Wetland Prioritization, Enhancement, and Protection through Interagency Cooperation

A "How-to" Report on Creating a Seven-Year Plan for Implementing Oklahoma's Comprehensive Wetlands Conservation Plan and Developing Wetland Assessment Models

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Introduction

The Oklahoma Conservation Commission was given a legislative directive to prepare a wetlands management strategy for the State of Oklahoma. Based on the Oklahoma legislative directive and a subsequent FY 93 EPA grant, Oklahoma's Comprehensive Wetlands Conservation Plan was completed through interagency cooperation in July 1996. The goal of the Wetlands Conservation Plan is to "...conserve, enhance, and restore the quantity and biological diversity of all wetlands in the state."

There was a need for the continuation of cooperation and coordination between the groups who participated in the preparation of Oklahoma's Comprehensive Wetlands Conservation Plan. During the development of the Oklahoma's Comprehensive Wetlands Conservation Plan, the working group was interacting in a manner to bring the plan into fruition. After its completion in July 1996, it was difficult to achieve the same level of interaction and participation due to no fault of the interagency working group but instead due to the everyday agency commitments, which are beyond the scope of the EPA funded wetlands program. Consequently, Oklahoma's Wetland Program needed coordination. The lack of coordination among agencies leads to duplication of effort as well as a potentially disjointed statewide wetlands program.

Without some level of coordination/facilitation of the interagency wetlands working group, meeting the twelve objectives of Oklahoma's Comprehensive Wetlands Conservation Plan, EPA Region 6 Water Quality Divisions Operating Plan, and the EPA National Water Quality Agenda would be challenging to say the least. Consequently, discussion, information exchange, education, cooperation and the sharing of resources by the interagency working group can only promote implementation of the objectives set forth in Oklahoma's Comprehensive Wetlands Conservation Plan making Oklahoma's approach to wetland resources and issues more comprehensive. Current members of the wetlands working group includes but is not limited to representatives from state agencies, federal agencies, tribes, academia, and other NGOs.

With the assistance of the wetlands working group, the research and development of wetland assessment methods for use in the state will also be pursued. Wetland assessment methods are important tools for determining the functions that wetlands are performing. By conducting wetland assessments, a wetland's functional capacity can be determined so if it has to be altered the functions that should be provided by mitigation wetlands will be known. This will help to preserve overall wetland functions within the environment.

The overall purpose of this project was to provide wetland technical support to Oklahoma's Wetland programs and research the development of wetland assessment methods for Oklahoma. Technical support addresses both EPA funded and non-funded wetland projects that are underway through the wetland working group. With the extensive wetlands programs Oklahoma maintains through and by each agency, it is important to preserve a level of funding to support the coordination of wetland activities.

This project continues to foster the interagency cooperation which led to the development of the Wetlands Conservation Plan while developing a strategy to address the objectives and action items from the Plan. This grant proposal specifically addresses Objectives 1 through 12 of Oklahoma's Comprehensive Wetlands Conservation Plan.

The project also coincides with the goals and objectives of EPA Region 6 and EPA Headquarters as follows:

> "Protect, restore, and enhance priority marine, coastal and wetland ecosystems." (Region 6 - Public Health/Ecosystems Protection)
>
> "Develop a framework for prioritizing wetlands management efforts in concert with other states and federal partners." (Region 6 - Public Health/Ecosystem Protection)
>
> "Increase the number of state, local, and tribal governments implementing comprehensive watershed programs." (Region 6 - Watershed Approach)
>
> "Enhance the capabilities of partners to establish and meet environmental goals as EPA improves the nature of its partnerships." (Region 6 - Partnerships)
>
> "Communicate information so that others can understand and fully participate in the decision making processes." (Region 6 - Partnerships)
>
> "Build capacity of State/Tribal programs through financial and technical assistance, regulatory flexibility, and partnership reviews." (Region 6 - Partnerships)
>
> "...development of procedures that will improve assessment of wetlands functions and project impacts to assure chemical, physical and biological integrity of wetlands are fully considered in making program decisions..." (National Water Program Agenda)

I. Creating a Seven-Year Plan

Forming a Workgroup

The ability to meet long-term demands of the wide spectrum of wetland issues in Oklahoma can only be completed through interagency cooperation. It is understandable that management decisions to meet the long-term demands of wetlands will be made by governmental agencies, tribes, individuals and private corporations. However, through the coordination/facilitation of discussions, education, and exchange of information in making management decisions, cooperative attitudes will make full use of the state's resources for the protection of Oklahoma wetlands. To meet the objectives of the state's Comprehensive Conservation Plan coordination of the wetlands working group is necessary.

