

Prioritization of Riparian Restoration Projects in the Kawuneechee Valley at Rocky Mountain National Park Using Wildlife Exclusion Fencing



Research for Rocky Mountain National Park

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Introduction to Willow Communities in Rocky Mt. National Park

Riparian communities dominated by tall willows are one of the most important habitats for wildlife in Rocky Mountain National Park (RMNP). This habitat is vital for migratory birds, beaver, small mammals, and large mammals, as well as invertebrates. Beaver use tall willows to build dams across streams, and these dams exert a tremendous influence on the hydrologic regime and landform development in many valley bottoms in RMNP (Westbrook et al. 2006). For example in the Kawunechee Valley, beaver dams can divert water onto floodplains, resulting in the inundation of large areas, which maintains existing willow and sedge communities and forms landforms suitable for new community development (Figure 1). In addition, dams influence ground water levels producing large areas with high water tables during the summer (Figure 2). The hydrologic influence of beaver dams is much greater than that produced by large floods in the Kawunechee Valley, and beavers are a key geomorphic engineer that has driven the formation of floodplains, fluvial landforms, and wetland and riparian habitat (Westbrook et al. 2006).

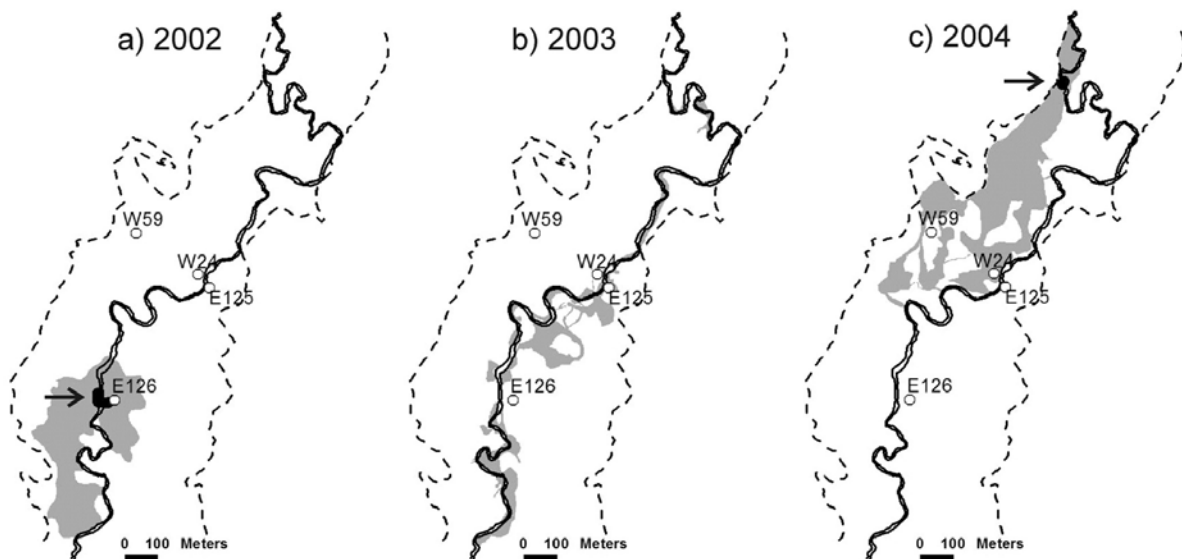


Figure 1. Extent of flooding in the Kawunechee Valley from beaver dams (2002 and 2004) and high stage of the Colorado River (2003), illustrating that single dams can divert river water to flood large areas of the valley. From Westbrook et al. 2006. Inset photo shows the 2004 dam location.

