



Kanab Watershed Coordinated Resource Management Plan

A resource issue approach to landscape level watershed management. This CRMP includes resource goals and concerns of local state, and federal shareholders.

Project Sponsors: Kane County
Conservation District, Utah Association of
Conservation Districts Zone Five & State of
Utah Department of Agriculture. 2015

~Acknowledgments~

The Kane County Conservation District Board and Utah Association of Conservation District Zone Five would like to express their thanks to the following organizations, and individuals for their numerous contributions in time, and knowledge in the development of the Kanab Watershed Coordinated Resource Management Plan. Additional thanks are extended to the support staff from these organizations and gratitude to the natural resources of Kanab Creek Watershed whose bounty we depend upon.

American Conservation Experience: Joe Beardsley, Jake Powell, Matt Fidler; Arizona Division of Water Resources: Krista Osterberg; Arizona Division of Water Rights: Kevin Hadder; Arizona Strip Field Office/BLM: Lorraine Christian, John Herron, Justin Reeves, Robert Smith; Arizona State Lands: Raymond Keough; Best Friends Animal Sanctuary: Jarad Brinkerhoff, Butch Page, Dave Porter; BLM Kanab Field Office: Dan Alberts, Lisa Church, Jon Christian, Levi LaFeve, John Reese, Carson Gubler ;BLM Color County Field Office: Vicki Tyler; Coral Pink Sand Dunes State Park: Michael Franklin; Dixie National Forest-Powell Ranger District: Paul Hancock ; BLM Grand Staircase Escalante National Monument: Raymond Brinkerhoff, Richard Madril, Cameron McQuivey, Kevin Miller, Cynthia Staszak, Matthew Zweifel ; BLM Arizona Fire and Vegetation: Rance Marquez; Arizona Fish and Game: Luke Thompson; Fredonia NRCS Field Office: Kyle Spencer, Claire Poulsen; Fredonia CD Board and Chair: Danny Bullets Jr.; Fredonia Town Council and management: Andre Bundy, Christy Riddle; North Kaibab Band of Paiute Indian Tribal Council Chairs and staff: Daniel Bullets, Scott King, Roland Maldonado, Manuel Savala;; Kanab City Librarians; Kane County CD Board Chair: Bruce Bunting; Kane and Garfield County USU Extension Office: Kevin Heaton; Kane County Volunteer Coordinator: Lanell Dove; Kane County Weed Department: Carl Gurr, Louis Potter; North Kaibab Forest(Kaibab National Forest): Angela Gatto, Mike Hanneman, David Herscher, Marilyn Porter, Connie Reid, David Vincelett, Randall Walker; North Rim Consulting: Byard Kershaw; Utah (Panguitch) Field Office-NRCS: Kristi Hatch-Westland, Zach Orton; SITLA: Barry Biedger, Ron Thompson; NRCS-Snow Survey: Randy Julander; St. George City Librarians and staff: Santa Clara City Librarians and staff; Utah Association of Conservation Districts: Anne Excel, Tyce Palmer; Utah State Farm Bureau: Utah Division of Oil, Gas and Mining: Utah Division of Water Resources: Carmen McDonald, Rick Webster; Utah Division of Water Quality: Amy Dickey, Christy Esplin, Merlin Esplin; Utah Division of Water Rights: Kurt Vest; Utah Division of Wildlife Resources: Gary Bezzant, Trail Kreitze; Utah State University: Department of Watershed Science: Dr. Joseph M. Wheaton

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TABLE of CONTENTS

PAGE

Chapter 1: Kanab Watershed CRMP

Introduction.....	1
Resource Issue Trends	2
Utah Association of Conservation Districts & Committees	5

Chapter 2: Executive Summary

Kanab Watershed Boundary Map : HUC 8-10	7
Waterbody ID.....	10

Chapter 3: Land Ownership and Demographics

Land Ownership and Demographics	11-14
Kane County Demographics.....	15-16
Fredonia Township and Coconino County Demographics.....	17

Chapter 4: Physical and Natural Features

Hydrology and Precipitation	18-20
Geology	21-23
Air Quality: Arizona and Utah	23-26
Climate	27-29
Rangeland	29-32
National Forests: North Kaibab and Dixie	33-36
Riparian Zones and Wetlands	37-38
Fire and Vegetation	38-40

TABLE of CONTENTS

PAGE

Fire Vegetation.....	38-40
Soils: Arizona and Utah.....	40-42
Noxious Weeds: Arizona and Utah	43-47
Wildlife.....	48-51

Chapter 5: Water Resources

Water Resources	52
Ambient Water Quality: AZ and UT	53-56
Benthic Microorganisms	57
Water Rights: AZ and UT.....	57-58
EPA: Nine Essential Elements and CRMP	58-69

Chapter 6: Cultural Resources

Cultural Resources	60
Water is Life.....	61

Chapter 7: Resource Issues and Concerns

Introduction.....	62
Agriculture and Rangeland: Arizona Strip BLM	63-67
Agriculture and Rangeland: Fredonia Conservation District	68
Agriculture and Rangeland: Utah.....	69-70
Air Quality: AZ and UT.....	70-71
Climate: AZ and UT	72
Cultural Resources	73

TABLE of CONTENTS

PAGE

Forests: AZ.....	81-87
Forests: UT.....	88
Information and Education: AZ and UT	89-90
Noxious Weeds Kane County.....	91-94
Oil, Gas and Mining: AZ and UT	95
Water Quality: AZ.....	96
Water Quality: UT	97
Wildlife: AZ.....	98-100
Wildlife: UT	101-103
Beaver Restoration Assessment Tool.....	104-107

Chapter 8: Appendices

Introduction.....	108
Natural Resource Survey Results Kane County.....	109-110
Natural Resource Survey Results Fredonia Township	111
Memorandum of Understanding	112-116
MOU Signatories	117
Alton Mine-BLM EIS.....	118
Arizona Climate Change Action Plan.....	118
Arizona Game and Fish Department Resource Management Plan	118
Arizona Strip Bighorn Sheep Management Plan	118
Arizona Strip Fire Management Plan	118

TABLE of CONTENT

PAGE

Arizona Division of Water Resources: 303d listed Waters	118
BLM: Arizona Strip Resource Management Plan	118
BLM: Grand Staircase Resource Management Plan	118
BLM: Kanab Field Office: Utah Greater Sage Grouse- Land Use Plan Amendment	118
BLM: Kanab Field Office Resource Management Plan	118
BLM: Summary of Location and Discharge for Springs, Seeps and Streams: EIS.....	118
BRAC: Governors Blue Ribbon Advisory Council: Utah Climate Change	118
BRAT: The Utah Beaver Restoration Assessment Tool:	119
Bureau of Indian Affairs: W. Region Integrated Noxious Weed Management Plan	119
Coconino County Resource Management Plan.....	119
Kane Conservation District Resource Management Plan	119
North Kaibab Ranger District Final Forest Plan and FEIS.....	119
North Kaibab Ranger District: Burnt Corral Vegetation Management Project	119
North Kaibab Ranger District: Kanab Creek Invasive(s)	119
North Kaibab Ranger District: Kanab Creek Vegetative Cover Types	119
Kaibab Band of Paiute Indians: Yanawant: Paiute Places and Landscapes in the AS...	119
Utah Division of Water Resources: M & I Water Supply and Uses in Kanab Creek	120
Utah 303d Listed Waters	120

Chapter 9: Supplemental Documents Links

List of Supplemental Documents	121-125
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References Cited

LIST of TABLES

TABLE 1.1:	Summary of the most frequently discussed natural resource and cultural issues of the Kanab Watershed.
TABLE 1.2:	UACD sponsored statewide conservation programs.
TABLE 1.3:	List of Kanab Creek CRMP participants and their advisory roles.
TABLE 2.1:	List of Arizona and Utah Kanab Creek HUC 8-10 Watershed maps.
TABLE 2.2:	Arizona and Utah List of the NEMO-Colorado-Grand Canyon Watershed (GCWS). HUC 10, sub-watershed name and area (sq. mi.). Kanab watershed is a sub-watershed of the GCWS.
TABLE 3.1:	Major land-use distribution: Arizona and Utah. 2015
TABLE 3.2:	United States census demographics data for Kane County, Utah, 2010
TABLE 3.3:	All dollar figures are in current dollars. Sources: Utah Population Estimates Committee; U.S. Census Bureau
TABLE 3.4:	Demographics of Fredonia township, Arizona.
TABLE 3.5:	Coconino County Demographics. Arizona Department of Commerce. 2008.
TABLE 4.1:	Annual precipitation rates by basins. Arizona and Utah Division of Water resources. 2010.
TABLE 4.2:	Kane County Resource Plan: Natural resource issues of concern. 2008
TABLE 4.3:	2005 Summary of Emissions by Source (in tpy). Coconino, Mohave Counties, AZ. Kane and Washington Counties, UT.
TABLE 4.4:	Summary of National Agricultural and Livestock laws and programs.
TABLE 4.5a:	Kaibab Forest and North Kaibab Ranger District (NKRd) Potential Natural Vegetative types (PNVT).
TABLE 4.5b:	Vegetation types Powell Ranger District: Dixie National Forest
TABLE 4.6:	Fire Regime Condition Class (FRCC).
TABLE 4.7:	Major land areas and soil types of Kane County http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs141p2_032411.pdf
TABLE 5.1:	Comparison of water sources Kane County, Utah (2006) and Coconino County, Arizona. (2001-2005)
TABLE 5.2:	List of water quality monitoring sites in Arizona and Utah. Contains links to testing sites, with the exception of Kaibab Band of Paiutes. STORET summary report, 2009.
TABLE 5.3:	Comparison of culinary and secondary water use between Kane and Coconino counties.
TABLE 5.4:	Sub-watersheds of Kanab Creek and metal contaminant levels, and areas requiring further testing. ADWQ.
TABLE 5.5:	List of Designated Uses for Surface Waters of Utah, Utah Division of Water Quality. 2015.
TABLE 5.6:	Utah Division of Environmental Quality reach description for upper Kanab Creek and designated uses.
TABLE 5.7:	303(d) listed Kanab Creek Assessment Units (Subject to change dependent on EPA comment-June 2015)
TABLE 5.8:	Summary of current Kanab Creek resource issues and Environmental Protection Agency (EPA) Nine Essential Elements for watershed management.
TABLE 5.9:	State of Arizona restricted and regulated noxious weed list by category.
TABLE 5.10:	State of Utah noxious weed list by category.
TABLE 5.11:	State of Arizona Regulated and Restricted Noxious Weed List https://agriculture.az.gov/r3-4-245-prohibited-noxio
TABLE 5.12:	State of Utah noxious weed list by category Class A, B or C.
TABLE 5.13:	Arizona and Utah State Wildlife Management Action Plans 2012-current.
TABLE 5.14:	Summary of Utah Wildlife Species of Greatest Conservation Need. (UACD/NRCS 2006)
TABLE 7.1:	Suggested Arizona Strip BLM rangeland treatments.
TABLE 7.2:	Arizona Strip BLM top resource issues and recommended treatments for rangeland and agriculture.
TABLE 7.3:	Agricultural and rangeland projects prioritized for Fredonia, AZ., Conservation District, and Arizona NRCS rangeland recommended current and potential projects.
TABLE 7.4:	Agricultural and rangeland projects as recommended for Utah boundaries and cooperative Arizona projects within the Kanab Watershed.
TABLE 7.5:	Summary of the Arizona air quality recommendations made by Kanab Watershed CRMP advisory committee members.
TABLE 7.6:	Summary of the Utah air quality recommendations made by Kanab Watershed CRMP advisory committee members.
TABLE 7.7:	Summary of Arizona climate change recommendations made by the Kanab Watershed CRMP advisory committee members.
TABLE 7.8:	Summary of Utah climate change recommendations made by the Kanab Watershed CRMP advisory committee.
TABLE 7.9:	Summary of Arizona and Utah cultural resources projects and assessments both present and future within the Kanab Watershed.
TABLE 7.10:	North Kaibab Ranger District prioritized main resource issue recommendations.
TABLE 7.11:	Utah Dixie National Forest did not identify any resource issues during the 2014-2014 Kanab Watershed CRMP development.
TABLE 7.12:	Multi-agency noxious weed resource issue recommendations in Arizona and Utah portions of the watershed.
TABLE 7.13:	The top information and education programs recommended by advisory committees.

TABLE 7.14:	Fire and Vegetation treatments and assessments as recommended by AZ and UT BLM, North Kaibab National Forest.
TABLE 7.15:	Arizona Oil, Gas and Mining Resource Issues. Kanab Creek CRMP. 2014-2015.
TABLE 7.16:	Utah Oil, Gas and Mining Resource Issues. Kanab Creek CRMP. 2014-2015.
TABLE 7.17:	State of Arizona water quality resource issues in the Kanab Creek Watershed CRMP. 2014-2015.
TABLE 7.18:	State of Utah water quality resource issues in the Kanab Creek Watershed CRMP. 2014-2015.
TABLE 7.19:	State of Arizona, and Arizona Strip wildlife related resource issues ranked according to immediate concern.
TABLE 7.20:	Utah wildlife resource issues, evaluations and time-table for future treatment prioritized goals.
TABLE 7.21:	Kane County resource issue survey results pertaining to water resources, air quality and vegetation.
TABLE 7.22:	Kane County resource issue survey results for water supply quality, and soil related issues. 2014-2015.
TABLE 7.23:	Kane County resource issue survey results for open-space, wild-life, wild-fire, agricultural and noxious weeds related issues 2014-2015.
TABLE 7.24:	Kane County resource issue survey results for open-space, wild-life, wild-fire, agricultural and noxious weeds related issues 2014 -2015.
TABLE 7.25:	Coconino County: Fredonia township Kanab Watershed CRMP natural resource survey results for culinary water protection, non-native specie removal and revegetation projects, water quality and soil. 2014-2015.
TABLE 7.26:	Coconino County: Fredonia township Kanab Watershed CRMP natural resource survey results for fire and vegetation questions, soil erosion, and other water related questions pertaining to culinary water concerns. 2014-2015.

LIST of FIGURES

FIGURE 1.1:	Summary of the EPA ‘Nine Essential Elements’ for Watershed Management plans
FIGURE 2.1:	Kanab Creek Watershed. Map Credit. D. Alberts. BLM KFO
FIGURE 3.1	Land Ownership Kanab Creek Watershed, Arizona. Map Credit: Arizona Department of Water Resources
FIGURE 3.2:	Kanab Creek Watershed land-ownership. Kane County. NRCS. Map credit. Lee. Woorsely
FIGURE 3.3:	Utah School and Institutional Trust Land Administration (SITLA) lands in Kanab Watershed. 2014
FIGURE 4.1:	Kanab Plateau Basin Meteorological Stations and Annual Precipitation. Arizona Department of Water Resources
FIGURE 4.2:	Geology of the Kaibab Plateau. AZGS. 1988
FIGURE 4.3:	NRCS Streamflow Forecasts. May 2015.
FIGURE 4.4:	Stratigraphic units in Kane County showing relationship; E-W. USGS.
FIGURE 4.5:	Proposed mineral withdrawal areas. Prepared by U.S. Geological Survey and AS BLM
FIGURE 4.6:	Geology of Coconino County, Arizona. ADM/USGS. http://pubs.usgs.gov/sim/2006/2895/SIM2895
FIGURE 4.7:	Kaibab National Forest boundaries.
FIGURE 4.8:	Dixie National Forest boundaries.
FIGURE 4.9:	Arizona soil types Kanab Creek Watershed. 1
FIGURE 4.10:	Arizona soil types Kanab Creek Watershed. 2
FIGURE 4.11:	Arizona soil types Kanab Creek Watershed. 3
FIGURE 4.12:	Utah Soil Profile. Utah State University Extension Service.
FIGURE 6.1:	Traditional Southern Paiute Territory Band Division. Bureau of Indian Affairs (BIA)
FIGURE 7.1:	Arizona Strip main noxious weed species, location and approximate acreage. 2014-2015. AS BLM
FIGURE 7.2:	Arizona Strip BLM route designations in Ferry Swale Area. Map credit: AS BLM
FIGURE 7.3	Upper Kanab Watershed Vegetative Management Project Alternative-A. Proposed action.
FIGURE 7.4:	Alternative B for Upper Kanab Creek Watershed Vegetative Management Projects. 2014-2015
FIGURE 7.5	Alternative C for Upper Kanab Creek Watershed Vegetative Management Projects. 2014-2015
FIGURE 7.6:	Kanab Creek Watershed. Kaibab National Forest. Map index for existing vegetation and noxious weeds
FIGURE 7.7:	Kaibab National Forest Boundary map, including riparian habitat, fire history polygons and invasive and noxious weeds.
FIGURE 7.8:	Kaibab National Forest threatened and endangered species habitat polygons for Mexican Owl (MEO) and Kaibab Squirrel (KASQ).
FIGURE 7.9:	Kane County Weed Department map of Hoary cress and Russian Thistle infestations and treatments. 2015. Map Credit. L. Pratt
FIGURE 7.10:	Kane County Weed Department map of Russian Thistle infestations and treatments. 2015. Map Credit. L. Pratt
FIGURE 7.11:	Kane County Weed Department map of Hoary cress and infestations and treatments. 2015. Map Credit. L. Pratt
FIGURE 7.12:	Arizona Fish and Game, Big Horn Sheep WHA. Map Credit: L. Thompson.
FIGURE 7.13:	Upper Kanab Watershed. Existing Beaver Dam Capacity Model. Map Credit: J. Wheaton. Utah State University
FIGURE 7.14:	Upper Kanab Watershed. Potential Beaver Management Zone. Map Credit. J. Wheaton. Utah State University
FIGURE 7.15:	Upper Kanab Watershed. Historic Beaver Dam Capacity Model. Map Credit. J. Wheaton. Utah State University
FIGURE 7.16:	Upper Kanab Watershed. Potential Beaver –Human Conflict Map Credit. J. Wheaton. Utah State University. BRAT

Kanab Creek Watershed: Kaibab National Forest. Map Index for existing vegetation and invasive botanical species.



Introduction: Kanab Watershed Coordinated Resource Management Plan

The wilderness holds answers to more questions than we have yet learned to ask. *Nancy Newhall*

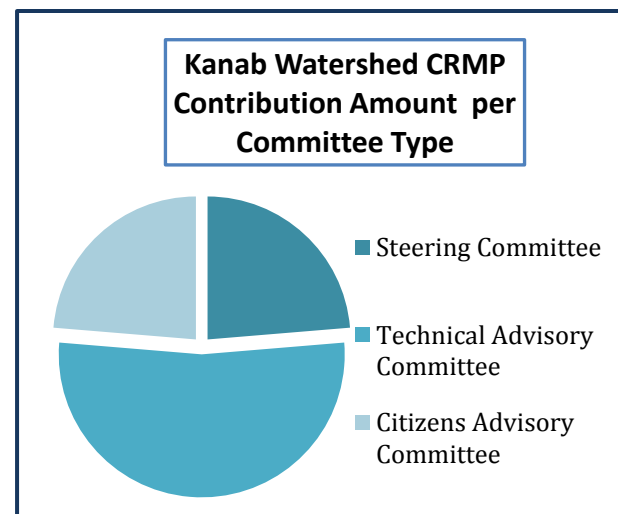
The Kanab Watershed Coordinated Resource Management Plan (CRMP) is a collaborative effort that addresses resource issues within a 1.5 million acre expanse of the most unique natural landscapes in North America. Spanning two states its boundaries encompass southern Utah and Northern Arizona; including Kane County, Utah; Coconino County, Arizona and the tribal boundaries of the North Kaibab Paiute, and other indigenous tribes. Sacred sites of these tribes are an integral component of the areas rich, and varied history. Resource issues of all major land-users within the upper and lower portions of the watershed have been given equal consideration; prior to the ranking process. (Figure 1.1)

How this project began:

In 2013, the Utah Department of Agriculture recognizing the importance of landscape level watershed management plans, awarded a development grant to the Kane County Conservation District; member of the Utah Association of Conservation Districts. After the initial assessment phase, the diverse group of stakeholders that includes federal, state, county, tribal and other local interests identified the major resource issues. The development of the CRMP is guided and managed by a group of leaders and citizens, concerned about the future of the watershed and its natural and cultural resources.

After a brief hiatus, the project gained momentum in 2014, and the different governing bodies were established. Their major contributions included:

- 1) Identify the major resource issues.
- 2) Prioritize identified projects.
- 3) Design and implement assessments.
- 4) Create feasible time-line for project completion.
- 5) Identify funding sources and data gaps.
- 6) Align assessments with EPA, Nine Essential elements of Watershed Management.
- 7) Provide additional technical assistance, as needed.



Memorandum of Understanding participants gathered in Kanab Utah, during August 2014; representatives from the major land-users made recommendations for the ‘*technical advisory committee*’ or TAC members. Their contributions are critical, as the watershed management plan is dependent upon their expertise. It is their commitment and support that determines the long-term success and viability of any KCCRMP. Moreover, their recommendations guide the decisions of the steering committee members for the implementation and assessment of the identified resource issues.

Like the interconnected living and non-living components of an ecosystem, every participating member whether steering, technical or citizens’ advisory participants-impart essential knowledge to the plans, future implementation and assessment of proposed projects, and funding opportunities. At the initial meetings, TAC members were divided into five resource groups. Their primary goal; appropriately identify the major natural resource, socio-economic and cultural resource issues; and develop strategies, when able, in support of the ‘*Nine Essential Elements*’ for Watershed Management plans; outlined by the Environmental Protection Agency (EPA). Fig. 1.1. For this effort, the TAC’s were organized into five different resource areas:

- (1) Agriculture and Rangeland
- (2) Fire, Vegetation and Noxious Weeds
- (3) Cultural Resources and Education/Information
- (4) Water/Air Quality and Oil, Gas and Mining
- (5) Wildlife, Threatened and Endangered Species.



FIGURE 1.1: Summary of the EPA ‘Nine Essential Elements’.

The coordinated recommendations of the Technical Advisory Steering Committee (TAC) and Citizens Advisory (CAC) meetings were held bi-monthly from August 2014 through June 2015. Steering Committee (SC) meetings were held three times. A distinct list of resource issues emerged from the insights of private entities, state, and federal natural resource agencies.

Resource Issue Trends:

The initial Technical Advisory Committee meetings were held at the North Kaibab Forest Field Offices in Fredonia, Arizona. While these discussions revealed an over-lap of resource issue and concerns between the TAC groups present, it was during the subsequent meetings, held at the Kanab Field Office (KFO)/Grand Staircase Escalante National Monument



Technical Advisory Committees

Technical advisory committees are comprised of stakeholders within the watershed who may have an interest, or provide an area of expertise. Technical advisory committee members may be recommended by the steering committee, or by other stakeholders that share a mutual interest concerning resources within the Kanab Watershed.

The Technical Advisory Committees will:

Be responsible for resource assessments and overall project development.

Be comprised of resource specialists, private landowners, and interested stakeholders that are knowledgeable about resource issues.

Kanab Watershed CRMP excerpt

(GSENM) in Kanab Utah, where specific trends began to coalesce.

In addition to the implementation of the identified resource issue recommendations and assessments, all groups identified that the participating federal agencies needed to evaluate the National Environmental Policy Act (NEPA) documentation process. Thus ensuring a more timely and efficient NEPA recommendations.

During the cultural, information and education (IE) TAC discussions it was repeatedly expressed that more cooperative inter-agency educational events needed to occur. These inter-agency educational events could be instrumental in reducing incidents harmful to the natural and cultural resources within the watershed. In addition to explaining the different treatment methodologies, increase public support of resource projects and facilitate better communication between land-users, and the various land managers.

A more cooperative IE programs was a predominant recommendation from all committee members. Furthermore, greater tribal involvement and evaluation of treatment projects and educational events would positively contribute to the preservation of pre-history and historical cultural resources.

Funding sources that support multiple agency or landscape resilient projects was listed as another high priority. Questions were also frequent such as; “What is the role of mitigation?” and, “How do we increase research opportunities to further the knowledge and understanding of resources issue concerns?”

Furthermore, most identified that increasing the evaluation and monitoring processes for “ground-truthing” data was needed. This was coupled with the importance of increased maintenance of past treatments.

Other identified resource issues included; the importance of long-term funding for habitat rehabilitation in upland and lowland habitats within the watershed; protecting wildlife, identification rehabilitation in upland and lowland habitats within the watershed; protecting wildlife, identification and enacting stringent Early Detection Rapid Response (EDDR) practices against infestations—held equal importance for most TAC teams.

Moreover, the non-regulatory status of the CRMP was also discussed. It was reiterated that the CRMP’s function is to provide multiple-agency cooperation through future grant proposals and to ensure that the prioritized treatment plans will enhance the watersheds health for perpetuity.

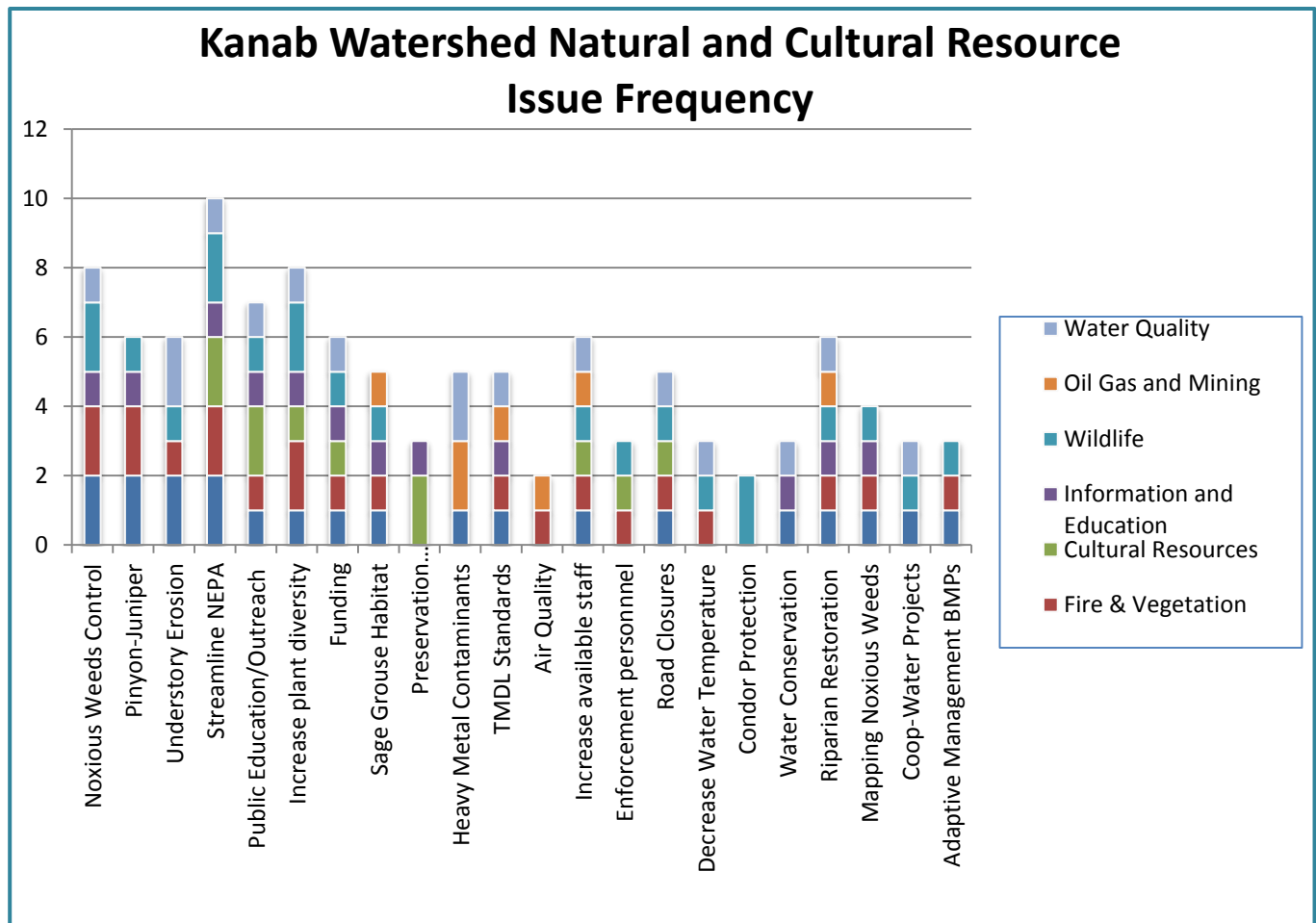


Table 1.1: A summary of the most frequently discussed natural resource and cultural issues of the Kanab Watershed are listed within this table. Many were listed on numerous instances. While five main teams were established, sub-committees were formed. Consequently, resource issues were ranked more than once; hence the greater values.

A summarization of the ranked projects (Table 1.1) by the Technical, Steering and Citizens Advisory Committees were categorized by:

- (1. What is the resource issue(s)?
- (2. Where is the location within the watershed?
- (3. What organization's and land-users are involved?
- (4. What is the timeline for project completion?
- (5. How are the goals and assessments determined?

In addition, to the HUC 10 level watershed treatments project location, both fluidity and adaptability was emphasized as management goals for most of the identified projects. Moreover, it is important to recall that the Kanab Watershed Coordinated Resource Management Plan is a 'living document;' these

tables and resource issues will contain amendments, either upon project completion or when additions are required. Resource issues are discussed in depth in Chapter Three, and within other land-users management plans.

In August 2014, meetings were held with representatives from the major land-users of the Upper and Lower Kanab Watershed; a reintroduction of the overall goals of the project was discussed, and signatures of support were obtained through the “Memorandum of Understanding. As the CRMP contains similar goals to previous agreements, some agencies did not provide a signature but are cooperating under previous M.O.U’s (AZ Fish and Wildlife). North Kaibab National Forest is participating through a cooperative agreement document.

The Utah Association of Conservation Districts:

A unique feature of the Kanab Creek Watershed CRMP is the Utah Association of Conservation Districts role within county, state, private and federal government partnerships. It is the states’ voice for promoting healthier natural resources in 38 districts, which are delineated by county boundaries.

The conservation movement grew out of the “Dust Bowl” days in the early 1930’s, when soil erosion created an unprecedented ecological disaster. President Franklin D Roosevelt recommended that all states pass legislation allowing for the creation of conservation districts. Utah passed the states Soil Conservation District Law in March 1937.

A national program, it is part of a network of 3,000 districts across the nation. Each district has 501c status, and elected board members that are entrusted with ensuring conservation solutions with other land-managers.



A yearly educational event sponsored by the UCCD is the Utah Enviro-thon. This event includes a competition debate and presentation of resource issues by statewide high school students.

Utah Association of Conservation District Programs	
Agriculture Resource Development Loan (ARDL)	Conservation Reserve Program (CRP)
Environmental Quality Incentives Program (EQIP)	Wildlife Habitat Incentives Program (WHIP)
Water Conservation Field Services Program	Colorado River Salinity Control Program
Partners for Fish and Wildlife	Non-point Source Implementation Grants
Area Scholarships and Envirothon Programs	Yearly Conservation Tree and A.C.E.S Programs

TABLE 1.2: UACD sponsored statewide conservation programs.

The Steering, Technical and Citizens Advisory Committees:

Steering, Technical and Citizen Advisory Committee Participants			
ORGANIZATION	TAC	SAC	CAC
American Conservation Experience Service			x
Arizona Strip: BLM	x	x	
Arizona Game and Fish Department	x	x	
Arizona BLM: Fire and Fuels Program	x		
Best Friends Animal Society			x
Canyon Country CWMA	x		
Color Country-BLM	x		
Kane County Conservation District	x	x	
Dixie National Forest-USFS	x	x	
Fredonia Township City Council-AZ			x
Grand Staircase Escalante National Monument-BLM	x	x	
Kaibab Band of Paiute Indians	x	x	
Kanab Field Office: BLM	x	x	
North Kaibab National Forest-USFS	x	x	x
Kane County Commissioners Office-UT			x
Utah State Extension- Kane County-UT	x		
National Resources Conservation Service-AZ	x		
National Resource Conservation Service-UT	x		
School and Institution State Lands Administration-UT	x	x	
Division of Oil, Gas and Mining-UT	x		
Division of Parks and Recreation-UT	x	x	
Division of Water Quality-UT	x	x	
Division of Wildlife Resources –UT	x	x	

TABLE 1.3: List of Kanab Creek CRMP participants and their advisory roles.

Committees (CAC) were also assembled. These volunteers represented a microcosm of the greater community including private business, non-profit and other area organizations.

Historic channel changes of the Kanab Watershed have occurred in both Utah and Arizona since human populations have practiced more expansive land-use practices. Indeed, these changes have impacted human populations and the ecological communities they rely upon. Moreover, land management practices have changed significantly as the predominant socio-economic practices of agriculture, ranching, forestry, tourism and recreational pursuits have influenced resource issues within the watershed.

The primary focus of the Kanab Watershed Coordinated Resource Management Plan (CRMP) was to address and prioritize these resource issues. Watershed management teams or Technical Advisory Committees (TAC) members were recommended by the Steering Committee Members (SC).

These individuals in turn, represented the primary decision makers concerning land-use within the watershed. As the success of watershed management plans are also dependent upon community involvement. Citizen Advisory



Executive Summary:

Being in the landscape allows entry into the mythological, the place where the land, the water, and all the creatures are equally living things with their own agency and power. *Anon*

Hydrological resources of the United States are divided into 21 expansive geographical regions that are further sub-divided into successively smaller hydrological units. These are classified into four areas: regions, sub-regions, accounting units, and cataloging units. Each hydrological unit is identified by a unique hydrological unit code (HUC) consisting of two to eight digits based on the four levels of classification in the hydrological unit system. As the Kanab Creek Watershed boundaries spans Utah and Arizona, it is part of both Region 14-Upper Colorado, and Region 15-Lower Colorado. The word Kanab in the Paiute dialect, Kanab means “willow.”

A tributary of the Colorado River, the perennial headwaters of Kanab Creek originate below the rim of the Pansaugant and Markagunt Plateaus near Alton, Utah. Kanab Creek drainage (KCD) HUC (15011003), encompasses approximately 626 mi² of Kane County, Utah. It traverses through alternating bedrock and alluvial reaches as it flows down the Grand Staircase; a series of cliffs formed in Mesozoic sandstone. In Utah, the drainage is bound by Glendale Bench to the west, the Pansaugant Plateau to the North, and the Skutumpah Terrace to the east. The only other significant perennial streams in the drainage are Johnson Wash and Skutumpah Creek. In total, the watershed drains 2,313 mi² of southern Utah and northern Arizona. (Hadley, J. 2007).

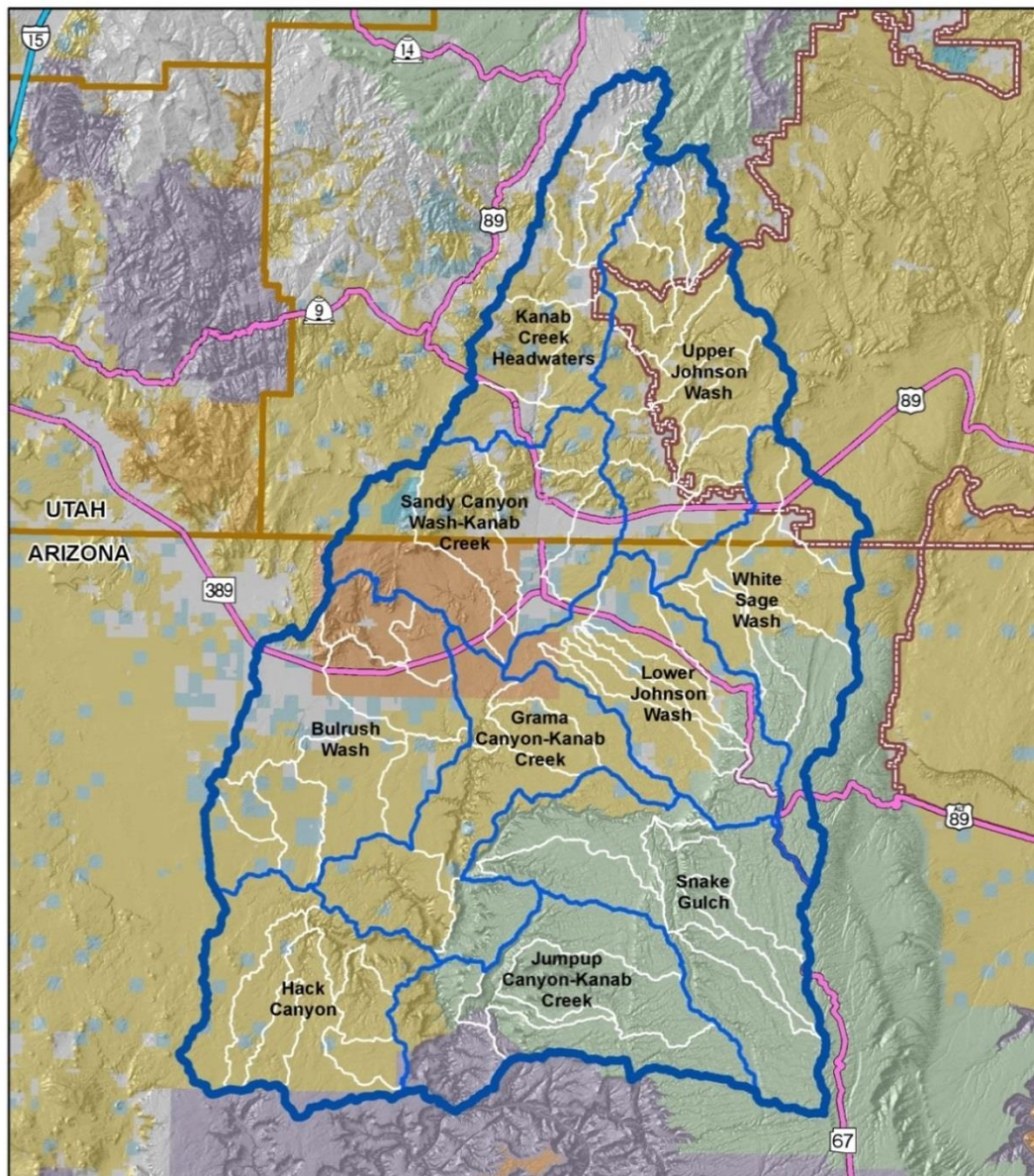
Kanab Creek passes into Arizona as it flows into the Kanab Plateau Basin, located between the Colorado River and the Utah state line. Kanab Creek is the main drainage across the basin and is designated a perennial stream; until passing into Fredonia where it becomes ephemeral. From 1979-1989 a stream gauge was maintained by the United State Geological Survey (09403660), measuring an average flow into Arizona of 11,470 acre-feet/year.

Perennial reaches for streams within the Kanab Plateau Basin listed from greatest to least length in miles include: Kanab Creek (50), Bright Angel Creek (10), Crystal Creek (8), Phantom Creek (7), Shinumo Creek (5), White Creek (5), Nankoweap Creek (4), North Canyon Wash (4), Thunder River (4) and Tapeats Creek (3). Kanab Creek also passes through the Kaibab Paiute Tribal lands as both perennial in the northeast (1 mile) and ephemeral in the south-east (6 miles). All of the other streams within the basin are dependent on precipitation, and are classified ephemeral. Kanab Creek is also the largest tributary on the north side of the Grand Canyon.

Kanab Creek Watershed HUC 8, HUC 10, HUC 12

March 2014

BLM



BLM
 UT BLM Wilderness
 National Forest
 National Park
 State
 State Park
 Private

Reservation



0 2.5 5 10 15 Miles
 0 10 20 Kilometers

Kanab Creek Watershed
 HUC 10
 HUC 12
 Utah Field Office Boundary
 National Monument Boundary

Projection: Transverse Mercator
 Coordinate System: UTM
 Datum: North American Datum of 1983 (NAD 83)

No warranty is made by the BLM for use of
 the data for purposes not intended by the BLM.

This product may not meet BLM standards for
 accuracy and content. Different data sources
 and input scales may cause some misalignment
 of data layers.



KANAB FIELD OFFICE

2.1: Kanab Creek Watershed Boundaries. HUC 8-12. GIS: Dan Alberts, Kanab Field Office., BLM.

Kanab Watershed Maps	
<i>Utah</i>	
Kanab Creek Headwaters HUC 10	https://drive.google.com/file/d/0B1ohXIC3gEUPd1lOb2FpSkc2NHM/view?usp=sharing
Kanab Creek Watershed Surface Ownership-HUC 10	http://tinyurl.com/qyusslw
Sandy Canyon Wash-Kanab Creek –Flora and Fauna Designations map: HUC 10	https://drive.google.com/file/d/0B1ohXIC3gEUPQ0RHU1F0Qlo1ekk/view?usp=sharing
Sandy Canyon Wash-Vegetation Categories Map: HUC 10	https://drive.google.com/file/d/0B1ohXIC3gEUPVTYySUx4N3gwZVE/view?usp=sharing
Upper Johnson Wash Surface Ownership Map: HUC 10	https://drive.google.com/file/d/0B1ohXIC3gEUPU291cnh0MWFScnM/view?usp=sharing
Upper Johnson Wash Flora and Fauna: HUC 10	https://drive.google.com/file/d/0B1ohXIC3gEUPbzJtX18wUklKeI/view?usp=sharing
Upper Johnson Vegetation Categories: HUC 10	https://drive.google.com/file/d/0B1ohXIC3gEUPRWpVeHNTX1p3UTQ/view?usp=sharing
White Sage Wash Surface Ownership Map: HUC 10	https://drive.google.com/file/d/0B1ohXIC3gEUPNXBubWRjM3VnTGM/view?usp=sharing
White Sage Wash Flora and Fauna Map: HUC 10	https://drive.google.com/file/d/0B1ohXIC3gEUPVUU5cnZ0OUd3YUk/view?usp=sharing
White Sage Wash Vegetation Categories Map: HUC 10	https://drive.google.com/file/d/0B1ohXIC3gEUPVUYxaXIPZlIKcTQ/view?usp=sharing
<i>Arizona</i>	
NEMO: Colorado River –Grand Canyon	https://www.azdeq.gov/envirom/water/watershed/download/nemo-colorado_gc-wp.pdf

TABLE 2.1: List of Arizona and Utah Kanab Creek HUC 8-10 Watershed; maps only



Tiny Canyon Upper Kanab Watershed: One of many, Utah DEQ water quality testing sites.

