



United States Department
of Agriculture



Natural Resources
Conservation Service

Lakewood, Colorado

RWA 11020009

July 2007

Upper Arkansas—John Martin Reservoir Watershed

Hydrologic Unit Code 11020009

Rapid Assessment



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Introduction

Background Information

The Natural Resources Conservation Service (NRCS) is encouraging the development of rapid watershed assessments in order to increase the speed and efficiency generating information to guide conservation implementation, as well as the speed and efficiency of putting it into the hands of local decision makers.

Rapid watershed assessments provide initial estimates of where conservation investments would best address the concerns of landowners, conservation districts, and other community organizations and stakeholders. These assessments help landowners and local leaders set priorities and determine the best actions to achieve their goals.

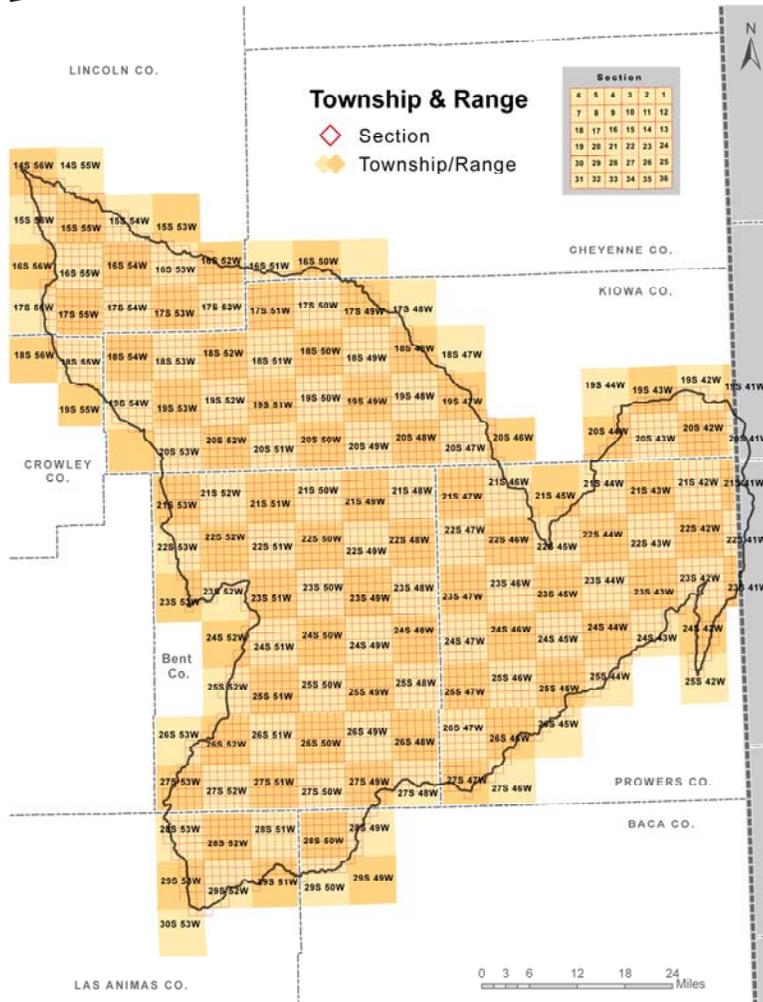
Benefits of these Activities

While rapid assessments provide less detail and analysis than full-blown studies and plans, they do provide the benefits of NRCS locally-led planning in less time and at a reduced cost. The benefits include:

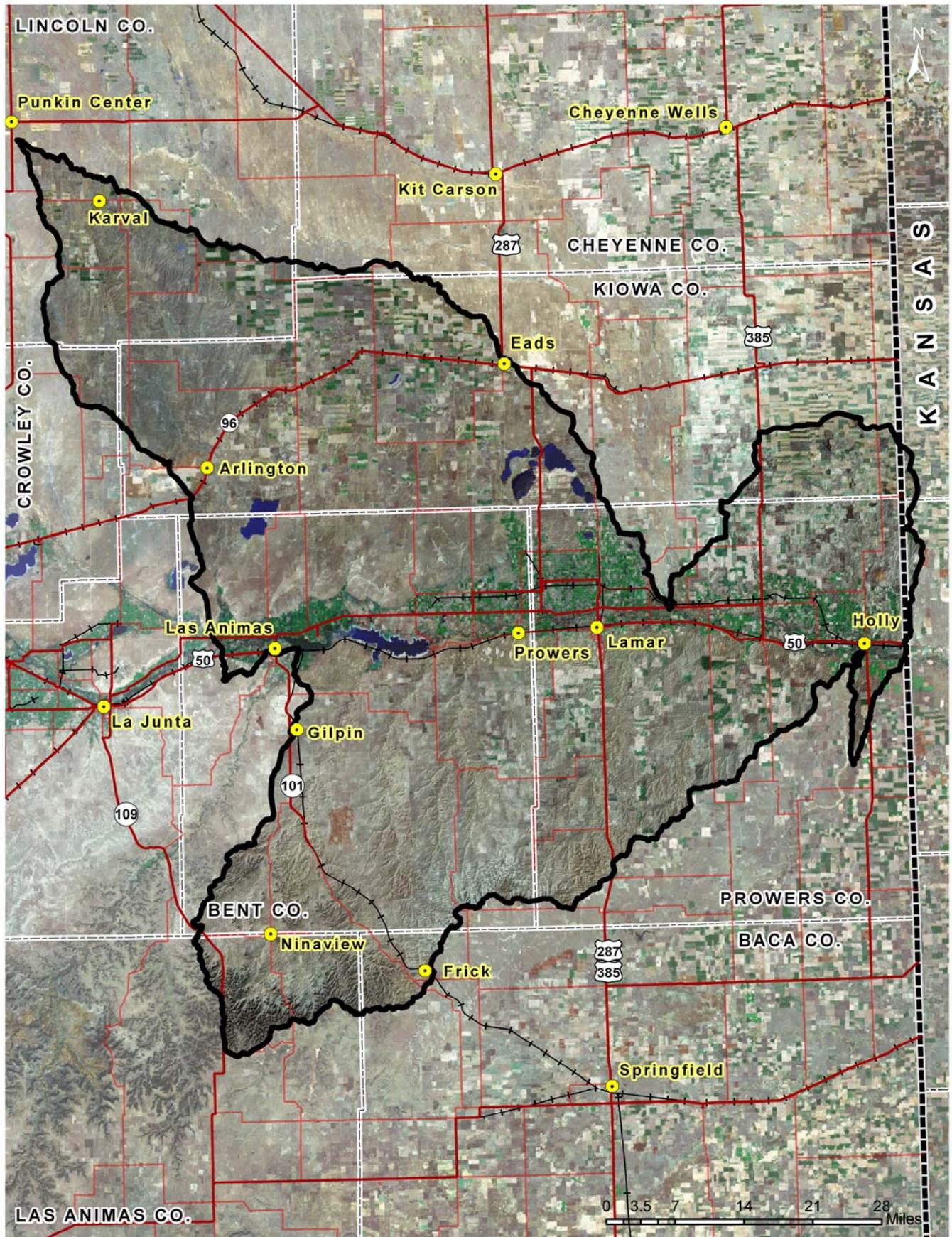
- Quick and inexpensive tools for setting priorities and taking action
- Providing a level of detail that is sufficient for identifying actions that can be taken with no further watershed-level studies or analyses
- Actions to be taken may require further Federal or State permits or ESA or NEPA analysis but these activities are part of standard requirements for use of best management practices (BMPs) and conservation systems
- Identifying where further detailed analyses or watershed studies are needed
- Plans address multiple objectives and concerns of landowners and communities
- Plans are based on established partnerships at the local and state levels
- Plans enable landowners and communities to decide on the best mix of NRCS programs that will meet their goals
- Plans include the full array of conservation program tools (i.e. cost-share practices, easements, technical assistance)

