Restoration Research

Award Program
Application Package

www.chesapeakebaytrust.org / 410-974-2941

AT A GLANCE

The Restoration Research Award Program funds key restoration questions focused on the effectiveness of watershed restoration practices, including stream practices.

Information Session

December 15 from 12 pm to 1 pm Chesapeake Bay Trust Office, 60 West Street, Suite 405, Annapolis, MD and by phone number 866-740-1260 and passcode 9742941

Applicant Q&A with Review Panel: April 13, 2017 (12 pm to 1 pm)

Deadline

5:00 pm, February 21, 2017

Submit Your Application by following instructions at:
www.cbtrust.org/restorationresearch

Background and Goal of the Program

The Chesapeake Bay Trust (the Trust), the Maryland Department of Natural Resources, the Maryland State Highway Administration, Montgomery County Department of Environmental Protection, and other partners announce a request for proposals for our jointly funded Restoration Research Award Program.

Efforts to restore the Chesapeake Bay and its tributaries call for a significant increase in the number of watershed restoration projects intended to improve both water quality and habitat. Questions about the performance and function of some of these practices persist in the regulatory community as well as the restoration practitioner community.

The goal of this award program is to answer several key restoration questions. Funding partners hope that answering these questions will ultimately lead to increased confidence in proposed restoration project outcomes, clarification of the optimal site conditions in which to apply particular restoration techniques, information useful to regulatory agencies in project permitting, and information that will help guide monitoring programs.

Additional Resources to Support Project Development

Information Session
A workshop at which the program will be described and questions from potential applicants will be answered will be held December 15, 2016 from 12 pm to 1 pm at the Chesapeake Bay Trust Office, 60 West Street, Suite 405, Annapolis, MD. Interested parties may attend in person or by phone at 866-740-1260, passcode 9742941.

Existing Scientific Literature
A list, though not exhaustive, of relevant literature is presented at: www.cbtrust.org/restorationresearch.

Current Research
Several projects focusing on these and related research questions have been funded. To become acquainted with the scope of ongoing work, forge partnerships, and avoid duplication of effort, visit www.cbtrust.org/restorationresearch and see the "Previously Funded Projects."

Restoration Project List
Given budget constraints, investigators are encouraged to couple efforts with planned or completed restoration projects where appropriate. The applicant is encouraged to compile the list of potential projects of interest. However, the Trust staff and collaborators will provide project list(s), though not exhaustive, of relevant restoration projects for consideration, as available. These project lists will be presented in the "Additional Resources to Support Project Development" section on the research program's webpage.

Types of Activities that May be Supported

Members of the regulatory and restoration communities have worked together to identify several key restoration questions. Investigators may propose with funds from this research program to:

a. Conduct a literature review/synthesis, if the case can be made that enough is already known about a question; or
b. Answer a component of the question with a research project in which specific hypotheses are tested. Research projects may include:
    i. experimental or descriptive work in the field;
    ii. experimental work in the laboratory;
    iii. modeling studies; and/or
    iv. use of existing data, if deemed appropriately suited (properly collected with appropriate metadata).

Key Restoration Questions

The following eight research questions are organized into three themes:

A. Effectiveness of restoration programs at the watershed/catchment scale
B. Effectiveness of restoration practices at the project scale
C. Trade-offs in resource improvements incurred by restoration practices and creating net ecological uplift

A. Effectiveness of restoration programs at the watershed/catchment-scale

1. Watershed restoration assessment: What are the cumulative effects of watershed restoration activities within a watershed? Of interest in the restoration community is whether, given the high temporal and spatial variability of nutrient concentrations and flows, a signal from the restoration activities even in a highly targeted, small watershed can be measured relative to a control site (before vs. after restoration activities). A related question: What percentage of the impervious surface in a watershed must be treated with best management practices (BMPs) before a difference can be measured at the outfall? Does BMP type (e.g., stream restoration, environmental site design (ESD) practices, and stormwater wetlands) influence that percentage? We recognize that this question is extensive and reviewers will accept proposals that address a component of this research question.

