nutrients in run-off). However widespread adoption of these technologies has fallen short, due to one or more social, economic, and/or logistical factors.

**CHALLENGE**

Accordingly, **your aim is to identify bold and innovative ideas to fundamentally transform the way we manage and recover nutrients in order to reduce pollution. More specifically, we are interested in solutions that address the problem within the Mississippi River Basin and its impact in the Gulf of Mexico.** The following resources provide an overview of the problem and current actions taking place in this watershed:

* An overview of current implementation strategies and action plans provided by the Mississippi River/Gulf of Mexico Task Force [http://water.epa.gov/type/watersheds/named/msbasin/index.cfm](http://water.epa.gov/type/watersheds/named/msbasin/index.cfm" \t "_blank)
* An assessment of conservation practices previously implemented at the Mississippi River Basin [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/ceap/?cid=stelprdb1176990](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/ceap/?cid=stelprdb1176990" \t "_blank)
* An overview of some of the implemented nutrient recovery technologies

[http://www.umesc.usgs.gov/aquatic/brichardson\_5003475.html](http://www.umesc.usgs.gov/aquatic/brichardson_5003475.html" \t "_blank)

[http://www.nwrc.usgs.gov/factshts/090-03.pdf](http://www.nwrc.usgs.gov/factshts/090-03.pdf" \t "_blank)

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We are primarily interested in submissions that address non-point pollution sources (for instance, agriculture - crop and livestock, urban and suburban fertilizer run-off) rather than point pollution sources (for instance, wastewater treatment facilities). Our interests include solutions covering a wide spectrum of development, from novel proposals all the way to innovations proven in pilot studies and being considered for large-scale implementation.

Two key areas we anticipates large impact could be made are:

* User Adoption Strategies - Increasing/promoting/incentivizing adoption of existing innovative technologies/practices/systems by the users of nutrients
* Technical Advances – Developing new technologies/practices/systems to address the problem of nutrient reduction / removal or capture.

Technical solutions that focus on nutrient removal are primarily of interest to us if they address near-source reduction and recovery of nutrients.

Solutions must provide a **bold**, **transformative solution, with significant impact in the field, rather than just leading to an incremental improvement** of the current situation. With that in mind, you must address the following **Solution Guidelines**:

1. Technical Feasibility – For submissions based on novel technical advances, how likely is it that the suggested solution can be developed and implemented? The solver should provide a reasonable general approach for developing the solution, identify key questions and/or contingencies that would need to be addressed during the development, and provide high-level evidence that developing the solution is possible.
2. Impact – Solvers should provide an estimation of the impact that the solution would have in dramatically reducing/containing nutrient pollution. This estimation could be based upon measures such as:
   1. Reducing nutrient waste production
   2. Reducing nutrient waste release
   3. Controlling run-off/leaching/deposition to water bodies
   4. Reducing the existing nutrient pollution in water bodies (although approaches to solving the problem should focus on near-source approaches)
3. Novelty – How distinct from other ideas is the suggested solution?  For this criterion, ideas will be rated higher the further removed they are from existing and/or already suggested approaches.
4. User Adoption – Solvers should provide a clear strategy explaining how their submission addresses the wide variety of reasons that have impeded adoption of many transformative innovations.  While frustrating, these hurdles usually reflect legitimate stakeholder needs and concerns that must be addressed in order for a solution to have the desired impact. Key barriers to user adoption include:
   1. Social / cultural
   2. Economic
   3. Logistical
   4. Timeframe – The solution could be implemented within 5 years

Project Criteria

The Challenge seeks to identify **bold and innovative ideas leading to a fundamental change in the way we manage or recover nutrients** – nitrogen (N) and phosphorus (P) –  in order to reduce pollution.

This is an Ideation Challenge that requires only a written proposal to be submitted. The submitted proposal should include the following:

* A detailed proposal that meets the **Solution Guidelines** in the **Detailed Description**.
* Rationale as to why the Solver believes that the proposed solution will work. This rationale should address **each** of the **Solution Guidelines** described in the **Detailed Description** and should be supported with relevant examples, diagrams, and literature citations.

After the challenge deadline, we will complete the review process and make a decision with regards to the Winning Solution(s). All students that submitted a proposal will be notified on the status of their submissions; and will be scored using the rubric for Transformative Assignment.