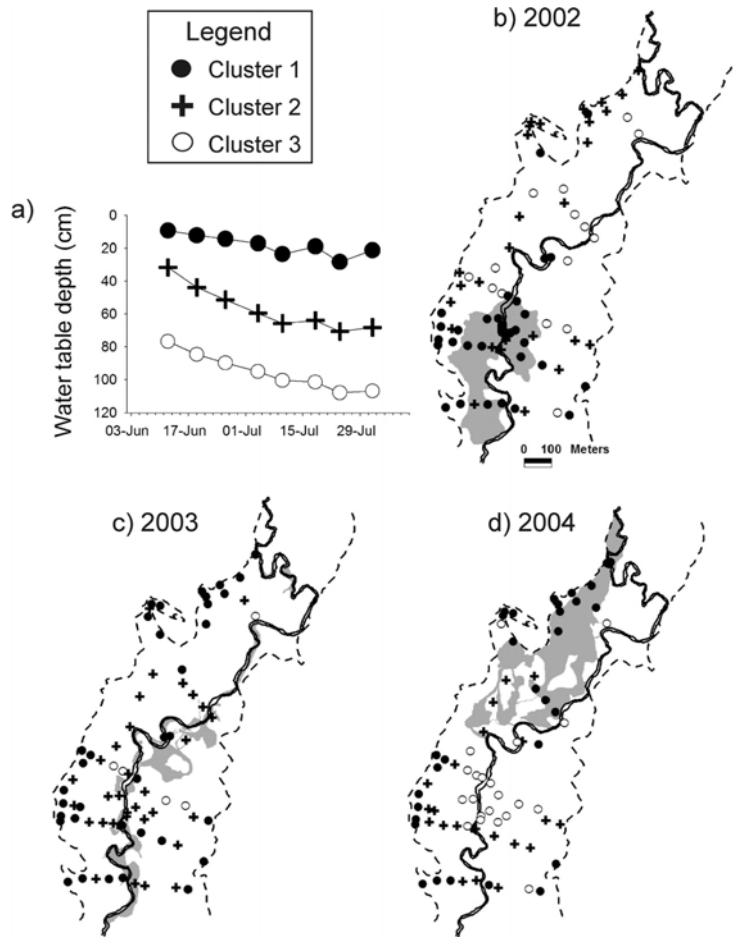


Figure 2. Beaver dams influence ground water levels in large areas near and downstream from dams. In areas influenced by dams in 2002 and 2004, many monitoring wells had very high water tables, termed Cluster 1 wells which had summer long high water tables. However, after the dams were breached, these same wells were termed Cluster 2 or 3 wells, with much deeper water tables. From Westbrook et al. 2006.

Willows in RMNP establish in three principal environments: (1) abandoned channels, (2) fine sediments adjacent to beaver ponds and on sediments trapped behind the dam after the dam breaches, and (3) point bars adjacent to streams. The first two processes are driven largely by beavers. A beaver dam may divert stream water onto a floodplain, as described above, causing the formation of a new channel and the abandonment of the former channel. Willows establish in these abandoned channels, and this landform is responsible for the linear nature of some willow stands. Abandoned channels fill with sediment from floods driven by stream and beaver dam caused flooding. Beaver dams accumulate fine-textured sediment, which is critical for the

establishment of many species in the family Salicaceae (Cooper et al. 1999). This fine grained sediment provides the most important habitat for the establishment of large willow stands.

Streams in RMNP typically have sufficient power to transport fine grained sediment downstream, and most river bars are of coarse grained sediments. The coarse grained sediment can function to trap willow seeds (Gage and Cooper 2005), but is also prone to soil drought which can reduce willow seedling survival (Gage and Cooper 2004, Woods and Cooper 2005). Thus, fine-grained sediment trapped behind beaver dams and on floodplains is critical for willow establishment.

From a geomorphic perspective the same stream reach may be influenced by multiple processes over time. A stream reach may be inundated by a beaver pond in one time period, and when the pond breaches river bars form, while a dam built years or decades later may cause a stream avulsion, leaving the abandoned stream reach disconnected from stream flow (Cooper et al. 2006) (Figure 3). These natural dynamics, driven by stream processes and beaver provide multiple pathways for willow establishment on RMNP floodplains.



Figure 3. Three time periods of the same river reach showing it inundated by a beaver pond in 1969, active river bars in 1990, and abandoned by channel avulsion in 1999.

