Appendix 5-B

Methods and Information Resources for Use in Analyzing Landscapes and Wetlands

Chapter 5 of this volume presents a number of questions, regardless of the method used, that should be answered when conducting landscape analysis. This appendix presents various methods and general references that are available for use in analyzing the landscape and its wetlands, as well as assessing the characteristics and functions of individual wetlands. These analyses can assist local governments in developing plans, regulations, and non-regulatory approaches to protect landscape processes and wetlands.

Methods for analyzing the larger geographic scales (contributing landscape and management area) are under development and being tested in pilot projects here in Washington. Therefore, there is very little information about the effectiveness of these methods at providing the information necessary to protect and manage wetlands from this broader perspective. One of the methods described briefly in this appendix is the approach that the Department of Ecology is developing for analyzing the landscape (a link to a web site is provided in that section of the appendix).

On the other hand, methods for analyzing the functions and characteristics of individual wetlands have been extensively used in Washington State. Numerous methods are summarized in this appendix.

References on Landscape Processes in the Pacific Northwest

The following two books are recommended for developing an understanding of landscape processes in the coastal region of the Pacific Northwest. Though these books focus on river systems in one geographic area of Washington, the concepts, principles, and research presented are very useful in understanding the interaction of processes that occur at larger geographic scales with all wetland types.

Naiman, R. and R. Bilby (eds.). 1998. River Ecology and Management: Lessons from the Pacific Coastal Ecoregion. Springer-Verlag, New York. 705 pp.

In particular, Chapters 2 through 4 in Part I (Physical Environment), Chapters 11 and 12 in Part III (Ecosystem Processes), and Chapters 19 and 20 in Part IV (Management) are very useful in understanding landscape processes and how to approach assessment of watersheds.

The following is text from the publisher's abstract:

> *Touching all parts of the natural environment and nearly all aspects of human culture, streams and rivers act as centers of organization within landscapes. They provide natural resources such as fish and clean water, transportation, energy, diffusion of wastes, and recreation. A basic ecological understanding of the structure and dynamics of running waters is needed to formulate sound management and policy decisions. The vast Pacific coastal ecoregion of the United States contains an extraordinary array of physical setting and examples of the range of dynamics associated with rivers and their management. The interface between the science and policy of natural resource management is illustrated by examples from this ecoregion, including the protection riparian forest, the marbled murrelet, salmon, and amphibians. This study includes sections on the physical environment, the biotic environments, ecosystem processes, management, and recommendations for the future. Specific topics include channel dynamics, hydrology, water quality, microbial process, primary production, fish and wildlife, riparian forest dynamics, organic matter and trophic dynamics, biogeochemical cycling, maintaining biodiversity, monitoring and assessment, economic perspectives, legal consideration, and the role of non-governmental organizations in river management.*

Montgomery, D., S. Bolton, D. Booth, and L. Wall (eds.). 2003. Restoration of Puget Sound Rivers. University of Washington Press. 512 pp.

The first five chapters of this book are very useful in gaining an understanding of landscape processes and the effect of alterations on these processes. The reference also addresses potential objectives for restoration based on landscape setting, geology, and land uses.

The following is text from the publisher's abstract:

> *In the Pacific Northwest, as in most regions of the United States, we are still learning about the processes that create habitat and river structure, how those processes influence aquatic ecosystems, and how to gauge the response of river systems to both land-use change and restoration efforts. River systems are still responding to historic changes, and degraded habitat may not be restored successfully if natural conditions are not well understood, particularly if massive change in watershed hydrology or other processes are the root cause…. The eighteen chapters of Restoration of Puget Sound Rivers – presented by the region's experts at a symposium of the Society for Ecological Restoration – examine geological and geomorphological controls on river and stream characteristics and dynamics, biological aspects of river systems in the region, and the application of fluvial river systems in the region, and the application of fluvial geomorphology, civil engineering, riparian ecology, and aquatic ecology in efforts to restore Puget Sound Rivers.*

General References for Analysis at a Landscape Scale

The following books provide some general information about tools for analyzing wetlands and aquatic resources at larger geographic scales. These may provide useful background information for anyone trying to develop an approach that will work in their jurisdiction.

