

ESF Restoration Science: an adaptive applied science strategy for delivering skilled professionals, philanthropy, and public support to rebuild our natural heritage

(1) A description of the discovery opportunity. Degraded ecosystems are a substantial global challenge and a stark reality of long-term neglect in the Anthropocene. So why are we optimistic? With the ecological, environmental, social, and economic service potential in our natural and built landscapes, an untapped transformation awaits through comprehensive restoration. The ESF Restoration Science Program (RSP) seeks to lead a hands-on transdisciplinary restoration effort to regain ecological function from degraded systems and rebuild our natural heritage using adaptive methodology and science. Through completion and study of a network of noteworthy demonstration projects, designed to bring back lost and damaged ecological gems for societal benefit, ESF will serve as the catalyst for positive grassroots change while training the next generation of environmental leaders.

PROGRAM MODEL: Our proposal draws on the expertise at ESF in integrating student education with public and private partnerships to restore degraded aquatic and terrestrial ecosystems. As part of this effort, we will develop new degree and certificate programs. We propose to: 1) select demonstration projects, 2) lead work with community groups and partners, 3) build research and monitoring programs, 4) use demonstration projects as the basis for new academic programs where students under guidance of coordinators (faculty and hired professionals) will engage in service learning, and 5) use program products (data, restored sites, science and management outcomes) to generate a restoration science information base. Our proposal expands geographically and thematically on ongoing restoration programs envisioned as a participant network of activities. Examples include ESF's Fish Habitat Conservation Strategy (FHCS), a multi-agency and non-government (NGO) partnership operated by the Thousand Islands Biological Station that led to an expansive and diverse set of restoration projects in the St. Lawrence River ecosystem. The FHCS effort is guided by adaptive research and management and has informed policy makers (e.g. Great Lakes Fishery Commission, DEC, USFWS and the International Joint Commission). The FHCS has provided extramural support to ESF (~\$5M) and training for undergraduate and graduate students and post-doctoral fellows. Other team project examples include: restoration and monitoring of Onondaga Lake; ecological assessments of restoration at the Montezuma Wetlands Complex; partnerships with stakeholder agencies to identify water stress indicators for riparian woodlands to support implementation of California's Sustainable Groundwater Management Act (The Nature Conservancy); critical habitat for TES species (U.S. Department of Defense); research and development of remediation of industrial sites with willow biomass (Honeywell, Inc.); assessing past and future priority planting strategies for NYC Parks and Recreation and the USDA Forest Service in the Bronx.

(2) A description of undergraduate and graduate programs that will be impacted including new degree programs, and how these new programs will better position ESF students for career advancement and leadership in environmental science, practice and policy. We propose a progressive model of collaboration that incorporates academia into the process of restoration. A new undergraduate Restoration Science degree program will enhance existing graduate degree programs in Ecosystem Restoration (GPES), and establish a new certificate program through the Society of Ecological Restoration (SER), a professional society dedicated to global environmental improvement. Certification programs will be delivered to provide training to agency, consultant and industry employees and would maintain standards set by the SER

(<https://www.ser.org/page/Certification>). Students in other ESF majors can access the RSP through capstone projects, internships and in undergraduate and graduate research opportunities. The RSP will attract students from the US and internationally to receive state-of-the-art training in applied restoration science. Demonstration projects build on the FHCS with a network of existing faculty initiatives from local to international scales that provide a living laboratory for holistic transdisciplinary approaches in restoration with potential for participation by all ESF units.

Our intent is to train young professionals to move seamlessly from academic to professional careers while attracting community and philanthropic support through highly-visible restoration projects