Many of the resource issues determined for the watershed were identified through using maps, on-the-ground site visits, and local expertise. HUC 10 maps illustrating flora, fauna, ownership, current and future treatment projects and Threatened and Endangered species information was utilized during the review process (Table 2.1). A complete list of maps is contained as part of the project record, and housed by the Zone 5 UACD Field Offices, Kane County Conservation District website.

The Environmental Protection Agency assigns a unique ID to each state waterbody or segment. The first two characters are the state abbreviation, followed by characters that are the water's Waterbody System ID, another state-derived ID, or an arbitrary ID assigned by the state. Most of the impaired waterbodies in the Kanab Watershed are located within the Utah. Additional waterbody identification and pertinent 303d waters can be found in the water quality section of the

CRMP. There are ninety-four, 10-digit HUC sub-watersheds in the Colorado-Grand Canyon Watershed; seventy-one are in Arizona, thirteen are in Utah and the remaining ten are located in Nevada. Kanab Creek is the largest tributary that drains into the Colorado River; while the sub-watersheds associated with the Kanab Watershed are high-lighted in Table 2.2.

Colorado –Grand Canyon Watershed 10-Digit HUC Designation and Sub-Watershed Areas		
HUC	Sub-watershed Name	Area (sq mi)
1501000301	Kanab Creek Headwaters*	194
1501000302	White Sage Wash*	214
1501000303	Upper Johnson Wash*	287
1501000304	Lower Johnson Wash*	186
1501000305	Sandy Canyon Wash-Kanab Creek*	242
1501000306	Bulrush Wash*	290
1501000307	Snake Gulch*	280
1501000308	Hack Canyon*	211
1501000309	Grama Canyon-Kanab Creek*	228
1501000310	Jump-up Canyon-Kanab Creek*	230

TABLE 2.2: Arizona and Utah List of the NEMO-Colorado-Grand Canyon Watershed. HUC 10, sub-watershed name and area (sq.mi.). Kanab watershed is a sub-watershed of the CGCW. https://www.azdeq.gov/environ/water/watershed/download/nemo-colorado_gc-wp.pdf* Utah sub-watershed HUC 10.



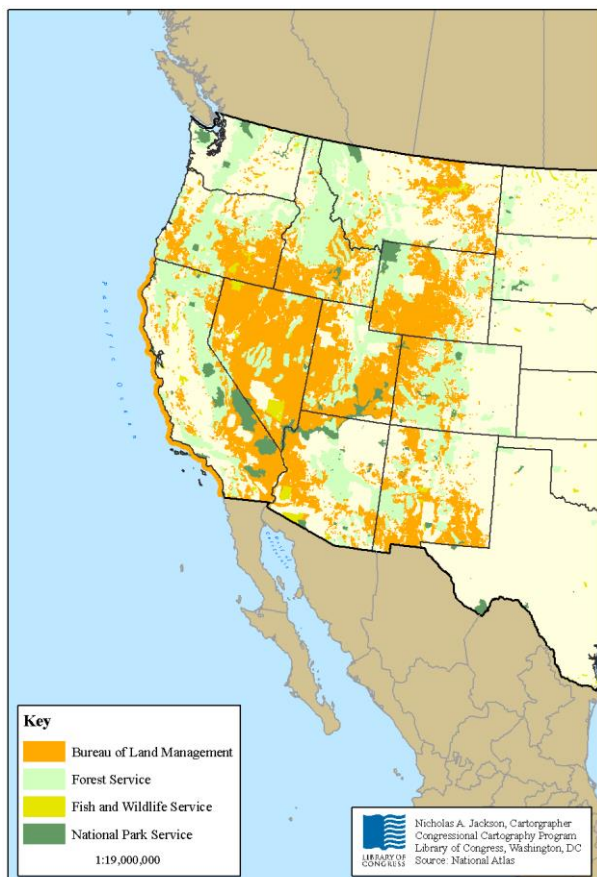
Land Ownership and Demographics:

The wilderness holds answers to more questions than we have yet learned to ask. *Nancy Newhall*

Federal lands and resources have been important throughout American history, providing revenue for transportation, schools, national defense and other state and local needs. The federal government owns roughly 635-640 million acres, 28% of the 2.27 billion acres of land in the United States.

Four agencies administer 609 million acres of this land: the Forest Service (USFS) in the Department of Agriculture, and the National Park Service (NPS), Bureau of Land Management (BLM), and Fish and Wildlife Service (FWS), all in the Department of the Interior (DOI). Most of these lands are in the West and Alaska. In addition, the Department of Defense administers 19 million acres in military bases, training ranges, and more. Numerous other agencies administer the remaining federal acreage (CRS Report 2012).

Prior to the predominantly European western land expansion in the late 1800's, the majority of the land-landscape was part of the Southern Paiute Tribal boundaries (Eisenberg). Today land ownership within the Kanab Watershed is similar between Kane County, Utah and Coconino County Arizona (Table 3.1).



Coconino County Land Ownership (Acres)

BLM	196,400	31.0%
USFS	377,169	59.0%
Tribal	13,170	2.0%
National Park	14,346	2.0%
Game & Fish	11,000	1.0%
Private	12,576	1.9%
State	23,052	3.0%
Total Acres	636,724 Acres	

Kane County Land Ownership (Acres)

GSNM-BLM	2,159	1.0%
BLM	126,436	60.0%
USFS	6,305	3.0%
Tribal	0	0%
Private	57,541	26%
State Parks	3,727	1.7%
State Trust Lands	12,841	6.2%
Total Acres	209,009 Acres	

TABLE 3.1: Major land-use distribution: Arizona and Utah. 2015

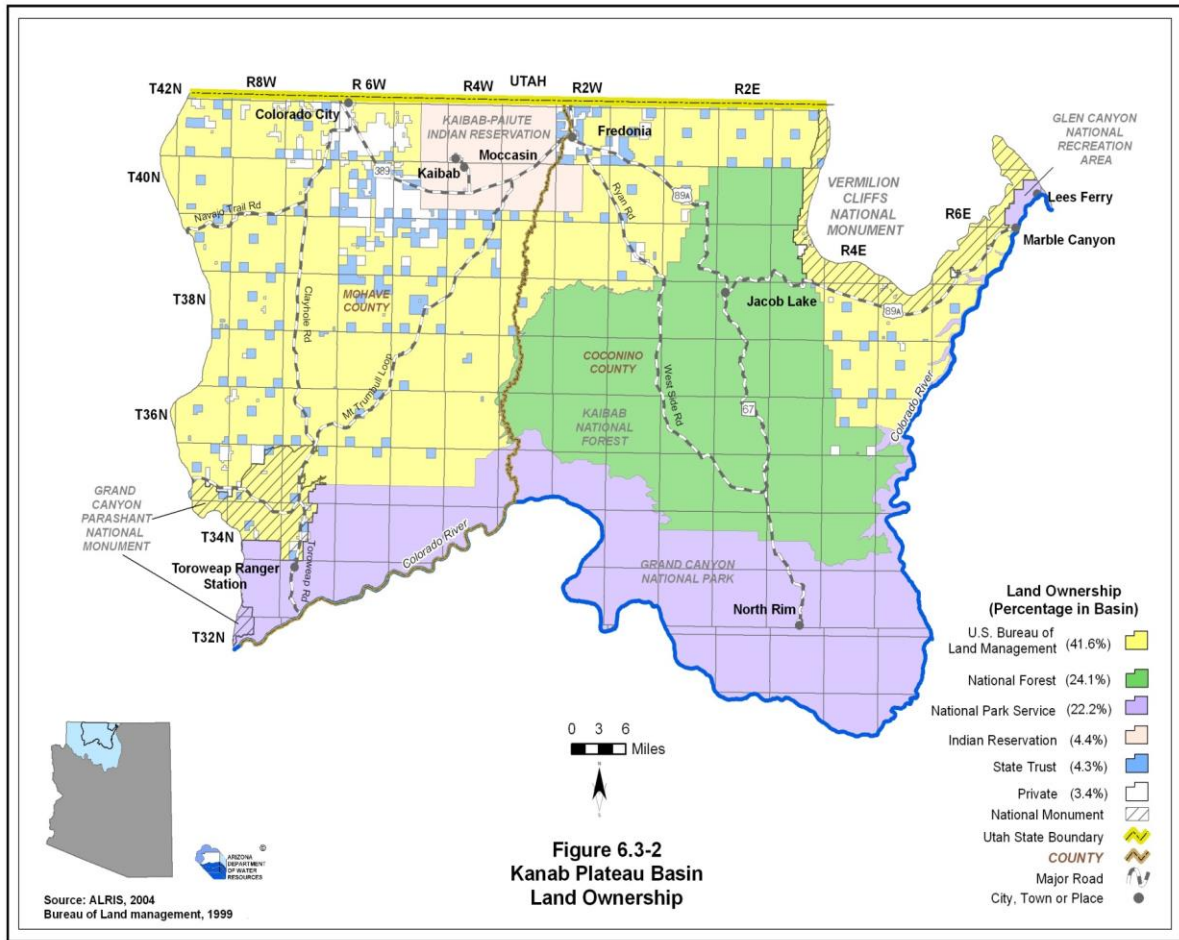


FIGURE 3.2 Land Ownership Kanab Creek Watershed, Arizona. Map Credit: Arizona Department of Water Resources.

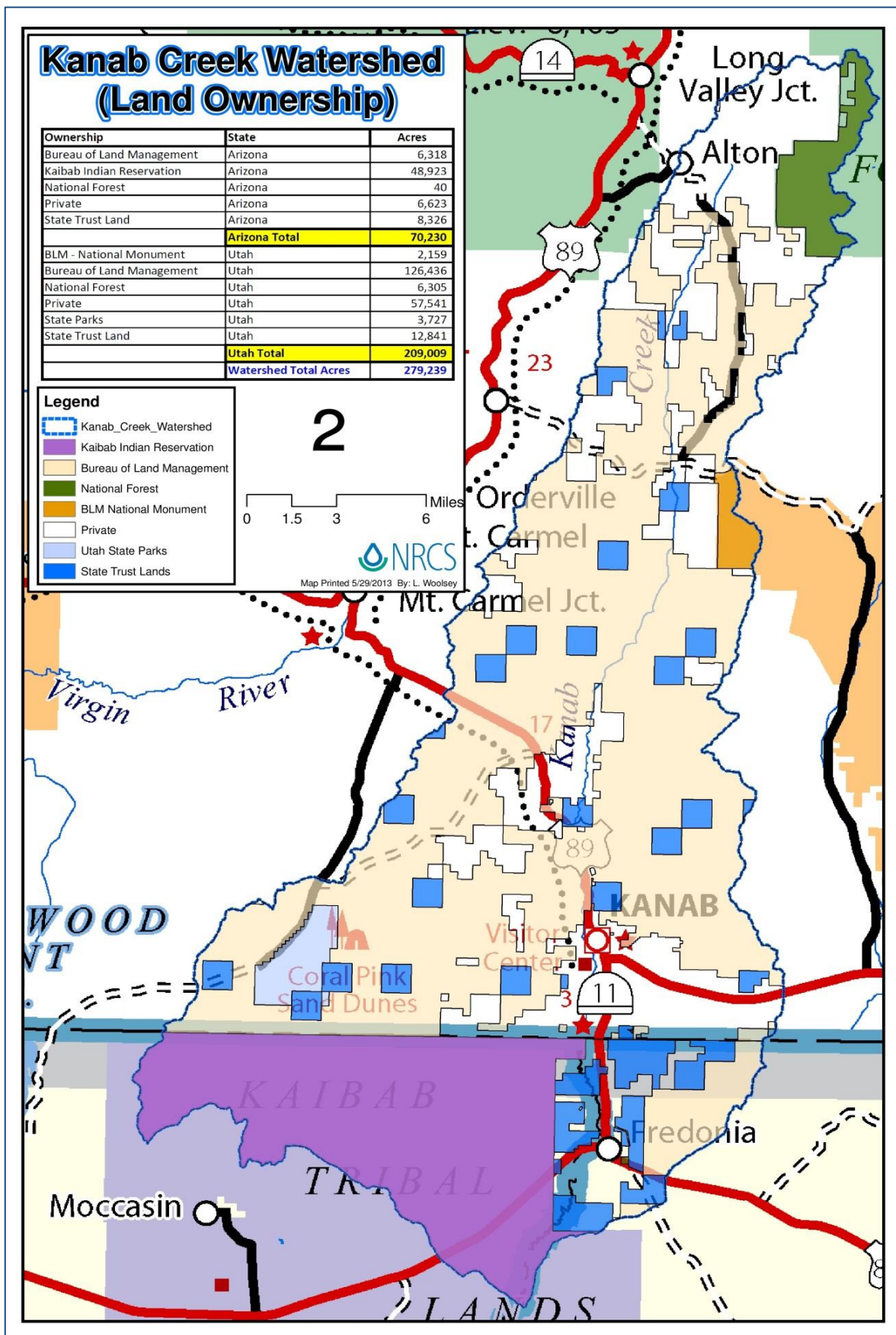


FIGURE 3.2: Kanab Creek Watershed land-ownership. Kane County. NRCS. Map credit. Lee. Woorsely.

Kane County Demographics:

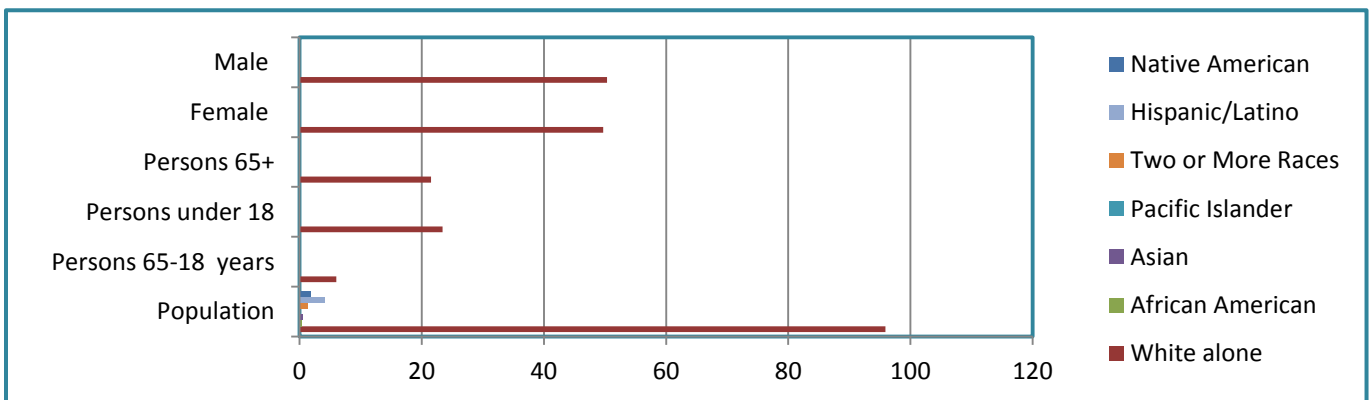
A pre-history census of Kane County would reveal a much different image than the most recent United States census. Archeological evidence shows that Paleo-Indian and Ancestral Pueblo people dwelt in areas where the town of Kanab is now located. Eventually, the hunter-gatherer Paiute replaced the Ancestral Pueblo, bringing their beliefs and practices. For the Paiute, the entire watershed is considered sacred, and they have intimately interacted with this landscape for thousands of years. Many still practice the activities of their ancestors such as hunting game and gathering native plants for both crops and medicines.



Ancestral Pueblo Dwelling: Cottonwood Canyon. Utah Div. of State History

History eventually brought additional explorers to this high desert. Some travelled by foot, horse and others by water such as the famous Colorado River explorer John Wesley Powell. Others came to stay. In 1858 Joseph Hamblin and other Mormon Pioneers interested in homesteading the area, built a few dug-out shelters. When additional settlers began to move in, change came again, and the predominant hunter-gathering practices were replaced by the growing township, including various livestock, and different types of agricultural practices. Soon small settlements began to dot across the landscape.

War often changes demographics, as did the Black Hawk Wars of 1866, interrupting the hopes for successful settlement that was both a goal and dream for the early pioneers. When the war ended, by 1870's the settlers began to return and other challenges arose—availability of water. After numerous challenges including flash-floods, failed water resources infrastructures, and other anthropogenic impacts, successful wells were installed. New water resources and demographic trends for Kane County began to emerge—the current population is now 7,245 (2010, U.S. Census).



Current Demographic and Economic Baseline of Kane County		
Population		
Average Annual Growth Rate (1970–2007)	2.6%	
Net In-Migration, (1970–2007)	2,234	
Median Age (2006)	38.6	
Households (2007)	2,479	
Employment		
Median Household Income (1999)	\$34,247	
Total Farm, Nonfarm and Proprietor Employment (2005)	4,111	
Average Annual Growth Rate, 1970–2005	3.9%	
Farm Employment as a Share of Total Employment	4.1%	
Nonagricultural Employment (2006)	3,092	
Average Annual Growth Rate, 1970–2006	4.4%	
Employer Firms (2006)	338	
Major Nonagricultural Employment Sectors (2006)	Number	Share
Government	721	23.3%
Accommodation and Food Services	605	19.7%
Other Services (except Public Administration)	407	13.2%
Retail Trade	378	12.3%
Arts, Entertainment, and Recreation	259	8.4%
Taxable 2006 Retail Sales (millions)	\$54.3	
Average Annual Inflation-Adjusted Growth Rate, 1980–2006	3.5%	
Major Retail Categories (millions)	Amount	Share
Food Stores	\$14.1	26.0%
Motor Vehicles	\$10.5	19.3%
Eating and Drinking	\$10.1	18.6%
Per Capita Retail Sales (2006)	\$8,630	
Wages and Income		
Total Nonagricultural Wages (2006, millions)	\$72.1	
Average Annual Inflation-Adjusted Growth Rate, 1970–2006	4.5%	
Average Monthly Wage (2006)	\$1,942	
Total Personal Income (2005, millions)	\$171.1	
Average Annual Inflation-Adjusted Growth Rate, 1970–2005	4.3%	
Housing, New Construction, and Real Estate Total Housing Units (2007) 5,094	Number	Share
Total Occupied Units (share of total housing units)	3,288	64.5%
Owner-Occupied (share of total occupied)	2,803	85.2%
Renter-Occupied (share of total occupied)	485	14.8%
Recreation or Seasonal Units (share of total housing units)	1,739	34.1%
Median Sales Price of Existing Single-Family Homes (2006)	\$152,220	
New Permit-Authorized Dwelling Units (2007)	151	
Value of Residential Construction (2007, millions)	\$30.1	
Land Ownership (2007)	Acres	Share
Privately Owned	270,235	10.3%
Federally Owned	2,177,294	82.9%
State Owned	106,046	4.0%

TABLE 3.3: All dollar figures are in current dollars. Sources: Utah Population Estimates Committee; U.S. Census Bureau

Fredonia, Arizona Demographics:

On the east side of the Kanab creek is Fredonia, Arizona's northern-most town. Located four miles south of the Utah-Arizona border in a geographical area commonly referred to as the Arizona Strip (AS). It is relatively unspoiled by excessive urbanization because the Grand Canyon isolates the AS from the remainder of the state. It resides within the boundaries of Coconino County and was founded in 1865 by Mormon settlers from Utah seeking freedom from federal laws against polygamy. The name Fredonia, was created by Mormon Apostle Erastus Snow, and is a combination of 'free' and 'donia', Spanish for woman.

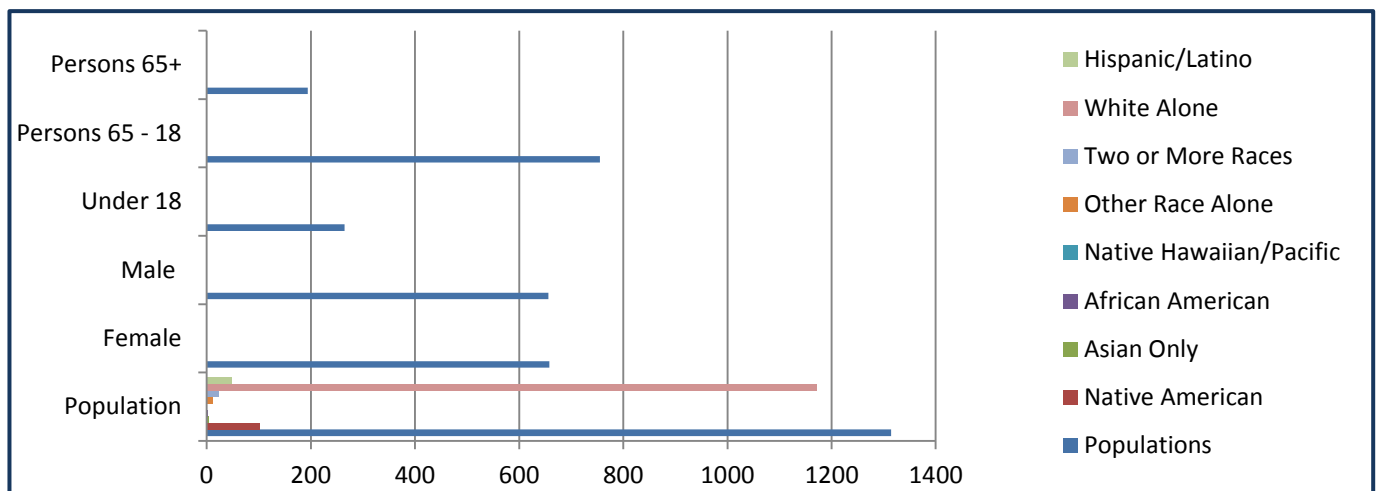


TABLE 3.4: Demographics of Fredonia Township, Arizona; based on the total population of 1,307. 2010.

General Economic Baseline of Coconino County	
Population	
Fredonia (2008)	1,130
Coconino County (2008)	135,613
Arizona (2008)	6,629,455
Employment (2008)	
Government	19,900
Leisure and Hospitality	13,200
Trade, Transportation and Utilities	10,300
Education	7,200
Manufacturing	3,900
Mining & Construction	3,200
Professional Business Services	3,100
Other Professional Services	1,900
Financial	1,600
Information	400

TABLE 3.5: Coconino County Demographics. Arizona Department of Commerce. 2008.



Physical and Natural Features:

“...short-sighted men who in their greed and selfishness will, if permitted, rob our country of half its charm by their reckless extermination of all useful and beautiful wild things...” *President Theodore Roosevelt*

Perennial and ephemeral tributaries, and wind, intermixed with immense stretches of time have shaped the Kanab Watershed landscape. Though the majority of the watershed lies mostly within Coconino County in Arizona; its headwaters originate in springs near Alton, Utah. In regards to total land mass of the watershed, Utah’s contribution is minimal, however Kane County Utah is one of the largest counties in the state. With some 3,904 sq. miles, or roughly 2.5 million acres it is a land of extremes. With seemingly boundless landscapes it contains sparsely populated human settlements.

The predominant goal of all major land users within the watershed is to preserve, conserve and implement management plans that support multiple-use. An exception to this goal of course is land designated as wilderness. Development of the Kanab Watershed Coordinated Resource Management Plan, though non-regulatory is a bridge of cooperation between many users. It is an opportunity to initiate cooperative efforts for landscape level natural resource projects, their treatments and assessments.

Hydrology & Precipitation: Utah

In addition to the Environmental Protection Agencies national HUC watershed groupings, the Utah Division of Water Resources (DWR) also divides the state into river basins. Kanab Creek is placed with the Virgin/Kanab River Basin. Some of the major characteristics that determine basin delineation include: annual precipitation, elevation, soil, temperature, and water-shed boundaries.

Typically, the basin experiences short, mildly warm summers and long, cold winters at the higher elevations. At lower elevations, the basin encounters hot and dry summers and mild winters. January temperatures range from less than 20°F to the mid-50s, while normal July temperatures range from the low 50’s to more than 100°F. Approximately seventeen inches of precipitation have been recorded annually; this value places the Kanab/Virgin River Basin ranks 8th lowest, when contrasted to the other twelve basins in Utah.

Hydrology & Precipitation: Arizona

Although Arizona is ranked as the 4th driest state in the western U.S. with an average precipitation rate

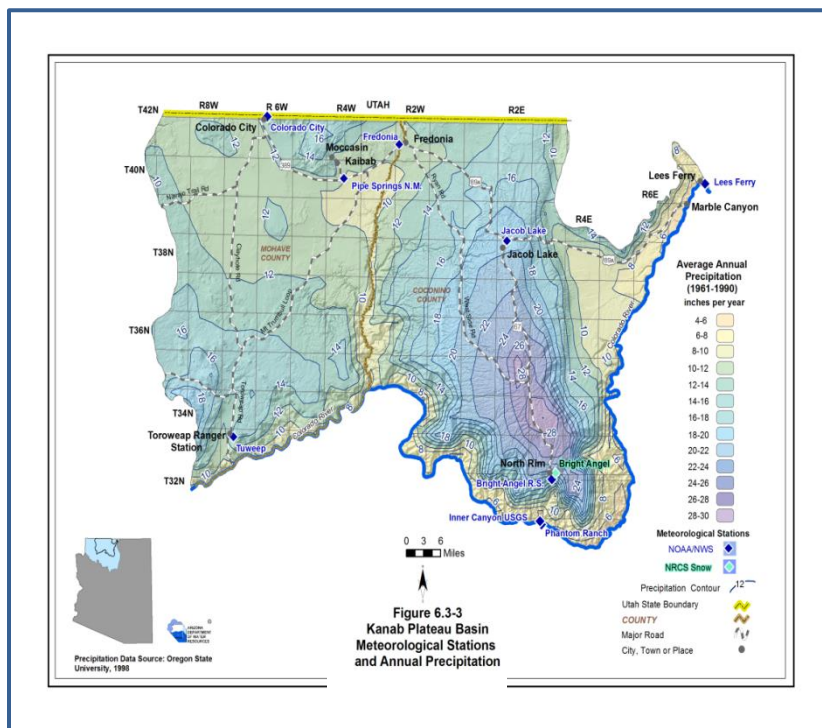


FIGURE 4.1: Kanab Plateau Basin Meteorological Stations and Annual Precipitation. Image credit: Arizona Department of Water Resources.

of 14 inches per year, this water is distributed unevenly. The wide variety of climates throughout the state, is primarily due variation in elevation, and latitude. Figure: 4.1.

In Arizona, the Kanab Plateau Basin is characterized by high plateaus, plains and incised canyons. The basin contains a flat-lying to gently sloping sequence of alternating sandstone, limestone and shale (ADWR). Groundwater is found in several aquifers composed of these sedimentary rocks, which are generally isolated and not hydraulically connected.

The town of Fredonia, on the north-central edge of the Kaibab Plateau’s culinary water supply originates from this type of aquifer. Also, the water bearing units near Pipe Spring National Monument, located within the North Kaibab Paiute tribal boundaries, includes alluvium, Navajo Sandstone, the Kayenta, Moenave formations, and the Shinarump Formation (Truini). While the Kanab Watershed CRMP advisory groups did not specifically identify any water resource issues, the most recent Utah Water Users Conference discussed the 2014-2015 NOAA Snow Survey data. The severity of water shortages

Average Annual Precipitation Rates by Basin				
Utah River Basin	Average Precipitation(inches/year)	Arizona River Basin	High	Low
Weber River	26	Coconino Plateau	40	4
Jordan River	23	Grand Wash	16	4
Bear River	22	Virgin River	16	4
Utah Lake	22	Paria	16	4
Uintah	15	Shivwits	20	4
Kanab Creek/Virgin R.	17	Kanab Plateau	15	
Sevier River	14	Arizona River Basin	Average	
Cedar/Beaver	13	Coconino Plateau	10.0	
SE Colorado River	11	Grand Wash	4.0	
West Colorado R.	10	Virgin River	7.59	
West Desert	10	Paria/ Shivwits	7.59/5	

TABLE 4.1: Annual precipitation rates by basins. Arizona and Utah Division of Water resources. 2010.

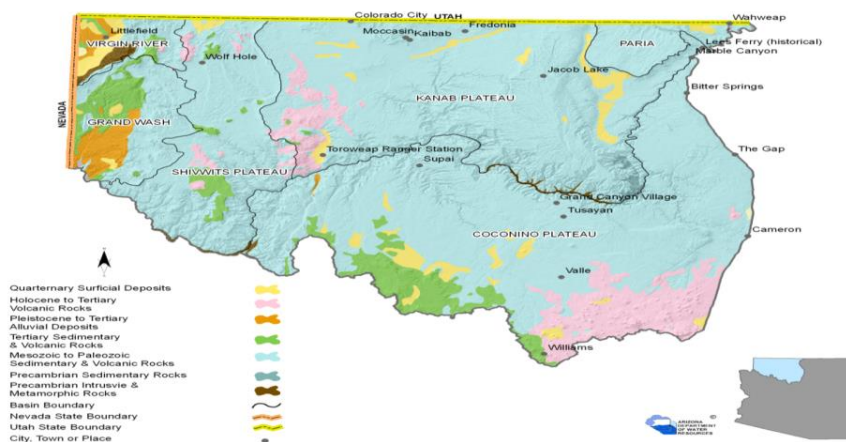


FIGURE 4.2: Geology of the Kaibab Plateau. AZGS. 1988

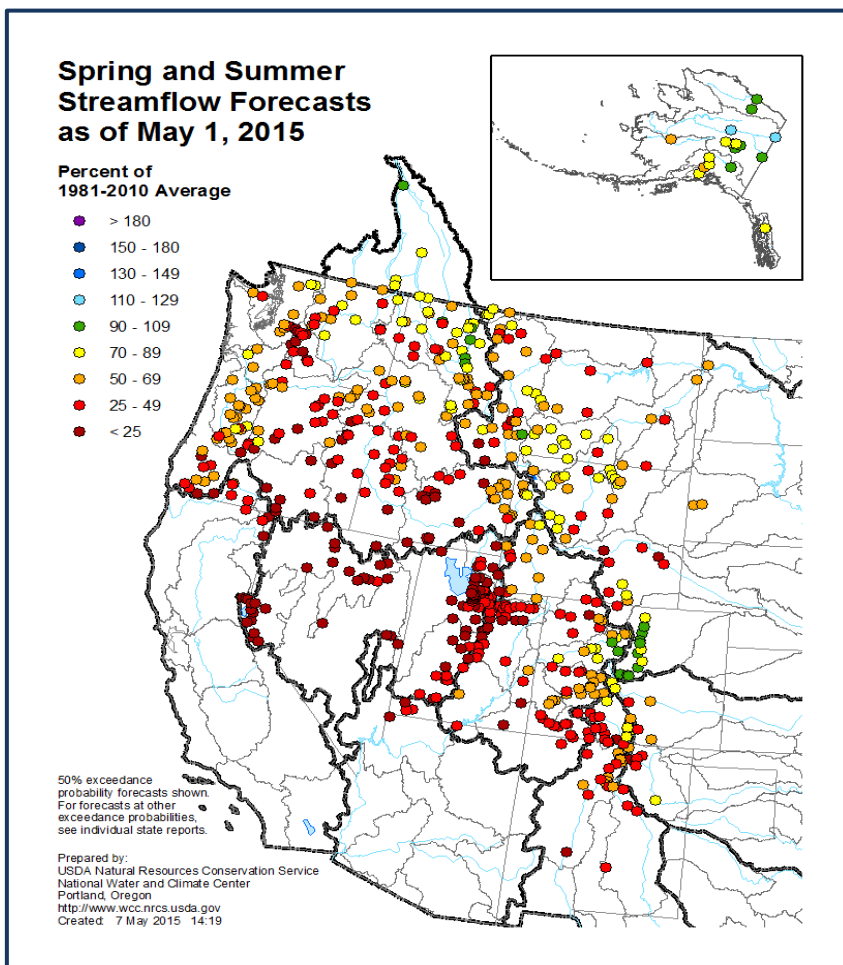


FIGURE 4.3: NRCS Streamflow Forecasts. 2015.

throughout the western U.S. and future predictions were presented. Future amendments to the CRMP will need to address how the identified resource issues will be impacted by a prolonged drought.

Snow Survey: Utah 2014-2015

Kanab Watershed main stream flows originates from springs, and precipitation rather than snow-pack. As shown in Figure 4.3, the most recent snow survey from the NRCS illustrates the stream flow forecasts. The most recent snow survey data places the majority of the watershed at 50-69% of average stream flow.

Currently the western United States has received below average precipitation rates combined with increased populations and use. Consequently, many western states are experiencing extreme drought conditions. Many have initiated water conservation measures, and rationing.

Snow Survey: Arizona 2014-2015

Due to the ephemeral flow regime of Kanab Creek, the NRCS SNOTEL only maintains one monitoring site at Bright Angel, on the North Rim of the Grand Canyon. This location, lies outside of the Kanab Watershed which is a part of the Kaibab Plateau. At over 8,000 ft above sea level, Bright Angel recorded on

average nine inches of snow pack in March, 2015. NOAA has installed nine co-op network weather station sites within the Kaibab Plateau, with the possibility of additional units.

The geomorphology and lack of regular flow determines the data gathering efforts. However, the Fredonia CD recently installed a weather station near Fredonia, Arizona. This station will provide additional data for local responses to climate change, and instigate proactive water conserving actions; to benefit communities and ecosystems.

Additional water quality issues are presented in greater detail within Chapter 5 of this document.

Coconino County and Kane County Geology:

In 1871, scientist and civil war veteran John Wesley Powell, and his survey team explored the tumultuous, Green and Colorado rivers. Recording geological features, they also named tributaries and other natural features, including the mighty Grand Canyon. Powell reflected, in the memoir, *Down the Great Unknown*, about the waters that previous explorers, mountain men, and indigenous groups had avoided and distained.

“The glories and beauty of form, color and sound unite in the Grand Canyon...forms unrivaled even by the mountains, colors that vie with sunsets, and sounds that span the diapason from tempest to twinkling raindrop; from cataract to bubbling fountain.”

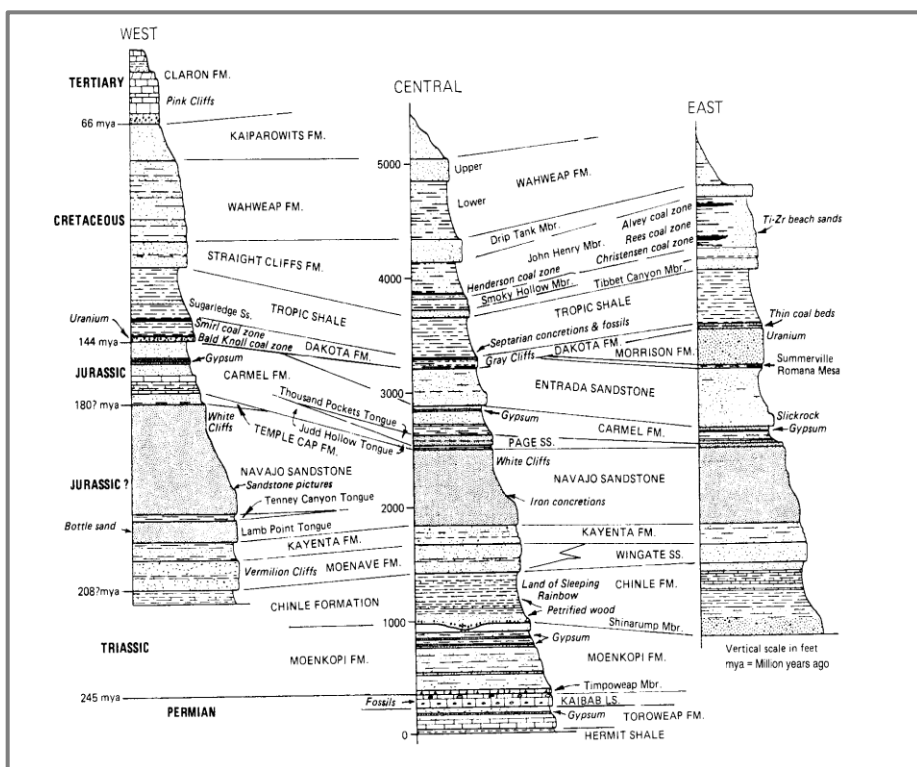


FIGURE 4.4: Stratigraphic units in Kane County showing relationship; E-W. USGS

These waters contributed to the unique geology of both Coconino and Kane Counties, and are unsurpassed throughout the world; indeed the Kanab Creek drains into the Grand Canyon Watershed, a designated World Heritage site.

For generations, this tableau of earth's time exposed in layers of sediment, has inspiring all who have gazed upon its unsurpassed splendor. It has also supplied substantial economic gains through the mining of its sedimentary and mineral resources; sometimes in detriment of the ecosystem.

The General Mining Law:

The General Mining Law of 1872, as amended (30 USC 29 and 43 CFR 3860, provides the successful mining claimant the right to patent (acquire absolute title to the land) mining claims or sites if they meet the statutory requirements.

Kanab Creek Watershed Mining policies and resources for federal and state(s):

Arizona Department of Mines and Mineral Resources:

http://repository.azgs.az.gov/sites/default/files/dlio/files/nid1128/arizona_mining_permitting_guide_2011.pdf

Arizona Mining Association:

<http://www.azmining.com/policy-legislation/>

Bureau of Land Management: Mining Materials.

http://www.blm.gov/wo/st/en/prog/more/non-energy_minerals.html

Utah Division of Oil, Gas and Mining.

<http://linux1.ogm.utah.gov/WebStuff/wwwroot/division/tabs.html>



Arizona Strip Uranium Mining Operation. Photo credit: AS BLM

Because of this rich geological history, Kane County strata has yielded particularly diverse and important fossil finds that have greatly contributed to our understanding of the earth's history (Doelling). Materials used by the transportation industry have been the most extracted items. Additional extractions include alabaster, and coal; one of the most controversial minerals, uranium, is not present in the upper Kanab Creek watershed.

However, renewed uranium extraction within the lower reaches of the Kanab Creek watershed in Arizona has a mixed legacy — due to concerns over the potential hazards to ground water quality, humans, wildlife and the overall integrity of the Colorado River (USGS).

Moreover, the Grand Canyon contains over 1,300 known or suspected breccia pipes, which are vertical, pipe-shaped bodies of highly fractured rock that collapsed into voids created by dissolution of underlying rock (Spencer, 2011). According to the USGS, these natural breccia pipes, contribute to the uranium levels in the Colorado River.

Total breccia-pipe uranium production of Dec. 31, 2010 has been more than 10,700 metric tons (23.5 million pounds) from nine underground mines, eight of which are north of Grand Canyon near Kanab Creek. Colorado River water in the Grand Canyon region currently contains about 4 µg/l (micrograms per liter) of uranium (equivalent to 4 ppb [parts per billion by mass]), with approximately 15 cubic kilometers annual discharge (USGS).



Greg Linder, USGS Columbia Environmental Research Center, instructs Emily Simpson, Bethel College undergraduate student, on the dissection of a pocket gopher Kaibab National Forest, Coconino County, AZ, USA. Photo credit: USGS 2013.

Thus, approximately 60 metric tons of dissolved uranium is naturally carried by the Colorado River through the Grand Canyon in an average year (Spencer).

In 2012, Secretary of the Interior Ken Salazar decided to withdraw about one million acres of federal land near the Grand Canyon from additional uranium mining development until the year 2032; citing uncertainties regarding the

effects of uranium mining on the Grand Canyon, its people, wildlife and water resources. The decision to withdraw federal lands from further mining activity allows time to study the potential effects of uranium mining (USGS).

Evaluating Uranium Exposure Levels:

Previous studies that established baseline data for the movement of uranium has also expanded into the Arizona Strip. The USGS Columbia Environmental Center coordinated an extensive study of 200 plant and animal species in 2013, involving four government agencies, two states, and three universities. These studies will be invaluable in establishing baseline data sets, in the event of renewed mining efforts.

Air Quality: Arizona and Utah



Air quality protection in the Kanab Creek Watershed began with the Clean Air Act of 1963, the first federal legislation developed to actually control air pollution. This legislation established the minimum requirements for states and local governments to reduce air pollution. Later, a 1967 amendment to the Clean Air Act enabled the federal government to enforce ambient and stationary (industrial) source inspections.

Research efforts were also increased in 1967, and

since then additional amendments addressing acid rain, ozone depletion, toxic air pollution, stationary (industrial) and mobile air pollutant sources have been included to national air quality improvement efforts.

Roles for state, federal and tribal participants vary and are dependent upon the nature of the air pollutant being monitored. Common pollutants that are found all across the United States such as ozone (O₃), particulate matter 10 microns in size or smaller (PM₁₀), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur oxides (SO_x) and lead (Pb) are monitored using the National Ambient Air Quality Standards (NAAQS). These common pollutants are also called “criteria pollutants” because science based guidelines are used to monitor their known effects on human and environmental health.

The Utah Division of Air Quality (UDAQ) a member of the states’ Department of Environmental Quality, (DEQ) is the government agency responsible for monitoring air quality and enforcing state laws. In addition to EPA air quality stations, the state has a network of twenty-four strategically located air monitoring stations to measure local and regional levels of air pollutants, including particulate matter (PM) and gaseous pollutants.