Rapid Watershed Assessments provide information that helps land-owners and local leaders set conservation priorities.

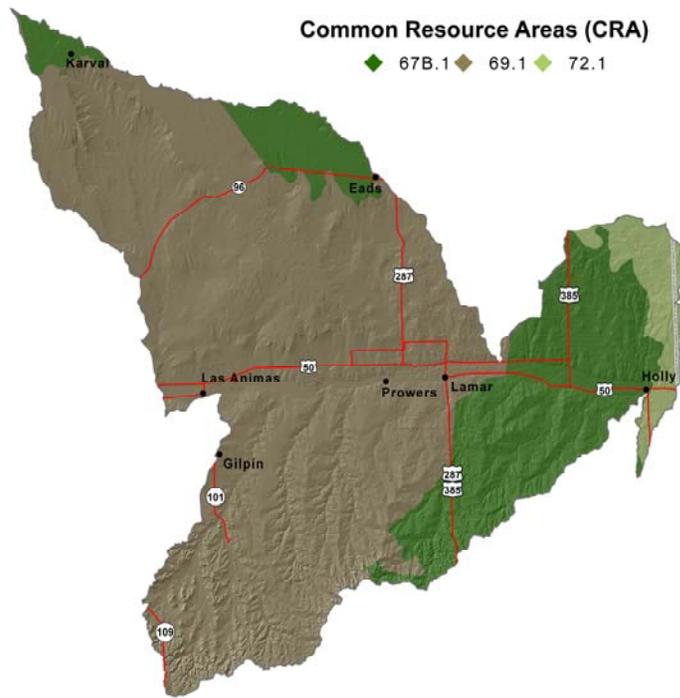
Watershed Location



	County Acres	County Acres in UAJMR Watershed	% of county in the Watershed
Baca	1,618,541	35,538	2.2%
Bent	986,170	805,749	81.7%
Cheyenne	1,140,362	7,788	0.7%
Crowley	512,068	21,444	42.0%
Kiowa	1,143,313	620,410	54.0%
Las Animas	3,054,954	93,069	3.0%
Lincoln	1,654,464	211,154	12.8%
Prowers	1,052,815	659,351	62.6%

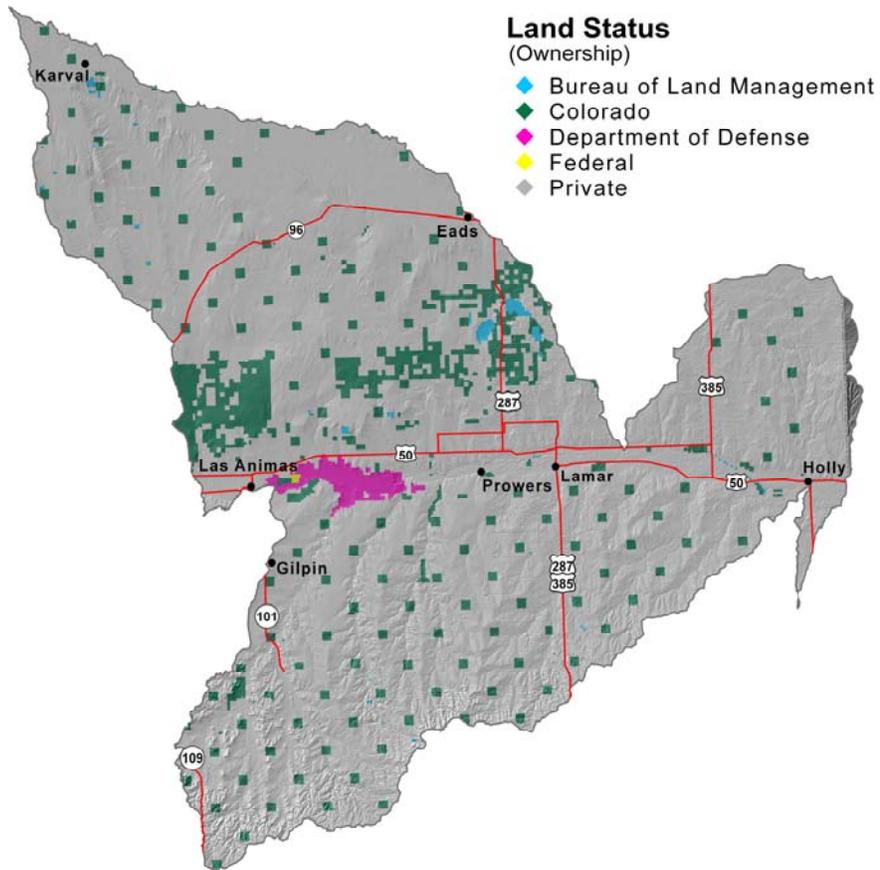
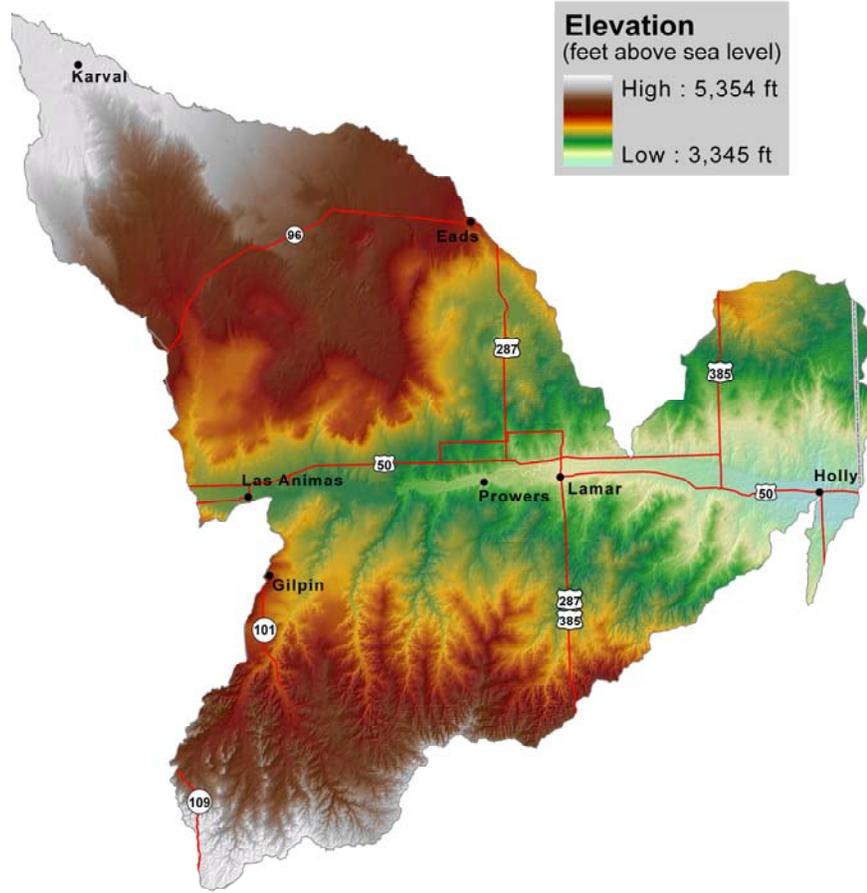


