



**Conservation Effects Assessment Project**  
**National Assessment – Wetlands Component**

**Conceptual Framework Document**  
**February 2006**

*Success will ultimately only happen to the degree to which we  
can learn and use what we have learned to improve our  
conservation efforts (Salafsky et al. 2001)*

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## INTRODUCTION

The goal of Conservation Effects Assessment Project National Assessment Wetlands Component (CEAP-Wetlands) is to quantify the effects of conservation practices and management systems on ecosystem services provided by wetlands on agricultural landscapes. This information will be made available to decision and policy makers, program managers, conservation practitioners, and other stakeholders involved in wetland conservation.

CEAP-Wetlands is assembling and analyzing quantifiable data to provide findings on the status, change, and level of ecosystem services provided by wetlands on agricultural landscapes, including U.S. Department of Agriculture (USDA) Farm Bill “program wetlands”, i.e. Wetlands Reserve Program, Conservation Reserve Program, wetland compliance “Swampbuster”). The inclusion of USDA program wetlands can help USDA define conservation program success, allow re-evaluation of program goals and standards, and inform internal USDA conservation technical sources, standards, specifications and expected outcomes.

CEAP-Wetlands is comprised of several activities that cumulatively produce an objective, scientifically based approach:

1. Conduct *collaborative* regional assessments to quantify onsite and offsite effects of USDA conservation practices and resource management systems on ecosystem services provided by wetlands on agricultural landscapes. Regional effects will be interpreted by quantifying ecosystem services provided by each regional wetland class(es) sampled. The following wetland ecosystem services (modified from Daily et al. 1997) will be quantified, depending on the regional wetland class(es) of interest:
  - biological conservation and sustainability
  - habitat quality for flora and fauna
  - pollutant reduction (e.g., erosion, sediment, nutrient, and pesticide reduction)
  - mitigation of floods (i.e., floodwater storage, reduction and attenuation)
  - greenhouse gas emissions reduction (e.g., carbon sequestration in soils and vegetation, nitrous oxide reduction)
  - water quantity sustainability and partitioning (i.e., groundwater recharge, base streamflow augmentation)

Other wetland ecosystem services, such as production of food or fiber, recreational support, production of livestock forage, and timber production may be assessed, including economic evaluation, as the initial assessments are completed.

Collaboration with experts in the economic and social sciences will be sought to undertake relevant data gathering and analysis, building upon and complementing the biological, ecological and environmental findings from the initial regional assessments.

2. Develop predictive functional condition indicator models for wetland ecosystem services from the regional assessment data. These models will be used to identify site and landscape-scale factors that influence the range of estimates produced for each wetland ecosystem service. The models can be used with geo-referenced data to track changes in wetland ecosystem services as a function of condition.
3. Model the effects of wetland conservation practices and management systems under varying environmental conditions or program scenarios.
4. Conduct a peer-review of the CEAP-Wetlands approach to a) evaluate its scientific merits, b) evaluate whether it is structured to meet its intended purpose, and c) assist USDA in developing a long-term plan to quantify conservation practice and resource management systems effects on wetland ecosystem services. A focus of the plan will be to develop models to distinguish temporal changes due to climatic variability from those due to the effects of Farm Bill conservation practices and resource management systems.
5. Develop partnerships to implement the long-term plan.
6. Validate and evaluate the efficacy of models to quantify the effects of changing wetland conditions that result from implementing conservation practices and resource management systems on agricultural landscapes.

### **Overview of the CEAP-Wetlands Approach**

USDA and its partners will conduct regional assessments in 10 geographic areas of the conterminous U.S.: Appalachian Highlands, Central Plains, Central Valley of California, Glaciated Interior Plains, Gulf-Atlantic Coastal Flats, Gulf-Atlantic Rolling Plain, The High Plains, Northwest, Mississippi Alluvial Valley, and Prairie Pothole Region (Figure 1). Through the regional assessments USDA will a) estimate wetland ecosystem services, b) interpret effects of USDA conservation practices and resource management systems on wetland ecosystem services, c) produce the predictive models, and d) simulate estimates

of the ecosystem services under varied scenarios. The findings may be extrapolated to similar wetland classes in areas not sampled if documentation exists to support that action through findings published in peer-reviewed journals.