In Arizona, the Inter-Tribal Council has an Air Quality Division that maintains, investigates and educates about air quality standards; while supporting other federal and regional air quality organization, such as the Arizona Department of Environmental Quality (ADEQ). Both entities have responsibilities similar to Utah that include:

- Collecting and analyzing quality assured and precision ambient air monitoring data;
- Preparing pollution forecasts to help people limit their emissions;
- Collecting and analyzing quality assured and precision ambient air monitoring data;
- Preparing pollution forecasts to help people limit their exposure to air pollution and air pollution sources;
- Conducting and collaborating on research and analyses to evaluate pollution sources and their impacts on public health and welfare;
- Investigating complaints and violations of, and achieving compliance with Arizona's air pollution laws;
- Issuing permits to industries and other facilities, and for open burning activities that protect public health and welfare;
- Operating and maintaining accurate, convenient, and affordable vehicle emissions inspections programs;
- Developing air quality plans and rules through partnerships, collaboration and public involvement.

In 2005, the Kane County Natural Resource Report released by the Utah Association of Conservation District, and the Utah NRCS, identified several areas of concern in regards to air quality in Kane County. Similar concerns were also identified within resource management plan documents for the North Kaibab Forest, Bureau of Land Management and the Grand Canyon National Park.

Categories of Concern High, medium, or low	Description and Specific Location	Categories of Concern High, medium, or low	Description and Specific Location
Soil-Wind <i>High</i>	Erosion is more of an issue than water erosion. In the valleys and lower areas where the wind is stronger there is a higher occurrence of wind erosion. Water erosion occurs along the Virgin River and Kanab Creek.	Water Quantity <i>High</i>	The concern over water quantity in Kane county is usually connected to the availability of water. In the past 7 years there has been such a shortage of water due to the drought that it became necessary to implement additional water savings efforts.
Water Quality Ground Water <i>Medium</i>	Ground Water quality is affected by a number of concerns. Including the ones mentioned in the soil erosion section above.	Water Quality Surface Water <i>High</i>	Water quality is affected by the same as mentioned above. Sedimentation due to the erosion is always affecting the water quality in this area.
Air Quality <i>Medium</i>	Air Quality is related to the occurrence of wind erosion in the valleys and lower areas with strong winds. Another concern is the Alton Coal Mining Operation.	Plant Suitability <i>High</i>	Noxious weeds are a concern throughout the county. They adversely affect agriculture and range land. The invasion of undesirable plants such as cheat grass and Pinyon/Juniper is an increasingly serious problem.
Plant Condition <i>Medium</i>	There has been a high occurrence of mortality in the sagebrush flats. The sagebrush is rapidly dying off in some areas. Many rangelands in Kane county that have been treated in past years have turned into a monoculture affecting the health of the ranges.	Wildlife <i>High</i>	In Kane County producers and land managers are working to keep species from being listed as an endangered species.
Domestic Animals <i>Low</i>	No Comments listed.	Domestic Social and Economic <i>Medium</i>	As in many areas throughout the state there is the ever increasing problem of developments. Ranches being broken down into 5-10 acre ranchettes. GSENM evaluating grazing standards.

TABLE 4.2: Kane County Resource Plan: Natural resource issues of concern. 2008

Locations in the Kanab Creek Watershed that are vulnerable to decreasing air quality include the areas immediately surrounding surface-disturbing activities, such as emissions from vehicles and machinery involved in energy and mineral development projects, local residential centers and high visitation sites. An examination of air quality measurements for local counties includes a miscellaneous category that encompasses agricultural tillage, light industry and other sources (Table 4.3).

Summary of Coconino, Mohave, Kane and Washington County Air Emissions by Source							
Source (tons per year) tpy	CO	NOx	PM10	PM2.5	SOx	VOC	Pb
Coconino County, Arizona							
• On-road Vehicles	39,250	6,475	182	132	140	3,066	--
• Electricity Generation	2,010	33,221	3,943	2,817	3,944	241	0
• Non-road Equipment	12,989	3,509	204	192	269	2,933	2
• Fossil Fuel Combustion	514	2,652	57	30	114	105	0
• Industrial Processes	25	--	836	218	--	104	--
• Fires	14,818	282	1,570	1,330	168	3,497	--
• Waste Disposal	2,045	74	318	306	5	259	--
• Residential Wood	348	4	48	48	1	75	--
• Miscellaneous	7	0	2,045	207	--	735	0

**Summary of Coconino, Mohave, Kane and Washington County
Air Emissions by Source continued**

Source (tons per year) tpy	CO	NOx	PM10	PM2.5	SOx	VOC	Pb
• Solvent Use	--	--	--	--	--	692	--
• Road Dust	--	--	6,698	594	--	--	--
• Fertilizer and Livestock	--	--	--	--	--	--	--
Subtotal	72,005	45,217	15,001	5,875	4,041	11,707	2
Mohave County, Arizona							
• On-road Vehicles	43,423	7,386	208	151	160	3,862	--
• Electricity Generation	7	22	1	1	3	1	--
• Non-road Equipment	23,633	4,339	284	270	356	6,413	1
• Fossil Fuel Combustion	174	788	66	28	149	44	0
• Industrial Processes	28	32	839	214	0	28	0
• Fires	14,280	313	1,551	1,314	171	3,384	--
• Waste Disposal	4,437	144	550	539	4	427	--
• Residential Wood	278	4	39	39	1	60	--
• Miscellaneous	10	0	3,857	412	--	920	0
• Solvent Use	--	--	10	9	--	1,086	--
• Road Dust	--	--	2,711	231	--	--	--
• Fertilizer and Livestock	--	--	--	--	--	--	--
Sub-total	86,270	13,028	10,116	3,208	844	16,225	1
Kane County Utah							
• On-road Vehicles	3,490	373	10	7	9	279	--
• Electricity Generation	--	--	--	--	--	--	--
• Non-road Equipment	2,208	72	24	22	7	760	--
• Fossil Fuel Combustion	23	46	8	4	73	9	0
• Industrial Processes	1	--	17	5	--	2	--
• Fires	734	11	86	76	9	156	--
• Waste Disposal	1	--	0	0	--	1	--
• Residential Wood	31	0	4	4	0	5	--
• Miscellaneous	803	16	393	33	8	277	0
• Solvent Use	--	--	--	--	--	127	--
• Road Dust	--	--	631	58	--	--	--
• Fertilizer and Livestock	--	--	--	--	--	--	--
Sub-total	7,506	517	1,173	209	105	1,616	0
Washington County, Utah							
• On-road Vehicles	22,270	3,591	78	55	87	1,771	--
• Electricity Generation	16	68	2	2	2	1	--
• Non-road Equipment	8,843	842	109	103	105	1,322	0
• Fossil Fuel Combustion	1,180	263	36	15	138	84	0
• Industrial Processes	26	8	145	45	7	31	0
• Fires	11,735	311	1,354	1,155	135	2,776	--
• Waste Disposal	--	--	8	0	--	23	--
• Residential Wood	518	6	68	63	1	91	---
• Miscellaneous	7,256	111	6,756	1,284	58	2,326	0
• Solvent Use	--	--	--	--	--	1,393	--
• Road Dust	--	--	1,041	80	--	--	--
• Fertilizer and Livestock	--	--	--	--	--	--	--
Subtotal	51,843	5,200	9,599	2,803	533	9,820	0

TABLE 4.3: 2005 Summary of Emissions by Source (in tpy). Coconino and Mohave Counties, AZ, Kane and Washington Counties, UT.

Climate: Utah and Arizona



Arizona Strip in winter. Photo credit: Spirit Eagle

At any given location in the Kanab watershed the troposphere, the weather breeder of earths' atmosphere has a specific set of physical properties that contributes to local weather. Examples are 1) temperature, 2) pressure, 3) humidity, 4) precipitation, 5) radiant energy (sunshine), 6) cloud-cover 7) wind direction and speed. These events, which are generally short-lived, are the local weather. Climate however, differs from weather as it represents a regions general pattern of weather over an extended period.

Statements and research issued by the former Utah Governor Jon Huntsman's Blue Ribbon Advisory Council on Climate Change

(BRAC); summarizes present scientific understanding of climate change and its potential impacts on Utah and the western United States.

BRAC reports were prepared by scientists from the University of Utah, Utah State University, Brigham Young University, and the United States Department of Agriculture. The report emphasizes consensus views about climate change models and research from both national and international scientific community.

- BRAC Section 1

<https://drive.google.com/file/d/0B1ohXIC3gEUPR2UxYmNITDVUMUU/view?usp=sharing>

- BRAC Section 2

<https://drive.google.com/file/d/0B1ohXIC3gEUPbk5paHV4dDFsX3c/view?usp=sharing>

- BRAC Section 3

<https://drive.google.com/file/d/0B1ohXIC3gEUPRjIhcjU5ZVJMukk/view?usp=sharing>

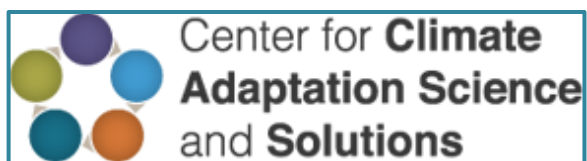
When considering potential impacts of climate change within the Kanab Creek Watershed there is no longer any scientific doubt that the Earth's average surface temperature is increasing and that changes in ocean temperature, ice and snow cover, and sea level are consistent with this global warming. In the past one-hundred years, the Earth's average surface temperature has increased by about 1.3°F, with the rate of warming accelerating in recent decades. Eleven of the last twelve years have been the warmest since 1850 (the start of reliable weather records). Cold days, cold nights, and frost have become less

frequent, while heat waves have become more common. Mountain glaciers, seasonal snow cover, and the Greenland and Antarctic ice sheets are decreasing in size, global ocean temperatures have increased, and sea level has risen about 7 inches since 1900 and about 1 inch in the past decade (BRAC).

Based on extensive scientific research, there is very high confidence that human-generated increases in greenhouse gas concentrations are responsible for most of the global warming observed during the past fifty years. It is very unlikely that natural climate variations alone, such as changes in the brightness of the sun or carbon dioxide emissions from volcanoes, have produced this recent warming. Carbon dioxide concentrations are now more than 35% higher than pre-industrial levels and exceed the highest natural concentrations over at least the last several hundred thousand years (BRAC).

In Utah, the average temperature during the past decade was higher than observed during any comparable period of the past century and roughly 2°F higher than the one-hundred year average. Precipitation in our state during the 20th century was unusually high; droughts during other centuries have been more severe, prolonged, and widespread. Climate models estimate an increase in the Earth's average surface temperature of about 0.8°F over the next twenty years. For the next one-hundred years, the projected increase is between 3 and 7°F, depending on a range of credible estimates of future greenhouse gas emissions. These projections, combined with extensive scientific research on the climate system, indicate that continued warming will take place over the next several decades as a result of prior greenhouse gas emissions (BRAC).

Utah is projected to warm more than the average for the entire globe and more than coastal regions of the contiguous United States. The expected consequences of this warming are fewer frost days, longer growing seasons, and more heat waves. Studies of precipitation and runoff over the past several centuries and climate model projections for the next century indicate that ongoing greenhouse gas emissions at or above current levels will likely result in a decline in Utah's mountain snowpack and the threat of severe and prolonged episodic drought in Utah is real (BRAC).



Arizona also has a robust network of university, government and non-profit organizations all dedicated to addressing how its geographical vulnerable state can prepare for climate change related events. A leader in these discussions is the [Center for Climate Adaptation Science and Solutions](#).

(CCASS) sponsored through the University of Arizona and its many partners. Further information in regards to climate change and resource issue concerns within the Kanab Creek Watershed can be found within the resource management plans (RMP) of each major land-use agency.

- [Western Regional Climate Center:](#)
- [University Corporation for Atmospheric Research](#)
- [Southwest Science Climate Center](#)
- [NOAA Climate Program](#)
- [National Climate Assessment Network](#)
- [Decision Center for A Desert City](#)

- [AQUASEC-Center for Excellence for Water Security](#)
- [Adaptation International](#)
- [Native Nations Climate Adaptation Program](#)

Rangeland: Arizona and Utah



Heaton Livestock Company: 2012 recipient of the Aldo Leopold Award. Photo Credit: Susan Murphy.

Ranching has been practiced in the Kanab Watershed since the 1800's when the first Anglo- settlers experienced the extreme challenges of irrigating crops in this arid landscape. As observed by John R. Young in 1871 about local efforts to grow crops:

"The grass hoppers have taken part of the wheat that was growing, and the crop was light at best, having been planted with a lick and a promise and not watered until too late to have a satisfactory stand."

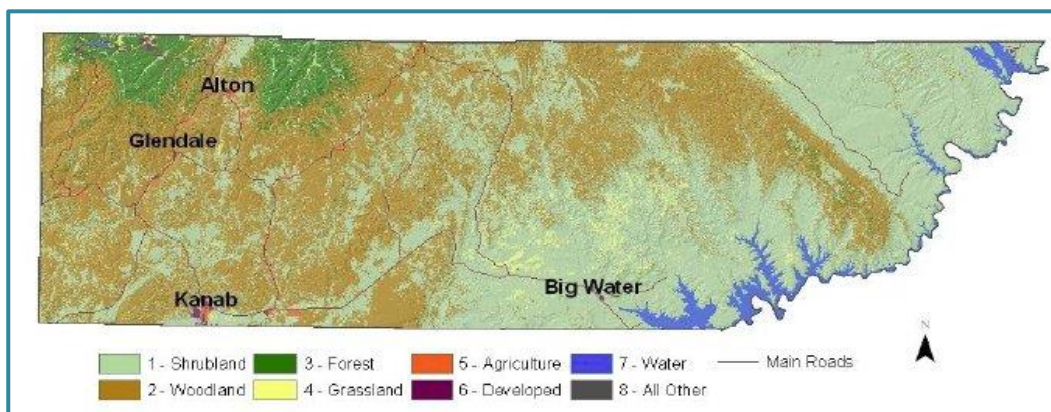
These ecological challenges, combined with an early inability to develop wells, and other water projects created enormous obstacles in the

establishment of an agricultural based economy, and the settlers soon turned to raising livestock. Communities settled where water could be easily obtained. However, due to its scarcity, water regulations became a norm, and soon irrigation companies and towns regulated the water; rather than separate homesteads. Additional water sources included area springs and seeps.

A Historical Perspective: Grazing Land Partnerships

Most ranches in the Southwest are dependent on grazing permits or leases upon federal or state lands. Grazing use on these lands has always been subject to government policies, regulations, and politics. The demand for other range uses, including environmental regulations, legal actions by activist environmental groups and other similar events have increased higher expectations when using these

lands to practice best management guidelines (Smith, 2013).





Rangeland worrkshop with USU Extension. 2013.

In addition to policy many state, federal and non-profit organizations supply technical and financial support to ensure wise-use, and best management guide-lines for rangeland improvement projects, thus ensuring a viable landscape for future generations.

Best Management Practices can be complimentary to other resource management goals by providing intact habitat for threatened and endangered flora and fauna; through cooperation, communication and a commitment to the watersheds ecological longevity.

History of Government Agricultural and Livestock Programs and Policy		
Land Management Policy	Goal	Year
Forest Reservation Amendment	Set apart and reserve, in any state or Territory, lands wholly or in part covered with timber or undergrowth, whether by commercial value or not	1871
Creation of Kaibab National Forest and Grand Canyon National Monument	To protect forests, deer herd populations, and Grand Canyon	1908
Agricultural Adjustment Administration (AAA)	Help local farmers learn methods of increasing fertility of depleted fields.	1932-1938
Taylors Grazing Act	The Taylor Grazing Act of 1934 (43 USC 315), "stop injury to the public grazing lands [excluding Alaska] by preventing overgrazing and soil deterioration.	1934
Civilian Conservation Corp	Put unemployed youth to work in area natural resource enhancement projects.	1932-1938
Federal Land Policy and Management Act of (FLPMA).	Cooperatively and creatively manage the public lands, and in the process, dispel the notion that a variety of uses and resources cannot co-exist.	1976

TABLE 4.4: Summary of National Agricultural and Livestock laws and programs.

Land Stewardship: A Story

Several states, federal and non-profit organizations give awards in recognition for outstanding ranching and agricultural practices. In his influential book, A Sand County Almanac, Aldo Leopold

called for an ethical relationship between people and the land that they own. The development of a land ethic was, he wrote, “is an evolutionary possibility and an ecological necessity.”



In recognition of these practices, the Sand County Foundation, a private, non-profit conservation group dedicated to working with private land-owners to improve habitat on their land, created the Aldo Leopold Conservation Awards; to recognize organizations and individuals who exemplify these practices.

In 2012, the Sand County Foundation awarded the Aldo Leopold Conservation Award to Kane County residents, and fourth generation ranchers (and cousins) Karl and Raymond Heaton.

Responsible for the management of over 140,000 private and federal acres, and approximately 1,250 head of cattle, the Heaton Ranch, is located in Alton, Utah. Their best rangeland management

practices contain strategies for other land-users to follow —both currently and in the future.



Additional support is provided through a voluntary certificate program developed by the state of Utah Department of Agriculture and Food (UDAF). This incentive based program called the Agriculture Conservation Environmental Stewardship (ACES) program, assists agriculture producers in their effort to protect the environment (natural resources) and remain sustainable. Though similar certificate programs are not offered by The Arizona Department of Agriculture, the

Upper-image: Heaton Ranch thirty years after seeding and rangeland re-vegetation. Foreground (bottom right): Heaton Ranch, site 1950's pre-seeding conservation efforts. Photo-credits: Heaton Ranch staff.

Arizona Cooperative Extension facilitates a website connecting farmers and ranchers to universities, non-profit organizations and federal programs that provide sustainability courses and certifications.

The National Forests: Kaibab and Dixie



North Kaibab National Forest: Photo credit: NAU.

Though changed after 15,000 plus years of human habitation the forest still remains a place of great beauty. The North Kaibab Forest is only one section of three areas of forest within the greater Kaibab National Forest Land Management Area.

In addition to the multitude of species that reside within its boundaries, humans have also relied heavily upon its many resources; its watersheds are of paramount importance both within and adjacent to the forests borders. They also contain ecologically important stands of old-growth forest species. In select areas, agricultural grazing allotments, and other important game species move into and out of the forest boundaries—depending upon the season.

Otto Lindh, an early Regional Forester described the close and sometimes fragile association between humans and the forests resources. The local economy he wrote is tied to the land:”....farming, both irrigated and dry land, ranching, lumbering, and recreation are mostly dependent on the land of the renewable

Perhaps one of the most distinctive features of the southwest is the forests of the North Kaibab Plateau. Located on the Northern side of the Grand Canyon, they are as one researcher observed, “an island of ponderosa pine.”

The Kaibab forest resources were a significant contributor of plant and animal food sources to the earliest indigenous populations and today remain home to several rare endemic species, including the North Kaibab squirrel, Northern goshawk and Mexican owl.

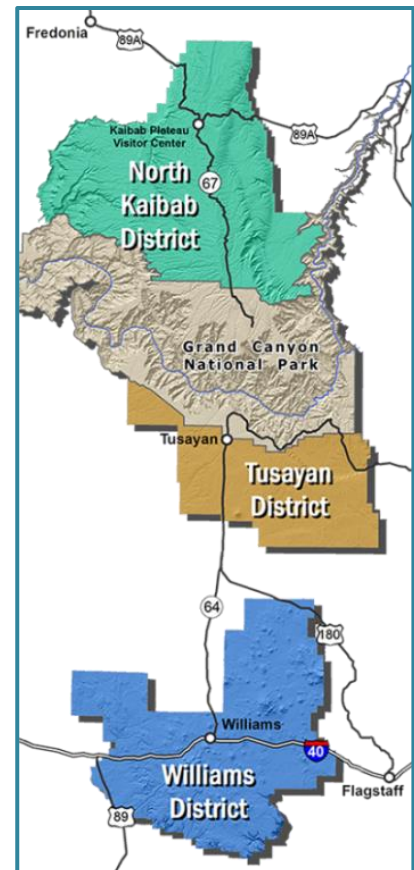


FIGURE 4.7: Kaibab Forest boundaries.

resources.” He further commented upon the importance of water, the resource whose lack, is most acutely felt by all.

The Kaibab National Forest is primarily a multiple use area. Its natural resources are harvested, mined and in some instances used to create energy through hydroelectric power generation. Furthermore, it is considered a northern gateway to the Grand Canyon; covering 1,000 square miles along its northern rim. Also much of the land that comprises Grand Canyon National Park was created out of the original Kaibab National Forest in 1919 (Arizona State University).

POTENTIAL NATURAL VEGETATION TYPES (PNVT) on Kaibab Ranger District			
Potential Natural Vegetation Types	Acres on North Kaibab Ranger District (NKRD)	% NKRD	Acres on Total Forest
Pinyon-Juniper Woodland	248,242	37.9%	647,604
Ponderosa Pine	155,209	33.7%	553,310
Mixed Conifer Forest ¹	113,620	17.3%	127,848
Sagebrush Shrubland	57,836	8.8%	89,450
Montane/Subalpine Grassland	6,545	1.0%	48,584
Colorado Plateau/Great Basin	0	0%	44,181
Spruce Fir Forest	29,002	4.4%	29,146
Semi-Desert Grasslands	25,115	3.8%	25,115
Desert Communities	13,773	2.1%	13,773
Gambel Oak Community	3,931	0.6%	5,364
Wetland/Cienega	608	0.1%	1,479
Cottonwood Willow Riparian	1,197	0.2%	1,197
Water, Urban, Agriculture & Other PNVTs ²	0	0.0	12,907

TABLE 4.5a: Potential Native Vegetation Types (PNVT) on Kaibab Ranger District

1 Wet and Dry Mixed conifer forest types are combined here and throughout the report unless it is important to separate them. Refer to the Vegetation and Fire Ecological Need for Change report (KNF 2008f) for an explanation.

2 The PNVTs of Interior Chaparral and Madrean Pine Oak Woodland account for 9 acres, or less than 0.1% of the Forest. Due to their limited extent, and the limited contribution the Forest can make in sustaining these PNVTs, they are not addressed in this report.

Dixie National Forest:

The Dixie National Forest lies within five Utah counties: Garfield, Washington, Iron, Kane, and Piute. County economies are driven by government (Iron), tourism (Garfield, Kane, and Wayne), agriculture (Garfield and Paiute), mining (Paiute), and trade/transportation/utilities and construction (Washington). The federal government is the prominent land administrator in each county. Of the four

main ranger districts, only the Powell Ranger District that manages 400,000 acres is within the northern boundaries of the Kanab Creek Watershed.

Active mixing of air and average precipitation for Utah, along with an absence of major air pollution sources results in low pollutant background values for the Dixie National Forest. Prescribed burns and wildfires are a source of air pollution, but in general, the air quality within the Forest is considered good to excellent. Recreational use, residential heating for support facilities, and limited vehicle traffic constitute the main sources of emissions (Dixie National Forest Oil, Gas and Mining FEIS.2015)

Many local communities obtain culinary and agricultural water from sources located on the Dixie National Forest. Extensive water developments such as reservoirs, diversions, and ditches have been constructed on the Forest to support these and other uses. The primary consumptive uses of surface water include off-Forest irrigation and culinary water supply. On forest uses include domestic water supplies for campgrounds and livestock/wildlife watering, and non-consumptive in-stream flows for aquatic habitat maintenance and recreation.

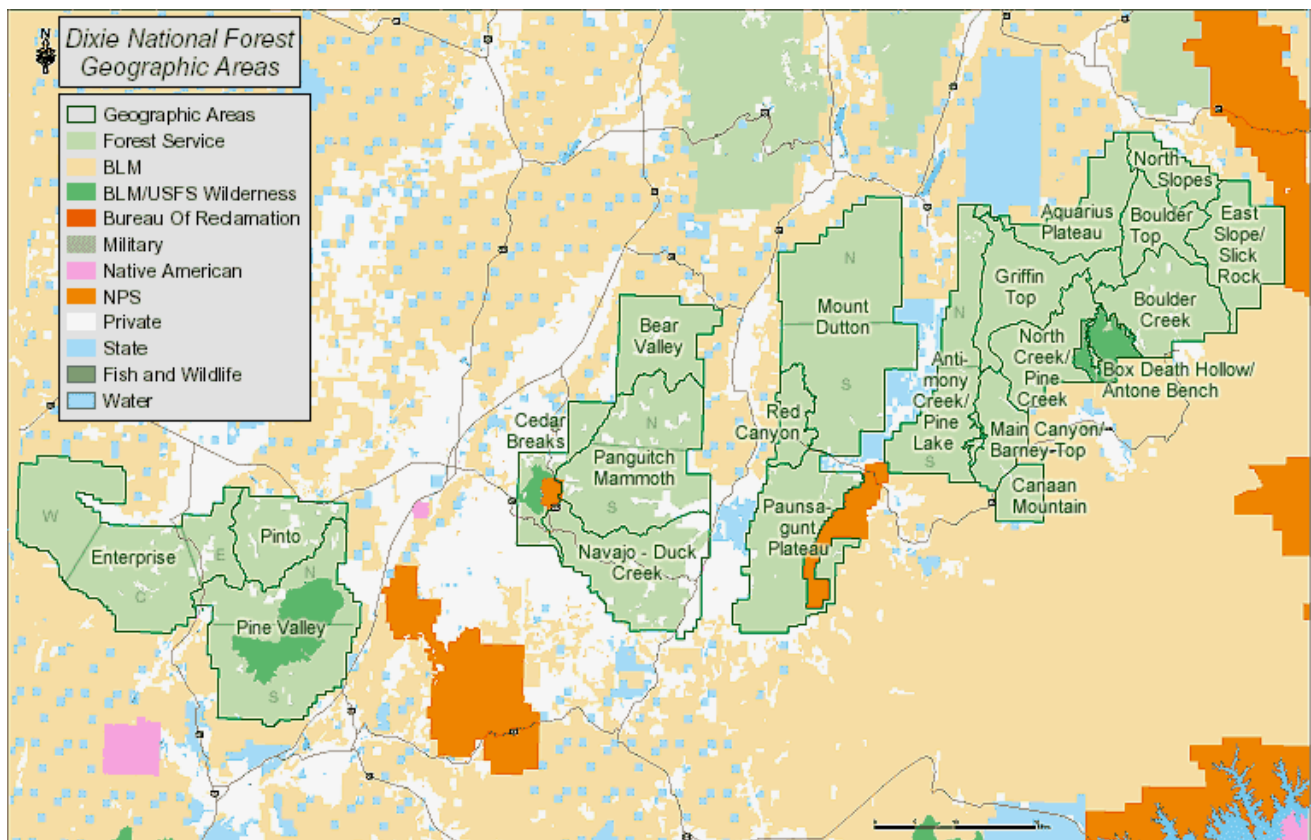


FIGURE 4.8: Dixie National Forest boundaries..

The Dixie National Forest contains many wildlife species, including small and large mammals, reptiles, and migratory birds that are protected by the Migratory Bird Treaty Act and other legislation. Migratory bird nests can be found in wet habitats as well as ponderosa pine/woodland, aspen, pinyon

VEGETATION TYPES Dixie National Forest-Powell Ranger District	
DESCRIPTION	ACRES
Aspen	2,926.51
Aspen/Grass-Forb	9,012.46
Basin Big Sage	31,782.25
Black Sage	23,237.12
Grass-Forb/Aspen	21,504.83
Mixed Conifer	35,720.91
Mixed Conifer/Aspen	1,327.04
Mountain Big Sage	18,656.63
Mountain Big Sage, Black Sage	71.39
Mountain Big Sage/Aspen	3,491.56
Mountain Big Sage/Black Sage	36,372.35
Mountain Big Sage/Spruce-Fir	5,645.55
Pinyon-Juniper	62,433.73
Ponderosa Pine	25,422.10
Ponderosa Pine/Mountain Big Sage	1,401.13
Rock	18,479.68
Rock/Ponderosa Pine	62,853.17
Sedge, Grass-Forb	3,416.98
Spruce-Fir	24,212.62
Water	144.43
Wyoming Big Sage	591.09
TABLE 4.5b: Vegetation types Powell Ranger District: Dixie National Forest	

toad, pygmy rabbit, two bat species, northern goshawk, greater sage-grouse, peregrine falcon, bald eagle, flammulated owl, three-toed woodpecker, bighorn sheep, and 24 plants (Powell Ranger District. 2015).

juniper, and conifer forest; most nests are found on the ground but may also occur in trees or shrubs. Native fisheries can be found in the 400 miles of aquatic habitat (streams, lakes, and reservoirs) on the Dixie National Forest. (Dixie National Forest, 2015).

Six threatened, endangered, or candidate (TEC) species are known or suspected to occur on the Dixie National Forest or in waters that flow from the Dixie National Forest. These species include two endangered fishes, three birds (California condor, Mexican spotted owl, and western yellow-billed cuckoo), and Utah prairie dog. Designated Critical Habitat for Mexican spotted owl occurs on the Escalante Ranger District. Many Forest-designated Sensitive species are also known or suspected to occur on the Forest, and include two cutthroat trout species, boreal

Riparian Zones & Wetlands:



Significant water flows into the upper reaches of Kanab Creek watershed and its associated drainages from springs. One predominant one is now Pipe Springs National Monument, named after a perennial water sources historically used by the Southern bands of Paiute and others.

Springs—hydrologic features where groundwater reaches, and usually flows from the surface—are among the most biologically diverse habitats. Particularly in arid regions where springs are isolated by harsh surrounding landscapes, springs are islands of habitat that support high biodiversity and endemism (Stevens and Meretsky 2008).

The Arizona Water Atlas, developed by Arizona Department of Water Resources documented the springs of the lower reaches of the Kaibab Plateau Watershed. Both major (>10gpm) and minor (<10gmp) springs were mapped (Fig 4.8). Kanab Creek spring discharge was

measured 1610 gmp (ADWR).

Springs below Kanab Falls. Upper Kanab Watershed.

A similar endeavor in Utah was completed by the Utah Division of Water Resources, who documented springs flows and locations in the Kanab Creek/Virgin River Watershed. These results are available in a manual titled: *Municipal and Industrial Water Supply and Uses in the Kanab Creek/Virgin River Basin*. <http://www.water.utah.gov/m&i/PDF/KanabVirgin/FinalKCVRM&I1-6-06.pdf>

Major and minor springs with their discharge rates, date of measurement, and the total number of springs in the basin are illustrated in Figure 4.6. Intermittent and perennial springs or significant perennial streams found in the basin include:

- Colorado River, the Paria River and Kanab Creek.
- Intermittent streams found south of Jacob Lake and in the vicinity of the
- Colorado River.
- Kanab Creek From the head-waters in Alton to the Johnson reservoir is also intermittent in the basin; changing into an ephemeral creek when it reaches Fredonia, AZ.
- There are thirty-nine major springs (AZ) with a measured discharge of ten gallons per minute (gpm) or greater at any time.
- There are twenty-three minor springs with measured discharge of one to ten gpm are not mapped.

Fire and Vegetation:

Numerous ecological studies across the Southwest have documented the decline in herbaceous vegetation (grasses and non-woody flowering plants) while forests thicken and brush invades. Evidence supports that these patterns are tied to changes in land use history, noxious weeds infestations (in particular non-native grasses), historical over-grazing, an extensive history of fire suppression, and drought ().

Fire Regime Condition Class (FRCC)		
Condition Class	Attributes	Management Options
Condition Class I	a. Fire regimes are within or near an historical range. b. The risk of losing key ecosystem components is low. c. Fire frequencies have departed from historical frequencies by no more than one return interval. d. Vegetation attributes (species composition and structure) are intact and functioning within an historical range.	Where appropriate these areas can be maintained within the historical fire regime by treatments such as fire use.
Condition Class 2	a. Fire regimes have been moderately altered from their historical range. b. The risk of losing key ecosystem components has increased to moderate. c. Fire frequencies have departed (either decreased or increased) from historical frequencies by more than one return interval. This results in moderate changes to one or more of the following: Fire size, frequency, intensity, severity, or landscape patterns. d. Vegetation attributes have been moderately altered from their historical range.	Where appropriate these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.
Condition Class 3	a. Fire regimes have been significantly altered from their historical range. b. The risk of losing key ecosystem components is high. c. Fire frequencies have departed from historical frequencies by multiple return intervals. d. This result in dramatic changes to one or more of the following: Fire size, frequency, intensity, severity, or landscape patterns.	Where appropriate these areas may need high levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.

TABLE 4.6: Fire Regime Condition Class (FRCC).

Moreover, these landscape and ecological changes, combined with prolonged drought cycles have resulted in severely altered fire regime. Plant communities within the western US, including the Kanab Creek Watershed have experienced severe fire events that have increased both in frequency, temperature and duration.

BLM Wildland Fire Ecology Goals and Objectives



Firefighter and public safety would be the primary goal in all fire management decisions and actions.

- Wildland fire would be used to protect, maintain and enhance resources and, when possible, be allowed to function in its natural ecological role.
- Hazardous fuels would be reduced to restore ecosystems; protect human, natural, and cultural resources; and reduce the threat of wildfire to communities.
- Fires would be suppressed at minimum cost, taking into account firefighter and public safety and benefits and values to be protected, consistent with resource objectives.
- The BLM would provide a consistent, safe, and cost-effective fire management program through appropriate planning (50 Code of Federal Regulations [CFR] 4.02, Counterpart Regulations), staffing, training, equipment, and management.
- Every area with burnable vegetation would have a Fire Management Plan (FMP) based on a foundation of sound science.
- Emergency stabilization, rehabilitation, and restoration efforts would be undertaken to protect and sustain resources, public health and safety, and community infrastructure.
- The BLM would work together with its partners and other affected groups and individuals to reduce risks to communities and restore ecosystems.
- The general Desired Wildland Fire Condition (DWFC) is to have ecosystems that are at a low risk of losing ecosystem components following wildfire and that function within their historical range (Proposed Kanab Resource Management Plan).

In recent years, many agencies have recognized the need for more pro-active fire management and have used tools such as the Fire Regime Condition Class (FRCC) classification system to rank existing ecosystem conditions and prioritize areas for fuels treatments. The FRCC describes the amount of departure of an area or landscape from historic to present conditions (Development of Coarse Scale Spatial Data for Wildland Fire and Fuel Management-RMRS-87).

Condition classes are a function of the degree of departure from historic fire regimes resulting in alternations of key ecosystem components such as species composition, structural stage, stand age and canopy closure. One or more of the following activities may have caused this departure:

- Fire exclusion
- Timber harvesting
- Grazing
- Introduction of exotic plant species
- Establishment of exotic plant species
- Insects and disease (native and introduced)
- Other past management activities

Though each major land user has specific resource management strategies for the utilization of prescribed fire, most guidelines' are similar. When considering the North Kaibab Ranger District the forested stands on the North Kaibab Ranger District have had unnaturally high live and dead fuel loading for some time, particularly in the ponderosa pine and mixed conifer vegetation types.

Consequently, thousands of acres are in need of treatment. Methods to achieve desired conditions include mechanical thinning, prescribed burning, and wildland fire use. The high costs associated with planning and implementation of prescribed burns and thinning projects have made wildland fire use a desirable option. In order to implement wildland fire use, fires must be naturally ignited (lightning)

and a “relative risk assessment” must be conducted. This assessment considers fire hazards, such as fire behavior, potential fire size, and forest conditions; probability factors such as time of season, barriers to fire spread, and seasonal severity; and values at risk; and (USDI and USDA 2005).

Arizona and Utah Soils:

Soils are a complex interactions between living and non-living components that plant, and animal communities are dependent upon. A diversity of soils is present across Arizona, and distributed in an intricate pattern throughout the state. These patterns are produced by extreme differences of climate, vegetation, lithology and physiography that are compressed within the state's boundaries (ASU Press). The general soil types are identified primarily by specific temperatures and precipitation trends.

TA1 Torriorthents-Camborthids-Rock-Out-Crop Association



Characteristics: Shallow and moderately deep soils and rock outcrop of the canyons, cliffs and mesas. This association consists primarily of the Grand Canyon area and the major tributaries to the Colorado River.

Soil Classification: 1) Torriorthents 2) Camborthids.

Percent Slope: 5 to vertical, some to 1,820 m (6,000 ft)

Elevation: 360 to 2,430 m (1,200 to 8,000 ft)

Mean Annual Precipitation mostly 150 to 250 mm (6 to 10 in); range is 150 to 500 mm (6 to 20 in).

FIGURE 4.9: Arizona locations of Torriorthents and Camborthids soil types.

MA1 Badland-Torriorthents-Torrifluvents Association



Characteristics: Shallow and deep, moderately fine and fine-textured, moderately sloping to very steep soils on eroded uplands and nearly level floodplains.

Soil Classification: 1) Typic Torriorthents 2) Typic Torrifluvents.

Percent Slope: Badland, none to 60 or more.

Elevation: 1,400 to 1,820 m (4,600 to 6,000 ft)

Mean Annual Precipitation: 150 to 300 mm (6 to 12 in).

FIGURE 4.10: Arizona location of Badland-Torriorthents-Torrifluvents soil types.

MA3 Sheppard-Fruitland-Rock Outcrop Association



FIGURE 4.11: Arizona location Sheppard-Fruitland-Rock Outcrop soil types.

Characteristics: Deep and moderately coarse-textured, nearly level to rolling soils and rock outcrop on plains.

Soil Classification: 1) Typic Torripsamments 2) Typic Torriorthents

Percent Slope: 2 to 15; some to 30

Elevation: 1,520 to 2,120 m (5,000 to 7,000 ft)

Mean Annual Precipitation: 150 to 250 mm (6 to 10 in)

Cryptobiotic Soils Arizona and Utah:



Biological soil crusts (BSC). Photo-credit: J.Belnap, USGS.

Within the Kanab Creek Watershed and the arid southwest the soils between the widely spaced vascular plants on the Colorado Plateau are generally dominated by a community of cyanobacteria, micro-fungi, lichens, and mosses collectively known as biological soil crusts.

Biological soil crusts (BSC) dominate this arid landscape, and can represent up to 70% of the living cover. Their presence or lack thereof can heavily influence system function in most ecosystems.

Furthermore, robust populations are critical for soil fertility, moisture, and stability. Like the higher plants of the Colorado Plateau, the physiological health of BSC's are governed by rainfall inputs and temperature. Biological soil crusts are extremely sensitive to rain events. However, unlike vascular plants they can respond to minimal precipitation.

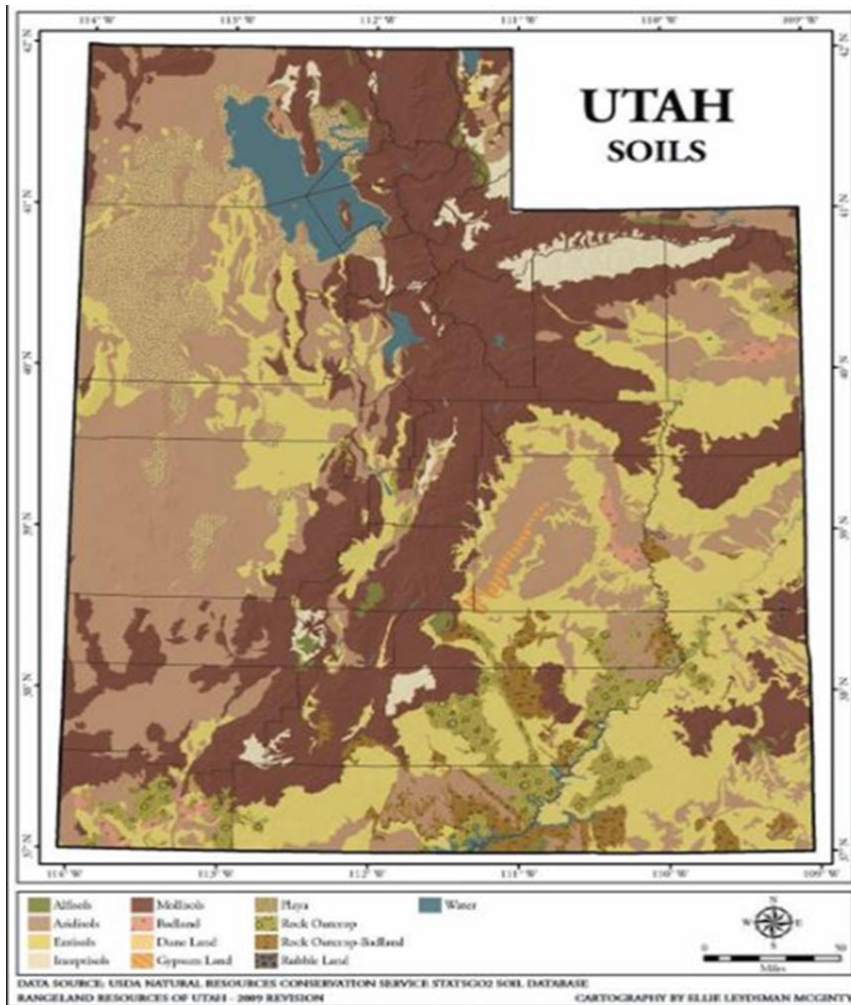
Biological soil crusts are an important source of C for subsurface soil organisms in these ecosystems, as soil C is limited in desert soils (Belnap, 2003). Whenever dry crusts are wetted, there is an immediate respiratory burst of carbon dioxide (CO₂) as well as a 30–60 min time lag before respired C can be replaced by photosynthesis (Lange 2003; Lange et al. 1996, 1997).

To compensate for this initial loss, and thus maintain a positive C balance, the soil surface must remain wet for an extended period of time during the day, a condition most likely to be satisfied in late fall through spring when air temperatures are cool.