The Oklahoma Wetland Working Group was formed in 1993 in order to develop Oklahoma's Wetlands Conservation Plan. The group is made up of members of governmental agencies, tribes, universities, individuals and private corporations. Prospective members were contacted via mail, email, and telephone to inform them of the new group. Quarterly meetings were then held along with the distribution of a newsletter. The effort involved with this interagency cooperation resulted in the completion of the Wetlands Conservation Plan in July 1996. In order to accomplish the objectives laid out in the plan, an FY 98 EPA grant was awarded to assist with the development of a 7-year strategy to meet the objectives of Oklahoma's Comprehensive Wetlands Conservation Plan. This 7-year plan focused on what has been done, what is being done, and what is left to do regarding wetlands in the state.

Getting Started

The objectives of Oklahoma's Comprehensive Wetlands Conservation Plan were used as the basis for the development of the 7-year implementation strategy. Plans were initiated for the development of the 7-year strategy by assigning the Working Group the task of reviewing their goals, objectives and accomplishments with respect to the State's wetland plan. This was the first step in developing the 7-year strategy, and it was important to keep these questions in mind:

- What has been completed?
- What is proposed?
- Who is responsible?
- When will objectives be initiated/completed?

Members of the group compiled lists of projects that their organization has completed relating to the objectives of the conservation plan. This was used as a starting point as to how to accomplish the remainder of the objectives. Next, members listed projects that are ongoing and proposed that address the objectives. The responsibility of completion of each action item contained within the objectives of the conservation plan was then assigned to appropriate entities within the group. The remaining objectives that were not addressed were then given target dates for initiation or completion.

Discussion

After members gave their input, their comments and concerns were compiled and sent out for group review. These items were then discussed at the next work group meeting. During the meeting members would discuss and sometimes debate about projects and action items pertaining to the conservation plan objectives. A general consensus would be reached on what should be done regarding each of the action items within the plan, and then an appropriate party or parties would be assigned the responsibility for overseeing the completion of the task. This process was continued until all of the action items within the wetlands conservation plan were discussed.

It is important to include the input of each of the group members so that all parties are involved with the process, which also lends credibility to the 7-year strategy and its outcome. The consensus should not be based on whoever speaks out the loudest, but on the majority opinion of the group. Dissenters' opinions should be taken into account, and compromises should be made whenever possible.

Ranking

Working group members were then asked to rank the twelve objectives (with 1 being the most important and 12 being the least important) within the wetlands conservation plan in order of importance to their organization. These rankings were then combined in order to determine a group average for importance of the twelve objectives.

The ranking of the objectives again allowed for group participation in the process of developing the 7-year strategy. By ranking the objectives, participants were able to demonstrate their support of some objectives over others. The combination of these rankings not only reflected the thoughts of the group, but also gave direction to the strategy by showing what is more and less important for wetland conservation according to the group.

Final Draft

After all discussions, comments, and drafts were reviewed a final draft was compiled. Any final comments that group members wanted included with the final draft were included as an appendix of the 7-year strategy. This draft was then sent out to the working group for a final review and a last chance to make comments or suggestions to the strategy. The strategy was then sent to the commissioners of the Oklahoma Conservation Commission for approval before submission to the Environmental Protection Agency. The 7-year plan will now be used as a guide for implementing wetland conservation projects in the State of Okahoma.

II. Developing Wetland Assessment Methods

Finding Applicable Methods

Functional assessment methods are used to represent the relationship between functional capacity and characteristics of wetlands. Wetland assessment approaches can help determine the role a wetland plays in its environment and whether it must be protected. These approaches also determine the compensation or mitigation required when wetlands have been damaged. A desire for improved wetland assessment methods has resulted in the development of many rapid assessment approaches in the United States and around the world since 1990 (World Wildlife Fund, 1992, Kusler, 1998, Magee, 1998, Bartoldus, 1999, Ainslie et al., 1999, Gernes and Helgen, 1999). A trend has developed among these methods where specific functions are not evaluated and a smaller number of indicators are used to evaluate functions. However, none of these methods is used on a widespread basis. The validity of wetland assessment methods is limited by several factors, including complex processes that support wetland function; lack of information about these processes; large variability among wetlands; many components of wetland value that must be accounted; and diversity of assessment objectives (World Wildlife Fund, 1992).

