Restoration Research
Application Package

www.chesapeakebaytrust.org / 410-974-2941

AT A GLANCE

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

Workshop
January 12th from 1-3 pm
Patuxent Research Refuge

Deadline
5:00 pm, March 10, 2016

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

Background and Goal of the Program

The Chesapeake Bay Trust (the Trust) and the Maryland Department of Natural Resources announce a request for proposals for its 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 research 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

Workshop Opportunity
A workshop at which the research questions will be discussed and questions from potential applicants will be answered will be held January 12th from 1-3 pm at the Patuxent Research Refuge located at 10901 Scarlet Tanager Loop, Laurel, Maryland.

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

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" section on the research program's webpage.

Key Restoration Questions and Methodological Guidance

Members of the regulatory and restoration communities 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).

The following nine research questions are organized into these three themes:

- Effectiveness at accomplishing water quality and habitat goals;
- Iron precipitation; and
- Stability.

Key Restoration Questions and Methodological Guidance

A. **Effectiveness at accomplishing water quality and habitat goals –** Watershed/catchment-scale effects of restoration practices:

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?

   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 TN, TP, 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. 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.

B. **Effectiveness at accomplishing water quality and habitat goals –** Differences among stream restoration techniques:

4. What is the impact on nutrient and sediment loads (flow and concentration) and/or habitat and biological factors of different stream restoration approaches 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), keeping site conditions constant?

   Possible Elements of the Experimental Design: Compare TN, TP, and TSS load reductions and/or fish abundance, macroinvertebrate presence, and/or other biological factors (at enough sites to capture the variability) across 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). The most robust analyses will be facilitated by using paired control and experimental (before and after the restoration activity) sites.

Methodological Guidance for Question 4

- Preference will be given to studies that compare across stream restoration techniques or changes in function (e.g., degree of floodplain reconnection) rather than simply producing values for one stream restoration technique.

- The strongest proposals will use paired series (Osenberg, et al., 2006) 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.
- Experimental BACI designs in which researchers collaborate with existing planned restoration projects and their leads are the most ideal. Descriptive studies that rely on existing completed projects will also be considered.

C. **Effectiveness at accomplishing water quality and habitat goals –** Trade-offs and creating net ecological uplift:

5. Trade-offs – Do different design approaches result in a net ecological benefit considering all resources potentially impacted (nutrients, sediment, habitat, hydrology, and biological resources) relative to pre-project conditions? To answer this question, trade-offs (reductions in functions vs. increases in functions) would be considered. Are we maximizing certain benefits at the expense of other benefits?

   Of particular interest are trade-offs concerning trees. Certain 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.

   Possible Elements of the Experimental Design: Measure water quality (e.g., TN, TP, and TSS load reductions) and habitat benefits, (e.g., any increases in bird, macroinvertebrate, fish populations or diversity) of a restoration approach (with appropriate site replication) and the negative impacts of the restoration (any water quality impacts, loss of buffering capacity, habitat losses of forest canopy, loss of forage, temperature impacts of removing trees, etc.). Subtract benefits from negative impacts to identify a net ecological change.

D. **Effectiveness at accomplishing water quality and habitat goals –** Effects of site condition on outcomes of stream restoration technique(s):

6. What is the impact of site condition (such as land use, % impervious cover, watershed condition, existing habitat, and/or valley type) and/or watershed position (headwaters vs. downstream near the receiving waters) on the nutrient, sediment, habitat, and/or biological impacts of stream restoration approaches that aim for different function (e.g., floodplain reconnection, frequency of inundation, bank stabilization, etc.) or that use different techniques (e.g., RSC, NCD, stream valley restoration/legacy sediment removal)?

   Possible Elements of the Experimental Design: Keeping restoration technique constant, compare TN, TP, and TSS load reductions accomplished across a range of % impervious cover of the drainage area.

Methodological Guidance for Question 6

- Preference will be given to studies that compare the factors within stream restoration techniques or changes in function (e.g., degree of floodplain reconnection) unless you have a large enough sample size to test the site condition factors across multiple stream restoration techniques.