Kroenert, R., U. Steinhardt, and M. Volk. 2001. Landscape Balance and Landscape Assessment. Springer-Verlag, New York. 304 pp.

The following is the abstract from the publisher:

> *During the last decades, landscape ecology has developed tremendously. It concerns both the theoretical basis and practical application. The authors follow a hierarchical approach that is inherent in landscape structures and processes as well as in planning practice. They show first approaches for the inclusion of factors of the landscape balance into planning procedures and new methods (GIS-coupled modeling, remote sensing) combined with more classical approaches from the basis of landscape assessment. Approaches for multi-criterial landscape assessments will be presented also. The overall target is to give recommendations for sustainable land-use and management. Each chapter concludes with a synthesis of the theme under discussion. Ideas concerning the state-of-the-art are integrated as well as future trends in research. All methodological approaches will be explained with examples from differing regions.*

Heathcote, I.W. 1998. Watershed Management: Principles and Practice. John Wiley & Sons, Inc. 414 pp.

The following is the abstract from the publisher:

> *This book presents a flexible, integrated framework for watershed management that addresses the biophysical, social, and economic issues affecting water resources and their use. Comprehensive in scope and multidisciplinary in approach, it equips you with the necessary tools and techniques to develop sound watershed management policy and practice - from problem definition and goal setting to electing management strategies and procedures for monitoring implementation. Topics include watershed components and processes; establishing management plan parameters and objectives; stakeholder identification and consultation; development of practical management options; both simple and detailed methods for the assessment of management alternatives; techniques for determining the legal implications and the environmental, economic, and social impact of a management plan; and choosing the best plan and putting it into action. Supplemented with case studies and examples, Integrated Watershed Management is an ideal resource for upper-level students and professionals in environmental science, natural resource management, and environmental engineering.*

Reimold, R.J. 1998. Watershed Management: Practice, Policies, and Coordination. McGraw-Hill Companies. 608 pp.

The following is the abstract from the publisher:

> *Ensuring a safe and adequate supply of water requires the combined efforts and expertise of resource managers, engineers, planners, technical experts, and policy analysts worldwide. This contributed volume is unique in recognizing this need and provides today's first truly comprehensive, international coverage of effective watershed management. Experts representing the full spectrum of environmental professions and viewpoints provide detailed case studies of how watershed management is being implemented around the world, focusing on the United States, France, the former Soviet Union, the Pacific Rim, the Nile River, and other areas. Successful approaches such as whole watershed and full stakeholder involvement; watershed sanitary surveys; urban watershed management; river basin planning; integrated management and water resource protection; watershed-based coastal management wetlands restoration; water quality monitoring and assessment; stormwater and other nonpoint pollution source management; water withdrawal; wastewater discharge permitting; and other tools for cost-effective watershed management are highlighted. Mathematical models demonstrate how various systems can be successfully managed for future sustainability.*

Methods for Analyzing the Contributing Landscape and Management Area

The following list identifies a few published methods that can provide information that can be used in protecting and managing wetlands at larger geographic scales.

Environmental Protection Agency's Synoptic Approach

Abbruzzese, B., and S.G. Leibowitz. 1997. A synoptic approach for assessing cumulative impacts to wetlands. Environmental Management 21(3): 457-475.

Leibowitz, S.G., B. Abbruzzese, P.R. Adamus, L.E. Hughes, and J.T. Irish. 1992. A synoptic approach to cumulative impact assessment: A proposed methodology. U.S. Environmental Protection Agency. EPA/600/R-92/167.

Washington State was one of the case studies used to demonstrate the concept of the synoptic approach.

