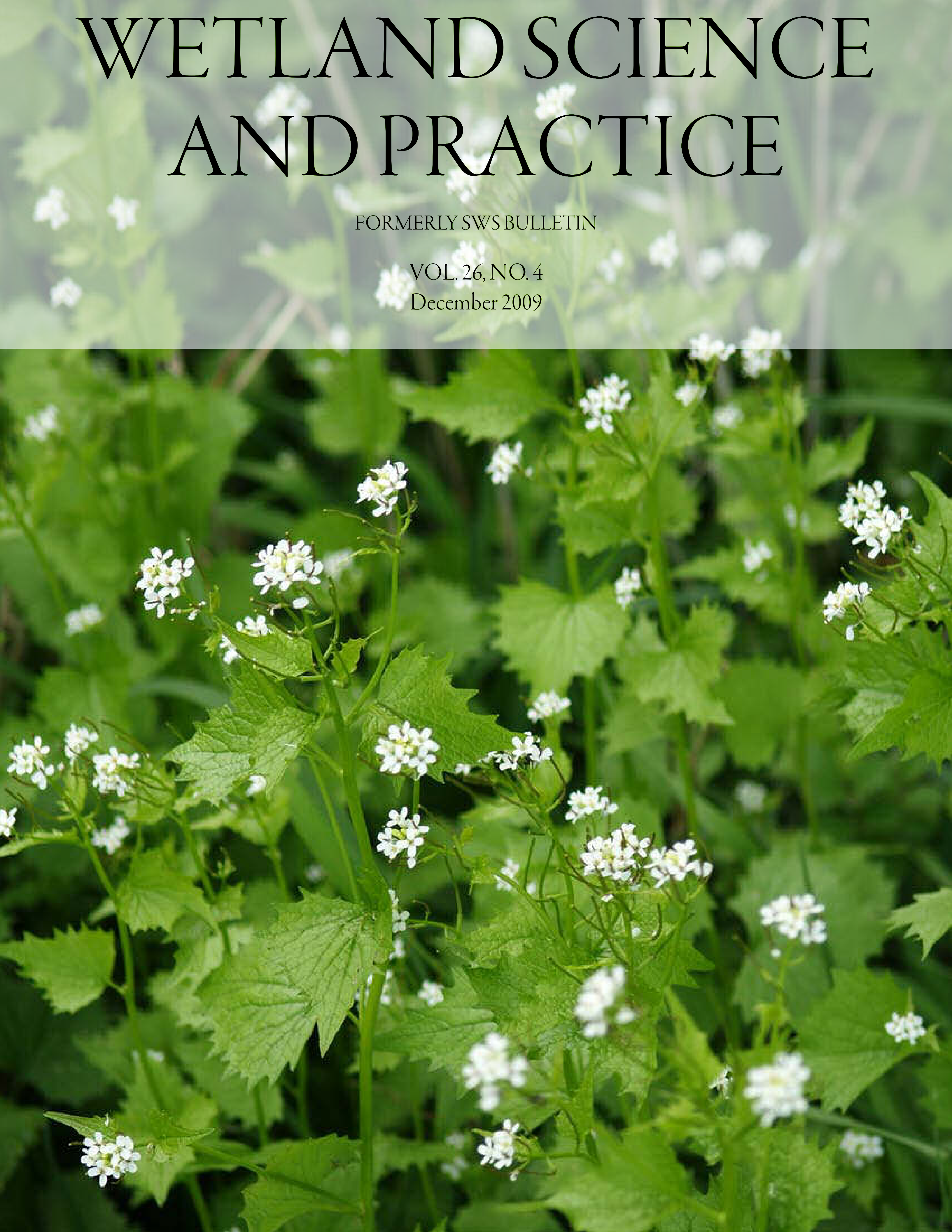
WETLAND SCIENCE AND PRACTICE

FORMERLY SWS BULLETIN

VOL. 26, NO. 4
December 2009



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Contents

Officers

Aim and Scope of Wetland Science and Practice

The *WSP* is the formal voice of the Society of Wetland Scientists. It is a quarterly publication focusing on news of the SWS, at international, national and chapter levels, as well as important and relevant announcements for members. In addition, manuscripts are published on topics that are descriptive in nature, that focus on particular case studies, or analyze policies. All manuscripts should follow guidelines for authors as listed for *Wetlands* as closely as possible. All papers published in *WSP* will be reviewed by the editor for suitability. Letters to the editor are also encouraged but must be relevant to broad wetland-related topics. All material should be sent electronically to the current editor of *WSP*. Complaints about SWS policy or personnel should be sent directly to the elected officers of SWS and will not be considered for publication in *WSP*.