- Factors pertaining to site condition to be included in the experimental design must be clearly articulated and a justification provided for their selection. Potentially confounding factors must be considered. Additional factors can be added as sample size allows. Any factors that are not explicitly included but that are hypothesized to be important must be articulated in the proposal and kept constant in the experimental design.
- The most robust analyses will be facilitated by using paired control and experimental (before and after the restoration activity) sites to generate load reductions in which temporal variability is factored out of the findings. Experimental BACI designs in which researchers collaborate with existing planned restoration projects and their leads are the most ideal. Descriptive studies that rely on existing completed projects will also be considered.

E. Iron precipitation

7. Iron can occur naturally in the soil and the groundwater. Some hypothesize that restoration practices can lead to precipitation of iron compounds. What stream restoration techniques are associated with increases in iron concentration in the surface water or sediment and how long do any increases persist? What is the impact of the iron on biological resources? Does the iron originate from the materials brought on site for stream restoration or does the iron originate from natural sources?

   Possible Elements of the Experimental Design: Measure iron precipitate in a subset (a large enough sample size to capture variability) of restoration projects 1 to 2 years post construction, a subset of restoration projects 1 to 6 months after construction, and a subset of non-restored sites. Measure one or more biological factors (e.g., macrofaunal abundance) and regress against iron precipitate concentrations observed in the streams. Measure iron content of restoration materials used and regress against iron precipitate concentrations observed in the streams. Conduct laboratory experiments to test effects of field concentrations on biota.

F. Stability of stream restoration practices and elements of 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.

8. How well can various modelling approaches predict the structural "success" or "failure" for the various stream restoration techniques and structures? What variables must be included in the models to make accurate predictions for stream restoration "success" or "failure" at the site?

   Possible Elements of the Experimental Design: Compare 1D and 2D model predictions with real life "success" or "failure" (i.e., degree of sediment movement, degree of loss of materials), including enough replicate study sites to capture variability.

9. What are the flow conditions under which different in-stream channel structures (e.g., vanes, step pools, constructed riffles, large woody debris) or approaches (e.g., RSC, NCD, stream valley restoration/legacy sediment removal) function and remain stable? What are the energy tolerances beyond which the structures or approaches begin to fail?

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" % in change in cross section occurs.

Methodological Guidance ***for All Projects***

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 nine RFP research questions.
- Contain **robust and scientifically defensible methods**, including a justification of sample size to be used given existing spatial/temporal variability.
- 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 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; and
- Stated willingness and plan to submit data to the Trust and partners no later than one year from when the data was compiled.

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 $550,000 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.

Review and Selection

The Trust evaluates each proposal on a case by case basis. Funding partners reserve the right to fund projects and budget items that advance their mission and meet their specific priorities and criteria. The Trust and funding partners may request that applicants include additional collaboration with other applicants prior to receiving the award.

Successful awardees will be asked to sign an agreement, in which the awardee agrees to:

- Disseminate research results in annual training sessions for regulators/policy makers (one per year, which could include the year(s) immediately following the award period);
- 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.

Contact

For technical assistance with projects, please contact: Sadie Drescher at 410-974-2941 ext. 103 or sdrescher@cbtrust.org

Application Submission Instructions and Deadlines

Applicants must submit proposals using our Online Application System, found at http://www.cbtrust.org/restorationresearch by **5:00 pm on March 10, 2016**. 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.

Awards will be announced in May 2016.

All applicants will receive a letter stating the funding partnership's decision. An application may be declined, partially awarded, or fully awarded. If approved, the Trust will send an agreement letter with award conditions and due dates of status and final reports.

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.

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)

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, for example square feet of impervious cover treated, number of trees planted, square feet of riparian buffer restored, etc. Disregard any deliverables that do not apply to your project.

Volunteer Involvement

Indicate the number of volunteers that will be involved, the total number of volunteer hours, and a description of volunteer activities. Disregard volunteer involvement if this does 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 (1-9).

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: 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**."

- 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.

References

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.