# Aquatic, Riparian, and Wetland Ecosystem Assessment
## San Juan National Forest, Colorado
## USDA Forest Service – Rocky Mountain Region

Report 3 of 3

Cumulative Influences
Synthesis and Discussion



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**The San Juan Aquatic, Riparian and Wetland Ecosystem Assessment is presented in three separate reports.  The reports can be cited as follows:**

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Winters, D.S. et al. 2006. Aquatic, riparian and wetland ecosystem assessment for the San Juan National Forest.  Report 2 of 3: Anthropogenic influences report.  Denver, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Region.

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Colorado River Cutthroat Trout
*Oncorhuynchus clarki pleuriticus*
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# Synthesis

Introduction

This chapter provides a meaningful link between the ecological driver analysis results of the 154 6th level HUBs intersecting or adjacent to the San Juan National Forest and the potential effects related to anthropogenic activities. The ecological context has been characterized by the ecological driver analysis for both riparian and wetland ecosystems, as reported in The Ecological Driver Analysis Chapter in Report 1 of this assessment. Ecological drivers have been defined as environmental factors that constitute the physiochemical template of an ecosystem, which in turn influence the fitness of individual organisms and their populations.

This chapter includes two analyses. The first analysis attempts to characterize the overall potential influences that anthropogenic activities have upon riparian and wetland ecosystems at the management scale. The purpose of this analysis is to identify the degree to which riparian and wetland ecosystems may be influenced by anthropogenic activities at this scale. The second analysis synthesizes the results of the first analysis with the results of the ecological driver Cluster analysis for both wetland and riparian ecosystems. The purpose of this analysis is to identify how each Cluster may respond to the potential influences of anthropogenic activities.

Key Findings

*Quantile Analysis*
1. The relatively high proportion of watersheds considered to have moderate to high potential for influence by management activities reflects the multiple uses associated with Forest Service management practices. Private lands off of the SJNF are typically associated with a single category of use, such as grazing, urbanization, or mineral extraction. These types of activities occur concurrently within watersheds within the

SJNF as delegated by MUSYA (Figure 3-1).
2. SJNF management activities are directed towards watersheds that are easily accessed. Watersheds with limited or no vehicular access typically have lower potential for influence by anthropogenic activities.
3. The distribution of management activities reflects a lack of consideration in planning for the physiographic characteristics that influence the presence of important aquatic, riparian or wetland ecosystems. Management strategies should consider aquatic, riparian and wetland values in the future.
4. There is a direct relationship between the percentage of the quantile area within the San Juan National Forest and the potential influence from anthropogenic activities. For example, Quantile 5 (most influenced watersheds) has 81% of it's area within the San Juan National Forest, while Quantile 1 (least influenced watersheds) has 50% of its area within the San Juan National Forest. This finding further suggests the influences of multiple uses on SJNF land relative to private lands.
5. Because of the high percentage of Quantile 5 (most influenced) within the San Juan National Forest, there may be more opportunities for retoration of ARW resources within the most influenced HUBs. HUBs that are least influenced by anthropogenic activities occupy less area within the San Juan National Forest, and may provide opportunities for reference conditions for individual Clusters and important resources..
6. The watersheds with the highest potential for anthropogenic influences on aquatic, riparian and wetland ecosystems are: HUB# 140801070104 – Chicken Creek; HUB# 140300020209 – Upper Dolores River-Taylor Creek, and HUB# 140801011601 – Beaver Creek.

7. The watershed with the least potential for anthropogenic influence on aquatic, riparian and wetland ecosystems is HUB# 140300020501 – Bear Creek-Disappointment Creek.

*Wetland Clusters*
1. Wetlands in Cluster 1w have a high potential for being influenced by cumulative anthropogenic activities. 89% of this cluster lies within the San Juan National Forest. This cluster is valuable for wetlands, and should have considerable diversity in both biota and habitat type. Further site level investigation could reveal that this cluster could benefit from wetland restoration.
2. Wetlands in Cluster 2w are completely contained within the San Juan National Forest. All seven of these watersheds have a moderate to high potential to be influenced by anthropogenic activities. Because of their location within the Forest boundary, there is a high potential for success of wetland restoration and mitigation implementation.
3. Wetlands in Cluster 3w have a high potential to be influenced by anthropogenic activities. Two of the watersheds that have the highest cumulative ranking of any watersheds are in this cluster; Upper Dolores River-Taylor Creek) HUB# 140300020209, value = 23) and Chicken Creek (HUB# 140801070104).
4. Cluster 4w supports a relatively small wetland area. This cluster has the greatest range of potential influences from anthropogenic activities. Watersheds with the lowest potential for anthropogenic influence in this cluster could be used as references for properly functioning wetland systems.
5. Cluster 5w is important for lower elevation wetland systems. Over 90% of the cluster is located within the forest, and these watersheds provide an opportunity for protection to promote rare low-elevation wetlands. This cluster has a moderate to be influenced by anthropogenic activities.
6. Cluster 6w is mainly located outside the San Juan National Forest. Watersheds in this cluster have a moderate potential for influence from anthropogenic activities. Wetlands are not common in this cluster, and wetland identification and protection techniques probably the best management.
7. Cluster 7w is considered to have the highest potential productivity for wetland systems. This cluster provides opportunites for protection and management of wetlands. The Sand Creek (HUB# 140801010103) and Beaver Creeek (HUB# 140801010202) watersheds have a moderately low potential influence from anthropogenic activities and is located entirely within the San Juan National Forest.
8. Cluster 8w is considered to be highly productive for wetland systems. This cluster includes the Upper Wenimuche Creek watershed (HUB# 140801020201) which has a low potential for influence from anthropogenic activities and is completely contained within the San Juan National Forest. This clusters of watersheds exhibits less anthropogenic influences than cluster 7w.
9. Cluster 9w has a high potential productivity for wetlands, and a low potential for influence by anthropogenic activities. As such, this cluster may provide a valuable protection area.

*Riparian Clusters*
1. Cluster 1r has a high potential to be influenced by anthropogenic activities, particularly those activities which increase sediment load. Two watersheds, Upper Wenimuche Creek (HUB# 140801020201) and Hermosa Creek – Dutch Creek (HUB# 140801040406) are located entirely within the San Juan National Forest, and may be used as a reference area for properly functioning aquatic and riparian systems.
2. Cluster 2r is the largest in the National Forest. This cluster has a wide variety of influences, and provides many opportunities for mitigation and restoration efforts.
3. Cluster 3r is one of the smallest and least productive groups of watersheds. The two watersheds in this cluster are considered

to have a moderately low potential for influence from anthropogenic activities.

4. Cluster 4r has a moderate to high potential to be influenced by anthropogenic activities. This cluster is readily accessible to management as it is located at lower elevations along the southwestern boundary of the SJNF. Watersheds in this cluster may not be suitable for use as reference areas due to excessive management.

5. Cluster 5r has a moderate to high potential to be influenced by anthropogenic activities. This cluster is also considered to be highly productive for aquatic and riparian systems. All watersheds that have a wide range of anthropogenic influence area and are partially located off-forest. Watersheds in this cluster may not be suitable for use as reference areas. There are numerous opportunities for mitigation projects within this cluster as access is quite good.

6. All watersheds in cluster 6r have some portion of their area located off-forest. Mitigation and restoration efforts may be difficult because of the proportion of area located off-forest. Large stream channels would be expected to be quite productive, there may be numerous ephemeral channels.

7. Cluster 7r contains only one watershed, of which only 33% of its area is located on-forest. This watershed has a moderately high potential for influence from anthropogenic activities, and is not considered to be very productive for aquatic and riparian systems.

8. Cluster 8r is relatively unproductive, and the three watersheds within it are located entirely within the National Forest. All three watersheds are considered to have a

moderately low to low potential for influence from anthropogenic activities.

Anthropogenic Activities:  Potential Additive Effects

The potential effects for all anthropogenic activities were analyzed by cumulating the percentile ranking for each of the twenty-two identified anthropogenic activities.   There were a total of 6 different activity categories used for this process using all the activities: Transportation,   Water   Use,   Vegetation Management,   Urbanization,   Mineral Extraction and Recreation.  For the additive effects analysis data for each category was clipped to the boundaries of the 154 6th level HUBs in and immediately adjacent to the San Juan National Forest. Each watershed was assigned an ordinal value of 0, 1, 2, 3, 4 or 5. HUBs assigned a value of 0 did not have the identified   activity   present   within   its boundaries.  The values of 1 – 5 were assigned based upon the percentile in which that HUB was located for the anthropogenic activity. Percentile ranges are: 0, 0.1-19.9, 20-39.9, 40-59.9, 60-79.9, and 80-100. Percentiles 0.9-19.9 were given an ordinal value of 1.  Percentiles from 20-39.9 were given an ordinal value of 2. Percentiles from 40-59.9 were given an ordinal value of 3.   Percentiles from  60-79.9 were given an ordinal value of 4.  Percentiles from 80-100 were given an ordinal value of 5. Each percentile range was then cumulated for the six activity categories.
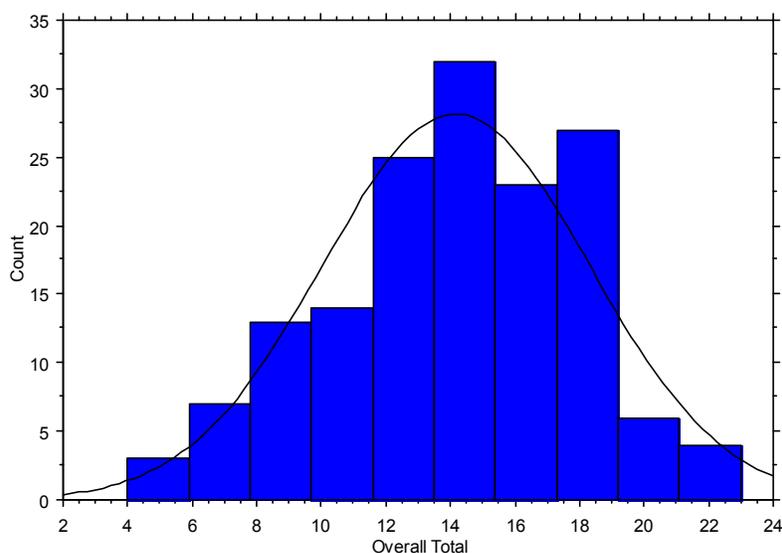
**Figure 3-1.** Histogram of overall additive effects cumulative percentile value.

It is assumed that the greater the ordinal value, the greater the potential influence of that activity upon aquatic, riparian, and wetland ecosystems. The highest possible value using this method was 30 (6 x 5). The highest identified value within the 154 HUBs was 23 (HUB# 140801070104 – Chicken Creek; HUB# 140300020209 – Upper Dolores River-Taylor Creek, and HUB# 140801011601 – Beaver Creek), and the lowest identified value was 4 (HUB# 140300020501 – Bear Creek-Disappointment Creek). The mean value was 14.17, with a standard deviation of 4.15. When viewed as a histogram (Figure 3-1), the distribution is skewed towards the lower values, and is leptokurtic (peaked). These results indicate that 76 out of 154 watersheds at the 6th level HUB, or 49.4% of the watersheds on the San Juan National Forest, have a high potential for cumulative anthropogenic influences to aquatic, riparian, and wetland resources. Cumulative is defined as the additive effect of minerals, transportation, urbanization, recreation, vegetation management and water use. The results of the cumulative analysis by watershed, for the entire San Juan National Forest are found at the end of this report (Table 3-1). Results for the biological category were not included due to the lack of spatial data associated with these types of management activities. These have been identified as a data need in the Biological section of Document 2.

For display and analysis purposes, the overall cumulative percentile value was divided into five Quantiles (Table 3-1). Quantile 1 is considered to be the grouping of ecosystems having the least potential influence resulting from anthropogenic activities, whereas Quantile 5 has the highest potential for influence on aquatic, riparian, and wetland resources resulting from anthropogenic activities. The potential for influence from management activities decreases with decreasing quantile number. The proportion of each quantile within the SJNF is summarized in Table 3-2

Table 3-3 summarizes the data for Quantile 5, which lists those watersheds with the highest potential for impacts to aquatic, riparian, and wetland resources. The 5th Quantile corresponds to the 100-80 percentile range. 25 HUBs were found to be within Quantile 5, which has the highest potential for watersheds to be influenced by the combination of six analyzed anthropogenic activity categories. 11 of these HUBs are found entirely on-forest. The overall total scores, for the 5th Quantile, range from a high of 23 to a low of 19. In this percentile range recreation, urbanization, minerals, transportation, vegetation management, and water uses are all present. Watersheds within

this percentile range are found across the

Forest except in the far west (Figure 3-2).

**Table 3-1.** Quantiles and their cumulative percentile ranges and potential influence by anthropogenic activities.

| Quantile | Percentile Range | Cumulative Value Range | Potential Influence | # of Watersheds |
|---|---|---|---|---|
| 1 | .01 - 19.9 | 4 – 7 | Least | 6 |
| 2 | 20.0 - 39.9 | 8 – 11 | Low | 26 |
| 3 | 40.0 - 59.9 | 12 – 14 | Moderate | 46 |
| 4 | 60.0 - 79.9 | 15 – 18 | High | 51 |
| 5 | 80.0 - 100.0 | 19 – 23 | Highest | 25 |

As 11 of the 25 HUBs found within Quantile 5 (100-80 percentile range) are located entirely within the San Juan National Forest, the potential for on-forest effects is expected to be higher than for off-forest downstream effects. The watersheds that have area both on and off forest have the potential for off-forest downstream effects to aquatic, riparian, and wetland resources as the downstream boundaries of these watersheds are located beyond the Forest boundary (Figure 3-2)

In order to more accurately assess the potential for effects to aquatic, riparian, and wetland resources both on and off-forest additional analysis was conducted. This analysis examined the relationship between the geographic positions of the HUBs in relation to the boundary of the San Juan National Forest as this plays a crucial role in the management of the anthropogenic activities occurring in each HUB.

For example, a HUB in Quantile 5 (those HUBs considered to have the highest potential for being influenced by anthropogenic activities) that is completely contained by the San Juan National Forest may require a different management strategy than another HUB in Quantile 5 that has only a small percentage of its total area located within the National Forest boundary. The percentage of the total area of each Quantile within the National Forest boundary has been identified for two reasons:
1) To identify areas where management decisions concerning anthropogenic activities may significantly influence aquatic, riparian, and wetland ecosystems;

2) Identify areas for potential restoration projects, and
3) To identify potential errors associated with cumulative values, as the cumulative values are extrapolated to areas outside the National Forest boundary based upon data that in some cases exists only for those areas within the San Juan National Forest.

Of the 25 HUBs comprising Quantile 5, 11 HUBs are completely contained by the San Juan National Forest (Table 3-2). As discussed earlier the overall totals for this percentile vary from a high of 23 to a low of 19. When analyzing the area of all of the HUBs comprising Quantile 5 (100-80 percentile), 80.64% of the area is contained within the San Juan National Forest boundary, which supports the data interpretation that there is a higher potential for on-forest vs. off-forest impacts to aquatic, riparian, and wetland resources.

Since such a large percentage of the area for this percentile range is located within the boundaries of the San Juan National Forest, management decisions concerning anthropogenic activities have the potential to alter or improve the aquatic, riparian, and wetland ecosystems within the Quantile with the highest potential influence from anthropogenic activities. It should be noted that potential restoration is ultimately based upon a number of factors, including cost, social values, downstream influences, etc.

**Table 3-2.** Summary of Percent Quantile in the San Juan National Forest, management scale

| Quantile | % of Quantile in NF | # of Watersheds | # of HUBs Completely within NF |
|---|---|---|---|
| 1 | 50.00 | 6 | 3 |
| 2 | 59.18 | 26 | 15 |
| 3 | 66.91 | 46 | 25 |
| 4 | 82.51 | 51 | 21 |
| 5 | 80.64 | 25 | 11 |

Quantile 4 corresponds to the 79.9-60 percentile range. There are a total of 51 watersheds within this Quantile. These watersheds are found across the entire Forest, with a concentration of watersheds being located along the southern forest boundary. Within this Quantile overall total scores for recreation, urbanization, minerals, transportation, vegetation management, and water uses activities range from 18 to 15. 21 of these watersheds are located entirely on-forest (Table 3-2). There is a slight increase in the potential for on-forest influences to aquatic, riparian, and wetland resources, when compared to the 5th Quantile. 82.5% of the area found within Quantile 4 is located on-forest compared to 80.6% for Quantile 5. There is an increased potential for off-forest effects as there is a concentration of watersheds found along the Forest's southern boundary. Similar to Quantile 5, the management decisions associated with anthropogenic activities, for Quantile 4, may significantly affect aquatic, riparian, and wetland ecosystems.

The 59.9-40 percentile range comprises the 3rd Quantile. 46 watersheds are within this Quantile with 25 watersheds being located entirely on Forest. Watersheds within this range are found across the Forest. Within this Quantile overall total scores for

recreation, urbanization, minerals, transportation, vegetation management, and water uses activities range from 14 to 12. For Quantile 3 66.9% of the area is located on-forest, representing a further decline in the potential for on-forest effects. 21 of the watersheds within this percentile range are located off-forest, which implies a continuing increase in potential for off-forest influences.

However, overall totals for recreation, urbanization, minerals, transportation, vegetation management, and water uses activities range are dominated by scores of "2" and "3". These lower overall total scores for these categories indicate a declining potential for impacts to ARW resources, so the potential for off-forest impacts is also less, even though a higher percentage of watershed area is located off-forest.

Quantile 2 is equivalent to the 39.9-20 percentile range and contains 26 watersheds, 15 of these watersheds are located on-forest. Watersheds are found across the Forest and most of their area is located off-forest, except for those watersheds located within the Weminuche Wilderness (Figure 3-2). The watersheds located in the Wilderness are the Upper Vallecito Creek (HUB# 140801011401), Needle Creek (HUB# 140801040203), Middle Vallecito Creek (HUB# 140801011402), Lake

Creek (HUB# 140801011303), and Upper Los Pinos River-Flint Creek (HUB# 140801011302).

Within Quantile 2 overall total scores for recreation, urbanization, minerals, transportation, vegetation management, and water uses activities range from 11 to 8. Although all activities have scores, transportation is the dominant activity in this Quantile with water uses being the least dominant activity.
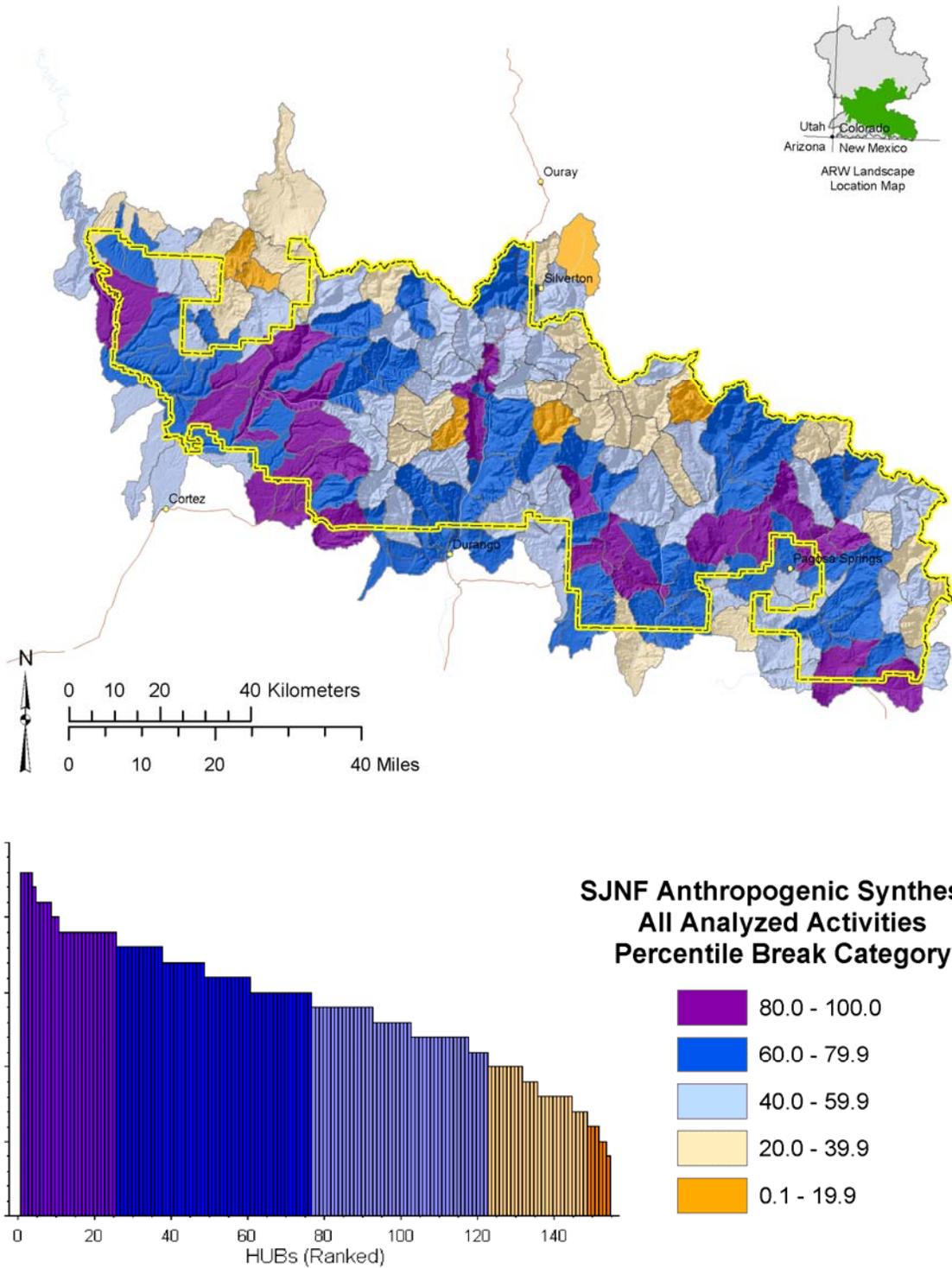
**Figure 3-2.** Summary of watersheds within Quantiles 5-1, management scale, San Juan National Forest

**Table 3-3.** Summary of watersheds within the 5th Quantile, management scale,
San Juan National Forest; Watersheds located entirely on-forest are highlighted in light green.

| HUB6 | HUB6 NAME | Recreation | Urbanization | Minerals | Transportation | Vegetation Management | Water Use | Over all Total | Quantile |
|---|---|---|---|---|---|---|---|---|---|
| 140801070104 | Chicken Creek | 3 | 4 | 3 | 5 | 5 | 3 | 23 | 5 |
| 140300020209 | Upper Dolores River-Taylor Creek | 4 | 2 | 3 | 5 | 4 | 5 | 23 | 5 |
| 140801011601 | Upper Beaver Creek | 2 | 3 | 5 | 3 | 5 | 5 | 23 | 5 |
| 140801020401 | Martinez Creek-Dutton Creek | 5 | 3 | 1 | 4 | 4 | 5 | 22 | 5 |
| 140801010302 | Fourmile Creek | 3 | 2 | 3 | 4 | 4 | 5 | 21 | 5 |
| 140300020105 | Lower West Dolores River | 2 | 3 | 3 | 3 | 5 | 5 | 21 | 5 |
| 140801050105 | Upper Cherry Creek | 2 | 5 | 3 | 5 | 3 | 3 | 21 | 5 |
| 140801040502 | Elbert Creek | 3 | 3 | 3 | 5 | 4 | 3 | 21 | 5 |
| 140300020401 | Upper Lost Canyon | 4 | 2 | 1 | 4 | 5 | 4 | 20 | 5 |
| 140801070103 | Upper Mancos Valley | 2 | 5 | 5 | 3 | 2 | 3 | 20 | 5 |
| 140801070102 | West Mancos River | 1 | 3 | 2 | 5 | 5 | 3 | 19 | 5 |
| 140801010303 | Laughlin Park | 3 | 2 | 3 | 3 | 3 | 5 | 19 | 5 |
| 140300020305 | Beaver Creek-Trail Canyon | 1 | 3 | 4 | 4 | 4 | 3 | 19 | 5 |
| 140300020404 | Stapleton Valley | 0 | 5 | 2 | 4 | 4 | 4 | 19 | 5 |
| 140300020407 | House Creek | 1 | 2 | 3 | 5 | 5 | 3 | 19 | 5 |
| 140300020604 | Dolores Canyon-Lake Canyon | 3 | 2 | 3 | 3 | 4 | 4 | 19 | 5 |
| 140801010304 | Upper Pagosa Springs | 2 | 4 | 3 | 3 | 4 | 3 | 19 | 5 |
| 140801010504 | Navajo River-Weisel Flat | 5 | 2 | 3 | 3 | 3 | 3 | 19 | 5 |
| 140801010507 | Coyote Creek | 2 | 2 | 3 | 4 | 4 | 4 | 19 | 5 |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 140801011404 | Vallecito Reservoir | 5 | 2 | 1 | 3 | 4 | 4 | 19 | 5 |
| 140801020301 | Upper Devil Creek | 4 | 2 | 1 | 4 | 5 | 3 | 19 | 5 |
| 140801020501 | Yellowjacket Creek | 2 | 3 | 3 | 3 | 4 | 4 | 19 | 5 |
| 140801070105 | East Fork of Mud Creek | 1 | 5 | 5 | 3 | 2 | 3 | 19 | 5 |
| 140801011602 | Middle Beaver Creek | 2 | 3 | 4 | 3 | 4 | 3 | 19 | 5 |
| 140801040303 | Lower Cascade Creek | 5 | 2 | 2 | 4 | 4 | 2 | 19 | 5 |

For Quantile 2, 59.2% of the area within this percentile range is located on-forest, which suggests that the potential for effects is almost equal for both on-and off-forest aquatic, riparian, and wetland resources.

