

Attachment O

Relationship Between Regulated Stream Flow and Establishment of Native Riparian Tree Species in the Dolores River Watershed

Summary of Field Research Work, Adam P. Coble 8/18/09

The main objective of this study is to investigate the relationship between regulated stream flow and the establishment of native riparian tree species (*Populus deltoides* subsp. *wislizenii*, *Populus angustifolia*, *Populus x acuminata*, *Acer negundo*) in the Dolores River watershed. Furthermore, the study will compare native riparian tree establishment and annual growth on the regulated Dolores River and its tributary, the unregulated San Miguel River. The results from this study will enhance management practices for sustaining establishment for native riparian tree species on the lower Dolores River. Comparing growth rates and establishment of *Populus* species and *Acer negundo* on regulated and unregulated sites will improve understanding of the impacts of river damming on native riparian trees.

From May 15th through August 14th field work was conducted in southwestern Colorado on the floodplains of the Dolores River below and above McPhee Dam, as well as the floodplains of the San Miguel River. Eight reaches on the lower Dolores River have been defined by Dolores River Dialogue based on gradient, sinuosity, vegetative characteristics, and limiting factors on channel movement and formation. The study sites on the lower Dolores River included reaches one through six, approximately 213 kilometers in length. The study site was located between McPhee dam and Saucer Basin, just above the confluence of the Dolores and San Miguel River, with an elevation difference of 539 meters. The Dolores River sites above McPhee dam and reach one of the lower Dolores River study site were similar in that both sites contained a relatively wide floodplain with at least one bench above the stream flow channel. The study sites above McPhee dam were located on the western bank of the river just past mile marker 17 along Highway 145, on the eastern bank of the river across from the Dolores Public Library, and on the eastern bank of the river across from Joe Rowell Park in the town of Dolores.

The study sites on the San Miguel River were located at the Tabeguache and Lower Canyon Preserve, managed and owned by the Nature Conservancy. The Tabeguache study area and reach six of the Dolores River study area are similar in that both sites contain wide floodplains suitable for riparian tree forests. The Tabeguache Preserve is located along Highway 141 between mile markers 67 to 74 just above the confluence of the San Miguel River and Tabeguache Creek. The Canyon Preserve is located along Highway 145 four miles north of Placerville, CO.

At the lower Dolores River study area, each reach was divided into two, three, or five equal-length segments depending on the length of the reach. Within each segment, travelling downstream, three trees per size class per topographic location were cored using an increment borer. At the Tabeguache Preserve, San Miguel River study site, the seven mile stretch of river was divided into two equal-length segments. At the upper Dolores River study site, above McPhee dam, a few segments of river were selected. The same process used at the lower Dolores River study area will be applied to the San Miguel River and upper Dolores River study sites.

We assigned trees to a 5.0 cm size class and a topographic location which includes: active channel, gravel/boulder bar, abandoned channel, first bench, and second bench (Galuszka and Kolb 2002). For trees with a dbh >5 cm, we cored 6 cm above the root collar using an increment borer. We extracted two increment cores spaced 90° apart per tree. For trees with a

dbh <5 cm, we estimated ages by branch structure and bud scale scars augmented by direct ring counts on a subsample of destructively sampled trees.

For each cored tree, we measured stem diameter at coring height (6 cm above the root collar) and at breast height. Stem diameters were measured in order to relate age and diameter which will be useful for determining age of trees which have rotted where tree rings are not present. We acquired the location of each cored tree using a GPS unit. We established variable-radius plots at each cored tree using a BAF prism in order to estimate tree basal area. We sampled a total of 678 trees (Table 1).

Table 1. Total number of tree species sampled within each reach.

| Location | | Tree species | | | |
|----------------------------|---------------------------------------|---|------------------------|-----------------------|---------------------|
| | | <i>P. deltoides</i> subsp. <i>wislizenii</i> | <i>P. angustifolia</i> | <i>P. x acuminata</i> | <i>Acer negundo</i> |
| Lower Dolores River | Reach 1 | - | 113 | 4 | 22 |
| | Reach 3 | - | 33 | 1 | 54 |
| | Reach 4 | 76 | 7 | 1 | 57 |
| | Reach 6 | 32 | - | - | 5 |
| Upper Dolores River | Hwy 145, Library, and Joe Rowell Park | 9 | 130 | 3 | 25 |
| San Miguel River | Tabeguache Preserve | 46 | 17 | 9 | - |
| | Canyon Preserve | - | 34 | - | - |
| Total Trees Sampled | | 163 | 334 | 18 | 163 |

In the next few months, we will prepare the cores for analysis in the laboratory by gluing them into wood mounts and sanding them using a series of sandpaper grades. Using an image analysis software program, WinDENDRO, we will cross-date the growth rings to check for missing or false rings, count the annual rings to determine the age of the trees, and measure the width of annual growth rings.

Hydrologic variables to describe variations in precipitation and flow for the year of interest and subsequent years such as peak flow, mean annual flow, total area under the hydrograph curve, and rate of recession of flows during and after seed dispersal will be determined for the Dolores River for the years 1971 through 2008 and the San Miguel River for the years 1954 through 2008. Multiple logistic regressions will be used to model riparian tree establishment (yes vs. no) as function of independent predictor variables relating to flow and precipitation. From this model, the probability of riparian tree establishment on the Dolores River for each species for any given year, after-construction of McPhee dam, can be determined. Furthermore, the relationship between the hydrologic independent predictor variables as well as climate factors with annual radial growth for *Populus angustifolia*, *Populus deltoides* subsp. *wislizenii*, *Populus x acuminata*, and *Acer negundo* will be examined for regulated and unregulated comparison river sites by regression. Radial growth rates for *Populus angustifolia* and *Populus deltoides* subsp. *wislizenii* will be compared between the lower Dolores, upper Dolores, and San Miguel Rivers by ANOVA. Stem diameters and age of all trees will be compared using linear regression.