Satellite Imagery: Arc IMS Server - Geographic Network Services hosted by ESRI

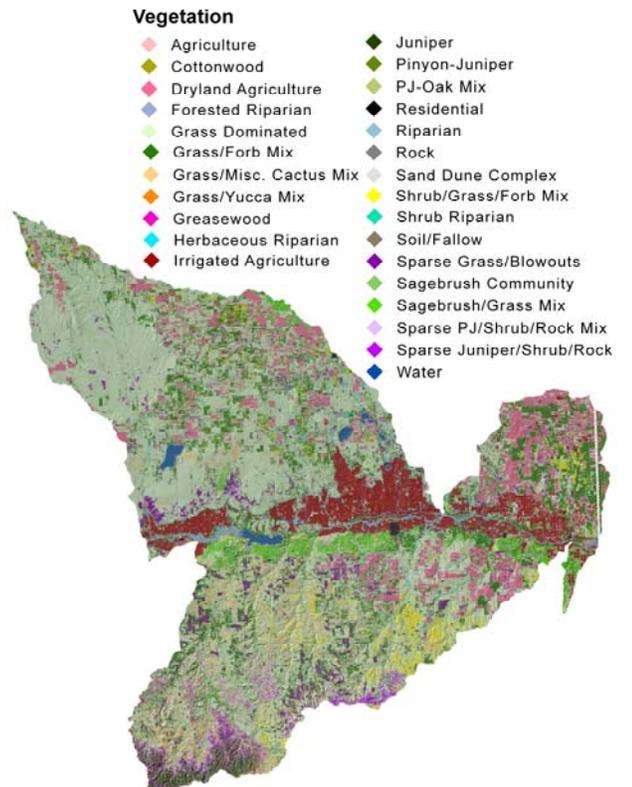


Common Resource Areas (CRA): Geographical areas where resource concerns, problems, and treatment needs are similar. Landscape conditions, soil, climate, human considerations, and other natural resource information are used to determine the geographical boundaries of the common resource area

MLRA	CRA	CRA NAME	CRA DESCRIPTION
67B	67B.1	Central Great Plains, Southern Part	The Central High Plains, Southern Part CRA is broad, undulating to rolling plains dissected by streams and rivers. Local relief is measured in tens of feet on the plains. Soils are deep and formed in aeolian and alluvial materials. Pre-settlement vegetation was short grass prairies. Nearly all of this area in fallow cropland rotations or rangeland. Some cropland areas are irrigated.
69	69.1	Upper Arkansas Valley Rolling Plains	The Upper Arkansas Valley Rolling Plains CRA is broad, undulating to rolling shale plains occurring along the upper tributaries of the Arkansas River. Local relief reaches 200 feet. Soils are shallow to deep and formed in loess, aeolian, alluvial and outwash materials. Pre-settlement vegetation was short grass prairies and pinyon and juniper stands on the stony and rocky soils. Nearly all of this area is in rangeland. Small areas of irrigated cropland occur along the floodplains and terraces.
72	72.1	Central High Tableland	The Central High Tableland CRA is broad, level to gently rolling, loess mantled tableland. Local relief is measured in feet on the tableland tens of feet and major river valleys bordered by steep slopes. Soils are deep. Pre-settlement vegetation was short grass prairies. Nearly all of this area in cropland, both dry land small grain crops and irrigated corn and grain sorghum.