There are only six watersheds on the San Juan National Forest that are within Quantile 1, which corresponds to the 19.9-0.1 percentile range. These watersheds are located across the Forest (Figure 3-2). Only three of the watersheds are located on-forest while three watersheds are located partially on-forest or located north of the Forest boundary. Transportation is the dominant activity category within this percentile range, with vegetation management a close second. Only

one watershed has any urbanization activity, the Bear Creek-Disappointment Creek (HUB #140300020501). 50% of this Quantile range is found within the Forest's boundary. On-forest effects would be expected to be low due to the low individual category and total overall scores and the low percentage of area located on-forest. However, in those watersheds located off-forest, the range in total overall score is from seven to four. The highest possible total overall score is 30. As a result, the potential for both on and off-forest impacts is considered to be fairly low.

No watersheds received a total overall score of "0", meaning no anthropogenic activities were recoreded.

Anthropogenic Activities: Synthesis with
Ecological Driver Analysis

Understanding the link between anthropogenic influences and the ecological setting requires the synthesis of the anthropogenic activities, and the ecological driver agglomerative Cluster analysis discussed in Report 1 of this 3 part assessment. This Cluster analysis identified similar groupings of 6th level HUBs based upon differences in the physiographic, geologic, and climatic setting variations with the watershed. As a result of the spatial variation of these ecological drivers within each HUB, each recognized Cluster will vary in its sensitivity to alterations of the present hydrologic and sediment regime. It is the purpose of this section to identify the relationship between ecological driver Cluster, sensitivity, and the extent of anthropogenic disturbance.

It should be noted that the scales for the analysis of ecological drivers and anthropogenic activities are different. The ecological driver analysis scale includes more 6th level watersheds (197) than the anthropogenic influence scale (154). The reason for this difference is that the GMUG and San Juan National Forests were combined for the identification and analysis of ecological driver Clusters. Despite the difference in the overall number of watersheds in each Cluster between the two analysis scales, the characteristics of each Cluster are the same as in Document 1.

This information should be valuable for prioritizing 6th level HUBs for management considerations (e.g., restoration and protection). In addition, the range of conditions found in HUBs within each Cluster should provide a template for identifying reference and threshold conditions for key reach/site scale characteristics.

Wetland Ecological Driver Clusters

The aggregate Cluster analysis of the ecological drivers for wetland ecosystems at the management scale identified nine unique Clusters. Each of these Clusters has a distinct signature represented by spatial variations in geology (calcareous and non-calcareous lithology), rock type, (igneous or non-igneous), climate (precipitation type) and presence or absence of Pleistocene glaciation (Table 3-4). Table 3-5 summarizes the distribution of watersheds within each watershed Cluster.

**Table 3-4.** Mean percentage of each driver within the 10 management scale wetland Clusters.

| Cluster | Ca | Cn | Ri | Ro | Qg | Prs | Ps | Pr | % in NF |
|---------|------|------|------|-------|------|------|------|------|---------|
| 1w | 46.6 | 53.4 | 3.2 | 96.8 | 6.8 | 13.1 | 86.8 | 0.1 | 46.1 |
| 2w | 44.6 | 55.4 | 11.3 | 88.7 | 47.3 | 24.2 | 73.7 | 2.1 | 57.5 |
| 3w | 14.1 | 85.9 | 1.3 | 98.7 | 1.7 | 66.6 | 23.5 | 9.8 | 56.5 |
| 4w | 52.3 | 47.7 | 0.3 | 99.7 | 0.2 | 75.9 | 11.3 | 12.8 | 46.2 |
| 5w | 26.6 | 73.4 | 0.0 | 100.0 | 31.9 | 45.6 | 18.0 | 36.3 | 65.2 |
| 6w | 26.5 | 73.5 | 0.5 | 99.5 | 0.0 | 9.0 | 0.0 | 91.0 | 1.1 |
| 7w | 77.0 | 23.0 | 2.9 | 97.1 | 62.5 | 9.4 | 90.6 | 0.0 | 44.8 |
| 8w | 26.9 | 73.1 | 16.4 | 83.6 | 83.2 | 1.6 | 98.4 | 0.0 | 61.0 |
| 9w | 3.8 | 96.2 | 88.5 | 11.5 | 87.0 | 0.9 | 99.1 | 0.0 | 100.0 |
| | | | | | | | | | |
| | **Ca:** Calcareous | | | | **Qg:** Pleistocene Glaciation<br>**Qn:** Non-Glaciated | | | | |
| | **Cn:** Non-Calcareous | | | | **Prs:** Rain and Snow Precipitation Regime | | | | |
| | **Ri:** Igneous Rocktype | | | | **Ps:** Snowfall Precipitation Regime | | | | |
| | **Ro:** Non-Igneous Rocktype | | | | **Pr:** Rainfall Precipitation Regime | | | | |

**Table 3-5. Ecological driver analysis results for wetland Clusters.**

| Cluster | % of Cluster in NF | # of Watersheds | # of HUBs Completely within NF |
|---------|---------------------|------------------|--------------------------------|
| 1w | 88.73 | 30 | 24 |
| 2w | 100.00 | 7 | 7 |
| 3w | 69.68 | 40 | 11 |
| 4w | 47.78 | 37 | 4 |
| 5w | 65.21 | 2 | 0 |
| 6w | 1.10 | 3 | 0 |
| 7w | 97.90 | 14 | 13 |
| 8w | 81.38 | 18 | 13 |
| 9w | 100.00 | 3 | 3 |

*Wetland Cluster 1w*

The 30 watersheds in Cluster 1w are typified by moderate to high elevation, non-glaciated catchments with a fairly even distribution of calcareous and non-calcareous geology formed by predominately non-igneous processes. A snowfall hydroclimatic regime drives the hydrology of this Cluster.

In terms of anthropogenic influences, wetland Cluster 1w is comprised of five 6th level HUBs in Quantile 5 of the cumulative percentile values, 13 HUBs in Quantile 4, 9 HUBs in Quantile 2, and 3 HUBs in Quantile 1 (Table 3-6). Twenty-four of the 30 HUBs are completely contained by the San Juan National Forest (Figure 3-3). 88.7% of the total area of Wetland Cluster 1w is located within the National Forest boundary. The Upper Lost Canyon sub-watershed (HUB# 140300020401) has the greatest potential to be influenced by anthropogenic activities (value = 20), This HUB is completely contained by the San Juan National Forest, and indicates high use and high potential for influencing wetland ecosystems.

The distribution of Quantiles within Cluster 1w is presented in Figure 1.4. The HUBs with the lowest potential to be influenced by anthropogenic activities (within Cluster 1w) include Disappointment Creek Headwaters (HUB# 140300020502), and Hermosa Creek-Dutch Creek (HUB# 140801040406). These watersheds may have the potential to be reference watersheds for wetland form and function within this Cluster.

**Table 3-6.** Wetland Cluster 1w: cumulative percentile values, ranks, and quantile designations, Watersheds highlighted in light green are located entirely on-forest.

| HUB6 | HUB6NAME | % in NF | Overall Total | Rank | Quantile |
|---|---|---|---|---|---|
| 140300020401 | Upper Lost Canyon | 100.00 | 20 | 4 | 5 |
| 140801070102 | West Mancos River | 86.97 | 19 | 5 | 5 |
| 140801010303 | Laughlin Park | 100.00 | 19 | 5 | 5 |
| 140801070101 | East Mancos River-Middle Mancos River | 99.32 | 18 | 6 | 4 |
| 140300020202 | Upper Dolores River-Cayton Valley | 100.00 | 17 | 7 | 4 |
| 140300020207 | Dolores River-Priest Gulch | 100.00 | 17 | 7 | 4 |
| 140300020204 | Upper Dolores River-Scotch Creek | 100.00 | 16 | 8 | 4 |
| 140300020208 | Stoner Creek | 100.00 | 16 | 8 | 4 |
| 140300020103 | Upper West Dolores River | 100.00 | 15 | 9 | 4 |
| 140801011306 | East Creek | 100.00 | 15 | 9 | 4 |
| 140801040402 | East Fork Hermosa Creek | 100.00 | 14 | 10 | 3 |
| 140801040803 | Lemon Reservoir | 100.00 | 14 | 10 | 3 |
| 140300020301 | Upper Beaver Creek -McPhee | 20.89 | 14 | 10 | 3 |
| 140801040407 | Lower Hermosa Creek | 100.00 | 14 | 10 | 3 |
| 140300020203 | Rico Valley | 100.00 | 13 | 11 | 3 |
| 140801010503 | Navajo Peak | 25.28 | 13 | 11 | 3 |
| 140300020102 | Fish Creek | 100.00 | 12 | 12 | 3 |
| 140300020201 | Dolores River Headwaters-Tin Can Basin | 100.00 | 12 | 12 | 3 |
| 140300020206 | Bear Creek | 100.00 | 12 | 12 | 3 |
| 140801020204 | First Fork | 100.00 | 12 | 12 | 3 |
| 140801040403 | Upper Hermosa Creek | 100.00 | 12 | 12 | 3 |
| 140300020205 | Roaring Forks Creek | 100.00 | 11 | 13 | 3 |
| 140801040401 | Hermosa Creek headwaters | 100.00 | 11 | 13 | 3 |
| 140300020101 | El Deinte Peak | 100.00 | 10 | 14 | 2 |
| 140300020104 | Groundhog Creek | 33.90 | 10 | 14 | 2 |
| 140801020203 | Sand Creek | 100.00 | 10 | 14 | 2 |
| 140801040405 | South Fork Hermosa Creek | 100.00 | 9 | 15 | 2 |
| 140801040404 | Middle Hermosa Creek | 100.00 | 8 | 16 | 2 |
| 140300020502 | Disappointment Creek Headwaters | 24.97 | 8 | 16 | 2 |
| 140801040406 | Hermosa Creek-Dutch Creek | 100.00 | 6 | 18 | 1 |
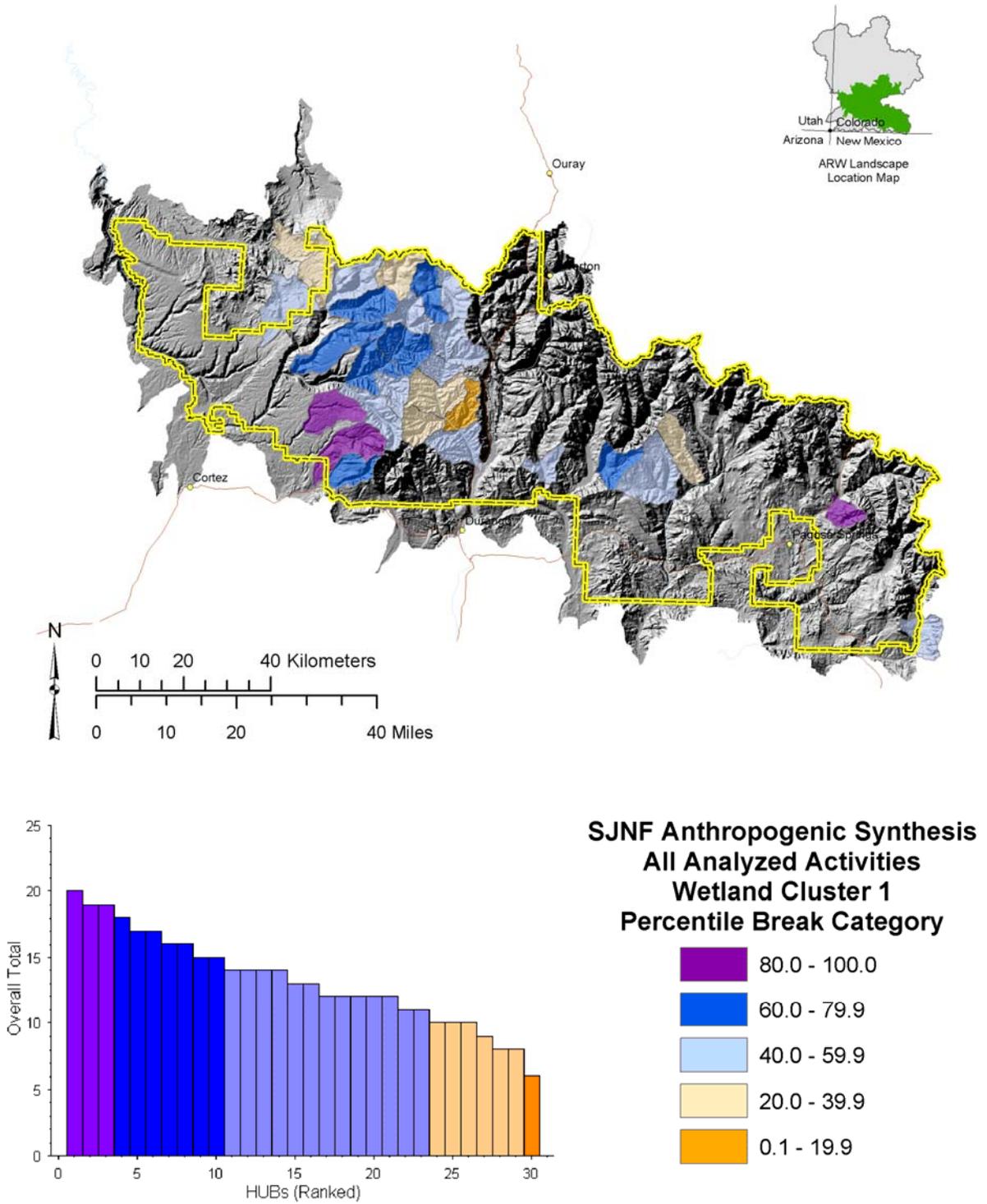
**Figure 3-3.** Wetland Cluster 1: cumulative percentile values.

*Cluster 1w Management Considerations:* Cluster 1w is valuable from a wetland ecosystem standpoint, as the high elevation areas within this Cluster may contain a high density of wetlands. Areas of glaciation would expect to have relatively high concentrations of wetlands. A large portion of this Cluster is contained by the San Juan National Forest, and thus we have considerable management opportunities, particularly in the important high elevation areas. The variability in

amounts of anthropogenic activities occurring in this Cluster indicates that from a biodiversity and habitat diversity standpoint there may be important areas for restoration and protection. In addition, because of the relative importance of this Cluster from a biodiversity and habitat diversity standpoint, more strategic emphasis on management for wetland resources may be necessary.

*Wetland Cluster 2w*

Wetland Cluster 2w is comprised predominately of high elevation, glaciated watersheds with a fairly even distribution of calcareous and non-calcareous geology formed by predominately non-igneous processes. This Cluster is predominately within the snowfall hydroclimatic regime. 100% of the total area of this Cluster is contained within the National Forest boundary (Figure 3-4).

Relative to the eight other wetland Clusters, Cluster 2w has a high potential to be

influenced by anthropogenic activities from a wetland ecosystem perspective. Four of the watersheds are within Quantile 4, with the remaining watersheds in Quartile 3 (Table 3-7). Three watersheds have the highest total values in this Cluster: Lower Vallecito Creek (HUB# 140801011403), Upper Animas Valley – Canyon Creek (HUB# 140801040501), and Williams Creek (HUB# 40801020103) (value = 16)

**Table 3-7.** Wetland Cluster 2w: cumulative percentile values, ranks, and quantile designations, Watersheds highlighted in light green are located entirely on-forest.

| HUB6 | HUB6NAME | % in NF | Overall Total | Rank | Quantile |
|---|---|---|---|---|---|
| 140801011403 | Lower Vallecito Creek | 100.00 | 16 | 8 | 4 |
| 140801040501 | Upper Animas Valley-Canyon Creek | 100.00 | 16 | 8 | 4 |
| 140801020103 | Williams Creek | 100.00 | 16 | 8 | 4 |
| 140801040503 | Upper Animas Valley-Stevens Creek | 100.00 | 15 | 9 | 4 |
| 140801010403 | Rio Blanco River-Blanco Basin | 100.00 | 14 | 10 | 3 |
| 140801011305 | Indian Creek | 100.00 | 14 | 10 | 3 |
| 140801010301 | Turkey Creek | 100.00 | 12 | 12 | 3 |

ARW Landscape
Location Map

N

0 10 20    40 Kilometers

0 10 20    40 Miles

SJNF Anthropogenic Synthesis
All Analyzed Activities
Wetland Cluster 2
Percentile Break Category

| | |
|---|---|
| (purple) | 80.0 - 100.0 |
| (blue) | 60.0 - 79.9 |
| (light blue) | 40.0 - 59.9 |
| (cream) | 20.0 - 39.9 |
| (orange) | 0.1 - 19.9 |
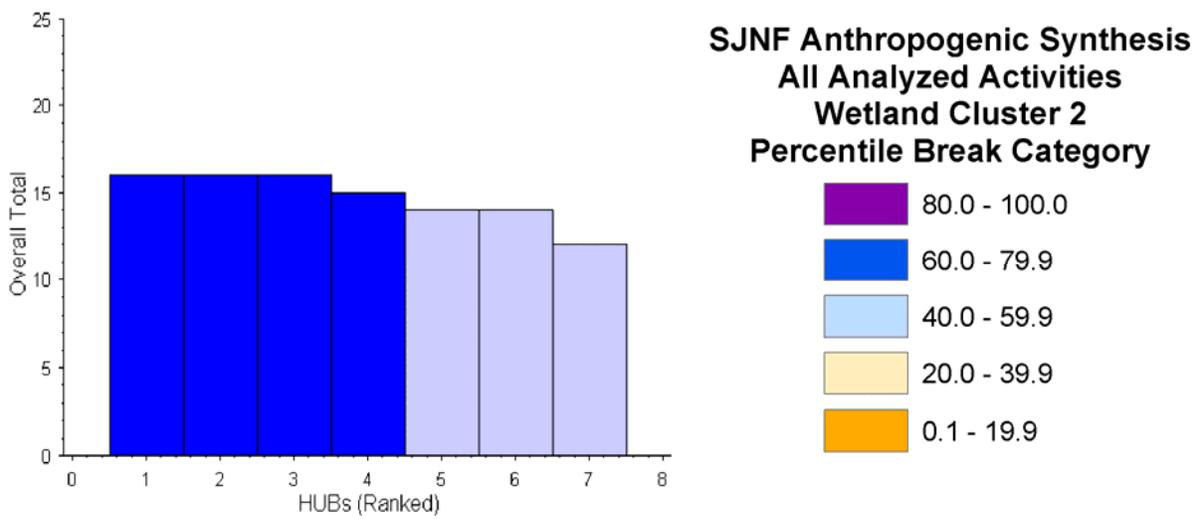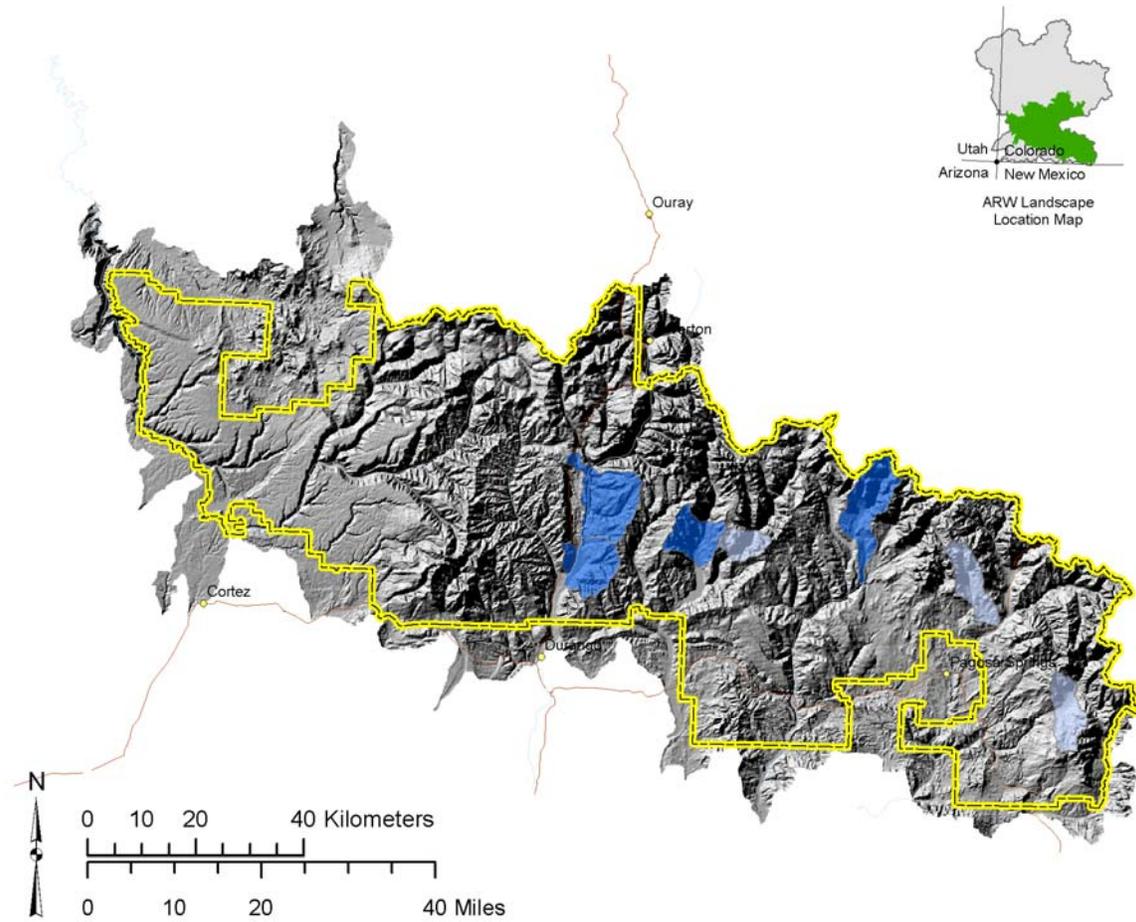
**Figure 3-4.** Wetland Cluster 2: cumulative percentile values.