The CEAP-Wetlands regional assessment approach is based, in part, on ecological tenets that provide the basis for the “hydrogeomorphic” approach (i.e., HGM) to wetland functional assessment (Smith et al. 1995). Where appropriate, terminology developed for the HGM classification (Brinson 1993) and functional assessment (Smith et al. 1995) will be used to describe the CEAP-Wetlands approach.

*A reference based approach* (Brinson 1993; Brinson and Rheinhardt 1996) provides the model construct for the CEAP-Wetlands regional assessments (Figure 2). In each CEAP-Wetlands regional assessment, wetland ecosystem services will be sampled and analyzed for one or more classes of wetlands in a defined geographic area. The sample population will include both USDA program and non-program sites. All wetlands of a particular class on agricultural landscapes represent the sample population, or “reference domain” (Brinson and Rheinhardt 1996; Smith et al. 1995). For example, in the Prairie Pothole Region, depressional wetlands, commonly known as prairie potholes, are the initial focus. In the Mississippi Alluvial Valley, the initial focus is on riverine class bottomland hardwood wetlands. The sites selected for sampling will represent the known range of natural disturbance and human alterations to that regional class of wetlands. Consequently, the level of wetland ecosystem services will reflect the degree of anthropogenic alteration within the range of natural variation represented by a particular wetland class. In each case, it is generally possible to identify a full range of human-induced alterations.

The reference based approach is critical to discerning changes in levels of wetland ecosystem services resulting from implementation of conservation practices and resources management systems on agricultural landscapes. Wetlands that are highly altered, such as those that are ditched or tilled and cropped, may still provide ecosystem services such as reducing nutrient loads to surface waters. The level of this service, however, is likely greatly diminished, or even reversed due to the altered landscape conditions. For example, sedimentation in a wetland basin beyond ambient levels results in degraded ecosystem services: a buried soil surface horizon, shortened hydroperiod, lowered water table, elimination of the surface aerobic-anaerobic zone, and alteration of nitrogen transformation processes.

Implementation of conservation practices and resource management systems on the cropland contributing the sediment load may halt further impairment. Full recovery to sustainable conditions would likely require implementation of practices that restore the wetland and surrounding upland to a condition that mimics or replicates the unaltered state. Given enough time, restored wetlands should function at levels approximating or achieving sustainable conditions within the landscape. The integration of a reference approach into the CEAP-Wetlands regional assessment framework provides a mechanism to quantify changing conditions and ecosystem services over time.

The regional assessment sampling design will be developed with collaborators involved in data collection and analysis. In addition to selecting sites along the alteration gradient, further stratification to control natural variation may be needed to improve the resolution of distinguishing human-induced alteration from natural variation. Such sources of variation include regional geomorphic features, subphysiographic regions, USDA program site 'age', conservation goals associated with the conservation practice or resource management system implemented (i.e., restoration of wildlife habitat, decreased sediment deposition downstream, increased soil carbon storage), and other possible factors specific to the assessment region. Stratification helps to partition the variability associated with a random sampling approach, and increases the statistical robustness and scientific credibility of the findings.

The CEAP-Wetlands regional assessment approach uses various analytical tools to calculate numerical estimates of wetland ecosystem services before and after implementation of conservation practice and resource management system implementation, to develop wetland functional condition indicator models, and to conduct simulations to model estimates under various program and environmental scenarios. The wetland ecosystem service estimates will provide information to interpret conservation effects for a subpopulation of the dominant HGM class or classes. In some cases, regional subclasses of wetlands may be evaluated for which regional HGM guidebooks have been developed. Where this occurs, that body of work can help inform the CEAP-Wetlands regional assessment scope, and where appropriate, build on the data collected to develop the guidebook.

The CEAP-Wetlands regional assessment produces quantifiable estimates of changes in wetland ecosystem services before and after conservation practice/system implementation for a population of wetlands within a geographic region. The before or "baseline"

conditions provide the benchmark for comparing effects of practice/system implementation, or the “conservation effect”. This information is then used to quantify changes resulting from the implementation of practices or resource management systems. The result is the production of information that then can be used to inform conservation actions for a region, such as identifying new conservation activities that may be needed or reinforcing existing activities to achieve demonstrated ecosystem service benefits.