Impacts to Willow Communities in Rocky Mt. National Park

Wetland and riparian areas in the Kawuneechee Valley have been impacted mainly by two processes, (1) dewatering by the Grand River Ditch, and (2) heavy browsing by elk and moose. Dewatering has lowered river stage in summer and reduced the opportunity for willow establishment on stream point bars because the summer water table drops sharply disconnecting willow seedlings from the water table (Woods and Cooper 2005). Because stream stage and water table dynamics impacts from the Grand Ditch limit willow establishment on river bars, the main pathway for willow establishment now is on beaver formed landscapes.

Dewatering has also reduced or eliminated peat formation in fens in the Kawuneechee Valley (Cooper et al. 2000, Chimner and Cooper 2003a, Woods et al. 2006), many of which also support willow communities. Research in RMNP has demonstrated that even slight water table declines during the summer can negatively influence the carbon budgets of fens (Chimner and Cooper 2003b).

Heavy browsing can remove leaves and stems, and animals may break entire branches from willows resulting in plant death or reduction in stem areas. A very significant reduction in willow leaf area, live stems, and structure occurred in the Kawuneechee Valley from 1995 to 2005 (Figure 4). It indicates that willow communities are rapidly declining in condition and area. Another significant issue is that beavers cut stems for use in dam construction and feeding. Once tall stems are cut by beaver they may be maintained in a short form almost indefinitely by elk or moose browsing (Baker et al. 2005).

Because beavers exert an important influence on stream and floodplain hydrologic regimes, landform generation, and vegetation maintenance and establishment, their ecological needs must be recognized. Beavers typically eat herbaceous and woody plants during the summer, but depend almost entirely on woody plants in winter. In addition, woody plant stems, primarily willow and alder in RMNP, are required for dam construction. Without tall woody plant stems beavers cannot build dams, and riparian ecosystems can revert to an alternative stable upland state, as we have documented for Yellowstone National Park, which cannot support willow establishment or high water tables (Wolf et al. 2007, Bilyeu et al. 2008).

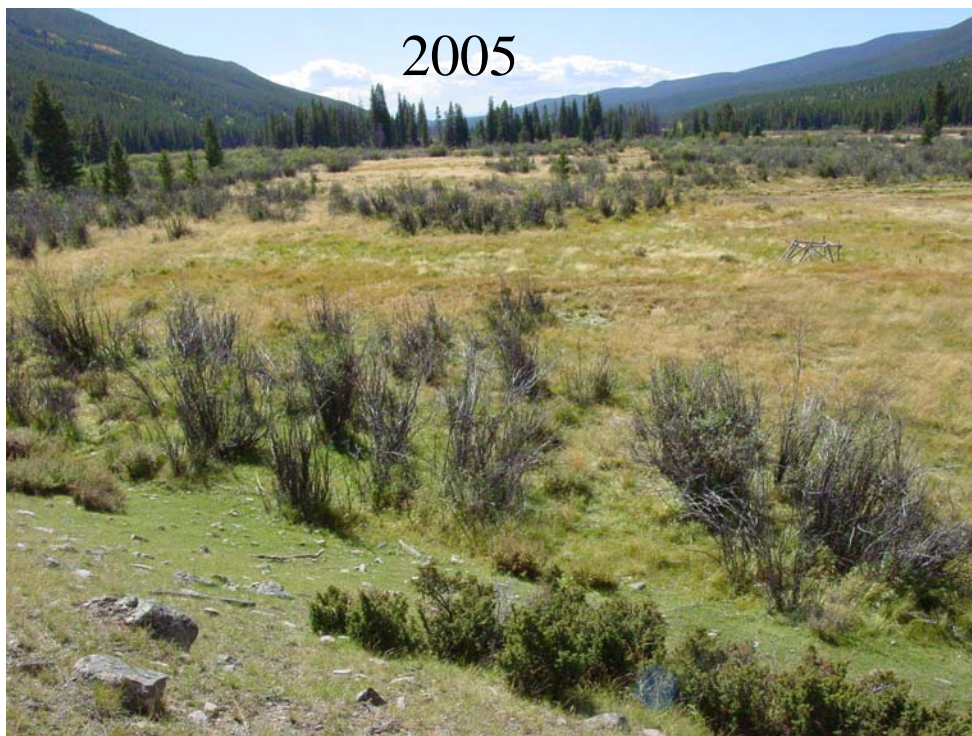
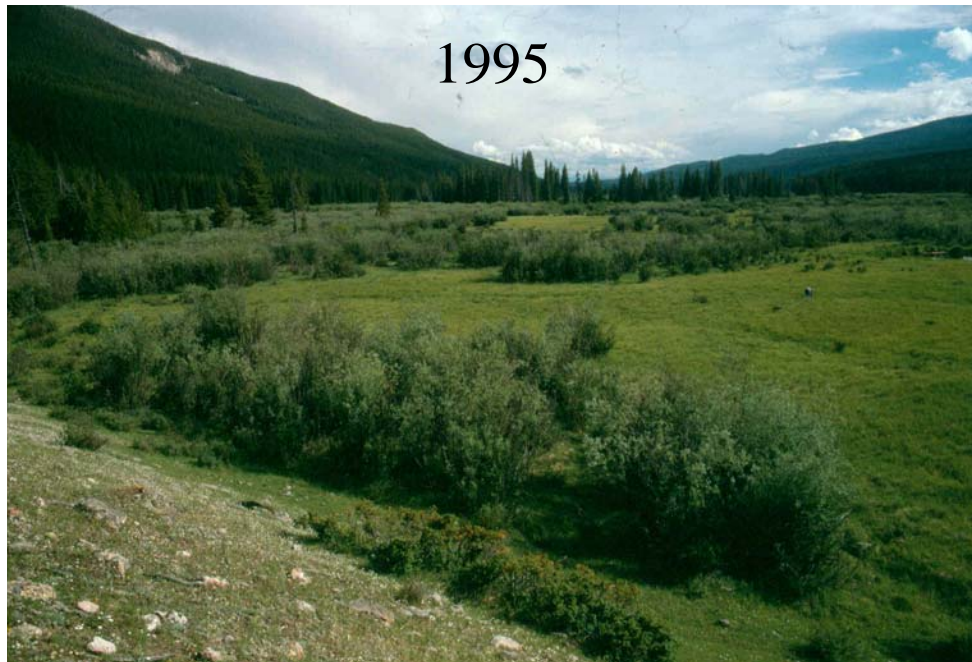