NRCS Major Land Area 35: Colorado and Green River Plateau			
Ecological Zone	Desert Semi-Desert	Upland	Mountain
Precipitation	5-9 "	9-13"	13-16"
Elevation	3,000 -5,000	4,500 -6,500	5,800 - 7,000
Soil Moisture Regime	Aridic	Ustic- Aridic	Aridic-Ustic
Soil Temp Regime	Mesic	Thermi- Mesic	Mesic

TABLE 4.7: Major land areas and soil types of Kane County http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs141p2_032411.pdf

Utah Soils:



The varied geology, topography, and climatic conditions in Utah have produced unique soils. Generally, soils of the mountains and benches are slightly acidic to neutral with thick, dark-colored surface horizons, while soils of the deserts are alkaline and lightly colored. Extensive areas of outcropping rock, drifting sand dunes, and playa lakebeds also characterize the state of Utah. The distributions of soils in Utah were mapped and updated by the Natural Resources Conservation Service and the National Cooperative Soil Survey in 2006.

Seven of the twelve soil orders are found in the state of Utah: 1) Aridisols,, 2) Entisols, and 3) Mollisols dominate, followed by 4) Alfisols and 5) Inceptisols 6) Histosols and 7) Vertisols that occur in very small tracts where

parent material or moisture influences their formation (Boettinger 2010). The primary soils found within Kane county include: Alfisols, Aridisols, Entisols, and Mollisols.

Noxious Weeds:



Noxious weeds have often been likened to a wild-fire as their presence impacts all land uses, including recreation, grazing, water quality and quantity and wildlife habitat. Noxious and/or non-desired invasive plants contribute to changes in the fire frequency and subsequent fire, wind and water erosions. Consequently, their presence negatively impacts any areas biodiversity.

Federal and state listed species of concern are listed within (Table 5.9). Definitions of habitat categories can be found in the Utah Comprehensive Wildlife Conservation Strategy and the Arizona Conservation Agreement Species: Species of Concern. A review of four best management practices utilized in various levels by county, state, federal and private entities is briefly discussed.

BMP 1: Mapping and Inventory of Weed Populations:

Successful management includes documenting any *current* and *future* populations of noxious weed infestation using GPS technologies. Correct identification and labeling of populations with the appropriate designated symbol as determined by the USDA Natural Resource Conservation Service Database. <http://plants.usda.gov/>

BMP 2: Early Detection & Rapid Response:

Adoption of an Early Detection and Rapid Response (ED & RR) program is a viable approach to weed control that emphasizes the control of new, invading weeds (Utah, PCD, 2009). This method focus’s upon the eradication of invasive species populations when they are small. Cost associated for ED & RR methods are typically far less than those associated with containing vast populations of weeds.

The adoption of this method is more likely to impede unmanageable and fast spreading weed populations. This method has been adopted by many states and counties and is excellent in controlling infestations before the associated cost in equipment, personnel and treatment methods are excessive. Definitions of classes:

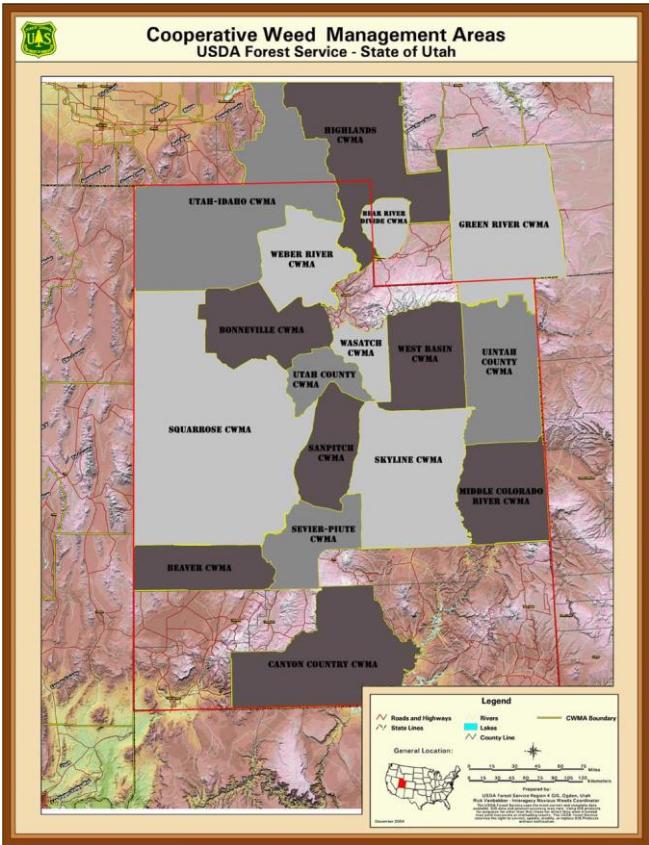
<u>Class A Weeds</u>	<u>Class B Weeds</u>	<u>Class C Weeds</u>
Relatively low population size within the State and are of highest priority being an Early Detection Rapid Response (EDRR) weed.	Moderate population throughout the State and generally are thought to be controllable in most areas.	Found extensively in the State and are thought to be beyond control. Statewide efforts would generally be towards containment of smaller infestations.

TABLE 5.9: Description of weed class categories of noxious weeds in the State of Utah.

Early Detection & Rapid Response Stages for Success:

- *Implementation:* Determine what actions need to be facilitated for the most effective and ecologically sensitive management of the invasive species.
- *Identify:* Correct identification of invasive species (genus species).
- *Inventory:* Mapping of the infestation, and photo-documentation of before and post-treatment, and determine establishment of a control perimeter.
- *Partnerships:* Utilization of technical and professional expertise through partnering with the Weber River CWMA (Central Weed Management Area).
- *Management:* Development of Environmental Scientist of Weed Specialist position.

BMP 3: Canyon Country CWMA-Southwest Vegetation Management



Cooperative Weed Management Areas (CWMA) link geography and shared boundaries. The benefits are numerous and include: (1 *Technical expertise*; (2 *Personnel*;(3 *Equipment*; (4 *Grant availability*; (5 *Management* of noxious weed populations not included within guidelines established by federal, state or other entities.

Weeds do not recognize boundaries. Consequently, the work of CWMA groups is an essential contributor to the control and eradication of noxious weed infestations. In Utah, Kane and Garfield counties belong with the Canyon Country CWMA. Established in 2006, this CWMA includes federal, county, state and private participants. Part of Region 4, as established by the United States Forest Service, its success have been numerous and varied.

Classification of weed species in Arizona differs from the State of Utah (Table 5.10).

Regulated	Restricted	Prohibited
" <u>Regulated pest</u> " means any of the following plant species, including viable plant parts (stolons, rhizomes, cuttings and seed, except agricultural, vegetable and ornamental seed for planting purposes), found within the state.	" <u>Restricted pest</u> " means any of the following plant species, including viable plant parts (stolons, rhizomes, cuttings and seed, except agricultural, vegetable and ornamental seed for planting purposes), found within the state shall be quarantined to prevent further infestation or contamination:	Definition described: including list: https://agriculture.az.gov/r3-4-245-prohibited-noxious-weeds

TABLE 5.10: Description of Arizona State regulated, restricted and prohibited pest species.

STATE OF ARIZONA NOXIOUS WEED LIST
REGULATED and RESTRICTED SPECIES

Common Name	Genus specie	Symbol	Link	Class	Present Watershed
Southern sandbur	<i>Cenchrus echinatus</i>	CEEC	http://plants.usda.gov/core/profile?symbol=CEEC	RGNW	Y
Field sandbur	<i>Cenchrus incertus</i>	CEIN	http://plants.usda.gov/core/profile?symbol=CESP4	RGNW	UK
Field bindweed	<i>Convolvulus arvensis</i>	COAR	http://plants.usda.gov/core/profile?symbol=COAR4	RGNW	Y
Floating water hyacinth	<i>Eichhornia crassipes</i>	EICR	http://plants.usda.gov/core/profile?symbol=EICR	RGNW	N
Burclover	<i>Medicago polymorpha</i>	MEVO	http://plants.usda.gov/core/profile?symbol=MEPO3	RGNW	Y
Common purslane	<i>Portulaca oleracea</i>	POOL	http://plants.usda.gov/core/profile?symbol=POOL	RGNW	Y
Puncture vine.	<i>Tribulus terrestris</i>	TRTE	http://plants.usda.gov/core/profile?symbol=TRTE	RGNW	Y
Russian knapweed	<i>Acroptilon repens</i>	ACRE	http://plants.usda.gov/core/profile?symbol=ACRE	RNW	Y
Jointed goatgrass	<i>Aegilops cylindrica</i>	AECY	http://plants.usda.gov/core/profile?symbol=AECY	RNW	Y
Camel-thorn,	<i>Alhagi pseudalhagi</i>	ALPS	http://plants.usda.gov/core/profile?symbol=ALMA12	RNW	Y
Hoary cress	<i>Cardaria draba</i>	CADR	http://plants.usda.gov/java/nameSearch	RNW	Y
Diffuse knapweed	<i>Centaurea diffusa</i>	CED13	http://plants.usda.gov/core/profile?symbol=CEDI3	RNW	Y
Spotted knapweed	<i>Centaurea maculosa</i>	CEMA	http://plants.usda.gov/core/profile?symbol=CESTM	RNW	Y
Dodder	<i>Cuscuta spp.</i>	CUSCU	http://plants.usda.gov/core/profile?symbol=CUSCU	RNW	Y
Floating water-hyacinth	<i>Eichhornia crassipes</i>	EICR	http://plants.usda.gov/core/profile?symbol=EICR	RNW	UK
Quack-grass	<i>Elytrigia repens</i>	ELRE	http://plants.usda.gov/core/profile?symbol=ELRE4	RNW	Y
Sweet resin bush	<i>Euryops sunbcarnosus:vulgaris</i>	UK	UK	RNW	UK
Halogeton	<i>Halogeton glomeratus</i>	HAGL	http://plants.usda.gov/core/profile?symbol=HAGL	RNW	Y
Texas blueweed,	<i>Helianthus ciliaris</i>	HECI	http://plants.usda.gov/core/profile?symbol=HECI	RNW	UK
Three-lobed morning glory	<i>Ipomoea triloba</i>	OPTR	UK	RNW	UK
Dalmation toadflax	<i>Linaria genistifolia</i>	LIDAD	http://plants.usda.gov/core/profile?symbol=LIDAD	RNW	Y
Scotch thistle	<i>Onopordum acanthium</i>	ONAC	http://plants.usda.gov/core/profile?symbol=ONAC	RNW	Y

TABLE 5.11: State of Arizona Regulated and Restricted Noxious Weed List <https://agriculture.az.gov/r3-4-245-prohibited-noxious-weeds>

STATE OF UTAH NOXIOUS WEED LIST
Class A, B, and C Species List

Common Name	Genus specie	Symbol	Link	Present Watershed
Bermuda grass	<i>Cynodon dactylon</i>	CNDA	http://www.utahweed.org/weed_bermuda.htm	X
Johnson grass	<i>Sorghum halepense</i>	SOHA	http://www.utahweed.org/weed_johnson.htm	X
Medusa head	<i>Taeniatherum caput-medusae</i>	TACA	http://www.utahweed.org/weed_medusa.htm	UK
Quack grass	<i>Elytrigia repens</i>	ELRE	http://www.utahweed.org/weed_quack.htm	UK
Field Bindweed	<i>Convolvulus arvensis</i>	COAR	http://www.utahweed.org/weed_bind.htm	Y
Sulfur Cinquefoil	<i>Potentilla recta</i>	SUCI	http://www.utahweed.org/weed_cinquefoil.htm	UK
Hoary Cress	<i>Cardaria draba</i>	CADR	http://www.utahweed.org/weed_hcress.htm	Y
Japanese knotweed	<i>Polygonum cuspidatum</i>	POCU	http://plants.usda.gov/java/nameSearch	UK
Oxeye Daisy	<i>Leucanthemum vulgare</i>	LEVU	http://www.utahweed.org/weed_oxeye.htm	UK
Poison Hemlock	<i>Conium maculatum</i>	COMA	http://www.utahweed.org/weed_hemlock.htm	Y
Black Henbane	<i>Hyoscyamus niger</i>	HYNI	http://www.utahweed.org/weed_henbane.htm	Y
Hounds tongue	<i>Cynoglossum officinale</i>	CYOF	http://www.utahweed.org/weed_hound.htm	N
St. Johnswort	<i>Hypericum perforatum</i>	HYPE	http://www.utahweed.org/weed_stjohns.htm	N
Diffuse Knapweed	<i>Centaurea diffusa</i>	CEDI	http://www.utahweed.org/weed_diff.htm	Y
Russian Knapweed	<i>Centaurea repens</i>	CERE	http://www.utahweed.org/weed_rusknap.htm	Y
Spotted Knapweed	<i>Centaurea maculosa</i>	CEMA	http://www.utahweed.org/weed_spotted.htm	Y
Squarrose Knapweed	<i>Centaurea virgata</i>	CEVI	http://www.utahweed.org/weed_squarrose.htm	UK
Purple Loosestrife	<i>Lythrum salicaria</i>	LYSA	http://www.utahweed.org/weed_purple.htm	UK
Perennial Pepperweed	<i>Lepidium latifolium</i>	LELA	http://www.utahweed.org/weed_pepper.htm	UK
Salt Cedar	<i>Tamarix ramosissima</i>	TARA	http://www.utahweed.org/weed_salt.htm	Y

Leafy Spurge	<i>Euphorbia esula</i>	EUES	http://www.utahweed.org/weed_spurge.htm	Y
Yellow Starthistle	<i>Centaurea solstitialis</i>	CESO	http://www.utahweed.org/weed_star.htm	Y
Canada Thistle	<i>Cirsium arvense</i>	CIAR	http://www.utahweed.org/weed_canada.htm	N
Musk Thistle	<i>Carduus nutans</i>	CANU	http://www.utahweed.org/weed_musk.htm	Y
Scotch Thistle	<i>Onopordum acanthium</i>	ONAC	http://www.utahweed.org/weed_scotch.htm	Y
Dalmatian Toadflax	<i>Linaria genistifolia</i>	LIGE	http://www.utahweed.org/weed_dtoad.htm	Y
Dyer's Wold	<i>Isatis tinctoria</i>	ISTI	http://www.utahweed.org/weed_woad.htm	Y
Buffalo Burr	<i>Solanum rostratum</i>	SORO	http://www.utahweed.org/weed_buffalo.htm	UK
Common Burdock	<i>Arctium minus</i>	ARMI	http://www.utahweed.org/weed_burdock.htm	Y
Camel Thorn	<i>Alhagi pseudalhagi</i>	ALPS	http://www.utahweed.org/weed_camel.htm	UK
Puncture Vine	<i>Tribulus terrestris</i>	TRTE	http://www.utahweed.org/weed_camel.htm	Y
Goatsrue	<i>Galega officinalis</i>	GAOF	http://www.utahweed.org/weed_goatsrue.htm	UK
Jointed goatsgrass	<i>Aegilops cylindrica</i>	AECY	http://www.utahweed.org/weed_jointed.htm	Y
Blue Lettuce	<i>Lactuca pulchella</i>	LATAP	http://www.utahweed.org/weed_lettuce.htm	Y
W. Whorled Milkweed	<i>Asclepias subverticillata</i>	ASSU2	http://www.utahweed.org/weed_milkweed.htm	Y
Silverleaf Nightshade	<i>Solanum elaeagnifolium</i>	SOEL	http://www.utahweed.org/weed_nightshade.htm	Y
Yellow Nut	<i>Cyperus esculentus</i>	CYESE2	http://www.utahweed.org/weed_nutsedge.htm	UK
Russian Olive	<i>Elaeagnus angustifolia</i>	ELAN	http://www.utahweed.org/weed_olive.htm	Y
Bull Thistle	<i>Cirsium vulgare</i>	CIVU	http://www.utahweed.org/weed_bull.htm	Y
Velvet Leaf	<i>Abutilon theophrasti</i>	ABTH	http://www.utahweed.org/weed_velvet.htm	Y

TABLE 5.12: State of Utah noxious weed list by category.

Wildlife Resources: Arizona and Utah



Mule deer buck and fawn Kaibab National Forest. Photo credit: AZSJ

For many millennia indigenous aboriginal tribes, and contemporary hunters, wildlife biologists, researchers, and nature enthusiasts have benefited from the Kanab Creek Watersheds over two-hundred species of wildlife.

Whether observing song-birds, avian populations passing through during migration, hunting deer herds following timeless seasonal movements, or other wildlife recreation activities--creative inspiration and even livelihoods are derived from the presence of the areas diverse wildlife and their management.

Over the past two centuries increases in human populations, industry and agricultural practices have altered both wildlife habitat and populations. Consequently, executive directives, such as the 20th century creation of the Grand Canyon Game preserve (11 years before receiving National Park Status), designation of area national forests and other public lands have contributed to wildlife's management and care. More recent legislation has extended even greater protections, such as the Endangered Species Act.

Among the fifty states, Utah ranks 10th in overall biological diversity, and 5th for endemism (this refers to species only found in one state). Though it is known for its robust and diverse big game hunting, it is also unfortunately ranked 5th in terms of species extinction rates—primarily among its fish species and 17th in other wildlife extinctions. This biodiversity is derived from its physical geology and differing habitats from high plateaus, mountains, low dry basins, and various riparian corridors and springs. While 64% of the states' wildlife and associated habitats are managed by federal organizations, 10% is managed by the state, 5% by Native American and 21% by private owners.

<i>Arizona and Utah State Wildlife Action Plans</i>		
State Agency	Wildlife Action Plans	Year Updated
Arizona Fish and Game	Arizona State Wildlife Action Plan-SWAP http://azgfdportal.az.gov/wildlife/actionplan	2012
Utah Division of Wildlife Resources	Utah Wildlife Action Plan http://192.168.1.1:8181/http://wildlife.utah.gov/wap/wap2015draft.pdf	2015-draft

TABLE 5.13: Arizona and Utah State Wildlife Management Action Plans 2012-current.

Arizona ranks fourth in the nation for biodiversity. However, the past one-hundred-fifty years of expansion and development has taken a toll on both habitat and wildlife resources—placing the state sixth for the number of species either listed or proposed in the Threatened and Endangered Species data base system. Conversely, the US Fish and Wildlife ranked Arizona third in the nation for wildlife-associated recreation. The various major land-managers commitment to conservation, wise-use and preservation has resulted in the state also ranking third in the nation for acres of protected expanses of wilderness. This dedication of the state’s various land-managers and policy makers has placed Arizona fifth in visitation to national parks and other wilderness areas

The Arizona Fish and Game partners with other state, federal and private land-users in the management of two-thirds of the Kanab Watersheds wildlife populations; their dedication to wildlife is evident in the multitude of programs and resource management plans. Their plans consider the migratory corridors and habitat both within, and beyond its borders. As wildlife populations, like water does not recognize state boundaries.



Upper right: Coral Pink Sand Dunes tiger beetle.
Lower left: Welsh's milkweed. Coral Pink Sand Dunes, Utah Division of State Parks.

In Utah, the Utah Division of Wildlife Resources, a member of the Utah Department of Natural Resources manages the wildlife populations in the upper Kanab Creek Watershed. In addition to partnering with federal area wildlife partners, they also work with State Parks, and SITLA concerning wildlife management concerns, in particular those concerning Threatened and Endangered Species (T and E).

Arizona Wildlife Programs:

http://www.azgfd.gov/w_c/edits/species_concern.shtml

Utah Division of Wildlife Resources:

<http://wildlife.utah.gov/>

Geographical areas and species are protected by a multitude of federal and state land management organizations within the Kanab Creek Watershed. However, often species, or geographically significant sites require supplemental efforts, and are designated additional protection status. Sensitive, endangered, threatened, proposed and candidate species of the watershed are tabulated within the Arizona and Utah Wildlife Comprehensive Wildlife Conservation Strategy: Species of Concern (Table 5.14).

ARIZONA and UTAH WILDLIFE COMPREHENSIVE WILDLIFE CONSERVATION STRATEGY <i>Species of Concern</i>						
FEDERALLY LISTED	AZ	UT	Common Name	Group	1° Habitat	2° Habitat
Endangered	X	X	California Candor	Bird	Cliff	
		X	Kanab Amber Snail	Mollusk	Water-Lentic	Wetland
		X	Bonytail	Fish	Water - Lotic	
		X	Colorado Pike minnow	Fish	Water-Lotic	
		X	Humpback Chub	Fish	Water - Lotic	
		X	Razorback Sucker	Fish	Water - Lotic	
Threatened		X	SW Willow Flycatcher	Bird	Low Riparian	Mtn. Riparian
	X	X	Mexican Spotted Owl	Bird	Cliff	Low Riparian
	X	X	Bald Eagle	Bird	Low Riparian	Agriculture
Candidate*		X	Utah Prairie Dog	Mammal	Grassland	Agriculture
		X	Coral Pink Sand Tiger Btl	Insect	Dunes	
	X	X	Yellow-billed Cuckoo	Bird	Low Riparian	Agriculture
	X	X	Gierisch Mallow	Plant	Desert	
	X	X	Pediocactus peeblesianus var Fickeiseniae	Plant	Low Desert	
Proposed	N/A	N/A	None			
STATE SENSITIVE	AZ	UT	Common Name	Group	1° Habitat	2° Habitat
Conservation Agreement Species	X	X	Northern Goshawk	Bird	Conifer/Aspen	
		X	Bonneville Cutthroat Trout	Fish	Water - Lotic	Mtn. Riparian
		X	Bluehead Sucker	Fish	Water - Lotic	Mountain
		X	Riparian Roundtail Chub	Fish	Water - Lotic	
		X	Flannelmouth Sucker	Fish	Water - Lotic	
Species of Concern	AZ	UT	Common Name	Group	1° Habitat	2° Habitat
	X	X	Allen's Big-Eared Bat	Mammal	Low Riparian	
		X	American White Pelican	Bird	Water - Lentic	Wetland
	X	X	Arizona Toad	Amphibian	Low Riparian	Wetland
		X	Big Free-tailed Bat	Mammal	Low Riparian	Cliff
	X	X	Burrowing Owl	Bird	High Desert	Grassland
	X	X	Common Chuckwalla	Reptile	High Desert	Low Desert
	X	X	Desert Night Lizard	Reptile	Low Desert	P & J
		X	Desert Sucker	Fish	Water - Lotic	
	X	X	Ferruginous Hawk	Bird	Pinyon-Junpr	Shrub steppe
		X	Fringed Myotis	Mammal	Northern Oak	P and J
		X	Greater Sage-grouse	Bird	Shrub steppe	
	X	X	Lewis's Woodpecker	Bird	Ponderosa	Riparian
	X	X	Kit Fox	Mammal	High Desert	
		X	Long-billed Curlew	Bird	Grassland	Agriculture
	X	X	Spotted Bat	Mammal	Desert Scrub	Cliff
	X	X	Siler Pincushion Cactus	Plant	Desert Scrub	
	X	X	Three-toed Woodpecker	Bird	Sub-Alpine Cnfr	Lodge-pole
	X	X	Townsend's Big-eared Bat	Mammal	Pinyon-Jnpr	Mtn. Shrub
	X	X	Western Toad	Amphibian	Wetland	Riparian Mtn.

TABLE 5.14: Summary of Utah Wildlife Species of Greatest Conservation Need. (UACD/NRCS 2006) Piñon-Juniper

Threatened and Endangered Species:

The Endangered Species Act

The ESA provides a means by which endangered and threatened species and the natural environments (ecosystems) upon which they depend may be protected and conserved.

ESA establishes a comprehensive program that is administered by the U.S. Fish and Wildlife Service to identify and actively conserve endangered and threatened species. The ultimate goal of the ESA is recovery of the species.



The U.S. Fish and Wildlife Service determines which species may face extinction and if the threat is the result of natural causes or human activities that altered habitats or directly eliminated the species.

When considering a request for listing, the federal agency must review all available information about the species to include: 1) the potential for threatened destruction, modifications, or curtailment of its habitat or range; 2) over-utilization for commercial, recreational, scientific, or educational purposes; 3) disease or predation; 4) inadequacy of existing regulatory mechanisms; and 5) other natural or man-made factors affecting its continued existence.

During the listing process the U.S. Fish and Wildlife Service provides a notice of review for species that are considered as candidates. These notices are published to seek additional biological information and input from states and other regulatory entities, regarding the candidate species.

Furthermore, if a species is declining or barely maintaining itself, some part of the natural system may have been disrupted. Knowledge of these relationships assists when determining the specific challenges. Also, some species play a key role in defining a given natural environment. For example, sage grouse habitats throughout their Utah range, defines a unique community on which many other species depend.

Declines in populations may also indicate a decline in aesthetical and economic values. Recent public opinion surveys conducted of Utah residents indicate that wildlife is an important economical, sociological, and aesthetical resource (Utah DWR). Moreover, an abundance and diversity of wildlife within the Kanab Watershed provides citizens the opportunity to participate in wildlife-associated recreational activities that enrich their lives. When considering the boon to local economies it is estimated that individuals in Utah spend an estimated \$237 million to watch wildlife (Utah DWR). This compares to \$231 million and \$150 million spent by anglers and hunters, respectively during the same year. Based on these estimates, a continued commitment in the preservation of wildlife diversity makes economic sense.



Water Resources:

"Water is the most critical resource issue of our lifetime and our children's lifetime. The health of our waters is the principal measure of how we live on the land." *Luna Leopold*

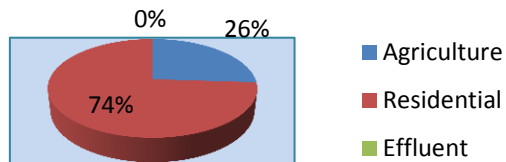
Water use is monitored by the Utah Division of Water Resources, Water Quality, state conservation districts, counties and the Utah Division of Water Rights. In Arizona, the Arizona Division of Water Resources monitors, surface and ground water use. Currently, wells and springs provide the majority of water resources for Kane County. Coconino and Moccasin counties follow a similar trend.

Within the watershed wells and springs provide the primary culinary water resources. Tables 5.1 and 5.2 illustrate the sources, and yearly water withdrawals. Water use is measured in acre-feet (ac/ft.), and spring water sources includes ground-water withdrawals. Most TAC, SC, and CAC members lacked the expertise to thoroughly address water rights and water quality issues within the watershed. Therefore, much reliance was placed on contacting those specific in setting regulations that impact water rights and conservation. Site specific data was also collected from regularly monitored sites in the upper reaches of the watershed. Water quality and quantity is a much debated topic within the Kanab Creek Watershed, much like it is throughout the western United States.

Kane County Water Sources (ac-ft)		Coconino County Water Sources (ac-ft)	
Sources	Units ac/ft	Sources	Units Acre Feet
Springs	816.3	Springs	Not Recorded
Wells	5,232.8	Wells	2,900
Surface	0.0	Surface	1,700~
TOTAL	6,049.1	TOTAL	3,600
UT Division of Water Resources Kanab/Virgin River Municipal & Industrial		Arizona Division of Water Resources: Water Sources	

TABLE 5.1: Comparison of water sources Kane County, Utah (2006) and Coconino County, Arizona. (2001-2005)

Water Use Kanab Plateau-Paria Basin



Coconino County Arizona is not a water provider. As the county is sparsely populated water use data is not delineated by potable, and non-potable only, 'Gallons Per Capita Per Day,' (GPCD), as utilized by municipal, industrial or agricultural. Moreover, only 25% of the connections within the Kanab Plateau and Paria Basin are metered, including the water supplied to Fredonia, originating in springs located in Utah is not monitored by the Arizona Department of Water Resources. (ADWR)

UTAH KANAB WATERSHED HUC 8 15010003 Ambient Water Quality Monitoring System

Monitoring UID	Monitoring ID	Name/Description	County	Latitude	Longitude
101204	4951750	Kanab CK BL Kanab WWTP at State Line	Kane	37.00609	-112.537
104448	4951770	Kanab CK AB KanabWWTP	Kane	37.03742	-112.532
104449	4951780	John R Canyon AB Kanab Ck	Kane	37.14773	-112.537
106176	4951810	Kanab CK at US89 XING	Kane	37.10082	-112.548
104452	4951830	Kanab CK at Falls XING E of Glendale	Kane	37.2911	-112.493
105968	5994480	Cottonwood Ck Lower	Kane	37.06165	-112.606
105964	5994410	Johnson Canyon @ Co RD Xing and Church Ranch	Kane	37.08596	-112.369
114124	4951940	Kanab Ck at County Rd Xing BL Alton	Kane	37.41939	-112.468
104450	4951800	Tiny Canyon ab cnfl/ Kanab Creek	Kane	37.09998	-112.549
104453	4951840	Cottonwood Spring AB Kane CK	Kane	37.27596	-112.559
106586	5994495	Cottonwood CK ~ 3/5 Mi BL Hell Dive Cyn.	Kane	37.04023	-112.608
103260	5994500	Cottonwood CK BL CNFL/ Water Canyon	Kane	37.06777	-112.63
103268	5994590	Seaman Wash Distribution System	Kane	37.10831	-112.251
103269	5994600	Pink Cove Catchment	Kane	37.18109	-112.288
103271	5994620	Johnson Canyon CK at US89 XING	Kane	37.0372	-112.357
103273	5994640	Mill CK AB Johnson/Robinson Diversion	Kane	37.32859	-112.329
106587	5994645	Mill CK ~1 Mi AB CNFL/ Tenny CK UT09ST-207	Kane	37.3567	-112.334
105971	5994740	Skutumpah Ck 2 Mi AB Thompson Ck	Kane	37.30804	-112.329
114372	5994788	Thompson Ck at Co. Rd AB Skutumpah	Kane	37.27934	-112.346
105976	5994790	Thompson Ck 2 MI AB cnfl Skumptah Ck	Kane	37.29526	-112.353

ARIZONA KANAB WATERSHED HUC 8 15010003

Ambient Water Quality Monitoring System Description

Monitoring UID	Monitoring ID	Name/Description	County	Latitude	Longitude
UK	Unknown	GRCA CMC KANA01 Kanab Ck/CNF CO RVR	Coconino	36.392222	-112.6294
UK	Unknown	GRCA NURE 0136 RVR/Stream	Coconino	36.4872	-112.1696
UK	Unknown	GRCA NURE 0135 RVR/Stream	Coconino	36.4718	-112.157
UK	Unknown	BRCA NURE 0088 CDCG027R/CDCG027S1	Kane	37.424	-112.4027
UK	Unknown	GRCA NURE 0133 River/Stream	Mojave	36.490	-112.8171
UK	Unknown	GRCA GS1 KANA02 Kanab Creek Below Old USGS Gaging Station	Mojave	36.3947	-112.6325

TABLE 5.2: List of water quality monitoring sites in Arizona and Utah. Contains links to testing sites, with the exception of Kaibab Band of Paiutes. STORET summary report, 2009.

Kane County Potable and Non-Potable Water Use-Acre-Feet (ac/ft)				Coconino County Potable & Non-Potable Water Use (ac/ft)					
Potable Uses	Ac/ft	Non-Potable	Ac/ft	Municipal		Industrial		Agriculture	
Residential Indoor	490.5	Residential Outdoor	760.1	Well Source	Surface Source	Well Source	Surface Source	Well	Surface
Residential Outdoor	728.5	Institutional	0.0						
Commercial	241.5	Commercial	104.0						
Industrial	377.3	Industrial/ Stock Water	0.0	1,600	700	300	Not Recorded	<1,000	<1,000
Industrial/Stock water	12.9	Residential Indoor	0.0						
TOTAL	1,850.7	TOTAL	864.1						

TABLE 5.3: A contrast of potable and non-potable municipal and industrial water use between Kane County and Coconino County. (Arizona Division of Water Resources, Utah division of Water Resources, 2005).



Water quality metal analysis sampling by the Arizona Department of Environmental Quality.

Arizona Water Quality Analysis:

Arizona Department of Environmental Quality (ADEQ) water quality assessments are described within Arizona's Integrated 305(b) Assessment and 303(d) Listing Report.

In addition the report contains a 303(d) list of Arizona's impaired surface waters requiring the development of a Total Maximum Daily Load (TMDL) and fulfills requirements of the federal Clean Water Act sections 305(b) (assessments), 303(d) (impaired water identification), and 314 (status of lake water quality). A recent 2012/14 Status of Water Quality in Arizona 305(b) Assessment Report is available in increments for easier analysis and viewing.

Water quality analysis in the Kanab Creek Watershed is also monitored by the U.S. Environmental Protection Agency the Division of Oil, Gas and Mining, National Park Service Water Resources Division, Kaibab Band of Paiutes, National Forest Service and varied university research projects.



DEQ monitoring site below Kanab Falls. Photo-credit S. Goldberry.

Utah Water Quality:

Utah Division of Water Quality segments waters into relatively homogenous units called Assessment Units (AUs). The physical, chemical, and biological conditions of the waters within an AU are more similar to each other than adjacent AU's.

Environmental factors such as flow, channel morphology, substrate, riparian condition, adjoining land uses, confluence with other waterbodies, and potential sources of pollutant loading are considered when delineating an AU. Lakes and reservoirs are typically a distinct AU. There are four AUs within the Kanab Creek Watershed.

Designated Use Class	Utah Water Use Description
1C	Protected for domestic purposes with prior treatment processes as required by Utah Division of Drinking Water.
2A	Protected for frequent primary contact recreation such as; swimming.
2B	Protected for infrequent primary contact and secondary contact recreation such as; boating or wading.
3A	Protected for cold water species of game fish and other cold water aquatic life, including aquatic organisms in their food chain.
3B	Protected for warm water species of game fish and other warm water aquatic life, including aquatic organisms in their food chain.
3C	Protected for nongame fish and other aquatic life, including aquatic organisms in their food chain.
3D	Protected for waterfowl, shore birds, and other water oriented wildlife not included in Classes 3A, 3B, or 3C, , including aquatic organisms in their food chain.
3E	Severely habitat-limited waters. Narrative standards will be applied to protect these waters for aquatic wildlife.
4	Protected for agricultural uses including irrigation of crops and stock watering.
5	Great Salt Lake specific.

TABLE 5.5: List of Designated Uses for Surface Waters of Utah, Utah Division of Water Quality. 2015.

The Clean Water Act requires DWQ to report on the health of all surface waters to Congress every other year, known as the Integrated Report (IR). Waterbodies that are not meeting their designated

uses are assessed as impaired in this report. After a waterbody is listed, a restoration plan or Total Maximum Daily Load (TMDL) is then developed for each pollutant. TMDL values define the total amount of pollutant that can be contained in the waterbody and still meet water quality standards. A TMDL includes the sum of pollutant loads from point sources (waste load allocations), non-point sources (load allocations), and a margin of safety (MOS) that accounts for uncertainty in the dataset and its analysis.

Reach Description	Designated Uses
<u>Kanab Creek 1:</u> Kanab Creek and tributaries from Arizona state line to irrigation diversion at confluence with Reservoir Canyon.	Infrequent primary contact (2B) Nongame fishery and other aquatic life (3C) Agricultural uses (4)
<u>Kanab Creek 2:</u> Kanab Creek and tributaries from irrigation diversion at confluence with Reservoir Canyon to headwaters.	Infrequent primary contact (2B) Cold water fishery and other aquatic life (3A) Agricultural uses (4)
<u>Johnson Wash 1:</u> Johnson Wash and tributaries from Arizona state line to confluence with Skutumpah Creek.	Infrequent primary contact (2B) Nongame fishery and other aquatic life (3C) Agricultural uses (4)
<u>Johnson Wash 2:</u> Johnson Wash and tributaries from confluence with Skutumpah Creek to headwaters.	Infrequent primary contact (2B) Cold water fishery and other aquatic life (3A) Agricultural uses (4)

TABLE 5.6: Utah DEQ reach description for upper Kanab Creek and designated uses.

Assessment Unit ID	AU Description	Parameter	Impaired Use	Year 303(d) Listed
UT15010003-002	Kanab Creek-1	Total Dissolved Solids	4: Agricultural Uses	2008
		Dissolved Oxygen	3C: Nongame fish and aquatic life	2014
UT15010003-003	Kanab Creek-2	Total Dissolved Solids	4: Agricultural Uses	2014
		Boron	4: Agricultural Uses	2014
UT15010003-004	Johnson Wash-1	Boron	4: Agricultural Uses	2014
		Selenium	3C: Non game fish and aquatic life	2014
		Total Dissolved Solids	4: Agricultural Uses	2008
UT15010003-005	Johnson Wash-2	Copper	4: Agricultural Uses 3A: Cold Water fish and aquatic life	2014
		Dissolved Oxygen	3A: Cold Water fish and aquatic life	2014
		Lead	4: Agricultural Uses 3A: Cold Water fish and aquatic life	2014
		Temperature	3A: Cold water fish and aquatic life	2014
		Total Dissolved Solids	4: Agricultural Uses	2014
		Zinc	3A: Cold water fish and aquatic life	2014

TABLE 5.7: 2012-2014 DRAFT 303(d) listed Kanab Creek Assessment Units (Subject to change dependent on EPA comment-June 2015).

Benthic Macroinvertebrates:

Biological data are important in interpreting aquatic life beneficial use support. DWQ has developed a model that assesses biological beneficial uses by quantifying the health of aquatic insect populations(benthic macroinvertebrates). Benthic macroinvertebrates are small animals living among the sediments and rocks on the bottom of streams, rivers and lakes. Insects comprise the largest diversity of these organisms and include mayflies, stoneflies, caddis flies, beetles, midges, crane flies, and dragonflies. Other members of the benthic macroinvertebrates community are snails, clams, aquatic worms, and crayfish. They are extremely important in the food chain of aquatic environments for fish and waterfowl.

Biological assessments compare the macroinvertebrates collected at a site with a reference list of species expected in that type of waterbody. UDWQ employs the RIVPACS model (River Invertebrate Prediction and Classification System) to assess biological integrity. To quantify the biological condition of a certain waterbody, the model compares the list of observed species (O) at a site to a list of expected species (E) that would be present in the absence of pollutant or habitat impairments. An O/E score of 0.7 means that 7 out of 10 taxa were discovered at the site or 30% of the taxa have died out as a result of human-caused impacts to the stream.

To date there haven't been any macroinvertebrate samples collected by the state, or by cooperating agencies, in the Kanab Creek watershed. Therefore, assessment based on biological data has not yet been done. Sites in this watershed can be targeted for future macroinvertebrate sampling if it's determined to be a priority.

For more information on the Utah 303(d) list, visit
<http://www.waterquality.utah.gov/WQAssess/currentIR.htm>.

A complete list of EPA approved TMDLs for Utah can be found on online:
<http://www.waterquality.utah.gov/TMDL/index.htm#approved>.

An online map of beneficial uses, assessment status and impairments can also be found at
<http://wq.deq.utah.gov>.

Arizona and Utah Water Rights:

The Division of Water Rights is the state agency that regulates the appropriation and distribution of water in the state of Utah. It is an office of public record for information pertaining to water rights, excepting that related to water right ownership. The office of public record for water right ownership is the county recorder's office for the county(ies) in which the water is diverted. All official and publicly accessible water right records for Kane County are available from both the Salt Lake City Utah, and the organization that manages the waters.

All waters in Utah and within the Kanab Watershed are public property. A “water right” is simply a right to divert (remove from its natural source) and beneficially use the water. The defining elements of a typical water right will include:

- 1) A defined nature and extent of beneficial use;
- 2) A priority date.
- 3) A defined quantity of water allowed for diversion by flow rate (cfs) and/or by volume (ac ft).
- 4) A specified point of diversion and source of water.
- 5) A specified place of beneficial use.

All other rights to the use of water in the State of Utah and Arizona must be established through the appropriation process administered by the Division of Water Rights. Moreover, there are specific steps to the “Application to Appropriate Water.” Many areas of the state are administratively “closed” to new appropriations of water. In those areas, new diversions and uses of water are established by the modification of existing water rights. Modifications are accomplished by the filing of “change applications.” These applications are filed and processed in a manner very similar to that described above for Applications to Appropriate Water. (UDWR)

Water appropriation issues in specific geographic areas of the state are often administered using policies and guidelines designed to address local conditions. These policies and guidelines are generally developed for all or part of a defined drainage basin. (Utah Division Water Rights, 2014)

EPA-Nine Essential Elements:

Recognizing that all watersheds have differing types of impairment the Environmental Protection Agency developed the nine minimum elements to help watershed manager address challenges. Often resource management plans may lack quantified estimates of current and projected pollutant loads and the reductions needed to achieve water quality standards and other watershed goals. These loading estimates and estimates of load reductions from proposed pollution control measures provide the analytic link between actions on the ground and attainment of water quality standards.

In summary they include:

- 1) Building partnerships: Identify key stake-holders, issues, goals and provide out-reach.
- 2) Characterize the watershed: Gather and analyze data. Identify any data-gaps.
- 3) Set goals and identify solutions: Management strategies.
- 4) Identify an implementation plan: Develop a schedule (short through long-term), and specific criteria to measure progress.
- 5) Implement the watershed plan: Conduct monitoring and work plans.
- 6) Measure progress and make improvements: Track progress and make improvements.
- 7) Implement Plan: Monitoring component that includes outreach information and education.
- 8) Design and Implementation Program: Enhance public understanding and participation.
- 9) Improve Plan: Measure progress, and apply assessments’.

A summary of how the Nine Essential elements will be integrated into the CRMP is in Table 5.8.