The following is the abstract from the authors:

> *The U. S. Environmental Protection Agency's Wetlands Research Program has developed the synoptic approach as a proposed method for assessing cumulative impacts to wetlands by providing both a general and a comprehensive view of the environment. It can also be applied more broadly to regional prioritization of environmental issues. The synoptic approach is a framework for making comparisons between landscape subunits, such as watersheds, ecoregions, or counties, thereby allowing cumulative impacts to be considered in management decisions. Because there is a lack of tools that can be used to address cumulative impacts within regulatory constraints, the synoptic approach was designed as a method that could make use of available information and best professional judgment. Thus, the approach is a compromise between the need for rigorous results and the need for timely information. It is appropriate for decision-making when quantitative, accurate information is not available; the cost of improving existing information or obtaining better information is high; the cost of a wrong answer is low; there is a high demand for the information; and the situation calls for setting priorities between multiple decisions versus optimizing for a single decision. The synoptic approach should be useful for resource managers because an assessment is timely; it can be completed within one to two years at relatively low cost, tested, and improved over time. An assessment can also be customized to specific needs, and the results are presented in mapped format. However, the utility of a synoptic assessment depends on how well knowledge of the environment is incorporated into the assessment, relevant to particular management questions.*

The Washington State Department of Ecology's Guidance for Landscape Analysis

The Washington State Department of Ecology is developing guidance for conducting a landscape analysis. This guidance is designed to assist local governments in applying landscape principles to planning and regulatory activities (e.g., updating comprehensive plans, developing area-specific plans, creating land-use plans, etc.). A landscape analysis can be used to determine whether environmental processes have been altered, identify the mechanisms and geographic locations of the alterations, determine patterns of future land uses and development standards that are compatible with maintenance of landscape processes and natural resources, and identify viable restoration opportunities.

The purpose of Ecology's guidance is to

- Provide information that can be used to sustain and restore environmental processes and aquatic resources
- Establish a common environmental framework for developing, updating, and coordinating planning efforts

- Assist in the preparation of updates to comprehensive plans and Shoreline Master Plans:
  - Provide direction on appropriate designations for land use and zoning
  - Promote the integration of the Growth Management Act and Shoreline Management Act (SMA)
  - Establish a framework for characterizing environmental processes and developing a restoration plan as required under the new SMA guidelines
  - Promote "no net loss" of shoreline functions and the maintenance of landscape processes and wetland functions

By applying the guidance, a general model of the key environmental processes and their relationship to aquatic habitat is developed and areas important to maintaining those processes are identified. Next, specific indicators, such as land use, land cover, population density, channelization, and ditching are used to qualify the degree of alteration to these processes. By comparing the model of environmental conditions to the location and number of alterations, measures for protection and restoration can be identified. These can include determining appropriate land-use activities as well as identification and ranking of wetland restoration areas.

Ecology's guidance involves the following five steps. Information for completing these steps is available online at: www.ecy.wa.gov/programs/sea/landscape.

1. Identify and map the aquatic resources of interest
2. Identify and map the area that contributes surface and ground water to the resources of interest
3. Identify processes critical to the integrity and functions of the resources
4. Identify and map areas important for sustaining key processes
5. Identify and map the type of alterations that have affected key processes

The results of the analysis can then be used to develop:

- Land-use recommendations that protect key processes in important areas that are unaltered
- Land-use recommendations that restore key processes in important areas that have been altered

Ecology's approach to landscape analysis uses existing environmental data and land-use information including surficial geology and geologic hazards, soil types, topography, land cover and land use, water quality and quantity, and mapping of critical habitats.

Maryland Stream Corridor Assessment Survey

The following describes an assessment developed by Maryland's Department of Natural Resources. It was taken from the survey's web page in April 2004: http://www.dnr.state.md.us/streams/stream_corridor.html.

