

Analysis of the Coldwater Fisheries Values in the San Juan and Dolores Basins of Southwest Colorado

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February 2009

The wild and native trout populations in the San Juan and Dolores Basins of southwest Colorado have a high conservation value to Trout Unlimited. Colorado River cutthroat trout are the native trout in these basins while rainbow, brown and brook trout are popular sport fish. Colorado River cutthroat currently occupy just 15% of their historic habitat. Most of the populations are fragmented and restricted to small headwater streams, with only small numbers of strongholds remaining, primarily in the Upper Green, Lower Green and Yampa River drainages.

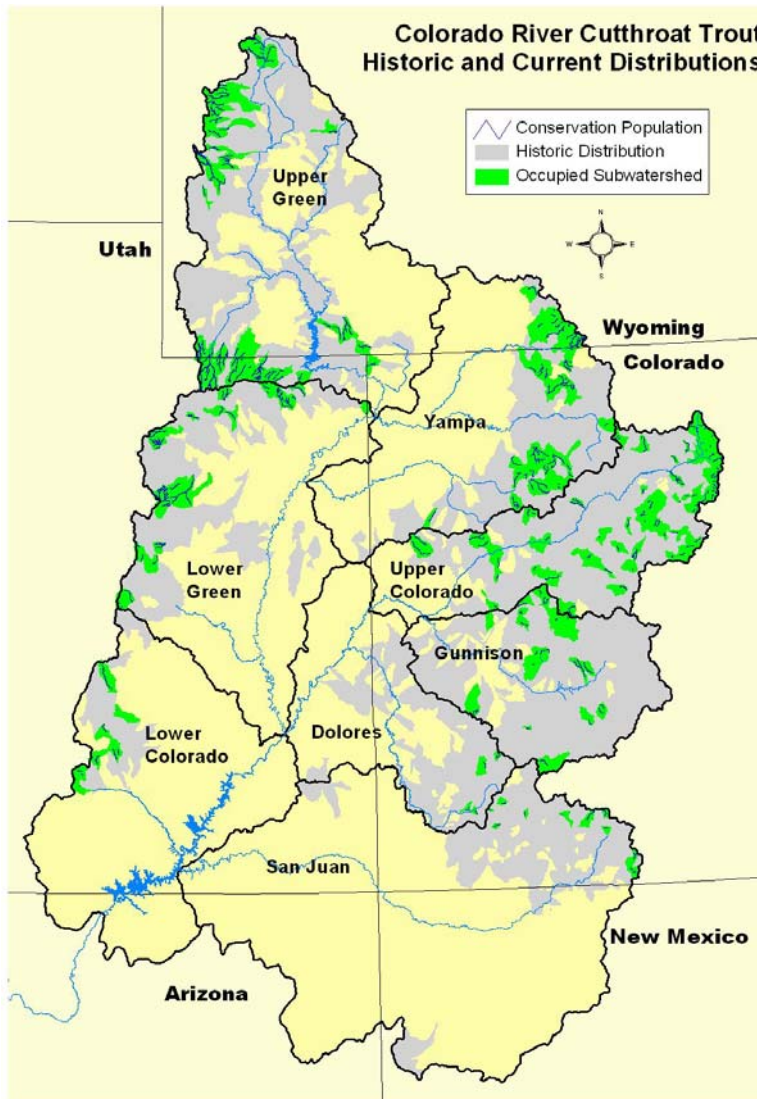


Figure 1 shows the historic range and distribution of conservation populations identified in the range-wide status assessment (Hirsch et al. 2005) and used in Trout Unlimited's Conservation Success Index analysis (see www.tu.org).

Management objectives for Colorado River cutthroat trout are organized by river basins, also shown in Figure 1. The populations of concern with regard to the Southwest Non-consumptive Use Roundtable are in the San Juan and Dolores river basins.

The populations of Colorado River cutthroat trout in the San Juan and Dolores river basins were historically part of well-connected river systems in the upper tributaries of the Dolores and San Juan

Figure 1. Distribution of Colorado River cutthroat trout.

rivers (Figure 2). Barriers, habitat degradation and the introduction of non-native species has resulted in the loss of fluvial and migratory life history forms, leaving these populations isolated in small headwater streams. Of the 5,300 km of historic habitat, just 287 km (5.4%) is currently occupied in the two basins. Based on genetic testing and conservation management objectives, only 90 km of the currently occupied habitat was identified in the range-wide status assessment as supporting conservation populations (Hirsch et al. 2005). The 90 km supports 16 distinct conservation populations with an average stream habitat extent of just 5.7 km and a range of 13.8 km – 1.3 km. All but two of the conservation populations are at least 90% genetically pure and, located at the southern extent of their range, all of the remaining populations in the San Juan and Dolores basins are peripheral.