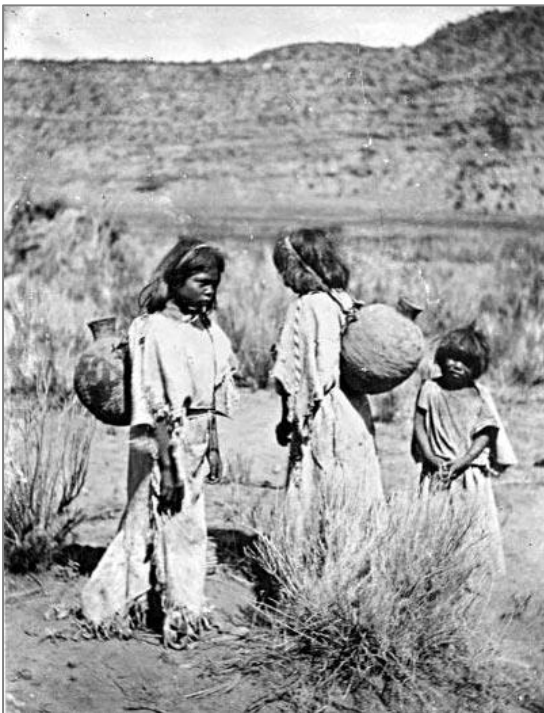
Evaluating EPA Nine Essential Elements and Natural Resource Categories of the Kanab Creek CRMP							
Kanab Creek Watershed Resource Issue Category	Measure Progress Assessments	Education Outreach Programs	How /will treatment(s) improve the watershed ?	Implementation Schedule	Keys to Successful Treatment	Funding Sources	How will results be shared?
Air Quality	UK	UK	NA	NA	NA	NA	CRMP
Climate	UK	UK	UK	NA	NA	NA	UK
Fire & Vegetation	T	T	T	T	T	T	CRMP
Ag & Rangeland	T	NA	T	T	T	NA	CRMP
Noxious Weeds	T	T	T	T	T	UK	CRMP
Wildlife and (TES	T	T	T	T	T	UK	CRMP
I & E	NA	T	NA	T	T	UK	CRMP
Water Quality	UK	UK	UK	UK	UK	NA	CRMP
Cultural Resources	NA	T	NA	T	NA	UK	CRMP
Forestry	T	T	T	T	T	T	CRMP
Oil Gas and Mining	UK	T	UK	UK	T	UK	UK
TABLE 5.8: Summary of methods of (EPA) Nine Essential Elements for watershed planning will be evaluated, and integrated into the coordinated resource management plan. Abbreviation key: CRMP: available on CRMP/UACD website; NA: not applicable; T: treatment plan; UK: unknown.							



Cultural Resources

"Do right always. It will give you satisfaction in life." *Paiute Wovoka*

Prior to the Anglo-European presence in the southwest, Arizona and Utah belonged to the Native Americans. Archaeology reconstructions suggest human habitation in these regions stretching back some 12,000 years. The most original aboriginal tribes, called the Kaibab Band of Paitute Indian are members of the Numic (Shoshone) speaking people who branched into four distinct groups during the historic period: the Northern Shoshone, Goshute or Western Shoshone, Southern Paiute and Ute peoples. For over a thousand years they have raised families, and lived successfully within the arid landscape of the Kanab Creek Watershed.



Young Paiute girls carrying water; Smithsonian Institute Archival Photo. Washington. D.C.

While many early Anglo-European settlers considered their hunter-gatherer lifestyle difficult, they intimately understood their plant and animal communities. Superb botanists, they often utilized within a single growing season up to ninety-six species of plants. As they systematically travelled across southern Utah, Arizona Strip and the Kaibab Plateau they were not only gathering food and hunting game but also collecting plants for their extensive pharmacopoeia (Knack, 2001).

Many useful items were also built from their gathered plant sources, such as beautiful and serviceable baskets. Collected seeds were ate, and also saved for later planting. In addition to planting they hunted primarily small game. Aware of the cycles of life they refrained from hunting animals during their mating seasons, and took only what was needed.

Archeological and historical accounts describe early agricultural practices; planting seeds near springs and along protected creek banks. These gardens received minimal tending over the growing season, as they needed to continue with their seasonal gathering. Upon completion of this task they returned to harvest what remained.

Believing that their land was sacred and nutritive they were secure in the knowledge that they could always make a living on their desert if they worked hard, were observant and imaginative (Knack,2001). They did not look upon their land as harsh and difficult as many of the early settlers did.

Tribal Integrated Resource Management Planning – IRMP

A key component of the Division of Forestry and Wildland Fire Management is the Integrated Resource Management Planning (IRMP) program. Activities of this program include:

- Produce Reference Materials: [Guidelines for IRMP in Indian Country](#) and [A Tribal Executive's Guide to IRMP](#)
- Provide IRMP Training and Support
- Conduct National IRMP Workshops
- Announce Annual [Request for Proposals for IRMP Development Project](#)
- Distribute Funds to Tribes Engaged in IRMP Development Work
- Manage the IRMP Development Project

A Tribal IRMP is a long-range, strategic level, comprehensive plan which integrates the management actions applied to a tribe's natural resources and other resources of value. It is a tribal policy document, based on the vision the tribe has for its resources.



Water is Life:

Cycles of nature are often unpredictable and the Paiute bands moved across valleys, plateaus, and mountains searching for the materials necessary to live within this majestic land. Of all the resources they searched for, water demanded their upmost attention. Abundance of water in this arid landscape is unpredictable, and scarce when considering that hundreds of miles between rivers that contain water with any regularity.

While the upper reaches of Kanab Creek were perennial in nature, the lower stretches are not. Consequently, the Paiutes relied upon area springs, seeps, and pools for their water needs. Today tribal natural resources, agricultural and livestock are managed by individual Paiute bands, with assistance from US Department of the Interior: Indian Affairs Integrated Resource Management Planning, or through participation in cooperative agreements, such as the Kanab Creek Watershed Coordinated Resource Management Plan.

Additional natural resource management planning and treatment funding is frequently provided by the Natural Resource Conservation Service (NRCS).

Kaibab Band of Paiute Indians Natural Resources:

Wildlife, Fisheries and Parks:

<http://www.kaibabpaiute-nsn.gov/Wildlife.html>

Environmental Departments:

<http://www.kaibabpaiute-nsn.gov/environmental.html>

Southern Paiute Consortium:

<http://www.kaibabpaiute-nsn.gov/SPC.html>

Intertribal Council of Arizona

<http://itcaonline.com/>



Resource Issues and Concerns Introduction:

“The happiest excitement in life is to be convinced that one is fighting for all one is worth on behalf of some clearly seen and deeply felt good.” *Ruth Benedict*

Throughout the resource issue evaluation process, the many participants contributed to the identification of the main resource issues. This section presents the various technical advisory, steering committee and citizen advisory committee team recommendations. Locations, project treatments, assessment goals, and time lines are also included in the analysis.

This watershed approach is the most effective framework to address today's water resource challenges. Nationally, watersheds supply drinking water, provide recreation and respite, and sustain life. More than \$450 billion in foods and fiber, manufactured goods, and tourism depends on clean water and healthy watersheds.



Pinyon-juniper community-North Kaibab Forest. Photo credit NAU.

Within this chapter funding strategies are also discussed, and a ranking of the top five highest priority resource issues. Moreover, an evaluation of the most appropriate treatments and assessments are included along with project-time lines. The following includes the Technical Advisory Committees (TAC) developed for the Kanab Creek Watershed CRMP. Their recommendations follow within this section.

- Agriculture and Rangeland
- Noxious Weeds
- Forests
- Water Quality
- Education and Information
- Cultural
- Wildlife
- Vegetation and Fire

Agriculture and Rangeland: Arizona Strip-BLM

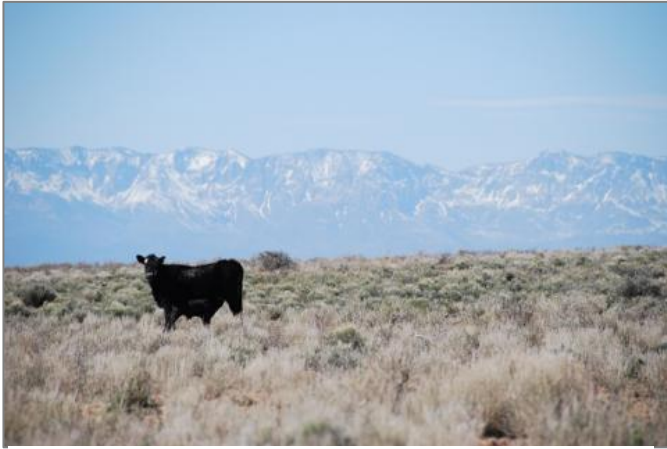


Photo credit: AS Livestock & Rangeland Workshop

Livestock grazing has held an important place in the history of the Arizona Strip, since the 1850s. However, by the 1930's over 100,000 head of cattle and a quarter of a million head of sheep competed with each other for limited forage and water.

Declines in both resources plummeted, and it wasn't until after the federal land-managers adopted the Taylors Act of 1934, that the time honored ranching practices were balanced with limits on use.

Afterwards, greater consideration was given to rangeland health and carrying capacity. Today, there are one-hundred and seventeen, cattle grazing permits on Arizona Strip lands. No permits are issued for sheep. In the Backroads of the Arizona Strip—A Biologists Paradise, author A. Phillips succinctly describes the Arizona Strip and its spectacular geological and biological vistas:

"The Arizona Strip is a vast land of broad plateaus, deep canyons, and spectacular cliffs. This landscape is punctuated in a few places by volcanic hills and mountains of much more recent origin than the ancient land surrounding them. Bound by the Grand Canyon on the east and south, the Strip Country is biologically and geographically two distinct areas separated by its highest plateau—the Kaibab. The smaller eastern section includes the Sandy Paria Plateau to the north and the broad House Rock Valley to the south. West of the Kaibabs is a rugged series of lower plateaus, each ending abruptly at its western edge with a steep escarpment and each deeply cut by canyons draining towards the Colorado River....It's vegetation is typical of the strip. The woodlands are dominated by two types of trees, Colorado Pinyon Pine and the Utah Juniper; usually interspersed and growing in equal number."

This description of the Arizona Strip (AS) creates a visual of a landscape with multi-use practices. One of the ecological management challenges within the AS BLM is the control of noxious weed populations, and other identified invasive species. Table 7.1 summarizes suggested future rangeland projects and identifies strategies to support the AS Resource Management Plan. Additional primary resource concerns within the AS BLM include; tamarisk and Russian olive removal and habitat restoration treatments; Figure 7.2 illustrates new route designations within the Ferry Swale area of the AS BLM; and multiple-use water projects.

BLM ARIZONA STRIP RECOMMENDED RANGELAND TREATMENTS			
Suggested Location	Treatment	Timeline (years)	Acreage
Grama Point New	Spike/Seed	5-10	1,726
Clay-hole	Spike	5-10	8,089
Yellowstone	Seeding Retreat	5-10	4,728
Moonshine	Bull-hog	5-10	1,349
Loco-point	Spike	5-10	3,188
Pigeon Tank	Spike	5-10	1,287
White Sage	Spike	5-10	5,358
Suicide	Bull-hog	5-10	965
Suicide	Spike	5-10	1,432
Shuttle-worth	Bull-hog	5-10	4,212
Fuller Road	Bull-hog	5-10	1,182
Sinks	Bull-hog	5-10	3,308
Cedar Knoll Treatments	Spike/ Retreat Seed	5-10	35,470
Gunsight	Spike/ Retreat	10-20	3,025
Grama Point Retreat	Spike/ Seed	5-10	1,712
TABLE 7.1: Suggested Arizona Strip BLM rangeland treatments.			

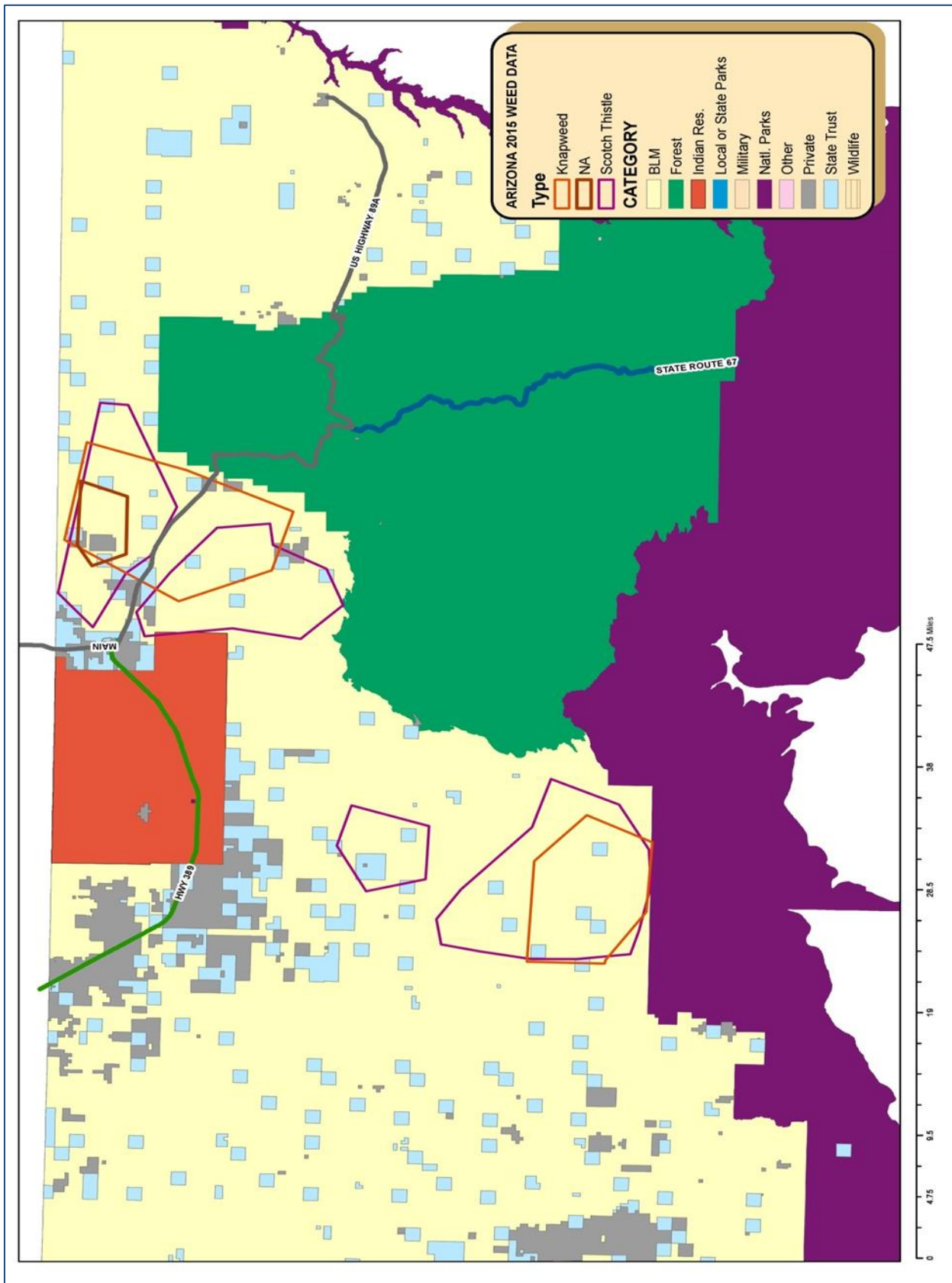
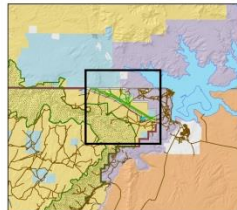
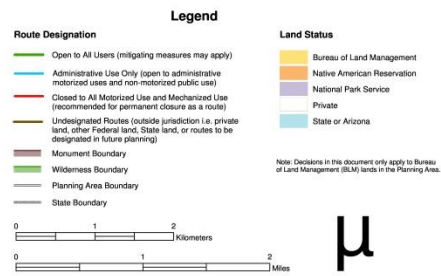
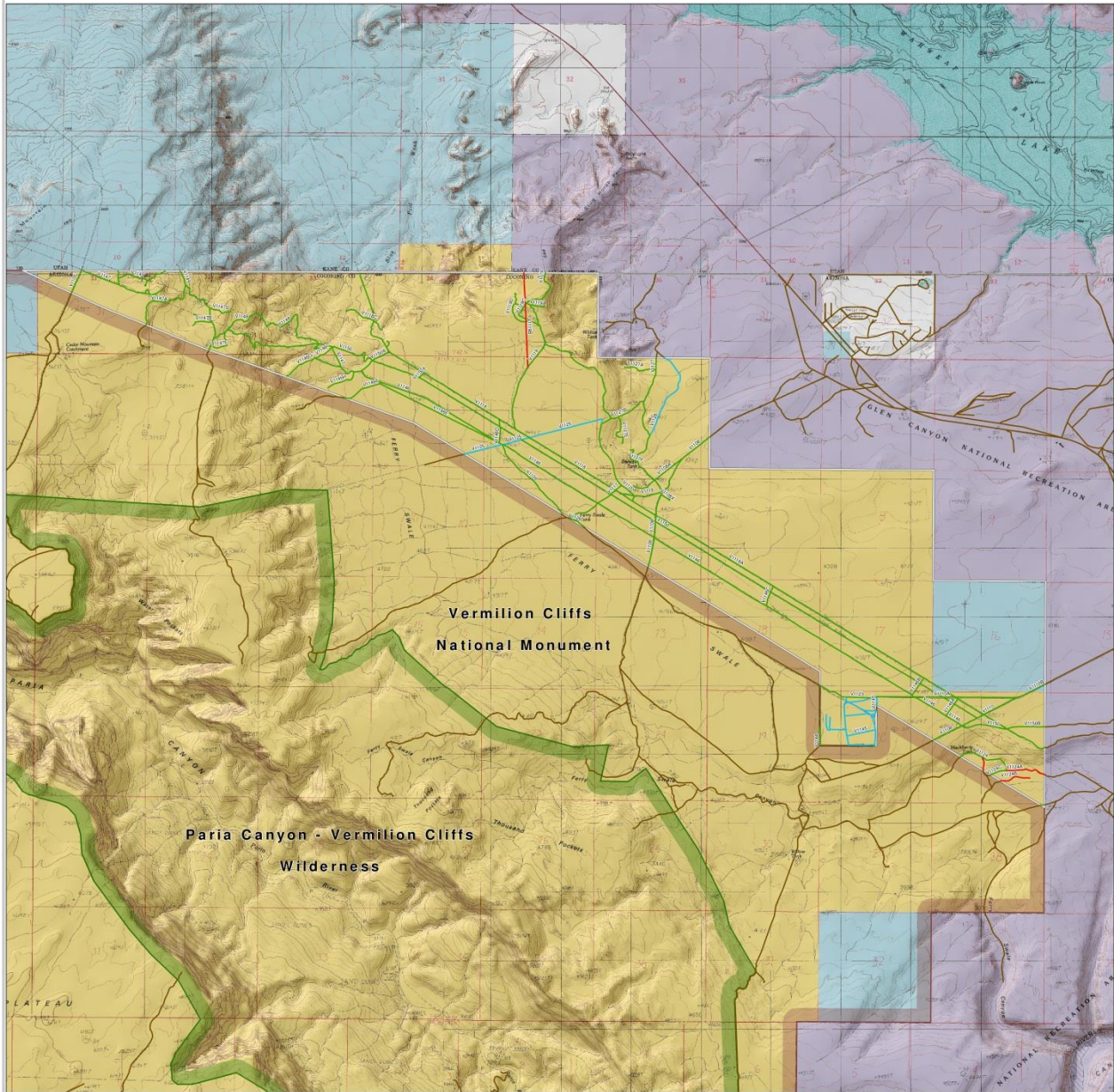


FIGURE 7.1: Arizona Strip top noxious weed species, location and approximate acreage. 2014-2015. AS BLM

FERRY SWALE AREA OF THE ARIZONA STRIP FIELD OFFICE ROUTE DESIGNATIONS

Bureau of Land Management
Arizona Strip District Office



Not all routes are labeled. Many smaller routes were not labeled due to overlap problems. If you have questions on specific routes that you cannot answer by viewing these maps, you can either contact the BLM or review the GIS data. This product may not meet BLM standards for accuracy and content. Different data sources and input scales may cause some misalignment of data layers.

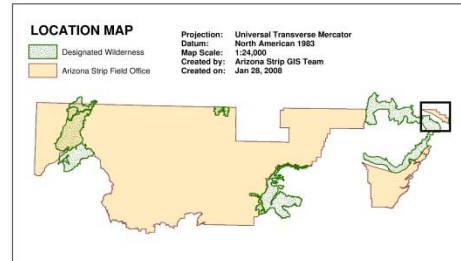


FIGURE 7.2: Arizona Strip BLM route designations in Ferry Swale Area. Map credit: AS BLM

Agriculture and Rangeland: Arizona Strip-BLM:

ADVISORY COMMITTEE	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME-LINE
ARIZONA: Arizona Strip BLM	1) <i>Rangeland rehabilitation.</i>	- Bulrush Wash - Hack Canyon¹ - Gramma Canyon - Kanab Wash - Jump-up Canyon - Lower Johnson - White Sage	a. Manage Piñon-Juniper encroachment and rehabilitation of upland vegetation (<i>Artemisia</i> spp.). b. Design projects to more accurately reflect watershed reverence conditions; and/or mimic watershed change agents. c. Target: 5,000-7,000 acres/year. (30-70% removal) Stage II & III d. Focus upon Stage I (100% removal) to eliminate invasive species within the sagebrush/steppe areas.	Immediate through twenty years.
	2) <i>Noxious weeds and invasive species control.</i>	- Gramma Canyon - Kanab - Jump-up Canyon - Lower Johnson Wash - White Sage Wash	a. Update and maintain sites of state and county listed noxious weeds and CWMA projects. Arizona Strip: Primary Weed Species of Concern: Russian Knapweed (<i>Rhaponticum repens</i>), Spotted Knapweed (<i>Centaurea stoebe</i>), Salt Cedar (<i>Tamarix</i> spp.) b. Collect additional data as needed: • BLM AZ noxious weed info. • CWMA's treatments that are completed. • USFS treated areas and available Lidar data. • Eco-regional assessments. • BLM-KFO noxious weed info. • Provide greater detail on expected benefits of riparian and upland veg surveys. • Utilize 'DWQ SVAP Method' for the evaluations. c. Clear Water Springs Project: • Removal of Tamarisk and Russian olive species from 21.6 miles stretch of Kanab Creek from Kaibab Paiute/BLM boundary to the US forest service/BLM boundary. • Restoration of area side drainages as needed. d. Right of way projects. • Arizona Strip Proposed Plan/FEIS, approximately 1900 existing routes in the Grand Canyon-Parashant National Monument, Ferry Swale, and Vermilion Cliffs National Monument.	Immediate through twenty years.
TABLE 7.2: Arizona Strip Bureau of Land Management primary resource issues relating to rangeland and agriculture.				

Agriculture and Rangeland Arizona: Fredonia AZ-NRCS, Fredonia Conservation District

ADVISORY COMMITTEE	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS/TREATMENTS & ASSESSMENT GOALS	TIME-LINE
ARIZONA Agriculture & Rangeland Contributors: AZ NRCS, Fredonia CD, Kane Conservation District. Citizens Advisory Committee	1) <i>Noxious weeds/Invasive species control.</i>	• Lower Johnson Wash • Bulrush Wash • Hack Canyon • Grama Canyon • Kanab Wash • Jump-up Canyon • Upper Johnson • Snake Wash • White Sage	a. Update and maintain sites of state and county listed noxious weeds and CWMA projects. • AS: Weed Species of Concern: Russian Knapweed (<i>Rhaponticum repens</i>), Spotted Knapweed (<i>Centaurea stoebe</i>), Salt Cedar (<i>Tamarix</i>) b. Collect additional data as needed: • BLM AZ noxious weed info. • CWMA's treatments that are completed. • USFS treated areas and available Lidar data. • Eco-regional assessments. • BLM-KFO noxious weed info. • Provide greater detail on expected benefits of riparian and upland veg surveys. • Utilize 'DWQ SVAP Method' for the evaluations.	Immediate through ten years.
	2) <i>Water quantity and quality.</i>	• Bulrush Wash* • Hack Canyon* • Grama Canyon • Kanab Wash • Jump-up Cyn. • Upper Johnson • Lower Johnson • Snake Wash • White Sage	a. Identify specific stream lengths, and upland vegetation projects. Describe inception, completion, through assessment. b. Prioritize livestock water availability and distribution. Include cooperative wild-life-agricultural water projects. c. Describe specific guidelines to maintain a healthy riparian corridor. d. Describe water-rights: In-stream flow rights for DWR (wildlife); BLM (water flow standards for livestock; when applicable). e. Identify any water rights that are not currently being asserted, and where they are specifically.	Immediate through project completion and monitoring phases.
	3) <i>Education and Information</i>	• Same treatment HUC's as precious.	a. Share economics on successful Ag/Rangeland projects; highlighting the participants and benefits. b. Install game cameras to monitor use and educate about use. c. Create range and livestock workshops to share successes. d. Share a water conservation plan that focuses on better management strategies.	Immediate through the ten years.
TABLE 7.3: Agricultural and rangeland projects prioritized for Fredonia, AZ., Conservation District, and Arizona NRCS rangeland specialists current and potential projects.				

Agriculture and Rangeland: Utah



The majority of Utah Agricultural and Rangelands within the Kanab Watershed are managed by the BLM Kanab Field Office, Grand Staircase Escalante National Monument, SITLA, Dixie National Forest and private entities.

Best Management Practices (BMP's) can help to reduce impacts from wildlife and livestock on rangelands and within riparian corridors. In addition to the adoption of BMP's, TAC members also categorized the following issues as highest priority: 1) Noxious weeds and invasive species management. 2) Water quality and quantity. 3) Information and Education (I & E) programs.

ADVISORY COMMITTEES	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS/TREATMENTS & ASSESSMENT GOALS	TIME LINES
UTAH Agriculture & Rangeland Contributors: Panguitch NRCS UT Field Office, SITLA, Kane County CD	1) Noxious weeds/ <i>Invasive species</i> control.	- Kanab Creek Headwaters - Upper Johnson Wash - Sandy Canyon Wash - White Sage Wash	a. Update and maintain sites of state and county listed noxious weeds and CWMA projects. b. Cooperate with the Canyon Country Cooperative Weed Management Area to eliminate or decrease Kane County Weed Species of Concern: White-top, (<i>Lepidium draba</i>), Russian Olive (<i>Elaeagnus angustifolia</i>), Salt Cedar (<i>Tamarix</i> spp.), Scotch Thistle (<i>Onopordum acanthium</i>) c. Collect additional data as needed: • BLM AZ noxious weed info. • CWMA treatments that are completed. • USFS treated areas and available Lidar data. • Eco-regional assessments.	Immediate through ten years.

			- AZ-BLM noxious weed info. - Provide greater detail on expected benefits of riparian and upland veg surveys. - Utilize 'DWQ SVAP Method' for the evaluations.	
2) <i>Water quantity and quality.</i>	- Kanab Creek Headwaters - Sandy Canyon Wash - Upper Johnson - White Sage Wash	- Identify specific stream lengths, and upland vegetation projects. Describe inception, completion, through assessment. - Prioritize livestock water availability and distribution. Include cooperative wild-life-agricultural water projects. - Describe specific guidelines to maintain a healthy riparian corridor. - Describe water-rights: In-stream flow rights for DWR (wildlife); BLM (water flow standards for livestock; when Ad). - Identify any water rights that are not currently being asserted, and where they are specifically.	Immediate through ten years.	
3) <i>Education and Information</i>	- Kanab Creek HW - Sandy Canyon - Upper Johnson - Bulrush Wash - Hack Canyon - Grama Canyon - Jump-up Canyon - Lower Johnson - White Sage	- Highlight: Utah Department of Agriculture ACES (Agriculture Certificate of Environmental Stewardship) recipients on the 'KCCD Website.' http://ag.utah.gov/aces/index.html - Share economics of successful Ag/Rangeland projects; highlighting the participants and benefits. - Install game cameras to monitor all use of shared water projects. - Create range and livestock workshops to share successes. - Share a water conservation plan that focuses on better management strategies.	Immediate through ten years.	

TABLE 7.4: Agricultural and rangeland projects as recommended for Utah boundaries and cooperative Arizona projects within the Kanab Watershed

TABLE 7.4: Agricultural and rangeland projects as recommended for Utah boundaries and cooperative Arizona projects within the Kanab Watershed.

Air Quality: Arizona

One of the primary air quality concerns in high visitation areas within the Kanab Creek Watershed in both Arizona and Utah are ozone levels (NPS). In Arizona, several state, federal and university departments contribute to air quality monitoring. Though members of the advisory committees recognized the negative cumulative effects of air pollution, and the importance of high air quality standards for healthy ecosystems; no air quality projects were identified. Area resource management plans address these concerns.

- Arizona Department of Environmental Quality <https://www.azdeq.gov/environ/air/>
- EPA: Air Pollution and the Clean Air Act www.epa.gov/air/caa/
- US EPA Tribal Air <http://www.epa.gov/oar/tribal/>

Air Quality: Arizona

ADVISORY COMMITTEE	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME-LINE
ARIZONA Division of Air Quality	Currently, no resource issues have been identified.	N/A	No projects or assessment goals have been identified.	N/A
TABLE 7.5: Summary of recommendations for Arizona Air quality from Kanab watershed CRMP advisory committee members.				

Air Quality: Utah

Alton Coal Mine operation and the EIS in response to potential air quality hazards, continues to be a public concern within the upper Kanab Creek Watershed. The Dixie National Forest (Powell Ranger District) recently submitted a supplemental air quality document titled: Oil and Gas Leasing on Lands Administered by the Dixie National Forest Supplemental Information Report-Air Quality. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5324696.pdf.

- Utah Department of Environmental Quality-Division of Air Quality <http://www.airquality.utah.gov/>
- Alton Coal Tract Lease by Application Supplemental DRAFT Environmental Impact Statement http://www.blm.gov/ut/st/en/prog/energy/coal/alton_coal_project.html

ADVISORY COMMITTEE	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME-LINE
Alton Mine EIS	1) Air Quality	• Kanab Creek HW • Sandy Canyon • Upper Johnson • White Sage	a. Appendix 1.1. Alton Coal Mine EIS, BLM Kanab Field Office.	Reference EIS.
TABLE 7.6: Summary of Utah air quality recommendations as suggested by Kanab Watershed CRMP advisory committee members.				

Climate: Arizona



Potential Kanab Creek restoration site near Utah and Arizona border. Photo credit: S. Goldberry

The State of Arizona, Department of Water Resources and several University organizations have developed both research programs and sensitive monitoring protocols to measure global climate change and its effects upon the natural resources of Arizona. Technical advisory committee members' top priority for climate change included one comment: 1) Climate change actions plans have been developed on the state levels; collaborate with these organizations.

Other projects include a weather station installed by the Fredonia NRCS that will provide data for local responses to climate change, and assist in contributing to water conservation actions to benefit local communities and ecosystems. Water availability for both livestock and wildlife was discussed by the Arizona Fish and Game, North Kaibab Ranger District, Arizona Strip BLM and the Kanab Field Office/BLM; support was expressed for the development of cooperative fresh drinking water projects.

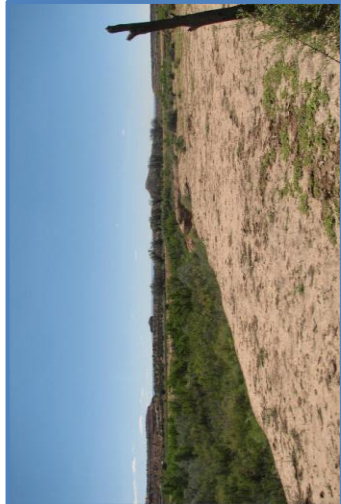
ADVISORY COMMITTEES	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME-LINE
ARIZONA Climate Change	1) <i>Climate change action plans have been developed on the state level.</i>	- Bulrush Wash¹ - Hack Canyon¹ - Gramma Canyon - Kanab Wash - Jump-up Cnyn - Lower Johnson - White Sage	a. Collaborate with state and organizations when considering climate change impacts upon future water resources. b. Consider and apply recommendations for reduction of greenhouse gases.	Not determined by Technical Advisory Committee.
TABLE 7.7: Summary of Arizona climate change recommendations made by the Kanab Watershed CRMP advisory committee members.				

Climate: Utah

Advisory committee members briefly discussed climate change, and the effects of the current and possible future drought conditions upon the Kanab Creek Watershed. Although, most of the major resource users within the Kanab Watershed have included comments about climate change; comments primarily focused upon future collaborations with state and other organizations when considering climate change impacts upon future water resources. Furthermore, the majority of federal land-users within the Kanab Watershed have issued statements and policy addressing global climate change.

ADVISORY COMMITTEES	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME-LINE
UTAH Climate Change	1) <i>Climate change action plans have been developed on the state level.</i>	• Kanab Creek HW • Sandy Canyon • Upper Johnson	a. Collaborate with state and other organizations when considering climate change impacts upon future water resources. b. Consider and apply area land managers recommendations for reduction of greenhouse gases.	Not determined by 'Technical Advisory Committee.'
TABLE 7-8: Summary of Utah climate change recommendations made by the Kanab Watershed CRMP advisory committee members.				

Cultural Resources: Arizona and Utah



The continued preservation and education about cultural resources of both indigenous people and early European communities were important resource issues ranked by TAC members. Agencies that significantly contributed to ranking the cultural resource projects and assessment goals included archeologists from the Arizona Strip Field Office, North Kaibab Forest Service, Grand Staircase Escalante Field Office, naturalists, historians and tribal council leaders from the Kaibab Band of Paiute Indians. Identified highest priority resource issues included: 1) Compliance with National Historic Preservation Act: a-g; 2) Public Education: a-g; 3) Funding Sources: a; and 4) Increased Tribal involvement with all projects. Additional resource issues included cooperative noxious weed control efforts, both in upland and lowland areas.

ADVISORY COMMITTEE	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME-LINE
ARIZONA and UTAH: Cultural Resources, contributors: Arizona Strip Field Office, North Kaibab Forest Service, Grand Staircase Escalante National Monument	1) <i>Comply with National Historic Preservation Act and other applicable cultural resource laws.</i>	• Kanab Creek HW • Sandy Canyon • Upper Johnson • Bulrush Wash • Hack Canyon • Grama Canyon • Kanab Wash • Jump-up Cyn. • Lower Johnson • White Sage Wash	- Initiate consultation with interested parties including state and federal land managers, local tribal governments and State Historic Preservation Offices (SHPO). - Complete a cultural resource overview of the watershed. - Conduct cultural resource inventories as necessary to locate and document cultural resource sites (historic and prehistoric features and artifact assemblages). - Consult with area Tribes to identify Traditional Cultural Properties and Sacred Sites. - Continue to develop measures to protect sites or mitigate adverse effects to sites from project activities. - Consult with 'State Historic Preservation Officers Advisory Council on Historic Places' when required. - Ensure site confidentiality.	Immediate and prior to any treatments.
	2) <i>Public Education</i> Interpretive Venues	• Kanab Creek HW • Sandy Canyon • Upper Johnson • Bulrush Wash • Hack Canyon • Grama Canyon • Kanab Wash • Jump-up Canyon • Lower Johnson • White Sage Wash	- Improve signage and brochures: - Highlight changes in water and land use through time utilizing local information learned from archaeology and paleo-environmental sciences. Incorporate a conservation message that emphasizes the need to improve watershed health. - Emphasize methods that will bring watershed conditions/function(s) to a healthier state. Place in high use areas (i.e., Hog Canyon ATV staging area or Johnson Canyon). - Educate that cultural resources are fragile <i>non-renewable</i> resources that can be damaged by ground disturbance, erosion, catastrophic wildfire, and vandalism. <u>They represent the history of human kind and should be protected.</u> - Elucidate that many sites represent the heritage of Native American people should be treated with respect. - Ensure site confidentiality. - Public Events - Provide field trips during Arizona and Utah state archeology month: http://saa.org/publicftp/PUBLIC/resources/ArchMont_h_2005.html - Incorporate information into other community events.	Immediate and prior to any treatments.
	3) <i>Funding Sources</i>	• Entire Kanab Watershed	Identify appropriate funding source (sponsoring agencies; permitted interests i.e., mining companies, ranchers; grants).	Immediate

RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME-LINE
4) <i>Tribal Involvement</i> Tribal Consultation and Public Education	• Bulrush Wash • Hack Canyon • Grama Canyon-Kanab Wash • Jump-up Canyon • Lower Johnson Wash • White Sage Wash	a. <u>Continue tribal consultation</u> 1. Consult with local tribal governments early, and throughout the process when conducting projects within the watershed. 2. Collaborate with tribes to address and mitigate issues or concerns that arise from the consultation process. 3. Invite the tribal natural resources programs to participate in project planning and collaboration efforts; as well as cultural resources staff. Tribal interests may extend beyond an interest in cultural resources; as tribal boundaries are within the watershed. b. <u>Increase public education</u> 1) Respect confidentiality and ancestral ties the tribal peoples have to the cultural and natural resources within the Kanab Creek watershed; and understand cultural significance placed upon those resources. 2) Develop Interpretive Venues: a. Work directly with the Tribes on any interpretive media that address tribal history and issues.	Immediate and prior to any treatment(s).

TABLE 7.9: Summary of Arizona and Utah cultural resources projects and assessments both present and future within the Kanab Watershed.

Fire and Vegetation: AZ and UT BLM, North Kaibab National Forest



Primary contributors to the Fire and Vegetation Resource Issues originated from TAC members of the Kanab Field Office--Bureau of Land Management (BLM), Arizona Fires and Fuels Program, Utah BLM Color Country District, and the North Kaibab National Forest offices.

Additional fire and vegetative resource issues treatment options for Pinyon-juniper encroachment management considerations were expressed from staff of the BLM Kanab Field Office, Grand Staircase Escalante National Monument, North Kaibab National Forest and the Utah Department of Water Quality. It was suggested that increasing prescribed burns when appropriate, would be beneficial to soil biota and habitat restoration efforts.

ADVISORY COMMITTEE	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME-LINE
Fire and Vegetation: AZ and UT BLM, North Kaibab National Forest	1. <i>Current Upper Kanab Creek Resource Projects:</i>	- Bulrush Wash - Hack Canyon - Grama Canyon - Kanab Wash - Jump-up Cyn. - Lower Johnson - White Sage	a. Continue to evaluate the many chaining and reseeding projects on private and BLM lands in various stages of completion within the upper Kanab Creek Watershed. b. Monitor success of stated goals: Improve watershed, increase opportunity for grouse, and elk and deer habitat. Improve washes near Kanab Creek to decrease erosion and general head-cutting. Partners: NRCS, Private Land-Owners.	Immediate through 2016 +
	2. <i>Forest Service Fire Analysis</i>	- Bulrush Wash - Hack Canyon - Grama Canyon - Kanab Wash - Jump-up Canyon - Lower Johnson Wash - White Sage Wash	a. Analyze firescape of the W-face, North-Kaibab forest; map expansion or, decrease of <i>Bromus tectorum</i> . b. Identify overlapping landscape level and multiple agency projects. c. Create joint objectives between AZ Game and Fish, US Fish and Wildlife, and North-Kaibab FS. d. Locate and map potential vegetation treatments on the west-side; utilize FS final report to identify high priority projects. e. Evaluate current and old chaining projects. f. Support co-op water projects; replace and upgrade when needed. g. Evaluate and monitor the landscape level project: Burnt Corral Veg. Management Project . 20,000 Acres . Appendix: <i>Management Plan for Kane Ranch</i> .	Five year plan analysis.

	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME-LINE
	3. <i>Reduce occurrences of noxious weeds and invasive species.</i>	• Kanab Creek Headwaters • Sandy Canyon Wash • Upper Johnson • White Sage	a. Encourage agencies and private land-owners to eliminate <i>all noxious</i> weeds. Particularly Class A populations. http://www.utahweed.org/weeds.htm b. Apply Early Detection Rapid Response (EDRR) methodologies when appropriate.	Five through ten years.
	4. <i>P/J removal and development of mosaics throughout open sagebrush grasslands.</i>	• Kanab Crk HW • Sandy Canyon Wash • Upper Johnson • White Sage	a. Eliminate creation of savannah's in restoration projects as their appearance is unnatural. b. Target: 5,000-7,000 acres/year. (30-70% removal) Stage II & III c. Focus upon Stage I (100% removal) to eliminate invasive species within the sagebrush/steppe areas.	Five through ten years.
	5. <i>Sagebrush steppe rehabilitation.</i>	• Kanab Crk HW • Sandy Canyon Wash • Upper Johnson • White Sage	a. Utilize Ely Chain, Harrow and other methodologies to diversify sagebrush age/classes. b. Standardize specific prescribed fire to make “small” 5-acre pockets within the sagebrush steppe.	Five through ten years.
	6. <i>Public Education and Outreach</i>	• Kanab Crk HW • Sandy Canyon Wash • Upper Johnson • White Sage	a. Increase public acceptance of treatments. b. Support other organizations (OPCD) also addressing this. c. Submit news and magazine articles d. Use existing events (fairs, extension, water fairs etc.) to increased public awareness. .	Immediate through twenty years.
	7. <i>NEPA</i>	• Kanab Crk HW • Sandy Canyon Wash • Upper Johnson • White Sage	a. Encourage Federal Agencies to conduct more “large-scale” (>50,000 acres) NEPA. b. Prioritize personnel and funding to accomplish these goals.	Immediate through twenty years.

TABLE 7.14: Fire and Vegetation treatments and assessments as recommended by AZ and UT BLM, North Kaibab National Forest.