For this study wetland assessment methods that are applicable to the diverse wetlands of Oklahoma were compiled into a database. Information was gathered from the original sources for each assessment method, including the type of experience and data required to adequately perform the assessment. The methods were examined to determine the materials and techniques that are necessary to complete the procedures. After this information was gathered, best professional judgment was used to develop a list of advantages and disadvantages for each of the assessment methods. The advantages and disadvantages were based on several aspects, such as: personnel requirements, expertise required, time to perform the assessment, field data collection requirements, and comparability of results. The database was then used to determine what assessment methods to apply in the field.

Choosing a Method for Application

Three rapid functional wetland assessment methods and one wetland biological assessment were chosen to apply across the state. The methods chosen include the Wetland Evaluation Technique (WET), Hydrogeomorphic Approach (HGM), A Rapid Procedure for Assessing Wetland Functional Capacity (RAP), and Index of Biological Integrity (IBI) for wetlands. Wetland assessment models were first developed in the early 1970's at the University of Massachusetts to aid in the decisions of government agencies concerning permits that would alter wetlands (Larson and Mazzarese, 1994). One of the first methods to consider the range of wetland functions that could be assessed quickly, accurately, and consistently was WET. WET is a broad-based wetland assessment approach that is designed to gather information rapidly regarding wetland functions (Adamus et al., 1991). Eleven functions and values are evaluated by WET according to social significance, functional capacity, or habitat suitability (Bartoldus, 1999). The data obtained using WET can be used for comparative analysis of all wetlands in a region (Novitzki, 1995).

HGM is being developed by the U.S. Army Corps of Engineers under a National Action Plan to perform wetland functional assessments across the country. HGM is a collection of concepts and methods used to develop functional indices that could be used to assess the capacity of a wetland to perform functions compared to other wetlands in the same regional class (Ainslie et al., 1999). HGM attempts to increase the accuracy of assessments, allow for reproducibility, and reduce the time required to perform an assessment. HGM is based on three factors that influence wetland function: position in the landscape, water source, and the dynamics of water once in the wetland. HGM differs from other assessments in that it classifies wetlands based on their different functions, it defines functions that each class performs, and it uses reference wetlands to develop a range of wetland functions (U.S. Army Corps of Engineers, 1996). Wetlands assessed with HGM can only be compared with other wetlands in the same regional class (Novitzki, 1995). Also, HGM does not provide information regarding social significance or specific species, which may be important for regulations. Additionally, HGM requires a team of experts and requires much time during the development phase (Kusler, 1998).

RAP was developed on the principles of HGM classification and the concept of functional capacity. So, geomorphology and hydrology were the primary factors used to determine the physical, chemical, and biological characteristics of wetlands for this method. Thirty-three landscape, hydrologic, soil, and vegetation variables are assessed to determine the functional capacity of eight different wetland functions. However, unlike HGM, RAP does not require the use of reference wetlands and quantitative measurements in order to develop a model for assessment. HGM requires more time and money to establish reference wetlands for each wetland subclass, therefore, the RAP was developed for rapid functional assessment when time and cost factors prohibit establishing reference wetlands (Magee, 1998).

Wetland biological assessments measure the health of biological communities in wetland habitats by taking quantitative measurements of assemblages of plants, invertebrates, fish, or wildlife. An IBI is a combination of several biological indicators, or metrics, in a summary index. The IBI can detect damage to a wetland caused by chemical, physical, or biological stressors. Other types of biological assessments include the Habitat Evaluation Procedure and Habitat Assessment Technique. Biological assessments can possibly be used with functional assessments to more accurately characterize wetland conditions and predict changes that may result from human activities (Danielson, 1998).

Selecting Study Sites

For this study, wetland assessment methods were applied to three wetland types. The research sites were chosen from three distinct ecoregions of the state to attain a variety of conditions under which wetlands exist. Using sites from different parts of the state will aid in determining the applicability of the assessment methods to diverse wetlands.

