



SECTION 1. Natural History Overview

Washington County contains diverse landscape features that continue to be shaped by the forces of nature and human activity. This section provides a brief summary of the region – how it was formed by nature, its past and present use by humans, the resulting land ownership patterns, and the present state of the natural environment. The integral relationship of these elements points to a need to carefully coordinate future development and preservation patterns in a rapidly growing region.

1.1 - Geology

Geologic formations in Washington County record the past 1.7 billion years of Earth's history in this region. Today the area's topography can be categorized into two physiographic provinces, the Basin and Range Province to the west, and the Colorado Plateau to the east. Running from north to south is a transition zone between the two provinces that creates a blend of features from both regions throughout much of the central part of the county.

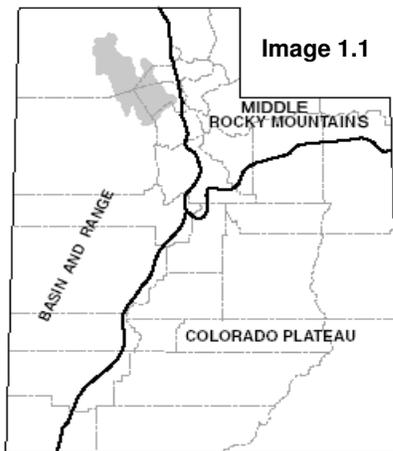


Image 1.1

The Basin and Range Province is characterized by steep, narrow, north-trending mountain ranges that are separated by wide, flat, sediment-filled valleys. The mountain ranges were formed when the earth's crust was slowly stretched by extensional forces that continue to affect the earth's crust today.¹ The stretching produced normal-slip faulting that caused the mountains to rise and basins to form between them. Sediment eroded from the mountains filled the basins creating wide, flat valleys, some of which contain a record of lake shorelines and sediment deposits.

The Colorado Plateau is a vast area covering parts of four states consisting of uplifted mostly flat-lying sedimentary rocks surrounded by eroded canyons and valleys. The sediments forming the rocks of the Colorado Plateau were originally deposited in seas, rivers, swamps, and deserts over a great expanse of geologic time. The entire Colorado Plateau began to rise about 10 million years ago, reaching elevations of over 10,000 feet. This upward pressure created drainages and erosive activity that formed the scenic flat top buttes, mesas, and canyons that now extend for hundreds of miles throughout southern Utah. as Also within the Colorado Plateau are comparatively small bodies of both intrusive and volcanic igneous rocks and a series of monoclinial flexures that locally warp the rock formations.²

Geologic activity has created an elevation difference of over 8,000 ft, ranging from 2,350 at the base of the Beaver Dam Slope along the Virgin River drainage - to the county's lofty Signal Peak at 10,365 feet in the Pine Valley Mountain Wilderness Area. This elevation difference helps capture snow and rain in the cooler mountains, which feeds the drainages and streams that flow into the Santa Clara and Virgin Rivers, and supplies homes and communities with stored surface water and ground water.



A significant geologic feature lies east of St. George and west of Hurricane along the transition zone between the Basin and Range and Colorado Plateau. There an upward fold of rock creates the Virgin anticline. This upward compression occurred as earth plates compressed toward each other about 60 million years ago to create an upward bending of the rock layers. Subsequent erosion over millions of years hollowed out the center of the anticline, exposing rock layers that tilted at steep angles.



Image 1.2 - The Virgin anticline.



Image 1.3 - The Quail Creek Reservoir is dammed at the north end of the anticline.

1.2 - Faulting, Landslides, and Rock Falls

Faulting has helped create scenic topographic features – such as colorful cliffs and deep canyons that add to the unique character and beauty of the region. Although earthquakes are not as frequent in southern Utah as they are in northern Utah, the eastern portion of Washington County is an active faulting area, particularly along the Hurricane Cliffs. Numerous earthquakes occur in southwestern Utah each year, but most are too small to be felt by humans.



Faults are present throughout much of the county, providing evidence of geologically recent crustal movement. The Hurricane fault is the largest and most active of these faults and trends north-south through Washington County. The Hurricane fault extends from from Cedar City, Utah on the north to south of the Grand Canyon in Arizona. It created the high, steep Hurricane Cliffs, which can be traced through Toquerville, La Verkin, and Hurricane, and within a few miles of the county's fastest growing cities -

Washington, St. George, Santa Clara, and Hurricane.