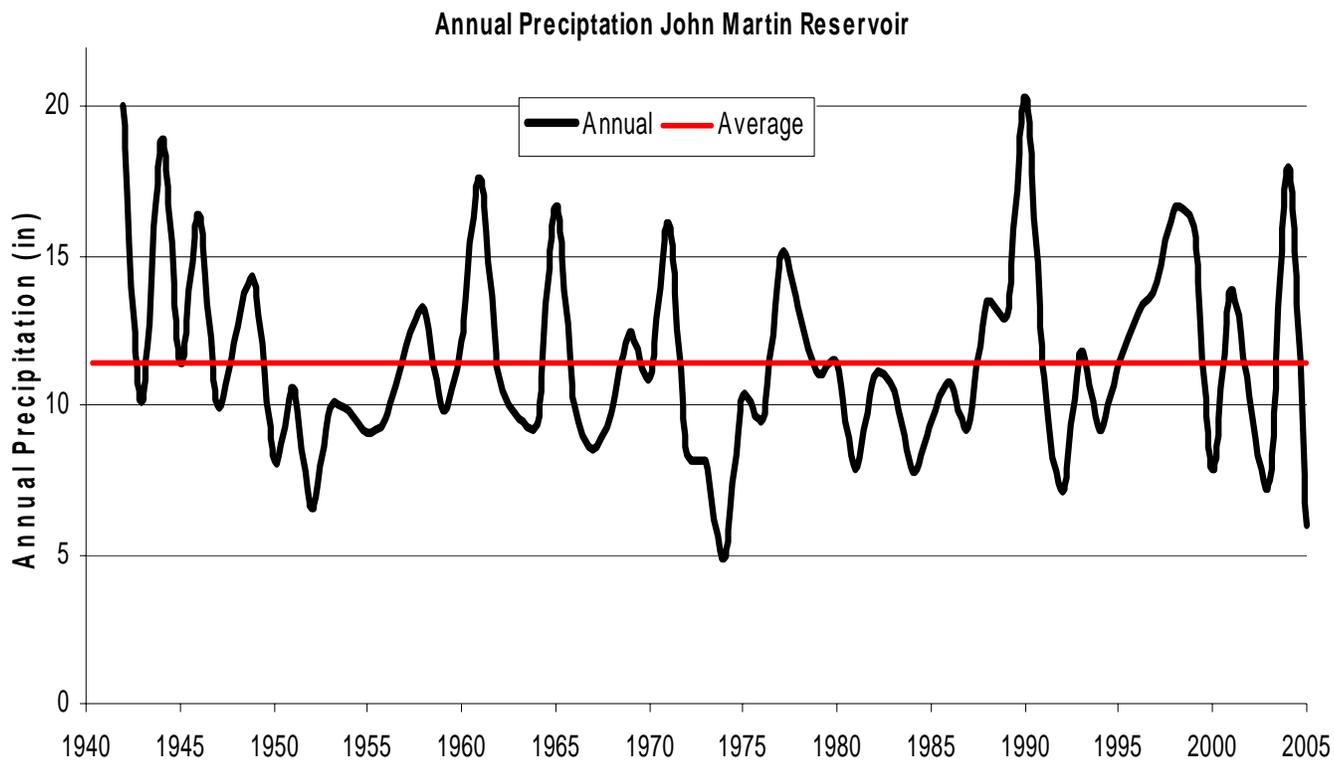
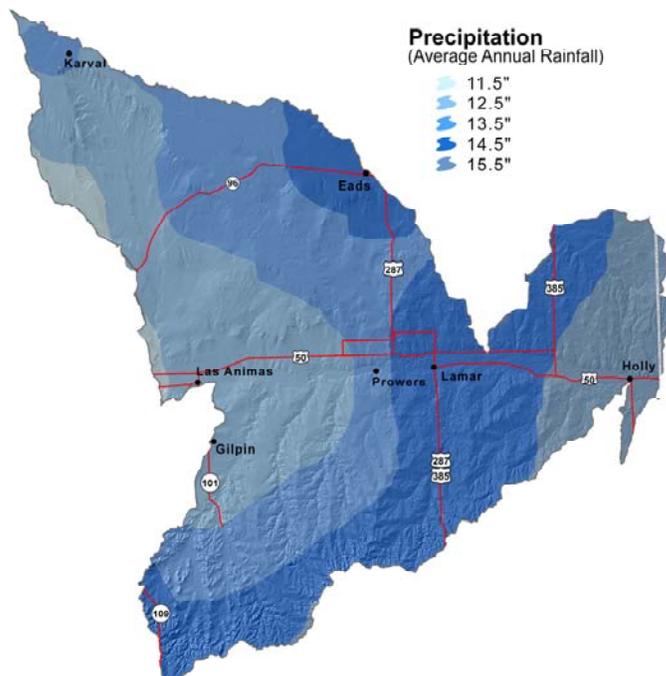


Vegetation Type	Acreage	Vegetation	Acreage		
Cropland	401,490	Agriculture	18,000		
		Dryland Agriculture	204,300		
		Irrigated Agriculture	174,410		
		Soil/Fallow	4,780		
Rangeland/ Grassland	2,045,600	Sparse Grass/Blowouts	79,720		
		Grass Dominated	1,156,140		
		Grass/Yucca Mix	320		
		Grass/Misc. Cactus Mix	142,260		
		Grass/Forb Mix	402,780		
		Greasewood	670		
		Shrub/Grass/Forb Mix	73,630		
		Sagebrush/Grass Mix	50,930		
		Sagebrush Community	8,080		
		Riparian	25,470		
		Herbaceous Riparian	26,540		
		Shrub Riparian	30		
		Forested Riparian	2,450		
		Juniper	38,940		
		Pinyon-Juniper	30		
		Sparse Juniper/Shrub/	37,580		
		Sparse PJ/Shrub/Rock	30		
		Forest	280	PJ-Oak Mix	1
				Cottonwood	280
		Urban/Built-up	2,860	Residential	2,860
Other	16,570	Sand Dune Complex	2,000		
		Rock	1		
Water	14,450	Water	14,450		
			2,466,682		



Precipitation

Droughts are regular visitors to the watershed as with the rest of Colorado. Statewide, in the 1900's alone, four prolonged dry spells occurred. There was one in the 1910s. Another, in the '30s, caused the dust-bowl period. The second worst drought on record in the state occurred in the mid-50s. A series of hot, dry summers following a period of scant mountain snowpack created water shortages. The fourth drought hit parts of Colorado in the late 1970s. In this century, the most severe drought since 1723 hit the state in 2002. Prior to the 1700's, researchers looking at tree ring records have found evidence of even more severe droughts, some lasting many years. Rainfall occurs as frontal storms in the spring and early summer and high intensity, convective thunderstorms in late summer. Maximum precipitation is from mid spring through late autumn. Precipitation in winter is snow. The average annual temperature is from 45 to 55 degrees F. The frost free period averages 162 days but ranges from 133 to 191 days.



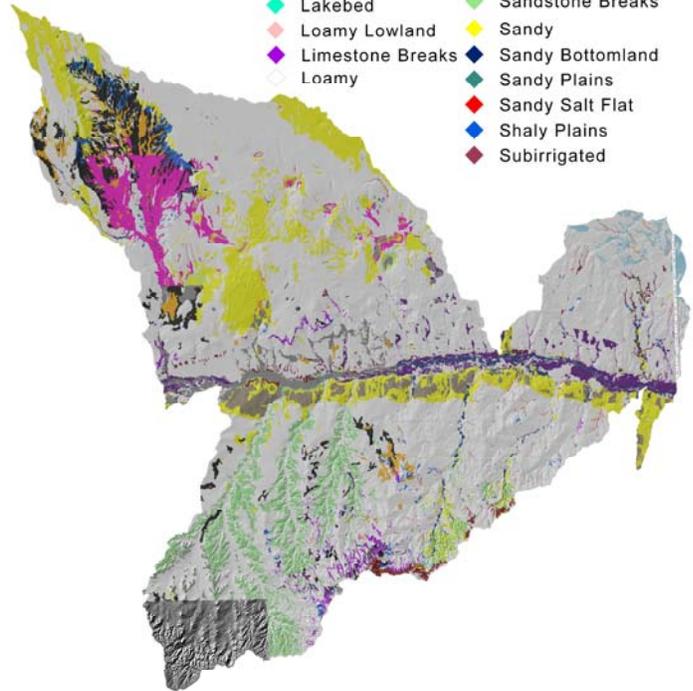
Ecological Sites

The plant community on an ecological site is typified by an association of species that differs from that of other ecological sites in the kind and/or proportion of species or in total production.

The Ecological Site names give an overall indication of the soils plant relationship in the area. More detailed descriptions of ecological sites are provided in the Field Office Technical Guide (FOTG). The FOTG is available in local offices of the Natural Resources Conservation Service (NRCS) and online at <http://www.nrcs.usda.gov/technical/efotg/>.

