Report as of FY2006 for 2006WI136B: "Assessing the Ecological Status and Vulnerability of Springs in Wisconsin"

Publications

Project 2006WI136B has resulted in no reported publications as of FY2006.

Report Follows

Annual Progress Report

Reporting Period: 7/1/2006 - 6/30/2007

Submitted By: Susan Swanson
Submitted: 6/8/2007

Project Title

WR05R004: Assessing the Ecological Status and Vulnerability of Springs in Wisconsin

Project Investigators

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Progress Statement

The need for a clear understanding of the physical and ecological status of springs in Wisconsin provides the overall motivation for this project. The topic is relevant because the State has taken steps to protect springs that result "in a current of flowing water with flows of a minimum of one cubic foot per second at least 80 percent of the time" (2003 Wisconsin Act 310, p.2), and the Wisconsin Department of Natural Resources (WDNR) is charged with evaluating impacts to these springs that may result from groundwater pumping by high-capacity wells. We hope to provide a mechanism to evaluate impacts and provide feedback to the question of whether springs covered under Act 310 are sufficient to protect the range of Wisconsin's spring resources.

The project includes cataloging historical and existing spring resources in Iowa and Waukesha Counties using a geographic information system (GIS) and characterizing a subset of springs in the two counties using a comprehensive springs classification system in development by Springer et al. (in prep.). This information will be used to develop typical hydrogeological conceptual models and associated descriptions of typical ecological characteristics of springs in each region.

Spring Surveys
Property owners for 271 of 406 historical springs in Iowa County were identified. We confirmed that approximately 185 of these springs persist in some form today. Conversations with property owners and observations in the field suggest that many other springs were not historically mapped, but do exist in Iowa County. Of the 185 springs for which locations were confirmed and access granted, a total of 24 springs were surveyed for the full suite of hydrological, physicochemical, and ecological characteristics included in the Springer et al (in prep.) classification system. These springs were selected on the basis of their proximity to major stratigraphic contacts; their elevation, slope, and aspect; and their geographic position within Iowa County. Only five of the springs are located on public lands. Most of these surveys were conducted in June 2006, and they were completed by early July 2006.

Property owners for 186 of 265 historical springs in Waukesha County were identified. Up to 65 of these springs may persist in some form today; however, actual confirmation of spring locations proved to be much more difficult in Waukesha County. Conversations with property owners and observations in the field suggest that many of the properties that historically contained springs have been developed for residential or commercial purposes. Ponds have also been created on at least six of the

properties that once contained distinct springs. A total of 20 springs in Waukesha County were surveyed for the full suite of hydrological, physicochemical, and ecological characteristics included in the Springer et al (in prep.) These springs were largely selected on the basis of property access permission and, to some degree, the geologic setting and geographic distribution within the county. For example, half of the springs surveyed in Waukesha County are located on public lands. Spring surveys were conducted in July and August 2006.

We also completed an entire year of monitoring at three additional springs in Iowa County. Two of the springs are located in northern Iowa County, one near Highland and the other near Otter Creek. The other spring was monitored as part of a complementary geological study being conducted by the Wisconsin Geological and Natural History Survey; it is located in Governor Dodge State Park. The springs occur at different stratigraphic positions, elevations, and aspects. They also vary in terms of their level of disturbance. The springs were sampled on a bimonthly basis for the full suite of hydrological, physicochemical, and ecological characteristics included in the Springer et al (in prep.) classification system. Flow was measured on a monthly basis. Monitoring events took place in 2006 on Jan. 31st/Feb. 1st (full suite), Feb. 22nd (flow), March 9th (full suite), April 22nd (flow), May 24th (full suite), June 13th (flow), July 6th (full suite), August 16th (flow), September 24th (full suite), October 25th (flow), November 19th (full suite), and December 30th (flow), and on January 15th in 2007 (flow).

Progress continues on the analysis of physiochemical and biological data collected during during the spring surveys. This information is being used to develop typical hydrogeological conceptual models and associated descriptions of typical ecological characteristics of springs in each region.

References:
Springer, A.E., Stevens, L.E., Anderson, D.E., Parnell, R.A., Kreamer, D.K., and Flora, S.P., in prep. A comprehensive springs classification system: integrating geomorphic, hydrogeochemical, and ecological criteria, in Stevens, L.E., and Meretsky, V.J., eds., Every last drop: ecology and conservation of springs ecosystems in North America: Tucson, AZ, University of Arizona Press.

Impacts

Description

• Application(s) – The springs database for Iowa and Waukesha Counties is currently being used to characterize the physical and ecological status of spring resources in each county. In the future, we hope that the database and approach will serve as a working model for environmental assessments of spring resources elsewhere in the State.

• Impacts – The spring surveys that were conducted in Iowa and Waukesha Counties in June and July, 2006 are the first attempts to survey spring resources in these regions since 1959. A total of 27 springs were surveyed in Iowa County, and a total of 20 springs were surveyed in Waukesha County.

• Benefits – The physical, biological, and sociocultural data that have collected will allow us to make assessments of the physical and ecological status of typical spring systems in each county. This is a critical first step in assessing vulnerability to groundwater pumping because it provides baseline conditions to which changes can be compared. To further address the issue of vulnerability, the data we collect will allow us to formulate viable hydrogeological conceptual models of the typical spring systems in each county, which may be useful for modeling studies if high-capacity wells are proposed in the future.

Awards, Honors & Recognition

Title	Geochemical and Flow Characteristics of Two Contact Springs in Iowa County, WI
Event Year	2007
Recipient	Brandon Bartkowiak
Presented By	American Water Resources Association - Wisconsin Section
Description	Outstanding Undergraduate Presentation Award at the AWRA-WI annual meeting.