Possible Elements of the Experimental Design: Select multiple watersheds (to allow for replication) of similar characteristics in which 0 to a significant percentage (e.g., 20%) of the impervious area can be treated. Some hypothesize that due to variability driven by spatial forces (e.g., watershed characteristics) or temporal forces (e.g., rainfall) at least 20% of the watershed must be treated to enable demonstration of an impact of restoration in the watershed. In choosing watersheds, ensure that watershed characteristics remain as consistent as possible, including factors of size, % impervious cover, and type and scale of BMPs to be used to treat impervious cover. Regress load reductions in total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), and other pollutants of interest (loads measured after vs. loads measured before restoration at a point where the watershed drains into the stream) against % of impervious surface treated in the watershed, considering the untreated watershed(s) as a control.

2. Stormwater management assessment: What is the effectiveness of stormwater management practices (implemented, for example, at a level required under the latest stormwater management regulations) on stream channel protection? What percentage of a catchment needs to be treated with ESD practices to reduce water flow enough to protect stream channels? Does location of ESD practices within the catchment make a difference in protecting the stream banks?

   Possible Elements of the Experimental Design: Select multiple catchments with similar characteristics (to allow for replication) in which 0 to a significant percentage (e.g., 20%) of impervious area will be treated with ESD practices. In choosing catchments, ensure that catchment characteristics remain as consistent as possible, including factors of size, % impervious cover, and type and scale of ESD practices to be used to treat impervious cover. Regress degree of bank loss (measured with cross sections and/or other method both before and after ESD installation) and load reductions in TSS (loads measured after vs. loads measured before restoration at the outfall) against % of impervious surface in the catchment treated with ESD practices, considering the untreated catchment(s) as a control.

3. Level of monitoring effort: Monitoring is expensive and money spent on monitoring is by definition not spent on pollution reduction implementation. What degree of representative sampling is required to determine levels of pollutant discharge at a county scale? What sample size is needed to capture variability? What is the cost of such a monitoring program? Can a reduced monitoring regime, either in terms of number of sampling stations or parameters measured at a station, or a factor such as % impervious surface treated in the region be used as a proxy?

   Possible Elements of the Experimental Design: To test whether % impervious cover treated can be used as a proxy for the region's pollutant load reduction, choose regions or counties with varying rates of % impervious cover treated and regress against measured pollutant load reductions at a representative sample size of outfalls in each region.

4. ESD research for plant ground cover versus mulch and for compost amendments versus soil replacement: Local governments aim to implement ESD practices that require low maintenance and provide high water quality treatment. However, there are often high maintenance requirements for ESD practices. To reduce this maintenance burden for ESD practices: 1) Can plant ground cover be used in place of traditional mulch and achieve the desired water quality benefits (e.g., remove TN, TP, TSS, sediment, toxics and/or trap pollution)? and 2) For soils that

infiltrate: a) Can compost amendments be used instead of soil replacement?; b) What is the optimal compost amount to use?; and c) What are the decision factors based on *in situ* soils?

Possible Elements of the Experimental Design: Use bioretention test plots that have plant ground cover and those that have mulch to determine if plant ground cover can serve the same functions as mulch (e.g., weed resistance, erosion prevention) and if plant ground cover includes functions that are superior to mulch (e.g., heavy metal retention). Use bioretention test plots that have soils that infiltrate and test the difference in compost amendment and soil replacement for water quality treatment.

B. Effectiveness of restoration practices at the project scale

5. Comparisons of water quality benefit across restoration technique or site condition. While many studies present data on a single restoration technique in a single set of conditions, few studies compare restoration effectiveness across restoration approaches or across a range of site conditions. Here we ask: How does water quality benefit (defined here as reduction in nutrient and sediment loads) compare across restoration approaches of different types and/or (depending on ability to replicate) across site conditions? The types of restoration approaches in which we are interested are those that aim for different function (e.g., floodplain reconnection, frequency of inundation, bank stabilization, etc.) or that use different techniques (e.g., regenerative stormwater conveyance (RSC), natural channel design (NCD), stream valley restoration/legacy sediment removal). The site condition factors in which we are interested include differences in land use, % impervious cover, watershed condition, valley type, and/or watershed position (headwaters vs. downstream near the receiving waters).