Some wetland ecosystem services are difficult to directly measure over large scales, require repeated sampling for reliable results, or produce variations that are difficult to interpret. Consequently, the initial regional assessment sampling will rely upon study designs that involve less intensive sampling of variables and include variables that are sensitive to alteration of ecosystem functions and services by humans. For each ecosystem service, a measure (i.e., a description of what is being quantified) and variables associated with the measure are developed. Calibration of the predictive functional condition indicator models, however, is required since the models will be developed from the initial regional assessment dataset. These calibrations may require that multiple samples be taken over multiple periods of time. Once the indicator models are calibrated (and in some cases validated), they may be applied routinely in CEAP-Wetlands regional assessments. Model calibration will be addressed by exploring opportunities with regional assessment collaborators and others undertaking such investigations.

The regional wetland functional condition indicator models will be developed through the use of statistical and multivariate tools that investigate the relationships between the wetland ecosystem service estimates produced and the multiple-scale data collected (Figure 3). These estimates will reflect the alteration gradient along which the regional wetland class exists. The predictive wetland functional condition indicator models serve to link ecosystem functions and services with wetland condition, and provide a means to identify those factors that contribute to the range in estimates for a wetland ecosystem service.

By simulating estimates of ecosystem services under varying practice and management system scenarios, CEAP-Wetlands will provide information to program and policy decision-makers for developing analysis of alternatives. Initially, the simulated estimates will reflect the wetland ecosystem services addressed in the regional assessment. As the regional estimates are refined, simulations will reflect the

scope of those activities. Simulations will be undertaken using a variety of analytical tools. Simulated estimates may be presented as index values, ranges or in other formats depending on the ecosystem service and the data supporting the simulation.

## **Collaboration**

### *Regional Assessments*

USDA cannot achieve the goals of this project without active partners. Synergistic partnerships are key to leveraging the resources necessary to produce scientifically credible results. USDA is actively seeking participation by other organizations that have similar needs and conservation interests. USDA resources will provide a catalyst to initiate assessment of wetlands on agricultural lands across broad geographic regions, but partnerships with organizations involved in complementary investigations are critical to producing comprehensive, credible results. Multi-state, inter-governmental, and public-private regional assessments will further individual organizational needs but also provide a forum to forge long-term partnerships to achieve common goals.

NRCS is leading CEAP-Wetlands. The Farm Service Agency (FSA) provides critical data and resources to support the assessment of conservation practice effects on wetlands enrolled in the Conservation Reserve Program. CEAP-Wetlands information is available on the CEAP web page (<http://www.nrcs.usda.gov/technical/NRI/ceap/wetlands.html>).

As each new regional wetland assessment begins, NRCS will conduct scoping meetings and internal net conferences to further collaborative activities, minimize duplication of effort, leverage resources, and maintain open lines of communication.

USDA has initiated two CEAP-Wetlands regional assessments: the Prairie Pothole Regional Assessment (PPR) and the Mississippi Alluvial Valley Regional Assessment (MAV). In the PPR, USDA is collaborating with the U.S. Geological Survey (USGS) Northern Prairie Wildlife Research Center (NPWRC) in Jamestown, North Dakota. The U.S. Fish and Wildlife Service (USFWS) is a partner in the intensive, longer term second phase of the PPR. In the MAV, USGS's National Wetlands Research Center (NWRC) in Lafayette, Louisiana and the USFWS are key collaborators with USDA. .

### *Peer Review Panel*

The Association of State Wetland Managers facilitated a peer review panel in May 2005 to critique the scientific merits of the CEAP-Wetlands approach, under an agreement with NRCS. The panel is composed of wetland researchers and managers. A summary report of the comments and recommendations from the panel is available on the CEAP website.

Membership of the panel may change over time depending on panel member availability and research interests, as well as new interest by other researchers. The panel will serve as a scientific sounding board. The panel is an important resource for USDA and will contribute to the evolution of CEAP-Wetlands.

### **Milestones and Expected Products**

CEAP-Wetlands will produce national and regional reports, as well as other types of documents.

A CEAP-Wetlands work plan is under development. A draft will be available for review in late 2006. The work plan will be revised as needed over the long-term to reflect changes in the approach, emerging issues, and application of new technologies to acquire, analyze and present conservation effects findings.

CEAP-Wetlands will provide quantifiable, scientifically-based information to USDA and other stakeholders. This information can help implement an adaptive management approach to wetland programs. CEAP-Wetlands will provide important information to identify refinements in conservation practice standards, including techniques, management activities, and timing along with other refinements which affect wetland sustainability on agricultural landscapes. For example, use of data and findings from the CEAP-Wetlands regional assessments can be used to refine the qualitative information contained in the Conservation Practice and Management Systems Physical Effects tables in the NRCS Field Office Technical Guides. It is only through the implementation of CEAP-Wetlands as an adaptive management tool that the full measure of USDA conservation practices and management systems can be evaluated and refined over time.