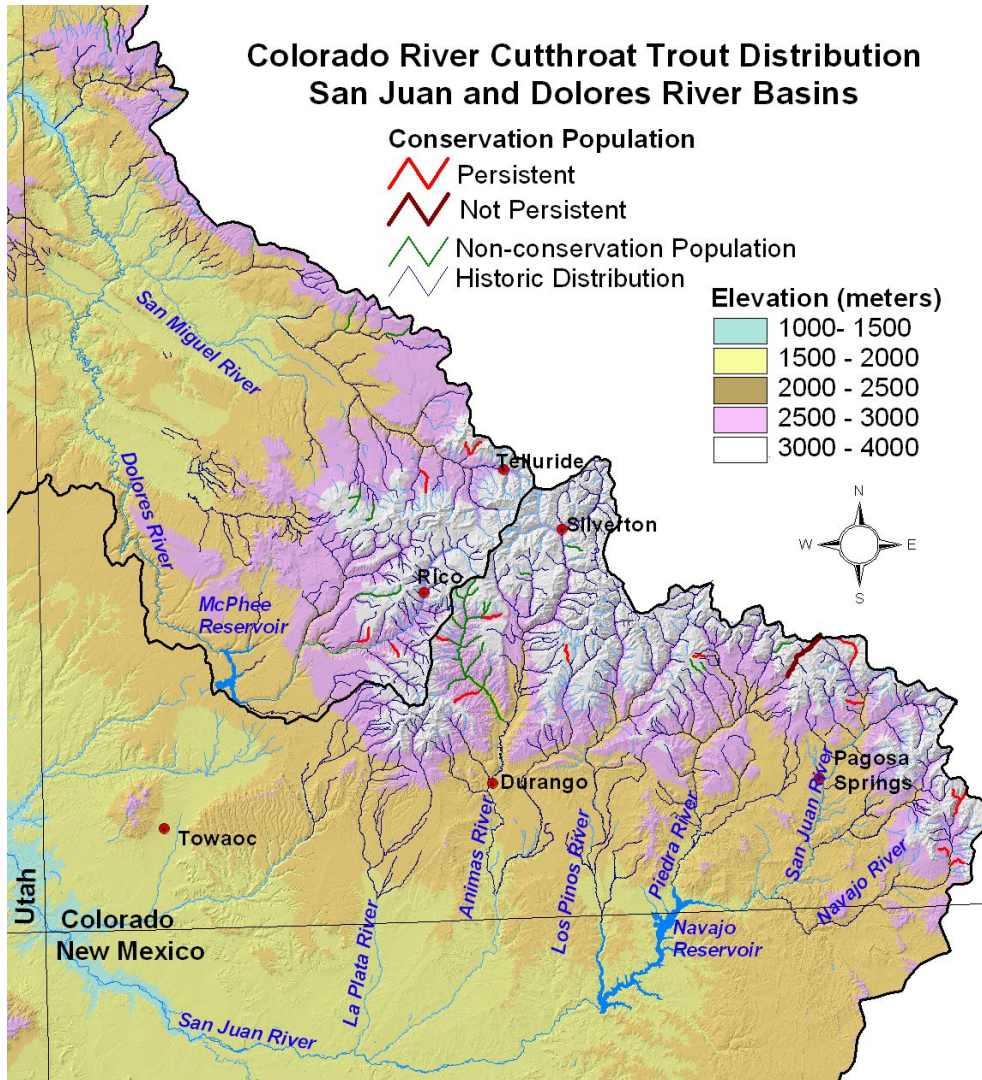


Figure 2 Colorado River cutthroat trout distribution in the San Juan and Dolores river basins.

‘Peripheral’ populations, located at the margins of a species’ range, are critically important to the long-term conservation of genetic diversity. In reviewing fossil records, Hampe and Petit (2005) found that populations at the constricting margins of a species’

range (in this case low elevations and southern latitude) are disproportionately important to the survival and evolution of the species because they commonly contain the bulk of the species' genetic diversity. This is a particularly important consideration when placed in the context of global warming induced environmental change because these populations may have unique adaptations that have allowed them to survive and evolve at the margins of suitable habitat.

