

WETLAND CREATION AND RESTORATION

THE STATUS OF THE SCIENCE

Edited by

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Foreword by Senator George J. Mitchell

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WETLANDS RESTORATION/CREATION/ENHANCEMENT TERMINOLOGY: SUGGESTIONS FOR STANDARDIZATION

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INTRODUCTION

This document includes a glossary that was prepared after review by all the authors. Four versions of the manuscript have been circulated for reviewers' comments, and each version was an improvement on the previous one. The specific definitions in the glossary represent an attempt to bring some order to the terminology applied to the topic of wetland creation and restoration. It has been our collective experience

that much confusion exists about specific terms, and they are used in different ways by different authors in different parts of the country. Unfortunately, much of the existing confusion is becoming formalized as states, counties, and municipalities develop their own regulations related to wetland creation and restoration. This discussion of terminology is meant to highlight the major problem areas.

HISTORICAL CONTEXT

In looking for a starting point we were able to find only three existing glossaries applicable to the topic. These were contained in the U.S. Army Corps of Engineers Wetlands Delineation Manual prepared by the Environmental Laboratory Waterways Experiment Station, Vicksburg (Environmental Laboratory 1987), the U.S. Fish and Wildlife Service's classification of wetlands and deepwater habitats of the United States (Cowardin et al. 1979), and the proceedings of a conference titled Wetland Functions, Rehabilitation and Creation in the Pacific Northwest: The State of Our Understanding, prepared by the Washington State Department of Ecology (Strickland 1986). Three additional glossaries (Helm 1985, Rawlins 1986, and Soil

Survey Staff 1975) were recommended by reviewers and have been used to improve this section. To these combined glossaries were added definitions from individual authors of published papers or proceedings, for example Zedler (1984) and Schaller and Sutton (1978), and regulatory or review agency rule promulgation, such as U.S. Fish and Wildlife Service (1981). Where the existing definitions were checked against dictionary definitions, Webster's Unabridged Dictionary, Second Edition (McKechnie 1983) was used as the reference dictionary. Some geological terms were taken from Bates and Jackson (1984) and Gary et al. (1972) as recommended by reviewers.

DISCUSSION

The five key definitions are: mitigation, restoration, creation, enhancement, and success. Briefly, McKechnie (1983) defines these terms as follows:

MITIGATION

alleviation; abatement or diminution, as of anything painful, harsh, severe, afflictive, or calamitous (p. 1152);

RESTORATION

a putting or bringing back into a former, normal, or unimpaired state or condition (p. 1544);

CREATION

the act of bringing into existence (p. 427);

ENHANCEMENT

the state or quality of being enhanced; rise, increase, augmentation (p. 603);

SUCCESS favorable or satisfactory outcome or result (p. 1819).

For the purposes of this document, we are defining these terms so that there is as little ambiguity and overlap as possible. The glossary definition and an explanation of each of the key terms is provided below.

MITIGATION - For the purposes of this document, the actual restoration, creation, or enhancement of wetlands to compensate for permitted wetland losses. The use of the word mitigation here is limited to the above cases and is not used in the general manner as outlined in the President's Council on Environmental Quality National Environmental Policy Act regulations (40 CFR 1508.20).

MITIGATION BANKING - Wetland restoration, creation, or enhancement undertaken expressly for the purpose of providing compensation for wetland losses from future development activities. It includes only actual wetland restoration, creation, or enhancement occurring prior to elimination of another wetland as part of a credit program. Credits may then be withdrawn from the bank to compensate for an individual wetland destruction. Each bank will probably have its own unique credit system based upon the functional values of the wetlands unique to the area. As defined here, mitigation banking does not involve any exchange of money for permits. However, some mitigation programs, such as those in California, do accept money in lieu of actual wetland restoration, creation or enhancement.

RESTORATION - Returned from a disturbed or totally altered condition to a previously existing natural, or altered condition by some action of man. Restoration refers to the return to a pre-existing condition. It is not necessary to have complete knowledge of what those pre-existing conditions were; it is enough to know a wetland of whatever type was there and have as a goal the return to that same wetland type. Restoration also occurs if an altered wetland is further damaged and is then returned to its previous, though altered condition. That is, for restoration to occur it is not necessary that a system be returned to a pristine condition. It is, therefore, important to define the goals of a restoration project in order to properly measure the success.