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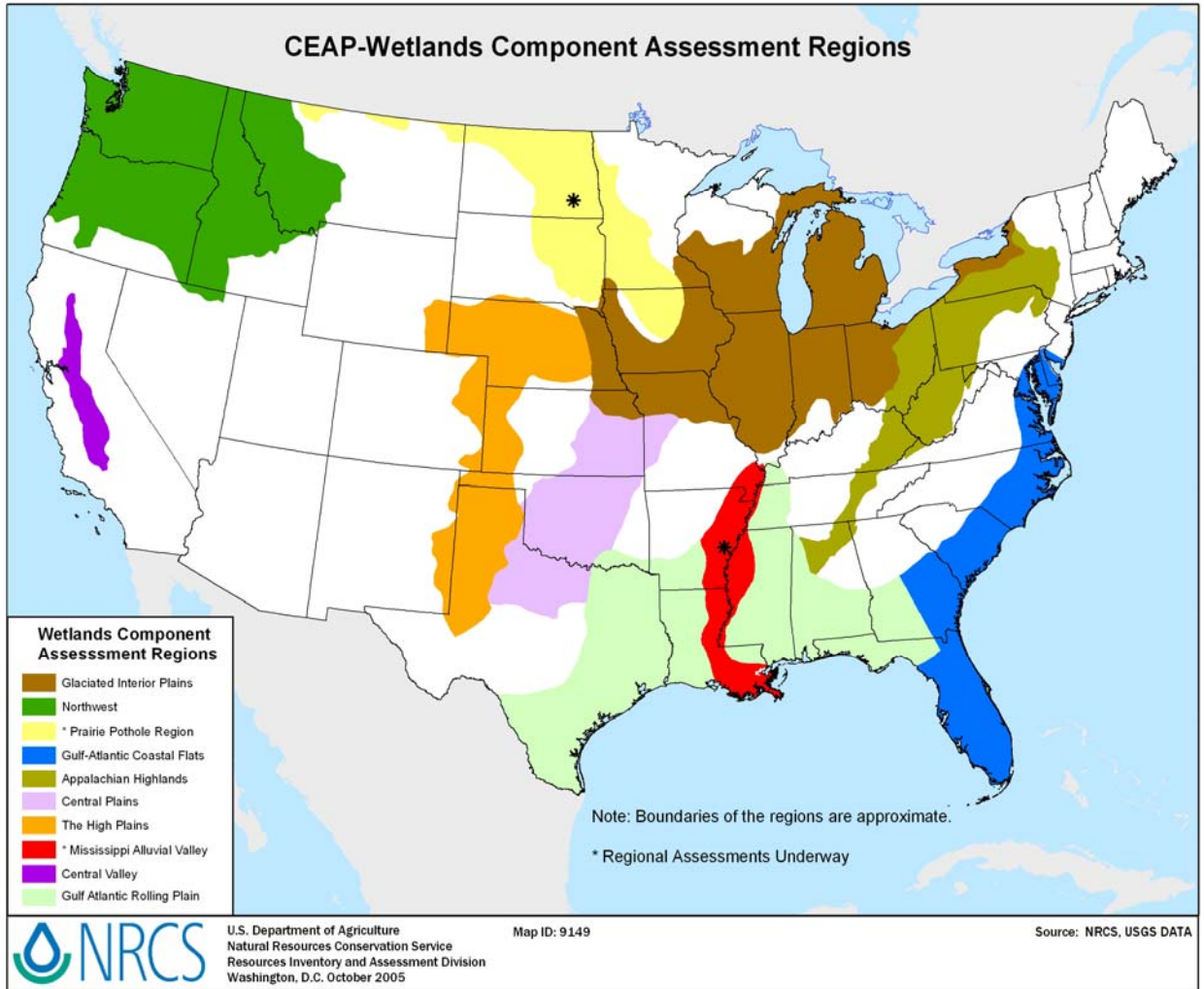
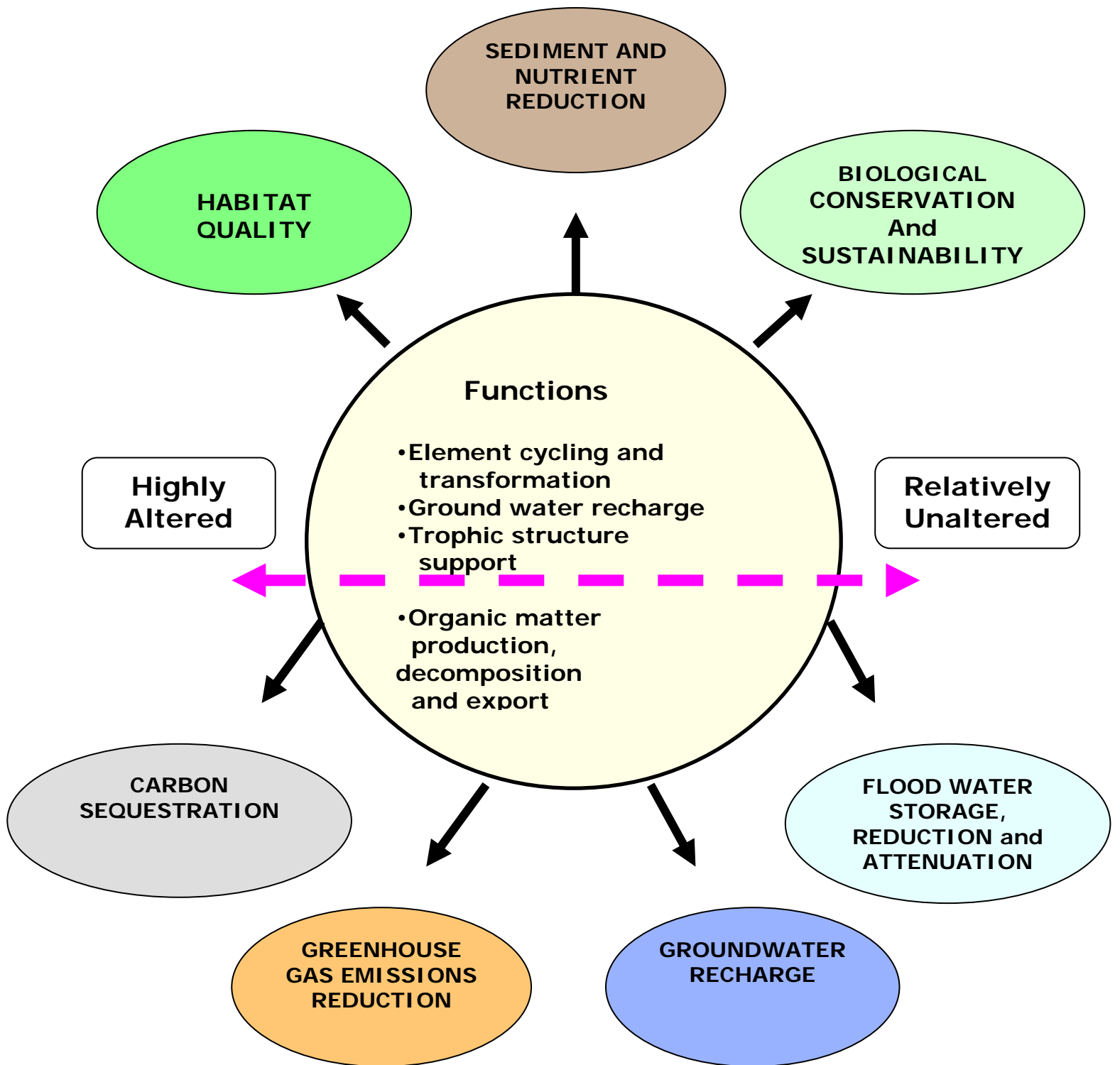