> *The Stream Corridor Assessment (SCA) survey was developed by DNR's Watershed Restoration Division as a tool to help environmental managers identify environmental problems and prioritize restoration opportunities on a watershed basis. As part of the survey, trained personnel walk the watershed's entire stream network and record information on a variety of environmental problems that can be easily observed within the stream corridor. Common environmental problems documented in the survey include: eroding stream banks, inadequate stream buffers, exposed pipes, altered stream channels, fish migration barriers, pipe outfalls, in-stream construction sites and trash dumping locations. In addition to identifying the location of common stream problems the survey also collects information on both in- and near-stream habitat conditions so that comparative assessments can be made of the condition of different stream segments.*
>
> *It is important to note that Stream Corridor Assessment Survey is not intended to be a detailed scientific evaluation of a stream system nor will it replace the more standard chemical and biological surveys. Instead the survey is intended to provide a rapid method of examining an entire drainage network so future monitoring and management efforts can be better targeted. Part of the need for this type of survey is that many existing scientific surveys are very time consuming, expensive and can only collect information for a relatively small section of stream at any one time. The Stream Corridor Assessment Survey, on the other hand, is designed so that teams of 2 or 3 volunteers are able to survey 2 or more stream miles per day. Individuals performing the survey receive training in both stream ecology and how to conduct the survey.*

North Carolina Coastal Region Evaluation of Wetland Significance (NC-CREWS)

Sutter, L.A. and J.R. Wuenscher. 1996. NC-CREWS: A Wetland Functional Assessment Procedure for the North Carolina Coastal Area (Draft). Division of Coastal Management, North Carolina Department of Environment and Natural Resources, Raleigh, NC. 61 pp/appen.

The following description was taken from the NC-CREWS web page in April 2004: http://www.wes.army.mil/EL/emrrp/emris/emrishelp6/north_carolina_coastal_region_evaluation_of_wetland_significance_tools.htm. Note that this method was developed to rate wetlands in North Carolina. The indicators of function used would have to be modified to reflect conditions in the region of Washington where the method is being used.

Primary purpose: To predict the relative ecological significance of wetlands within their watershed and region using a GIS-based landscape-scale procedure. Developed for use in planning and overall management of wetlands rather than for regulatory decisions.

Eleven functions are addressed: surface runoff storage; floodwater storage; shoreline stabilization; terrestrial wildlife; aquatic life; nonpoint source; floodwater cleansing; landscape character; water characteristics; replacement difficulty; and restoration potential.

Procedure: Using GIS analysis, a High, Medium, or Low rating is assigned to each of 39 parameters that describe the landscape and internal wetland characteristics. The parameter ratings are successively combined to produce ratings (H, M, or L) for subfunctions and primary functions. The primary function ratings are combined to form an overall rating of the wetlands ecological significance (i.e., beneficial significance, substantial significance, or exceptional significance).

Output: Measure of overall ecological significance of a wetland within its watershed and the larger landscape.

Contact person: Jim Stanfill, Division of Coastal Management, North Carolina Department of Environment and Natural Resources, P.O. Box 27687, Raleigh, NC 27611 phone: (919) 733-2293; fax: (919) 733-1495; e-mail: jim_stanfill@mail.enr.state.nc.us

Limitations listed by authors: "The NC-CREWS models should not be used as a guide to design, however, individual variables (parameters) may provide useful information. It is not the intended purpose for the procedure, therefore, it contains properties that limit its application for this purpose. For example, NC-CREWS uses opportunity variables, but does not set upper limits on those opportunities that could potentially reduce functional capacity (e.g., a wetland located near a pollutant generating area is assigned a high rating). In some circumstances, a wetland may not have the capacity to remove all nutrient input. An upper limit on the opportunity must be defined to insure that the existing or planned wetland can predictably have the capacity to provide a function."

Spatial Wetland Assessment for Management and Planning (SWAMP)

Sutter, L.A., J.B. Stanfill, D.M. Haupt, C.J. Bruce, and J.E. Wuenscher. 1999. NC-CREWS: North Carolina Coastal Region Evaluation of Wetland Significance. North Carolina Division of Coastal Management, Department of Environment and Natural Resources. Raleigh, NC.

The following description was taken from the SWAMP web page in April 2004: http://www.csc.noaa.gov/lcr/swamp/text/p661.htm#intro. Note that this method was developed to rate wetlands in North Carolina. The indicators of function used would have to be modified to reflect conditions in the region of Washington where the method

is being used. Ecology is presently working on adapting this method to the coastal region of the Pacific Northwest.