The Utah Geologic Survey (UGS) reported that two of the three Hurricane fault segments in Utah have experienced “geologically recent large earthquakes and accompanying surface faulting.” UGS geologists consider the Hurricane fault “to be active and capable of generating earthquakes in excess of magnitude 7.0. Earthquake hazard is measured by 1) the size (magnitude) of the event and the distance from the earthquake epicenter, 2) the local geology (rock and soil characteristics) and ground-water conditions, and 3) secondary hazards produced chiefly by ground shaking such as rock falls, landslides, liquefaction, subsidence, and floods. Earthquake risk depends on the number, location, design, and construction of manmade structures in the area affected by the earthquake.”²

In 1992, the Hurricane fault produced a magnitude 5.8 earthquake that originated about 10 miles southeast of St. George. The quake was felt over an area of 55,212 square miles, with the majority of damage occurring from a triggered landslide near Springdale that blocked State Route 9; ruptured utility lines; and destroyed two water tanks, several storage buildings, and three homes. The landslide occurred over a 10 hour period following the tremors, and has not moved since. Shaking also caused rock falls along the Hurricane Cliffs and changes to the water flow at the Pah Tempe Resort hot springs.³ Prior to 1992, the last moderate sized earthquake in Washington County was in 1902. That earthquake had an estimated magnitude of 6.0. Many smaller earthquakes have been recorded in southwestern Utah by the University of Utah Seismograph Stations, showing the propensity for seismic activity in Washington County.

The University of Utah Seismograph Stations encourage communities to prepare for future earthquakes and related hazards where a moderate or large earthquake is likely to occur. “Residents should be aware of hazards related to earthquakes including ground rupture, ground shaking, rock falls and landslides, liquefaction, and dam failure and flooding.”³ Although surface traces of fault lines are mostly mapped along the Hurricane cliffs, the whole region is going to be subject to ground shaking, not just the communities along the fault’s surface trace.

The Five County Association of Governments prepared a regional Natural Hazard Mitigation Plan in 2003. Hazard addressed include wildfire, landslides, flooding, earthquakes, volcanoes, drought, problem soils, severe weather, insect infestations and radon gas. A 72-page section lists community-by-community mitigation strategies, objectives, and actions. This document can be accessed at:
<http://homelandsecurity.utah.gov/nathaz/plans.htm>



1.3 - Water Courses



The Virgin River

Almost all of Washington County lies within the Virgin River Watershed. The watershed drainage extends to Alton, Glendale and Orderville at the headwaters of the East Fork of the Virgin River. The North Fork of the Virgin River drains much of Zion National Park. Ash Creek and LaVerkin Creek are tributaries to the Virgin River on the north side of the watershed. The Santa Clara River is a large subbasin that drains the western side of the county including

Moody Wash and Magotsu Creek. The Santa Clara River flows through the cities of Santa Clara and St. George and discharges to the Virgin River near the Dixie Center. An often overlooked tributary to the river is Fort Pearce Wash. It has a drainage basin area that exceeds the Virgin River basin and collects drainage from Colorado City and a portion of the Arizona Strip. The Pah Tempe or LaVerkin Hot Springs discharge 11 cubic feet per second of high temperature and very high salinity water from the bed of the Virgin River and areas adjacent to the river.



The Santa Clara River originates in the Pine Valley Mountains and drains into the Virgin River south of St. George. The river was named by the early travelers of the Old Spanish Trail that followed the river. For a short time it was known as the Tonaquint River, named for the small tribe of Tonaquint Indians living further downriver, near the mouth. Some of the primary and secondary irrigation ditches that divert and still carry water today were created over 1,000 years ago by Pueblo Indians.⁶

Watershed Drainages: Connecting to these two perennial (year round) water courses are many branching drainages that carry snow melt or storm water from mountains, hills, and valleys. Intermittent (seasonal) streams such as the Beaver Dam Wash are defined by areas where surface water is present much of the time, but then ceases to flow when seepage or evapotranspiration exceed the available water supply. Other drainage washes are ephemeral, meaning that water flow occurs after a major rain storm for a few days or weeks after which the wash returns to a dry creek bed condition. Limited annual precipitation in Washington County comes infrequently as concentrated rain storms that can deliver a significant amount of rain in a short time - called monsoons. Given the sparse vegetation through much of Washington County, sudden rain storms dump water directly onto sun-baked soils, and dry wash gullies quickly fill with water.⁷

This natural phenomenon poses a risk of flash flooding throughout much of the undeveloped areas in the county, particularly where plant community cover is sparse.