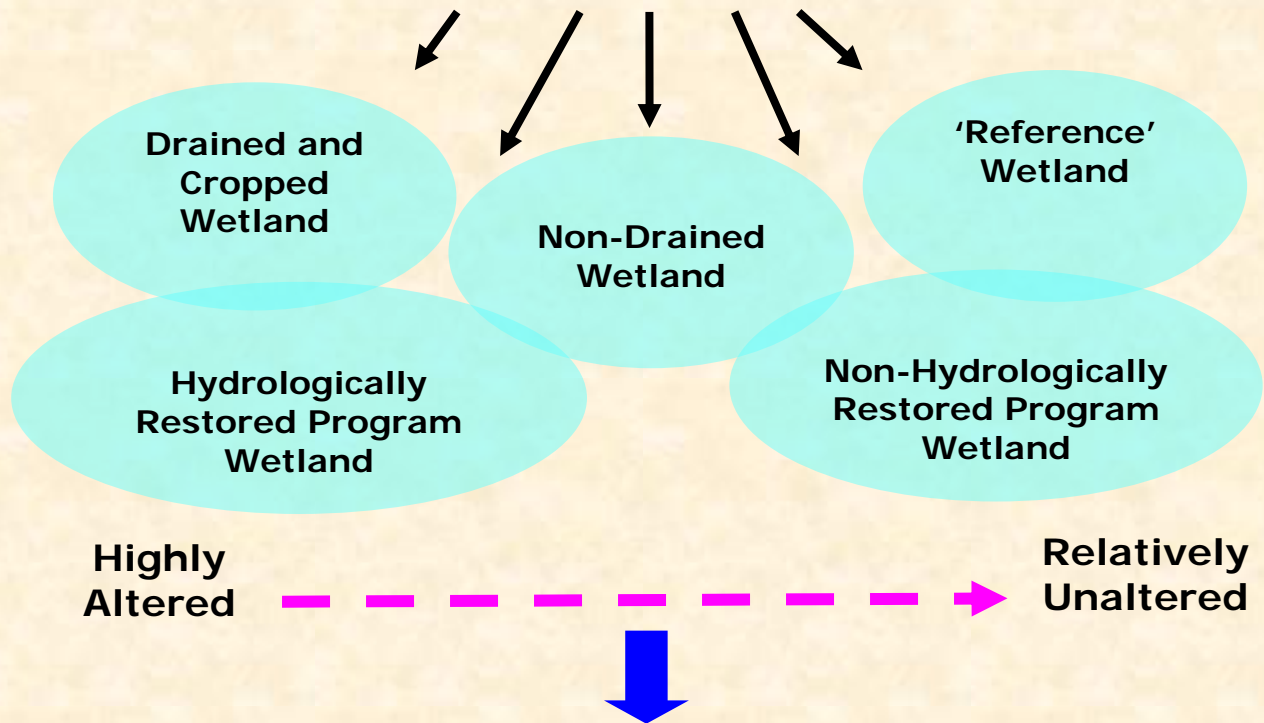
Figure 1. CEAP-Wetlands assessment regions.