Wetland Assessment Alphabet Soup: How to Choose (or not Choose) the Right Assessment Method

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Introduction

For more than 25 years wetland scientists have been striving to develop scientifically defensible wetland assessment methods that are robust, easily applied, affordable, and provide sufficient discrimination to guide management or regulatory decision making. While each generation of methods attempts to build upon the concepts and techniques developed in the previous generation, the fundamental goal remains to evaluate wetland(s) relative to a gradient of condition ranging from natural and undisturbed to extremely perturbed or altered. The progression from one method to the next is a natural and healthy indication that wetland science continues to advance and society learns. However, each generational transition is often accompanied by discourse about the benefits of various methods/approaches and the need or desirability to alter the assessment approach. Such was the case when the Corps of Engineers shifted from the Wetland Evaluation Technique (WET) to the Hydrogeomorphic Assessment Method (HGM). More recently, similar discussions have arisen around the development and application of Rapid Assessment Methods (RAMs) for wetland condition. The recent release of the Corps/EPA rule that strongly promotes use of condition or functional assessment in mitigation monitoring and performance evaluation (U.S. Army Corps and Engineers and Environmental Protection Agency 2008) has once again intensified debates about the efficacy of various assessment approaches.

We assert that debate over the utility of HGM, indices of biotic integrity (IBIs) the various RAMs, and other wetland assessment methods is somewhat misdirected. Rather than focusing on details of one specific method or debating the merits of one method over another, discussion should focus on the institutional structure and goals for which the methods are developed, tested, and ultimately implemented. Although wetland assessment methods vary in the scale of assessment and quantitative detail of the data collected and the assessment output, they are all designed to achieve a common objective: to evaluate the complex ecological condition of a wetland using a finite set of observable field indicators, and to express the relative condition of a particular site in a manner that informs ecosystem management (Figure 9). The design of an assessment method should be based on the information required to make management decisions and what resources (e.g., time, expertise, and equipment) are available to obtain that information? It is critical that *management needs drive the selection of an assessment approach and not the other way around.*

Technical Considerations

Decisions regarding the development of a new assessment method or selection of an existing one must reconcile the following ecologically relevant issues in ways that best meet management objectives.

1. Classification: The goal of classification is to reduce the effect of natural variation on assessment output so the assessment tool can better discriminate either functional capacity or condition (Figure 10). For example, both depressional and riverine wetlands provide habitat support functions; however, the structure of these wetland types and how those functions are performed, and thus scaled, differs markedly. Similarly, both depressional wetlands in dead-ice kettles on subarctic outwash plains and in collapse karst features on subtropical carbonate platforms provide hydrologic functions. As with the example above, the structure of these wetland types and how those functions are performed, and thus scaled, differs markedly. Different assessment approaches deal with this heterogeneity differently, some by devising a method for each class or subclass, and some by weighting a common set of metrics according to class. In the latter case, the metrics are scored relative to reference sites within the same class. Classification allows assessment metrics to be better customized for specific wetland types, thereby increasing the ability of the assessment method to discern differences

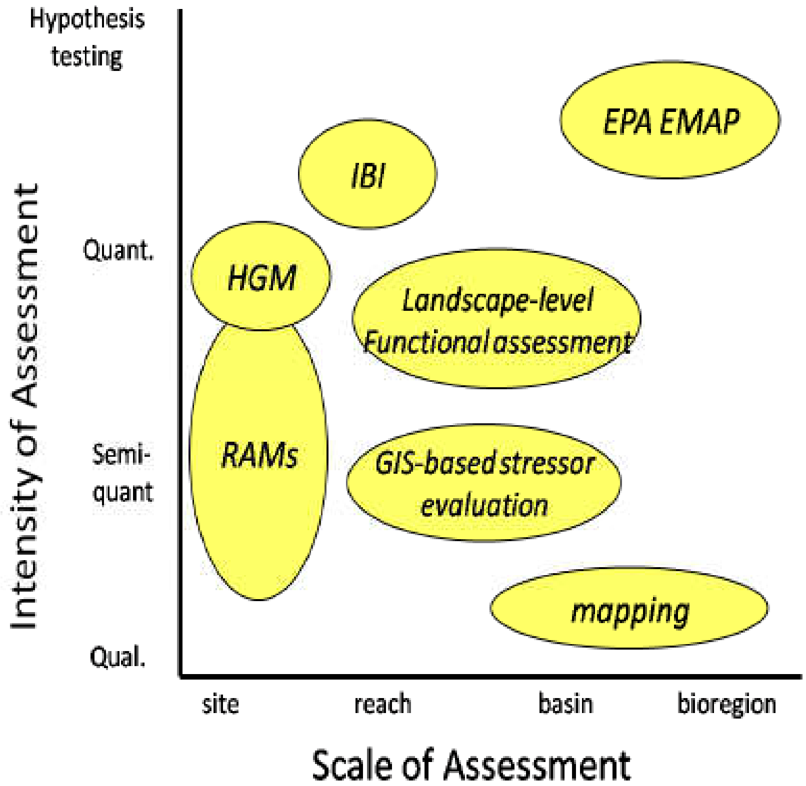

Figure 9. Diagram depicting the relationship of wetland assessment methods relative to spatial scales and the relative intensities at which they can be conducted, (after R. Dan Smith, U.S. Army Corps of Engineers, unpublished).