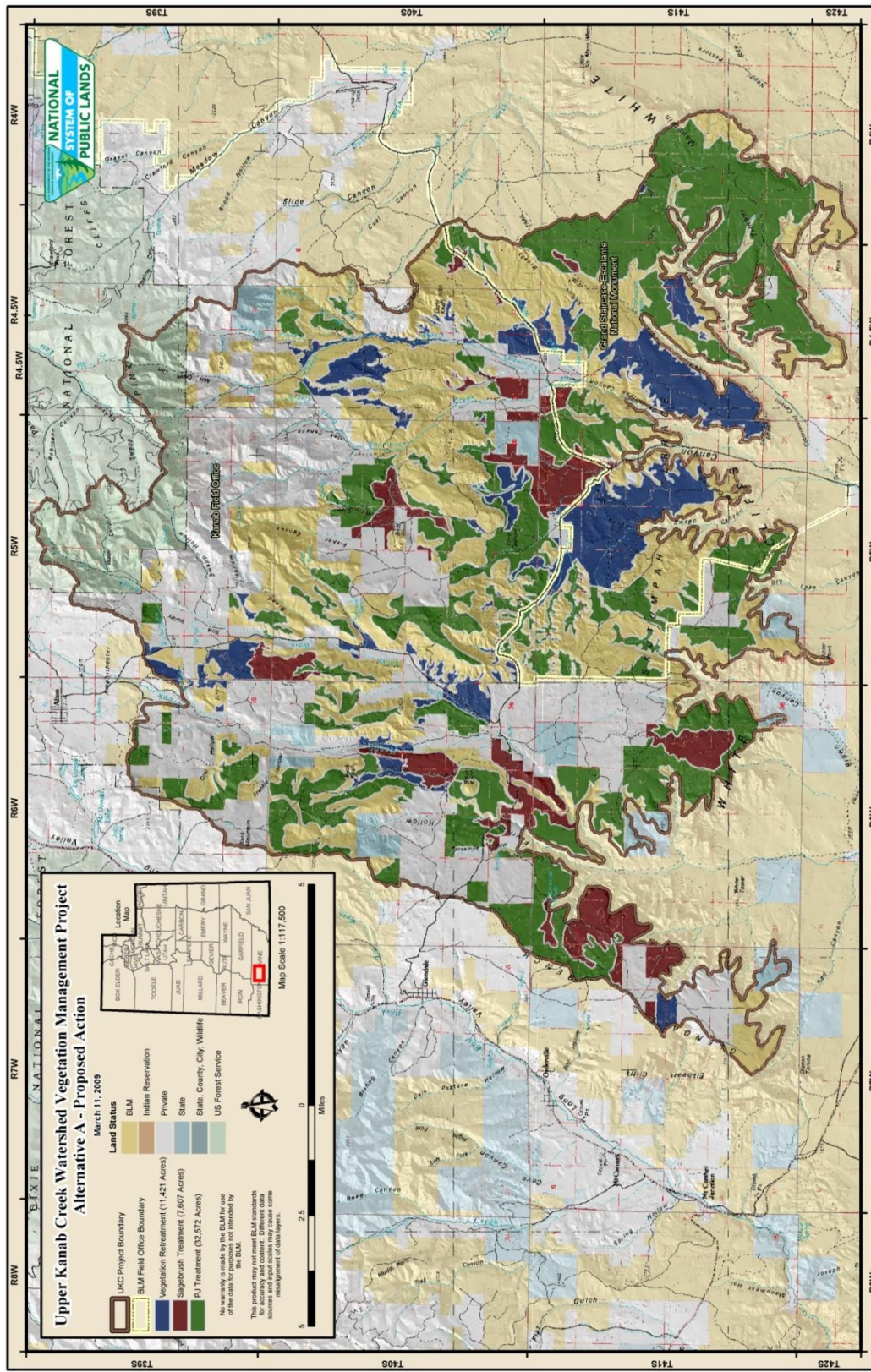


FIGURE 7.3: Upper Kanab Watershed Vegetative Management Project Alternative-A.

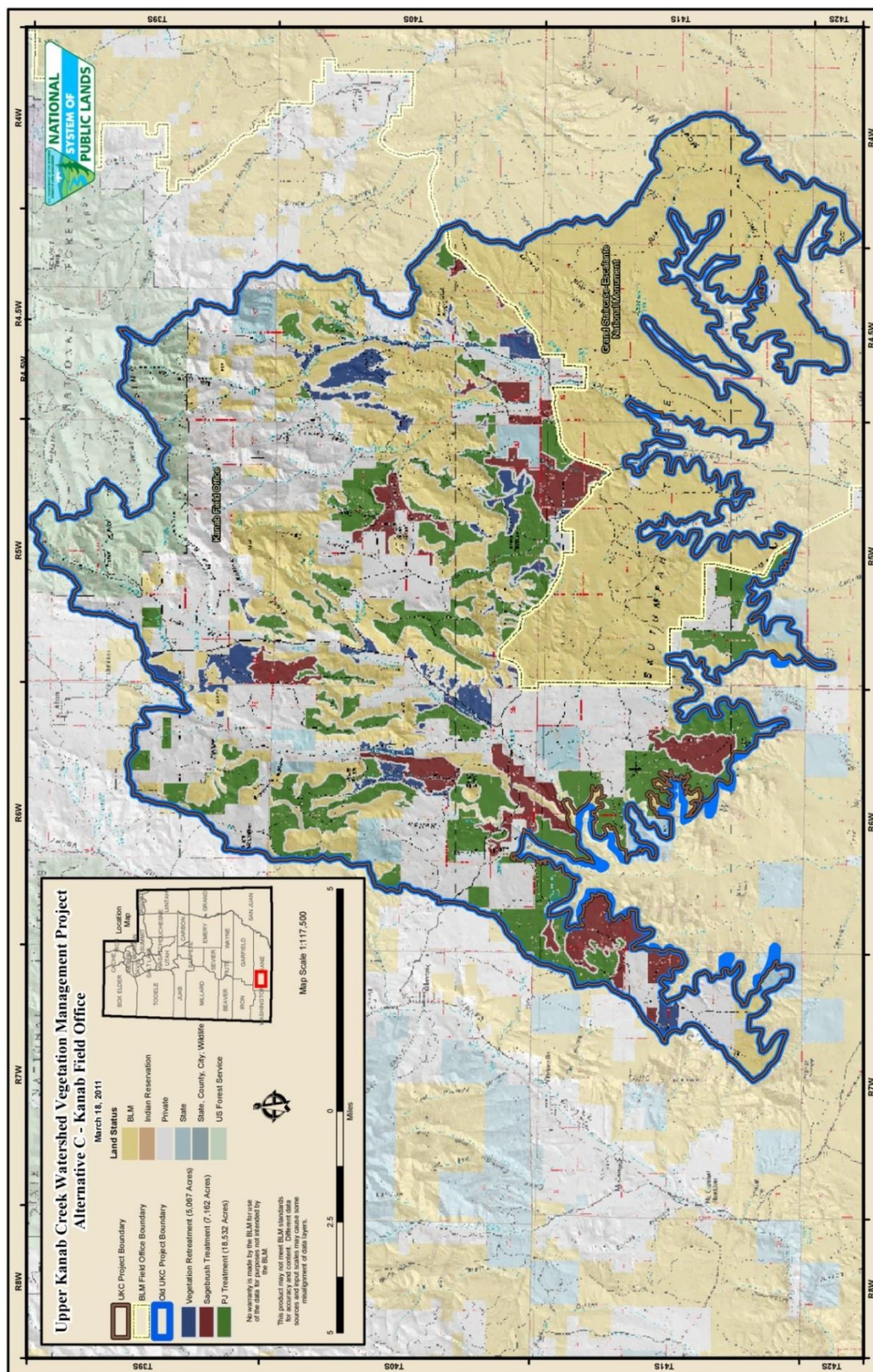


FIGURE 7.5: Alternative C for Upper Kanab Creek Watershed Vegetative Management Projects.

Forest: Arizona

The visionary efforts of former President Theodore Roosevelt and others preserved the Kaibab Plateau for future generations. While some of the original boundaries of the forest have changed, the Kaibab remains to be a forested island surrounded by lower elevation populations of sage and grassland habitats. Many resource issues were considered by the TAC, SC and CAC member in support of the Kaibab forests regional management plans. They can also be accessed within the *North Kaibab Forests Regional Management Plan* and the *Management Indicator Species of the Kaibab National Forest: An Evaluation of Population and Habitat Trends*.

Though the Kanab Creek grazing allotment is not being utilized for grazing at this time, other prioritized resource issues are listed from greatest to least: 1) Noxious and invasive weeds. 2) Cultural Resources. 3) Education and information. 4) Grazing and Rangeland health relating to the North Kaibab Ranger District. 5) Endangered Species Issues. 6) Wildlife Management and 7) Water Quality. A summary of each resource issues is listed below, followed by project boundary maps illustrating for (1), (4), (5), and (6 more thorough description of the forest resource management plans can be accessed from the following links, however this list may not be inclusive.



Land and Resource Management Plan for the Kaibab National Forest

<http://www.fs.usda.gov/detail/kaibab/landmanagement/planning/?cid=stelprdb5106605>

Kaibab National Forest Schedule of Proposed Projects

<http://www.fs.fed.us/sopa/components/reports/sopa-110307-2013-10.html>

Burnt Corral Vegetation Management Program

<http://tinyurl.com/p7ddvog>

Kanab Creek Watershed: Forest Service Invasive(s)

<https://drive.google.com/file/d/0B1ohXlC3gEUPRDV4V2jXTzVOQIk/view?usp=sharing>

Kanab Creek Watershed: Forest Service Vegetative Categories

<https://drive.google.com/file/d/0B1ohXlC3gEUPRLUhsZmpoc1VZeFk/view?usp=sharing>

ADVISORY COMMITTEES	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME LINE
ARIZONA Forestry Kaibab National Forest (NKRd)	1) <i>Noxious and invasive weeds</i>	- Hack Canyon - Gramma Canyon - Kanab Wash - Jump-up Canyon - Lower Johnson Wash - White Sage Wash	a. Monitor and treat invasive species before they disrupt the structure and function of ecosystems. i.e. negative impacts to wildlife. b. Monitor treatment(s): Class B: Musk Thistle (<i>Carduus nutans</i>) and Scotch Thistle (<i>Onopordum acanthium</i>). Class C -Canada thistle (<i>Cirsium arvense</i>), and Salt cedar (<i>Taxarix ramosissima</i>) within Kanab Creek Canyon. c. Monitor and treat additional invasive and non-native plant species including: Cheat grass (<i>Bromus tectorum</i>), Russian thistle (<i>Salsola tragus</i>) and Russian olive (<i>Elaeagnus angustifolia</i>) within Kanab Creek Canyon. d. Manage noxious and invasive weeds in accordance with approved program or according to project specific treatments approved through NEPA. USDA, Forest Service, Southwestern Region 2005. e. Support the final Environmental Impact Statement for '<i>Integrated Treatment of Noxious or Invasive Weeds</i>,' Coconino, Kaibab, Prescott National Forests within Coconino, Gila, Mojave, and Yavapai Counties, Arizona, MB-R3-16-1.	Immediate-five years.
	2) <i>Cultural Resources</i>	- Hack Canyon - Gramma Canyon - Kanab Wash - Jump-up Canyon - Lower Johnson - White Sage	a. Increase public understanding about cultural resources and historic preservation issues and how everyone can contribute to their protection.	Immediate-five years.
	3) <i>Education and Information</i>	- Hack Canyon - Gramma Canyon - Kanab Wash - Jump-up Cyn - Lower Johnson - White Sage	a. Develop additional educational outreach by KNF NKRd through interpretive presentations, and other modalities for the public each year.	Immediate-five years.

RESOURCE ISSUE(s) Continued:	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME-LINE
4) <i>Grazing and rangeland health relating to the KNF</i>	• Hack Canyon • Grama Canyon • Kanab Wash • Jump-up Canyon • Lower Johnson • White Sage	a. Continue to monitor and evaluate rangelands within the North Kaibab National Forest (NKR D) especially along the lower-west benches on west side of KNF-NKR D and the Kanab Creek Wilderness Area; both during the current to moderate drought conditions and/or into the future. b. Support and adjust as needed the grazing management plans that are site-specific through NEPA analysis. Currently, the Kaibab NF NKR D manages the range resource to balance livestock numbers with forage capacity. c. Continue to monitor and protect the Frank's Lake Geologic-Botanic Area (145 acres).	Immediate-five years.
5) <i>Endangered species issues</i>	• Hack Canyon • Grama Canyon • Kanab Wash • Jump-up Cyn • Lower Johnson • White Sage	a. Integrate project activities and special uses occurring within federally listed species habitat with habitat management objectives and species protection measures from approved recovery plans. b. Support established partnerships: c. Protect and monitor the threatened and endangered species listed under the Endangered Species Act of 1973. On the Kaibab NF, these species include: Mexican spotted owl habitat (<i>Strix occidentalis lucida</i>), and the ten non-essential experimental populations of California condor (<i>Gymnogyps californianus</i>).	Determined within the management plan.
6) <i>Wildlife Management</i>	• Hack Canyon • Grama Canyon • Kanab Wash • Jump-up Canyon • Lower Johnson • White Sage	a. Manage the established resource issues relating to wildlife management: b. Continue to evaluate habitat configuration and availability of wildlife populations; adjust their movements (e.g., seasonal migration, foraging, etc.) in response to climate change and promote genetic flow between wildlife populations. c. Project activities and special uses should be designed and implemented to maintain refuges and critical life cycle needs of wildlife, particularly for raptors. d. Continue to monitor the Grand Canyon Game Preserve and the Kaibab Squirrel National Natural Landmark. e. Continue to evaluate and monitor the ponderosa pine habitat for the Kaibab squirrel. Managed with the "Land and Resource Management Plan for the Kaibab National Forest (March 2014)" f. Coordinate the Grand Canyon Game Preserve that provides quality	Determined within the management plan.

			habitat for game animals. Monitor the variety of vegetation types, in all stages of development, and evaluate the range of habitats for native and desired nonnative wildlife species, including natural preserve.	
	7. Water Quality Non-Point and Point-source pollution	• Bulrush Wash • Hack Canyon • Grama Canyon • Kanab Creek HW • Jump-up Canyon • Lower Johnson • White Sage	a. Evaluate and monitor the non-point source sediment loading from natural erosion events; ephemeral washes tend to fill as part of the natural erosion process. b. Monitor post fire recovery areas prone to erosion: i.e. Warm Fire and Bridger-Knoll fire areas that are more prone to erosion, especially during seasonal monsoon events. c. Utilize when necessary the 'Beneficial Uses and Water Quality Assessment Map: HTTP://wq.deq.utah.gov'	Determined by the NKRDR management plan.
TABLE 7.10: North Kaibab Ranger District prioritized main resource issue recommendations.				

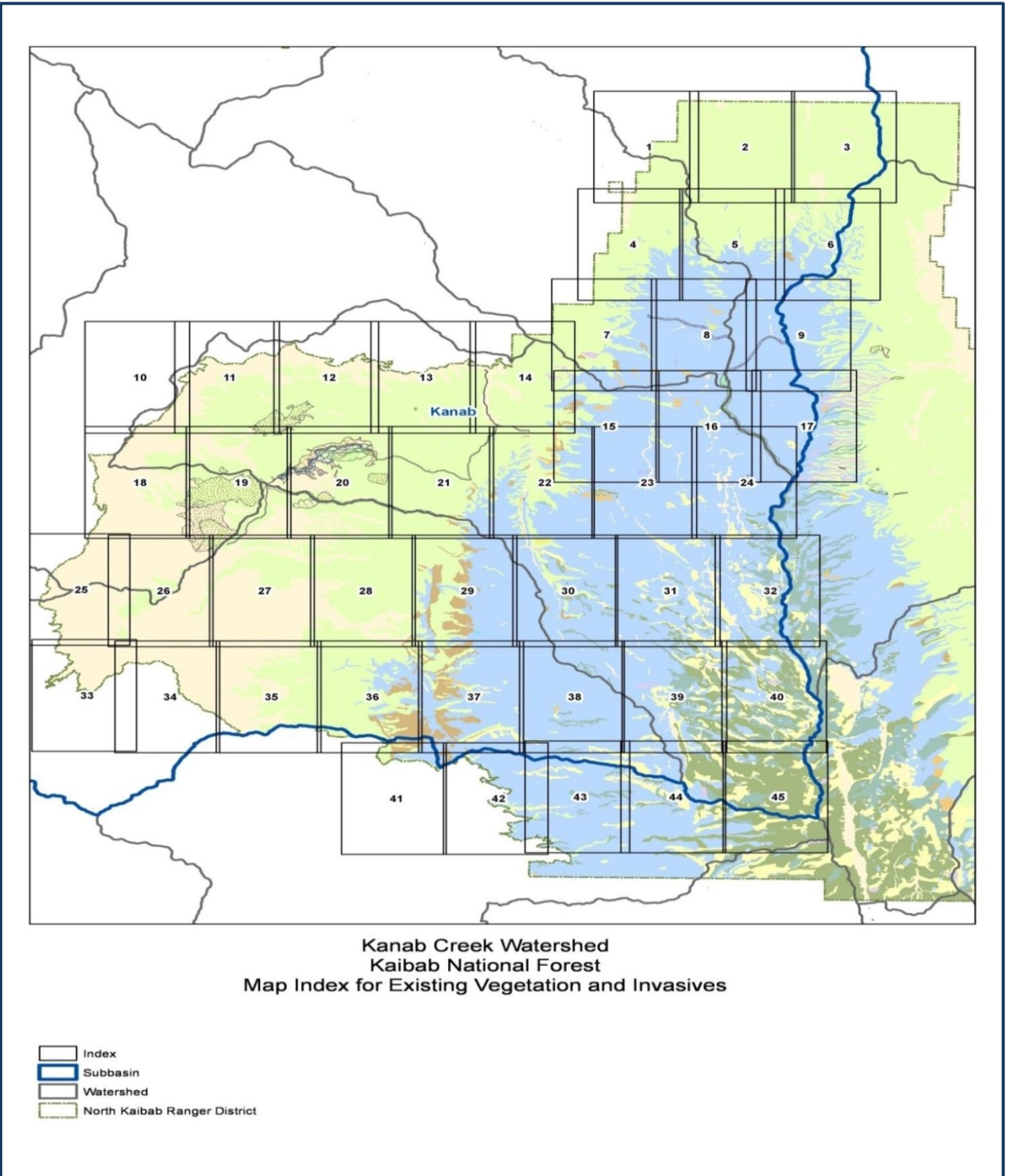


FIGURE 7.6 Kanab Creek Watershed: Kaibab National Forest. Map Index for existing vegetation and invasive botanical species. Reference the Appendices for a link to maps 1-45.

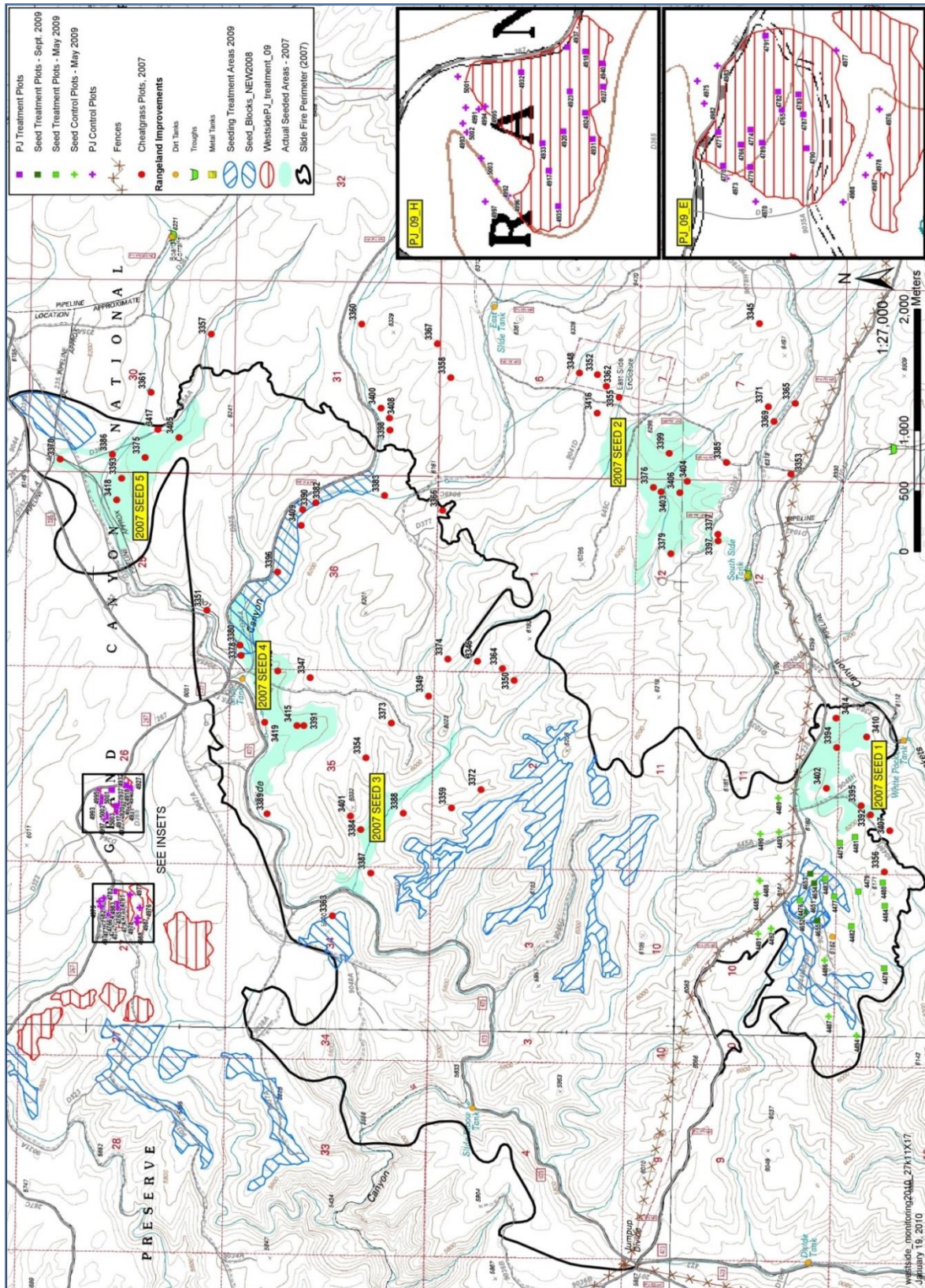


FIGURE 7.7: Kaibab National Forest Boundary map, including riparian habitat, fire history polygons and invasive and noxious weeds.

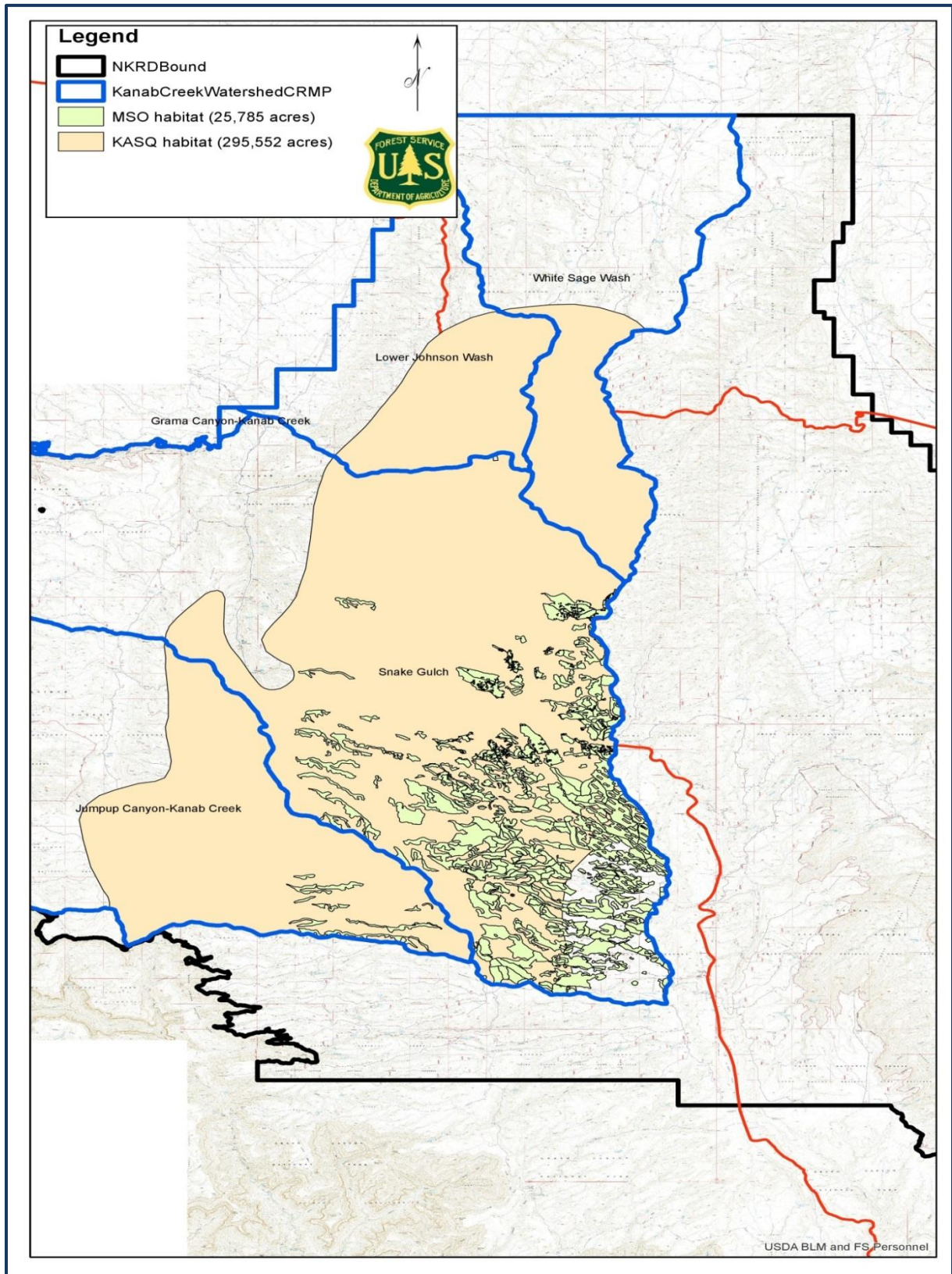
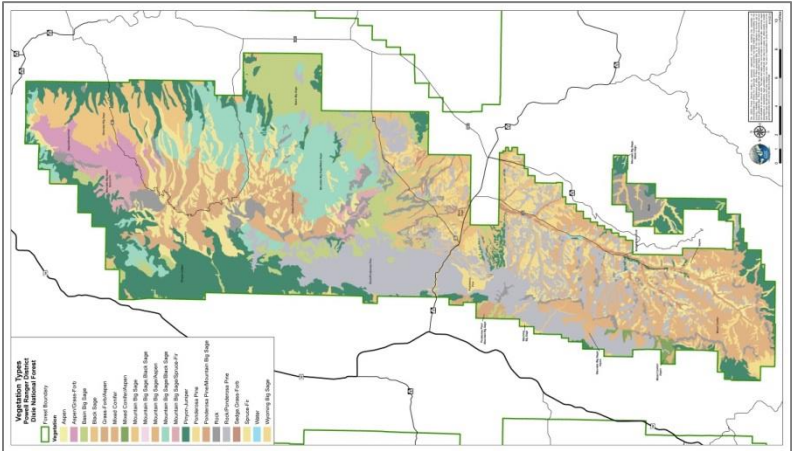


FIGURE 7.8 : Kaibab National Forest threatened and endangered species habitat polygons for Mexican Owl (MEO) and Kaibab Squirrel (KASQ).

Forest: Utah

Though the Dixie National Forest contains the largest tracts of forested lands in Utah, the acreage that falls within the Kanab Watershed is minimal. Consequently, no pertinent resource issues were discussed during CRMP planning. Noxious weed populations that are documented in Kane County have not extended into the Powell Ranger District forest boundaries.

ADVISORY COMMITTEE	RESOURCE ISSUE	LOCATION(S)	PROJECTS & ASSESSMENT GOALS	TIME-LINE
UTAH Dixie National Forest	1. No resource issues have been identified.	Kanab Creek Headwaters	a.Not applicable	Undete rmined
TABLE 7.11: The advisory committees did not identify any resource issues for the Dixie National Forest during the 2014-2014 Kanab Watershed CRMP development.				



Information and Education (I & E): Arizona and Utah



Increasing the education and information programs and additional collaborative (I & E) programs was recommended by all TAC, SC and CAC committee members, and often ranked in the top five resource concerns for each category discussed. Although a separate team had been created to identify key resource issues, and design project and assessment goals; I & E projects were supported by all advisory members. The following lists the main targeted goals, and associated resource issues.

ADVISORY COMMITTEE	RESOURCE ISSUE	LOCATION(S)	PROJECTS & ASSESSMENT GOALS	TIME-LINE
ARIZONA and UTAH: Education and Information TAC, SC, and CAC participants	1) <i>Education and Information</i> General Natural Interpretation and Education	HUC 10 - Kanab Creek HW - Sandy Canyon - Upper Johnson - Bulrush Wash - Hack Canyon - Gramma Canyon - Kanab Wash - Jump-up Cnyn - Lower Johnson - White Sage	a. Develop local AZ-UT 4th grade water fair event for Kane, Fredonia-Moccasin, and Big-Valley school districts (include charter and private schools). b. Support education and information recommendations from other TAC members: Air quality, Ag & Range, Climate, Cultural, Fire and Veg, Oil-Gas and Mining, Wildlife, Water Quality. c. Continue to support the Range and Livestock Workshop: 37th year in 2015. A joint venture in Utah and Arizona. d. Support the Weed Days (Kane County, and Color Country CWMA). e. Develop additional CWMA Kane County Fair booth and educational outreach programs. f. Utilize the watershed model at public out-reach events. g. Support the Earth Day Celebration: KFL BLM/Arizona Strip Field Office. h. Support BLM: Resource Camp for middle and high school students. i. Continue to support the Archeology Month Celebrations: March.; and develop supplemental materials about the watershed.	Immediate –ten years.

	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME-LINE
	2) Cultural resource education and information.	• Hack Canyon • Gama Canyon • Kanab Wash • Jump-up Canyon • Lower Johnson • White Sage • Kanab Creek • HW • Sandy Canyon • Upper Johnson • Bulrush Wash	a. Increase public understanding about cultural resources and historic preservation issues and illustrated how everyone can contribute to their protection. b. Develop additional supplemental educational materials for North Kaibab Ranger District using interpretive presentations, and other modalities for the public,	Immediate through five years.
	3. Educational programs for all endangered species issues within the watershed.	• Hack Canyon • Grama Canyon • Kanab Wash • Jump-up Cyn • Lower Johnson • White Sage • Upper Kanab • Creek locations • Kanab Creek • HW • Sandy Canyon • Upper Johnson • Bulrush Wash	a. Continue to educate the public concerning threatened and endangered species listed under the Endangered Species Act of 1973. b. Support and supplement educational programs of the Kaibab NF concerning area endangered and/or sensitive species: Mexican spotted owl habitat (<i>Strix occidentalis lucida</i>), populations of California condor (<i>Gymnogyps californianus</i>). c. Support the non-lead ammunition program and continue with public outreach programs.	As determined within the management plan.
TABLE 7.13: The top information and education programs recommended by advisory committees. Kanab Creek CRMP. 2014-2015.				

Noxious Weeds: Kane County and Color Country CWMA

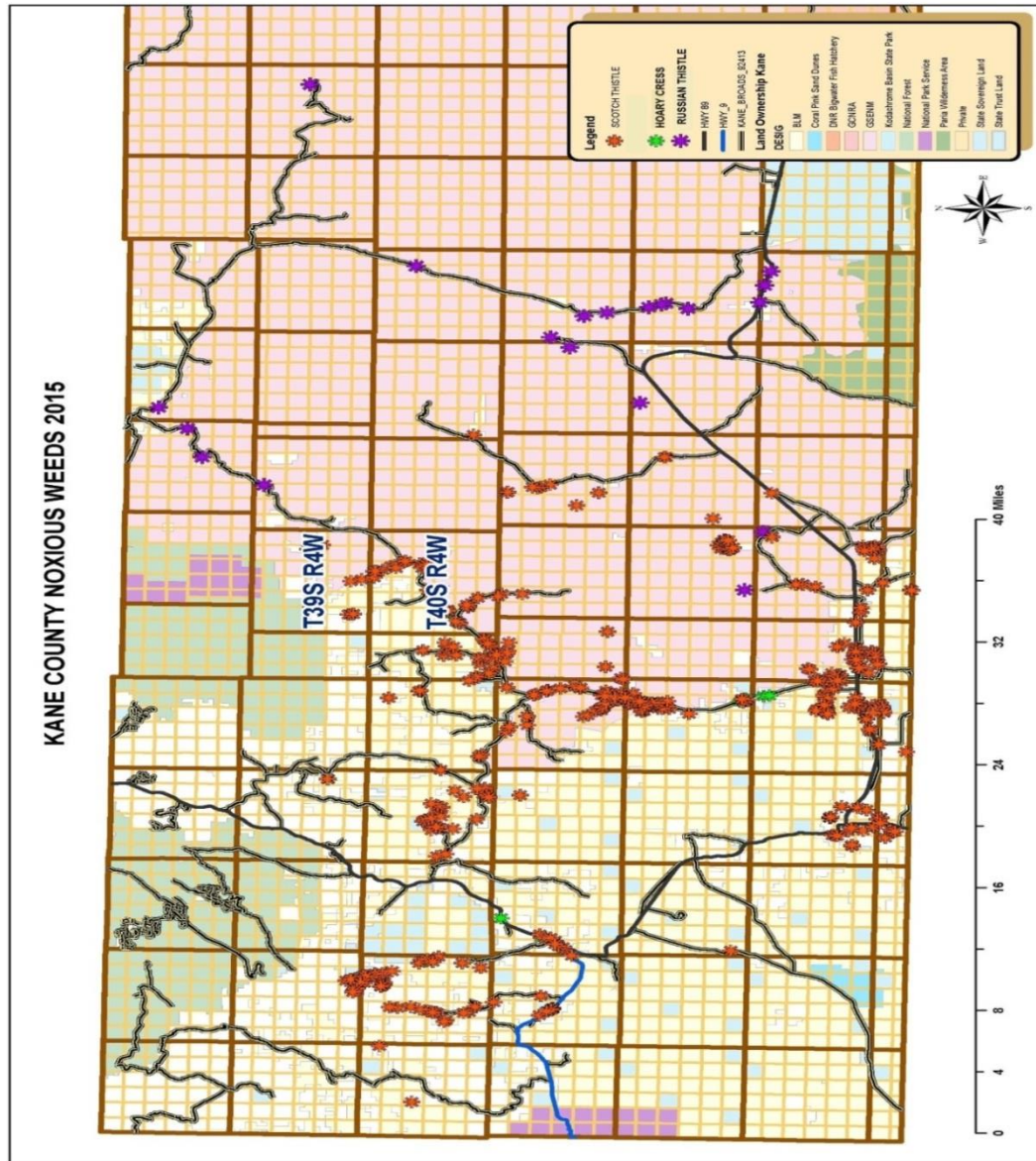


FIGURE 7.9: Kane County Weed Department map of Hoary Cress, Russian Thistle infestations and treatments. Map Credit L. Pratt.

Kane County Weed Department is an active member of the Color Country Central Weeds Management Area and actively supports federal, county private and state entities in their endeavors to control, manage and eradicate noxious weeds species. Noxious Weed management Best Management Practices (BMP's), state weed lists and resource concerns from all TAC groups are also addressed. With the exception of cultural resources, noxious weeds were ranked as a top resource concern by all of the resource groups.

Advisory comments, treatment strategies and cooperative treatments for several species are included in this section. In addition to noxious weed populations being monitored by the Bureau of Land Management (KFO and GSENM), Dixie National Forest, Coral Sand Dunes State Park, private land-owners and State lands, the following species are of great concern to Kane County: 1) Hoary Cress, 2) Scotch Thistle, and 3) Russian Thistle.

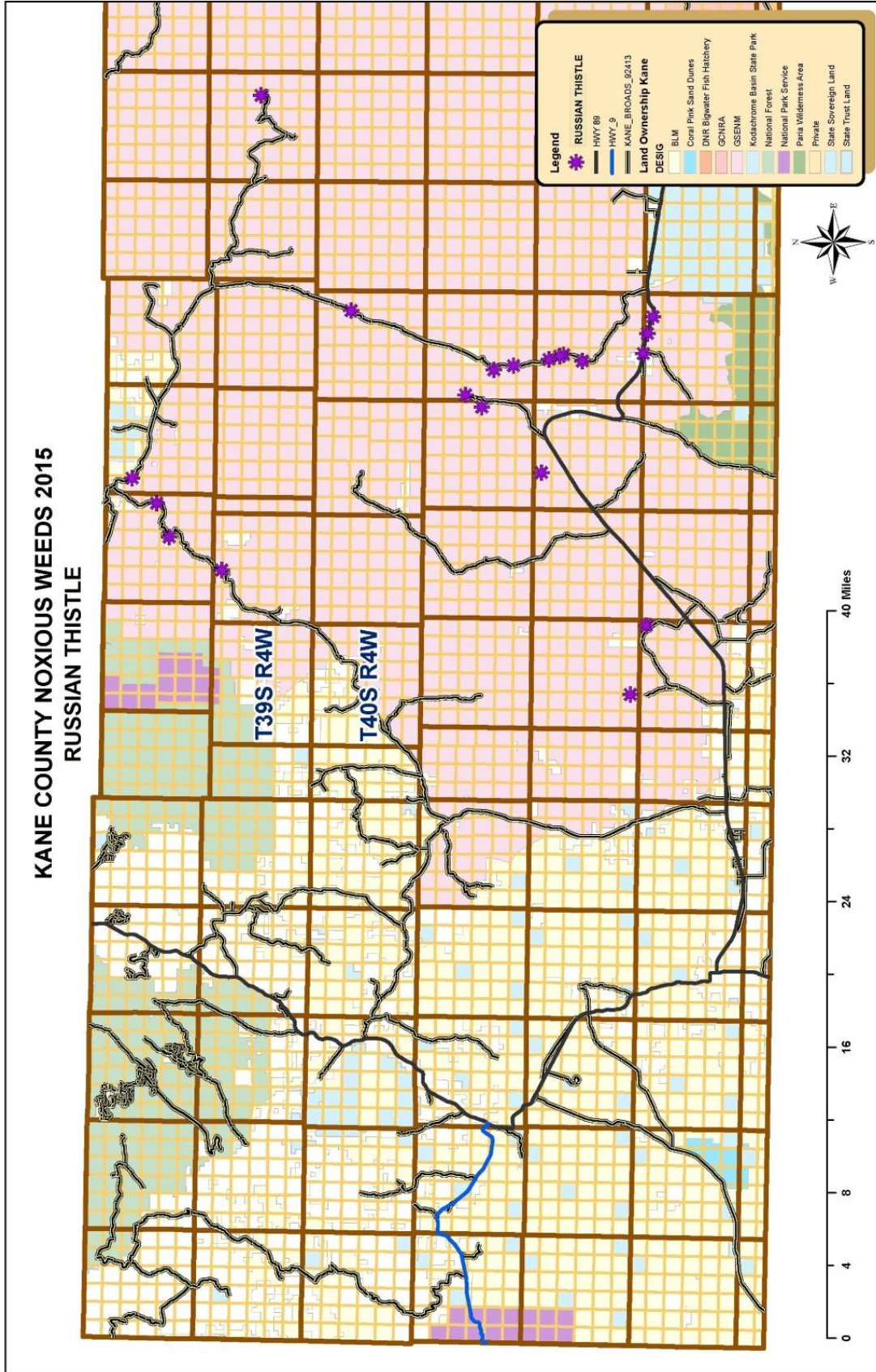


FIGURE 7.10 Kane County Weed Department. Russian Thistle infestations and treatments. Map Credit. L. Pratt. 2015

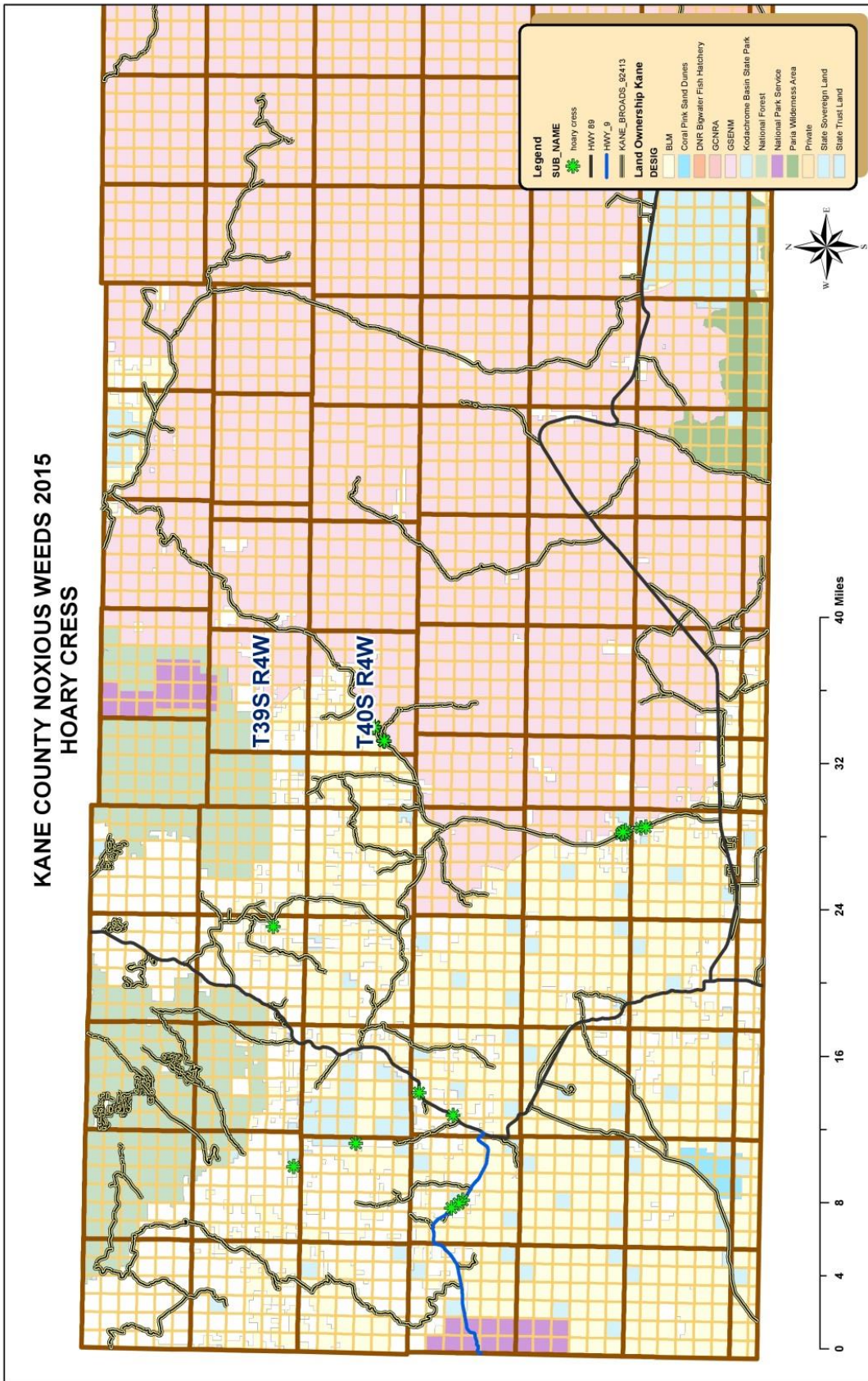


FIGURE 7.11: Kane County Weed Department map of Hoary cress infestations and treatments. 2015. Map Credit: L. Pratt

ADVISORY COMMITTEE	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME-LINE
Kane County Weed Department, Arizona Strip BLM, GSENM, Kanab Field Office BLM, NRCS (AZ, and UT), North Kaibab Ranger District, Fredonia NRCS, Panguitch Field Office NRCS	1. <i>Noxious weeds and invasive species control.</i>	• Grama Canyon • Kanab Wash • Jump-up Canyon • Lower Johnson • White Sage	a. Continue to monitor the removal of Tamarisk and Russian olive species from 21.6 miles stretch of Kanab Creek from Kaibab Paiute/BLM boundary to the US forest service/BLM boundary. b. Restore Kanab Creek side drainages as needed.	Immediate through 20+ years.
	2. <i>Seek funding opportunities for multi-agency and individual (private land-owner) TRO and other noxious weed projects.</i>	• The entire watershed (Arizona and Utah).	a. Pursue multi-state and agency RCPP (NRCS) funding opportunities. b. Manage and treat Tamarisk and Russian Olive (TRO) on upland sites adjacent to Kanab Creek and its sub-drainages. c. Determine TRO control measures; evaluate conditions and sites managed and allow natural recruitment of native species, revegetated with native willow, and cottonwood, or with upland, xeric species. d. Evaluate and delineate TRO project objectives: 1) to support the Tamarisk and Russian Olive (TRO), noxious weed projects of Kanab Watershed Coordinated Resource Management Partners within the Kanab Creek Watershed; and 2) increase the water availability in the Kanab Creek drainage and adjacent sub-drainages. 3) Reclaim previously infested TRO areas with native and/or xeric species, thus increasing habitat for upland and riparian wildlife. 4) Increase water availability for future cooperative water projects as described in the Kanab Watershed Coordinated Resource Management Plan. e. Support similar efforts by the Color Country Coordinated Weed Management Area, and the Arizona Strip BLM TRO projects.	Immediate through 20+ years.
TABLE 7.12: Multi-agency noxious weed resource issue recommendations in Arizona and Utah portions of the watershed. 2014-2015.				