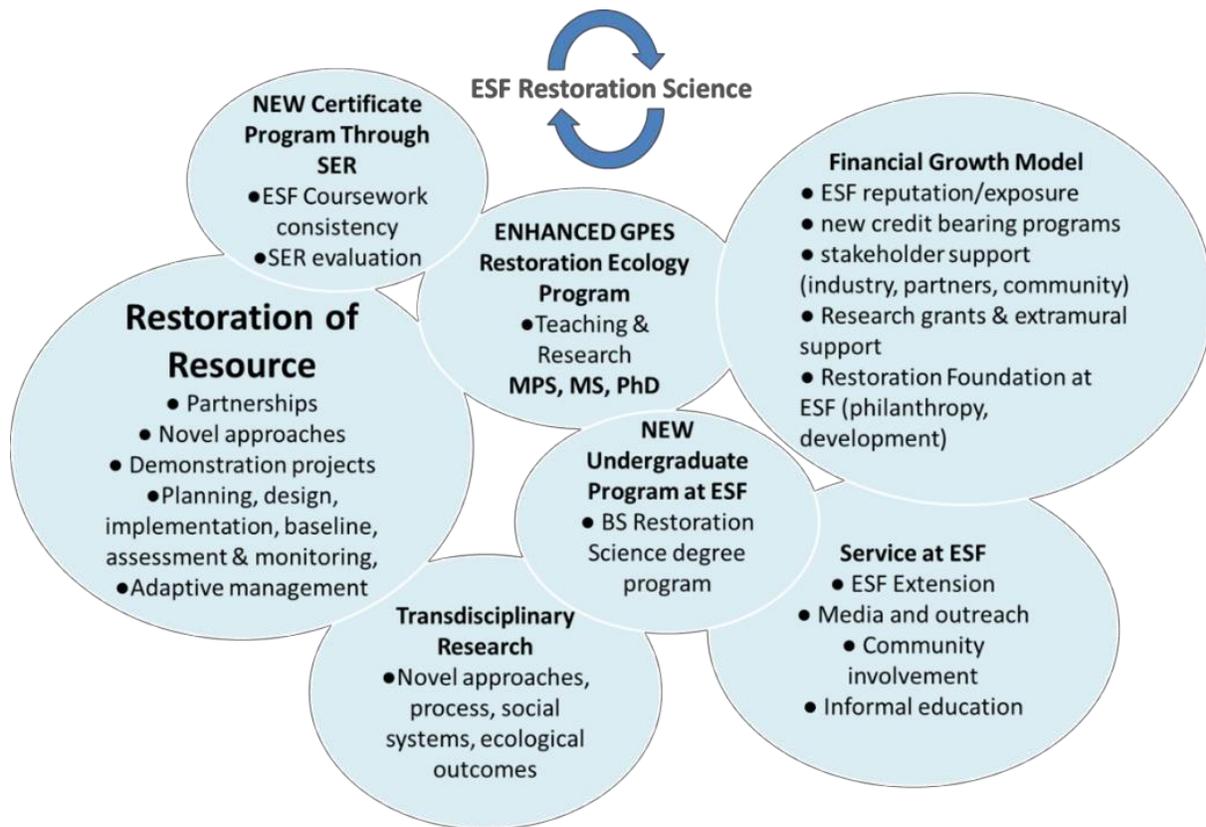


Figure 1. Program relationships leading from the primary goal of environmental improvement (restoration of the resource) with education, science, and service (ESF and partners).

(3) A list of agencies, partners, and funding entities either currently or anticipated to be interested in funding research, education, and outreach projects in the initiative area. Funding sources exist at multiple levels, including increased student enrollment in the new undergraduate, graduate and SER certificate programs, extramural grants for restoration activities and research, philanthropic gifts, and industry support. Over \$3T is invested in restoration globally. The North American Wetlands Conservation Act has funded \$1.6B in restoration projects. Numerous regional funding sources are focused on environmental restoration such as the \$475M Great Lakes Restoration Initiative, the \$26M Fish Enhancement Mitigation and Research Fund, and the \$16M Habitat Enhancement and Restoration Fund.

Numerous companies, the Department of Defense and other public agencies need green solutions to resolve environmental issues. **PARTNER LIST (examples):** NYSDEC, NYSDOH, USFWS Partners for Fish and Wildlife Program, USDA-NRCS, USDA-FS, USGS, USFS, Ducks Unlimited, EPA, The Nature Conservancy, Trout Unlimited, Cornell University Biological Field Station. **FUNDING LIST (examples):** Moore Charitable (Louis Bacon), Waterfowl Research Foundation, Campfire Club, WWF, individual donors, Honeywell, Cargill, Constellation NRG, State & Federal agencies.

(4) A description of how the initiative will expand current or create new partnerships with other academic, government, and private organizations. Restoration by its nature requires actively engaged partnerships to achieve desired outcomes. Students in the program will benefit greatly from interactions with state and federal agencies, NGOs, other universities, and community stakeholders. A nucleus of scientists and practitioners exists in Central New York and beyond and can participate in the program at a variety of levels. With partners, we envision culturing funding, logistical support, hands-on learning experiences for students. Agencies will engage with regulation, management and permitting of program activities. In the private sector, industry partners seeking to improve the environment or meet regulatory requirements would be sought for support and active participation.

(5) A description of how the initiative will increase the use of ESF assets especially properties beyond the Syracuse main campus. Because restoration represents the ‘acid test’ for ecological theory, the cascading and complex influences of restoration can serve as a science laboratory for our students and faculty contributing advancement and knowledge to this exciting and growing field. We will apply iterative, adaptive management models to discover underlying ecological and social mechanisms and their implications to society by using ESF CORE facilities, laboratories (such as ESF’s Center for Research and Teaching in Aquatic Sciences, CIRTAS) and field stations (especially the Cranberry Lake Biological Station, Thousand Islands Biological Station, and the Onondaga Lake Science Center, as well as other ESF properties).