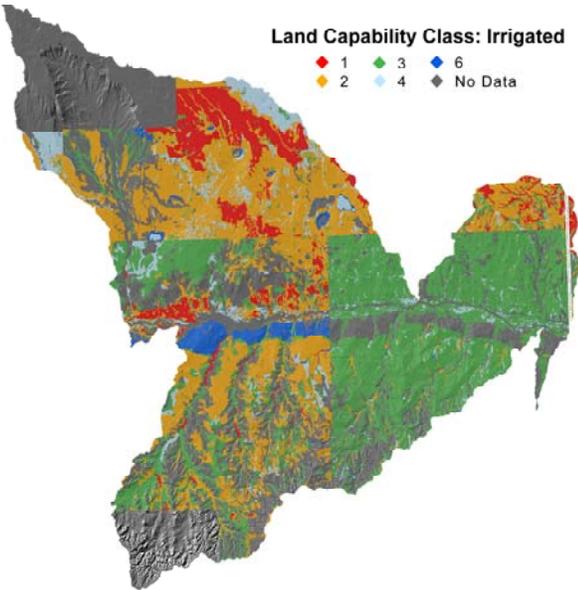
Soil: Ecological Site Names

- | | |
|--------------------|--------------------|
| ◆ No Data | ◆ Loamy Plains |
| ◆ Alkaline Plains | ◆ Overflow |
| ◆ Basalt Breaks | ◆ Plains Swale |
| ◆ Basalt Loam | ◆ Saline Overflow |
| ◆ Choppy Sands | ◆ Salt Flat |
| ◆ Clayey | ◆ Salt Meadow |
| ◆ Gravel Breaks | ◆ Sand - Deep |
| ◆ Lakebed | ◆ Sandstone Breaks |
| ◆ Loamy Lowland | ◆ Sandy |
| ◆ Limestone Breaks | ◆ Sandy Bottomland |
| ○ Loamy | ◆ Sandy Plains |
| | ◆ Sandy Salt Flat |
| | ◆ Shaly Plains |
| | ◆ Subirrigated |



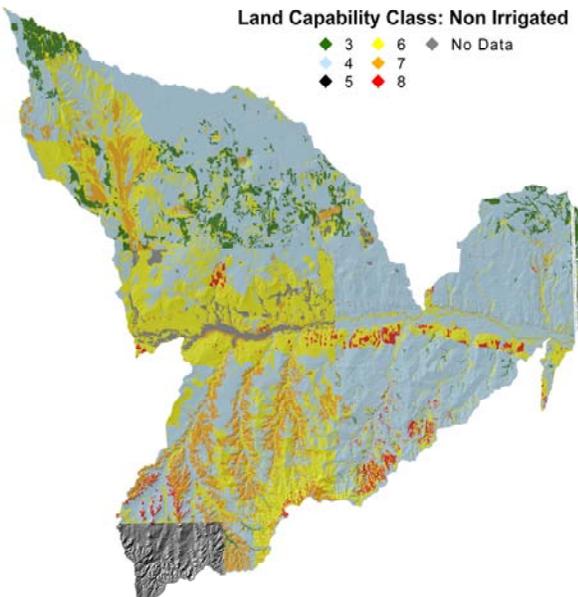
Land Capability Class: Irrigated

- | | | |
|-----|-----|-----------|
| ◆ 1 | ◆ 3 | ◆ 6 |
| ◆ 2 | ◆ 4 | ◆ No Data |



Land Capability Class: Non Irrigated

- | | | |
|-----|-----|-----------|
| ◆ 3 | ◆ 6 | ◆ No Data |
| ◆ 4 | ◆ 7 | |
| ◆ 5 | ◆ 8 | |



Class 1 - soils have few limitations that restrict their use.

Class 2 - soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class 3 - soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class 4 - soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class 5 - soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

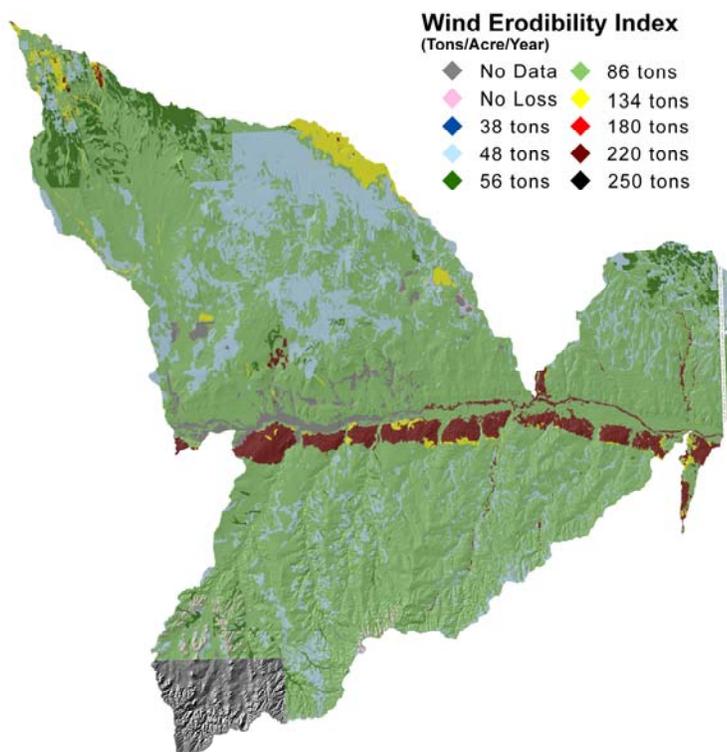
Class 6 - soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 - soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 - soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or aesthetic purposes.

The Wind Erodibility Index (I), is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion if it is assumed there is no vegetative cover or management.

There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

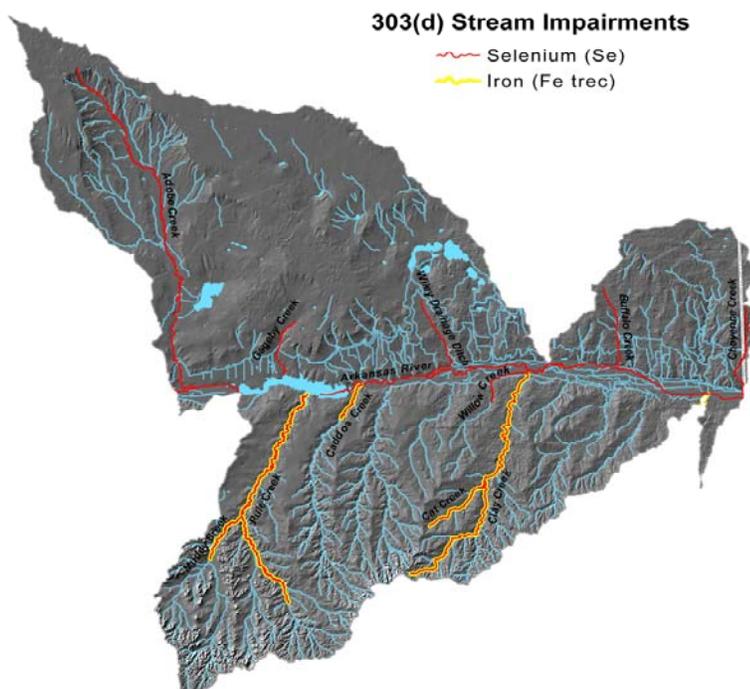


Section 303(d) of the Clean Water Act requires states to identify and list all water bodies where state water quality standards are not being met. Thereafter, TMDLs compromising quantitative objectives and strategies have been or will be developed for these impaired waters within the watershed in order to achieve their water quality standards.