   Possible Elements of the Experimental Design: Compare TN, TP, and TSS load reductions, (at enough sites to capture the variability) between/among two or more different techniques that aim for the same function (e.g., RSCs, NCDs, stream valley restorations/legacy sediment removal, or a combination of those techniques that aim for the same degree of floodplain reconnection), keeping site condition constant OR across a range of one of the site condition factors, keeping other site condition factors and technique constant. If enough replication is available, it may be possible to address multiple factors within the same analysis, but experimental design must be supported. The most robust analyses will be facilitated by using paired control and experimental (before and after the restoration activity) sites.

Methodological Guidance for Question 5

- Studies that simply produce nutrient and sediment reduction values for one stream restoration technique in one set of site conditions will not be supported. We are looking for comparative studies.
- Levels of the factor(s) (either restoration technique or site condition) to be compared must be clearly articulated in the description of the experimental design and a justification provided for their selection. Potentially confounding factors must be considered and, if sample size does not allow it, kept constant. Additional factors can be added as sample size allows.

- The strongest proposals will use paired series (Osenberg, et al., 2006[1]) or BACI (before-after-control-impact) designs with sufficient replication to capture variability and control sites to capture variability due to other factors. Sample size to be used must be justified.
- Collaboration with leads of planned restoration projects to enable full BACI design is encouraged. Descriptive studies that rely on completed projects (preventing collection of "before" data) will also be considered.
- All water quality sampling projects intended to quantify loads must include methodology that captures both base flow and storm flow in a representative way. The best way to achieve this standard is flow-paced sampling using automated samplers. See Thompson, et al. (2014[2]) for water quality sampling methods, associated error, and optimal sampling to reduce error.

6. Stability of restoration practices. Research is needed to better understand why and when stream restoration practices "fail" in order to reduce "failures" and increase "successes." (We recognize that there is no standard definition of "failure," definition of "stability," or agreed upon tolerance for movement of stream materials within or from a project.) What are the flow conditions under which different in-stream channel structures that are currently used in Maryland stream restoration projects (e.g., vanes, step pools, constructed riffles, large woody debris) or approaches (e.g., RSCs, NCDs, stream valley restorations/legacy sediment removal, or a combination of those techniques that aim for the same degree of floodplain reconnection) function and remain stable? What are the energy tolerances beyond which the structures or approaches begin to fail?

   Note: "Failure" should not just be limited to stability. If the project does not meet any outcomes or performance standards for water quality improvement or living resources, the project could be considered a failure. Likewise, if the water quality restoration project worsens water quality or results in failure to meet water quality standards, then the project could be considered a failure.

   Possible Elements of the Experimental Design: Within one stream restoration technique or structure, compare stream cross sections at a subset (a large enough sample size to capture variability) of projects with variable flow rates. Regress change in cross section against flow rate. Repeat for other restoration structure types and compare flow rates at which "unacceptable" % change in cross section occurs.

7. Water quality of an urban tree: Although there are several guidance documents and recommendations for urban tree benefits, the empirical data to determine the stormwater benefits of urban trees of a variety of species are needed in the Mid-Atlantic region. Projects will be expected to fully quantify the stormwater treatment value (volume, TN, TP, and TSS) for an urban tree or stand of trees, with tree species, tree size, tree age, and soil volume as factors. The stormwater treatment value derived from empirical data will be compared to modeled stormwater treatment value (e.g., iTree, Maryland Assessment Scenario Tool, etc.). This study can be a combination of literature review, empirical data collection, and models.

[1] Osenberg, C.W., B.M. Bolker, J.S.S. White, Colette M. St. Mary, and J.S. Shima. 2006. Statistical Issues and Study Design in Ecological Restorations: Lessons Learned from Marine Reserves. Foundations of Restoration Ecology. Eds. Donald A. Falk, Margaret A.Palmer, and Joy B. Zedler. Washington, D.C.: Island Press. pp. 280-302.

[2] Thompson, Joshua, Rachel Cassidy, Donnacha G. Doody, Ray Flynn. 2014. Assessing suspended sediment dynamics in relation to ecological thresholds and sampling strategies in two Irish headwater catchments. Science of Total Environment (468-469): 345-357.