Drainages and gullies should be avoided during rainstorms by hikers and motorists, particularly in high walled canyons. Homes, businesses, or buildings should not be built in the path of drainage gullies to avoid damage from flash flooding or debris flow deposits.

River History

Between 1854 and 1910, numerous dams and hundreds of miles of canals were built on the Virgin and Santa Clara rivers and their tributaries. This resulted in dramatic changes as a result of irrigation and livestock grazing. During summer months, the demand for water often exceeded the available supply. It was common for entire sections of the river to be diverted into irrigation canals. About 99 percent of all major water rights to the Virgin River system were already allocated by 1910 and probably being fully used. In addition, livestock grazing depleted riparian vegetation along the drainage, increasing erosion and siltation, which led to a decrease of available fish covers.⁸

Since 1910, several small reservoirs have been constructed on Virgin River tributaries, primarily to collect water for irrigation use. These reservoirs reduce water flows, affect natural flow patterns, and affect water quality.⁸ This alteration of hydrologic flows and riparian vegetation has severely impacted water flows, water quality and vegetation which define the habitat for many birds, mammals and fish species. Fish water habitats have also been altered through the introduction of exotic fish species, such as the Red Shiner. As a result of these river alterations, two species of fish (Woundfin and Chub) and one bird species (the Southwest Willow Flycatcher) are listed as endangered by the U.S. Fish and Wildlife Service.

1.4 Flooding



Residents of Washington have experienced periodic incidents of torrential flooding and flash flooding since early settlement days. Two of the most notable events include January 1862, when a raging flood destroyed most of the early settlements of Grafton, Duncans Retreat, Adventure, and Northup along the Virgin River. Grafton's settlers relocated to one mile upstream onto higher ground where the current townsite now stands.⁹ This extreme level of destruction was not seen again until January 12, 2005 when Governor Huntsman issued an executive order

declaring Washington County a disaster area. Ravaging floodwaters destroyed over \$150 million of homes, roads, bridges and other infrastructure along the Santa Clara River.¹⁰ Other recent flooding events occurred in 1997, and in August 2007.

1.5 - Vegetation - Plant Communities

Several major plant communities in Washington County have adapted to the region's varied topography, temperatures, and rainfall patterns. These topographical subsections are called ecoregions, which define the boundaries of varied plant communities in the region. A plant community is a grouping of plants that grow together and share similar water, soil, and climate tolerances created by the geology, topography and regional climate of an area. Plants communities often provide symbiotic relationships with other plants, or with animals that require habitat cover and food from plants. For example, some under story plants grow in shade that is provided by taller sun loving plants. A symbiotic plant and animal relationship would be a plant that requires rodents or birds to eat its fruit to disperse seeds for successful reproduction.

The United States Environmental Protection Agency provides classifications of an ecoregion or plant community at different levels of resolution, depending on the scale of study desired. For example, Level I and II ecoregions define general regions of plant communities at a continental or national scale. Level III ecoregions provide a broad delineation of general plant communities at the statewide or multi-county scale, as shown in Figures 1.8 and 1.9 below. Level III ecoregions of Washington County include the Central Basin and Range (13), the Mohave Basin and Range (14), Wasatch Mountains (19), and Colorado Plateaus (20).