Impairment Definition

Selenium (Se): A naturally occurring metal in marine shale that serves as a micronutrient. Excessive amounts impair aquatic life and bioaccumulation up the food chain occurs causing toxicity to birds, mammals, and humans.

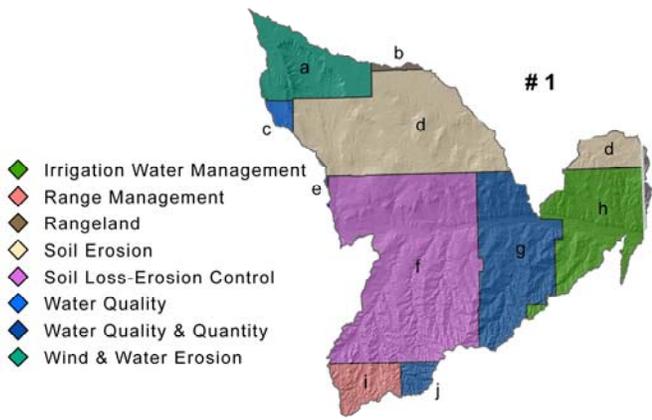
Iron (Fe): Iron is the fourth most abundant, by weight, of the elements that make up the earth's crust . The ferrous, orbivalent (Fe⁺⁺), and the Ferric, or trivalent (Fe⁺⁺⁺) irons are the primary forms of concern in the aquatic environment. Fe⁺⁺ can persist in waters void of dissolved oxygen and originate from groundwaters or mines when these are pumped or drained.



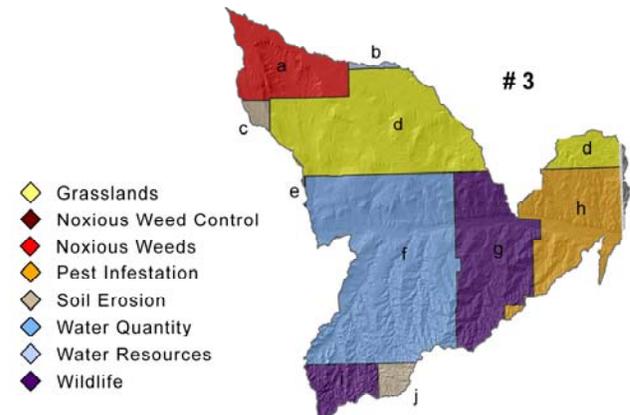
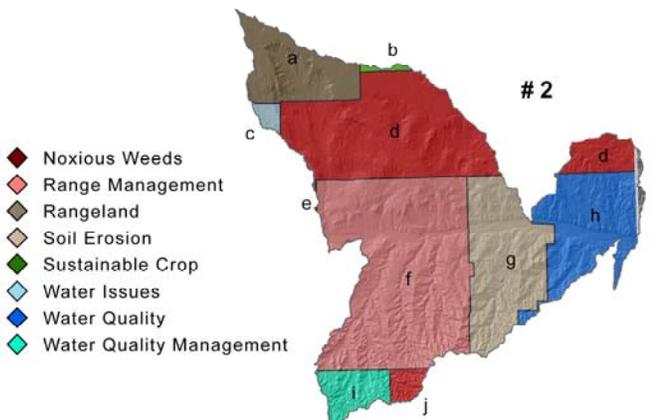
John Martin Reservoir Watershed Natural Resource Concerns

I. Conservation District Rankings of Natural Resource Concerns

Conservation District Map Legend	Erosion	Water Quantity & Quality	Rangeland	Noxious Weed Control	Wildlife Habitat	Trees	Salinity & Drainage
a PRAIRIE	5		4	3	2		
b CHEYENNE	4	3	5			2	
c WEST OTERO TIMPAS	4	5	2	3			
d KIOWA COUNTY	5		3	4	2		
e EAST OTERO	4	5	3	2	1		
f BENT COUNTY	5	3	4		2		
g PROWERS	4	5		2	3		1
h NORTHEAST PROWERS		5		4			
i BRANSON-TRINCHEA	1	4	5	2	3		
j BACA COUNTY	3	5		4	2		
TOTALS	35	35	26	24	15	2	1



Note: The Colorado Conservation Districts identified and prioritized these resource concerns during facilitated public meetings and are included in their Long Range Plans.



II. Other Identified Resource Concerns

Colorado State University

- On-going research in the Arkansas River has increased awareness of the following trends in agriculture and the environment in the river valley:
 - * Saline High Water Tables
 - * Soil Waterlogging/Salinization
 - Crop Yield Reduction
 - * Salt and Selenium Dissolution in the aquifer
 - Substantial return flow of salts and trace metals to the river
 - * High Water Tables Under Fallow Land and Invasive Phreatophytes
 - Nonbeneficial water consumption

NRCS—Major Land Resource Area Descriptions

- As more agricultural drainage is returned to the rivers, the level of dissolved solids and sediment causes some problems in this watershed.
- Major resource concern in this watershed include wind erosion, soil compaction due to tillage practices, increased salinization of cropland due to irrigation water management practices, and overall degradation of soil quality.