Possible Elements of the Experimental Design: Use test plots to monitor the stormwater treatment (volume, TN, TP, and TSS) for an urban tree or stand of trees that vary in species, size and age with enough replication to capture the variability. Model the urban tree or stand of trees and compare the difference in modeled outputs versus empirical data.

C. Trade-offs in resource improvements incurred by restoration practices and creating net ecological uplift

8. Resource trade-offs in different types of restoration projects. The decision to install a restoration project at any given site by definition implies that an existing condition at that site will be modified, replaced, and/or improved. The hypothesis of the restoration practitioner is that the net condition will be *improved.* However, a value judgment is placed on the existing condition, deeming the existing condition to be inferior to the desired "restored" condition that is often not based on quantification. In addition, there is an accompanying value judgment on the proposed resulting condition which may not take into account reductions of certain functions. Therefore, resource protection "officials," many of whom find themselves "stove piped" or in aquatic resource "silos" as to their particular responsibilities, find themselves having to make value judgments about the existing condition and what is in need of improvement.

   The goal of this question is to encourage quantification of the resources present prior to the activity compared to quantification of the resources available after an "intervention" or activity, calculating net ecological impact after evaluation of individual functional components. With certain kinds of restoration projects or practices, are we maximizing certain benefits (nutrients, sediment, habitat, hydrology, and biological resources) at the expense of other benefits in an unacceptable way? This research should allow restoration practitioners to more accurately calculate the resource's functional uplift at a particular site in order to optimize system functions in their decision making.

   a) Tree trade-offs in stream restoration projects: Certain stream restoration practices by necessity can result in removal of trees: 1) trees may need to be removed on a short-term basis for construction site access; 2) trees may be removed for various methods of stream restoration in nontidal forested wetlands; 3) trees may be removed to accomplish legacy sediment removal in which the stream banks are forested; and 4) trees, even when remaining after restoration, may experience mortality due to changes in hydrology leading to higher water levels/inundation. What is the water quality and habitat cost of tree removal of certain practices compared to the benefit of the other elements of the restoration practice?

   b) Wetland trade-offs in stream restoration projects: Certain stream restoration practices can impact type and function of existing wetlands. Impacts can include changes to the wetland's hydrology and plant community extent and distribution. What are the wetland impact losses compared to the benefits of stream restoration?

   c) Submerged Aquatic Vegetation (SAV) trade-offs in living shoreline projects: Living shoreline projects, by definition, require more cross-shore space than shoreline armor projects, given that the creation of a platform for intertidal wetland vegetation and potentially an associated sill, must extend either into the subtidal zone or into the riparian zone. Such extension means that existing condition in either neighboring zone will be

replaced with emergent wetland. With the resurgence of SAV in the Chesapeake, more living shoreline locations will have SAV habitat. How does impacting SAV compare to the benefit of creating intertidal wetland? Under what conditions (e.g., SAV coverage in an embayment) is an SAV impact tolerable? In addition, research shows that the sill can indirectly cause SAV loss to a nearby bed due to the sediment dropping out channelward of the sill and covering the SAV. How can indirect impacts of the sill on SAV loss be better predicted?

Proposal Guidance

All proposals must:

- Begin with a short review of the literature to support the research direction and methodology chosen.
- Contain a detailed description of the specific hypothesis to be tested. Hypotheses proposed must be directly linked to one or more of the eight RFP research questions.
- Contain **robust and scientifically defensible methods section**, including a narrative describing the experimental design and justification of sample size to be used given existing spatial/temporal variability.
- Depict the experimental design in either tabular or graphical form, which greatly helps reviewers efficiently understand your approach.
- Describe in detail the data analysis methodology, including articulation of statistical tests to be used.
- Conclude with a section describing the products of the work, at a minimum to include:
    - At least one scientific paper in the peer-reviewed scientific literature;
    - A talk at a restoration conference for the practitioner audience; and
    - Annual presentations to the regulatory community at regulatory training events for the duration of the study period.

Reviewers will carefully consider how clearly the hypothesis, methods, and analysis approach were crafted.