> *The Spatial Wetland Assessment for Management and Planning (SWAMP) uses basic ecological principles to evaluate the significance of wetlands within a watershed while allowing the decision maker to establish the rules for overall rating. The model is based on the NC-CREWS model (Sutter et al. 1999) but has significantly faster processing time and offers greater flexibility in adjustment of parameters and rating rules. Three groups of functions are evaluated including water quality, hydrology and habitat.*
>
> *Procedure: Requires digital information in GIS format. including:(1) wetland boundaries and types; (2) land cover; (3) soils data; (4) hydrography; and (5) watershed boundaries.*
>
> *The functional significance of wetlands is rated (non quantitative) on the basis of three broad categories: exceptional functional significance, substantial functional significance, and beneficial functional significance.*
>
> *Output: To produce information about the relative ecological importance of wetlands that would be useful for wetland planning and management.*

The authors describe its limitations as follows:

> *The result of the procedure is not a substitute for a site visit in making regulatory decisions, but a predictor of what a site visit would determine. The parameters and thresholds developed for the ACE Basin would be more defensible if data had been collected to specifically support the assumptions behind each parameter.*

Methods for Analyzing Wetlands at the Site Scale

An assessment of the functions performed by a wetland is often required when impacts to that wetland will result from a change in land use. In many jurisdictions, the level of analysis depends upon the type, severity, and extent of the proposed impacts such that the detail necessary will be commensurate with the impacts.

As a minimum, many local governments require an analysis of functions be performed using a rating system. Rating systems also help determine if particular features or situations of concern exist at the site, such as the presence of a mature forest (see Chapter 8, Section 8.3.4, for more on rating). If Ecology is involved in a project, the applicant will generally be requested to apply the wetlands rating system for western Washington or eastern Washington (see below) to determine the category of the wetland and how well it performs three basic functions (improving water quality, reducing flooding and erosion, and potential to provide habitat for many species). However, a more thorough assessment of functions may be needed when wetland impacts will be significant. In such cases regulatory agencies may request that an applicant complete an assessment using the wetland function assessment method for Washington State, if the wetland is in one of the classes for which a method has been developed (see below).

The following is a list of methods that were specifically developed to analyze wetlands in Washington or are commonly used in the state.

Washington State Wetlands Rating Systems

Hruby, T. 2004. Washington State Wetland Rating System for Eastern Washington – Revised. Washington State Department of Ecology Publication #04-06-015. Olympia, WA.

Hruby, T. 2004. Washington State Wetland Rating System for Western Washington – Revised. Washington State Department of Ecology Publication #04-06-025. Olympia, WA.

The Washington State Wetlands rating systems for eastern and western Washington are technically characterizations that group wetlands based on sensitivity, rarity, functions, and other criteria including the performance of basic functions as described above. For more information and to download the rating systems go to the following web addresses:

For western Washington: http://www.ecy.wa.gov/biblio/0406025.html

For eastern Washington: http://www.ecy.wa.gov/biblio/0406015.html

Advantages

- Designed to categorize wetlands into one of four groups which allow agencies/local governments to determine how the wetlands should be protected and managed
- Rapid and relatively easy to perform; the vast majority of sites can be rated within 1 to 2 hours in the field

Limitations

- Not a numeric assessment of functions, but a characterization
- May oversimplify the performance of functions and understanding of the wetland functions needed to adequately protect it, especially in large wetlands having several types within one boundary

Recommended Uses

- Determine into which category a wetland is grouped, often for regulatory purposes to determine buffer widths and ratios for compensatory mitigation
- May provide sufficient characterization of potential functions for impacts to small (e.g., <1 acre), degraded wetlands when determining needs for compensation

Washington State Wetland Function Assessment Methods (WFAM)

Hruby, T, S. Stanley, T. Granger, T. Duebendorfer, R. Friesz, B. Lang, B. Leonard, K. March, and A. Wald. 2000. Methods for Assessing Wetland Functions, Volume II: Depressional Wetlands in the Columbia Basin of Eastern Washington. Parts I and II. Washington State Department of Ecology Publication #00-06-47 and#00-06-48. Olympia, WA.