Turkey Creek (HUB# 140801010301) has the least potential to be influenced by anthropogenic activities relative to the other seven HUBs comprising Cluster 2w, but still has a moderate potential to be influenced in comparison to the HUBs included in the management scale.

*Cluster 2w Management Considerations:* Watersheds within this Cluster could be considered one of the highest for strategic wetland protection and management. All of the HUBs in this Cluster are within the top 12 ranking of the 154 HUBs at this scale for cumulative anthropogenic activities. Based on these results, it would appear that there is a high potential for restoration in these HUBs. Rather than mitigating for other activities, which seems to have been the historical management strategy, a more proactive management strategy may be more effective in maintaining the integrity of these HUBs.

*Wetland Cluster 3w*

The 40 watersheds in Cluster 3w are typified by moderate elevation; non-glaciated catchments with a low proportion of
.

calcareous geology formed by predominately almost entirely non-igneous processes. A majority of the area of this Cluster is within the mixed hydroclimatic regime. HUBs in this Cluster occupy low elevation foothills on the southern and western edges of the San Juan Mountains. The HUBs have a rain and snowmelt driven hydrologic regime, with monsoon rains providing significant rain in late summer on many years. 69.7% of the total area of Cluster 3w is located within the San Juan National Forest (Table 3-8).

Relative to the other six wetland Clusters, Cluster 3w has a high potential to be influenced by anthropogenic activities. Two of the watersheds that have the highest cumulative ranking Upper Dolores River-Taylor Creek) HUB# 140300020209, value = 23) and Chicken Creek (HUB# 140801070104) are in Cluster w3. Of the 40 watersheds in Cluster 3w, 13 are in Quantile 5, 13 are in Quantile 4, 9 are in Quantile 3, and the remaining 3 are in Quantile 2. The watersheds with the highest potential for influence by anthropogenic activities are mainly located within the San Juan National Forest (Figure 3-5).

**Table 3-8.** Wetland Cluster 3w: cumulative percentile values, ranks, and quantile designations, Watersheds highlighted in light green are located entirely on-forest.

| HUB6 | HUB6NAME | % in NF | Overall Total | Rank | Quantile |
|---|---|---|---|---|---|
| 140801070104 | Chicken Creek | 70.63 | 23 | 1 | 5 |
| 140300020209 | Upper Dolores River-Taylor Creek | 100.00 | 23 | 1 | 5 |
| 140801010302 | Fourmile Creek | 95.49 | 21 | 3 | 5 |
| 140300020105 | Lower West Dolores River | 97.68 | 21 | 3 | 5 |
| 140300020305 | Beaver Creek-Trail Canyon | 100.00 | 19 | 5 | 5 |
| 140300020404 | Stapleton Valley | 100.00 | 19 | 5 | 5 |
| 140300020407 | House Creek | 97.42 | 19 | 5 | 5 |
| 140300020604 | Dolores Canyon-Lake Canyon | 65.03 | 19 | 5 | 5 |
| 140801010304 | Upper Pagosa Springs | 61.92 | 19 | 5 | 5 |
| 140801010504 | Navajo River-Weisel Flat | 31.52 | 19 | 5 | 5 |
| 140801010507 | Coyote Creek | 67.85 | 19 | 5 | 5 |
| 140801011404 | Vallecito Reservoir | 100.00 | 19 | 5 | 5 |
| 140801020301 | Upper Devil Creek | 100.00 | 19 | 5 | 5 |
| 140300020403 | Middle Lost Canyon | 86.71 | 18 | 6 | 4 |
| 140300020406 | Upper Dolores River-Italian Creek | 66.13 | 18 | 6 | 4 |
| 140801050102 | Mayday Valley | 33.21 | 18 | 6 | 4 |
| 140300020601 | Dolores River-Salter Canyon | 95.95 | 17 | 7 | 4 |
| 140801010404 | Middle Rio Blanco | 100.00 | 17 | 7 | 4 |
| 140801020206 | Upper Piedra River-Indian Creek | 100.00 | 17 | 7 | 4 |
| 140801020302 | Lower Devil Creek | 89.29 | 17 | 7 | 4 |
| 140801010506 | Little Navajo River | 94.95 | 16 | 8 | 4 |
| 140300020306 | McPhee Reservoir-Beaver Creek Inlet | 100.00 | 16 | 8 | 4 |
| 140300020402 | Spruce Water Canyon | 100.00 | 16 | 8 | 4 |
| 140300020603 | Dolores Canyon-Cabin Creek | 54.33 | 16 | 8 | 4 |
| 140801040601 | Junction Creek | 78.54 | 15 | 9 | 4 |
| 140300020507 | Dawson Draw | 64.82 | 15 | 9 | 4 |
| 140300020509 | Pine Arroyo | 79.65 | 15 | 9 | 4 |
| 140801020404 | Middle Stollsteimer Creek | 80.90 | 15 | 9 | 4 |
| 140801020202 | Lower Weminuche Creek | 100.00 | 14 | 10 | 3 |
| 140801020205 | Upper Piedra River-Box Canyon | 100.00 | 14 | 10 | 3 |
| 140801040602 | Upper Lightner Creek | 69.02 | 14 | 10 | 3 |
| 140801040804 | Upper Florida River-Red Creek | 74.75 | 14 | 10 | 3 |
| 140801010601 | San Juan River-Trujillo | 27.55 | 14 | 10 | 3 |
| 140300020605 | Dolores Canyon-Joe Davis Hill | 6.79 | 13 | 11 | 3 |
| 140300020405 | Lower Lost Canyon | 2.08 | 12 | 12 | 3 |
| 140802020201 | Upper Yellowjacket Canyon | 0.71 | 12 | 12 | 3 |
| 140801011501 | Middle Los Pinos River-Red Creek | 81.06 | 12 | 12 | 3 |
| 140300020511 | Disappointment Valley-Wild Horse Reservoir | 21.86 | 10 | 14 | 2 |
| 140801020503 | Piedra River-Navajo Reservoir Inlet | 22.86 | 10 | 14 | 2 |
| 140801010604 | Upper Cat Creek | 0.56 | 9 | 15 | 2 |
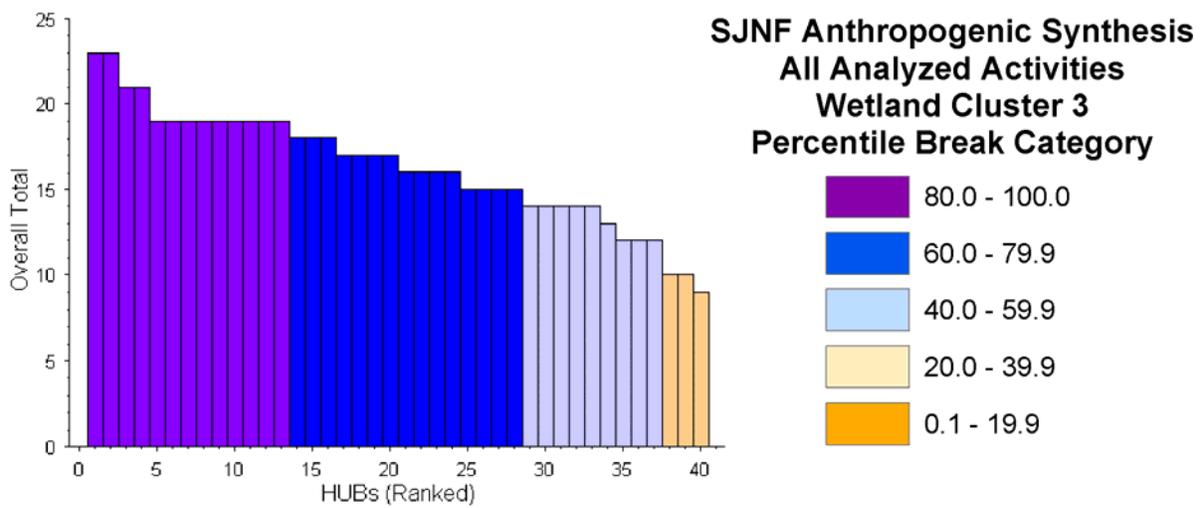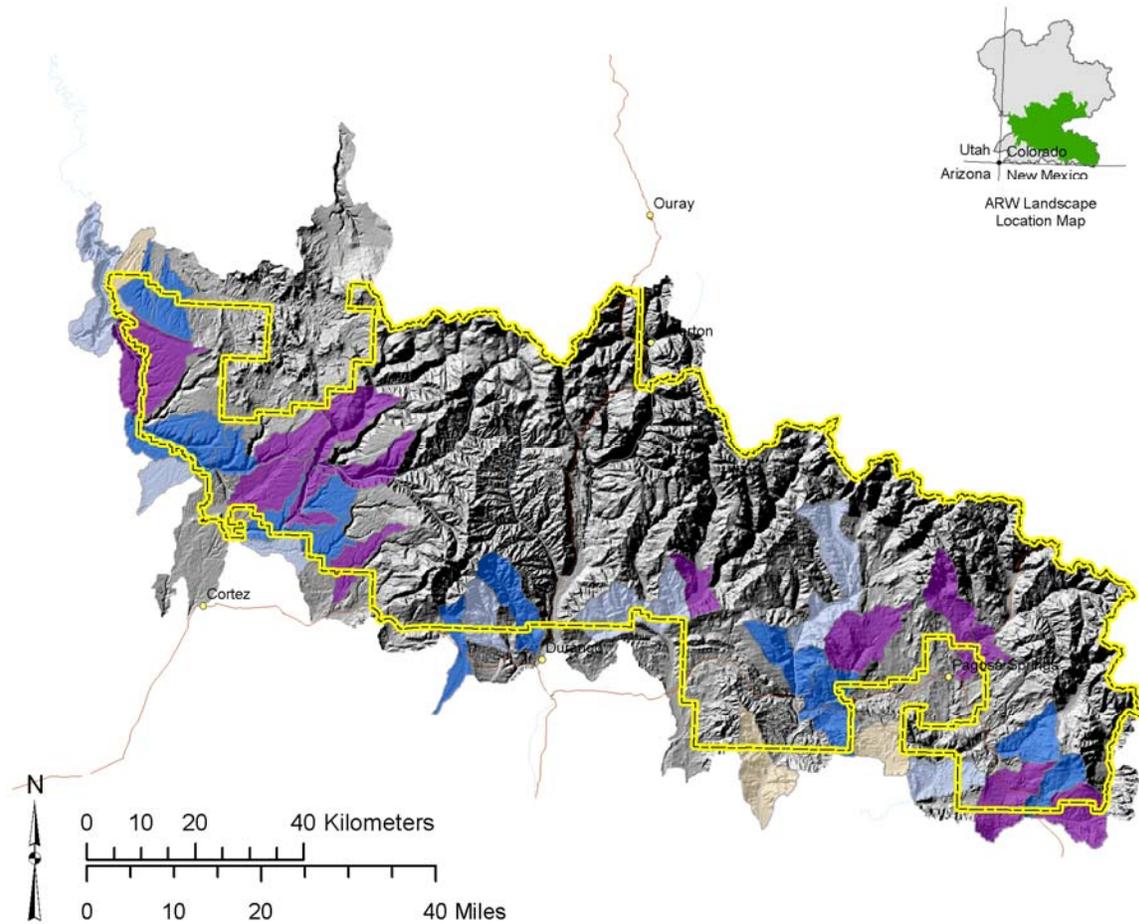
**Figure 3-5.** Wetland Cluster 3: cumulative percentile value.

*Cluster 3w Management Considerations:*
Cluster 3w is expected to be less important for wetland resources than other Clusters. Wetlands are most likely isolated and smaller. As a result, mitigation measures for other management activities may be the most reasonable means of managing wetlands. However, individual wetlands may be important for habitats for rare species as well as maintaining connectivity across the landscape. Restoration of individual wetlands may be an important means of improving conditions in these relatively rare wetlands, especially given the high level of activity in some of the watersheds.

*Wetland Cluster 4w*

The 37 watersheds in Cluster 4w are typified by low elevation; non-glaciated catchments with fairly equal proportions of calcareous and non-calcareous geology formed by predominately almost entirely non-igneous processes. A majority of the area of this Cluster is within the mixed hydroclimatic regime. 47.8% of the total area of Cluster 4w is within the San Juan National Forest (Table 3-9).

Relative to the other six wetland Clusters, Cluster 4w has a greater variance in the amount of potential influences from anthropogenic activities (Figure 3-6). Cluster 4w contains the one of the highest, (Upper Beaver Creek – HUB# 140801011601, value = 23), second highest (Martinez Creek-Dutton Creek – HUB# 140801020401; value = 22), and third highest: (Upper Cherry Creek – HUB# 140801050105, value = 21) ranked watersheds in the San Juan NF management scale. This Cluster also contains the lowest ranked watershed in the analysis scale (Bear Creek-Disappointment Creek – HUB# 140300020501, value = 4).

**Table 3-9.** Wetland Cluster 4w: cumulative percentile values, ranks, and quantile designations, Watersheds highlighted in light green are located entirely on-forest.

| HUB6 | HUB6NAME | % in NF | Overall Total | Rank | Quantile |
|---|---|---|---|---|---|
| 140801011601 | Upper Beaver Creek | 100.00 | 23 | 1 | 5 |
| 140801020401 | Martinez Creek-Dutton Creek | 92.69 | 22 | 2 | 5 |
| 140801050105 | Upper Cherry Creek | 45.36 | 21 | 3 | 5 |
| 140801070103 | Upper Mancos Valley | 8.91 | 20 | 4 | 5 |
| 140801020501 | Yellowjacket Creek | 100.00 | 19 | 5 | 5 |
| 140801070105 | East Fork of Mud Creek | 1.96 | 19 | 5 | 5 |
| 140801011602 | Middle Beaver Creek | 96.18 | 19 | 5 | 5 |
| 140801010406 | Lower Rio Blanco-San Juan River | 92.86 | 18 | 6 | 4 |
| 140801010305 | McCabe Creek | 35.76 | 18 | 6 | 4 |
| 140801010405 | Rito Blanco | 100.00 | 18 | 6 | 4 |
| 140801020104 | Piedra River-O'Neal Creek | 100.00 | 18 | 6 | 4 |
| 140801020402 | Upper Stollsteimer Creek | 36.97 | 18 | 6 | 4 |
| 140801011704 | Upper Spring Creek | 44.38 | 18 | 6 | 4 |
| 140300020408 | McPhee Reservoir-Dolores River | 68.18 | 17 | 7 | 4 |
| 140801010306 | Mill Creek | 68.67 | 17 | 7 | 4 |
| 140801011603 | Lower Beaver Creek | 81.73 | 17 | 7 | 4 |
| 140801040603 | Lower Lightner Creek | 14.39 | 16 | 8 | 4 |
| 140801020502 | Piedra River-Stollsteimer | 82.84 | 16 | 8 | 4 |
| 140300020602 | Narraguinnep Canyon Natural Area | 92.42 | 15 | 9 | 4 |
| 140300020304 | Lower Plateau Creek | 48.69 | 15 | 9 | 4 |
| 140801011502 | Bear Creek | 90.88 | 15 | 9 | 4 |
| 140801040901 | Lower Florida River-Ticalotte | 1.18 | 15 | 9 | 4 |
| 140801011703 | Ute Creek | 54.58 | 15 | 9 | 4 |
| 140801020405 | Lower Stollsteimer Creek | 44.02 | 15 | 9 | 4 |
| 140801010602 | Montezuma Creek | 27.72 | 14 | 10 | 3 |
| 140801010307 | Echo Canyon Reservoir | 24.70 | 14 | 10 | 3 |
| 140801010308 | San Juan River-Eightmile Mesa | 63.68 | 14 | 10 | 3 |
| 140801020403 | Stollsteimer Creek-Dyke Valley | 15.73 | 13 | 11 | 3 |
| 140300020303 | Calf Creek | 41.17 | 13 | 11 | 3 |
| 140801011503 | Los Pinos River-Bayfield | 0.85 | 13 | 11 | 3 |
| 140300020504 | Ryman Creek | 75.89 | 11 | 13 | 3 |
| 140300020506 | Brumley Valley | 48.52 | 11 | 13 | 3 |
| 140300020505 | Upper Disappointment Creek | 35.06 | 10 | 14 | 2 |
| 140300036101 | Naturita Creek | 2.63 | 10 | 14 | 2 |
| 140300020302 | Upper Plateau Creek | 2.82 | 8 | 16 | 2 |
| 140300020503 | Sheep Camp Valley | 2.72 | 5 | 19 | 1 |
| 140300020501 | Bear Creek-Disappointment Creek | 0.00 | 4 | 20 | 1 |

**Figure 3-6.** Wetland Cluster 4: cumulative percentile value.

*Cluster 4w Management Considerations:*
Similar to Cluster 3w, Custer 4w contains mostly isolated, smaller wetlands. Mitigation measures could be taken on a project-by-project basis to maintain the integrity of most wetlands. Springs may be abundant in watersheds with calcareous geology. In addition, a few watersheds in this Cluster exhibit a relatively low ranking for cumulative anthropogenic activities, indicating limited management influences. These watersheds may provide a unique opportunity for restoration projects designed to maintain function in these relatively rare systems.

*Wetland Cluster 5w*

The two watersheds in Cluster 5w are typified as having equal proportions of calcareous and non-calcareous geology formed by exclusively non-igneous processes. This Cluster has a majority of its area uninfluenced by Pleistocene glaciation. Hydroclimatic regime is not an identifying characteristic of these watersheds, as fairly equal proportions of rainfall, snowfall and mixed hydroclimatic regimes are found. HUBs in this Cluster occupy intermediate elevation watersheds around the edges of the San Juan Mountains. and include the larger river valleys. Pleistocene glaciers flowing from the high San Juan Mountains reached the lower elevations of these HUBs and at least one valley glacier had its terminus in each HUB. Thus, these are unusual lower elevation landscape that had glaciers in their largest valleys. 65.2% of the total area of Cluster 5w is within the San Juan National Forest (Figure 3-7).

The Upper Animas Valley-Trimble watershed (HUB# 140801040504, value = 18) and the Animas River – Spring Creek (HUB# 140801040604, value = 15) are in Quantile 4. The Upper Animas Valley - Trimble watershed in this Cluster is located almost entirely within the San Juan National Forest (Table 3-10).

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**Table 3-10.** Wetland Cluster 5w: cumulative percentile values, ranks, and quantile designations, Watersheds highlighted in light green are located entirely on-forest.

| HUB6 | HUB6NAME | % in NF | Overall Total | Rank | Quantile |
|---|---|---|---|---|---|
| 140801040504 | Upper Animas Valley-Trimble | 90.46 | 18 | 6 | 4 |
| 140801040604 | Animas River-Spring Creek | 4.15 | 15 | 9 | 4 |
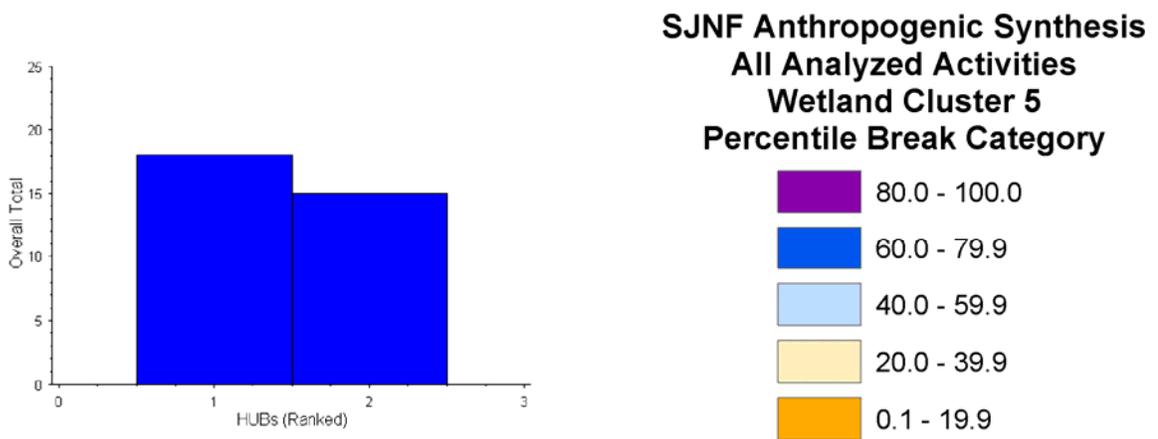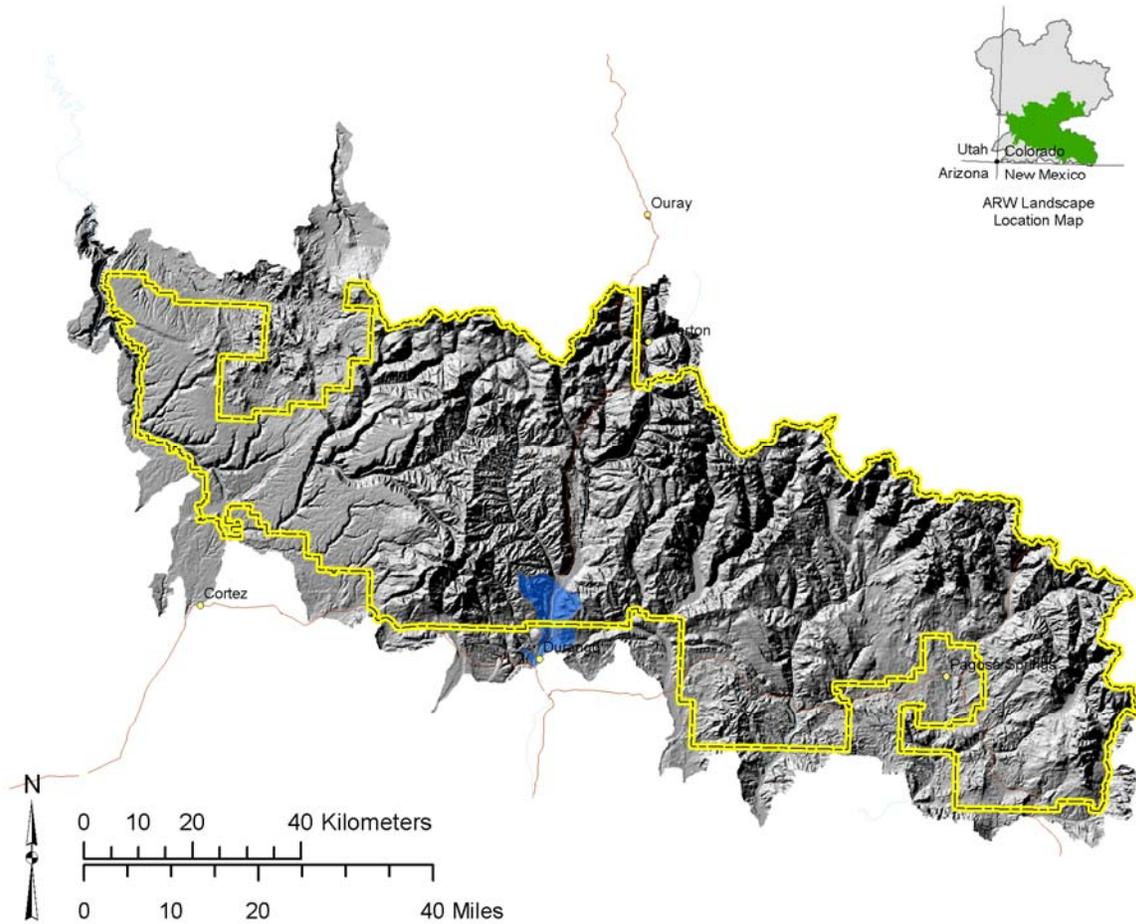
**Figure 3-7.** Wetland Cluster 5: cumulative percentile values.