Criteria

All projects will be evaluated on the following criteria:

- Ability to successfully and objectively answer one or more of or a component of one or more of the key restoration questions described earlier;
- Use of scientifically robust methods, including sampling regimes and parameters, and statistical analysis appropriate to address the proposed hypothesis;
- Demonstration that project sites selected for study will be available and accessible as proposed;
- Organization and lead staff qualifications;
- Transferability of the results to key audiences, such as regulators, restoration implementers (e.g., local governments) and restoration practitioners; and
- Stated willingness and plan to submit data to the Trust and partners no later than one year from when the data were compiled.

Funding partners reserve the right to fund projects and budget items that advance their mission and meet their specific priorities and criteria.

Eligible Applicants

Both not-for-profit entities (academic institutions, non-profit organizations) and for-profit entities are permitted to apply. The strongest proposals will show committed partnerships with various types of organizations. Organizations need not be based in Maryland, but the work conducted with these funds must occur in Maryland.

Funding Available and Timeline

Funding partners have allocated approximately $1,200,000 for this research program. Literature reviews will be funded at a level of less than $50,000 and must be concluded within six (6) months of execution of award. Field and laboratory research will generally be less than $200,000; applicants may request more with additional justification. Project timeframe for research projects should correspond with the goals of the project. However, the upper end of the project time limit is 3 years.

Eligible Budget Items

Budget and Match

- Cash and in-kind match is not required but is one criterion against which the project will be judged. Preference will be given to projects with the most robust research plan. Therefore, leveraging funds and indicating matching resources can result in higher scores.
- Appropriateness and scale of budget, including research personnel time and indirect costs, will be evaluated.

The following cannot be funded:

- Endowments, deficit financing, building programs, annual giving, direct mail fund raising, or venture capital.
- Mitigation activities.
- Political lobbying.
- Reimbursement for a project that has been completed or materials that have been purchased.

Application, Review, Decision, and Award Processes

Application Process: Applicants must submit proposals using our Online Application System, found at http://www.cbtrust.org/restorationresearch by **5:00 pm on February 20, 2017**. Late applications will not be accepted and the **online funding opportunity closes promptly at 5:00 pm**. **Applicants are strongly encouraged to submit at least a few days prior to the deadline** given potential for high website traffic on the deadline date. The Trust cannot guarantee availability of technical assistance for your online application on the deadline date.

Review Process: Applications will be disseminated for peer review between February 20, 2017, and March 20, 2017. By March 20, 2017, applicants may be provided with a set of questions from a first round of proposal review. Applicants must make a representative available to answer reviewer questions on April 13, 2017, (12 pm to 1 pm) either in person at the Chesapeake Bay Trust office (60 West Street, Suite 405, Annapolis, Maryland) or by phone. The date and time are subject to change.

Decision Process: Awards will be announced in May 2017. All applicants will receive a letter stating the funding partnership's decision. An application may be declined, partially awarded, or fully awarded. The Trust and funding partners may request that applicants include additional collaboration with other applicants prior to receiving the award.

Award Process: If approved, the Trust will send an agreement letter with award conditions and due dates of status and final reports. In the agreement, awardees will agree to:

- Disseminate research results in annual training sessions for regulators/policy makers (one per year during the award period as well as the year immediately following the award period upon conclusion of the work);
- Provide the Trust with the research data produced as part of this award. Agreements shall specify the data to be delivered and delivery schedules for the data. The timeframe for data delivery may be up to one year from the completion of the work and may be made publically available for use; and
- Commit to submit one or more publications as a result of the work to a peer reviewed scientific journal.

In cases in which the awardee fails to submit a status report or final report by the due date, the Trust reserves the right to terminate the agreement and require a refund of funds already transferred to the awardee. When the project is complete, awardees are required to complete final reports, including submission of all invoices, receipts, and timesheets, if staff time is used. Organizations with outstanding final reports will not receive additional awards.

Contact

For technical assistance with projects, please contact: Sadie Drescher at 410-974-2941 ext. 105 or sdrescher@cbtrust.org

Proposal Instructions

When completing the online application, you will be asked for the following information:

Project Title: List the title of your project

Organization Information

1) Organization Name
2) Address and Phone Number
3) Mission of Organization
4) Organization Type
5) Employer Identification Number (EIN) and DUNS number if for-profit entity

An Executive Officer and Project Lead must be identified for all proposals and must be different individuals. Both individuals must be staff or board members of the applicant organization.