between individual wetlands. Classification can be based on a combination of physical, chemical, and/or biological attributes of a wetland, as well as consideration of geography, physiography, scale, and assessment objectives. Whichever approach is used, the assessment objective should be a key consideration because the ultimate purpose of classification is to guide the subsequent assessment and decision-making processes.

2. *Reference condition:* All assessment methods include some aspect of reference, whether based on data or best professional judgment or a combination. Reference provides benchmarks against which assessment scores for specific wetlands can be compared. Reference should encompass the range of variation in condition across a gradient of disturbance from most disturbed to least disturbed, the latter of which is often termed the reference standard (Brinson and Rheinhardt 1996). The reference standard is defined as the highest possible scores across all metrics associated with natural, undisturbed conditions or the highest variable scores provided by the assessment method. The reference standard may be defined as the highest condition or level of function theoretically possible for a specific wetland subclass, often referred to as "culturally unaltered" (Stevenson and Hauer 2002). Alternatively, the reference standard may be defined as the conditions observed or expected at sites subject to minimal anthropogenic stress, given existing landscape constraints; often referred to as best attainable (Meyer 1997) or site potential (Smith et al. 1995). The choice of a reference standard based on culturally unaltered vs. best attainable condition should be based on the goals and intended use of the assessment, and the availability of sites that meet these definitions. Regardless of which is chosen, the assessment endpoint must be clearly

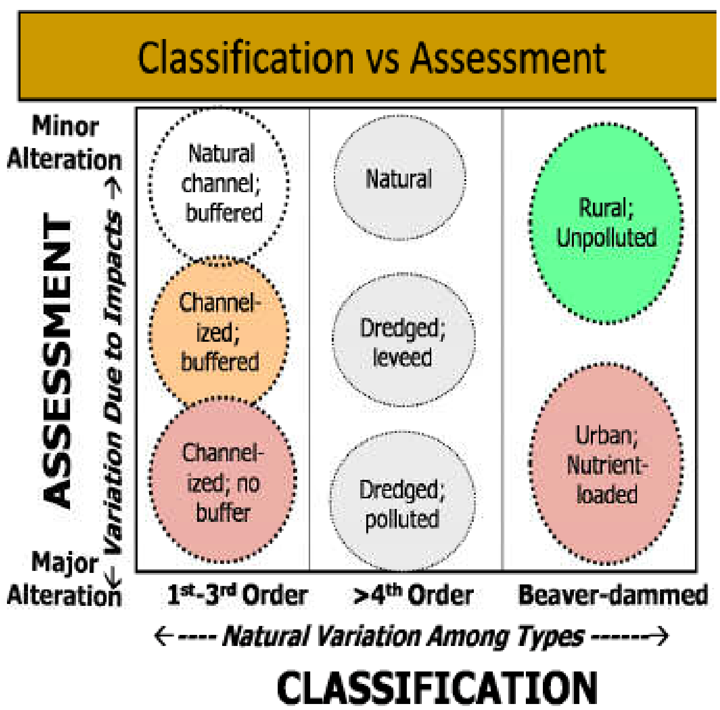

Figure 10. Distinction between classification, which partitions natural variation among wetland classes, and assessment of condition or function, which evaluates the effect of impacts relative to unaltered conditions. The classification axis separates subclasses of riverine wetlands according to stream order and influence by beaver dams. The assessment axis ranks subclasses by their departure from reference standard conditions. Modified from Brinson (2009).

stated and understood to avoid erroneous conclusions.

3. Assessment endpoint: Few methods directly assess "function". Function is defined as an ecological process occurring over time (Novitsky et al. 1996), or more simply, "the things that wetlands do" (Smith et al. 1995). Therefore, determination of function requires repeated measures that quantify rates of processes occurring over time. Most wetland assessment methods measure a combination of physical and biological structural attributes at a moment in time, providing a snapshot of the status of a wetland that is used to infer the degree, or capacity, to which certain functions are being performed. Similarly, methods that assess condition are based on physical and biological structural attributes with the goal of documenting departure from the reference standard condition. For example, many assessment methods measure the connectivity between a stream channel and its adjacent flood-prone area. This measure is then used to infer the occurrence and magnitude of hydrologic processes that result in temporary water storage on the floodplain, which, in turn, may attenuate downstream flood peaks or result in the deposition of sediments.