Figure 4. Willows in the Kawunechee Valley in 1995 (top) and 2005 (bottom) showing the rapid dieback of plants, and the poor condition of willows in this area.

Because willow establishment along the Colorado River is limited due to Grand Ditch effects, the main mode of willow establishment is through beaver generated landforms and hydrologic processes. Thus, maintaining willow populations requires beaver, and maintaining

beaver requires willow populations. In addition, beaver dams have a profound influence on the area of Colorado River floodplain that is inundated each year, and the floodplain water tables, which maintains wetlands and riparian communities that that are dominated by sedges and other plants. For beavers to perform these critical functions, tall riparian woody plant communities adjacent to or near the Colorado River are required, which are jeopardized by elk and moose browsing.

Proposed Exclosure Identification Criteria and Suggested Locations

To meet the food and dam building material needs of beavers in the Kawuneechee Valley, tall willows are required. To preserve beaver habitat in the short term Rocky Mountain National Park could build one or more exclosures to reduce or eliminate elk and moose browsing on willows. Exclosures would be most effective where they protect willow stands adjacent to or near the Colorado River. Based upon the work of Westbrook et al. (2006) we know that there are certain locations in the Kawuneechee Valley where beaver dams can divert water onto the floodplain and hydrologically influence large portions of the valley, as shown in Figure 1. Using these criteria I identified five (5) potential exclosure sites based upon field investigations and air photo analyses. These sites range from 5.9 to 15 acres in size. The sites are prioritized based upon their importance for beaver habitat and potential for hydrologic and geomorphic interactions with the Kawuneechee Valley.

Table 1. Perimeter length (m) and exclosure area in acres and hectares for five exclosures shown in Figure 5.