These populations are particularly vulnerable to the effects of climate change and habitat alteration due simply to their limited extent and isolation. Trout Unlimited has conducted an analysis of population persistence for Colorado River cutthroat trout based on criteria established by Hilderbrand and Kershner (2000) for inland cutthroat trout in small mountain streams. These criteria, related to population density and occupied habitat, are appropriate for evaluating the likelihood of long-term persistence of Colorado River cutthroat trout populations under current conditions. An 'effective population' of at least 500 spawning adults, which may require a total adult population of 1,000 – 2,000, is considered to be the minimum population size necessary to maintain genetic diversity and reduce extinction risk due to demographic collapse or stochastic events. Populations that occupy less than 9.3 km of habitat are considered at risk regardless of population size (Hilderbrand and Kershner 2000). Range-wide, just 58 (20%) of the 285 remaining conservation populations meet the minimum requirements for persistence. Of the 16 conservation populations in the San Juan and Dolores basins, only one, at the headwaters of the Piedra River, meets the persistence threshold. In fact, 14 (88%) of these populations occupy less than 9.3 km of habitat.

Through competition, predation, and hybridization, non-native trout have displaced native cutthroat in much of their historic range. Trout Unlimited is committed to the conservation and restoration of native trout. However, we also recognize that it is not possible to restore native cutthroat to all of their historic habitat. In these areas we are committed to the conservation of healthy wild trout populations for their ecological and social values. Figure 3 shows the more popular wild trout waters in the basins.

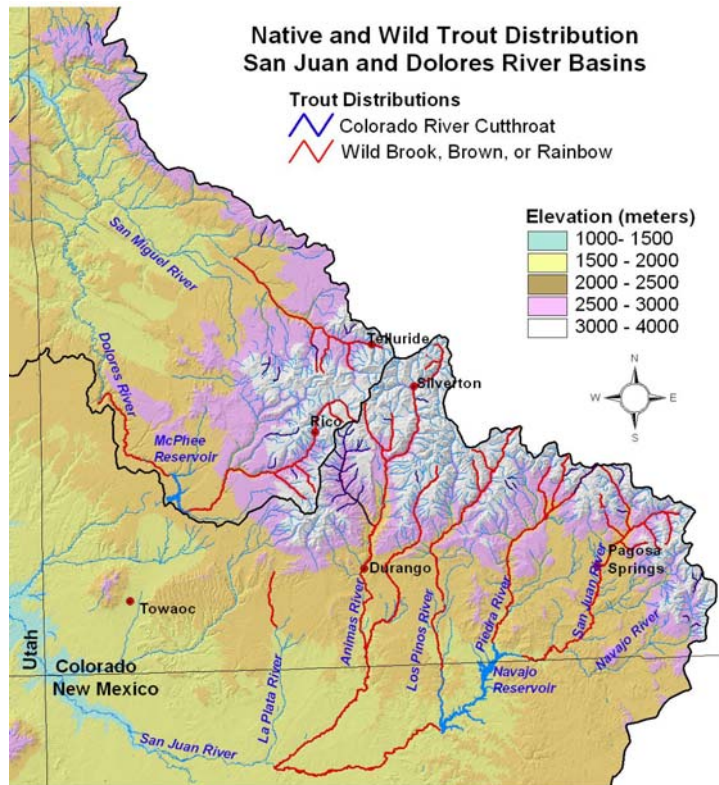


Figure 3. Wild and native trout distributions.

Although the non-natives, particularly brown trout, are more tolerant of warmer water temperatures than native cutthroat, they all still require access to cold, clean water. Trout Unlimited’s Conservation Success Index (CSI) is used to assess the conservation status of native and wild trout across a series of 20 indicators (Williams et al. 2007a). The CSI has been completed for Colorado River cutthroat trout. This includes an analysis of habitat integrity and future security across the cutthroat’s historic distribution which now encompasses many of the region’s wild trout streams. The analyses are conducted at the subwatershed scale using publicly available information on land use and landscape features. Figures 4 and 5 below show the results of these analyses.