State and Federal Threatened, Endangered, and Candidate Species and Species of Special Concern in Upper Arkansas-John Martin Reservoir Watershed

Common Name	Scientific Name	Class	State Status/Federal Status	Comments
Arkansas Darter	<i>Etheostoma cragini</i>	Fish	Threatened/Candidate	Occurs in the watershed
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Birds	Threatened/None	May migrate through watershed and may winter near Arkansas River
Black-footed Ferret	<i>Mustela nigripes</i>	Mammals	Endangered/Endangered	No current records of occurrence
Black-tailed Prairie Dog	<i>Cynomys ludovicianus</i>	Mammals	Concern/None	Occurs in the watershed
Burrowing Owl	<i>Athene cunicularia</i>	Birds	Threatened/None	Occurs in the watershed
Common Kingsnake	<i>Lampropeltis getula</i>	Reptiles	Concern/None	Occurs in the watershed
Couch's Spadefoot Toad	<i>Scaphiopus couchii</i>	Amphibians	Concern/None	May occur in the watershed
Ferruginous Hawk	<i>Buteo regalis</i>	Birds	Concern/None	Occurs in the watershed
Flathead Chub	<i>Platygobio gracilus</i>	Fish	Concern/None	Occurs in the watershed
Least Tern	<i>Sterna antillarum</i>	Birds	Endangered/Endangered	Occurs in the watershed
Lesser Prairie Chicken	<i>Tympanuchus pallidicinctus</i>	Birds	Threatened/Candidate	Occurs in the watershed
Long-Billed Curlew	<i>Numenius americanus</i>	Birds	Concern/None	Occurs in the watershed
Massasauga	<i>Sistrurus catenatus</i>	Reptiles	Concern/None	Occurs in the watershed
Mountain Plover	<i>Charadrius montanus</i>	Birds	Concern/None	Occurs in the watershed
Northern Leopard Frog	<i>Rana pipiens</i>	Amphibians	Concern/None	Occurs in the watershed
Piping Plover	<i>Charadrius melodus circumcinctus</i>	Birds	Threatened/Threatened	Occurs in the watershed
Plains Leopard Frog	<i>Rana blairi</i>	Amphibians	Concern/None	Occurs in the watershed
Plains Minnow	<i>Hybognathus placitus</i>	Fish	Endangered/None	Occurs in the watershed
Swift Fox	<i>Vulpes velox</i>	Mammals	Concern/None	Occurs in the watershed
Texas Horned Lizard	<i>Phrynosoma cornutum</i>	Reptiles	Concern/None	Occurs in the watershed
Yellow Mud Turtle	<i>Kinosternon flavescens</i>	Reptiles	Concern/None	Occurs in the watershed
Suckermouth Minnow	<i>Phenacobius mirabilis</i>	Fish	Endangered/None	May occur in the watershed
Western Snowy Plover	<i>Charadrius alexandrinus</i>	Birds	Concern/None	May occur in the watershed

Shortgrass prairie and sandsage-mixed bunchgrass rangeland are the dominant terrestrial habitat types in this watershed. Burrowing owl, mountain plover, black-tailed prairie dog, massasauga, and swift fox are representative species for the shortgrass habitat. Lesser prairie chickens use the sand sage-mixed bunchgrass rangeland habitats. Water is scarce on the shortgrass prairie and the native species using this habitat are those that can survive without abundant water supplies. The Arkansas River with its associated riparian areas, several large reservoirs, and scattered livestock ponds provide aquatic habitats in the area. Declining warmwater fish species are important in this watershed. The permanent water provided by the Arkansas River supports some fish species of concern that are not usually found in other places in Colorado. Tamarisk has displaced the native willow-cottonwood riparian ecosystem in many places along the Arkansas River. Bald eagles winter in the area around the Arkansas River and the large reservoirs, using these aquatic and riparian habitats for foraging and roosting. Economically important wildlife species that occur in the watershed include black bullhead, catfish, crappie, sunfish, pronghorn (antelope), mule and white-tailed deer, wild turkey, and bobwhite and scaled quail.

Social Data	Lincoln	Kiowa	Las Animas	Bent	Prowers	Baca	Crowley
Demographics (US Census, American Fact-finder)							
Total population	6,087	1,622	15,207	5,998	14,483	4517	5,518
Male	3,451	811	7,441	3,379	7,278	2247	3,711
Female	2,636	811	7,766	2,619	7,205	2270	1,807
Median age (years)	37.8	39.7	40.9	37.3	32.4	42.9	36.6
White	5,253	1,559	12,566	4,770	11,379	4,234	4,577
Black or African American	302	8	60	219	43	2	389
American Indian and Alaska Native	57	18	387	134	177	54	143
Asian	34	0	57	34	54	7	45
Native Hawaiian and Other Pacific Islander	2	1	30	0	4	4	1
Some other race	344	23	1525	315	2487	135	263
Hispanic or Latino (of any race)	519	51	14816	1814	4766	317	1244
Economic Characteristics							
In labor force-population 16 years & over	2,535	776	6,558	2,303	6,976	2,072	1,469
Median household income (dollars)	31,914	30,494	28,273	28,125	29,935	28,099	26,803
Median family income (dollars)	39,738	35,536	34,072	34,096	34,202	34,018	32,162
Per capita income (dollars)	15,510	16,382	16,829	13,567	14,150	15,068	12,836
Families below poverty level	114	43	572	231	546	165	148
Individuals below poverty level	590	195	2573	988	2755	749	653
County Agricultural Characteristics							
Farms (number)	455	357	567	265	531	608	217
Land in farms/ranches (acres)	1,428,400	896,772	2,304,766	735,826	861,778	1,080,386	375,413
Average size farm/ranch (acres)	3,139	2,512	4,065	2,777	1,623	1,777	1,730
Median size farm (acres)	1,497	1,280	1,000	580	640	1,120	540
Average age of farmer or rancher	55.6	55.2	57.6	53.9	53.3	57.2	56.7
Net cash return from ag sales (\$1,000)	4,829	944	1,798	5,898	8,467	5,944	5,501
Cattle and calves (number)	43,500	15,000	47,000	45,000	110,000	56,000	48,000

Selected Conservation Application Data John Martin Watershed 110200009						
	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	Total
Total Conservation Systems Planned (Acres)	958,635	186,252	Not Avail.	165,411	192,505	1,502,803
Total Conservation Systems Applied (Acres)	430,848	250,850	Not Avail.	150,570	71,803	904,071
Practices						
Prescribed Grazing	40,915	10,907	9,644	120,616	13,731	195,813
Upland Wildlife Habitat Management	14,780	18,566	8,622	25,005	8,061	75,034
Conservation Cropping System	Not Avail.	Not Avail.	7,912	11,892	16,440	36,244
Irrigation Water Management	10,810	8,690	3,760	6,411	7,077	36,748

Conservation Systems to Address Major Resource Concerns				
Primary Resource Concern:		Rangeland Health		
Conservation System Description:	Prescribed Grazing—planned management that provides adequate recovery opportunity between grazing events and proper stocking of animals. Estimate 1,448,657 acres to be treated on median sized ranches of 4,500 acres.			Based on Conservation System Guide Code: CO 67B.1-GR-01-R-Grazing
Practices	Unit	Quantity	Cost/Unit (\$)	Estimated Cost per Median Sized Ranch (\$)
Prescribed Grazing				
Fence (382)	Ft.	21,120	0.6	12,672
Pest Management (595)	Ac.	300	4,500	4,500
Pipeline (516)	Ft.	15,000	2.40	36,000
Upland Wildlife Habitat Management (645)	Ac.	300	na	0
Watering Facility (614)	No.	2	410	820
Windbreak/Shelterbelt Establishment (380)	Ft.	1,000	.85	850
Costs to apply prescribed grazing per median sized ranch of 4,500 acres	No.	322	54,842	\$17,659,124
Subtotal Rangeland costs:				\$17,659,124