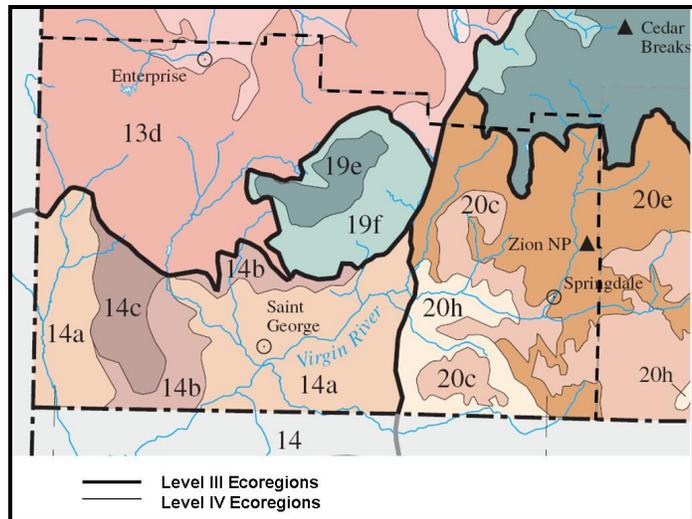
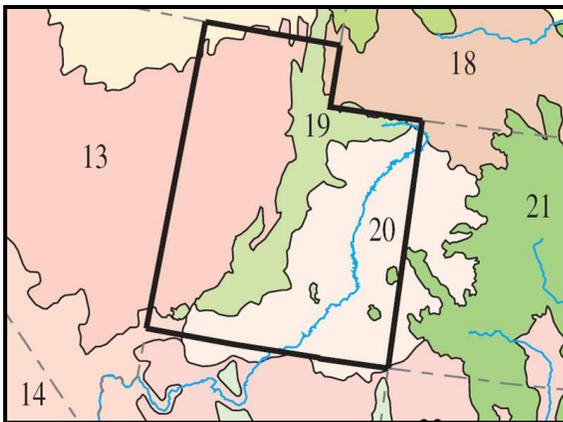


Image 1.8, Above: Class III ecoregions of Utah and surrounding states. Image 1.9, Right: Class IV Ecoregions shown within Class III transition lines.

Level IV ecoregions define the diverse and scenic landscape visible throughout the county at a greater resolution, including the topography, plant and animal life, and rainfall patterns. The Virgin and Santa Clara Rivers create a long, linear riparian plant community that is distinct from other ecoregion types. This plant community thrives along a year-round water supply, forming a long and narrow plant community called an ecotone where fish, birds and mammals seek shelter, food and water. The following descriptions¹¹ summarize the ecoregions in Washington County as shown in figures 1.8 and 1.9 above:



13. Central Basin and Range



Image 1.10

13d Woodland- and Shrub-Covered Low Mountains – are covered by Juniper woodlands at lower elevations, and are mixed with pinyon at higher elevations. The vegetation mix in this ecoregion is distinctly different from surrounding ecoregions, and supports more grazing activity than lower elevation Mojave Basin and Range vegetation. Mountain slopes, hills, and alluvial fans tend to be rocky and rugged, and also contain mountain brush such as bitterbrush and western service berry that provide important browse for mule deer. Croplands and grazing are supported in valleys near water sources.

14. Mojave Basin and Range – is the warmest and driest portion of Washington



Image 1.11

County, with little grazing activity due to the sparse vegetation and lack of water sources. Situated in the lower southwestern corner of Washington County, it is the northeastern extent of a much larger Mojave Desert that covers southern Nevada, northwestern Arizona, and a portion of southeastern California. This is the traditional native habitat of the Desert Tortoise, and the well known Joshua tree. Growth of this tree ends where slopes of the Beaver Dam Mountains transition to the summit of Utah Hill (Ref). The Utah Mojave in Washington County includes low Mojave desert floor elevations, the Beaver Dam Wash, and the Beaver Dam Slope.

14a Creosote Bush-Dominated Basins ecoregion contains the lowest elevation in the state of Utah and Washington County at 2,200 feet, and is composed of alluvial fans, valleys, and scattered buttes. Lower elevation creates warmer temperatures and higher evapotranspiration rates. Warmer soils support creosote bush, Joshua tree, blackbrush, big sagebrush, turpentine broom, and associated grasses.

14b Arid Foothlopes ecoregion lies between 3,000 and 5,000 feet, and is composed of foothlopes, alluvial fans, hills, basalt flows, mesas, and badlands. Sparsely vegetated slopes yield a high sediment erosion loads during summer thunderstorms. Soils sustain big sagebrush, blackbrush, Mormon tea, yellowbrush, galleta, Indian ricegrass, cholla, and unfortunately, the noxious cheatgrass.



14c Mountain Woodland and Shrubland ecoregion is defined as the Beaver Dam Mountains, or Beaver Dam Slope that occurs between 4,000 and 7,800 feet next to the Arid footslopes and the Creosote Bush-Dominated Basins. These mountains are an eroded fault block with mountains and mesa tops that are higher in elevation than the other Mojave ecoregions, with temperatures that are slightly cooler. The landscape is characterized by sparse Juniper-pinyon woodlands and mountain brush with no perennial streams. Although the vegetation is distinctly different, Mojave Desert fauna is found here, including the desert tortoise and the speckled rattle snake.