(6) How the initiative will inform policy decisions, enhance ESF’s reputation, and have a global impact. The applied nature of restoration, with focus on real-world problems and their solutions, is of global significance and provides the information base for policy making. The direct link with management agencies creates opportunities for rapid information transfer to policy through what is learned from demonstration projects. We will work closely with the SER, with its international focus as a professional home, along with numerous other national and international partners leading to greater prominence of ESF.

(7) A description of new investments (including new faculty hires & support) to move the initiative forward over a 3-year period leading to financial sustainability by year four. We envision hiring two program coordinators at the Senior Research Support Specialist level, one to assist with laying the groundwork in restoration planning and implementation, including development of partner relationships, and a second to establish curricular and program elements. We also plan to hire web and media design personnel on contract items and support several undergraduate and graduate students as part-time staff/interns. We need dedicated access to ESF development office personnel. New faculty hires in stream ecology and restoration ecology are needed that could be filled to support new degree programs and in the RSP.

Team Information: Project Co-leads; Michael L. Schummer (585) 319-6763; mkschumm@esf.edu; John M. Farrell (315) 243-5978 jmfarrell@esf.edu; **Current members:** Donald J. Leopold (EFB); Chuck Kroll (ERE); John Stella (FNRM); Timothy Volk (FNRM).

Species and Ecosystem Restoration Science Center (SERSC): Transformative research coupled with an experiential degree program for our changing world (Farrell, Powell, Fernando, Leopold, Schummer, Stella, Volk, Ettinger, Kroll, Parry, McGee)

1. Project feasibility statement containing two key items

(A) Description of the initial start-up of the project: As per the request of the Discovery Grant Committee, the SERSC combines our two synergistic pre-proposals to integrate novel restoration science with a transformative academic program through a transdisciplinary and multiscale approach. It capitalizes on the successes of current participants and enables inclusion of all academic departments on campus which are directly and indirectly engaged in restoration research, education, and outreach. The SERSC will transform how students learn about ecosystem restoration science and on-the-ground delivery of restoration projects. We will increasingly and adaptively integrate research, education and outreach such that students are deeply engaged in our transdisciplinary research, and these research activities will feed directly back into the application of on-the-ground restoration projects. Initial start-up needs include hiring one Center Coordinator (research, integration of Program into research) and one Program Coordinator (curricula development, integration of students into restoration deliver) both at the level of a Senior Research Assistant, a media and web designer to market the center and program, and a Development Officer dedicated to SERSC. We expect that our planned marketing strategy and novel degree program in Restoration Science will initially attract a mix of 50 new doctoral, Master's, MPS, Honors, and undergraduate students per academic class. We further anticipate our collaborative approach to scientific inquiry will greatly enhance grant and philanthropic opportunities.

(B) How the project will grow into a substantial & self-sustaining program beyond the seed period: We are not aware of any single institution that uses the array of restoration techniques on threatened plant and animal species and their habitats that are the foundation of SERSC, and concurrently engages the number of students anticipated to participate in the academic program. We believe that our unique academic program and integrated research at the center will become a flagship, show-casing and building on the core tenets of SUNY ESF. As such, enrollment will grow to help sustain the College, and the inclusion of on-the-ground restoration projects will be self-sustaining through FTEs charged on grant projects and progressive philanthropy. Integrating research grants (e.g., NSF), foundations, and philanthropy with positive outcomes of restoration ensure the SERSC remains viable. As successes accumulate, SERSC will attract increasingly larger donors and foundations who want to support our highly innovative and comprehensive approach to improving our world. Given our positive track record of grantsmanship and culturing philanthropic relationships, this proposal is a sound investment with low risk.

2. Statement regarding how the discovery idea is transformative with both general and more specifically with respect to research and education programs at ESF: The SERSC is transformative because it deeply integrates the training of the next generation of professionals with ongoing research to deliver increasingly effective ecosystem restoration and environmental outreach. The Program is novel in that components will integrate ethics, leadership training, environmental studies, conservation biology, wildlife science, construction management, engineering, chemistry and design. Research by SERSC into restoring and thereafter conserving keystone and rare species and plant and animal diversity will link directly with the Program to deliver restoration. In turn, students will have ground-breaking knowledge transferable to careers in conservation, making ESF graduates the best-of-the-best at restoring degraded ecosystems, ensuring a healthy planet for people, and restoring ethics into how people interact with their environments.