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Physiological Response to Flooding for Wetland Indicator Plants

PURPOSE: This Technical Note describes a general method that may help refine the indicator categories of some problematic wetland plant species within different geographic regions.

BACKGROUND: The U.S. Department of the Interior, Fish and Wildlife Service, publishes regional lists of plant species that occur in wetlands. These lists are compiled from literature, field data, comments received from biologists within each region, and the experience of regional review panel members. Each species within a region that occurs in wetlands is assigned a wetland indicator status based upon its frequency of occurrence in wetlands. Table 1 shows the estimated probability of occurrence for indicator categories for wetland plant species.

Wetland plant species with little field data or with broad ecological amplitude are difficult for regional review panels to categorize accurately, and are therefore problematic. Regional problematic species, when repeatedly part of the hydrophytic vegetation determination, can leave the delineator uncertain about the wetland determination. There is a need to develop method(s) to refine indicator status of problematic species.

Species that have a higher probability of occurrence in wetlands likely exhibit a higher tolerance of wetland conditions, i.e., water saturated, chemically reduced soils. Differential physiological responses to flooding may provide a potential method to refine the indicator status of some problematic wetland plant species. The method presented in this technical note uses photosynthetic response to inundation by wetland plant species that have been identified as having reliable indicator status as a baseline for comparison.

METHODS: Species with dependable indicator status were selected by biologists who routinely perform wetland delineations within the geographic area of the U.S. Army Engineer District, Buffalo, NY. Plant species studied were *Typha latifolia* (Cattail), *Scirpus cyperinus* (Wool-grass), *Parthenocissus quinquefolia* (Virginia Creeper), and *Solidago nemoralis* (Gray Goldenrod). The indicator status assigned to these species by Reed (1988) is: Cattail (OBL), Wool-grass (FACW+), Virginia Creeper (FACU), and Gray Goldenrod (UPL). Live specimens of each species were collected, vegetatively propagated, and grown in the greenhouse. Plants were inundated in fiberglass tanks to 5 cm above the top of the pots. Most of the leaves were above the water. Photosynthesis and other gas exchange parameters were measured before inundation, and weekly after inundation. Control plants were not inundated. Measurements were made in the greenhouse under constant light intensity. Three replicate plants were measured for each of the control and inundated treatments.

RESULTS: Photosynthetic response of the plant species to inundation is presented in Figure 1. Day zero represents pre-inundation measurements. The OBL, FACW+ and FACU species showed an initial decline in photosynthetic rate associated with inundation (Fig. 1). Photosynthesis of both the OBL and FACW+ species recovered after seven days of inundation, while that of the FACU species continued to decline. Inundated FACU plants were dead after 30 days. Photosynthesis of the inundated OBL species recovered after two weeks and exceeded that of the non-flooded control plants.

Table 1. Probability of occurrence in wetlands and uplands of species with different wetland indicator status

Indicator status	% of frequency of occurrence in:	
	Wetlands	Uplands
OBL*	>99	<1
FACW	67-99	1-33
FAC	34-66	34-66
FACU	1-33	67-99
UPL	<1	>99

* In addition, the FACW, FAC, and FACU categories may be modified with '+' or '-' to indicate the higher or lower part, respectively, of the range of occurrence in wetlands for that category.

Although photosynthesis of the inundated FACW+ species also recovered after two weeks, it did not exceed that of the control. The response of the UPL species was difficult to characterize because of scatter in the data. The general decline in photosynthesis observed in control plants of all species may represent a response to elevated daytime greenhouse temperatures.

CONCLUSION: The responses of the OBL, FACW+ and FACU species were distinct, perhaps reflecting different levels of flooding tolerance. This preliminary study suggests that photosynthetic response to inundation may be helpful in refining the indicator status of some problematic wetland plant species. Additional species of each indicator status must be studied to verify and refine the trends observed here. A larger set of reliable baseline species of all indicator classes should be characterized. Then several problematic species should be tested and their responses compared to those of the baseline species.

REFERENCES:

Reed, P. B. (1988). National List of Plant Species That Occur in Wetlands: Northeast (Region 1), U.S. Fish and Wildlife Service, Biological Report 88(26.1).

