

HIGH-ELEVATION WET MEADOWS IN ARIZONA: DISTRIBUTION, THREATS, AND BIODIVERSITY

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High-elevation riparian meadows occur in numerous locations throughout northern, eastern, and southeastern Arizona. They are often referred to simply as wet meadows. For the purposes of this paper, we define "high-elevation" to be >2000 m and therefore differentiate wet meadows from cienegas and other wetlands found at lower elevations (cf. Hendrickson and Minckley 1984).

Where they have not been excessively altered, sedges (*Carex spp.*), rushes (*Juncus spp.*) and other wetland-obligate plant species tend to be dominant in Arizona's wet meadows (Patton and Judd 1970, Judd 1972, Medina 1996). Willow (*Salix*), alder (*Alnus*) and other woody species may also occur in these meadows. Wet meadows typically experience shallow flooding and/or high water tables throughout much of the spring and early summer (Allen-Diaz 1991, Castelli et al. 2000).

The assemblage of vegetation that is found in wet meadows, along with ready access to water, provides good habitat for a wide variety of wildlife species (Hoffmeister 1956, Mecham 1968, Patton and Judd 1970). It is also likely that wet meadows perform many of the same ecosystem and hydrologic functions associated with other wetland types, such as water quality improvement, reduction of flood peaks, and carbon sequestration (Mitsch and Gosselink 2007). Their perceived hydrologic functions, particularly the storage and gradual release of water, are one of the key factors driving the efforts to restore wet meadows currently underway in the Sierra Nevada Mountains of California (National Fish and Wildlife Foundation 2009).

We briefly review the distribution of wet meadows in Arizona and describe some of the major threats to these ecosystems in this paper. The main focus, however, is on the biodiversity values of wet meadows and, in particular, species that occur in wet meadows which have some level of federal or state protection.

DISTRIBUTION

While many individual meadows exist in the state, their total area is relatively small. Less than 1 percent

of the landscape in the state is characterized as wetland (Dahl 1990) and wet meadows are just one of several wetland types that occur. The only estimate of the extent of wet meadows that has been located to date is by Patton and Judd (1970), who reported that approximately 17,700 ha of wet meadows occur on national forests in Arizona and New Mexico. While they are believed to be most extensive in the White Mountains, wet meadows are also common throughout the ponderosa pine and mixed conifer forest belt that extends to the northwest of the White Mountains and some also occur within the "Sky Islands" in the southeastern part of the state (Hoffmeister 1956, Ricketson 1990).

THREATS

Despite their apparent value, wet meadows appear to be one of the most heavily altered types of ecosystems in Arizona. Among other things, they have been used extensively for grazing livestock, have become the site of many small dams and stock tanks, have had roads built through them, and have experienced other types of hydrologic alterations, most notably the lowering of their water tables due to stream downcutting, surface water diversions, or groundwater withdrawal (Allen-Diaz 1991, Zeedyk 1996, Long 2002).

Some wet meadows appear to have been affected by the regional-scale incisional event at the end of the 19th century (Cooke and Reeves 1976, Anderson et al. 2003). This event may have been caused by a combination of drought and land use change, most notably heavy cattle grazing, followed by a period of wet conditions (Graf 1988, Hereford 2002). Wet meadows have been impacted, and in some cases possibly created, by large-scale fires in adjacent uplands, followed by the deposition of sediments and woody material on valley floors (Joyal 2004, Long and Burnette 2004). It is also possible that the extirpation of beaver in the Southwest led to profound changes in wet meadow environments by reducing flooding and potentially facilitating some of the stream downcutting that has occurred in so many riparian areas (Parker et al. 1985).

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