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# Woody Vegetation Success Standards for WSDOT Wetland Mitigation Sites in Washington

*WSDOT proposes to establish realistic woody vegetation "standards" incorporating survival, stem density, and aerial cover at different stages of site development.*

Rapid growth and a direct response to environmental change make trees and shrubs strong indicators of wetland health and condition (USEPA 2002). Both the rate and extent of woody species plant establishment may be important factors when evaluating the success of created wetland mitigation sites (Hammer 1997). For these reasons, performance criteria that require specific levels of tree and shrub canopy cover in wetland and upland zones of mitigation sites are frequently included in success standards and permit requirements of site mitigation plans.

Woody species cover is one of the most common measures of plant community growth and development because it is unbiased by either the size or distribution of individual plants (Floyd and Anderson 1987). While measurements of canopy cover are generally easy to quantify, writing meaningful and achievable success standards can be difficult (Ossinger 1999). The following discussion presents guidance that may help ensure woody species cover standards and performance measures provide a meaningful and achievable measurement.

## Performance Measure for the First Year of Plant Establishment

Cover of woody species is difficult (generally impossible) to measure with any reasonable level of accuracy and precision one year after site planting is completed. Quantitative aerial cover estimates for immature trees and shrubs with few leaves are impracticable, and results generally lack value from a statistical, ecological, or management perspective (Elzinga et al. 1998).

To document planting success, WSDOT proposes to perform survival surveys as an alternative to woody species cover during the first year of monitoring or one year after site planting is completed. It is important to recognize, plant mortality and natural recruitment may confound survival estimates if measured long after initial plant establishment. For this reason, survival is not a reliable measure of planting success after the first year (WSDOT 2000, 2001, and 2002).

Plant density may provide another viable alternative to woody cover estimates in the first three years of monitoring. For documenting temporal loss and natural recruitment in wetland tree and shrub plant communities, comparisons of stem density may be possible over several years. However, in some specific situations, stem density has limitations when used as a measurement tool. First, density estimates in multiple-stemmed plant communities (e.g., willow thickets) may be unreliable where identification of individual plants is problematic. Second, an inverse relationship exists between stem density and

plant size for some species. In these situations, other measurement techniques may be more appropriate (Bonham 1989).

**Performance Measures Three Years after Planting**

Monitoring results (WSDOT 2000, 2001, and 2002) indicate growth of trees and shrubs is often slow through the first few years of site development. On many sites, a growth surge commonly occurs four to five years after planting. When plant growth is delayed, targets for woody species cover may not be a strong indicator of eventual site success. Instead, density estimates three years after site planting is completed may be more appropriate as a guide for site management activities.

**Performance Measures and Success Standards Five to Ten Years after Planting**

As a performance measure in the fifth year of monitoring, cover is generally both measurable and meaningful. If targets are not set too high, aerial cover estimates for trees and shrubs provide a reasonable gauge of plant community development.

In scrub-shrub and forested wetland zones on mitigation sites in the lowlands of western Washington, monitoring results (WSDOT 2000, 2001, and 2002) suggest woody cover targets of 50 percent may be reasonable five years after site planting is completed. Recent study results (Celedonia 2002) support these findings and indicate standards that require more than 50 percent cover five years after planting are unachievable in most cases. In this study, data were collected from wetland mitigation sites six to 11 years after planting. For sites in western Washington, results show aerial cover values of 80 percent cannot be reliably achieved in tree and shrub canopies until eight years after planting is completed.

WSDOT proposes the following approach for developing woody cover “measures” and “standards” for wetland mitigation projects:

- Instead of cover, woody species survival and/or density estimates should be used to document the success of site planting efforts in the first year of monitoring.

- Survival estimates should not be used to document the success of woody species planting efforts after the first year of monitoring.

- Woody species stem density may be used to guide site management activities one to three years after planting. Plants naturally colonizing sites will be included in stem density estimates.

- Performance measures for woody species cover should not be used until five years after initial site planting has been completed. Cover estimates collected in the interim may be used to guide site management activities.

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- Should the success standard be met at the fifth or any subsequent year's performance measures, the permitting agencies will be contacted for requesting closure of monitoring.

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