In contrast with restoration, creation (defined below) involves the conversion of a non-wetland habitat type into wetlands where wetlands never existed (at least within the recent past, 100-200 years). The term re-creation is not recommended here due to confusion over its meanings. Schaller and Sutton (1978) define restoration as a return to the exact pre-existing conditions, as does Zedler (1984). Both believe

restoration is therefore seldom, if ever, possible. Schaller and Sutton (1978) use the term rehabilitation equivalent to our restoration. For our purposes, "rehabilitation" refers to the conversion of uplands to wetlands where wetlands previously existed. It differs from restoration in that the goal is not a return to previously existing conditions but conversion to a new or altered wetland that has been determined to be "better" for the system as a whole. Reclamation is also used to mean the same thing by some, but "wetland reclamation" often means filling and conversion to uplands, therefore its use is not recommended.

CREATION - The conversion of a persistent non-wetland area into a wetland through some activity of man. This definition presumes the site has not been a wetland within recent times (100-200 years) and thus restoration is not occurring. Created wetlands are subdivided into two types: artificial and man-induced. An artificial created wetland exists only as long as some continuous or persistent activity of man (i.e., irrigation, weeding) continues. Without attention from man, artificial wetlands revert to their original habitat type. Man-induced created wetlands generally result from a one-time action of man and persist on their own. The one-time action might be intentional (i.e., earthmoving to lower elevations) or unintentional (i.e., dam building). Wetlands created as a result of dredged material deposition may have subsequent periods during which additional deposits occur. Man-initiated is an acceptable synonym.

ENHANCEMENT - The increase in one or more values of all or a portion of an existing wetland by man's activities, often with the accompanying decline in other wetland values. Enhancement and restoration are often confused. For our purposes, the intentional alteration of an existing wetland to provide conditions which previously did not exist and which by consensus increase one or more values is enhancement. The diking of emergent wetlands to create persistent open-water duck habitat is an example; the creation of a littoral shelf from open water habitat is another example. Some of the value of the emergent marsh may be lost as a result (i.e., brown shrimp nursery habitat).

SUCCESS - Achieving established goals. Unlike the dictionary definition, success in wetlands restoration, creation, and enhancement ideally requires that criteria, preferably measurable as quantitative values, be established prior to commencement of these activities. However, it is important to note that a project may not succeed in achieving its goals yet provide some other values deemed acceptable when evaluated. In other words, the project failed but the wetland was a "success". This may result in changing the

success criteria for future projects. It is important, however, to acknowledge the non-attainment of previously established goals (the unsuccessful project) in order to improve goal setting. In situations where poor or nonexistent

goal setting occurred, functional equivalency may be determined by comparison with a reference wetland, and success defined by this comparison. In reality, this is easier said than done.

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GLOSSARY

AREAL COVER - A measure of dominance that defines the degree to which above-ground portions of plants (not limited to those rooted in a sample plot) cover the ground surface. It is possible for the total areal cover in a community to exceed 100% because (a) many plant communities consist of two or more vegetative strata (overstory, understory, ground cover, undergrowth); (b) areal cover is estimated by vegetative layer, and (c) foliage within a single layer may overlap.

ARTIFICIAL WETLAND - A created wetland requiring constant application of water or maintenance to provide wetland values.

BASAL AREA - The cross-sectional area of a tree trunk measured in square inches, square centimeters, etc. Basal area is normally measured at 4.5 feet (1.4 m) above ground level or just above the buttress if the buttress exceeds that height and is used as a measure of dominance. The most easily used tool for measuring basal area is a tape marked in units of area (i.e., square inches). When plotless methods are used, an angle gauge or prism will provide a means of rapidly determining basal area. This term is also applicable to the cross-sectional area of a clumped herbaceous plant, measured at 1.0 inch (2.54 cm) above the soil surface.

BASELINE STUDY - An inventory of a natural community or environment that may serve as a model for planning or establishing goals for success criteria. Synonym: reference study.

BENCH MARK - A fixed, more or less permanent reference point or object, the elevation and horizontal location of which is known. The U.S. Geological Survey [USGS] installs brass caps in bridge abutments or otherwise permanently sets bench marks at convenient locations nationwide. The elevations on these marks are referenced to the National Geodetic Vertical Datum [NGVD], also commonly known as Mean Sea Level [MSL] although they may not be exactly the same. For most purposes of wetland mitigation, they can be assumed to be equivalent although a local surveyor should be consulted for final determination. Locations of these bench marks on USGS quadrangle maps are shown as small triangles. The existence of any bench mark should be field verified before planning work that relies on a particular reference point. The USGS, local state surveyor's office, or city or town engineer can provide information on the existence, exact location and exact elevation of bench marks, and the equivalency of NGVD and MSL.

CANOPY LAYER - The uppermost layer of vegetation in a plant community. In forested areas, mature trees comprise the canopy layer, while the tallest herbaceous species constitute the canopy layer in a marsh.

CONTROL PLOT - An area of land used for measuring or observing existing undisturbed conditions.

CONTOUR - An imaginary line of constant elevation on the ground surface. The corresponding line on a map is called a "contour line".