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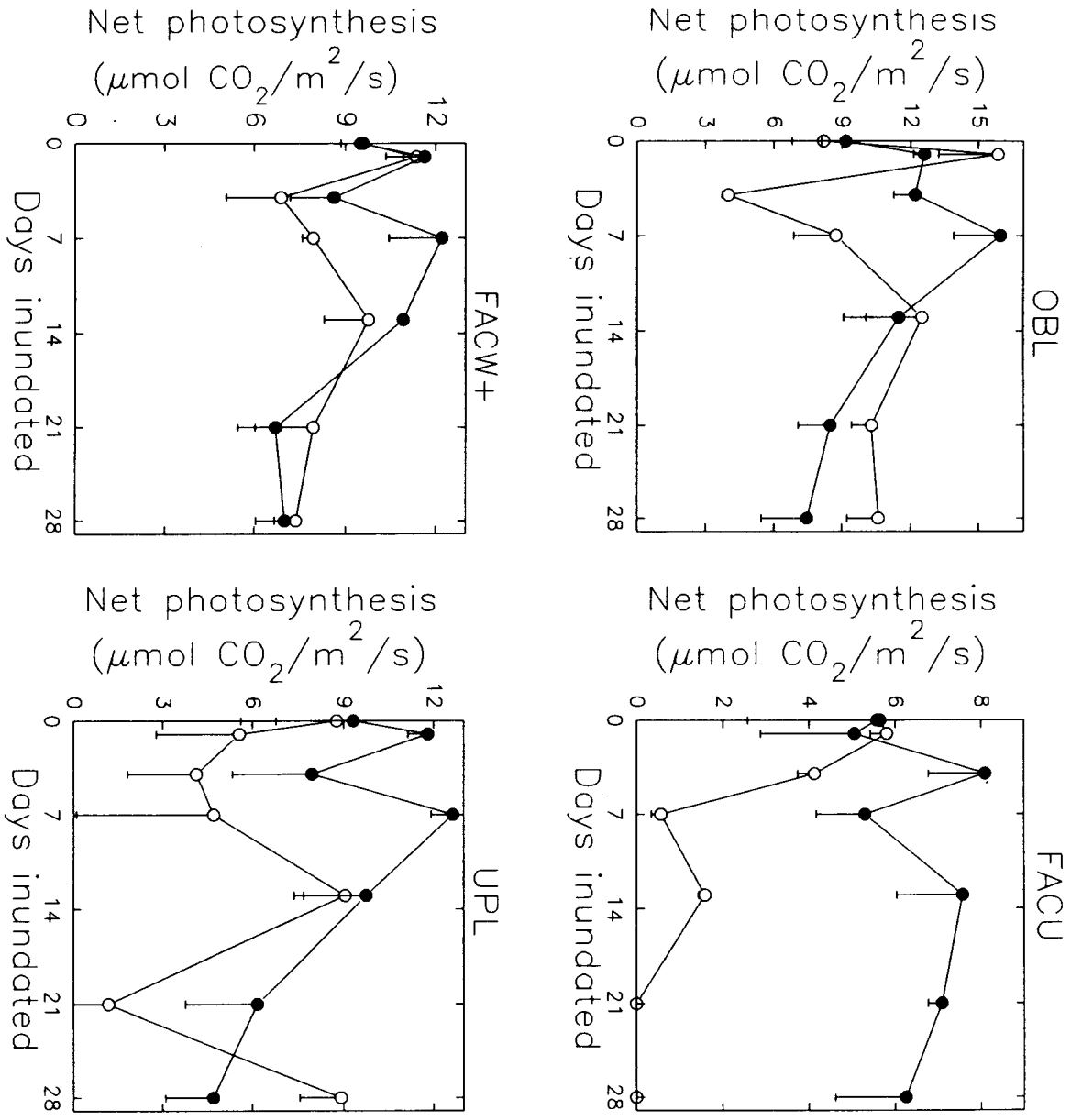

Figure 1. Net photosynthesis for four plant species exposed to inundation. OBL = *Typha latifolia*, FACW + = *Scirpus cyperinus*, FACU = *Parthenocissus quinquefolia*, and UPL = *Solidago nemoralis*. Open circles represent inundated plants, closed circles represent noninundated plants. Each circle represents the mean of three replicates. Vertical bars are standard deviations of the mean.