*Cluster 5w Management Considerations:* The influence of Pleistocene valley glaciers makes this Cluster important for lower elevation wetland systems. As over 90% of the higher impacted watershed is located within the National Forest, mitigation and protection efforts might be necessary for preservation of these relatively rare ecotypes.

*Wetland Cluster 6w*

Cluster 6w contains three watersheds with low proportions of their area located on the SJNF (Table 3-11). These watersheds are typified as having equal proportions of calcareous and non-calcareous geology formed by exclusively non-igneous processes. A small percentage of the Cluster area is modified by Pleistocene glaciation. Hydroclimatic regime for this Cluster is predominately rainfall or mixed precipitation, although the snowfall regime does constitute a small proportion of the total area. HUBs in this Cluster occupy the lowest elevations in the far western portion of the study area. These are the only rain driven HUBs in the study area (Figure 3-8). Wetlands will be relatively uncommon, and consist of small marshes where rain fills basins, irrigated lands, and small springs. Only 1.1% of the total area of Cluster 6w is located within the San Juan National Forest.

*Cluster 6w Management Considerations:* As wetlands are not common in this Cluster, and such a small proportion of the watersheds in this study are located inside of the forest boundary, management for wetland should be viewed on a case-by-case basis.

**Table 3-11.** Wetland Cluster 6w: cumulative percentile values, ranks, and quantile designations, Watersheds highlighted in light green are located entirely on-forest.

| HUB6 | HUB6NAME | % in NF | Overall Total | Rank | Quantile |
|---|---|---|---|---|---|
| 140802020106 | Lower Alkali Canyon-Narraguinnep Canyon | 0.74 | 13 | 11 | 3 |
| 140802020103 | Hartman Canyon | 0.05 | 12 | 12 | 3 |
| 140300020510 | Upper Disappointment Valley | 3.66 | 10 | 14 | 2 |
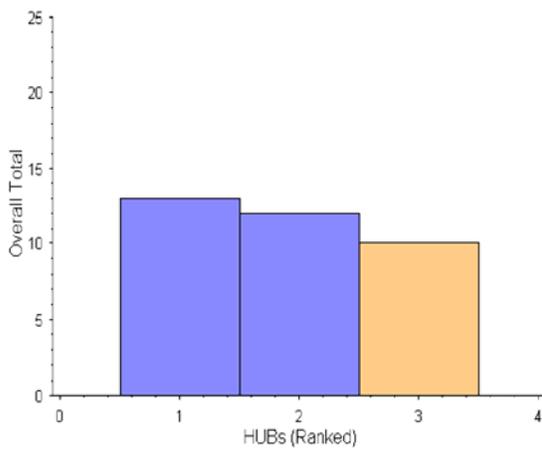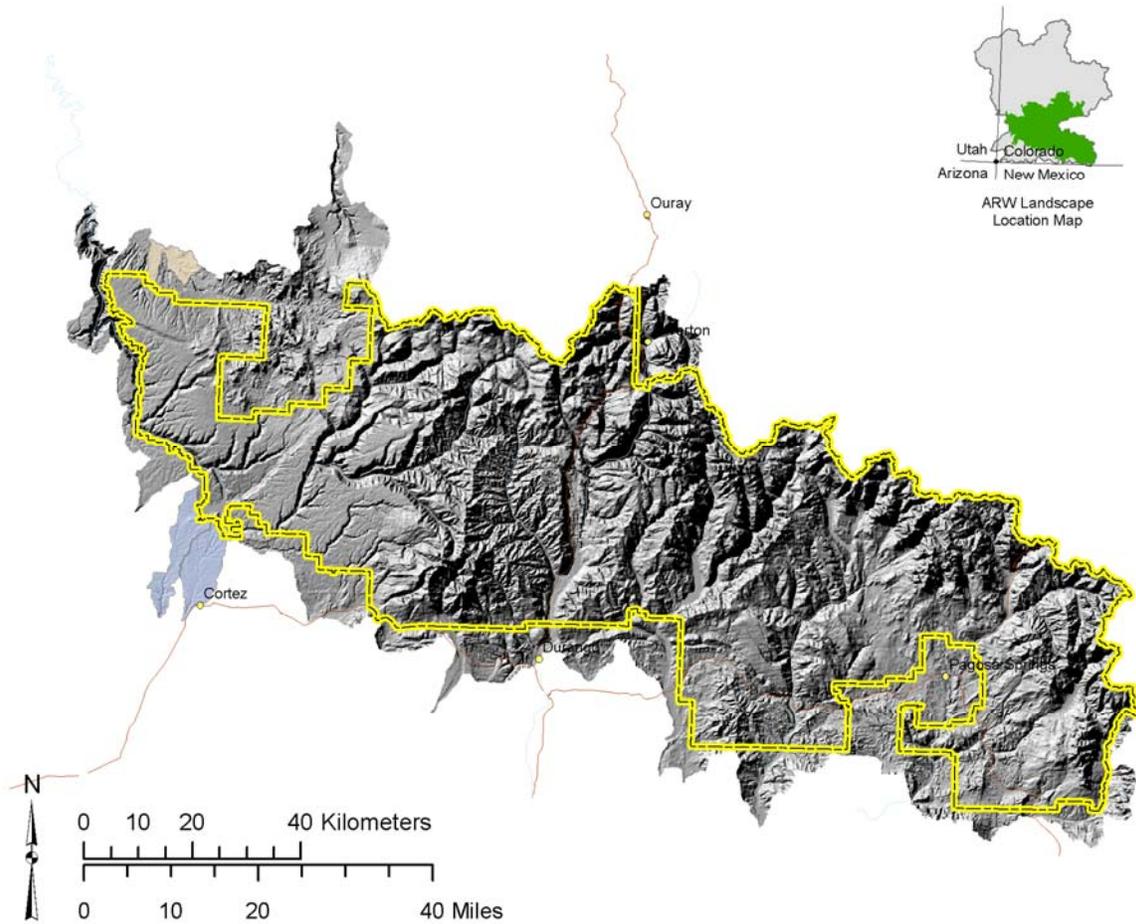
**Figure 3-8.** Wetland Cluster 6: cumulative percentile values.

*Wetland Cluster 7w*

The 14 watersheds in Cluster 7w are typified as having a majority of their area underlain by calcareous geology formed by almost exclusively non-igneous processes. This Cluster has a slight majority of its area modified by Pleistocene glaciation and typically within the snowfall hydroclimatic regime. Relative to the other eight wetland Clusters, Cluster 7w has the lowest potential to be influenced by anthropogenic activities. Of the 14 HUBs comprising Cluster 7w, one is designated as Quartile 5, five are designated as Quartile 4, four are designated as Quartile 3, and the remaining four HUBs are designated as Quartile 2 (table 1.9). 13 watersheds within Cluster 6w are completely contained by the San Juan National Forest. 97.9% of this Cluster is located in the San Juan National Forest (Table 3-12).

Two of the watersheds with the lowest potential for influence from anthropogenic activities within this Cluster, Sand Creek (HUB# 140801010103), and Beaver Creek (HUB# 140891919292) are completely contained in the National Forest. This Cluster is considered to be very suitable for productive wetland systems. This Cluster also contains several watersheds with a high potential for anthropogenic influence, as 6 watersheds are within Quantile 4 or 5 (Figure 3-9).

**Table 3-12.** Wetland Cluster 7w: cumulative percentile values, ranks, and quantile designations.

| HUB6 | HUB6NAME | % in NF | Overall Total | Rank | Quantile |
|---|---|---|---|---|---|
| 140801040502 | Elbert Creek | 100.00 | 21 | 3 | 5 |
| 140801020102 | Middle Fork Piedra River | 100.00 | 18 | 6 | 4 |
| 140801010203 | Wolf Creek | 100.00 | 17 | 7 | 4 |
| 140801010204 | Lower West Fork San Juan River | 100.00 | 16 | 8 | 4 |
| 140801020101 | East Fork Piedra River | 100.00 | 15 | 9 | 4 |
| 140801040802 | Upper Florida River-Transfer Park | 100.00 | 15 | 9 | 4 |
| 140801010101 | Headwaters East Fork San Juan River | 100.00 | 13 | 11 | 3 |
| 140801010102 | Quartz Creek | 100.00 | 12 | 12 | 3 |
| 140801010104 | East Fork San Juan River-The Clamshell | 100.00 | 12 | 12 | 3 |
| 140801010402 | Fish Creek | 100.00 | 12 | 12 | 3 |
| 140801010401 | Rio Blanco Headwaters | 100.00 | 10 | 14 | 2 |
| 140801010103 | Sand Creek | 100.00 | 8 | 16 | 2 |
| 140801010202 | Beaver Creek | 100.00 | 8 | 16 | 2 |
| 140801010502 | West Fork Navajo River | 78.22 | 8 | 16 | 2 |

**Figure 3-9.** Wetland Cluster 7: cumulative percentile values.

*Cluster 7w Management Considerations:*
Cluster 7w provides unique opportunity for the management of wetland ecosystems. Of the 14 watersheds within the Cluster, 13 are located entirely within the San Juan National Forest. As this Cluster is considered to have a high potential for wetland productivity, this may be an ideal Cluster to focus management strategies. The watersheds with the highest potential for anthropogenic influence may be good candidates for mitigation efforts, while those with lower potential for anthropogenic influence may provide ideal reference areas or restoration sites.

*Wetland Cluster 8w*

The 18 watersheds in Cluster 8w are typified as having a lower majority of their area underlain by calcareous geology formed by mainly non-igneous processes. This Cluster has a significant majority of its area modified by Pleistocene glaciation. This Cluster is typically within the snowfall hydroclimatic regime. 13 watersheds within Cluster 6w are completely contained by the San Juan National Forest (Table 3-13). 81.4% of the area of this Cluster is within the San Juan National Forest.

Cluster 8w contains the largest proportion of watersheds with moderate to low potential for anthropogenic influence (Figure 3-10). It contains one of the watersheds with the lowest potential for influence from anthropogenic activities: Animas River above Howardsville (HUB # 140801040101). 7 watersheds are within Quantile 2 and 2 watersheds are in Quantile 1.

**Table 3-13.** Wetland Cluster 8w: cumulative percentile values, ranks, and quantile designations, Watersheds highlighted in light green are located entirely on-forest.

| HUB6 | HUB6NAME | % in NF | Overall Total | Rank | Quantile |
|---|---|---|---|---|---|
| 140801040303 | Lower Cascade Creek | 100.00 | 19 | 5 | 5 |
| 140801040103 | Mineral Creek | 97.02 | 17 | 7 | 4 |
| 140801040301 | Upper Cascade Creek | 100.00 | 14 | 10 | 3 |
| 140801040302 | Lime Creek | 100.00 | 14 | 10 | 3 |
| 140801040104 | Animas River-Cunningham Creek | 11.64 | 13 | 11 | 3 |
| 140801040202 | Animas River-Tenmile Creek | 96.73 | 13 | 11 | 3 |
| 140801011301 | Upper Los Pinos River-Ricon La Vaca | 100.00 | 12 | 12 | 3 |
| 140801040204 | Animas River-Needleton | 100.00 | 12 | 12 | 3 |
| 140801050101 | La Plata River headwaters | 100.00 | 11 | 13 | 3 |
| 140801010201 | Upper West Fork San Juan River | 100.00 | 9 | 15 | 2 |
| 140801040201 | Elk Creek | 100.00 | 9 | 15 | 2 |
| 140801011303 | Lake Creek | 100.00 | 8 | 16 | 2 |
| 140801011402 | Middle Vallecito Creek | 100.00 | 8 | 16 | 2 |
| 140801040102 | Cement Creek | 12.31 | 8 | 16 | 2 |
| 140801011302 | Upper Los Pinos River-Flint Creek | 100.00 | 7 | 17 | 2 |
| 140801011401 | Upper Vallecito Creek | 100.00 | 7 | 17 | 2 |
| 140801020201 | Upper Weminuche Creek | 100.00 | 6 | 18 | 1 |
| 140801040101 | Animas River above Howardsville | 0.00 | 5 | 19 | 1 |
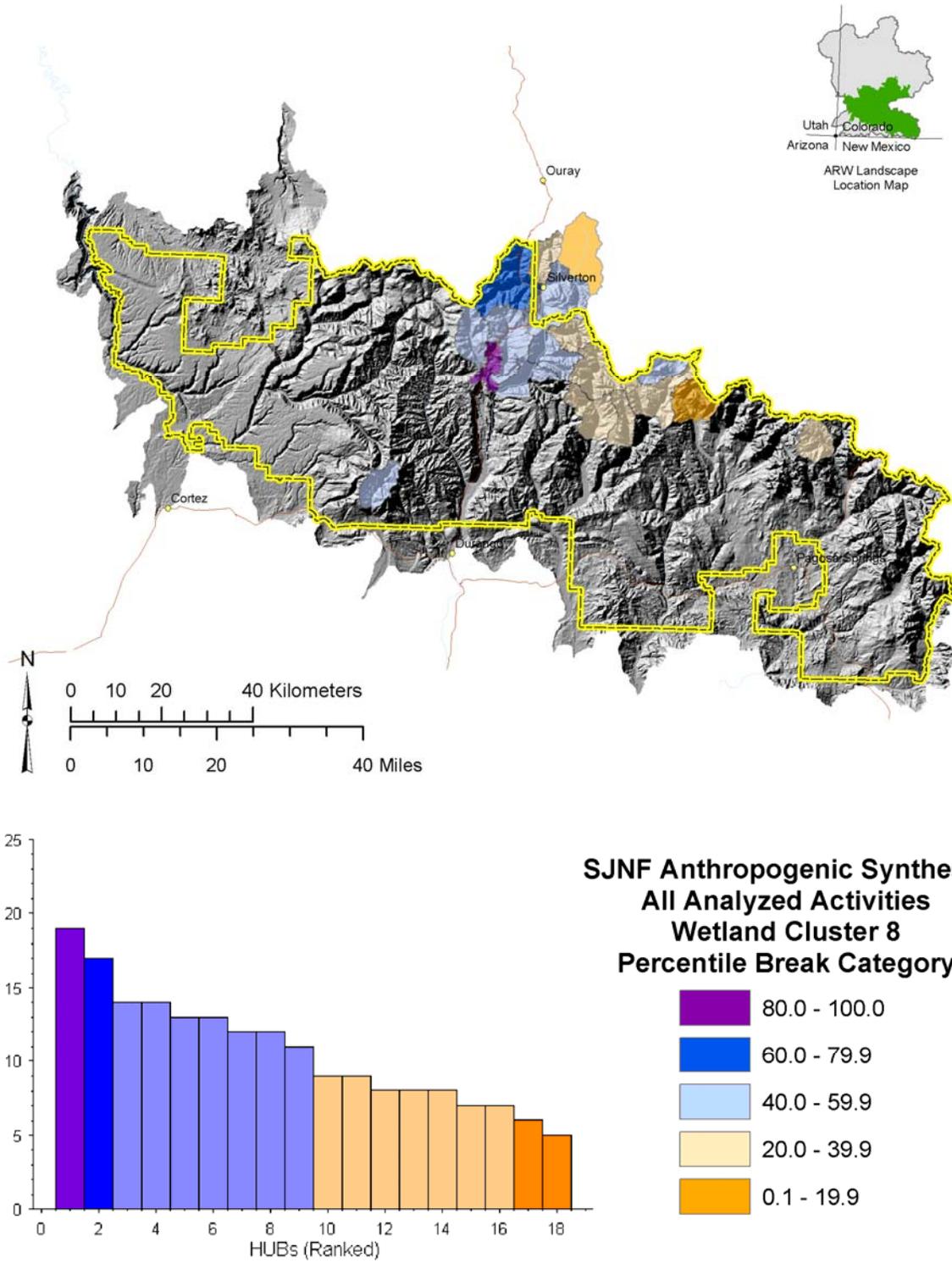
**Figure 3-10.** Wetland Cluster 8: cumulative percentile values.

*Cluster 8w Management Considerations:* The physiographic characteristics of Cluster 8w combine to create a setting productive for the establishment and propagation of wetland ecosystems. Rare wetland types, including iron fens, are present in this Cluster. As this Cluster also has the least potential for influence from anthropogenic activities, watersheds in this Cluster should be made a priority for the management of wetland ecosystems. Mitigation strategies for highly impacted wetlands in this watershed should be applied. Wetlands with little or no anthropogenic influence should be considered for reference areas or restoration efforts.

*Wetland Cluster 9w*
The three watersheds in Cluster 9w have a fairly even distribution of calcareous and non-calcareous geology formed by mainly igneous processes. This Cluster has a significant majority of its area modified by Pleistocene glaciation, and is typified as being a part of the snowfall-driven hydroclimatic regime. All three watersheds in Cluster 9w are within the San Juan National Forest (Table 3-14).

All watersheds in Cluster 9w have a relatively low potential for anthropogenic influence (Figure 3-11). It contains one of the watersheds with the lowest potential for influence from anthropogenic activities.

**Table 3-14.** Wetland Cluster 9w: cumulative percentile values, ranks, and quantile designations, Watersheds highlighted in light green are located entirely on-forest.

| HUB6 | HUB6NAME | % in NF | Overall Total | Rank | Quantile |
|---|---|---|---|---|---|
| 140801011304 | Three Sisters | 100.00 | 7 | 17 | 2 |
| 140801040203 | Needle Creek | 100.00 | 7 | 17 | 2 |
| 140801040801 | Florida River Headwaters | 100.00 | 6 | 18 | 1 |
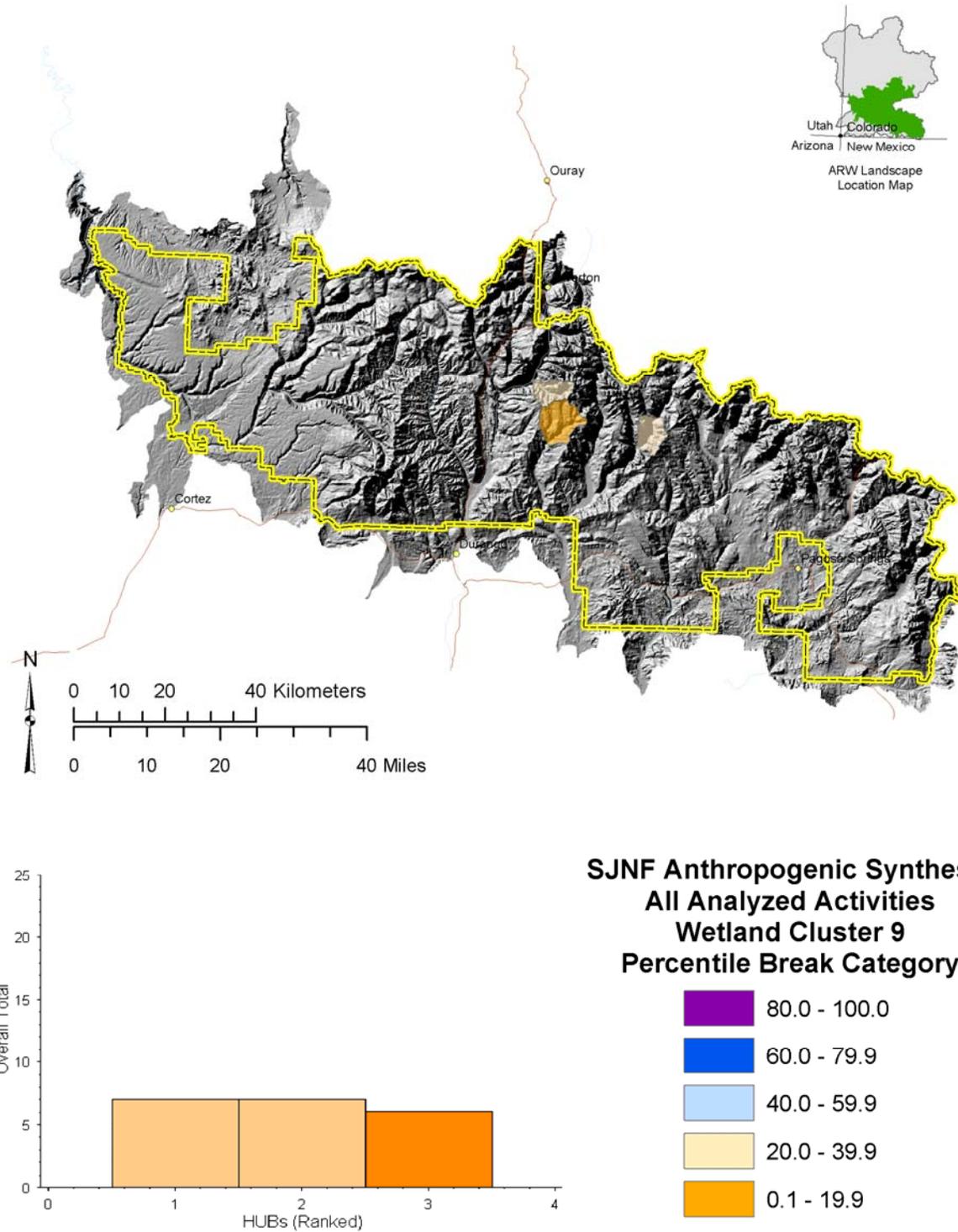
**Figure 3-11.** Wetland Cluster 9: cumulative percentile values.