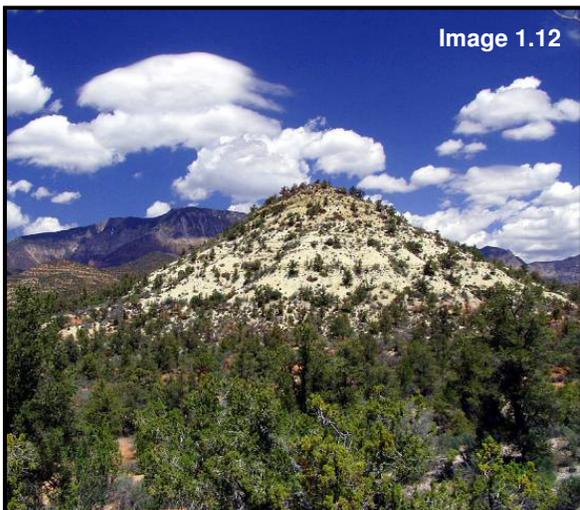


Image 1.12

19. Wasatch Mountains

19e The High Plateaus ecoregion is largely capped by flat-lying igneous rock and is lithologically distinct from the Wasatch Mountain Zone. Elevations usually range from about 8,000 to 11,000 feet, and are accompanied by differences in precipitation and temperature. The subalpine fir, Englemann spruce, Douglas-fir, and aspen communities of plants and animals are widespread, but the ponderosa pine community also occurs at lowest elevations. The vegetation is unlike the juniper-pinyon woodland and mountain

brush found at the Semiarid Foothills. Land uses include seasonal grazing, and recreation.

19f The Semiarid Foothills ecoregion lies between an elevation range of 5,000 and 8,000 feet. The vegetation coverage includes widely spaced juniper and pinyon with sagebrush, grama grass, mountain mahogany, and gambel oak. Some wooded vegetation has been cleared and converted to grasses to support grazing.

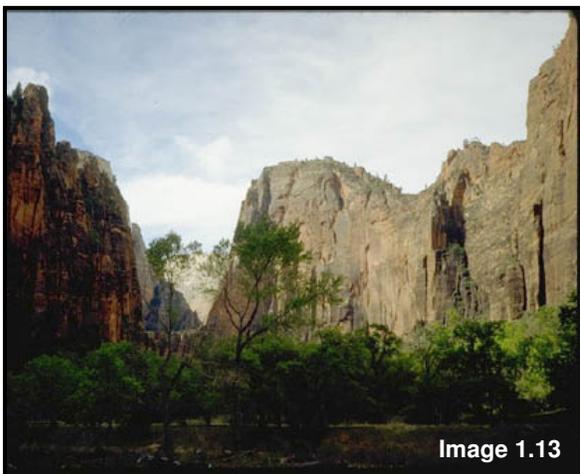


Image 1.13

20. Colorado Plateaus – are characterized by uplifted, eroded, and deeply dissected tableland. Benches, mesas, buttes, salt valleys, cliffs, and canyons are formed in and underlain by thick layers of sedimentary rock. The Plateau region of Utah's Dixie includes the Navajo sandstone, chinlea, and other rock formation knolls, buttes, and mesas located in the south southeastern portion of Washington County including Warner Ridge, Sand Mountain, Mollies Nipple, Vermillion Cliffs and Hurricane Cliffs transitioning into Zion National Park.



Plants typical of this diverse landscape include pinyon/juniper woodlands, grasslands with Blue Grama Grasses, bunch grasses, and big sagebrush.

20c – The Semiarid Benchlands and Canyonlands ecoregion ranges in elevation from 5,000 to 7,500 feet, and is characterized by broad grass, shrub, and woodland-covered benches and mesas. Low escarpments can be seen that separate remnant mesa tops and narrow canyons from surrounding benches. Bedrock exposures are common along rimes, escarpments, and on steep dip slopes. Soils are composed of fine sand and support warm season grasses, winterfat, Mormon tea, four-wing saltbush, and sagebrush. Pinyon and juniper occur on shallow, stony soils. Fire suppression and erosion has allowed this woodland to expand beyond its original range.

