Suggested Reclassification of Marshes of the Colorado River

by Susan B. Infalt and Morgan A. King

Marshes are a novel community found along the margin of the Colorado River since the installation of Glen Canyon Dam in 1963 (Stevens et al. 1995). They have formed because the high water line is lower than in pre-dam conditions and fluctuates daily, thus increasing the area of wetted bank appropriate for germination and colonization; and because seasonal floods no longer scour sandbar vegetation. In 1991, riparian marshes covered over 25 hectares along the mainstem (Stevens et al. 1995). After completing observational surveys of the marshes present along the mainstem, we would like to present a suggested reclassification of marsh types along the Colorado River.

A categorization of riparian marshes of the Colorado River was produced by Stevens et al. (1995), (Figure 1). Marshes were split into four distinct groups: clonal wet, nonclonal wet, woody phreatophyte, and dry (Stevens et al. 1995). **Clonal wet marshes** have silty loam soil, and are inundated 50% of the time by water. The species that typify this category of marsh are cattails (*Typha domingensis*) and reeds (*Phragmites australis*), (Stevens et al. 1995). The second wet marsh is the **nonclonal wet marsh**, which is dominated by herbaceous horseweed (*Conyza canadensis*) and Bermuda grass (*Cynodon dactylon*), (Stevens et al. 1995). These two wet marshes are formed within the intermediate flood zone from steady daily or seasonal discharges from the dam. Stevens et al. (1995) also identify two types of dry marshes which have sandy soils and are rarely inundated. **Woody phreatophyte marshes** are dominated by woody perennials such as tamarisk (*Tamarix ramosissima*)and arrowweed (*Pluchea sericea*), (Stevens et al. 1995). **Dry marshes** are comprised of horsetails (*Equisetum* spp.) and willows (*Salix* spp.), (Stevens et al. 1995). Both of these drier marshes are found in the new high water zone.

Association	*n*	Mean inundation frequency (1 SD)	Soil texture	Mean total basal area (cm^2/m^2) (1 SD)	Species richness (S, no./m^2) (1 SD)
1) Clonal wet marsh (cattail/reed) *Typha domingensis* (68), *Phragmites australis* (49), *Juncus torreyana* (40), *J. articulatus* (36), *J. balticus* (37), *J. encifolius* (38), *Carex aquatilis* (17), *Chenopodium* sp. (69), *Equisetum arvense* (28), *Scirpus acutus* (57), *Agrostis stolonifera* (2), *Echinochloa crus-galli* (25), *Veronica anagallis-aquatica* (74)	50	0.54 (0.251)	silty loam	52.9 (80.931)	4.6 (2.914)
2) Nonclonal wet marsh (horseweed/Bermuda-grass) *Conyza canadensis* (22), *Polygonum aviculare* (52), *Cynodon dactylon* (23), *Melilotus alba* and *M. officinale* (43)	43	0.17 (0.17)	loamy sand	14.7 (14.554)	4.9 (2.320)
3) Woody phreatophyte (tamarisk/arrowweed) *Tamarix ramosissima* (65), *Pluchea sericea* (66), *Alhagi camelorum* (3), *Artemisia ludoviciana* (6), *Aster spinosus* (7), *Bromus* spp. (12), *Baccharis salicifolia* (11), *Baccharis sarothroides* (10), *Epilobium adenocaulon* (27), *Erigeron divergens* (31), *Gnaphalium chilense* (33), *Gutierezzia sarothrae* (34), *Hordeum jubatum* (35), *Oenothera hookeri* (46), *O. pallida* (47), *Salix gooddingii* (55), *Salsola iberica* (56), *Sonchus asper* (59), *Sporobolus cryptandrus* (62), *Sporobolus contractus* (61), *Xanthium strumarium* (75), *Castilleja* sp. (16), *Erigonum inflatum* (32), *Centarium calycosum* (18)	68	0.16 (0.197)	sand	39.9 (86.812)	4.5 (2.465)
4) Dry marsh (horsetail/willow) *Equisetum laevigatum* × *hyemale* (29), *Salix exigua* (54), *Andropogon glomeratus* (76), *Artemesia dracunculus* (5), *Aster subulatus* (8), *Baccharis emoryi* (9), *Bromus tectorum* (13), *Bromus wildenowii* (14), *Chrysothamnus nauseosus* (20), *Corispermum nitidum* (21), *Dicoria brandegei* (24), *Elymus canadensis* (26), *Acacia greggii* (1), *Lepidium latifolium* (41), *Muhlenbergia asperifolia* (45), *Plantago lanceolata* (50), *Plantago major* (51), *Polypogon monspeliensis* (53), *Solidago canadensis* (60), *Sporobolus flexuosus* (63), *Taraxacum officinale* (64), *Panicum capillare* (48), *Medicago sativa* (44), *Cercium* sp. (19), *Ambrosia* sp. (4), *Tragopogon dubius* (67), *Mentha arvensis* (42)	146	0.18 (0.194)	sand	16.4 (19.456)	4.7 (2.459)

Figure 1. Marsh classification (Stevens et al. 1995)

We conducted qualitative surveys of the marsh communities along the Colorado River from March 18 to March 28 between river miles 88 and 224. During this survey we began to question the classification of certain areas as marshes. We found that most marshes encountered were not diverse community associations as defined by Stevens et al. (1995), but that they were more frequently monotypic patches. Most of the channel marshes observed on the portion of the river surveyed were dominated (sometimes entirely) by either horsetail (*Equisetum* sp.) or reed (*Phragmites australis*). This incongruity could be due either to an over-generalization in the TWINSPAN analysis conducted by Stevens et al. (1995), or it is possible that the November 2004 flood scoured or buried the subdominant species. The diversity of the associations presented in the Stevens et al. (1995) table compared to that we observed on our survey make it

seem as though rare species were over-represented in the vegetation association that resulted from Stevens' analysis. This was a bit misleading to us, because we expected to encounter more than just one or two species in the marshes we were observing. However, it is also difficult to determine if these species were found prior to the flood in the marshes we surveyed, and whether they had been scoured or buried before our site visit.

We also had a difficult time accepting the classification of the woody phreatophyte association and dry marsh associations we observed as true marshes. Most of these marshes found along the mainstem did not fit the typical image of a marsh (low, persistently wet area with herbaceous vegetation), so we think the two dry associations would be better classified as woody scrub/shrub or riparian associations rather than as marsh associations. Therefore, we suggest that the marshes found along the mainstem be classified into two, rather then four, associations: clonal wet marsh and nonclonal wet marsh. These associations would correspond directly with those identified by Stevens et al. (1995), (Figure 1), but would include horsetails. We do not believe that the woody phreatophyte and dry marsh associations are true marshes. They are not sufficiently inundated and consist mainly of riparian scrub vegetation with varying herbaceous understories. Though some tamarisk stands observed did have horsetails as an understory, the presence of facultative marsh species does not constitute the classification of the community as a marsh.

REFERENCES

Stevens, L.E., J.C. Schmidt, T.J. Ayers, and B.T. Brown. 1995. Flow regulation, geomorphology, and Colorado River marsh development in the Grand Canyon, Arizona. *Ecological Applications* **5**:1025-1039.