**Figure 2. The relationship between wetland functions and ecosystem services, and the quality of services as affected by the condition of the wetland and contributing landscape.**

# Quantifiable Estimates of Conservation Practice and Resource Management Effects on Wetland Ecosystem Services:

## *Sequestration of Soil Carbon*



Highly Altered

Relatively Unaltered

## Predictive Functional Condition Indicator Models for *Sequestration of Soil Carbon*

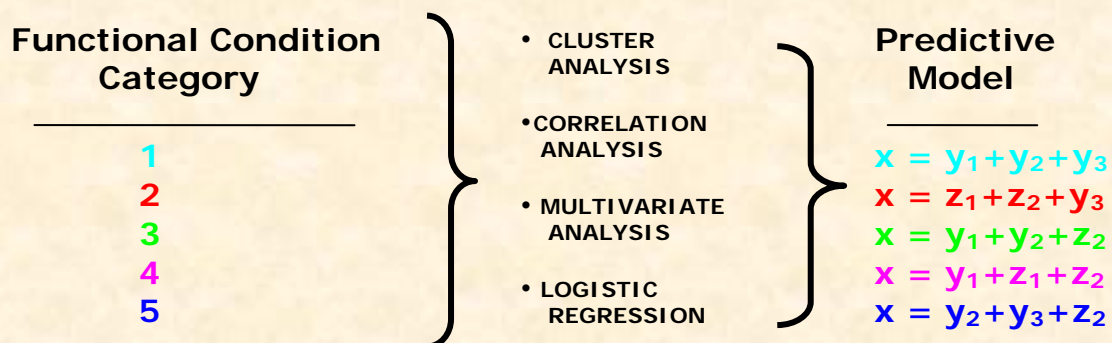


Figure 3. Conceptual process to develop wetland predictive functional condition indicator models from estimates produced for one wetland ecosystem service, *Sequestration of Soil Carbon*.