CREATED WETLAND - The conversion of a persistent upland or shallow water area into a wetland through some activity of man.

DEGRADED WETLAND - A wetland altered by man through impairment of some physical or chemical property which results in a reduction of habitat value or other reduction of functions (i.e., flood storage).

DENSITY - The number of individuals per unit area.

DIAMETER AT BREAST HEIGHT [DBH] - The width of a plant stem as measured at 4.5 feet (1.4 m) above the ground surface or just above the buttress if over 4.5 feet (1.4 m).

DISTURBED WETLAND - A wetland directly or indirectly altered from a natural condition, yet retaining some natural characteristics; includes natural perturbations.

DOMINANCE - As used herein, a descriptor of vegetation that is related to the standing crop of a species in an area, usually measured by height, areal cover, density, or basal area (for trees), or a combination of parameters.

DOMINANT PLANT SPECIES - A plant species that exerts a controlling influence on or defines the character of a community.

DRAINED - A condition in which the level or volume of ground or surface water has been reduced or eliminated from an area by artificial means.

DRIFT LINE - An accumulation of debris along a contour (parallel to the water flow) that represents the height of an inundation event.

EMERGENT PLANT - A rooted plant that has parts extending above a water surface, at least during portions of the year but does not tolerate prolonged inundation.

ENHANCED WETLAND - An existing wetland where some activity of man increases one or more values, often with the accompanying decline in other wetland values.

EXOTIC - Not indigenous to a region; intentionally or accidentally introduced and often persisting.

EXPERIMENTAL PLOT - An area of land used for measuring or observing conditions resulting from a treatment (i.e., an installation of particular plants).

FILL MATERIAL - Any material placed in an area to increase surface elevation.

FREQUENCY (vegetation) - The distribution of individuals of a species in an area. It is quantitatively expressed as:

$$\frac{\text{Number of samples containing species A}}{\text{Total number of samples}} \times 100$$

FUNCTIONAL VALUES - Values determined by abiotic and biotic interactions as opposed to static measurements (e.g., biomass).

HABITAT - The environment occupied by individuals of a particular species, population, or community.

HABITAT VALUE - The suitability of an area to support a given evaluation species.

HEADWATER FLOODING - A situation in which an area becomes inundated primarily by surface runoff from upland areas.

HERB - A nonwoody individual of a macrophytic species.

HERBACEOUS LAYER - Any vegetative stratum of a plant community that is composed predominantly of herbs.

HYDRIC SOIL - A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation. Hydric soils that occur in areas having positive indicators of hydrophytic vegetation and wetland hydrology are wetland soils.

HYDROLOGIC REGIME - The distribution and circulation of water in an area on average during a given period including normal fluctuations and periodicity.

HYDROLOGY - The science dealing with the properties, distribution, and circulation of water both on the surface and under the earth.

HYDROPHYTE - Any macrophyte that grows in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content; plants typically found in wet habitats. Obligate hydrophytes require water and cannot survive in dry areas. Facultative hydrophytes may invade upland areas.

HYDROPHYTIC VEGETATION - The sum total of macrophytic plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content. When hydrophytic vegetation comprises a community where indicators of hydric soils and wetland hydrology also occur, the area has wetland vegetation.

IMPORTANCE VALUE - A quantitative term describing the relative influence of a plant species in a plant community, obtained by summing any combination of relative frequency, relative density, and relative dominance.

INDIGENOUS SPECIES - Native to a region.

IN-KIND REPLACEMENT - Providing or managing substitute resources to replace the functional values of the resources lost, where such substitute resources are also physically and biologically the same or closely approximate those lost.

INUNDATION - A condition in which water from any source temporarily or permanently covers a land surface.

MACROPHYTE - Any plant species that can be readily observed without the aid of optical magnification. This includes all vascular plant species and mosses (e.g., *Sphagnum* spp.), as well as large algae (e.g., *Chara* spp., kelp).

MAINTENANCE - Any activities required to assure successful restoration after a project has begun (i.e., erosion control, water level manipulations).

MAN-INDUCED WETLAND - Any area of created wetlands that develops wetland characteristics due to some discrete non-continuous activity of man.

MEAN SEA LEVEL - A datum, or "plane of zero elevation", established by averaging hourly tidal elevations over a 19-year tidal cycle or "epoch". This plane is corrected for curvature of the earth and is the standard reference for elevations on the earth's surface. The National Geodetic Vertical Datum [NGVD] is a fixed reference relative to Mean Sea Level in 1929. The relationship between MSL and NGVD is site-specific.

MESOPHYTIC - Any plant species growing where soil moisture and aeration conditions lie between extremes. These species are typically found in habitats with average moisture conditions, neither very dry nor very wet.