Hruby, T., T. Granger, K. Brunner, S. Cooke, K. Dublanica, R. Gersib, L. Reinelt, K. Richter, D. Sheldon, E. Teachout, A. Wald, and F. Weinmann. 1999. Methods for Assessing Wetland Functions, Volume I: Riverine and Depressional Wetlands in the Lowlands of Western Washington. Parts I and II. Washington State Department of Ecology Publication #99-115 and #99-116. Olympia, WA.

Methods for Assessing Wetland Functions, commonly called Washington State Wetland Function Assessment Methods (WFAM), are a collection of assessment methods developed by interdisciplinary teams of experts and published by Ecology. Unlike rating systems which categorize wetlands using information about basic functions, the assessments provide a score for the degree to which several functions (up to 15) are performed by a wetland. The methods are based on the hydrogeomorphic (HGM) classification for wetlands. For more information and to download the methods go to the following web address: http://www.ecy.wa.gov/programs/sea/wfap/index.html.

Advantages

- Relatively rapid for the scientific rigor of the assessments that are needed
- Provide a numeric expression of the level of performance of wetlands in regard to their potential to perform and their opportunity to perform numerous functions
- Developed for specific areas in Washington and for specific wetland types
- Peer reviewed and field tested in the area for which they were developed
- Results are reproducible to ±10%, especially with training

Limitations

- Large, structurally complex sites may require a few days to complete an assessment
- Site visits at different times of the year may be necessary to accurately determine the water regime (e.g., the length and extent of inundation)
- Specific training in the application of WFAMs is required before one uses it for regulatory purposes
- WFAMs are lacking for specific wetland types. Methods do not exist for riverine wetlands in eastern Washington, any montane areas, or any slope, tidal, or interdunal wetlands
- Numeric results may be misused to assume scores are continuous functions rather than discrete integers

Recommended Uses

- Projects involving significant wetland impacts in terms of size (e.g. >2 acres) or estimated level of performance of the wetland
- Determine if functions lost to impacts have been adequately replaced in compensatory mitigation

Wetland Functions Characterization Tool for Linear Projects

Null, W., G. Skinner, and W. Leonard. 2000. Wetland Functions Characterization Tool for Linear Projects. Washington State Department of Transportation Environmental Affairs Office, Olympia, WA.

This method is also a characterization. It uses a list of criteria for each function to guide decision-making. It relies on professional judgment regarding the likelihood that the function is being performed. The tool is available online at: http://www.wsdot.wa.gov/environment/biology/docs/bpjtool.pdf.

Advantages

- Provides documentation of the criteria and rationale used when applying best professional judgment to analyze functions
- Can be very rapid when used by trained wetland ecologists
- Can also be used to characterize a portion of a larger wetland when a wetland exists on multiple properties and access to all parts of the wetland is restricted
- Based on WFAM, which corresponds to "best available science"

Limitations

- Cannot determine the level at which a function may be performed to plan compensatory mitigation
- This method should not be used to measure change over time or as the result of alterations (e.g., impacts or mitigation)
- Method is subjective and results may vary significantly based on the experience and expertise of the user

Recommended Uses

- Rapid screening of many wetlands to determine best areas for development or roads

Semi-Quantitative Assessment Methodology (SAM)

Cooke Scientific Services Inc. 2000. Wetland and Buffer Functions Semi-quantitative Assessment Methodology (SAM). Final Working Draft User's Manual. Cooke Scientific Services Inc. Seattle, WA.

This method has not been published but is available on the web at: http://www.cookescientific.com/sam.htm or http://www.cookescientific.com/SAM%20Stuff/SAM2000.pdf.

Although SAM is in wide use, better tools have been developed more recently. The WFAM method is much more accurate in its ability to characterize the functions and their performance in wetlands and should be used in its place, especially for larger (> 1 acre) wetlands.

SAM provides a rapid method for rating various wetland attributes, including functions, with high, medium, and low rating.