Interactions

Description A Spring Projects Coordination Group, coordinated by the WDNR, met on April 12, 2006 at the Southern District office of the WDNR. Several representatives from the WDNR also attended this meeting, which focused on providing updates on the four projects to the Groundwater Advisory Committee, which was created by 2003 WI Act 310 to make recommendations to the State Legislature regarding future groundwater management needs in Wisconsin.

Event Date 4/12/2006

Description On October 18, 2006, Sue Swanson presented preliminary results of the project to the Iowa County Board. The meeting was organized by the Wisconsin Geological and Natural History (WGNHS) to communicate the status of their ongoing geological investigation of Iowa County. We have been working closely with the WGNHS because the project complements their study.

Event Date 10/18/2006

Presentations & Public Appearances

Title An Assessment of Spring Resources in Southern Wisconsin
Presenter(s) Susan Swanson
Presentation Type Government briefing
Event Name Iowa County Board meeting
Event Location Wisconsin Geological and Natural History Survey Core Repository, Mt. Horeb, Wisconsin
Event Date 10/18/2006
Target Audience Other
Audience Size 20
Description On October 18, 2006, Susan Swanson presented preliminary results of the project to the Iowa County Board. The meeting was organized by the Wisconsin Geological and Natural History (WGNHS) to communicate the status of their ongoing geological investigation of Iowa County. We have been working closely with the WGNHS because the project complements their study.

Title Assessing the ecological significance and vulnerability of springs in southern Wisconsin
Presenter(s) Susan Swanson
Presentation Type Professional meeting
Event Name American Water Resources Association - Wisconsin Section Annual Meeting
Event Location Wisconsin Dells, Wisconsin
Event Date 3/2/2007
Target Audience Scientific audience
Audience Size 75
Description

Wisconsin's springs are generally poorly studied. However, recently conducted surveys reveal the range of geological and biological conditions associated with springs in Iowa and Waukesha Counties

and illustrate the utility of baseline information in assessing the ecological significance and vulnerability of spring systems in these regions. The two counties differ in their bedrock geology, surficial geology, and development pressures. In Iowa County, springs are associated with every major stratigraphic unit, but most commonly occur as contact springs that discharge from Ordovician Sinnipee Group rocks, near the upper contact of the Ordovician St. Peter Formation, or near the upper contact of the Cambrian sandstones. Most of the springs that were mapped by the Wisconsin Conservation Department in 1958 still persist, but many springs are impacted by agricultural practices. Spring waters can be distinguished on the basis of major ion geochemistry, and springs discharging from stratigraphically higher units tend to have lower and more variable flow.

Spring systems in Waukesha County have been compromised by urban and residential development; very few historically identified springs remain in pristine condition. Those that do remain are largely found on public lands, in or near wetlands associated with former glacial lakebeds. Major ion geochemistry is less variable among springs, and flow rates are generally low. Preliminary results show that the springs in both settings have a relatively low diversity of aquatic insects, although springs with close biogeographical relationships to receiving waters have more taxa present, including more insects.

Title	Geochemical and Flow Characteristics of Two Contact Springs in Iowa County, WI
Presenter(s)	Brandon Bartkowiak, Susan Swanson
Presentation Type	Poster session
Event Name	American Water Resources Association - Wisconsin Section Annual Meeting
Event Location	Wisconsin Dells, Wisconsin
Event Date	3/1/2007
Target Audience	Scientific audience
Audience Size	75
Description	Two contact springs in Iowa County, Highland Big Spring and Otter Creek Big Spring, were monitored from January 2006 to January 2007 to better understand groundwater flow paths to the springs. The springs are representative of those in Iowa County and the entire Driftless Area in that they occur near major stratigraphic contacts. Highland Big Spring discharges near the contact of the Prairie du Chien Group with the St. Peter Formation. Otter Creek Big Spring discharges near the contact of the Jordan Formation with the Prairie du Chien Group. Discharge was measured monthly using a current meter or a cutthroat flume, and geochemical sampling occurred on a bi-monthly basis. Alkalinity, conductivity, temperature, dissolved oxygen and pH were measured in the field using a multiparameter sonde, and grab samples were analyzed for major ion concentrations and stable isotopes of oxygen and hydrogen. The average monthly discharge is 0.9 cfs at Highland Big Spring and 0.3 cfs at Otter Creek Big Spring. Flow is more variable at the Highland Big Spring. Major ion concentrations are similar, but calcium and magnesium concentrations are slightly higher at the Highland Big Spring. The differences in flow variability and geochemistry may be due to a more direct groundwater flow path to the Highland Big Spring.

Students & Post-Docs Supported

Student Name	Brandon Bartkowiak
Campus	Beloit College

Advisor Name	Susan Swanson
Advisor Campus	Beloit College

Degree	Undergraduate
Graduation Month	May
Graduation Year	2007
Department	Geology
Program	
Thesis Title	
Thesis Abstract	

Student Name	Rebecca Carvin
Campus	University of Wisconsin-Madison

Advisor Name	
Advisor Campus	University of Wisconsin-Madison

Degree	Masters
Graduation Month	May
Graduation Year	2008
Department	Water Resources Management
Program	Institute for Environmental Studies
Thesis Title	
Thesis Abstract	

Student Name	Natalie Hunt
Campus	University of Wisconsin-Madison

Advisor Name	
Advisor Campus	University of Wisconsin-Madison

Degree	Masters
Graduation Month	August
Graduation Year	2007
Department	Water Resources Management
Program	Institute for Environmental Studies
Thesis Title	
Thesis Abstract	