*Cluster 9wManagement Considerations:* Similar to Cluster 7w, the physiographic characteristics of Cluster 9w combine to create a setting productive for the establishment and propagation of wetland ecosystems. Rare wetland types, are present in this Cluster. As this Cluster also has the least potential for influence from anthropogenic activities, watersheds in this Cluster should be made a priority for the proactive management of wetland ecosystems. Mitigation strategies for highly impacted wetlands in this watershed could be identified. Wetlands with little or no anthropogenic influence should be considered for reference areas or restoration.

Riparian Ecological Driver Clusters

The aggregate cluster analysis of the ecological drivers for riparian ecosystems at the management scale identified eight unique clusters (Winters et al. 2006a). Each of these clusters has a distinct signature represented by spatial variations in geology (calcareous and non-calcareous lithology), rock type, (igneous or non-igneous), climate (precipitation type) and presence or absence of Pleistocene glaciation, and low, medium or high stream gradient (Table 3-15). The ecological context of each driver combination will influence channel morphology, species diversity, and aquatic productivity. Table 1.2 Table 3-16 summarizes the distribution of watersheds within each watershed cluster.

**Table 3-15.** Ecological driver results for riparian clusters.

| Riparian Cluster | Ca | Cn | Ri | Ro | Pr | Prs | Ps | Low Stream Gradient | Medium Stream Gradient | High Stream Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| Cluster 1r | **76.58** | 23.42 | 6.43 | **93.57** | 0.02 | 11.60 | **88.38** | 3.41 | 7.34 | **89.25** |
| Cluster 2r | 35.67 | **64.33** | 6.99 | **93.01** | 0.23 | 17.15 | **82.62** | 4.68 | 9.01 | **86.32** |
| Cluster 3r | 1.05 | **98.95** | 0.98 | **99.02** | 0.00 | 0.00 | **100.00** | 1.64 | 7.44 | **90.92** |
| Cluster 4r | 16.22 | **83.78** | 0.21 | **99.79** | 16.25 | **78.20** | 5.54 | 12.66 | 32.17 | **55.18** |
| Cluster 5r | **52.85** | 47.15 | 0.67 | **99.33** | 6.85 | **71.64** | 21.51 | 12.87 | 20.16 | **66.97** |
| Cluster 6r | 31.61 | **68.39** | 0.10 | **99.90** | 66.58 | **31.94** | 1.48 | 16.81 | 22.08 | **61.11** |
| Cluster 7r | 13.22 | **86.78** | 5.94 | **94.06** | 0.00 | **73.38** | 26.62 | 4.52 | **68.48** | 27.01 |
| Cluster 8r | 3.25 | **96.75** | **89.65** | 10.35 | 0.00 | 2.14 | **97.86** | 4.17 | 4.13 | **91.70** |
| | | | | | | | | | | |
| | | | **Ca:** Calcareous | | **Prs:** Rain and Snow Hydroclimatic regime | | | | | |
| | | | **Cn:** Non-Calcareous | | **Ps:** Snowfall Hydroclimatic regime | | | | | |
| | | | **Ri:** Igneous Rocktype | | **Pr:** Rainfall Hydroclimatic regime | | | | | |
| | | | **Ro:** Non-Igneous Rocktype | | **Low:** Low Gradient ( > 2.0) | | | | | |
| | | | | | **Medium:** Medium Gradient (2.0 - 4.0) | | | | | |
| | | | | | **High:** High Gradient ( > 4.0) | | | | | |

**Table 3-16.** Ecological driver results for riparian clusters.

| Cluster | % of Cluster in NF | # of Watersheds | # of HUBs Completely within NF |
|---------|--------------------|-----------------|--------------------------------|
| 1r | 98.09 | 15 | 14 |
| 2r | 91.03 | 50 | 39 |
| 3r | 55.31 | 2 | 1 |
| 4r | 60.29 | 30 | 6 |
| 5r | 60.00 | 39 | 12 |
| 6r | 36.95 | 14 | 0 |
| 7r | 33.21 | 1 | 0 |
| 8r | 100.00 | 3 | 3 |

*Riparian Cluster 1r*

The 15 6th level HUBs in cluster 1r are characterized by high elevation, snowfall driven hydroclimatic regimes. The predominately high gradient streams are underlain by calcareous geology formed by non-igneous processes.

Riparian Cluster 1r is comprised of 5 6th level HUBs in Quantile 4 of the cumulative percentile values, four watersheds were found to be in Quantile 3, four watersheds in Quantile 2, and two watersheds in Quantile 1. In addition, 98.1% of the total area of Riparian Cluster 1r is located within the boundary of the San Juan National Forest. This equates to all but one of the watersheds being located entirely on-forest (Table 3-17). Wolf Creek (HUB# 140801010203) has the greatest potential to be influenced by anthropogenic activities with an overall total of 17 out of a possible maximum of 30. This HUB, which is located entirely on-forest, indicates high use

and high potential for influences on riparian resources, relative to all other watersheds.

The distribution of quantile within cluster 1r was mapped (Figure 3-12). Within Cluster 1r, the Upper Weminuche Creek (HUB# 140801020201) and Hermosa Creek - Dutch Creek (HUB# 140801040406) watersheds had the lowest potential to be influenced by anthropogenic activities and could possibly function as a reference area for comparison with the other watersheds within this cluster. The relatively high numbers of Hubs within this cluster as well as the variety anthropogenic activities would indicate that a monitoring strateguy could be developed to understand the influences of various cumulative influences on this ecological type (cluster)

**Table 3-17.** Riparian Cluster 1r: cumulative percentile values, ranks, and quantile designations, Watersheds highlighted in light green are located entirely on-forest.

| HUB6 | HUB6NAME | % in NF | Overall Total | Rank | Quantile |
|---|---|---|---|---|---|
| 140801010203 | Wolf Creek | 100.00 | 17 | 7 | 4 |
| 140801011403 | Lower Vallecito Creek | 100.00 | 16 | 8 | 4 |
| 140801040501 | Upper Animas Valley-Canyon Creek | 100.00 | 16 | 8 | 4 |
| 140801020101 | East Fork Piedra River | 100.00 | 15 | 9 | 4 |
| 140801040802 | Upper Florida River-Transfer Park | 100.00 | 15 | 9 | 4 |
| 140801010101 | Headwaters East Fork San Juan River | 100.00 | 13 | 11 | 3 |
| 140801010102 | Quartz Creek | 100.00 | 12 | 12 | 3 |
| 140801010104 | East Fork San Juan River-The Clamshell | 100.00 | 12 | 12 | 3 |
| 140801010402 | Fish Creek | 100.00 | 12 | 12 | 3 |
| 140801010401 | Rio Blanco Headwaters | 100.00 | 10 | 14 | 2 |
| 140801010103 | Sand Creek | 100.00 | 8 | 16 | 2 |
| 140801010202 | Beaver Creek | 100.00 | 8 | 16 | 2 |
| 140801010502 | West Fork Navajo River | 78.22 | 8 | 16 | 2 |
| 140801020201 | Upper Weminuche Creek | 100.00 | 6 | 18 | 1 |
| 140801040406 | Hermosa Creek-Dutch Creek | 100.00 | 6 | 18 | 1 |
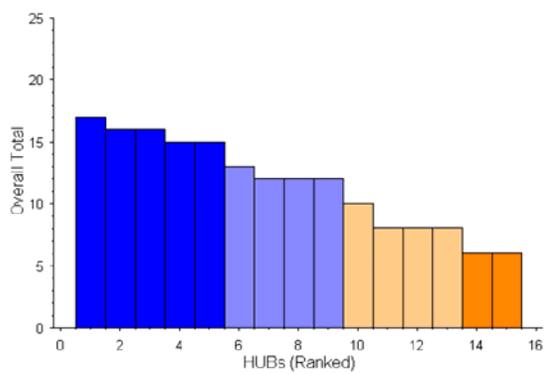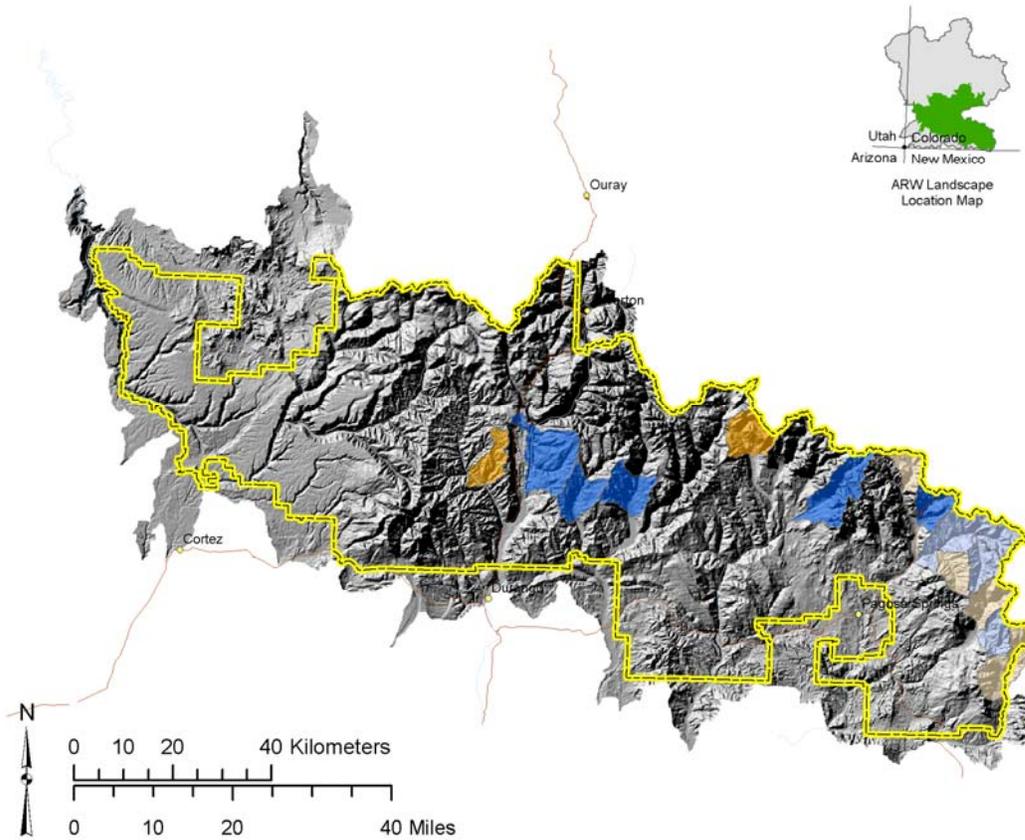
**Figure 3-12.** Riparian Cluster 1: cumulative percentile values.

*Riparian Cluster 1r Management Considerations:* Riparian and aquatic systems in Cluster 1r are sensitive to alterations in sediment and thermal regimes. Several watersheds in this cluster are in the moderate to high potential for influence by anthropogenic activities. The high elevation and relative low potential productivity make these watersheds less responsive to mitigation and restoration than watersheds that are considered to be more conducive to the establishment and propagation of riparian and aquatic systems. Given the abundance of high and moderate gradient reaches in Cluster 1r, the importance of low gradient reaches for riparian vegetation and aquatic plants and animals is magnified. The watershed in this cluster that has the highest potential for anthropogenic influence is Wolf Creek, which is dominated by mineral, vegetation management and transportation related activities. These activities are very likely to produce sediment that would influence the productivity of the relatively rare low gradient stream reaches. Management efforts could be recommended for low gradient reaches with a high potential for anthropogenic influences. In addition, quantifying cumulative influences through monitoring of "key" site/reach characteristics could identify specific management needs.

*Riparian Cluster 2r*

There are 50 HUBs found in riparian cluster 2r with 39 of these HUBs located completely within the boundaries of the San Juan National Forest (Table 3-18). 91% of the watershed area, found within riparian Cluster 2r, is located on the Forest. This cluster has the highest total number of watersheds compared to the other seven riparian clusters. Watersheds in cluster 2r are located across the Forest except for the far-western portion (Figure 3-13).

The watersheds in cluster 2r are characterized by a high elevation snowfall driven hydroclimatic regime. The largely high and moderate gradient streams are underlain by rock units derived from mainly non-igneous formative processes. While calcareous bedrock is not dominating in this cluster, it is prevalent to the point that $6^{th}$ level HUB productivity could be influenced considerably.

Riparian cluster 2r has four watersheds in Quantile 5; there are 13 watersheds in Quantile 4. 22 watersheds are in the $3^{rd}$ quantile, ten watersheds in the $2^{nd}$ quantile and one watershed in Quantile 1. Overall total values for Cluster 2r range from 21 (Fourmile Creek HUB# 140801010302) to a total overall low score of seven for Animas River above Howardsville (HUB# 140801040101), which is located entirely outside the forest boundary.

Fourmile Creek (HUB# 140801010302) has the greatest potential to be influenced by anthropogenic activities with a total overall score of 21. It has both the potential for on and off-forest influences as almost all the watershed is located on-forest, with the southern end of the watershed located off-forest. The high total overall score implies high use and a high potential for anthropogenic activities to influence riparian health.

**Table 3-18.** Riparian Cluster 2r: cumulative percentile values, ranks, and quantile designations, Watersheds highlighted in light green are located entirely on-forest.

| HUB6 | HUB6NAME | % in NF | Overall Total | Rank | Quantile |
|---|---|---|---|---|---|
| 140801010302 | Fourmile Creek | 95.49 | 21 | 3 | 5 |
| 140300020401 | Upper Lost Canyon | 100.00 | 20 | 4 | 5 |
| 140801040303 | Lower Cascade Creek | 100.00 | 19 | 5 | 5 |
| 140801070102 | West Mancos River | 86.97 | 19 | 5 | 5 |
| 140801020102 | Middle Fork Piedra River | 100.00 | 18 | 6 | 4 |
| 140801070101 | East Mancos River-Middle Mancos River | 99.32 | 18 | 6 | 4 |
| 140300020202 | Upper Dolores River-Cayton Valley | 100.00 | 17 | 7 | 4 |
| 140300020207 | Dolores River-Priest Gulch | 100.00 | 17 | 7 | 4 |
| 140801040103 | Mineral Creek | 97.02 | 17 | 7 | 4 |
| 140300020204 | Upper Dolores River-Scotch Creek | 100.00 | 16 | 8 | 4 |
| 140300020208 | Stoner Creek | 100.00 | 16 | 8 | 4 |
| 140801010204 | Lower West Fork San Juan River | 100.00 | 16 | 8 | 4 |
| 140801010506 | Little Navajo River | 94.95 | 16 | 8 | 4 |
| 140801020103 | Williams Creek | 100.00 | 16 | 8 | 4 |
| 140300020103 | Upper West Dolores River | 100.00 | 15 | 9 | 4 |
| 140801011306 | East Creek | 100.00 | 15 | 9 | 4 |
| 140801040601 | Junction Creek | 78.54 | 15 | 9 | 4 |
| 140801010403 | Rio Blanco River-Blanco Basin | 100.00 | 14 | 10 | 3 |
| 140801011305 | Indian Creek | 100.00 | 14 | 10 | 3 |
| 140801020202 | Lower Weminuche Creek | 100.00 | 14 | 10 | 3 |
| 140801040301 | Upper Cascade Creek | 100.00 | 14 | 10 | 3 |
| 140801040302 | Lime Creek | 100.00 | 14 | 10 | 3 |
| 140801040402 | East Fork Hermosa Creek | 100.00 | 14 | 10 | 3 |
| 140801040803 | Lemon Reservoir | 100.00 | 14 | 10 | 3 |
| 140300020203 | Rico Valley | 100.00 | 13 | 11 | 3 |
| 140801010503 | Navajo Peak | 25.28 | 13 | 11 | 3 |
| 140801040104 | Animas River-Cunningham Creek | 11.64 | 13 | 11 | 3 |
| 140801040202 | Animas River-Tenmile Creek | 96.73 | 13 | 11 | 3 |
| 140300020102 | Fish Creek | 100.00 | 12 | 12 | 3 |
| 140300020201 | Dolores River Headwaters-Tin Can Basin | 100.00 | 12 | 12 | 3 |
| 140300020206 | Bear Creek | 100.00 | 12 | 12 | 3 |
| 140801010301 | Turkey Creek | 100.00 | 12 | 12 | 3 |
| 140801011301 | Upper Los Pinos River-Ricon La Vaca | 100.00 | 12 | 12 | 3 |
| 140801020204 | First Fork | 100.00 | 12 | 12 | 3 |
| 140801040204 | Animas River-Needleton | 100.00 | 12 | 12 | 3 |
| 140801040403 | Upper Hermosa Creek | 100.00 | 12 | 12 | 3 |
| 140300020205 | Roaring Forks Creek | 100.00 | 11 | 13 | 3 |
| 140801040401 | Hermosa Creek headwaters | 100.00 | 11 | 13 | 3 |
| 140801050101 | La Plata River headwaters | 100.00 | 11 | 13 | 3 |
| 140300020101 | El Deinte Peak | 100.00 | 10 | 14 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| 140300020104 | Groundhog Creek | 33.90 | 10 | 14 | 2 |
| 140801020203 | Sand Creek | 100.00 | 10 | 14 | 2 |
| 140801010201 | Upper West Fork San Juan River | 100.00 | 9 | 15 | 2 |
| 140801040405 | South Fork Hermosa Creek | 100.00 | 9 | 15 | 2 |
| 140801011303 | Lake Creek | 100.00 | 8 | 16 | 2 |
| 140801011402 | Middle Vallecito Creek | 100.00 | 8 | 16 | 2 |
| 140801040404 | Middle Hermosa Creek | 100.00 | 8 | 16 | 2 |
| 140801011302 | Upper Los Pinos River-Flint Creek | 100.00 | 7 | 17 | 2 |
| 140801011401 | Upper Vallecito Creek | 100.00 | 7 | 17 | 2 |
| 140801040101 | Animas River above Howardsville | 0.00 | 5 | 19 | 1 |
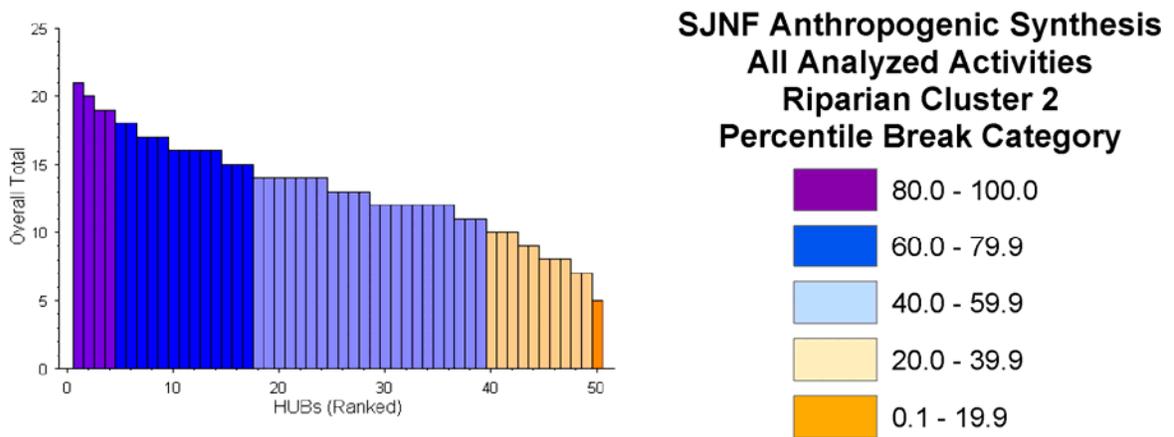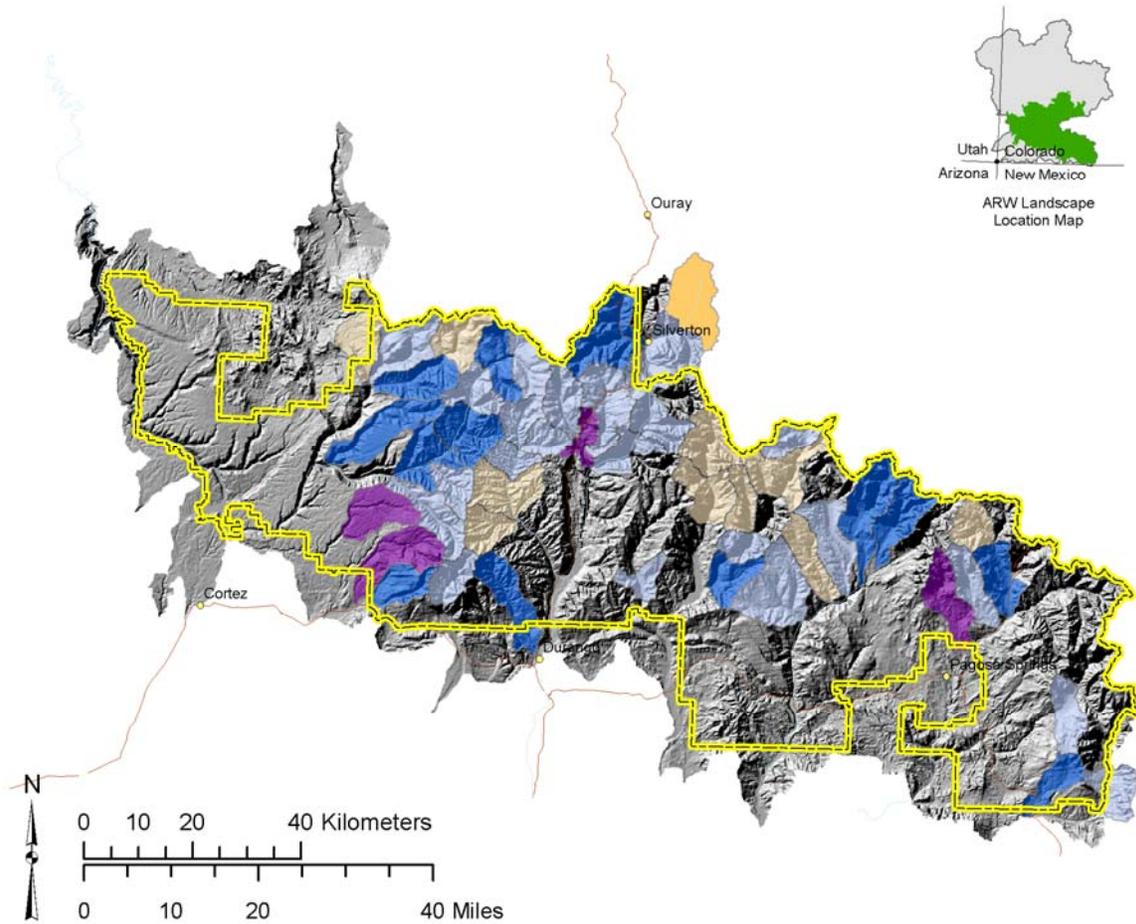
**Figure 3-13.** Riparian Cluster 2: cumulative percentile values.