Oil, Gas and Mining: Arizona

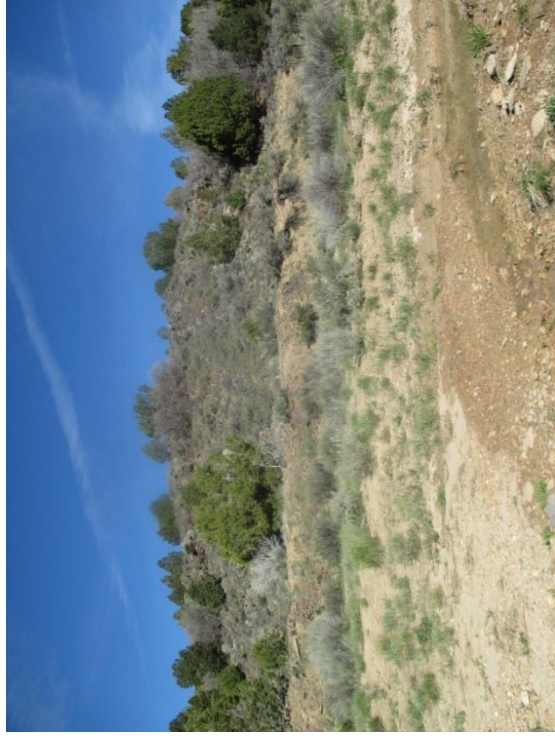
Technical advisory members were not present for the State of Arizona Oil, Gas and Mining resource issues. Though mentioned briefly during some of the meetings, the advisory committee members lacked expertise to make appropriate recommendations.

ADVISORY COMMITTEE	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME-LINE
ARIZONA: Oil, Gas and Mining	1. <i>No resource issues were recommended</i>	Not determined	Not determined	Not Applicable
TABLE 7.15: Arizona Oil, Gas and Mining Resource Issues. Kanab Creek CRMP. 2014-2015.				

Oil, Gas and Mining: Utah

ADVISORY COMMITTEE	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME-LINE
UTAH Oil, Gas and Mining	1. <i>Ground water monitoring of mining operations.</i>	- Kanab Creek Headwaters - Sandy Canyon - Upper Johnson - White Sage	a. Continue monitoring following current state, and federal guidelines. Implement regulatory measures if need arises.	Immediate through duration of all area oil, gas and mining operations.
	2. <i>Evaluate and monitor mining impacts upon wildlife.</i>	- Kanab Creek Headwaters - Sandy Canyon - Upper Johnson - White Sage	a. Evaluate data on relevant species submitted by the regulatory agencies.	Immediate through duration of all area oil, gas and mining operations.
	3. <i>Increase technical and scientific staff for state OGM.</i>	- Kanab Creek Headwaters - Sandy Canyon - Upper Johnson - White Sage	a. Support appropriate lobbyist events with the state legislature.	Not determined by TAC.
TABLE 7.16: Utah Oil, Gas and Mining Resource Issues. Kanab Creek CRMP. 2014-2015.				

Water Quality: Arizona



During the Kanab Watershed CRMP resource issue reviews, specific Arizona water quality concerns were briefly reviewed. Though the Arizona Department of Environmental Quality (ADEQ) was unable to actively contribute to the CMRP, extensive water resource issues have been addressed in by state, federal, university and county entities.

Moreover, the ADEQ water quality assessment of the Little Colorado Watershed, referenced non-point source pollution issues associated within the Utah headwaters of Kanab Creek and other tributaries. Other TAC, CAC and SC committee members identified that future NRCS RAMP grant opportunities between the states would be beneficial.

Also, Arizona DEQ partnered with area extension agencies and University of Arizona's Water Resources Research Center, and designed a program called NEMO: Nonpoint, Education for Municipal Officials program. The goal of the network is to "help communities better protect natural resources while accommodating growth"; one tool is using geospatial (GIS) and remote sensing data.

ADVISORY COMMITTEE	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME-LINE
ARIZONA Department Water Quality	1) 303d list-impaired waters Water quality and mining.	- Bulrush Wash - Hack Canyon - Grana Canyon - Kanab Wash - Jump-up Cnyn - Lower Johnson - White Sage	a. Continue to communicate with ADEQ Water Quality Division on water quality updates. Currently there are no 303(d) listed waters in this area. b. Increase monitoring stations as there is limited data from this area of the watershed. c. Evaluate and include the Integrated 305(b) Assessment/303(d) Listing Report within the Kanab Watershed Coordinated Resource Management Plan.	Not identified.
TABLE 7.17: State of Arizona water quality resource issues in the Kanab Creek Watershed CRMP. 2014-2015.				

Water Quality: Utah



Total Maximum Daily Loads (TMDL) values are not yet established for the Kanab Watershed by the Utah Department of Environmental Quality: Division of Water Quality environmental scientists, and the major land user management. Consequently, specific recommendations, treatments and assessments will not be considered until these values are established. However, general water quality recommendations were discussed. Exceedances for (TSS) and temperature at several locations in Utah, and vegetation solutions for several water quality recommendations were made by the TAC, SC and SAC members.

When the TMDL values are established, specific upland and riparian vegetation enhancements will be addressed and treatments recommendations made per site.

ADVISORY COMMITTEE	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME-LINE
UTAH Water Quality	1. 303d list-impaired waters. Water quality and mining practices.	- Kanab Creek HW - Sandy Canyon Wash - Upper Johnson - White Sage	- Begin dialoging goals and develop standard TMDL values amongst land-owners and/or managers (include public outreach to land-users). - Ensure all users understand the process may result in funding and the importance of public in-put. - Address any pertinent AZ water quality challenges as they arise.	Immediate and on-going.
	2. These water quality resources issues have all been given equal ranking of importance.	- Kanab Creek HW - Sandy Canyon Wash - Upper Johnson - White Sage	- Reduce water temperatures at identified sites. - Increased agriculture efficiency. - Implement water efficiency methods in urban and suburban in Kane County. - Determine relevant TMDL values for the watershed. - Monitor ground water quality. - Funding Strategies to address the current water quality challenges.	Immediate and on-going.

TABLE 7.18: State of Utah water quality resource issues in the Kanab Creek Watershed CRMP, 2014-2015.

Wildlife: Arizona



The primary wildlife resource concerns within the Arizona boundaries of the Kanab Creek Watershed Coordinated Resource Management Plan included: 1) Support and collaborate when applicable, the four main resource issues out-lined by the BLM, Kanab Field Office; 2) Support and collaborate when applicable, the five main resource issues as discussed by the Arizona Strip, BLM offices; 3) Maintain Arizona wildlife water features and determine future placements; 4) Continue with condor recovery efforts within Arizona and Utah; 5) Increase public education and out-reach to reduce ill-legal OHV use.

ADVISORY COMMITTEE	RESOURCE ISSUE	LOCATION(S) HUC 10	RESOURCE ISSUES	TIME-LINE
ARIZONA Department of Game and Fish, AS BLM	1. BLM (East of Fredonia)	- Bulrush Wash - Hack Canyon - Gramma Canyon - Kanab Wash - Jump-up Canyon - Lower Johnson Wash - White Sage Wash	a. Identify new Piñon-juniper veg management treatment opportunities. b. Evaluate fencing along HWY-89 to decrease deer /vehicle collisions and increase migration opportunities between AZ/UT. c. Analyze deer use of fencing-crossing structures by utilizing satellite and collar studies. d. Continue to track deer movements and target vegetation treatments and water developments that will improve deer use of the watershed.	Immediate-ten years.
	2. BLM (West-side of Kanab Creek)	- Bulrush Wash - Hack Canyon - Gramma Canyon - Kanab Wash - Jump-up Canyon - Lower Johnson	a. Install co-op water projects for bighorn and livestock populations. b. Translocate/increase bighorn sheep pop. within Kanab Creek Watershed by Fall 2015. c. Coordinate veg treatments (Mt. Trumbull/Uinkaret Project Area). d. Implement Mule Deer Plan Coordination BLM/AS-AZ Game and Fish. (water & vegetation). e. Continue to implement the Arizona Bighorn Sheep Management Plan: AZGF.	Immediate ten years.

RESOURCE ISSUE	LOCATION(S)	RESOURCE ISSUES	TIME-LINE
3. <i>Water Feature Maintenance</i>	- Bulrush Wash - Hack Canyon - Gramma Canyon - Kanab Wash - Jump-up Cyn - Lower Johnson - White Sage	a. Maintain existing cooperative livestock and wildlife water features. b. Determine future placement of guzzlers, and drinkers.	Immediate ten years.
4. <i>Condor Recovery</i>	- Bulrush Wash - Hack Canyon - Gramma Canyon - Jump-up - Lower Johnson - White Sage	a. Continue AZ state non-lead ammunition education program. b. Partner with Peregrine Fund and support their condor recovery programs. http://www.peregrinefund.org/project-info/california-condor	Immediate-five years.
5) <i>Illegal OHV: Public education/outreach and monitoring. (Issue caused primarily by antler gathering and recreation).</i>	- Bulrush Wash - Hack Canyon - Gramma Canyon - Jump-up Cyn - Lower Johnson - White Sage	a. Decrease erosion through closure of illegal roads. b. Educate ATV users on how erosion occurs and quantify erosion rates. c. Map sensitive soils within and adjacent to OHV areas. d. Encourage legal and responsible OHV use and how OHV's when used legally, decreases impacts to wildlife, soils and other e. Provide collaborative agency OHV/trail maps at high-use areas. Increase public knowledge of designated transportation routes (kiosk development). f. Increase OHV educational events and include the message that that OHV use is a privilege not a right. g. Increase law enforcement personnel to help decrease OHV use.	Undefined timelines.
TABLE 7.19: State of Arizona, and Arizona Strip wildlife related resource issues ranked according to immediate concern.			

Wildlife: Utah

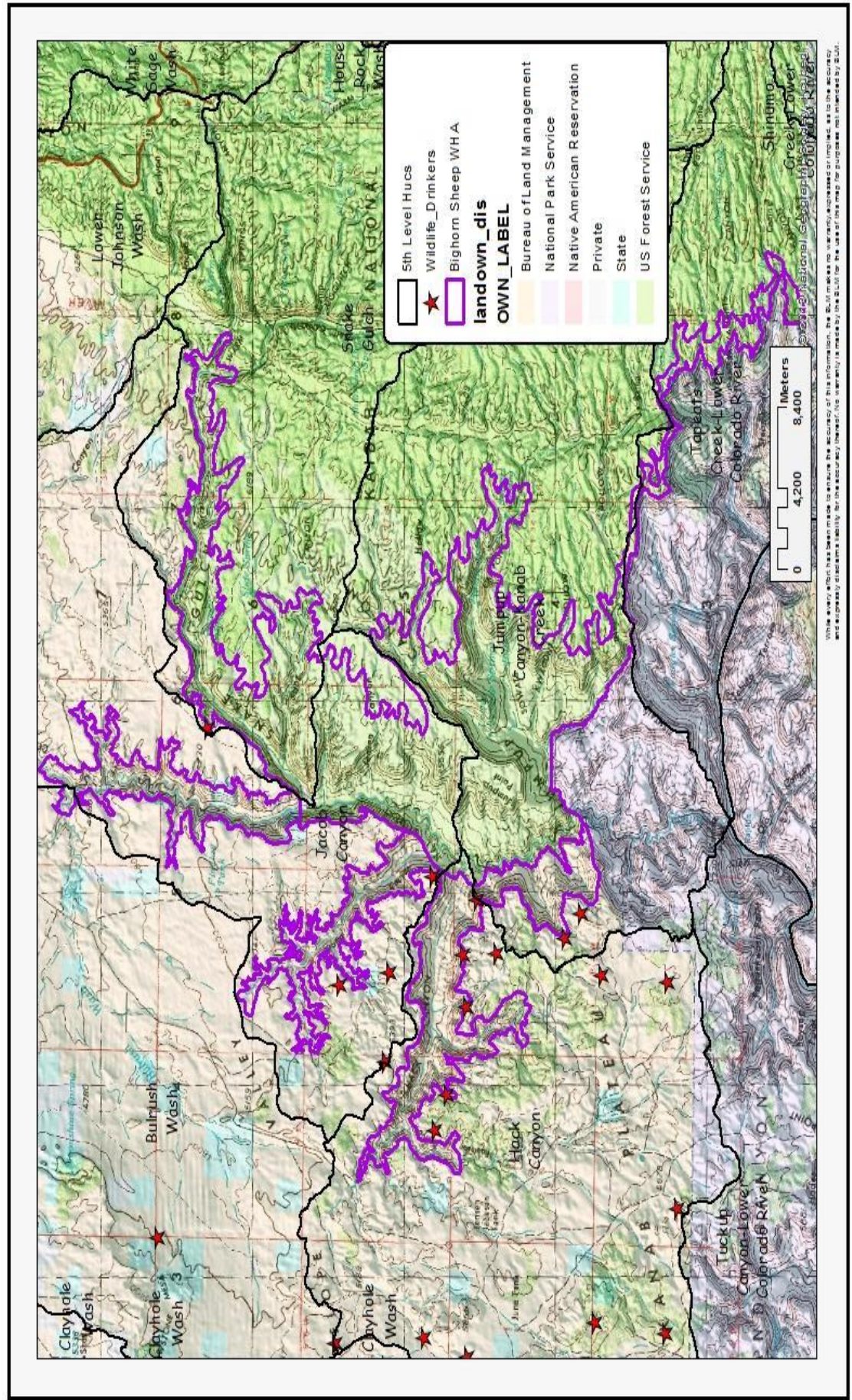


FIGURE 7.12: Arizona Fish and Game,, Big Horn Sheep WHA. Map Credit: Thompson.



Wildlife concerns of the Kanab Watershed are varied, and are managed by a myriad of wildlife biologists and other habitat professionals. Due to the distribution of state and federal lands, the Kanab Field Office, GSENM, Utah Division of Wildlife Resources, and Utah Division of State Parks, are the primary decision makers concerning wildlife concerns.

Top resource concerns, actions, project and assessment goals, funding and timelines are ranked below. TAC members did not specifically address climate, or the effects of drought conditions upon the Kanab Creek Watershed, primarily because of a lack of expertise within the various technical advisors. However, water scarcity was addressed as many recommended cooperative water feature projects for wildlife and livestock.

A biological habitat restoration concept was introduced by watershed scientists, concerning a strategic re-introduction of beaver into the upper Kanab Creek Watershed. Primarily the resource issue goal would be to reduce the flashiness of the lower Kanab watershed, and increase water table levels. In support of this endeavor, is research conducted by the Utah Division of Wildlife Resources and Utah State University of Utah, Watershed Science who developed the Utah Beaver Restoration Assessment Tool (BRAT).

While evaluating 42 km of perennial stream, the watershed scientists ran BRAT analysis on 2,166 km² of the watershed inclusive of Upper Johnson Wash, Kanab Creek Headwaters, Sandy Canyon Wash, and White Sage Wash. Afterwards, they modeled a modest probability, that indicated a robust beavers presence; mainly owing to the extent of the perennial stream network of Kanab Creek (142 km). In addition to modern measurements and evaluations, the beaver's historical presence is reflected in the naming of Paunsagunt Plateau, which means, *beaver place* in Paiute.

BRAT analysis of the upper Kanab Creek Watershed:

- 1) Length of Perennial streams: 142 km
- 2) Existing Capacity to Support Beaver Dams: 8.1 dams/km or 1,156 dams' total.
- 3) Historic Capacity to Support Beaver Dams: 14.2 dams/km or 2,014 dams' total.
- 4) Existing streams that could support beaver and are **not** in areas with moderate to high conflict potential: 57 km
- 5) Existing Capacity: 10.5 dams/km or 599 dam's total 40% of perennial network

ADVISORY COMMITTEE	RESOURCE ISSUE	LOCATION(S) HUC 10	PROJECTS & ASSESSMENT GOALS	TIME-LINE
UTAH Wildlife: KFO BLM, Coral Sand Dune State Park, GSENM	1. Project Funding	• Upper Johnson Wash² • Sandy Canyon² • Kanab Creek Headwaters • White Sage	a. Obtain long-term funding to complete projects that benefit wildlife. Identify appropriate assessments to measure success; i.e. WRI, Pulling-It-Together, NRCs Resources Management Grants-RCCP.	Five through ten years.
	2. Threatened and Endangered Species	• Kanab Creek HW • Sandy Canyon Wash • Upper Johnson Wash • White Sage	a. Increase sage-grouse habitat and conductivity. b. Utilize State identified Action Plans (Utah/Arizona) to help guide management actions, and other species (milk-weed, owls) populations as identified. c. Continue to monitor condor recovery programs.	Five through ten years.
	3. Public education/outreach and monitoring.(Illegal OHV: Issue caused primarily by antler gathering and recreation).	• Kanab Creek HW • Sandy Canyon Wash • Upper Johnson Wash • White Sage	a. Identify where erosion issues occur because of illegal roads and OHV use, and work through legal processes to close illegal roads. Decrease erosion through closure of illegal roads. b. Educate and quantify erosion rates, causes and solutions to public. c. Protect RS2477 roads. d. Map sensitive soils within and adjacent to OHV areas. e. Educate public about differences between legal vs. illegal OHV use. f. Provide collaborative agency maps at high-use areas. Increase public knowledge of designated transportation trails (kiosk development). g. Educate that OHV use is a privilege not a right. h. Increase enforcement personnel.	Undefined timelines.
	4. Industrial impacts	• Kanab Creek HW • Sandy Canyon • Upper Johnson • White Sage	a. Monitor impacts to wildlife due to mining operations. b. Implement resource issues management decisions within Alton mine EIS as needed. c. Determine if mining practices are contributing to pollutants within the watershed; quantify results and address accordingly.	Immediate through ten years.

			d. Determine off-site mitigation from mining procedures. e. Reduce current water quality impaired water values.		Five through ten years.
5. Education and outreach	• Kanab Crk HW • Sandy Canyon • Upper Johnson • White Sage		a. Increase educational outreach at a variety of levels: general public outreach, educational programs, and multiple agency kiosks.		Five through ten years.
6. Migration routes and avian populations	• Kanab Creek • Headwaters • Sandy Canyon • Upper Johnson • White Sage		a. Identify key avian species, and specific habitat needs. Conduct inventories on upland and riparian areas to include such species as; Southwestern Willow Fly-Catcher, Yellow Billed Cuckoo and Greater Sage Grouse. b. Identify avian presence by county/state. c. Continue supporting avian programs with 'Partners in Flight': BCR Data, Audubon Society Bird Counts. d. Continue to support efforts to implement projects in accordance with the Migratory Bird Treaty Act.		Five through ten years.
7. Climate	• Kanab Creek • Headwaters • Sandy Canyon • Upper Johnson • White Sage		a. Support climate change research opportunities that assist in determining impacts to wildlife.		Five through ten years.
8. Condor Recovery	• Kanab Creek • Headwaters • Sandy Canyon • Upper Johnson • White Sage		a. Continue state non-lead ammunition education program. b. Partner with Peregrine Fund for public outreach/educational events. http://www.blm.gov/ut/st/en/fo/kanab/more_wildlife.html		Five through ten years.
9. Strategic beaver re-introduction	• Kanab Creek • Headwaters • Sandy Canyon • Upper Johnson • White Sage		a. Utilize the BRAT: Bearer Restoration Assessment Tools to determine best places to reintroduce Beaver into the watershed. b. Work to reduce flash-flooding in the lower watershed to stable water levels; consider introduction of Beaver as a way to provide more even flows in the lower reaches.		Five through ten years.
TABLE 7.20: Utah wildlife resource issues, evaluations and time-tables for future treatments.					

UPPER KANAB WATERSHED - Existing Beaver Dam Capacity Model

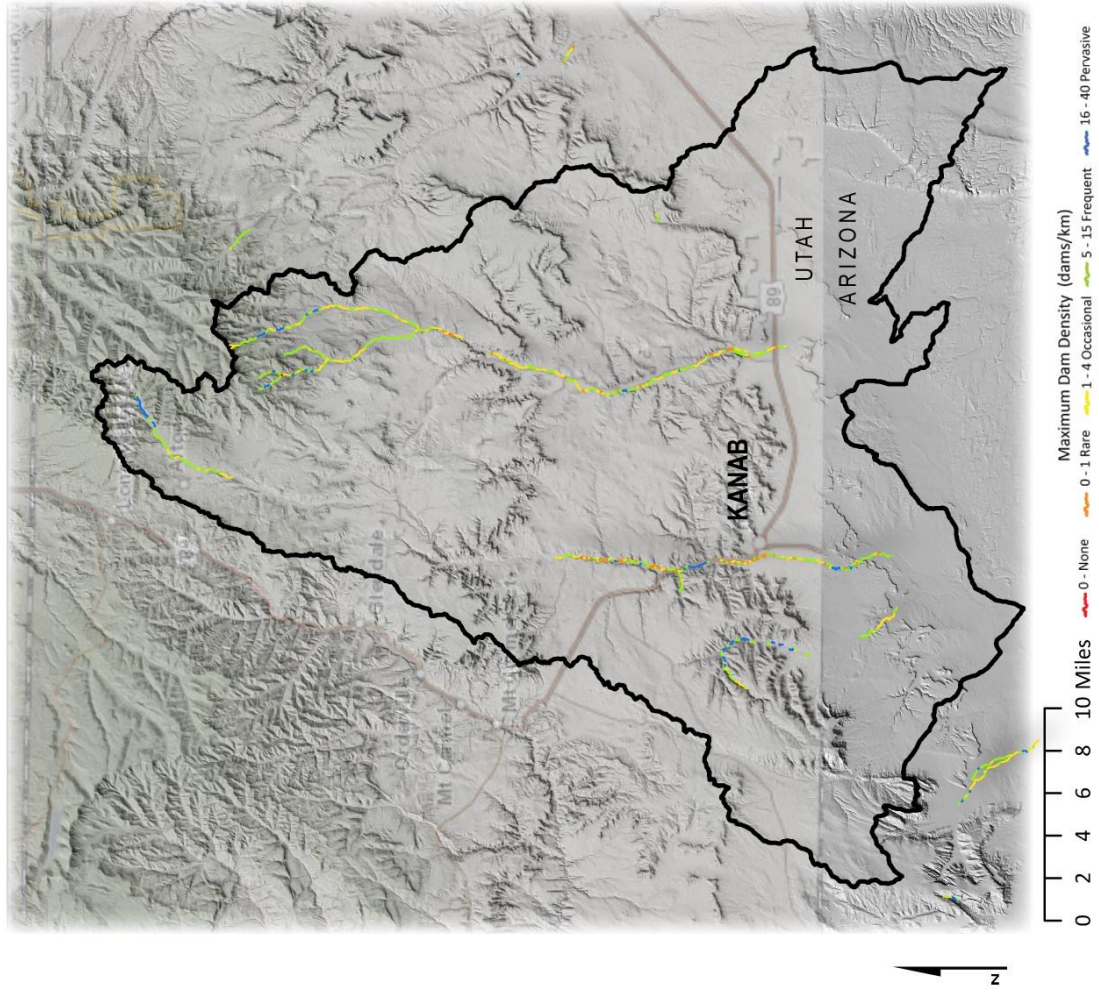


FIGURE 7.13: Upper Kanab Watershed. Existing Beaver Dam Capacity Model. Map Credit: J. Wheaton. Utah State University Department of Watershed Science.

UPPER KANAB WATERSHED - Potential Beaver Management Zones

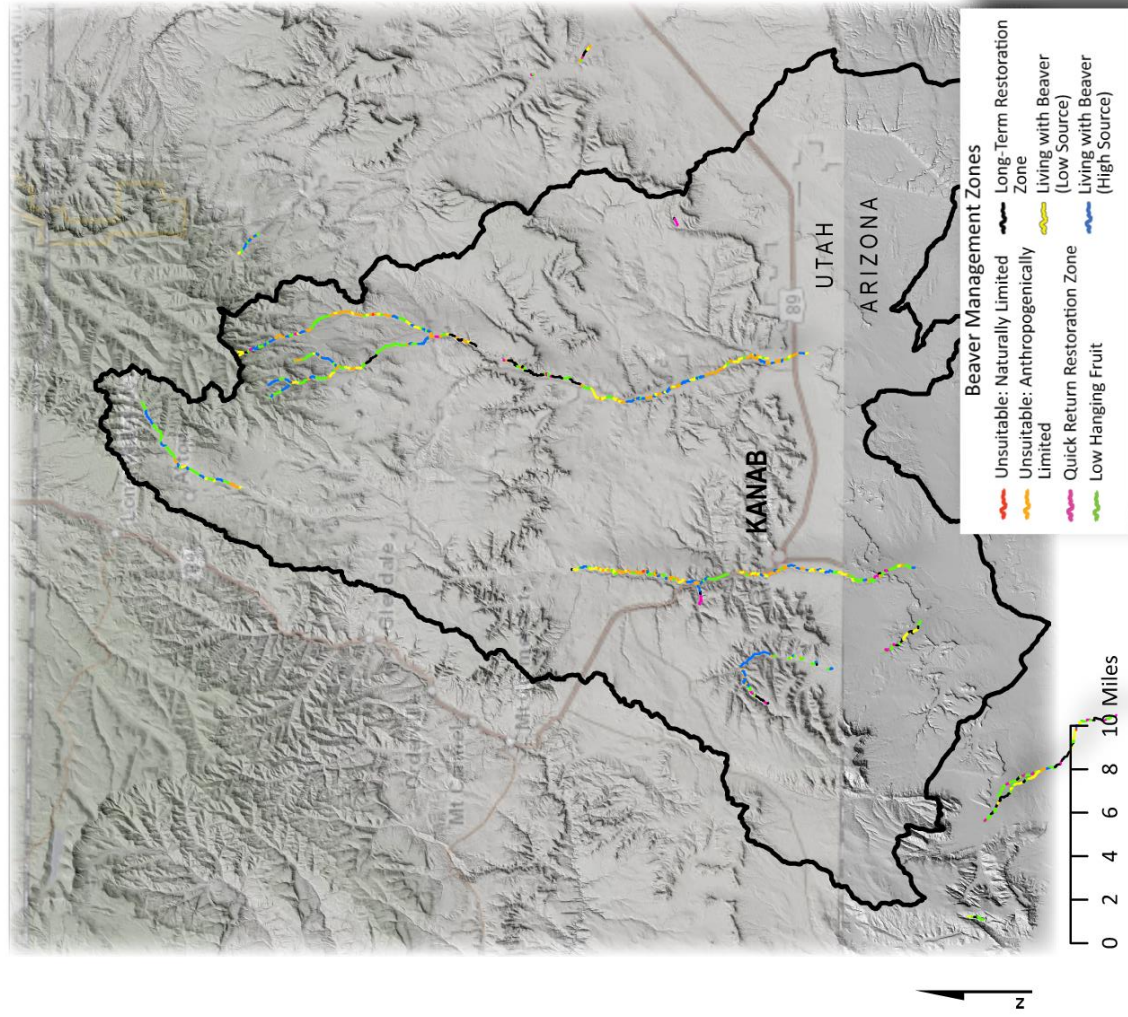


FIGURE 7.14.: Upper Kanab Watershed. Potential Beaver Management Zone. Map Credit: J. Wheaton. Utah State University, Department of Watershed Science, 2015.

UPPER KANAB WATERSHED - Historic Beaver Dam Capacity Model

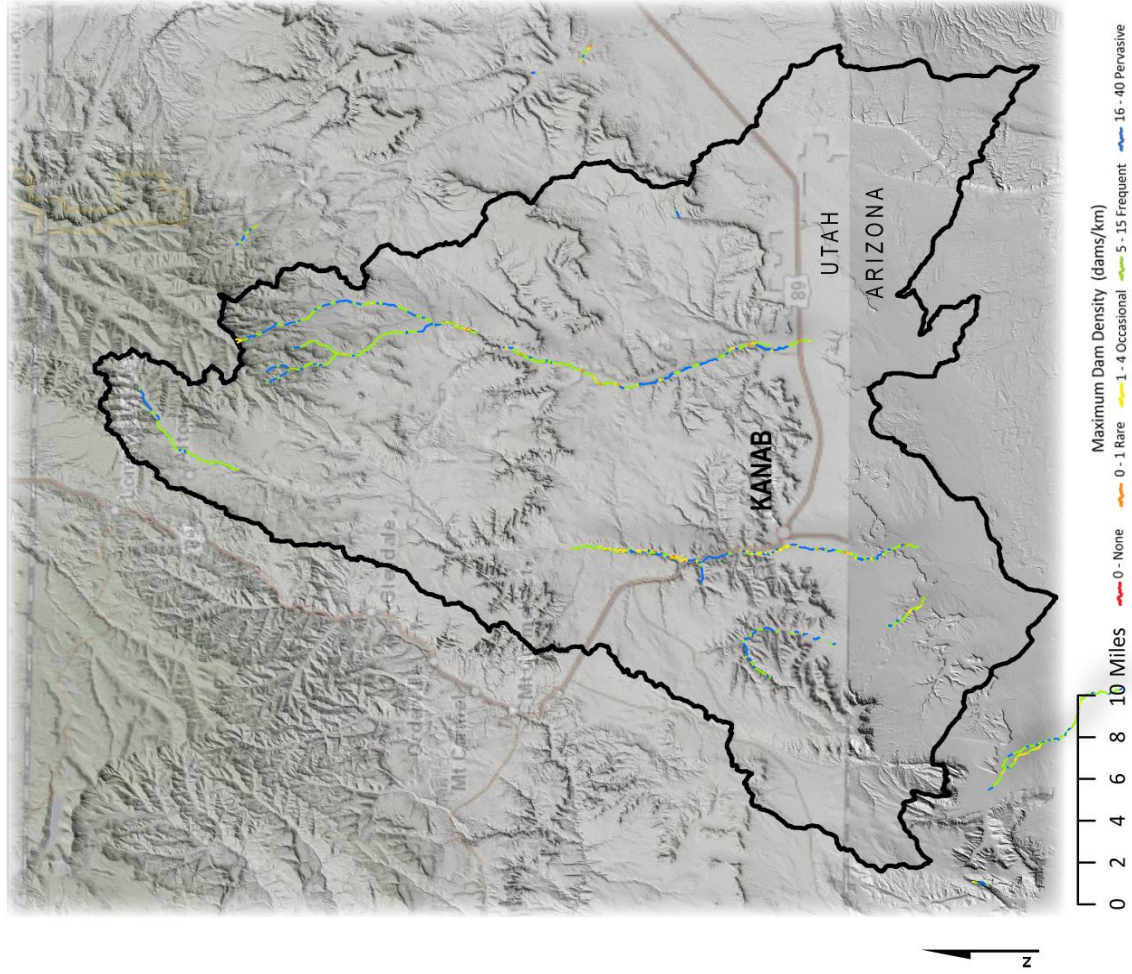


FIGURE 7.15: Upper Kanab Watershed. Historic Beaver Dam Capacity Model. Map Credit: J. Wheaton, Utah State University, Department of Watershed Science.

UPPER KANAB WATERSHED - Human-Beaver Conflict Potential

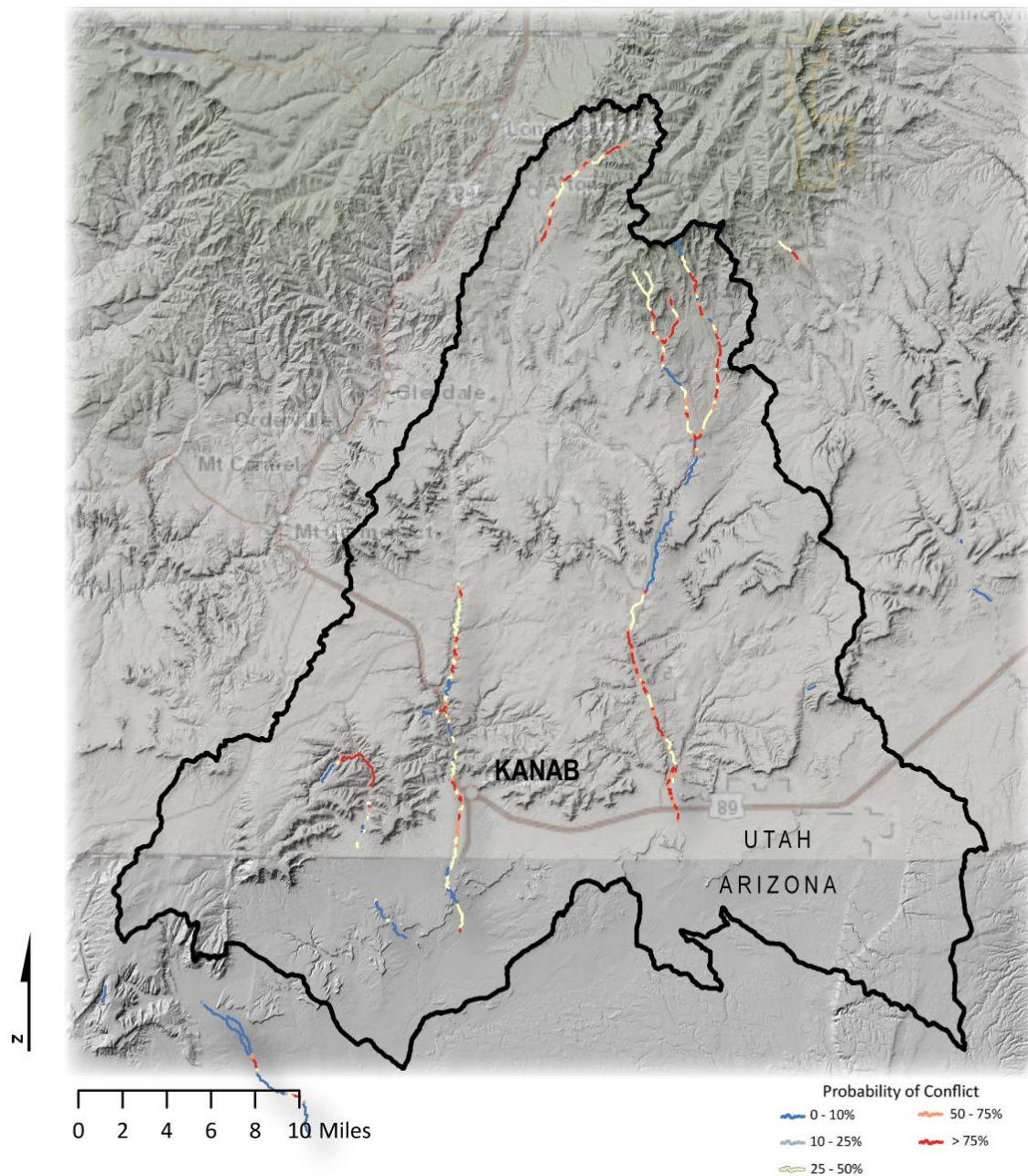


FIGURE 7.16: Upper Kanab Watershed. Potential Beaver –Human Conflict Map Credit. J. Wheaton. Utah State University-Watershed Lab.



Appendices:

The last word in ignorance is the person who says of an animal or plant: "What good is it?...If the land mechanism as a whole is good, then every part of it is good, whether we understand it or not...Harmony with land is like harmony with a friend; you cannot cherish his right and chop off his left." *Aldo Leopold*

The primary land-users and decision makers of the Kanab Creek watershed are the signatories for the Memorandum of Understanding between the various partners. However, because the Kanab Watershed CRMP coincides with similar M.O.U. documents, several agencies only provided letters of cooperation.

While consideration was made to ensure that the majority of supportive documentation relating to the M.O.U. was included into the appendices, some may not be listed. Of the appendices listed, the Kanab Creek Watershed M.O.U., signatories and the natural resource and the natural resource survey results are the only documents provided in their entirety. Links for the additional documents are provided in the index section.

Community Survey Questions and Results:

While natural resource issues queries have a predominant role in the development of the Kanab Creek CRMP, consideration was also given to social, ecological and economic concerns. Resources issues associated with agriculture and rangeland practices were emphasized; as these occupations are income sources for many. Additional economic demographics can also be found in the Kane County Resource Management Plan.

Residents of Kane County and Fredonia Township were provided with many opportunities to respond to the survey. The CRMP survey was based upon a questionnaire developed by the Utah Association of Conservation Districts. Multiple outreach methods were utilized in order to provide ample opportunities for replies. Surveys in Kane County were made available via mailers, electronic surveys, the Kane County library and other public recreational venues. In Kane County, one-hundred and ten individuals participated; their replies were quantified

After a public scoping meeting, the Fredonia City Council, and city manager recommended that some of the resource questions be tailored specifically for their community. The Fredonia Soil and Water Conservation District, and Kane County Conservation District with assistance from the Fredonia

township administration amended some of the questions. A mailer was included with the monthly water bill, and the total number of responses totaled fifty-nine. These were also quantified in Table 8.

An introductory statement and a description of the ranking system preceded the survey questions, with three reflecting the greatest concern, two and one less so, and a zero indicating no opinion. In Kane County, the resource issues of greatest concern based on numbers of responses were assigned to adequate water supplies, water quality, flooding soil erosion and ground water quantity.