MITIGATION - The President's Council on Environmental Quality defined the term "mitigation" in the National Environmental Policy Act regulations to include "(a) avoiding the impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (e) compensating for the impact by replacing or providing substitute resources or environments" (40 CFR Part 1508.20(a-e)). For the purposes of this document, mitigation refers only to restoration, creation, or enhancement of wetlands to compensate for permitted wetland losses.

MITIGATION BANKING - Wetland restoration, creation or enhancement undertaken expressly for the purpose of providing compensation credits for wetland losses from future development activities.

MONITORING - Periodic evaluation of a mitigation site to determine success in attaining goals. Typical monitoring periods for wetland mitigation sites are three to five years.

NATURAL - Dominated by native biota and occurring within a physical system which has developed through natural processes (without human intervention), in which natural processes continue to take place.

NUISANCE SPECIES - Species of plants that detract from or interfere with a mitigation project, such as most exotic species and those indigenous species whose populations proliferate to abnormal proportions. Nuisance species may require removal through maintenance programs.

OUT-OF-KIND REPLACEMENT - Providing or managing substitute resources to replace the functional values of the resources lost, where such substitute resources are physically or biologically different from those lost.

PHYSIOGNOMY - A term used to describe a plant community based on community stratification and growth habit (e.g., trees, herbs, lianas) of the dominant species.

PLANT COMMUNITY - All of the plant populations occurring in a shared habitat or environment.

PLANT COVER - see AREAL COVER.

PONDED - A condition in which water stands in a closed depression. Water may be naturally removed only by percolation, evaporation, and/or transpiration.

POORLY DRAINED - Soils that are commonly wet at or near the surface during a sufficient part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these conditions.

PRODUCTIVITY - Net annual primary productivity; the amount of plant biomass that is generated per unit area per year.

QUANTITATIVE - A precise measurement or determination expressed numerically.

RECLAIMED WETLANDS - Same as restored wetland, but often used in other parts of the world to refer to wetland destruction due to filling or draining.

REHABILITATION - Conversion of an upland area that was previously a wetland into another wetland type deemed to be better for the overall ecology of the system.

RELATIVE DENSITY - A quantitative descriptor, expressed as a percent, of the relative number of individuals in an area; it is calculated by:

$$\frac{\text{Number of individuals of species A}}{\text{Total number of individuals of all species}} \times 100$$

RELATIVE DOMINANCE - A quantitative descriptor, expressed as a percent, of the relative amount of individuals of a species in an area; it is calculated by:

$$\frac{\text{Amount of species A}}{\text{Total amount of all species}} \times 100$$

The amount of a species may be based on percent areal cover, basal area, or height.

RELATIVE FREQUENCY - A quantitative descriptor, expressed as a percent, of the relative distribution of individuals in an area; it is calculated by:

$$\frac{\text{Frequency of species A}}{\text{Total frequency of all species}} \times 100$$

RELIEF - The change in elevation of a land surface between two points; collectively, the configuration of the earth's surface, including such features as hills and valleys. See also TOPOGRAPHY.

RESTORED WETLAND - A wetland returned from a disturbed or altered condition to a previously existing natural or altered condition by some action of man (i.e., fill removal).

SAMPLE PLOT - An area of land used for measuring or observing existing conditions.

SOIL - The collection of natural bodies on the earth's surface containing living matter and supporting or capable of supporting plants out-of-doors. Places modified or even made by man of earthy materials are included. The upper limit of soil is air or shallow water and at its margins it grades to deep water or to barren areas of rock or ice. Soil includes the horizons that differ from the parent material as a result of interaction through time of climate, living organisms, parent materials and relief.

SLOPE - A piece of ground that is not flat or level.

SUBSTRATE - The base or substance on which an attached species is growing.

TIDAL - A situation in which the water level periodically fluctuates due to the action of lunar and solar forces upon the rotating earth.

TOPOGRAPHY - The configuration of a surface, including its relief and the position of its natural and man-made features.

TRANSECT - As used here, a line on the ground along which observations are made at some interval.

TRANSITION ZONE - The area in which a change from wetlands to nonwetlands occurs. The transition zone may be narrow or broad.

TREE - A woody plant >3.0 inches in diameter at breast height, regardless of height (exclusive of woody vines).

UPLAND - As used herein, any area that does not qualify as a wetland because the associated hydrologic regime is not sufficiently wet to elicit development of vegetation, soils, and/or hydrologic characteristics associated with wetlands. Such areas occurring within floodplains are more appropriately termed non-wetlands.

WATER TABLE - The upper surface of groundwater or that level below which the soil is saturated with water. The saturated zone must be at least 6 inches thick and persist in the soil for more than a few weeks.

WETLANDS - Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.