Conservation Systems to Address Major Resource Concerns (cont'd)

Primary Resource Concern: Soil Erosion By Wind on dryland crops				
Conservation System Description: Seasonal residue management with Conservation crop rotation, Nutrient and Pest Mgt			Reference Conservation System Guide Code: CO 67B.1-CR-Dryland-R-2	
Practices	Unit	Quantity	Cost/Unit (\$)	Estimated Cost (\$)
Conservation Crop Rotation (328)	Ac	60,317	10	603,170
Residue Mgmt, Seasonal (344)	Ac	60,317	5	301,585
Nutrient Management (590)	Ac	53,000	5	265,000
Pest Management (595)	Ac	53,000	15	795,000
Subtotal Costs Dryland Crops:				\$1,964,755
Primary Resource Concern: Water Quality				
Conservation System Description: Sprinkler irrigation system with IWM, Crop rotation, Mulch-till, Nutrient and Pest Mgt..			Reference Conservation System Guide Code: CO 67B.1-CR-Pivot-R-2	
Practices	Unit	Quantity	Cost/Unit (\$)	Estimated Cost (\$)
Irrigation System, Sprinkler (442)	Ac	70,023	779	54,547,917
Irrigation Water Management (449)	Ac	63,000	5	315,000
Pest Management (595)	Ac	63,000	15	945,000
Subtotal Irrigated Crops:				\$55,807,917

General Effects, Impacts, and Estimated Costs of Application of Conservation Systems

Landuse	Resource Concern	Measurable Effects	Non-measurable Effects	Estimated Cost (\$)
Rangeland	Plants		Improved plant condition, productivity, health and vigor. Grazing animals have adequate feed, forage, and shelter.	17,659,124
Dryland Crop	Soil	258,650 Total Tons/Year	Cropland sustainability	1,964,755
Irrigated Crop	Water		Nutrients and organics are stored, handled, disposed of, and managed so that surface water uses are not adversely affected.	55,807,917
Estimated Total Costs to Address Major Resource Concerns:				\$75,431,796

FOOTNOTES/ BIBLIOGRAPHY

303(d) listed streams within John Martin Reservoir Watershed were created using data from Colorado Department of Public Health & Environments' Water Quality & Control Commission. Impaired streams are current as of April 30, 2006. For a list of all Colorado impaired streams, locations and priority ratings, visit

<http://www.cdphe.state.co.us/regulations/wqccregs/100293wqlimitedsegtmls.pdf>.

Threatened and Endangered Species information was gathered using data from the Colorado Division of Wildlife (CDOW) Natural Diversity Information Source (NDIS). NDIS GIS data may be downloaded at <http://ndis.nrel.colostate.edu>. For more information on Colorado's Endangered & Threatened Species, as well as Species of Concern, visit <http://wildlife.state.co.us/WildlifeSpecies/SpeciesOfConcern/ThreatenedEndangeredList/ListOfThreatenedAndEndangeredSpecies.htm> or <http://mountainprairie.fws.gov/endspp/CountyLists/COLORADO.htm>

Resource Concerns were identified using the Colorado Association of Conservation Districts' (CACD) long range (10 year) plans from the period of 1996-2000. For more information on Colorado's Conservation Districts, visit <http://www.cacd.us>.

Maps were generated using Soil Survey Geographic Database (SSURGO) tabular and spatial data. SSURGO data was downloaded for the following Colorado surveys:

Baca County (CO009) Published 12/07/2005

Bent County (CO011) Published 12/07/2005

Crowley County (CO025) Published 12/20/2005

Lincoln County (CO073) Published 12/19/2005

Kiowa County (CO061) Published 12/19/2005

Las Animas County Area (CO628) Published 05/01/2006

Prowers County (CO099) Published 12/20/2005

To download SSURGO data, visit <http://soildatamart.nrcs.usda.gov>. The surveys were then loaded into Soil Data Viewer <http://soildataviewer.nrcs.usda.gov> (a tool built as an extension to ArcMAP for quick geospatial analysis of soil data for use in resource assessment) and the subsequent data was exported to a shapefile.

Vegetation data was generated using the Colorado Division of Wildlife's "Colorado Vegetation Classification Project" (CVCP) data. Completed in 2003, the CVCP is a landscape level vegetation dataset created using Landsat TM imagery and then formatted for GIS use. The species identified are an overview of the most common species associated in each cover type, in order of greatest occurrence. For more information on the Colorado Vegetation Classification Project, visit <http://ndis.nrel.colostate.edu/coveg>. Kansas vegetation generated from the National Land Cover Database (NLCD 2001). For more information, visit http://www.mrlc.gov/mrlc2k_nlcd.asp

Common Resource Area (CRA), a subdivision of the Major Land Resource Area (MLRA), is a geographical area where resource concerns, problems, or treatment needs are similar. Geographic boundaries of a CRA are determined by landscape conditions, soil, climate, human considerations and other natural resource information. For more information on Common Resource Areas visit <http://soils.usda.gov/survey/geography/cra.html>.

Average Annual Precipitation data was developed through a partnership between the Natural Resources Conservation Service's (NRCS) National Water and Climate Center (NWCC), the National Cartography and Geospatial Center (NCGC), and the PRISM (the Parameter-elevation Regressions on Independent Slopes Model) group at Oregon State University (OSU), developers of PRISM. Mean annual precipitation maps were developed calculating averages of rainfall for the period of 1961-1990. For more information on PRISM data visit <http://www.ncgc.nrcs.usda.gov/products/datasets/climate/docs/fact-sheet.html> or for more information about technical aspects of PRISM, visit the PRISM website at <http://www.ocs.orst.edu/prism>.

Land Ownership (status, 2004 dataset) data was obtained from the Colorado Department of Transportation (CDOT). For more information, visit <http://www.dot.state.co.us>.

Relief & Elevation maps were created using the National Elevation Dataset (NED), 30m Digital Elevation Model (DEM) raster product assembled by the U.S. Geological Survey (USGS). A hillshade grid was created from the 30m DEM to create a 3D effect. For more information about the NED visit <http://ned.usgs.gov>. The data was downloaded from the NRCS Geospatial Data Gateway at <http://datagateway.nrcs.usda.gov>.

Footnotes/Bibliography continued

Conservation Systems to address major resource concerns were extracted from the Conservation Systems Guides (CSG) compiled from local conservationists by the NRCS Ecological Sciences Section at the Lakewood State Office. Contact is Eugene Backhaus, 720-544-2868.

Effects and Impacts of application of conservation systems were extracted from Colorado eFOTG, Section III, Resource Quality Criteria, NRCS, Colorado, March 2005 and CSG.

Cost Estimates to apply conservation systems were developed by estimating costs per median size farm and ranch and calculating costs from the field office cost lists.