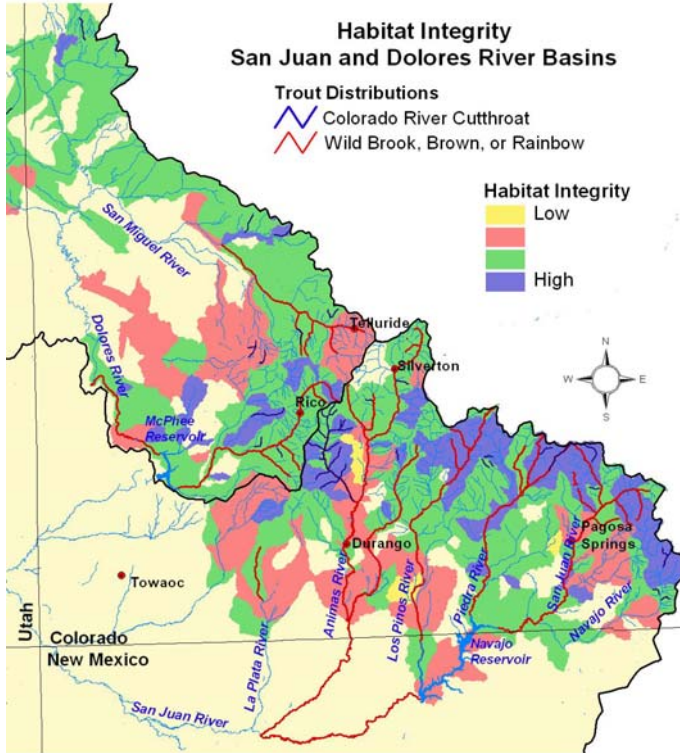


Figure 4. Conservation Success Index: Habitat Integrity

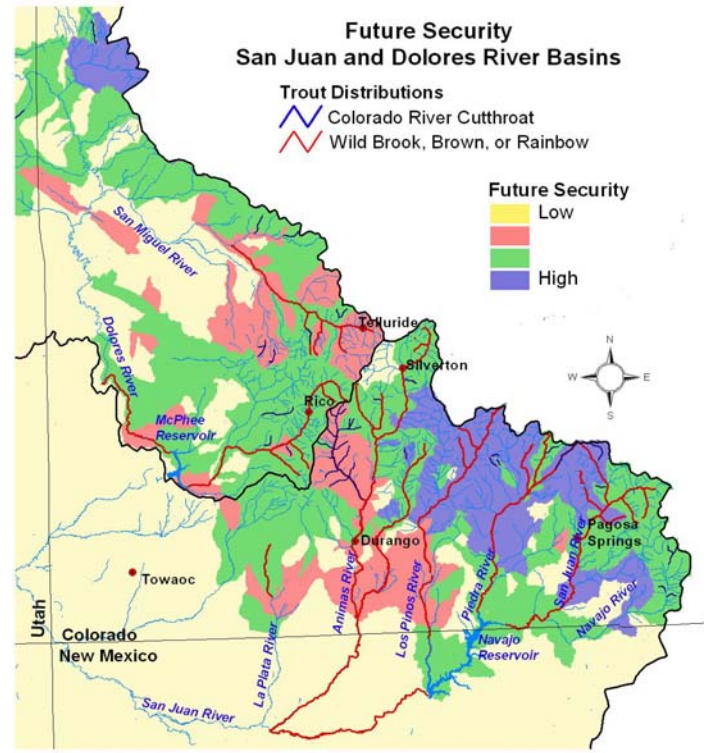


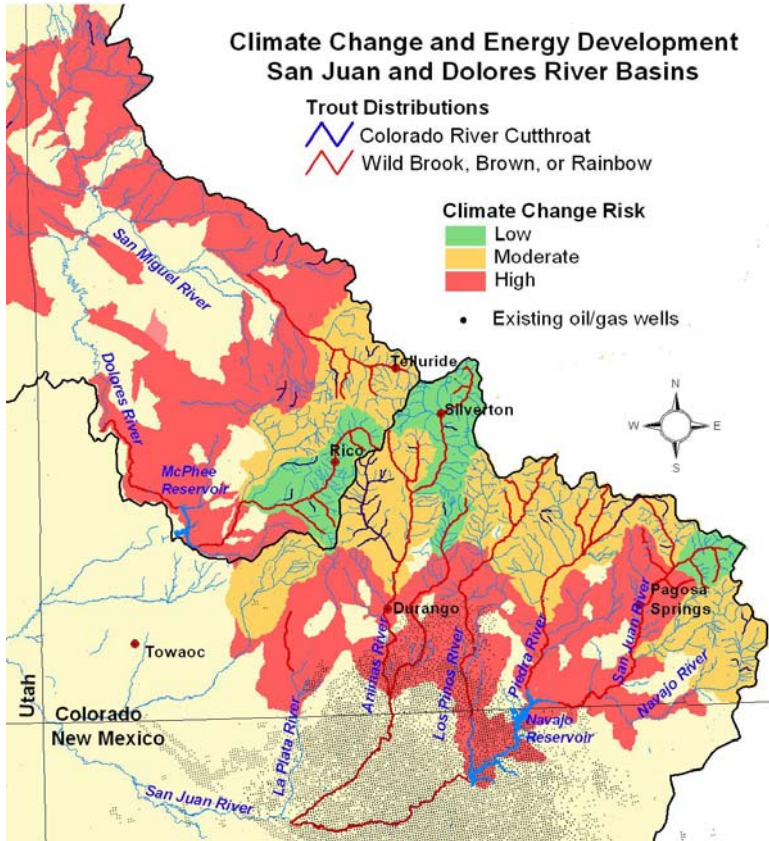
Figure 5. Conservation Success Index: Future Security