*Riparian Cluster 2r Management Considerations:*

Similar to Cluster 1r, Cluster 2r has relatively few low gradient reaches, which are important habitats for terrestrial animals and plants. The dominance of high gradient streams results in a high sensitivity to anthropogenic activities which increase sediment load. Anthropogenic activities which alter the sediment load, local base level, or subsurface hydrology may dramatically alter the extent of riparian vegetation within watersheds in Cluster 2r. Most of the watersheds in this cluster are considered to have a moderate to high potential for anthropogenic influences. Transportation, vegetation management and recreation activities contribute to the high potential for anthropogenic influence in this cluster. As many of the watersheds in this cluster are completely within the San Juan National Forest, watershed management strategies implemented at the watershed level may be quite effective. Riparian vegetation is particularly important in this cluster.

*Riparian Cluster 3r*

Cluster 3r has only two watersheds and only one of these is located entirely on-forest (Table 1.20). These two watersheds are located along the north-central forest border, near Silverton (Figure Riparian Cluster 3r).

The 2 watersheds in Cluster 3r are entirely within the snowfall driven hydroclimatic regime. The predominately high gradient streams in this cluster are nearly entirely underlain by non-calcareous lithology of a non-igneous origin. 55.3% of the clusters' area falls within the Forest. Both clusters are located in Quantile 2, indicating limited activity. Elk Creek (HUB# 140801040201) has the lowest overall total with a score of nine, while Cement Creek (HUB# 140801040102) has an overall score of 10. Elk Creek watershed is located within the Weminuche Wilderness, limiting further influences. Foot trails, and vegetation management (fire) are the 2 main influences. In Cement Creek the dominant anthropogenic influence is related to mineral development.

**Table 3-19.** Table Riparian Cluster 3r: cumulative percentile values, ranks, and quantile designations, Watersheds highlighted in light green are located entirely on-forest.

| HUB6 | HUB6NAME | % in NF | Overall Total | Rank | Quantile |
|---|---|---|---|---|---|
| 140801040201 | Elk Creek | 100.00 | 9 | 15 | 2 |
| 140801040102 | Cement Creek | 12.31 | 8 | 16 | 2 |
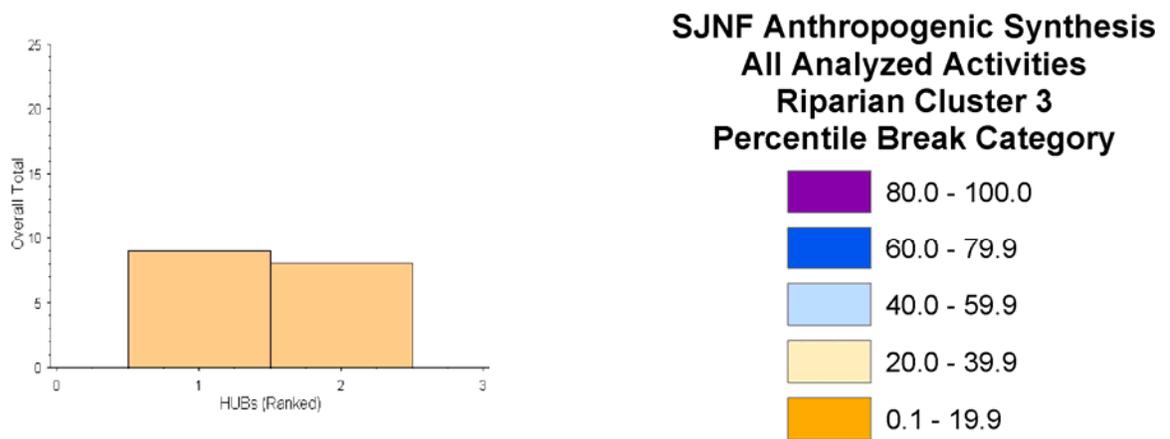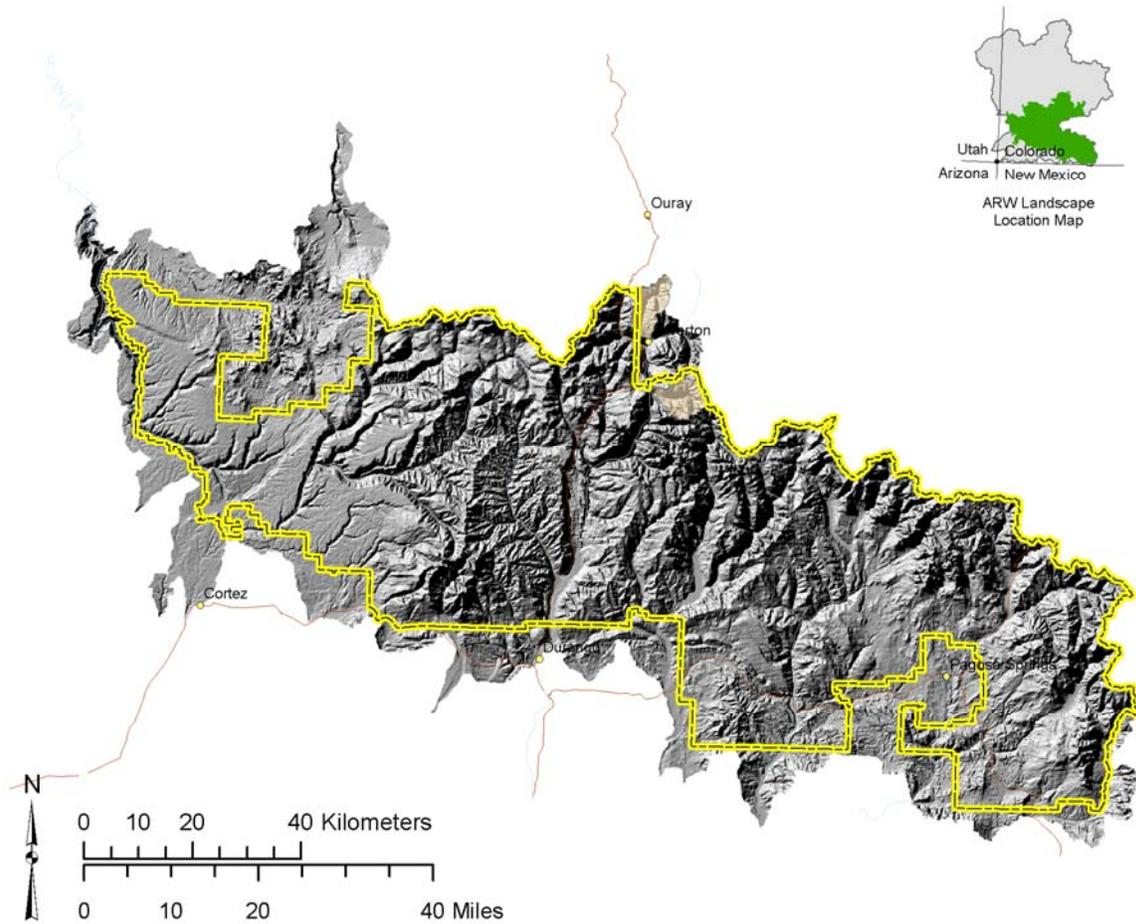
**Figure 3-14.** Riparian Cluster 3: cumulative percentile values.

*Riparian Cluster 3r Management Considerations:*

The prevalence of high gradient, non-calcareous streams in this cluster reduces the overall productivity of aquatic systems. However, the relatively few low gradient reaches are sensitive to an increase in the amount of fine material flushed downstream.

As these watersheds have a moderate potential influence from anthropogenic activities, more information should be gathered regarding the relative abundance and productivity of aquatic and riparian systems in Cluster 3r.

*Riparian Cluster 4r*

A total of 30 watersheds are found within riparian Cluster 4r, with six of the watersheds located entirely on-forest (Table 3-20). The watersheds are found across the Forest and are concentrated along the southern boundary for the Forest (Figure 3-15). The 30 watersheds in Cluster 4r are driven by a predominately mixed precipitation hydroclimatic regime. The largely high gradient streams in this cluster are typically underlain by non-calcareous lithology of a non-igneous origin. 60.3% of the cluster's area is located on-forest.

Within riparian Cluster 4r Quantile 5 contains ten watersheds; Quantile 4 contains 14 watersheds which were the most of any of the quantiles. Quantile 3 has five watersheds while Quantile 2 has one watershed. There are no watersheds ranked within Quantile 1. Overall total scores within riparian Cluster 4r range from a high of 23 to a low of 9. The maximum possible overall total is 30. Chicken Creek (HUB# 140801070104) has the highest overall total score of 23 and has 70.6% of its area within the Forest. Upper Cat Creek (HUB# 140801010604) has the lowest overall total score of 9, but only has 0.6% of its area within the Forest boundary.

This cluster is highly influenced by anthropogenic activities of several different types. It would appear that the location of these HUB's near the Forest boundary has some influence on the amount of activity, possibly through high accessibility. Due to high overall scores and the lack of watershed area within forest boundaries there isn't a watershed that would function as a good reference watershed for riparian Cluster 4r. Upper Yellowjacket Canyon and Upper Cat Creek (HUB# 140801010604) have the lowest overall scores of 12 and 8, respectively; they both have less than 1% of their area located on-forest. Spruce Water Canyon (HUB# 140300020402), has 100% of its area located on-forest, but has an overall score of 16.

**Table 3-20.** Riparian Cluster 4r: cumulative percentile values, ranks, and quantile designations, Watersheds highlighted in light green are located entirely on-forest.

| HUB6 | HUB6NAME | % in NF | Overall Total | Rank | Quantile |
|---|---|---|---|---|---|
| 140801070104 | Chicken Creek | 70.63 | 23 | 1 | 5 |
| 140300020305 | Beaver Creek-Trail Canyon | 100.00 | 19 | 5 | 5 |
| 140300020404 | Stapleton Valley | 100.00 | 19 | 5 | 5 |
| 140300020407 | House Creek | 97.42 | 19 | 5 | 5 |
| 140300020604 | Dolores Canyon-Lake Canyon | 65.03 | 19 | 5 | 5 |
| 140801010304 | Upper Pagosa Springs | 61.92 | 19 | 5 | 5 |
| 140801010504 | Navajo River-Weisel Flat | 31.52 | 19 | 5 | 5 |
| 140801010507 | Coyote Creek | 67.85 | 19 | 5 | 5 |
| 140801020501 | Yellowjacket Creek | 100.00 | 19 | 5 | 5 |
| 140801070105 | East Fork of Mud Creek | 1.96 | 19 | 5 | 5 |
| 140300020403 | Middle Lost Canyon | 86.71 | 18 | 6 | 4 |
| 140300020406 | Upper Dolores River-Italian Creek | 66.13 | 18 | 6 | 4 |
| 140801010406 | Lower Rio Blanco-San Juan River | 92.86 | 18 | 6 | 4 |
| 140300020408 | McPhee Reservoir-Dolores River | 68.18 | 17 | 7 | 4 |
| 140300020601 | Dolores River-Salter Canyon | 95.95 | 17 | 7 | 4 |
| 140801010306 | Mill Creek | 68.67 | 17 | 7 | 4 |
| 140801010404 | Middle Rio Blanco | 100.00 | 17 | 7 | 4 |
| 140300020306 | McPhee Reservoir-Beaver Creek Inlet | 100.00 | 16 | 8 | 4 |
| 140300020402 | Spruce Water Canyon | 100.00 | 16 | 8 | 4 |
| 140300020603 | Dolores Canyon-Cabin Creek | 54.33 | 16 | 8 | 4 |
| 140801040603 | Lower Lightner Creek | 14.39 | 16 | 8 | 4 |
| 140300020507 | Dawson Draw | 64.82 | 15 | 9 | 4 |
| 140300020509 | Pine Arroyo | 79.65 | 15 | 9 | 4 |
| 140300020602 | Narraguinnep Canyon Natural Area | 92.42 | 15 | 9 | 4 |
| 140801010602 | Montezuma Creek | 27.72 | 14 | 10 | 3 |
| 140300020605 | Dolores Canyon-Joe Davis Hill | 6.79 | 13 | 11 | 3 |
| 140801020403 | Stollsteimer Creek-Dyke Valley | 15.73 | 13 | 11 | 3 |
| 140300020405 | Lower Lost Canyon | 2.08 | 12 | 12 | 3 |
| 140802020201 | Upper Yellowjacket Canyon | 0.71 | 12 | 12 | 3 |
| 140801010604 | Upper Cat Creek | 0.56 | 9 | 15 | 2 |
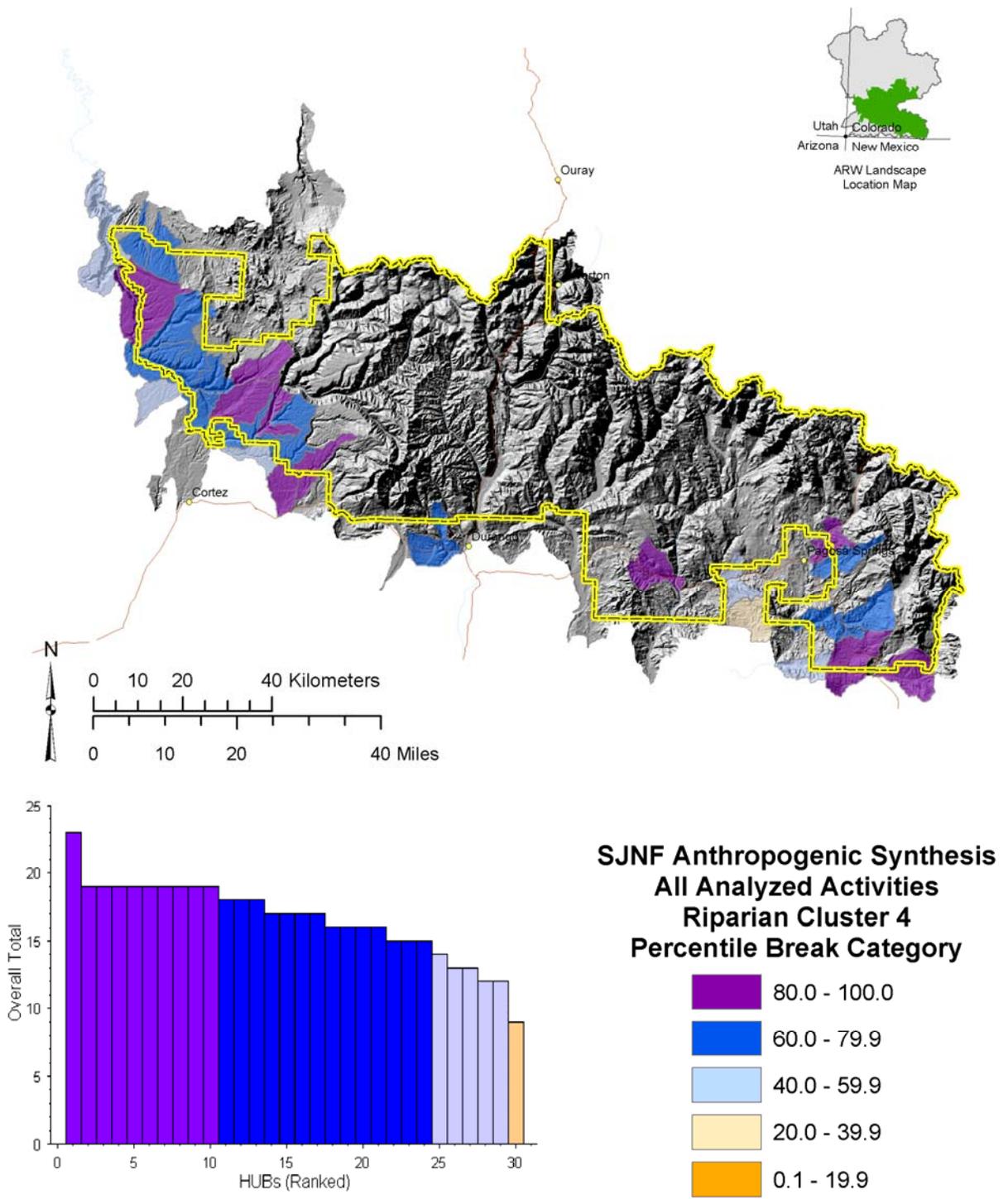
**Figure 3-15.** Riparian Cluster 4: cumulative percentile values.

*Riparian Cluster 4r Management Considerations:*

Cluster 4r is characterized by a majority of watersheds in the moderate to high potential categories for influence from anthropogenic activities. Anthropogenic disturbances that increase sediment production would be detrimental to fish populations and riparian communities in low gradient reaches throughout much of this cluster. In addition, ground disturbing activities appear to be prevalent throughout this cluster. As transportation, vegetation management and mineral activities dominate the watersheds with a high potential for anthropogenic disturbance, mitigation as well as proactive management techniques may be necessary in high potential influence watersheds.

*Riparian Cluster 5r*

Cluster 5r contains 39 watersheds with only 12 watersheds being found completely within the Forest boundary. Watersheds within riparian Cluster 5r are primarily concentrated east of Durango, in the eastern half of the Forest (Figure 3-16). 60% of the cluster is located in the San Juan National Forest (Table 3-21).

The 39 watersheds in Cluster 4r are driven by a predominately mixed precipitation hydroclimatic regime. The largely high gradient streams in this cluster are typically underlain by lithology of a non-igneous origin. Geochemistry is not a defining characteristic of this cluster.

Within riparian Cluster 5r, Quantile 5 contains 11 watersheds, Quantile 4 contains 11, and Quantile 3 contains 11 watersheds. Quantile 2 contains four watersheds while Quantile 1 contains only two watersheds. The Upper Dolores River-Taylor Creek (HUB# 140300020209) and Elbert Creek (HUB# 140801040502) watersheds both have the highest overall total score of 23, with a maximum possible overall score of 30. Both of these watersheds are located within the Forest boundary. Bear Creek-Disappointment Creek (HUB# 140300020501) has the lowest overall total score with a rating of 4. However, this watershed is located entirely off-forest on BLM and private land. The watershed with the lowest overall total score, and located on the Forest, is the Upper Piedra River-Box Canyon (HUB# 140801020205) and Lower Hermosa Creek (HUB# 140801040407). These watersheds have a total overall score of 14. While reference conditions may be limited to somewhat impacted watersheds, they are considerable less disturbed than the watersheds within quantile 5.

**Table 3-21.** Riparian Cluster 5r: cumulative percentile values, ranks, and quantile designations, Watersheds highlighted in light green are located entirely on-forest.

| HUB6 | HUB6NAME | % in NF | Overall Total | Rank | Quantile |
|---|---|---|---|---|---|
| 140300020209 | Upper Dolores River-Taylor Creek | 100.00 | 23 | 1 | 5 |
| 140801011601 | Upper Beaver Creek | 100.00 | 23 | 1 | 5 |
| 140801020401 | Martinez Creek-Dutton Creek | 92.69 | 22 | 2 | 5 |
| 140300020105 | Lower West Dolores River | 97.68 | 21 | 3 | 5 |
| 140801040502 | Elbert Creek | 100.00 | 21 | 3 | 5 |
| 140801050105 | Upper Cherry Creek | 45.36 | 21 | 3 | 5 |
| 140801070103 | Upper Mancos Valley | 8.91 | 20 | 4 | 5 |
| 140801010303 | Laughlin Park | 100.00 | 19 | 5 | 5 |
| 140801011404 | Vallecito Reservoir | 100.00 | 19 | 5 | 5 |
| 140801011602 | Middle Beaver Creek | 96.18 | 19 | 5 | 5 |
| 140801020301 | Upper Devil Creek | 100.00 | 19 | 5 | 5 |
| 140801010305 | McCabe Creek | 35.76 | 18 | 6 | 4 |
| 140801010405 | Rito Blanco | 100.00 | 18 | 6 | 4 |
| 140801020104 | Piedra River-O'Neal Creek | 100.00 | 18 | 6 | 4 |
| 140801020402 | Upper Stollsteimer Creek | 36.97 | 18 | 6 | 4 |
| 140801040504 | Upper Animas Valley-Trimble | 90.46 | 18 | 6 | 4 |
| 140801011603 | Lower Beaver Creek | 81.73 | 17 | 7 | 4 |
| 140801020206 | Upper Piedra River-Indian Creek | 100.00 | 17 | 7 | 4 |
| 140300020304 | Lower Plateau Creek | 48.69 | 15 | 9 | 4 |
| 140801011502 | Bear Creek | 90.88 | 15 | 9 | 4 |
| 140801040503 | Upper Animas Valley-Stevens Creek | 100.00 | 15 | 9 | 4 |
| 140801040901 | Lower Florida River-Ticalotte | 1.18 | 15 | 9 | 4 |
| 140300020301 | Upper Beaver Creek -McPhee | 20.89 | 14 | 10 | 3 |
| 140801010307 | Echo Canyon Reservoir | 24.70 | 14 | 10 | 3 |
| 140801010308 | San Juan River-Eightmile Mesa | 63.68 | 14 | 10 | 3 |
| 140801020205 | Upper Piedra River-Box Canyon | 100.00 | 14 | 10 | 3 |
| 140801040407 | Lower Hermosa Creek | 100.00 | 14 | 10 | 3 |
| 140801040602 | Upper Lightner Creek | 69.02 | 14 | 10 | 3 |
| 140801040804 | Upper Florida River-Red Creek | 74.75 | 14 | 10 | 3 |
| 140300020303 | Calf Creek | 41.17 | 13 | 11 | 3 |
| 140801011503 | Los Pinos River-Bayfield | 0.85 | 13 | 11 | 3 |
| 140801011501 | Middle Los Pinos River-Red Creek | 81.06 | 12 | 12 | 3 |
| 140300020504 | Ryman Creek | 75.89 | 11 | 13 | 3 |
| 140300020505 | Upper Disappointment Creek | 35.06 | 10 | 14 | 2 |
| 140300036101 | Naturita Creek | 2.63 | 10 | 14 | 2 |
| 140300020302 | Upper Plateau Creek | 2.82 | 8 | 16 | 2 |
| 140300020502 | Disappointment Creek Headwaters | 24.97 | 8 | 16 | 2 |
| 140300020503 | Sheep Camp Valley | 2.72 | 5 | 19 | 1 |
| 140300020501 | Bear Creek-Disappointment Creek | 0.00 | 4 | 20 | 1 |
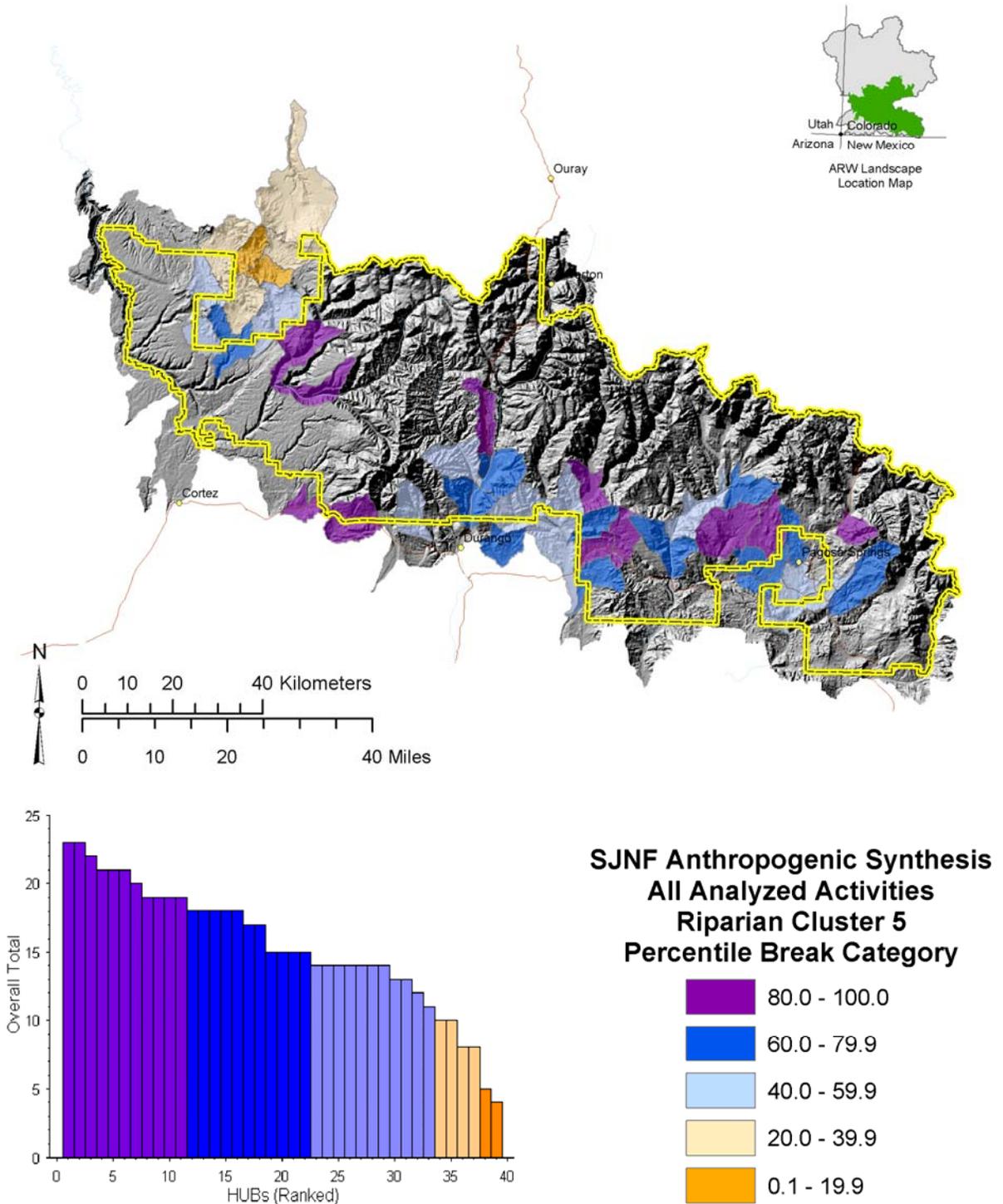
**Figure 3-16.** Riparian Cluster 5: cumulative percentile values.

