

Report for 2003PA14B: Spruce Creek Watershed Keystone Project

There are no reported publications resulting from this project.

Report Follows

Abstract:

This proposal seeks support for a graduate assistant working with two interdisciplinary teams of graduate students and faculty engaged in a two year watershed assessment and planning practicum (Keystone Project) in the Spruce Creek watershed of the Little Juniata River, Pennsylvania. One team of eight students will be assigned to the first phase (2003/2004) and a second team of nine students will be engaged in the second phase (2004/2005). Through participation in a watershed case problem, the students will develop competence in scientific data collection techniques and problem analysis tools directed at quantifying, analyzing, and ultimately mitigating widespread types of polluted runoff. The Keystone Project will also afford the graduate assistant an enhanced education in community-based, team-oriented watershed management and will provide outreach to the host watershed community. The project itself will address water quality issues in Spruce Creek, a high quality trout stream threatened by land development, agricultural enterprises, and in-stream flow reductions from groundwater withdrawals. The entire Spruce Creek watershed is designated as a High Quality-Cold Water Fishery by the PADEP Chapter 93 Water Quality Standards. However, two major tributaries and part of the mainstream were recently listed as impaired for suspended solids by the PADEP 303(d) list, attributable to agriculture and land development activities. Watershed stakeholders are concerned that other stream segments may be impaired, and there are emerging problems with inadequate treatment of sewage effluent from on-lot systems. Data on stream flow and water chemistry are insufficient to calculate pollutant loadings as the baseline to determine appropriate reductions needed to achieve water quality standards and protect designated uses. Modeling polluted runoff in the impaired reaches will serve to target critical contributions and serve as a basis for development of a watershed restoration plan.

Project Objectives:

- a) Conduct an assessment of biophysical and cultural factors in the watershed related to protection and restoration of water quality to support designated uses and progressive land use.
- b) Analyze assessment data to identify problems and opportunities and engage a broad base of stakeholders in developing shared watershed restoration and protection goals.
- c) Produce a watershed stewardship plan responsive to those goals and that incorporates implementable recommendations and strategies for cooperative action. A model Total Maximum Daily Load (TMDL) would be prepared for the impaired reach of Halfmoon Creek.
- d) Produce a Watershed Restoration Plan for Halfmoon Creek
- e) Replicate the TMDL analysis for the second impaired tributary (Warriors Mark Creek) as a precursor for future restoration planning in that subwatershed.

Methods:

Water samples will be collected beginning August 2003 at five stations on Halfmoon Creek - three within the impaired reach, one upstream of the impaired reach, and one reference station in the upper watershed. A sampling location will also be established on an unnamed tributary, locally known as Loveville Creek. Analysis will be done for total suspended solids, total nitrogen, and total phosphorus. Runoff event samples will also be collected randomly through

the project period. Measurement of stream flow will be done concurrently using portable current meters. Pennsylvania Spatial Data land cover and other data will be retrieved and clipped using Arc-View GIS. The Keystone team and the research assistant will be engaged in organizing a series of community stakeholder input meetings. A day-long watershed planning workshop of experts will be convened in Spring 2004 to review and critique the proposed pollution abatement recommendations developed by the student team and to develop strategies for implementation of management practices. These recommendations would be presented at a public forum at the completion of the first phase of the Keystone Project in April 2004. The graduate research assistant funded by this proposed grant would have lead responsibility of communicating the data findings and the analysis to layperson and technical audiences at the various forums and workshop and in direct meetings with private landowners and representatives of collaborating agencies involved in implementation of watershed restoration practices.

Over the summer, 2004, the graduate assistant will be involved in digitizing site maps and coordination with landowners and partner organizations relevant to a site specific restoration plan for Halfmoon Creek. Beginning in the fall 2004 semester, the full student team will commence work on a more extensive assessment and field data collection at a number of sites throughout the Spruce Creek. Methods will include an IBI, Rapid Bioassessments, electrofishing, Arc-View GWLF modeling and a variety of other data collection and analytical tools. The team will also work in collaboration with watershed stakeholders to define task areas that would be supportive of an emerging community-based watershed protection and restoration program in the Spruce Creek watershed. The 2004/2005 team will utilize a similar schedule of planning workshops and meeting and produce a report document and community presentation in April 2005.

