Evaluating Methods for Analyzing Vegetation and Determining Hydrophytic Vegetation for Wetland Delineation

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The U.S. Army Corps of Engineers (Corps), Engineering and Research and Development Center (ERDC) recently release two publications evaluating proposed revisions to the 1987 Corps Wetland Delineation Manual (Environmental Laboratory 1987) (hereafter the 1987 Wetland Manual). These two studies address problematic technical issues in the 1987 Wetland Manual as identified by the National Technical Committee for Wetland Vegetation (NTCWV). The NTCWV is a composed of 16 members from six federal agencies and four academic institutions, all of whom are botanists or vegetation ecologists. A primary goal of the NTCWV is to suggest scientifically tested and sound methods to improve the sampling and determination of hydrophytic vegetation for wetland delineation purposes. This includes methods of areal plant cover estimation, plot size, and the calculation of hydrophytic vegetation, which require scientific testing before possible inclusion into the revised Corps Wetland Manual under development. The first of the two recent publications discussed here compares three methods for making hydrophytic vegetation determinations during wetland delineations (Lichvar and Gillrich 2014a) while the second tests the effects of different plot designs and sampling methods used during this process (Lichvar and Gillrich 2014b).

Evaluating Hydrophytic Vegetation Determination Methods

In support of the update to the 1987 Wetland Manual, three common methods for making hydrophytic vegetation determinations - the Hydrophytic Cover Index (HCI), the Dominance Ratio (DR) and the Prevalence Index (PI) - were tested and compared using a large national dataset of delineation data (Lichvar and Gillrich 2014a). The HCI was recommended by the National Technical Committee for Wetland Vegetation (NTCWV) in light of recent work showing that up to 20% of determinations made using the DR are biased (Lichvar et al. 2011) and that up to 14% of determinations made using the PI are incorrect (Lichvar and Gillrich unpublished data). The national dataset is from nine Corps regions collected during the development and field testing of the Regional Supplements to the Army Corps of Engineers Wetland Delineation Manual (Berkowitz 2011). It consists of data from 637 plots at 232 sites. For each site, nested circular sample plots with 9 m and 2m radii were located on each side of the wetland boundary or along a wetland-to-upland transect. The HCI, the PI, and the DR were calculated for each plot in the national data set (n = 637), and the number of plots containing hydrophytic vegetation were tallied for each method. The HCI was calculated using wetland ratings and the percent cover data from each plot, as follows:

$$HCI = (\Sigma C_{OBL} + \Sigma C_{FACW} + \Sigma C_{FAC})/(\Sigma C_{OBL} + \Sigma C_{FACW} + \Sigma C_{FAC} + \Sigma C_{FACU} + \Sigma C_{UPL}) \times 100$$

where Σ is the sum and C is the cover – the percent areal cover for species represented by each of five wetland indicator status ratings: Obligate Wetland (OBL), Facultative Wetland (FACW), Facultative (FAC), Facultative Upland (FACU), and Upland (UPL). The PI and the DR were

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calculated according to descriptions in the 1987 Wetland Manual and the Regional Supplements (Environmental Laboratory 1987; e.g., USACE 2010). For the HCI method, plots with summed areal cover values >50% of the total were considered hydrophytic vegetation.

The dataset was divided into two subsets: 1) plots with >50% hydrophyte cover and 2) plots with ≤ 50% hydrophyte cover (where hydrophyte species are considered those rated FAC, FACW, or OBL). The percentage of hydrophytic vegetation determinations was compared among the three methods. Overall, the HCI demonstrated 100% accuracy in classifying plots as hydrophytic or nonhydrophytic in 637 wetland delineation plots, outperforming the PI and DR which demonstrated 88% and 91% accuracy, respectively. Overall, the PI (69%) and the DR (76%) produced significantly fewer hydrophytic vegetation determinations than the HCI (80%). One explanation for these discrepancies is that the PI assigns larger weighted values to nonhydrophytes (which subsequently have a disproportionate impact on the results), while DR results are potentially distorted by a built-in odd-even bias and the use of strata to select dominant species (e.g., one species may be a dominant in more than one stratum). By contrast, the HCI is a simplified method that relies only on wetland ratings and percent cover values, and thus produces consistently accurate results. Note that the greater frequency of hydrophytic vegetation determinations produced by the HCI does not necessarily result in an expansion of the wetland boundary since the vegetation calculation is only one aspect of a 3-factor approach to wetland delineation where soils and signs of hydrology are also considered. The HCI formula for making hydrophytic vegetation determinations is therefore recommended for use in the revised Corps wetland delineation manual and its supplements.

The Effect of Sampling Procedures on Hydrophytic Vegetation Determinations

The second study assessed the impact of vegetation sampling procedures on the outcome of hydrophytic vegetation determinations using the HCI formula discussed above (Lichvar and Gillrich 2014b). HCI results using nested circular plots with 9 m and 2 m radii were compared with those using rectangular 10 x 2 m plots. Data were collected from forested, scrub-shrub, and herbaceous meadow wetland types (n = 66) in three regions: 1) Northcentral–Northeast, 2) Western Mountains, Valleys, and Coast, and 3) Alaska. Vegetation near wetland boundaries was sampled in circular plots with 9 m and 2 m radii according to the routine delineation method described in the 1987 Wetland Manual and in rectangular 10 × 2 m plots using a strata-less approach suggested by the NTCWV to estimate areal cover by species. Results showed that plot dimensions had no notable effect on the percentage of hydrophytic vegetation determinations produced by the HCI. Therefore, using rectangular 10 × 2 m plots and absolute percent areal cover data collected without stratifying vegetation by growth form appears to be an accurate method for wetland boundary delineations.

In addition to plot dimensions, the NTCWV suggested that the HCI results be compared using different percentages of the total cover identified within a plot. Using data from the same national delineation dataset used in the first study, the HCI was calculated using 100%, 90%, and 80% of the cover data and the associated wetland ratings from each plot. Results showed no notable distinctions in the number of hydrophytic determinations made, regardless of whether 80%, 90%, or 100% of the total vegetation was included in the analysis. This suggests that accurate results can be obtained by identifying only 80% of the total cover to the species level, thus potentially increasing the efficiency of wetland determinations.

As part of the continued testing of these proposed changes to the 1987 Wetland Manual, the Corps will lead an interagency effort to test the methods contained in the revised manual during the summer of 2014. The modification of on-site sampling procedures, plots sizes, areal cover estimates, hydrophytic vegetation determinations, and all other indicators for the three-factor wetland delineation method will be tested. The effort will evaluate whether there is any change in wetland boundaries and if the newly proposed methods are clear and easier to apply than current methods.

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