_Cluster 5r Management Considerations:_

The high proportion of reaches underlain by calcareous geology makes this cluster one of the most productive for aquatic and riparian systems. The location of most of these watersheds in the "mid elevation" ranges indicates that accessibility is generally good and numerous activities have taken place there. Most watersheds in this cluster are potentially influenced by moderate and high levels of anthropogenic activity. The wide range of conditions found in this cluster should make it possible to identify acceptable levels of influences and goals for watershed improvement. Where the overall potential for influence is high watersheds could be targeted for watershed management techniques. The watersheds with a low potential for anthropogenic influence, while few, may provide a unique opportunity for restoration efforts. While not a part of this analysis, it would be important to identify municipal watersheds within this cluster and identify areas of restoration. It would appear that based on their location in the San Juan Mountains, there could be several of these watersheds within this cluster.

_Riparian Cluster 6r_

Riparian Cluster 6r contains fourteen watersheds with none located entirely on the San Juan National Forest (Table 3-22). Watersheds within this Cluster are found along the southern border of the east half of the Forest. They are also found in the far western portion of the Forest, along the southern and northern boundaries of the Forest (Figure 3-17). A majority of the area of the watersheds in Cluster 6r are driven by a rainfall hydroclimatic regime, with a smaller proportion driven by a mixed regime. A high degree of variability is found within the distribution of stream gradients. The streams in this cluster are underlain by rock units formed by predominately non-igneous processes. A majority of these units are calcareous. Only 35% of this Cluster's area is found on San Juan National Forest lands.

Within Riparian Cluster 6r Quantile 4 contains seven watersheds, Quantile 3 has four watersheds, and Quantile 2 contains three watersheds. There are no watersheds within Quantiles 1 and 5 for Riparian Cluster 6r. Upper Spring Creek (HUB# 140801011704) watershed has the highest score with an overall total of 18 out of a possible 30, while the lowest overall total score is found in the Upper Disappointment Valley (HUB# 140300020510), Disappointment Valley-Wild Horse Reservoir (HUB# 140300020511), and Piedra River-Navajo Reservoir Inlet (HUB# 140801020503) watersheds, each with a score of 10.

As none of the watersheds are located entirely on-forest there is not a suitable on-forest reference watershed, although there may be appropriate reaches..

**Table 3-22.** Riparian Cluster 6r: cumulative percentile values, ranks, and quantile designations, Watersheds highlighted in light green are located entirely on-forest.

| HUB6 | HUB6NAME | % in NF | Overall Total | Rank | Quantile |
|---|---|---|---|---|---|
| 140801011704 | Upper Spring Creek | 44.38 | 18 | 6 | 4 |
| 140801020302 | Lower Devil Creek | 89.29 | 17 | 7 | 4 |
| 140801020502 | Piedra River-Stollsteimer | 82.84 | 16 | 8 | 4 |
| 140801011703 | Ute Creek | 54.58 | 15 | 9 | 4 |
| 140801020404 | Middle Stollsteimer Creek | 80.90 | 15 | 9 | 4 |
| 140801020405 | Lower Stollsteimer Creek | 44.02 | 15 | 9 | 4 |
| 140801040604 | Animas River-Spring Creek | 4.15 | 15 | 9 | 4 |
| 140801010601 | San Juan River-Trujillo | 27.55 | 14 | 10 | 3 |
| 140802020106 | Lower Alkali Canyon-Narraguinnep Canyon | 0.74 | 13 | 11 | 3 |
| 140802020103 | Hartman Canyon | 0.05 | 12 | 12 | 3 |
| 140300020506 | Brumley Valley | 48.52 | 11 | 13 | 3 |
| 140300020510 | Upper Disappointment Valley | 3.66 | 10 | 14 | 2 |
| 140300020511 | Disappointment Valley-Wild Horse Reservoir | 21.86 | 10 | 14 | 2 |
| 140801020503 | Piedra River-Navajo Reservoir Inlet | 22.86 | 10 | 14 | 2 |
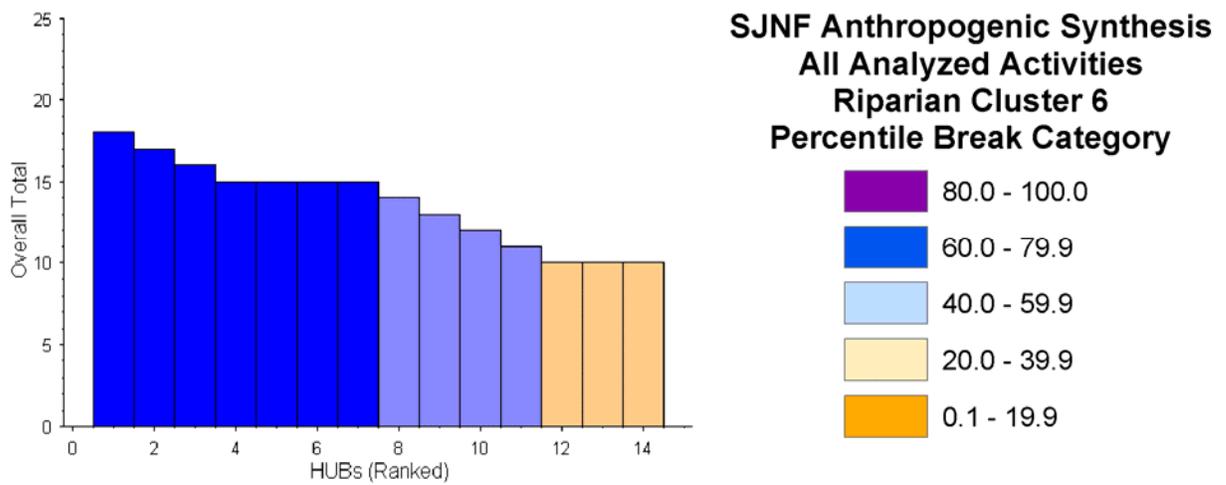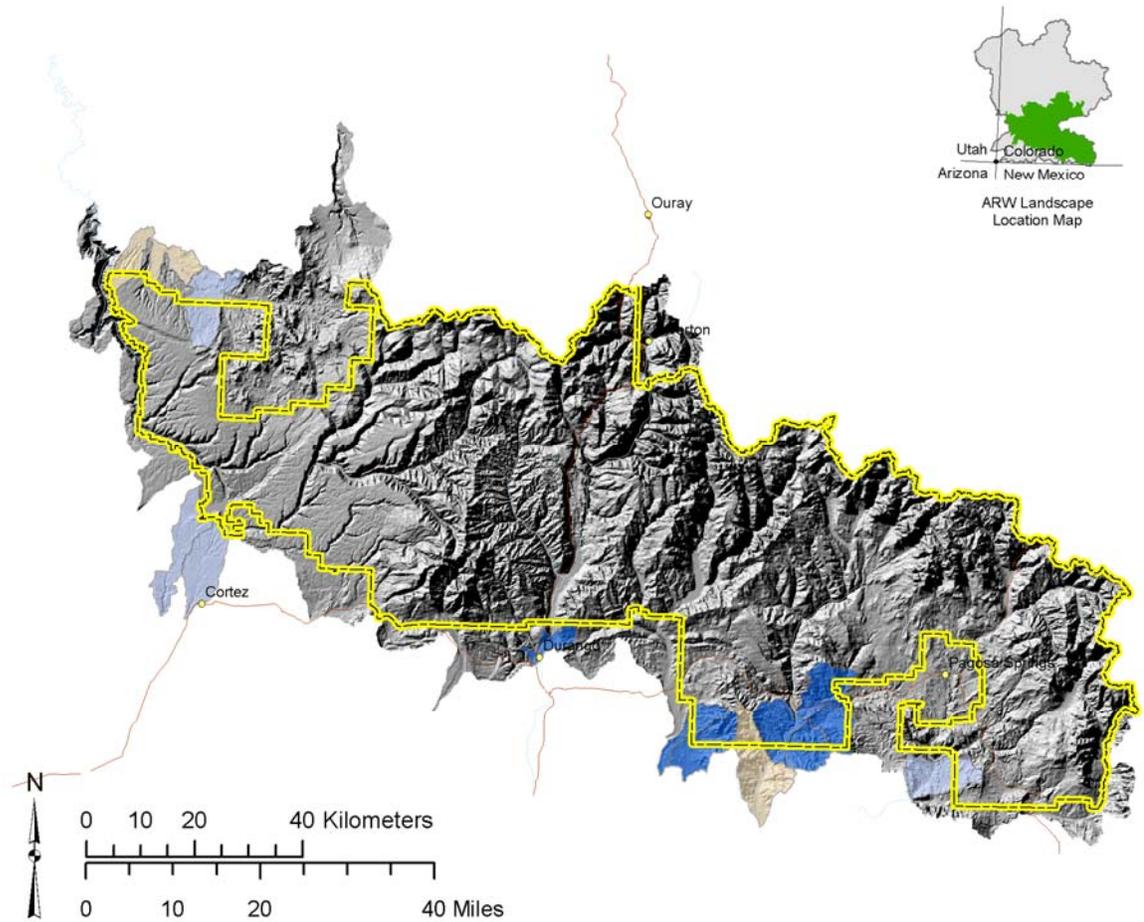
**Figure 3-17.** Riparian Cluster 6: cumulative percentile values.

*Cluster 6r Management Considerations:*

The variability in gradient and streamflow in Cluster 6r are conducive to the establishment and propagation of a variety of riparian habitats. The large proportion of streams underlain by calcareous lithology increases the potential for productivity and rare ecosystems, such as springs. However, the low elevation and dominance of rainfall and mixed precipitation flow events make this cluster sensitive to anthropogenic activities that alter the surface and subsurface hydrology. In addition, watersheds originating upstream of this cluser could transport a considerable amount of sediment into loew gradient stream reaches, altering riparian habitats. As the watersheds considered having a high potential for influence by anthropogenic activities are moderate in all activity categories, and the characteristics of the watersheds so dynamic, careful consideration and planning of riparian management and watershed restoration is necessary.

*Riparian Cluster 7r*

Riparian Cluster 7r contains only one watershed, Mayday Valley (HUB# 140801050101). 33.2% of its area is located within Forest boundaries (Table 3-15). This watershed is found along the southern border.of the Forest, east of Durango (Figure 3-18).

The single watershed in Cluster 7r has a slight majority of its streams in the moderate gradient category.

These streams are driven by a largely mixed precipitation type and snowfall driven hydroclimatic regimes. No stream length is within the rainfall driven hydroclimatic regime. Rock units in this watershed are largely non-calcareous, and formed by mainly non-igneous processes.

Mayday Valley has an overall total score of 18 and is found in Quantile 4. All other quantiles are absent from this riparian cluster. There is no reference watershed available for this riparian cluster.
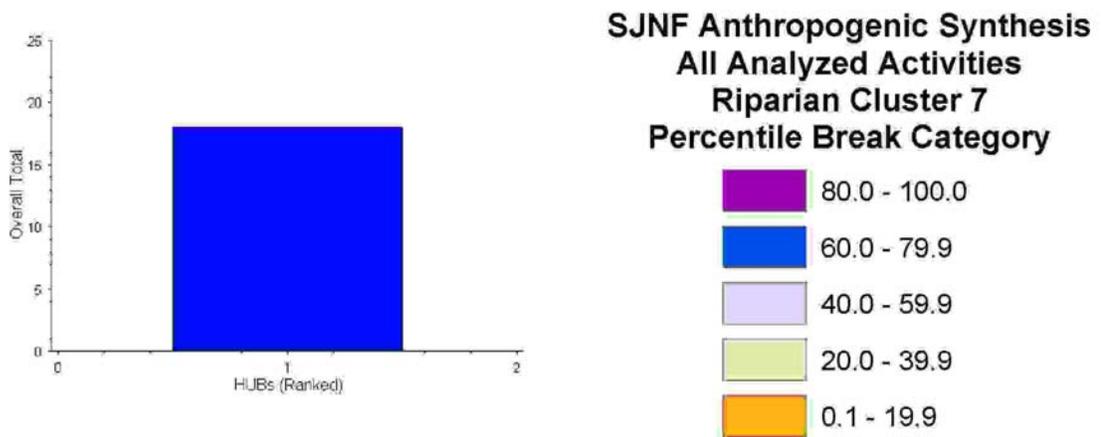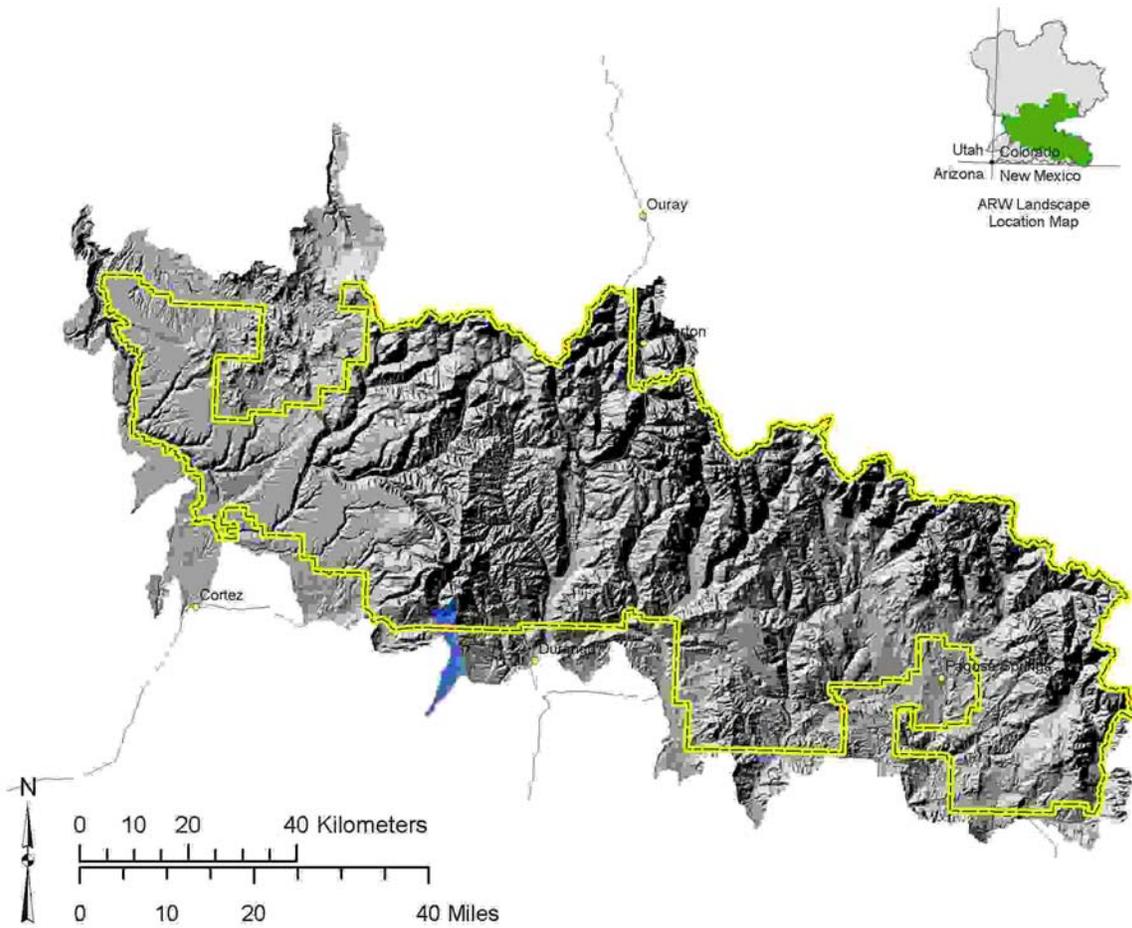
**Figure 3-18.** Riparian Cluster 7: cumulative percentile values.

*Cluster 7r Management Considerations:*

The single watershed in this cluster has a high potential for influence by mineral activities, and a moderate potential influence from all other activities. This watershed does not have a high potential productivity for aquatic and riparian systems. Due to the limited amount of area within the national Forest boundary as well as being the only watershed within this cluster, only very

limited habitats could be managed in a proactive nature. Mitigation from potential impoacts could be implemented to limit downstream influences.

*Riparian Cluster 8r*

Riparian Cluster 8r contains three watersheds, all of which are located within the San Juan National Forest boundary (Table 3-23). These watersheds are found in the central portion of the Forest northeast of Durango (Figure 3-19). The three watersheds in cluster 8r are unique in that the streams in these watersheds are underlain by predominately non-calcareous lithology formed by igneous processes. These streams are typically high gradient, and are driven by a snowfall hydroclimatic regime.

Quantiles 5, 4, and 3 are absent from Cluster 8r. One watershed is within Quantile 2 and two watersheds are within Quantile 1 (Table Riparian Cluster 8r). Needle Creek (HUB# 140801040203) has an overall total score of 11 and is within Quantile 2. The Florida River Headwaters (HUB# 140801040801) and the Three Sisters (HUB# 140801011304) have overall total scores of seven, and are within Quantile 1. The Three Sisters and the Florida River Headwaters might be able to be reference watershed, but this should be field verified.

**Table 3-23.** Riparian Cluster 8r: cumulative percentile values, ranks, and quantile designations, Watersheds highlighted in light green are located entirely on-forest.

| HUB6 | HUB6NAME | % in NF | Overall Total | Rank | Quantile |
|---|---|---|---|---|---|
| 140801040203 | Needle Creek | 100.00 | 11 | 12 | 2 |
| 140801011304 | Three Sisters | 100.00 | 7 | 16 | 1 |
| 140801040801 | Florida River Headwaters | 100.00 | 7 | 16 | 1 |
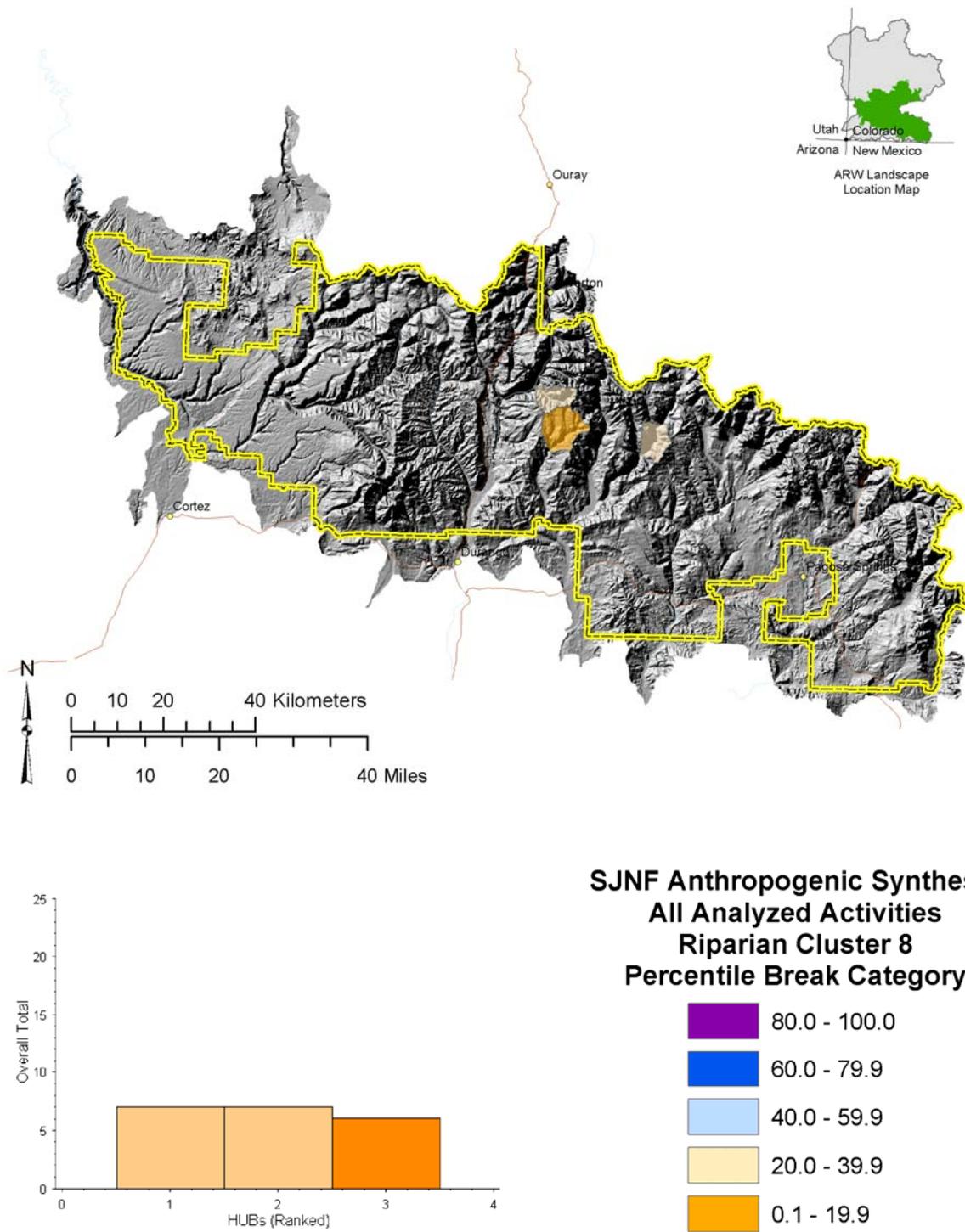
**Figure 3-19.** Riparian Cluster 8: cumulative percentile values.