Advantages

- Easy to use and requires no specific training (some knowledge of wetland ecology would obviously be beneficial)
- Reproducible between users
- Developed for western Washington

Limitations

- Provides very general information
- "Low" ratings miss many site-specific details that are important for protection and management
- Allocates high ratings to large, rural, undisturbed wetlands, while smaller wetlands in urban areas rate lower
- Should not be used for wetlands east of the crest of the Cascade Mountains

Wetland Evaluation Technique (WET)

Adamus, P.R., E.J. Clairain, Jr., R.D. Smith, and R.E. Young. 1987. Wetland evaluation technique (WET), volume II: Methodology. Department of the Army, Waterways Experiment Station, Vicksburg, MS. NTIS No. ADA 189968.

WET is a rating method that was developed in the late 1980s by the U.S. Army Corps of Engineers in cooperation with Paul Adamus.

WET is no longer recommended for use in Washington's wetlands. Better tools have been developed more recently.

Wetland Values: Concepts and Methods for Wetlands Evaluation (often called the Reppert method after the author)

Reppert, R.T., W. Sigleo, E. Stakhiv, L. Messman and C. Beyers. 1979. Wetland Values: Concepts and Methods for Wetland Evaluation. U.S. Army Corps of Engineers, Institute for Water Resources. Fort Belvoir, Virginia.

Published in 1979, this was one of the first methods developed to help determine how wetlands function. It is a rating that groups wetlands into high, medium, or low based on "functional values."

This method is no longer recommended for use in Washington's wetlands. Better tools have been developed more recently.

Proper Functioning Condition for Lentic Areas (PFC)

Prichard, D., C. Bridges, R. Krapf, S. Leonard, and W. Hagenbuck. 1994. Riparian Area Management: Process for Assessing Proper Functioning Condition for Lentic Riparian-Wetland Areas. TR 1737-11. Bureau of Land Management, BLM/SC/ST-94/008+1737, Service Center, CO. 37 pp.

PFC is a qualitative method to characterize streams, riparian areas, and riparian wetlands. It was developed by the Bureau of Land Management to assess how well the physical processes in a wetland are functioning.

Advantages

- Provides good information for designing restoration of riparian wetlands

Limitations

- Correct application of this method requires an interdisciplinary team of experts
- Does not separate wetlands from the rest of the riparian resources
- Primarily for riparian wetlands
- Not an assessment that can be used independently to rate, characterize, or assess wetlands and their functions

Recommended Uses

- Could be useful in combination with other assessment methods
- For wetlands that are "functional - at risk" or "nonfunctional" the methods can help to identify what is lacking (vegetation, soil, water) and may provide guidance on the likelihood of improving the condition and what actions could be taken to improve the condition

Best Professional Judgment (BPJ)

Application of BPJ is the most common method used to determine the functions that a wetland provides. Application of this method requires that a wetland biologist/consultant decide how well a wetland performs functions based on his/her own experience or knowledge.

Most methods are based to some degree on the best professional judgment of the individuals or the teams of individuals who developed them.

Advantages

- Can be very rapid
- If the expert has local knowledge, the information on functions may be very specific to the region and wetland type

Limitations

- Not reproducible. Reliability of results varies greatly with expertise
- Can't track the criteria used to base the judgment unless they are carefully recorded
- Easier to be biased in regard to functions for which the expert has more knowledge

Recommended Uses

BPJ may be used in analyzing functions for small impacts where more intensive analysis is not warranted. BPJ should also be used in concert with other methods to help define and clarify the functional performance of wetlands, based on specific site conditions of the wetland and adjacent watersheds.

Hydrogeomorphic Approach (HGM)

Smith, D. R., Ammann, A., Bartoldus, C., and Brinson, M. M. 1995. An approach for assessing wetland functions using hydrogeomorphic classification, reference wetlands, and functional indices. Technical Report WRP-DE-9, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. NTIS No. AD A307 121.

The HGM approach is not a method to assess, characterize, or rate wetlands. This approach has been developed by the U.S. Army Corps of Engineers to provide guidance on how to develop regional methods for analyzing functions. It was put forth by the Corps for use in Section 404 permitting. WFAM is based on many concepts in this approach. Other documents associated with this approach are available at: http://www.wes.army.mil/el/wetlands/hgmhp.html.