<u>Study Area 1: Deep Fork BLH</u> is located along the Deep Fork River in Okmulgee County in east-central Oklahoma. It lies in the Central Oklahoma/Texas Plains ecoregion (Omernik, 1987). This ecoregion is made up of rolling sandstone hills that support a variety of natural communities because it is a transition zone between eastern forests and western grasslands. The level areas consist of mostly prairie systems, while upland forests cover slopes and hills with bottomland forests along streams (Oklahoma Cooperative Extension Service, 1998). This wetland is a large (~3800 ha) bottomland hardwood forest system on the Okmulgee Wildlife Management Area with several vegetative layers dominated by a high broadleaf deciduous tree canopy including *Quercus sp.*, *Carya cordiformis*, and *Ulmus alata*, and an understory of *Chasmanthium latifolium* and *Carex sp*. The region receives an average of 40 inches of precipitation annually (Sparwasser et al., 1968). This forested wetland is inundated when it receives water from overbank flooding of the river and runoff from adjacent uplands. During the winter and early spring groundwater tables are near the surface (Oklahoma Conservation Commission, 2001). High water marks are on trees about 1.2 meters above the soil surface. Soils are of the Verdigris-Pulaski complex formed in recent alluvium with partially decomposed plant material that has a charcoal appearance in the top layer (Sparwasser et al., 1968).

Study Area 2: Cimarron Terrace Depression is located in northwestern Oklahoma in Kingfisher County in the Central Great Plains ecoregion (Omernik, 1987). Mixed grass prairie predominates this ecoregion, with woodlands scattered along streams and ravines. Along major rivers of this ecoregion, sand dunes or terraces have formed by wind and water forces mostly on north banks. The wetland site is a ~20 ha depressional marsh, known locally as Hajek Marsh. This wetland is one of the many Cimarron Terrace Depressions that are located in this region. This wetland type formed on a hummocky, sandy terrace in northwest Oklahoma, known as the Cimarron Terrace, where windblown sediments have blocked drainage ways or the wind has blown out depressions in the sandy soil. Typically these wetlands are round to narrow ovals in shape and maintain nearly permanent water during wet cycles but may dry up during drought cycles (Oklahoma Cooperative Extension Service, 1998). However, the research wetland site contained water even during a drought year. It is dominated by the emergent vegetation *Typha angustifolia* and *Scirpus americanus* with the woody vegetation *Cephalanthus occidentalis* and *Salix nigra* prevalent on the wetland edges. This area of the state receives ~30 inches of precipitation per year (Fisher et al., 1962). The wetland receives water through precipitation and overland flow, and is influenced by a shallow groundwater table. The soil is very sandy, grayish-brown, and is classified as wet alluvial land (Fisher et al., 1962).

Study Area 3: SE OK Slope Seep is located in McCurtain County in southeastern Oklahoma in the South Central Plains ecoregion (Omernik, 1987). Moist upland forests with tall, dense canopies dominate this ecoregion. These forests are multilayered, which creates more habitat components and increases animal diversity. Forested swamps are a prevalent type of wetland that is often inundated occurring along low-lying streams and rivers, but the study site is a different forested habitat (Oklahoma Cooperative Extension Service, 1998). The wetland is a hillside, forested wetland (~6 ha) and is hydrologically fed by a groundwater seep. It has a canopy dominated by broadleaf deciduous trees such as *Quercus alba*, *Acer rubrum*, and *Liquidambar styraciflua*, but also includes many *Ilex opaca*, which is a broadleaf evergreen tree, with the understory vegetation dominated by the ferns *Osmunda regalis* and *Osmunda cinnamomea*. The region receives an average of 54 inches of precipitation annually (Reasoner, 1974). The seep flows continuously throughout the year and was found to be seeping during the driest part of the year. There is a thick layer of partially decomposed organic matter above a gleyed soil matrix, which indicates a very wet soil. The soil is classified as a Bibb-Iuka complex, which is a mixture of fine sandy loam soils (Reasoner, 1974).