Executive Officer of Requesting Organization: Name, Title, Address, Phone, and E-mail

Project Lead: Name, Title, Address, Phone, and E-mail

Award Information:
1) Amount of funding requested
2) Award Period: enter project start and end dates
3) In which county will the project be located?
4) In which stream, river or watershed will the project be located?
5) Latitude and longitude (in decimal degrees) representative of project site(s)

Project Abstract
In a text box, you will be asked to provide a brief (3 to 4 sentences) summary of the project, including details such as type of project and main objectives, including hypothesis to be tested.

Project Timeline
You will be asked to complete a table listing major project tasks, with start and end dates.

Project Deliverables
You will be asked to fill in estimated deliverables for a variety of metrics. Disregard any deliverables that do not apply to your project.

Project Partnerships and Qualifications
You will be asked to complete a table listing all project partner organizations, individuals, their areas of expertise, and their role in your project. Applicants are encouraged to upload a letter of support for the project from each partner outlining the partner's project role. Letters may be added to the Project Narrative File or uploaded as an attachment.

Project Narrative Upload
Answer the project narrative questions and upload the MS Word or PDF file. The project narrative should not exceed seven (7) pages of text. We recommend that you copy and paste the questions to use as an outline in the project narrative to demonstrate that the narrative addresses all questions. You may add photos, letters of support, and other materials to support your project proposal as additional file attachments.

Project Narrative Questions:

1. Key Restoration Question(s): Articulate the key restoration question(s) your project will address. Reference the question number listed in the Request for Proposals (1-8).

2. Introduction and Brief Literature Review. Please discuss the background of the hypothesis you will be testing, including other relevant studies (peer-reviewed and gray literature) and their findings. How does your work build on previous activities? How does your proposed project advance the knowledge to the next level?

3. Methodology: Provide a description of the experimental design in narrative form as well as in tabular or graphic form. Describe your methodology, including identification of sampling sites (if applicable), sampling regime (if applicable), sample size, parameters measured, and statistical analyses to be used.

4. Requesting Organization and Qualifications: Briefly describe your organization. Describe the experience of your organization, the staff selected in your organization to perform this work, and the contractors selected to perform this work.

5. Transferability: Explain how you plan to disseminate the information (above and beyond the required participation in regulatory/policy-maker workshops described earlier).

6. Regulatory Support: Describe the regulatory support for your project plan, project site(s), and proposal, as appropriate.

7. Conflict of Interest: Projects in which there is independence between the lead investigator(s) and other phases of the project (e.g., design, build, monitor, maintain, etc.) will be ranked highest. Independence is defined as lack of involvement of the investigator(s) proposed here and the design or construction of the project(s) to be used to answer the questions in this study. Please describe any connections your project team has with the design, construction, and/or funding of the restoration project(s) that could impact *or be perceived to impact* the results and their use.

Budget Upload

You will be asked to upload your budget using the Chesapeake Bay Trust Application Budget Form, an excel file template. The template is available in the online application and can be found by visiting www.cbtrust.org/forms where you click on “Budget Forms” and then the "**Application Budget Form Spreadsheet**."

- Please be as detailed as possible.
- For any staff cost requests, list the percentage of overall time devoted to the project by each staff member in the budget item column. It is expected that all personnel included in budgets will be directly involved in the research conducted under this program. Requests that do not include full justification for personnel involved may not be fully funded.
- Matching/leveraged resources are encouraged. Please indicate whether each match entry is applied for, pledged, or in-hand. Indicate in the narrative whether your organization has requested financial support from any other sources for the project not listed as match in the “Application Budget Form.”

Budget Category Information

This final online award program component will ask applicants to enter budget category totals. These totals will be automatically calculated in the Application Budget Form**.** Finally, check that the project total you entered earlier in the application is correct.

Use the “Additional Budget Justification” section in the online application to justify and explain costs. Budgets that are detailed, justified, and itemized are ideal.

The body of work described in your proposal should be able to be accomplished with the resources requested in your budget. If the success of the work is contingent upon award of other funds, please make this clear in your budget justification section.