Statement of Critical Need:

Spruce Creek is a nationally recognized trout fishery potentially threatened by residential and commercial land development pressure, a variety of agricultural enterprises, and in-stream flow reductions from groundwater withdrawals. The entire Spruce Creek watershed is designated as a High Quality-Cold Water Fishery by the PADEP Chapter 93 Water Quality Standards, which mandates special protection under the “non-degradation” criteria of the Federal Clean Water Act. However, a 1.4-mile reach of Halfmoon Creek, a major tributary, a 16 mile segment of Warriors Mark Run, and two miles of the main stem of Spruce Creek were recently listed as water quality impaired for suspended solids by the PADEP 303(d) list, attributable to poor livestock pasture management practices at several beef cattle, dairy, and horse stable operations and to residential land development activities. There are concerns among watershed stakeholders that other stream segments may be similarly impaired, or are becoming so, as well as emerging problems with excessive nutrient loadings and pathogens associated with inadequate treatment of domestic sewage effluent from on-lot systems. Quantitative data on stream flow and water chemistry are insufficient to calculate current pollutant loadings as the baseline to determine appropriate reductions required to achieve water quality standards and protect designated uses. Despite deep-seated concerns about future water resources trends and strong motivation among stakeholders to protect the water resource and fishery, there is a lack of a cohesive watershed initiative grounded in the community or collaborative approaches and restoration strategies and programs in place to address the problem.

Statement of Results or Benefits:

We will produce a watershed stewardship plan and a watershed restoration plan in two phases which are responsive to watershed residents' goals and incorporates implementable recommendations and strategies for cooperative action. Deliverables at the conclusion of the Keystone Project in May 2005 will include: printed color copies of the final plan document; CD-ROM files of all related work products such as public meeting information and educational display posters and digital presentations, GIS data layers, field data, and relevant analyses used on specific assessment topics; documentation of community focus group sessions, planning meetings and workshops to develop management recommendations and; a model TMDL prescription for suspended solids impairment of Halfmoon Creek in the form of a restoration plan

Nature, Scope, and Objectives of the Project, including a Timeline of Activities:

The nature and scope of the project essentially entails experiential training of graduate students in water resources disciplines through a scientific watershed assessment utilizing existing and original data and a team-based, case problem planning approach conducted in close collaboration with community stakeholders, governmental agencies, and academics. The project objectives are to: a) Collect original and existing data on water chemistry and flow, land cover and land use, aquatic biota, and other information relevant to the restoration of impaired water quality and the protection of water resources to meet designated uses in the study watershed; b) Analyze data to assess problems and engage a broad base of stakeholders in developing shared watershed restoration goals; c) Produce a watershed stewardship plan that is responsive to those goals and that incorporates recommendations and strategies for cooperative action. A model Total Maximum Daily Load (TMDL) prescription would be prepared for the impaired reach of Halfmoon Creek; d) Produce a Watershed Restoration Plan for Halfmoon Creek; and, e) Replicate the TMDL analysis for the second impaired tributary (Warriors Mark Creek) as a precursor for future restoration planning in that subwatershed.

Timeline of Major Project Activities:

March 2003	Initiate on-going water sampling and flow measurements; retrieve existing data from DEP, EPA Mid-Atlantic Assessment, and other sources.
April 2003	Establish working group of community stakeholders and involved agency staff.
June 2003	Commence organization and scheduling watershed stakeholder meetings.
Aug. 2003	Commence Keystone Project practicum, (Fall semester, "Assessment"). Semester objective is to produce a quantitative and qualitative assessment of watershed conditions with particular emphasis on the range of pollutant loadings causing water quality impairment and probable sources.
Dec. 2003	Draft Watershed Assessment Report complete
Jan. 2004	Keystone Project practicum (Spring semester, "Analysis and Planning"). Semester objective is to engage students, faculty, agency and university

	technical advisors in analysis of assessment findings and development of management recommendations.
March 2004	Planning Workshop Format involves expert critique and refinement of proposed management strategies and recommendations to be included in Watershed Stewardship plan. A TMDL proposal for impaired stream segment will be a primary plan element.
April 2004	Delivery of completed plan to watershed stakeholders and working group. Deliverables include printed and digital versions with supporting data, a public presentation of recommendations, and educational outreach materials generated to assist in implementation by local sponsors.
May-Aug. 2004	Base mapping and field evaluation of non-point contributors. Identification and access agreements with landowners. Restoration Plan coordination with partner agencies and organizations.
Fall 2004	Assessment phase-qualitative and quantitative characterization of surface water, groundwater, and other resources. Interaction and input with community stakeholders on implementing restoration/protection practices and programs.
Spring 2005	Analysis and plan development
April/May 2005	Results and findings presented to watershed stakeholders. Recommendations for actions.