Conducting Assessments

All of the assessments were conducted according to each of the published methods and examined the following wetland functions:

- Groundwater recharge
- Groundwater discharge
- Storm and floodwater storage
- Modification of stream flow
- Modification of water quality
- Export of detritus
- Wetland vegetation diversity/abundance
- Wetland fauna diversity/abundance

The HGM methodology, *A Regional Guidebook for Assessing the Functions of Low Gradient, Riverine Wetlands in Western Kentucky*, consisted of measuring 27 variables using topographical maps, aerial photographs, conducting field investigations, and using sample plots. These measures were then analyzed using two steps. The first step was to transform the measurement of the assessment variables into a variable subindex. This was done by using prepared graphs for each variable, or by using a spreadsheet prepared to do the calculations automatically as laid out in the methodology. The second step was to insert the variable subindices into the assessment models to calculate the Functional Capacity Indexes (FCIs). The FCI, a number between 0 and 1, would then be used to compare functions to those of reference sites within the region (Ainslie et al., 1999).

The RAP methodology, *A Rapid Procedure for Assessing Wetland Functional Capacity*, required the use of aerial photographs, maps, field observations, and any other available resources to measure the variables used to determine functional capacity. There were five landscape variables, fifteen hydrologic variables, one soil variable, and twelve vegetation variables that were measured to establish the functional capacity of a wetland. Different ranges or choices exist, defined by the developers of the RAP, that best describe each of the variables for a wetland. The variables and their possible descriptions can be found on the field data sheets. After all of the variables have been described, a weighted scoring sheet is used to assign values between 0 and 3 to the variables that affect each of the eight functions. The values for the variables are then added up and divided by the total possible to give the FCI score for that particular function. For example, if a function received a value of 11 for the variables associated with it and the total possible was 12, then the FCI would be 0.92.

$$\mathrm{FCI} = \frac{\text{variable score}}{\text{total possible}} = \frac{11}{12} = 0.92$$

The FCIs range from 0 to 1.0, with 0 showing dysfunction and 1.0 demonstrating that the wetland should be performing the function adequately. Each of the eight functions receives a score between 0 and 1.0 to show its functional capacity (Magee, 1998).

The evaluations for WET, *Wetland Evaluation Technique Volume II: Methodology*, consist of series of 50 yes or no didactic questions that pertain to predictors that directly or indirectly measure the physical, chemical, and biological processes or attributes of a wetland area. By using topographic maps, NWI maps, aerial photographs, county soil surveys, and field observations, the questions are answered about the wetland and its surroundings. The responses to the questions are then analyzed with a series of interpretation keys for each of the functions. A rating is assigned based on the results for a function of low, moderate, or high for social significance, effectiveness, and opportunity (Adamus et al., 1987).

There were two sets of metrics involved with the IBI method, *Indexes of Biotic Integrity (IBI) for Wetlands: Vegetation and Invertebrate IBI's*, implemented on Study Site 2. The vegetation IBI used the releve method of vegetation sampling (Mueller-Dombois and Ellenberg, 1974) because it is adaptable to a variety of vegetation habitats and community structures of depressional wetlands. The releve plot was established by placing a re-bar rod at the first corner of the plot. Then 14.14 meters was measured as the diagonal to the opposite corner of the plot, and a second rod was placed. The third and fourth rods were placed at right angles and 10 meters from the first two rods to form a 10 x 10 meter plot, while minimizing trampling the plot area. The plot was then walked to inventory the plant species present. Then the cover class was estimated for all of the plant taxa in the sample. The vegetation sampling was done in July, which is roughly the middle of the growing season for Oklahoma, and is a good time for determining community structure.

The vegetation IBI developed by the Minnesota Pollution Control Agency (MPCA) uses aquatic plants as the basis of the multimetric biological criteria to evaluate wetland quality. The metrics are biological attributes that have a consistent and predictable response to human disturbances. This IBI consists of ten metrics. Four of the metrics concentrate on life-form guilds and two each focus on taxa richness, sensitive and tolerant taxa, and community structure. It is advantageous to use plants as indicators of wetland quality because both vascular and nonvascular plants are common and diverse enough to provide clear signals of human disturbance. Plants are also relatively easy to work with and are known to be acutely sensitive to disturbances such as heavy metal contaminants (Gernes and Helgen, 1999).