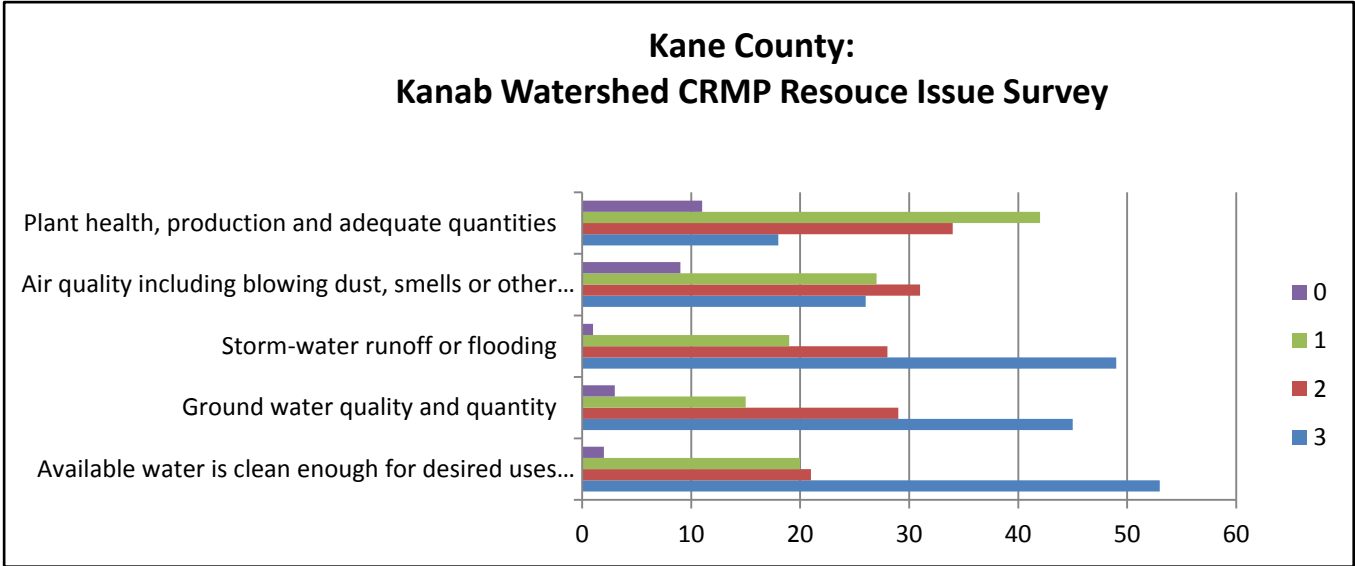


TABLE 7.21: Kane County resource issue survey results for available water, air-quality, and ground-water issues. 2014-2015.

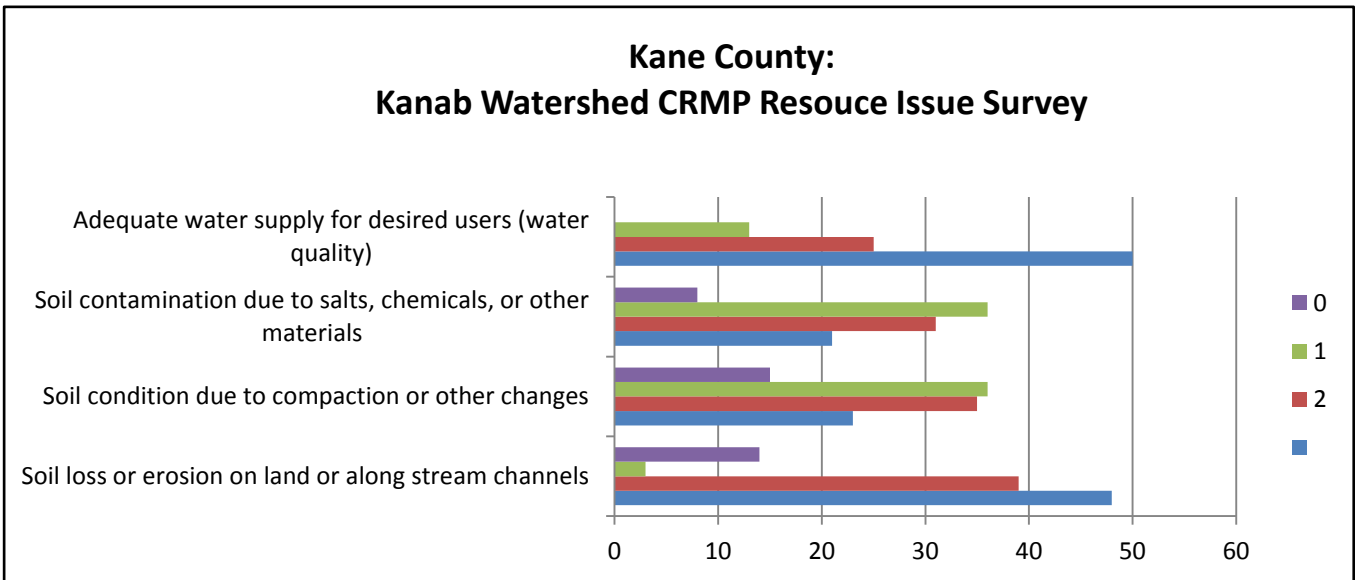


TABLE 7.22: Kane County resource issue survey results for water supply quality, and soil related issues. 2014-2015.

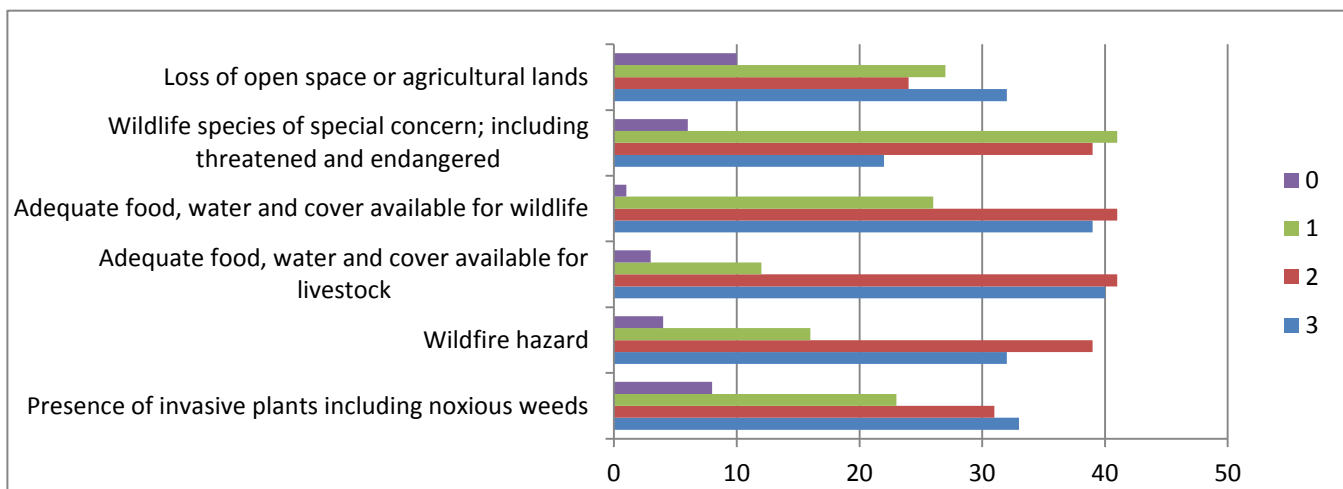


TABLE 7.23: Kane County resource issue survey results for open-space, wild-life, wild-fire, agricultural and noxious weeds related issues 2014-2015.

The total number of responses varied, as many individuals only partially completed the survey. Consequently the results reflect that trend. When responding to providing adequate food, water and cover to wildlife and agricultural livestock the responses both ranked as moderate to high concern. Wildfire hazards within and around the county ranked moderate to low; whereas noxious weeds that are often likened to a wildlife fire event were ranked moderate concern.

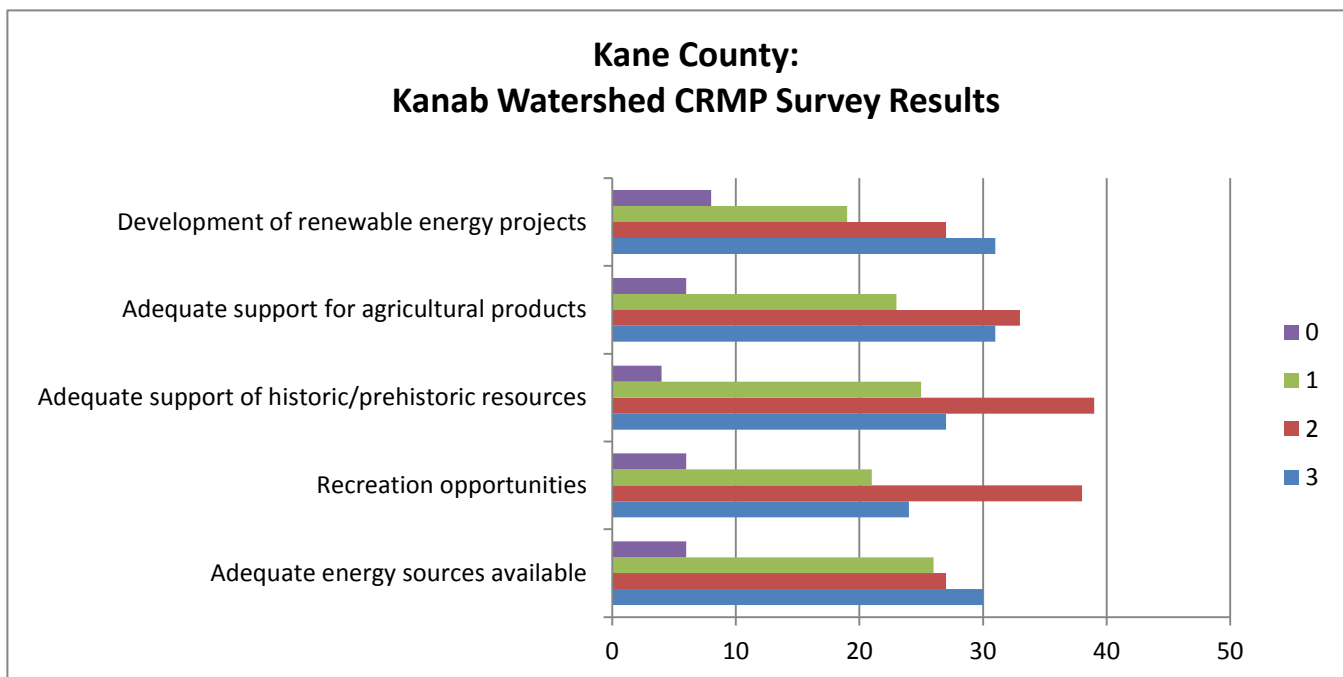


TABLE 7.24: Kane County resource issue survey results for open-space, wild-life, wild-fire, agricultural and noxious weeds related issues 2014 -2015.

When considering energy natural resources availability and development of renewable energy projects the majority of the responders ranked these issues with moderate importance. However, support cultural resources and agricultural products received moderate to low ranking. Recreational opportunities in the county were also ranked from moderate to low in importance.

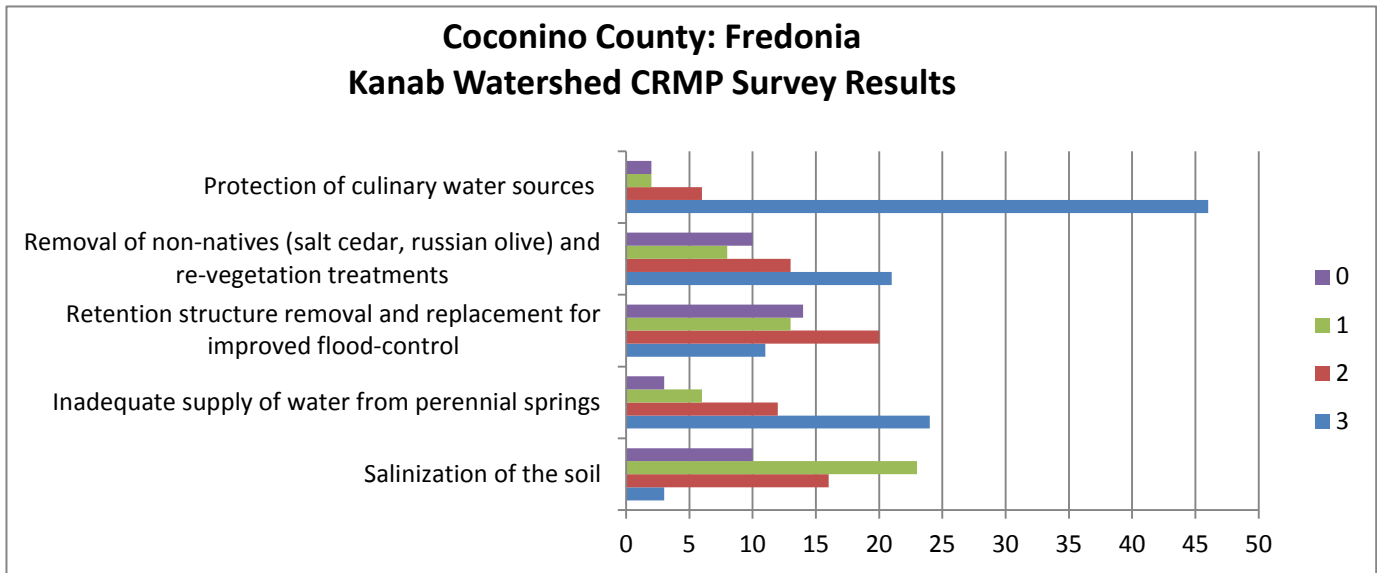


TABLE 7.25: Coconino County: Fredonia township Kanab Watershed CRMP natural resource survey results for culinary water protection, non-native specie removal and revegetation projects, water quality and soil. 2014-2015.

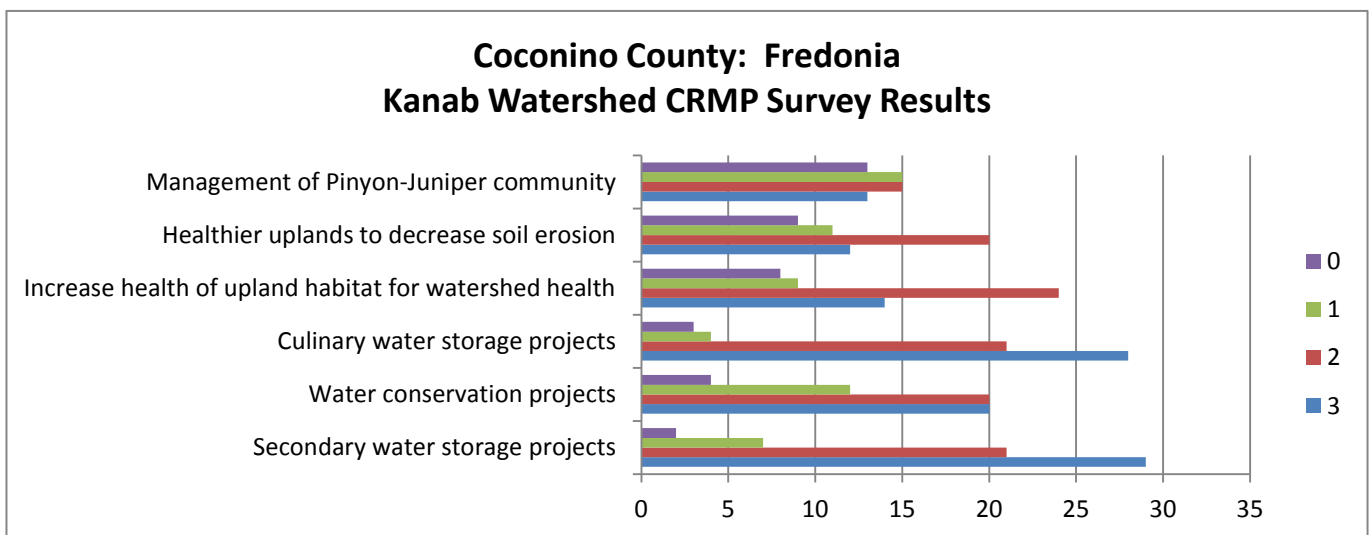


TABLE 7.26: Coconino County: Fredonia township Kanab Watershed CRMP natural resource survey results for fire and vegetation questions, soil erosion, and other water related questions pertaining to culinary water concerns. 2014-2015.

As previously mentioned the Coconino County-Fredonia Township natural resource survey was designed to address questions relating to local natural resource concerns. The greatest pertained to the protection, and conservation of culinary water; both in storage, quality and conservation projects. Soil erosion, rehabilitation of habitats, and noxious weeds ranked moderate to low. Flood control lowest

Memorandum of Understanding
Kanab Creek Watershed Partners
Coordinated Resource Management Plan July 2014

This Cooperative Agreement (MOU) is entered into by:

Utah

Bureau of Land Management (Kanab Field Office)
Bureau of Land Management–(Staircase-Escalante National Monument)
Kane County Conservation District (representing private landowners)
State and Utah Institutional Trust Lands Administration (SITLA)
State of Utah Division of Parks and Recreation (Coral Pink Sand Dunes)
State of Utah Division of Wildlife Resources
United States Forest Service (Powell Ranger District)

Arizona

Arizona State Game and Fish Department
Arizona State Trust Lands
Bureau of Land Management (Arizona Strip District)
Kaibab Indian Reservation
Fredonia Natural Resource Conservation District (representing private landowners)
Pipe Springs National Monument
National Park Service – Grand Canyon National Park
United States Forest Service – Kaibab Forest

Purpose

The purpose of the Kanab Creek Watershed Project is to foster collaborative relationships between users, through the development of a Coordinated Resource Management Plan (CRMP). This CRMP will assist local communities, watershed organizations, government, private and other non-governmental agencies operating within the watershed to develop and implement social, environmental and economically sustainable watershed management standards and objectives.

The Kanab Creek Watershed encompasses 1.5 million acres in Arizona and Utah. Alton, a township in Utah lies near the headwaters of the watershed; which eventually runs into the Grand Canyon of the Colorado River. The watershed is cooperatively managed by a variety of federal, state and local entities, including private landowners. Kanab Creek is valued for its natural resources and recreational opportunities as well as its importance to local economies for commercial and non-commercial commodity production.

The area is also a sacred site for many local tribes. Cooperators have identified water quality issues in Cottonwood Canyon, Johnson Wash, and Kanab Creek. These findings will prompt the development of Total Maximum Daily Loads (TMDL's) in accordance with the Environmental Protection Agency Clean

Water Act, Section 319 Nonpoint source program. Furthermore, development of a CRMP for the Kanab Creek watershed, will quantify watershed characterization and determine existing water quality issues. Coordinated technical, research and funding efforts between stakeholders, will guide future watershed uses and restoration opportunities.

Geography

A tributary of the Colorado River, the perennial headwaters of Kanab Creek originate below the rim of the Pansaugant and Markagunt Plateaus near Alton, Utah. Kanab Creek drainage (KCD), HUC (15011003), encompasses approximately 626 mi² of Kane County, Utah. It traverses through alternating bedrock and alluvial reaches as it flows down the Grand Staircase; a series of cliffs formed in Mesozoic sandstone. In Utah, the drainage is bound by Glendale Bench to the west, the Pansaugant Plateau to the North, and the Skutumpah Terrace to the east. The only other significant perennial streams in the drainage are Johnson Wash and Skutumpah Creek. In total, the watershed drains 2,313 mi² of southern Utah and northern Arizona. (Hadley, J. 2007).

As Kanab Creek passes into Arizona it flows into the Kanab Plateau Basin, located between the Colorado River and the Utah state line. Kanab Creek is the main drainage across the basin and is designated a perennial stream; until passing into Fredonia where it becomes ephemeral. From 1979-1989 a stream gauge was maintained by the United State Geological Survey (09403660), measuring an average flow into Arizona of 11,470 acre-feet/year. Perennial reaches for streams within the Kanab Plateau Basin listed from greatest to least length in miles include: Kanab Creek (12), Bright Angel Creek (10), Crystal Creek (8), Phantom Creek (7), Shinumo Creek (5), White Creek (5), Nankoweap Creek (4), North Canyon Wash (4), Thunder River (4) and Tapeats Creek (3). (AWR, 2014). Kanab Creek also passes through the Kaibab Paiute Tribal lands as both perennial in the north-east (1) and ephemeral in the south-east (6). All of the other streams within the basin are dependent on precipitation, and are classified ephemeral.

Goals

The 'Cooperators' seek to combine efforts, wherever possible, to develop working relationships that support long-term sustainability of natural resources within the Kanab Creek Watershed.

Stakeholders will work to:

1. Coordinate and integrate programs and projects across jurisdictional boundaries where feasible, in order to most effectively realize resource benefits.
2. Develop a CRMP for the watershed that includes watershed characterization, analysis of existing water quality issues, in coordination with the local stakeholders.
3. Establish consistent protocols for the collection, storage, and use of information and data gathered by the 'Cooperators.'
4. Foster a better understanding of watershed issues between the public and resource management agencies; by the development of educational programs.
5. Utilize and share expertise between the respective 'Cooperators,' public and private agencies, organizations and individuals for the purpose of natural resource restoration.
6. Work cooperatively to leverage funds and seek grant opportunities for the purpose of improving resource conditions within the watershed.

Funding

In addition, this plan may be used as a resource and funding tool when prioritizing watershed projects and programs that incorporate the Environmental Protection Agency 9-step requirements for watershed planning. Specific inter-state funding opportunities will become attainable when the CRMP outlines cooperative restoration projects between Arizona and Utah.

Steering Committee

The steering committee is comprised of a representative from each of the entities listed as cooperators in this agreement. The steering committee will:

1. Be responsible for overall plan direction and for coordinating project implementation.
2. Responsible for fostering and developing partnerships at the local and national level.
3. Recommend technical advisory committee members and consider CRMP recommendations from them when developing programs of work.

Technical Advisory Committees

Technical advisory committees are comprised of stakeholders within the watershed who may have an interest, or provide an area of expertise. Technical advisory committee members may be recommended by the steering committee, or by other stakeholders that share a mutual interest concerning resources within the Kanab Watershed. The Technical Advisory Committees will:

1. Be responsible for resource assessments and overall project development.
2. Be comprised of resource specialists, private landowners, and interested stakeholders that are knowledgeable about resource issues. Interested stakeholders may be from but are not limited to the Cooperating agencies and other entities as follows:
 - Arizona Department of Environmental Quality
 - Arizona Farm Bureau
 - Arizona Game and Fish
 - Arizona Natural Resources Conservation Districts State Association
 - Arizona State Forestry Division
 - Arizona State Game and Fish Department
 - Arizona State Land Department
 - Bureau of Land Management – Grand Staircase-Escalante National Monument
 - Bureau of Land Management (Arizona Strip District)
 - Bureau of Land Management (Kanab Field Office)
 - Coconino County
 - Fredonia Conservation District
 - Fredonia town
 - Kaibab Band of Paiute Indians
 - Kaibab Indian Reservation
 - Kanab Irrigation Company

- Kane County Conservation District
 - Kane County Cooperative Weed Management Area
 - Kane County Water Conservancy District
 - Mohave County
 - National Park Service – Grand Canyon National Park
 - Natural Resources Conservation Service, Arizona State Office
 - Natural Resources Conservation Service, Utah State Office
 - Pipe Springs National Monument
 - State of Utah Division of Forestry, Fire and State Lands
 - State of Utah Division of Parks and Recreation (Coral Pink Sand Dunes)
 - State of Utah Division of Wildlife Resources
 - State of Utah School and Institutional Trust Lands Administration (SITLA)
 - State of Utah Division of Water Quality
 - United States Forest Service – Kaibab Forest
 - United States Forest Service (Powell Ranger District)
 - University of Arizona Extension
 - Utah Association of Conservation Districts
 - Utah Farm Bureau
 - Utah State University Extension
3. Recommend and seek funding to implement projects identified during the CRMP process.
4. The technical advisory committees would represent and make recommendations for the following resources:
- *Soil*: (erosion, salinity, etc.).
 - *Water*: (water quality/quantity, point/non-point source pollution, water conservation).
 - *Plant*: (noxious/invasive species, fuel loading, riparian health, etc.).
 - *Animal*: (wildlife, invasive species, fisheries, livestock).
 - *Energy*: (alternative energy development, education, initiatives).
 - *Human*: (watershed education, economic development, cultural resources, recreation, non-profit organizations).
 - *Oil/Gas/Mining*: (ground-water monitoring, TMDL, air quality, economic development).

The ‘Cooperators’ Mutually Agree and Understand that:

- Specific work projects or activities that involve the transfer of funds, services, or property among the ‘Cooperators’ will require the execution of separate agreements or contracts, contingent upon the availability of funds.
- This agreement does not restrict the ‘Cooperators’ from participating in similar activities or arrangements with other public or private agencies, organizations, or individuals.
- Records, data, and other information acquired, developed, collected, or documented under this agreement shall be the property of the originating agency.

- Nothing in this MOU obligates the 'Cooperators' to either expend funds or enter into any contract or other obligations.
- This instrument is neither a fiscal nor a funds obligation document. Any endeavor involving reimbursement, contribution of funds, or transfer of anything of value between the parties to this instrument will be handled in accordance with applicable laws, regulations, and procedures including those for Government procurement and printing.

Kanab Creek Watershed Coordinate Resource Management Plan: M.O.U. Participants and Signatories:

Arizona Game and Fish Department	<i>Luke Thompson</i>	Participating under another MOU.
Arizona State Land Department	<i>Stephen Williams (Natural Resources ASL Dir.)</i>	Participating as future CRMP reviewer.
Bureau of Land Management (ASD)	<i>Lorraine M. Christian</i>	Signatories
Fredonia Natural Resource Cons. District (private land owners)	<i>Danny Bullets Jr.</i>	Participating as TAC members.
Kaibab Band of Paiute Indians	<i>Roland Maldonado</i>	Signatories
Pipe Springs National Monument	<i>John Hiscock</i>	Currently unable to contribute.
National Park Service: Grand Canyon National Park	<i>Dave Ueberuaga</i>	Currently unable to contribute.
North Kaibab Forest Ranger District	<i>Randall Walker/Mike Hannemann</i>	Participating as cooperative agreement.
Bureau of Land Management (KFO)	<i>Harry Barber</i>	Participating as TAC and SC members.
BLM: Grand Staircase-Escalante Natl. Monument	<i>Cindy Stansack</i>	Signatories
Kane County Conservation District (rep. private land owners)	<i>Mark Spencer</i>	Signatories
State and Institutional Trust Lands (SITLA)	<i>Ron Torgerson</i>	Signatories
Utah Parks and Recreation (Coral Pink Sand Dunes)	<i>Michael Franklin</i>	Signatories
State of Utah Division of Wildlife Resources	<i>Kevin Bunnell</i>	Signatories
USFS (Powell Ranger District) Utah	<i>Paul Hancock</i>	Signatories

Alton Mine-BLM EIS

<https://drive.google.com/file/d/0B1ohXIC3gEUPRmY0NFVUSi14NGc/view?usp=sharing>

Arizona Climate Change Action Plan

<http://azmemory.azlibrary.gov/cdm/ref/collection/statepubs/id/3104BLM>

Arizona Game and Fish Department Resource Management Plan

<https://drive.google.com/file/d/0B1ohXIC3gEUPS3J3REFiOVdqdEk/view?usp=sharing>

Arizona Strip Bighorn Sheep Management Plan

<http://azgfdportal.az.gov/wildlife/actionplan>

Arizona Division of Water Resources: 303d listed Waters

<https://drive.google.com/file/d/0B1ohXIC3gEUPaTNleUd1WkZ0aHM/view?usp=sharing>

Arizona Strip Fire Management Plan

http://www.blm.gov/style/medialib/blm/az/pdfs/nepa/library/fire_plans.Par.98331.File.dat/ASDO-2013.pdf

Arizona Strip Resource Management Plan

http://www.blm.gov/az/st/en/info/nepa/environmental_library/eis/strip_FEIS_07.html

BLM: Grand Staircase Resource Management Plan

<https://drive.google.com/file/d/0B1ohXIC3gEUPeEdsa2pXdFE5VIU/view?usp=sharing>

BLM: Kanab Field Office: Utah Greater Sage Grouse and Land Use Plan Amendment (plus final EIS)

http://www.blm.gov/ut/st/en/prog/planning/SG_RMP_rev.html

BLM: Kanab Field Office Resource Management Plan

http://www.blm.gov/ut/st/en/fo/kanab/planning/rod_approved_rmp.html

BLM: Northern Arizona Mineral Withdrawal Final Environmental Impact Statement

http://www.blm.gov/az/st/en/info/nepa/environmental_library/eis/naz-withdraw.html

BLM: Summary of Location and Discharge for Springs, Seeps and Streams: Draft EIS

<http://www.blm.gov/style/medialib/blm/az/pdfs/withdraw/deis.Par.81411.File.pdf/AppendixD.pdf>

BRAC: Governors Blue Ribbon Advisory Council: Utah Climate Change

BRAC Section 1

<https://drive.google.com/file/d/0B1ohXIC3gEUPR2UxYmNITDVUMUU/view?usp=sharing>

BRAC Section 2

<https://drive.google.com/file/d/0B1ohXIC3gEUPbk5paHV4dDFsX3c/view?usp=prinsharing>

BRAC Section 3

<https://drive.google.com/file/d/0B1ohXIC3gEUPRjlhcjU5ZVJMUkk/view?usp=sharing>

BRAT: The Utah Beaver Restoration Assessment Tool:

http://etal.usu.edu/Downloads/BRAT/UTAH_BRAT_FinalReport.pdf

Bureau of Indian Affairs: Western Region Integrated Noxious Weed Management Plan

<http://www.bia.gov/cs/groups/xregwestern/documents/document/idc1-026854.pdf>

Coconino County Resource Management Plan

<http://www.coconino.az.gov/index.aspx?NID=101>

Kane County Conservation District Resource Management Plan

<https://drive.google.com/file/d/0B1ohXIC3gEUPT1RjX3VPYXINSIU/view?usp=sharing>

Kane Conservation District Resource Management Plan

<https://drive.google.com/file/d/0B1ohXIC3gEUPbE1FbTlwcQQtQXc/view?usp=sharing>

North Kaibab Ranger District Final Forest Plan and FEIS

<http://www.fs.usda.gov/detail/kaibab/landmanagement/planning/?cid=stelprdb5106605>

North Kaibab Ranger District: Burnt Corral Vegetation Management Project

<https://drive.google.com/file/d/0B1ohXIC3gEUPMHVvdy1lX3N0SzA/view?usp=sharing>

North Kaibab Ranger District: Forest Invasive Species Location Maps

<https://drive.google.com/file/d/0B1ohXIC3gEUPaDUtMGhuemI1YnM/view?usp=sharing>

North Kaibab Ranger District: Kanab Creek Vegetative Cover Types

<https://drive.google.com/file/d/0B1ohXIC3gEUPaWZmUXRIYlJlcEk/view?usp=sharing>

Kaibab Band of Paiute Indians Light Management Plan

<https://drive.google.com/file/d/0B1ohXIC3gEUPUUpWaUNJc09zVTg/view?usp=sharing>

Kaibab Band of Paiute Indians: Yanawant: Paiute Places and Landscapes in the Arizona Strip

http://www.blm.gov/style/medialib/blm/wo/Planning_and_Renewable_Resources/coop_agencies/new_documents/az.Par.46588.File.tmp/AZ%20Strip%20Volume%20II%20FINAL%20DRAFT.pdf

Utah Division of Water Resources: Municipal and Industrial Water Supply and Uses in Kanab
Creek/Virgin River Basins:

http://www.water.utah.gov/m&i/pdf/kanabvirgin/09KCVR_M&I_2005.pdf

Utah 303d Listed Waters

<https://drive.google.com/file/d/0B1ohXlC3gEUPM3dmcVpUMDFDVnM/view?usp=sharing>



Additional CRMP Related Links:

The crisis of our diminishing water resources is just as severe (if less obviously immediate) as any wartime crisis we have ever faced. Our survival is just as much at stake as it was at the time of Pearl Harbor, or the Argonne, or Gettysburg, or Saratoga.
 Jim Wright, U.S. Representative

ARIZONA
<i>Agriculture and Rangeland</i>
https://agriculture.az.gov/
<i>Bureau of Land Management (Arizona Strip)</i>
http://www.blm.gov/az/st/en/fo/arizona_strip_field.html
http://www.blm.gov/wo/st/en/prog/more/Landscape_Approach/reas/dataportal.html
http://www.blm.gov/ut/st/en/fo/kanab/planning/rod_approved_rmp.html
<i>Bureau of Land Management (Fire and Aviation)</i>
http://www.blm.gov/az/st/en/prog/fire.html
<i>Bureau of Land Management (Landscape Management and Planning)</i>
https://www.youtube.com/watch?v=LciTBPG2-Ss&feature=youtu.be
<i>Climate</i>
http://www.ccass.arizona.edu/
http://www.epa.gov/statelocalclimate/state/state-examples/action-plans.html
http://www.epa.gov/climatechange/impacts-adaptation/southwest-adaptation.html
<i>County Government</i>
http://www.coconino.az.gov/
<i>Cultural Resources</i>
http://www.visitarizona.com/places-to-visit/american-indian-tribes
http://www.havasupai-nsn.gov/tourism.html
http://www.azheritagewaters.nau.edu/loc_PipeSprings.html
http://www.kaibabpaiute-nsn.gov/
https://www.youtube.com/watch?v=pSn7g9jn95U Camp Kwiya muntsi: Rich Heritage, Bright Futures
<i>Demographics</i>
https://www.americanprogress.org/issues/poverty/news/2012/02/28/11060/arizonas-demographic-changes/
<i>Forestry</i>
http://www.fs.usda.gov/kaibab

https://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5114494.pdf
http://www.stream.fs.fed.us/RelatedWebsites/index.html
https://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5155275.pdf
<i>Environmental Quality</i>
http://www.azdeq.gov/function/about/water.html
<i>Extension</i>
http://extension.arizona.edu/
<i>Grand Canyon National Monument Proposal</i>
http://www.biologicaldiversity.org/news/press_releases/2015/grand-canyon-watershed-01-30-2015.html
http://matchbinassets.s3.amazonaws.com/public/sites/990/assets/D9DJ_Grand_Canyon_Watershed_National_Monument_1.pdf
http://knau.org/post/az-senators-oppose-grand-canyon-watershed-national-monument-proposal
https://utah.sierraclub.org/content/grand-canyon-watershed-national-monument
<i>Invasive Species</i>
http://az.gov/invasivespecies/about_plan.html
http://az.gov/invasivespecies/about.html
http://www.blm.gov/style/medialib/blm/az/pdfs/nepa/projects/strip/11.Par.68801.File.dat/AZ-A010-11-0004-CX.pdf
<i>Mining</i>
http://www.blm.gov/az/st/en/info/nepa/environmental_library/eis/naz-withdraw.html
http://www.usgs.gov/blogs/features/usgs_top_story/uranium-mining-in-the-grand-canyon-region/
http://www.blm.gov/pgdata/etc/medialib/blm/wy/resources/efoia/IBs/2007.Par.50407.File.dat/wy2007-029.pdf
<i>National Monuments</i>
http://www.nps.gov/pisp/index.htm
<i>National Parks</i>
http://www.nps.gov/grca/index.htm
<i>Noxious Weeds</i>
https://plants.usda.gov/java/noxious?rptType=State&statefips=04
http://plants.usda.gov/java/noxious?rptType=State&statefips=04
http://www.blm.gov/style/medialib/blm/az/pdfs/energy/rdep/deis/vol2.Par.75194.File.dat/AppdxE.pdf
https://agriculture.az.gov/r3-4-244-regulated-and-restricted-noxious-weeds
https://agriculture.az.gov/r3-4-245-prohibited-noxious-weeds
http://192.168.1.1:8181/http://www.tamariskcoalition.org/sites/default/files/files/TRO_Assessment_FINAL%2012-09.pdf (Colorado River TRO Management)
<i>AZ NRCS</i>
http://www.nrcs.usda.gov/wps/portal/nrcs/site/az/home/
<i>USGS: Watershed Boundary Dataset</i>
http://nhd.usgs.gov/wbd.html

<i>Water Resources</i>
http://www.azwater.gov/azdwr/
http://www.azwater.gov/AzDWR/StatewidePlanning/WaterAtlas/WesternPlateau/Cultural/KanabPlateau.htm
http://www.azwater.gov/AzDWR/StatewidePlanning/WaterAtlas/WesternPlateau/PlanningAreaOverview/WaterSupply.htm
http://www.azwater.gov/AzDWR/StatewidePlanning/drought/2008AnnualWaterUse.htm
https://www.azdeq.gov/environ/water/watershed/download/nemo-colorado_gc-wp.pdf * Utah sub-watershed HUC 10.
<i>Water Rights</i>
http://www.azwater.gov/AzDWR/SurfaceWater/SurfaceWaterRights/default.htm#
http://www.azwater.gov/AzDWR/StatewidePlanning/WaterAtlas/WesternPlateau/PlanningAreaOverview/WaterSupply.htm
<i>Watershed Science</i>
https://www.azdeq.gov/environ/water/watershed/download/nemo-colorado_gc-wp.pdf
http://wiki.landscapetoolbox.org/doku.php/protocols:blm_aim_strategy_assessment_inventory_and_monitoring
<i>Wildlife</i>
http://www.peregrinefund.org/contact
http://www.azgfd.net/wildlife/conservation-news/10-most-unwanted-arizona-invasive-species-plants-animals
UTAH
<i>Agriculture and Rangeland</i>
http://ag.utah.gov/
http://www.uacd.org/
<i>Bureau of Land Management</i>
http://www.blm.gov/ut/st/en/fo/kanab.html
http://www.blm.gov/wo/st/en/prog/more/Landscape_Approach/reas/dataportal.html
http://www.blm.gov/ut/st/en.html
http://www.blm.gov/ut/st/en/fo/kanab/planning/rod_approved_rmp.html
http://www.blm.gov/style/medialib/blm/ut/kanab_fo/planning/rmp/rod_approved_rmp.Par.51627.File.dat/Kanab%20Final%20Plan.pdf
http://www.blm.gov/wo/st/en/prog/more/weeds/nisims.html
<i>Bureau of Land Management: Alton Mine EIS</i>
http://www.blm.gov/ut/st/en/prog/energy/coal/alton_coal_project/alton_coal_eis.html
<i>Clean Air</i>
http://www.ucair.org/hot_topics/
<i>County Government</i>
http://kane.utah.gov/
<i>Climate</i>
http://www.epa.gov/climatechange/impacts-adaptation/southwest-adaptation.html
http://www.rachelcarsoncouncil.org/index.php?page=climate-change-action-plans

Demographics
http://www.utah.gov/about/demographics.html
http://pioneer.utah.gov/research/utah_counties/kane.html
Extension (Kane County)
http://extension.usu.edu/kane/
Fire and Vegetation: BLM
http://suwa.convio.net/site/DocServer/Upper_Kanab_Creek_Final_EA_100709.pdf?docID=10064
Redmond,http://www.researchgate.net/publication/264246061_Limits_to_Understory_Plant_Restoration_Following_Fuel-Reduction_Treatments_in_a_Pion-Juniper_Woodland.
Forestry
http://www.fs.usda.gov/dixie
http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fswdev3_006333.pdf
http://www.fs.usda.gov/detailfull/dixie/landmanagement/?cid=stelprdb5285669
http://www.treesearch.fs.fed.us/pubs/22940
Forestry: Zone 4 Central Weed Management Areas
http://www.fs.usda.gov/detail/r4/landmanagement/resourcemanagement/?cid=fsbdev3_015966
Geology Kane County
http://192.168.1.1:8181/http://files.geology.utah.gov/maps/geomap/7_5/pdf/mp-01-04.pdf
http://www.invasivespeciesinfo.gov/unitedstates/ut.shtml
Kane County
http://kane.utah.gov/att/38/store/m8_R-2015-5-Kane-County-Resource-Management-Plan.pdf
Lidar
https://mail.google.com/mail/u/0/#search/agatto%40fs.fed.us/14b511532fbd6bb6?projector=1
Mining
http://www.sourcewatch.org/index.php/Coal_Hollow_Mine#cite_note-6
http://www.blm.gov/style/medialib/blm/ut/lands_and_minerals/coal/alton_coal_project.Par.14370.File.dat/11__Alton%20DEIS%20Chapter%206.pdf
National Monuments
http://www.blm.gov/ut/st/en/fo/grand_staircase-escalante.html
Noxious Weeds
http://www.utahweed.org/cwma_css.html
http://www.utahweed.org/PDF/strategic_plan.pdf
http://www.utahweed.org/PDF/dewey.pdf
http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5410127.pdf (USDA-Salt Cedar)
http://www.tamariskcoalition.org/sites/default/files/resource-center-documents/Field_Guide_for_Managing_RO_SW.pdf (USDA Field Guide Tamarisk Management)
NRCS
http://www.nrcs.usda.gov/wps/portal/nrcs/site/ut/home/
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/ut/contact/local/?cid=stelprdb1244086
State Parks
http://stateparks.utah.gov/park/coral-pink-sand-dunes-state-park
Threatened and Endangered Species

http://dwrcdc.nr.utah.gov/ucdc/ViewReports/sslist.htm
<i>Water Resources</i>
http://www.water.utah.gov/
http://www.watereducation.utah.gov/postercontest/basins&districts.pdf
http://water.utah.gov/M&I/PDF/KanabVirgin/KANVIR.pdf
<i>Water Quality (DEQ)</i>
http://www.waterquality.utah.gov/
<i>Water Rights</i>
http://www.waterrights.utah.gov/wrinfo/
http://utstnrwrt6.waterrights.utah.gov/cgi-bin/mapserv.exe
<i>Watershed Science</i>
http://wikiwatershed.org/
<i>Wildlife</i>
http://dwrcdc.nr.utah.gov/ucdc/default.asp

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"It is not what we have that will make us a great nation; it is the way in which we use it."

Theodore Roosevelt