A key difference between methods that assess functional capacity, such as HGM, and those that assess condition, such as RAMs, is that the former focuses on the capacity to perform individual functions, while the latter produces a more general evaluation that often aggregates multiple functions. The former provides more detailed information about specific functions, while the latter provides an integrated score on overall "ecosystem health" by which the relative functional capacity of the site is inferred. The choice of approach should be based on the management questions being asked; ultimately, there is a place for both in the assessment toolbox.

Few methods assess social values, which are the values society places on the performance of the various functions or the maintenance of ecological condition. It is hoped that this shortcoming will be addressed by developing assessment tools for ecological valuation (Ruhl et al. 2009), or assessing the ability of a wetland to provide ecosystem services (Millennium Ecosystem Assessment 2005).

Institutional Considerations

For even the most robust methods, the institutional setting in which an assessment method is developed, rather than its technical approach, may be the most important determinant of whether a method ever gains broad enough acceptance to affect management decisions.

1. Validity and Confidence: A basic concern of end-users of any assessment method is having confidence in the results and thus confidence in the conclusions and management recommendations that follow from the results. Each assessment method has its strengths and weaknesses and, if validated with independent measures of wetland structure or function, most assessment methods provide valid output. The best assessment methods are sufficiently robust to detect ecological change or departure from the reference standard condition along a stressor-response gradient. Sensitivity to change and confidence in the method are best achieved when: 1) the metrics that are aggregated to provide the assessment scores are based on robust and transparent data, and 2) the models, whether logic or descriptive models, have a strong foundation in ecological theory. In other words, the assessment has to make sense to the end-user and that person must be able to point directly to specific metrics that are driving the scores up or down along the stressor-response gradient.

2. Flexibility: Assessment methods should be adapted over time to meet the needs of the end-user community rather than be constrained by a rigid institutional structure. Flexibility provides the capacity for cross-program implementation and coordination, which can help bridge the gap between routine or ambient monitoring and assessment programs and regulatory or project monitoring efforts. This in turn allows project assessment results to be evaluated in the context of regional or ambient assessment data. In addition, methods should be transparent; compatible with the attitudes, values, and needs of potential adopters; relatively easy to use; and produce output in a form that can be readily communicated to a broad audience. Finally, methods should be structured so they can be implemented incrementally to allow users to gain comfort with them over time (Muth and Hendee 1980).

3. External Technical Review: External technical review of many assessment methods is often inadequate. We consider external technical review to be comprised of three components, each of which is necessary to ensure valid and successful implementation. First, a broad range of technical experts and potential end-users should be included in the development process. This promotes robustness and helps address practical considerations for implementation early in the development process. Second, an independent technical review of draft products should be conducted. This can occur via traditional peer-reviewed literature or by independent review by local agency or academic scientists. Third, end-user acceptance of the final product should be sought, as this is the ultimate stage of technical review and confirms the utility of the assessment method.

4. Implementation: Development of the assessment method should not be viewed as an end result but, rather, as the beginning of the implementation phase. In other words, the long-term success of any assessment method is more often based on what happens during the implementation phase than during the development phase. Assessment methods that will gain support and acceptance by management are those that are robust and valid yet simple, intuitive, transparent, and produce results that are easily understood and explained. No method will persist without a firm and long-term commitment to implementation by the primary users and the infrastructure needed to adopt, maintain and revise the assessment protocols. Method implementation must include an ongoing training and technical support program, defined quality control and auditing, and an information management system that allows data to be easily captured and, more importantly, provides ready access of compiled data back to the practitioner community with minimal restrictions. All of this provides a foundation for institutional memory and eliminates, to the extent possible, unwarranted reliance on best professional judgment in assessment output.

Conclusions

Regardless of the assessment method selected, all should include a mechanism for continued review and refinement with the expectation that any assessment method will ultimately evolve into a new and improved generation of assessment tools, thus setting the stage for a new debate on the efficacy of various methodologies. A likely next step is the consideration of ecosystem goods and services (sensu Costanza 2000) similar to that framed by the Millennium Ecosystem Assessment (2005). Assessment of wetland ecosystem services, for example, is becoming a part of the wetlands component of the Conservations Effects Assessment Program designed to evaluate the effectiveness of the Farm Bill legislation to slow wetland loss (USDA, NRCS 2008), and has been adopted by USEPA in its wetland research framework. It remains to be seen how this and other similar efforts can take advantage of assessment approaches already developed given the rather broad spectrum of institutional cultures. Regardless, we have experienced a rich history of wetland assessment approaches, and look forward to the development of additional creative efforts to reflect the best information that science has to offer.

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