Methods, Procedures, and Facilities:

Water samples will be collected beginning August 2003 at five stations on Halfmoon Creek, including three stations within the water quality impaired reach, at one station upstream of the impaired reach, and at one reference station in the upper watershed. A sampling location will also be established on an unnamed tributary, locally known as Loveville Creek. Analysis by standard methods will be done for total suspended solids, total nitrogen, and total phosphorus by the Water Quality Laboratory at the Penn State Institutes for the Environment. Samples will be routinely collected approximately monthly during the project period. Runoff event samples will also be collected randomly through the same time period. Measurement of stream flow will be done concurrently with water quality sampling using portable Price-type current meters. These data are essential in determining the magnitude of pollutant loading to the impaired tributary and receiving stream and enabling the development and implementation of abatement measures. Once the baseline monitoring network is in place, ongoing data collection will be useful in evaluating the accuracy of the pollutant reduction formula and the effectiveness of management practices. Existing published reports and field data from state, federal, county and local agencies will be acquired for background information. Pennsylvania Spatial Data (PASDA) land cover and other data will be retrieved and clipped to the Spruce Creek watershed in the CWS Arc-View GIS lab. The Keystone Team and the research assistant will be engaged in organizing a series of community stakeholder input meetings. A day-long watershed planning workshop of invited experts will be convened in Spring 2004 to review and critique the proposed pollution abatement recommendations developed by the student team and to develop strategies for implementation of management practices. These recommendations would be presented at a public forum at the completion of the first phase of the Keystone Project in April 2004. The graduate research assistant funded by this proposed grant would have lead responsibility of communicating the

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This project will occur under the sponsorship of the Center for Watershed Stewardship at Penn State University. Penn State is the land-grant institution for Pennsylvania and has a full set of facilities available for our use (library, computing, water analysis laboratories, dry and wet lab space, office space).

Principal Findings and Significance:

Water quality data and modeling (ARC-View GWLF) on the impaired segment of Halfmoon Creek reconfirmed the 2002 designation by PA DEP on the 303(d) list of impaired waters due to sediment. Further, our water quality/stream flow data indicates that Nitrogen (N) exceeds EPA-recommended levels at all stations, at all flows (base, median, and flood event) and that Phosphorus (P) and Total Suspended Solids (TSS) exceed recommended levels during flood events, and with few exceptions, during median flow periods. Similarly, a fish species Index of Biotic Indicators, macroinvertebrate collection and electrofishing indicated a dominance of generalist feeders tolerant of pollution. Although wild brown trout were collected at all stations on Halfmoon Creek, young of the year were found at only one station (HM-5) near the junction with Spruce Creek.

The significance of these findings is that a more extensive biological degradation of Halfmoon Creek exists than is reflected in the 1.4 mile segment presently identified on the 303(d) list as not meeting the HQ Cold Water Fishery designation criteria of being capable of maintaining a self-reproducing trout fishery. A restoration plan for Halfmoon Creek to be undertaken in the second phase of the Keystone Project partially funded by the USGS grant is expected to begin to mitigate the environmental conditions causing the stream's impairment.

The project has also raised stakeholder awareness of watershed stewardship issues and has served as a catalyst for the formation of a steering committee of watershed residents interested in organizing a Spruce Creek watershed group. The various public meetings, planning workshop, community presentation and open house, had a direct positive influence in stimulating a broader

engagement of community stakeholders and the participation of governmental entities in addressing restoration and protection of the Spruce Creek watershed.

Students Supported:

Cristina Maria Torres, a MS candidate in Environmental Pollution Control, was directly supported in her thesis research with assistance in field data collection by her Keystone Project peers. Her analysis contributed significantly to the findings described above. Seven other master's students in Landscape Architecture, Ecology, and Forest Resources degree programs received training through their participation in the Keystone Project.

Presentations and Other Information Transfer:

Students made public presentations at three public meetings during the assessment phase, a day-long planning workshop held in March 2004, and a concluding presentation for the first year held in April 2004. The format of the latter included a "poster session" at topical stations, e.g. Groundwater Resources, involving seven large format color posters describing assessment findings, watershed management issues, and recommended strategies and programs for stewardship of the watershed's environmental and cultural assets. Representatives of various public and private entities participated in the open house with displays and handout educational materials to inform watershed residents of available programs and resources to assist local efforts. Participants include Penn State Cooperative Extension, PA Master Well Owners Network, Centre County Conservation District, and Juniata Clean Water Partnership.

A Spruce Creek Watershed website was created by a Keystone Project team member to facilitate communication and information exchange among people and organizations involved in protection and management of the watershed.

Awards:

None