Fence_ID	Perimeter (m)	Acres	Hectares
1	34808.5	11.3	4.6
2	44543.1	15.0	6.1
3	36039.4	10.3	4.2
4	24008.9	5.9	2.4
5	30949.3	9.0	3.7

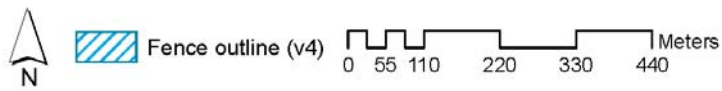
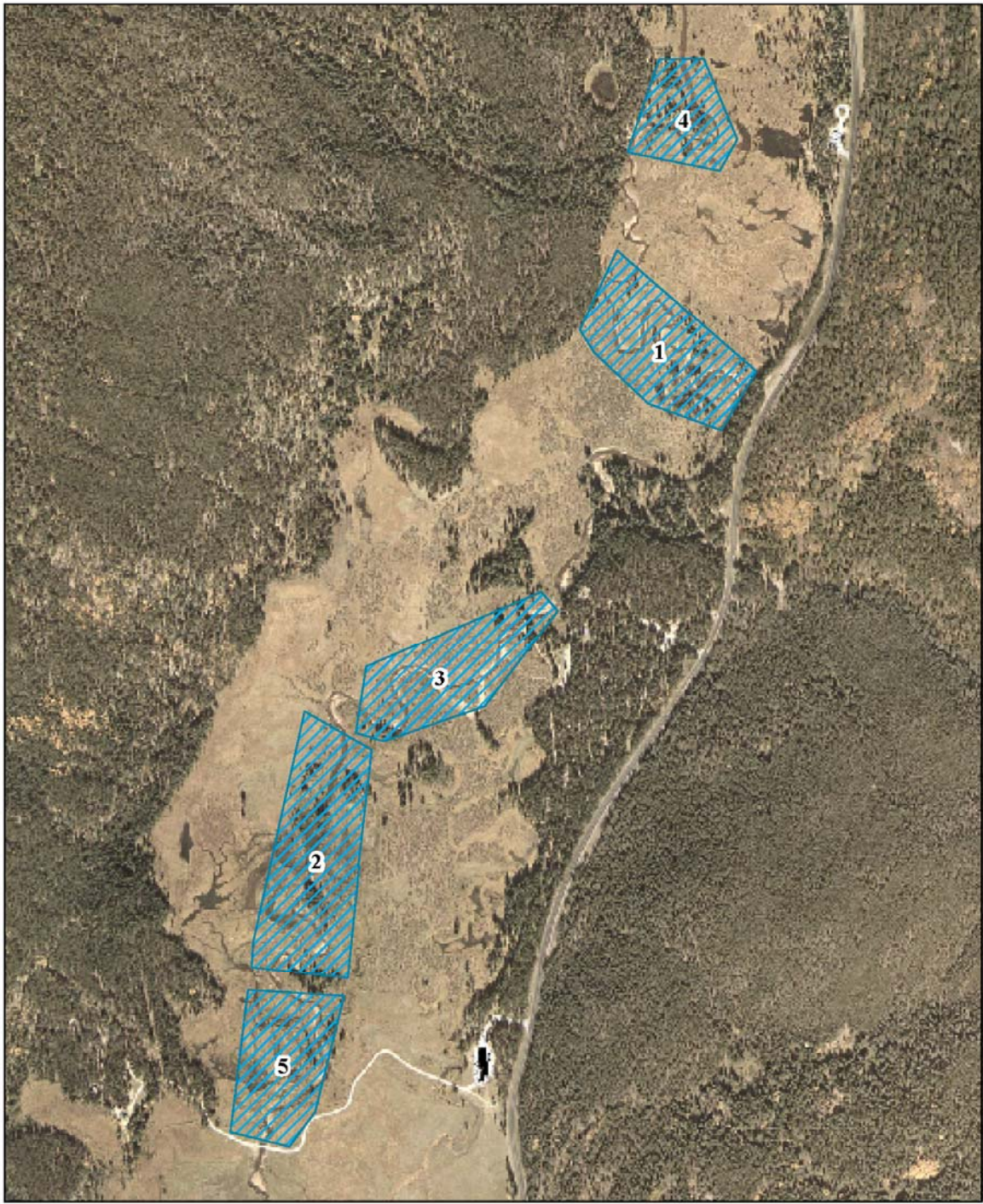


Figure 5. Location of 5 potential elk and moose exclosures in the Kawunechee Valley.

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