*Cluster 8r Management Considerations:*

Watersheds in this cluster are typically high gradient and relatively unproductive. There is a low potential for significant cumulative influences in all three watersheds, although individual activity influences may be present. These watersheds should need relatively little restoration or mitigation of riparian and aquatic systems. However, because of the "unique" nature of watersheds in cluster 8r, rare conditions and habitats may be present that could be in need of protection from future management. These watersheds may provide considerable opportunities for reference condition analysis, although they may be limited to a few areas of the Forest with similar conditions.

**Table 3-24.** Summary of Additive Analyses by Category and Overall Total for the San Juan National Forest.

| HUB6 | HUB6NAME | Recrea-tion | Urbani-zation | Minerals | Transpor-tation | Vegetation Mgmt | Water Use | Overall Total | Quantile |
|------|----------|-------------|---------------|----------|-----------------|-----------------|-----------|---------------|----------|
| 140801070104 | Chicken Creek | 3 | 4 | 3 | 5 | 5 | 3 | 23 | 5 |
| 140300020209 | Upper Dolores River-Taylor Creek | 4 | 2 | 3 | 5 | 4 | 5 | 23 | 5 |
| 140801011601 | Upper Beaver Creek | 2 | 3 | 5 | 3 | 5 | 5 | 23 | 5 |
| 140801020401 | Martinez Creek-Dutton Creek | 5 | 3 | 1 | 4 | 4 | 5 | 22 | 5 |
| 140801010302 | Fourmile Creek | 3 | 2 | 3 | 4 | 4 | 5 | 21 | 5 |
| 140300020105 | Lower West Dolores River | 2 | 3 | 3 | 3 | 5 | 5 | 21 | 5 |
| 140801050105 | Upper Cherry Creek | 2 | 5 | 3 | 5 | 3 | 3 | 21 | 5 |
| 140801040502 | Elbert Creek | 3 | 3 | 3 | 5 | 4 | 3 | 21 | 5 |
| 140300020401 | Upper Lost Canyon | 4 | 2 | 1 | 4 | 5 | 4 | 20 | 5 |
| 140801070103 | Upper Mancos Valley | 2 | 5 | 5 | 3 | 2 | 3 | 20 | 5 |
| 140801070102 | West Mancos River | 1 | 3 | 2 | 5 | 5 | 3 | 19 | 5 |
| 140801010303 | Laughlin Park | 3 | 2 | 3 | 3 | 3 | 5 | 19 | 5 |
| 140300020305 | Beaver Creek-Trail Canyon | 1 | 3 | 4 | 4 | 4 | 3 | 19 | 5 |
| 140300020404 | Stapleton Valley | 0 | 5 | 2 | 4 | 4 | 4 | 19 | 5 |
| 140300020407 | House Creek | 1 | 2 | 3 | 5 | 5 | 3 | 19 | 5 |
| 140300020604 | Dolores Canyon-Lake Canyon | 3 | 2 | 3 | 3 | 4 | 4 | 19 | 5 |
| 140801010304 | Upper Pagosa Springs | 2 | 4 | 3 | 3 | 4 | 3 | 19 | 5 |
| 140801010504 | Navajo River-Weisel Flat | 5 | 2 | 3 | 3 | 3 | 3 | 19 | 5 |
| 140801010507 | Coyote Creek | 2 | 2 | 3 | 4 | 4 | 4 | 19 | 5 |
| 140801011404 | Vallecito Reservoir | 5 | 2 | 1 | 3 | 4 | 4 | 19 | 5 |
| 140801020301 | Upper Devil Creek | 4 | 2 | 1 | 4 | 5 | 3 | 19 | 5 |
| 140801020501 | Yellowjacket Creek | 2 | 3 | 3 | 3 | 4 | 4 | 19 | 5 |
| 140801070105 | East Fork of Mud Creek | 1 | 5 | 5 | 3 | 2 | 3 | 19 | 5 |
| 140801011602 | Middle Beaver Creek | 2 | 3 | 4 | 3 | 4 | 3 | 19 | 5 |
| 140801040303 | Lower Cascade Creek | 5 | 2 | 2 | 4 | 4 | 2 | 19 | 5 |
| 140801070101 | East Mancos River-Middle Mancos River | 1 | 3 | 2 | 4 | 5 | 3 | 18 | 4 |
| 140300020403 | Middle Lost Canyon | 3 | 1 | 3 | 3 | 4 | 4 | 18 | 4 |
| 140300020406 | Upper Dolores River-Italian Creek | 0 | 2 | 4 | 5 | 5 | 2 | 18 | 4 |

| HUB6 | HUB6NAME | Recrea-tion | Urbani-zation | Minerals | Transpor-tation | Vegetation Mgmt | Water Use | Overall Total | Quantile |
|---|---|---|---|---|---|---|---|---|---|
| 140801050102 | Mayday Valley | 3 | 3 | 5 | 3 | 2 | 2 | 18 | 4 |
| 140801010406 | Lower Rio Blanco-San Juan River | 2 | 3 | 1 | 4 | 4 | 4 | 18 | 4 |
| 140801010305 | McCabe Creek | 2 | 5 | 2 | 3 | 3 | 3 | 18 | 4 |
| 140801010405 | Rito Blanco | 2 | 2 | 2 | 3 | 5 | 4 | 18 | 4 |
| 140801020104 | Piedra River-O'Neal Creek | 4 | 2 | 1 | 3 | 4 | 4 | 18 | 4 |
| 140801020402 | Upper Stollsteimer Creek | 3 | 4 | 1 | 4 | 3 | 3 | 18 | 4 |
| 140801011704 | Upper Spring Creek | 3 | 4 | 3 | 3 | 3 | 2 | 18 | 4 |
| 140801040504 | Upper Animas Valley-Trimble | 2 | 2 | 3 | 4 | 3 | 4 | 18 | 4 |
| 140801020102 | Middle Fork Piedra River | 5 | 1 | 1 | 3 | 4 | 4 | 18 | 4 |
| 140300020202 | Upper Dolores River-Cayton Valley | 4 | 1 | 3 | 4 | 4 | 1 | 17 | 4 |
| 140300020207 | Dolores River-Priest Gulch | 2 | 2 | 1 | 5 | 3 | 4 | 17 | 4 |
| 140300020601 | Dolores River-Salter Canyon | 2 | 0 | 2 | 4 | 4 | 5 | 17 | 4 |
| 140801010404 | Middle Rio Blanco | 2 | 1 | 1 | 3 | 5 | 5 | 17 | 4 |
| 140801020206 | Upper Piedra River-Indian Creek | 2 | 1 | 1 | 3 | 5 | 5 | 17 | 4 |
| 140801020302 | Lower Devil Creek | 4 | 2 | 0 | 4 | 4 | 3 | 17 | 4 |
| 140300020408 | McPhee Reservoir-Dolores River | 1 | 2 | 4 | 4 | 3 | 3 | 17 | 4 |
| 140801010306 | Mill Creek | 2 | 3 | 2 | 3 | 4 | 3 | 17 | 4 |
| 140801011603 | Lower Beaver Creek | 2 | 2 | 4 | 3 | 4 | 2 | 17 | 4 |
| 140801010203 | Wolf Creek | 5 | 1 | 1 | 3 | 4 | 3 | 17 | 4 |
| 140801040103 | Mineral Creek | 3 | 2 | 3 | 5 | 2 | 2 | 17 | 4 |
| 140300020204 | Upper Dolores River-Scotch Creek | 3 | 0 | 3 | 5 | 2 | 3 | 16 | 4 |
| 140300020208 | Stoner Creek | 2 | 1 | 2 | 4 | 4 | 3 | 16 | 4 |
| 140801011403 | Lower Vallecito Creek | 3 | 2 | 1 | 3 | 4 | 3 | 16 | 4 |
| 140801040501 | Upper Animas Valley-Canyon Creek | 2 | 1 | 1 | 5 | 5 | 2 | 16 | 4 |
| 140801020103 | Williams Creek | 3 | 1 | 1 | 3 | 4 | 4 | 16 | 4 |
| 140801010506 | Little Navajo River | 3 | 1 | 3 | 3 | 3 | 3 | 16 | 4 |
| 140300020306 | McPhee Reservoir-Beaver Creek Inlet | 1 | 0 | 3 | 4 | 4 | 4 | 16 | 4 |
| 140300020402 | Spruce Water Canyon | 0 | 4 | 2 | 3 | 4 | 3 | 16 | 4 |

| HUB6 | HUB6NAME | Recrea-tion | Urbani-zation | Minerals | Transpor-tation | Vegetation Mgmt | Water Use | Overall Total | Quantile |
|---|---|---|---|---|---|---|---|---|---|
| 140300020603 | Dolores Canyon-Cabin Creek | 2 | 2 | 3 | 3 | 4 | 2 | 16 | 4 |
| 140801040603 | Lower Lightner Creek | 2 | 3 | 5 | 3 | 2 | 1 | 16 | 4 |
| 140801020502 | Piedra River-Stollsteimer | 2 | 1 | 3 | 3 | 3 | 4 | 16 | 4 |
| 140801010204 | Lower West Fork San Juan River | 5 | 2 | 0 | 2 | 3 | 4 | 16 | 4 |
| 140300020103 | Upper West Dolores River | 0 | 2 | 3 | 3 | 3 | 4 | 15 | 4 |
| 140801011306 | East Creek | 4 | 1 | 1 | 3 | 4 | 2 | 15 | 4 |
| 140801040503 | Upper Animas Valley-Stevens Creek | 3 | 1 | 1 | 4 | 4 | 2 | 15 | 4 |
| 140801040601 | Junction Creek | 2 | 2 | 2 | 3 | 4 | 2 | 15 | 4 |
| 140300020507 | Dawson Draw | 2 | 0 | 2 | 3 | 4 | 4 | 15 | 4 |
| 140300020509 | Pine Arroyo | 2 | 1 | 3 | 3 | 3 | 3 | 15 | 4 |
| 140801020404 | Middle Stollsteimer Creek | 3 | 2 | 2 | 3 | 3 | 2 | 15 | 4 |
| 140300020602 | Narraguinnep Canyon Natural Area | 2 | 0 | 2 | 3 | 4 | 4 | 15 | 4 |
| 140300020304 | Lower Plateau Creek | 1 | 0 | 2 | 5 | 4 | 3 | 15 | 4 |
| 140801011502 | Bear Creek | 1 | 2 | 2 | 2 | 5 | 3 | 15 | 4 |
| 140801040901 | Lower Florida River-Ticalotte | 2 | 3 | 4 | 3 | 2 | 1 | 15 | 4 |
| 140801011703 | Ute Creek | 2 | 2 | 5 | 2 | 2 | 2 | 15 | 4 |
| 140801020405 | Lower Stollsteimer Creek | 2 | 2 | 3 | 3 | 3 | 2 | 15 | 4 |
| 140801040604 | Animas River-Spring Creek | 2 | 3 | 4 | 2 | 2 | 2 | 15 | 4 |
| 140801020101 | East Fork Piedra River | 3 | 1 | 1 | 3 | 3 | 4 | 15 | 4 |
| 140801040802 | Upper Florida River-Transfer Park | 5 | 1 | 0 | 3 | 5 | 1 | 15 | 4 |
| 140801040402 | East Fork Hermosa Creek | 5 | 0 | 1 | 3 | 4 | 1 | 14 | 3 |
| 140801040803 | Lemon Reservoir | 2 | 2 | 0 | 3 | 5 | 2 | 14 | 3 |
| 140300020301 | Upper Beaver Creek -McPhee | 2 | 2 | 1 | 3 | 3 | 3 | 14 | 3 |
| 140801040407 | Lower Hermosa Creek | 2 | 1 | 2 | 3 | 4 | 2 | 14 | 3 |
| 140801010403 | Rio Blanco River-Blanco Basin | 2 | 1 | 1 | 3 | 3 | 4 | 14 | 3 |
| 140801011305 | Indian Creek | 4 | 1 | 1 | 3 | 3 | 2 | 14 | 3 |
| 140801020202 | Lower Weminuche Creek | 4 | 1 | 1 | 3 | 3 | 2 | 14 | 3 |
| 140801020205 | Upper Piedra River-Box Canyon | 3 | 0 | 1 | 3 | 4 | 3 | 14 | 3 |
| 140801040602 | Upper Lightner Creek | 2 | 1 | 3 | 2 | 3 | 3 | 14 | 3 |

| HUB6 | HUB6NAME | Recrea-tion | Urbani-zation | Minerals | Transpor-tation | Vegetation Mgmt | Water Use | Overall Total | Quantile |
|---|---|---|---|---|---|---|---|---|---|
| 140801040804 | Upper Florida River-Red Creek | 2 | 2 | 0 | 4 | 4 | 2 | 14 | 3 |
| 140801010601 | San Juan River-Trujillo | 4 | 2 | 1 | 2 | 3 | 2 | 14 | 3 |
| 140801010602 | Montezuma Creek | 3 | 1 | 4 | 3 | 1 | 2 | 14 | 3 |
| 140801010307 | Echo Canyon Reservoir | 2 | 3 | 3 | 3 | 2 | 1 | 14 | 3 |
| 140801010308 | San Juan River-Eightmile Mesa | 2 | 2 | 2 | 3 | 3 | 2 | 14 | 3 |
| 140801040301 | Upper Cascade Creek | 3 | 1 | 2 | 3 | 3 | 2 | 14 | 3 |
| 140801040302 | Lime Creek | 4 | 1 | 2 | 3 | 3 | 1 | 14 | 3 |
| 140300020203 | Rico Valley | 2 | 0 | 3 | 5 | 1 | 2 | 13 | 3 |
| 140801010503 | Navajo Peak | 3 | 2 | 3 | 2 | 2 | 1 | 13 | 3 |
| 140300020605 | Dolores Canyon-Joe Davis Hill | 2 | 1 | 3 | 3 | 2 | 2 | 13 | 3 |
| 140801020403 | Stollsteimer Creek-Dyke Valley | 3 | 3 | 0 | 2 | 3 | 2 | 13 | 3 |
| 140300020303 | Calf Creek | 2 | 0 | 2 | 3 | 3 | 3 | 13 | 3 |
| 140801011503 | Los Pinos River-Bayfield | 0 | 3 | 5 | 2 | 2 | 1 | 13 | 3 |
| 140802020106 | Lower Alkali Canyon-Narraguinnep Canyon | 1 | 5 | 1 | 3 | 1 | 2 | 13 | 3 |
| 140801010101 | Headwaters East Fork San Juan River | 3 | 3 | 2 | 2 | 2 | 1 | 13 | 3 |
| 140801040104 | Animas River-Cunningham Creek | 2 | 2 | 4 | 2 | 2 | 1 | 13 | 3 |
| 140801040202 | Animas River-Tenmile Creek | 2 | 1 | 2 | 4 | 2 | 2 | 13 | 3 |
| 140300020102 | Fish Creek | 0 | 1 | 1 | 4 | 4 | 2 | 12 | 3 |
| 140300020201 | Dolores River Headwaters-Tin Can Basin | 2 | 1 | 2 | 3 | 3 | 1 | 12 | 3 |
| 140300020206 | Bear Creek | 2 | 1 | 2 | 3 | 3 | 1 | 12 | 3 |
| 140801020204 | First Fork | 2 | 0 | 1 | 3 | 5 | 1 | 12 | 3 |
| 140801040403 | Upper Hermosa Creek | 4 | 0 | 1 | 3 | 3 | 1 | 12 | 3 |
| 140801010301 | Turkey Creek | 2 | 1 | 0 | 3 | 3 | 3 | 12 | 3 |
| 140300020405 | Lower Lost Canyon | 1 | 2 | 3 | 5 | 1 | 0 | 12 | 3 |
| 140802020201 | Upper YellowjaCreeket Canyon | 0 | 5 | 3 | 2 | 1 | 1 | 12 | 3 |
| 140801011501 | Middle Los Pinos River-Red Creek | 1 | 2 | 1 | 3 | 3 | 2 | 12 | 3 |
| 140802020103 | Hartman Canyon | 0 | 5 | 2 | 3 | 1 | 1 | 12 | 3 |
| 140801010102 | Quartz Creek | 3 | 0 | 3 | 3 | 2 | 1 | 12 | 3 |
| 140801010104 | East Fork San Juan River-The Clamshell | 2 | 1 | 1 | 2 | 3 | 3 | 12 | 3 |

| HUB6 | HUB6NAME | Recrea-tion | Urbani-zation | Minerals | Transpor-tation | Vegetation Mgmt | Water Use | Overall Total | Quantile |
|---|---|---|---|---|---|---|---|---|---|
| 140801010402 | Fish Creek | 5 | 0 | 0 | 3 | 2 | 2 | 12 | 3 |
| 140801011301 | Upper Los Pinos River-Ricon La Vaca | 2 | 0 | 1 | 3 | 2 | 4 | 12 | 3 |
| 140801040204 | Animas River-Needleton | 2 | 0 | 1 | 4 | 3 | 2 | 12 | 3 |
| 140300020205 | Roaring Forks Creek | 1 | 0 | 1 | 3 | 4 | 2 | 11 | 3 |
| 140801040401 | Hermosa Creek headwaters | 3 | 0 | 1 | 3 | 3 | 1 | 11 | 3 |
| 140300020504 | Ryman Creek | 2 | 0 | 1 | 3 | 3 | 2 | 11 | 3 |
| 140300020506 | Brumley Valley | 2 | 0 | 1 | 3 | 3 | 2 | 11 | 3 |
| 140801050101 | La Plata River headwaters | 2 | 0 | 3 | 3 | 2 | 1 | 11 | 3 |
| 140300020101 | El Deinte Peak | 1 | 0 | 1 | 3 | 3 | 2 | 10 | 2 |
| 140300020104 | Groundhog Creek | 2 | 1 | 1 | 2 | 3 | 1 | 10 | 2 |
| 140801020203 | Sand Creek | 2 | 0 | 1 | 3 | 4 | 0 | 10 | 2 |
| 140300020511 | Disappointment Valley-Wild Horse Reservoir | 1 | 1 | 2 | 3 | 2 | 1 | 10 | 2 |
| 140801020503 | Piedra River-Navajo Reservoir Inlet | 2 | 1 | 2 | 2 | 2 | 1 | 10 | 2 |
| 140300020505 | Upper Disappointment Creek | 2 | 0 | 2 | 2 | 2 | 2 | 10 | 2 |
| 140300036101 | Naturita Creek | 2 | 1 | 2 | 3 | 1 | 1 | 10 | 2 |
| 140300020510 | Upper Disappointment Valley | 2 | 0 | 3 | 3 | 1 | 1 | 10 | 2 |
| 140801010401 | Rio Blanco Headwaters | 3 | 1 | 1 | 2 | 2 | 1 | 10 | 2 |
| 140801040405 | South Fork Hermosa Creek | 2 | 0 | 1 | 3 | 3 | 0 | 9 | 2 |
| 140801010604 | Upper Cat Creek | 2 | 2 | 1 | 2 | 2 | 0 | 9 | 2 |
| 140801010201 | Upper West Fork San Juan River | 2 | 0 | 1 | 2 | 2 | 2 | 9 | 2 |
| 140801040201 | Elk Creek | 2 | 0 | 1 | 3 | 2 | 1 | 9 | 2 |
| 140801040404 | Middle Hermosa Creek | 2 | 0 | 1 | 2 | 2 | 1 | 8 | 2 |
| 140300020502 | Disappointment Creek Headwaters | 0 | 1 | 0 | 3 | 3 | 1 | 8 | 2 |
| 140300020302 | Upper Plateau Creek | 2 | 0 | 1 | 2 | 1 | 2 | 8 | 2 |
| 140801010103 | Sand Creek | 1 | 0 | 1 | 2 | 2 | 2 | 8 | 2 |
| 140801010202 | Beaver Creek | 2 | 0 | 1 | 3 | 2 | 0 | 8 | 2 |
| 140801010502 | West Fork Navajo River | 2 | 1 | 0 | 3 | 1 | 1 | 8 | 2 |
| 140801011303 | Lake Creek | 2 | 0 | 1 | 3 | 2 | 0 | 8 | 2 |
| 140801011402 | Middle Vallecito Creek | 1 | 0 | 1 | 2 | 3 | 1 | 8 | 2 |
| 140801040102 | Cement Creek | 1 | 2 | 3 | 1 | 1 | 0 | 8 | 2 |
| 140801011302 | Upper Los Pinos River-Flint Creek | 2 | 0 | 0 | 3 | 2 | 0 | 7 | 2 |

| HUB6 | HUB6NAME | Recrea-tion | Urbani-zation | Minerals | Transpor-tation | Vegetation Mgmt | Water Use | Overall Total | Quantile |
|---|---|---|---|---|---|---|---|---|---|
| 140801011401 | Upper Vallecito Creek | 2 | 0 | 1 | 2 | 1 | 1 | 7 | 2 |
| 140801011304 | Three Sisters | 2 | 0 | 0 | 3 | 2 | 0 | 7 | 2 |
| 140801040203 | Needle Creek | 1 | 0 | 1 | 2 | 2 | 1 | 7 | 2 |
| 140801040406 | Hermosa Creek-Dutch Creek | 0 | 0 | 0 | 3 | 2 | 1 | 6 | 1 |
| 140801020201 | Upper Weminuche Creek | 0 | 0 | 0 | 2 | 2 | 2 | 6 | 1 |
| 140801040801 | Florida River Headwaters | 0 | 0 | 1 | 2 | 2 | 1 | 6 | 1 |
| 140300020503 | Sheep Camp Valley | 2 | 0 | 0 | 1 | 2 | 0 | 5 | 1 |
| 140801040101 | Animas River above Howardsville | 1 | 0 | 3 | 0 | 1 | 0 | 5 | 1 |
| 140300020501 | Bear Creek-Disappointment Creek | 0 | 1 | 1 | 1 | 1 | 0 | 4 | 1 |