Of the five habitat integrity indicators evaluated (land stewardship, watershed connectivity, watershed conditions, water quality, and flow regime) land stewardship and water quality generally scored the lowest. Although much of the upper basins are in public ownership, little is formally protected and a history of resource extraction has resulted in degraded water quality in many of the watersheds. However, overall the habitat quality is relatively high through-out much of the region analyzed.

The future security analysis evaluates future threats that are a function of long-term regional trends such as climate change, residential development, resource extraction and non-native species invasions. Specific water developments or other local projects that may compromise the integrity of local streams and trout populations are not included in this assessment and instead must be addressed at the local level. From the perspective of native cutthroat, introduced species are a significant issue throughout much of the upper

San Juan and Dolores basins. However, the major threats to both native and wild trout include energy development and climate change.

Trout are particularly vulnerable to environmental change brought on by global warming due to their dependence on cold, clean water. Trout Unlimited has analyzed four climate change impacts assuming a 3°C temperature increase by the year 2050: winter flooding, wildfire, summer temperatures, and drought. The composite risk from these four factors is shown in Figure 6 where most of the region is at moderate to high risk, with the exception of some of higher mountains.



Of the four climate change risk factors, higher temperature and drought pose the greatest threat. According to work done by Martin Hoerling and colleagues at NOAA (Hoerling and Eischeid 2007) the Southwest and Rocky Mountain region is entering a 'new drought era' in which a 'near perpetual state of drought will materialize in the coming decades as a consequence of increasing temperature'. Therefore it is no surprise that the majority of the historic range for Colorado River cutthroat trout is at high risk for drought. The lower elevations and warmer regions such as these

Figure 6. Climate change risk and energy development threats. southern basins are also at high risk for unsuitable summer temperatures. Energy development has the potential to compound the environmental stresses associated with global warming. Figure 6 shows the extent of existing oil and gas wells in the San Juan basin. In recent years there have also been a number of oil and gas leases issued for this region so the number of wells can be expected to proliferate far beyond what is currently shown on this map.

Trout are very resilient and have adapted to many fluctuations in climate and environmental conditions over their evolutionary history. In order to help them survive climate change and continue to adapt and evolve to new circumstances, Trout Unlimited advocates the reduction of non-climate habitat stressors through the protection, reconnection, and restoration of important habitat areas and populations (Williams et al. 2007b). Although these populations of native cutthroat currently occupy relatively high

quality habitat, they are at the environmental margins for suitable habitat and are therefore very vulnerable to the adverse effects of climate change. In order to insure the long-term viability of these populations, which are an important part of the genetic diversity for Colorado River cutthroat, it is essential that their habitat remain high quality. This includes a healthy riparian zone for shade and protection of the headwaters to provide cold, clean water downstream. These same conditions are also important to the future of wild trout in the San Juan and Dolores basins.

References Cited

Hampe, A., and R.J. Petit. 2005. Conserving biodiversity under climate change: the rear guard matters. *Ecology Letters* 8:461-467.

Hilderbrand, R.H. and J.L. Kershner. 2000. Conserving inland cutthroat trout in small streams: How much stream is enough? *North American Journal of Fisheries Management* 20:513-520.

Hirsch, C.L., S.E. Albeke, and T.P. Nesler. 2006. Range-wide status of Colorado River cutthroat trout (*Oncorhynchus clarkii pleuriticus*): 2005. Colorado River Cutthroat Trout Conservation Team, Wyoming Game and Fish Department, Cheyenne.

Hoerling, M., and J. Eischeid. 2007. Past peak water in the Southwest. *Southwest Hydrology* 6(1):18-19, 35.

Williams, J.E., Haak, A.L., Gillespie, N.G., and W.T. Colyer. 2007a. The Conservation Success Index: Synthesizing and communicating salmonid condition and management needs. *Fisheries* 32:477-492

Williams, J.E., Haak, A.L., Gillespie, N.G., Neville, H.M., and W.T. Colyer. 2007b. Healing troubled waters: Preparing trout and salmon habitat for a changing climate. Trout Unlimited, Arlington, VA.