The overall vegetation IBI was calculated by summing all of the scores obtained from the ten metrics described above. This creates a multimetric vegetation index that assesses the biological integrity of the wetland area. This information can then be used to compare the health of a wetland to relatively undisturbed and impaired sites. The overall IBI score comparison can then indicate whether the wetland is in excellent, good, or poor condition.

For the invertebrate IBI, invertebrates were collected using dipnetting and activity trap methods. Dipnetting was used to capture the greatest richness of invertebrates, but it undercollects large actively swimming or night-active predators. So, activity traps or bottletraps were placed in the wetland over the period of two nights to collect the active swimmers and night-active predators.

The wetland invertebrate IBI developed by MPCA uses aquatic invertebrates to determine the condition of wetlands since they are sensitive to a variety of environmental stresses. Invertebrates exhibit acute and chronic effects in response to disturbances such as metals, pesticides, acidification, siltation, and eutrophication. The types of invertebrates that are used to assess depressional wetlands include insect and non-insect taxa. Data on species richness and composition is more important that biomass or abundance information because it shows a strong correlation to human disturbances. This data may then be used to develop the metrics to calculate the IBI. Since there is wide variety of wetlands, study sites would need to be stratified by wetland class to reduce the biological variability. Different wetland types would be expected to have different biological assemblages and may require some adjustments to the metrics or in the expectations of the metric scoring (Gernes and Helgen, 1999).

The overall invertebrate IBI was calculated by summing all of the scores obtained from the ten metrics described above. This creates a multimetric invertebrate index that assesses the biological integrity of the wetland area. This information can then be used to compare the health of a wetland to relatively undisturbed and impaired sites. The overall IBI score comparison can then indicate whether the wetland is in excellent, good, or poor condition.

Analyzing Assessment Methods

The HGM assessment method requires a great amount of time to develop. The method proved to be thorough, but it is only useful for one regional wetland type. A specific method must be developed for each regional wetland type. The method is based on reference sites, which allows for an accurate development of standards to compare to other sites and also requires much time. After the development phase of the method it can be applied quickly in the field. The quantitative measures that are incorporated into the method allow for reproducibility and strengthen the output of the assessment. In order to implement this method in Oklahoma, a list of dominant plant species for each vegetation strata for BLH wetlands in the state would need to be made. The method would also need to be applied to other BLH wetlands in the state. This would enable adjustments to be made to make it regionally specific to Oklahoma. Then, in order to assess different wetland types in the state it would be necessary to develop a regionally specific method for each type. This would require much time, but it would be comprehensive.

The RAP assessment method is similar to the HGM method in that they both use an FCI scoring procedure, but the actual calculating procedure differs. The RAP relies on semiquantitative variables to calculate its FCIs, unlike the quantitative measurements required by HGM. RAP can be applied to different wetland types, and it can be used quickly in the field.

The WET assessment method has been around longer than any of the other assessments applied in this paper. It can be applied to any wetland type, and all of the results are qualitative. While this method can be used on a widespread basis, its questions and interpretation keys become tedious and confusing at times.

The qualitative comparisons of the outputs of the RAP and WET assessments on the Cimarron Terrace Depression were very similar, while the output for RAP was generally higher than the output for WET for the Deep Fork BLH and SE OK Slope Seep. This may be due to the age of WET, which may have put greater emphasis on wetlands with standing and open water areas and RAP better accounts for "drier-end" wetlands such as these.

In order to implement RAP in Okalahoma, the method would need to be applied to a variety of wetlands in the state. This would display a range of FCI values that could be used for comparisons, making the method regionally specific to Oklahoma.

The bioassessments have a purpose of indicating the condition of a wetland in regard to disturbances. These are valuable tools that can be used to determine the quality of a wetland that may be altered, but they lack the functional information that functional assessments can provide. Bioassessments cannot take the place of functional assessments, but they could be used in conjunction with functional assessments to get a better overall picture of the wetland "health". The functional assessment would provide information about the activities a wetland is performing while a bioassessment could provide better information about the quality of a wetland. In order to implement these methods in Oklahoma, lists of tolerant and sensitive species in Oklahoma would need to be developed. Also, the methods need to be applied to a range of wetlands that are relatively undisturbed and impaired. This would provide metric ranges specific to Oklahoma that could be used to assess other wetlands in the state.

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