20e The Escarpments ecoregion is characterized by cliff bench complexes that can create local relief as great as 3,000 feet, often forming a dramatic transition from the benchlands and canyonlands ecoregion to the forested mountain rim. Escarpments provide a rugged, remote, and varied landscape with abundant habitat for wildlife. At higher elevations, natural vegetation includes Douglas-fir forests on steep, north-facing slopes, semidesert grassland or shrubland on lower, drier sites, and Pinyon-juniper woodlands on escarpments and benches that are covered by shallow soils.

20h The Sand Deserts ecoregion is flat and arid, with soils that are sandy, and contain a low water holding capacity. Soils formed from sandy eolian deposits, shifting dunes, and exposed sandstone bedrock. With only 5 to 8 inches of annual precipitation, grazing capacity is severely limited, with drought-vegetation growing sparsely on stable sand blankets, including Indian ricegrass, sand dropseed, yucca, and blackbrush. and stock carrying capacity is limited.



The Virgin River Basin is defined as the Santa Clara and Virgin River riparian corridors within the greater St. George drainage basin. This plant community is referred to as an ecotone, or a transitional plant community that creates an abrupt edge or change in an ecoregion. Riparian plants rely on the continual flow of surface water or ground water, and include creosote bush, big saltbush, common reed, false seep willow, sandbar willow, cottonwood, and, sadly, the noxious *Tamerisk* (salt cedar) and Russian olive that escaped cultivation over the past

century. Many animals rely on the cover or shade provided by these plants, including the Southwest Willow Flycatcher, the Yellow Billed Cuckoo, the Woundfin, and Humpback Chub, as well as larger ungulates that access water ways for drinking water and foraging.



Plant Communities and Wildfire Risk



Wildfires occur as part of the natural lifecycle of a plant community, particularly where wooded vegetation is present in arid or semiarid climates. Fire hazard potential throughout the county is largely based on the types of forest fuels present in various ecoregions, or plant communities. Contiguous coverage of woody tree and shrub forests present a greater potential fire hazard due to the increased fuel load, and potential for fire to burn hotter and longer. A new wildfire risk threatens to disrupt the natural cycle of plant communities

through out the west, and in Washington County. Non native species are overtaking native vegetation, causing a dramatic increase in the frequency of fires. Increased wildfire occurrences are threatening to the public as development spreads further out into wooded vegetation areas, and to animals that rely on vegetation for food and cover. The threat of increased erosion and water quality degradation is also a serious problem following wildfires. These combined factors require additional resources to provide fire protection and mitigation to protect lives and property.

Annual Grasses Posing Increased Wild Fire Risks



Cheatgrass is an aggressive annual grass that has infiltrated much of the natural landscape of the western United States, and continues to spread rapidly in Utah and nearby states, including Nevada, Idaho, and Oregon. The grass is native to central Asia, and was introduced in America through contaminated seed in the 1890s. Cheatgrass grows between 2 inches and 24 inches tall, and becomes dormant by mid June. Dormancy simply means that the grass is in remission, and will return in full force once the spring rains return.

Cheatgrass, and other noxious annual grasses are competing and overtaking native perennial grasses and plants. Although they look like a fresh blanket of green in the spring months, exotic annual grasses quickly becomes dry and brittle in the summer – just as summer temperatures reach their peak and induce fire season. Replacement of longer season native grasses with short season grasses creates ground-level tinder that threatens native plant communities, wildlife, and human development with a heightened



risk of wildfire. Without cheatgrass and other annuals, wild fire occurrences have typically been every 30 to 70 years in Utah, giving native plant communities a chance to reestablish. However, where annual grasses have their way in native plant communities, the wildfire cycle is now every three to five years.¹² Dead annual grass fires burn rapidly, consuming thousands of acres in an hour's time.¹³ Where plant communities contain frequent woody shrubs and trees such as Utah Juniper, pinyon pine or sagebrush, a cheat grass fire ignites fuel that will burn hotter and longer, threatening homes that are built amidst native plant communities.

Although annual grasses die when spring rains subside into early summer heat, new seeds are released and spread by wind and water erosion for renewed growth the following spring. With the threat of increased wildfire frequency, native plants, including shrubs, trees, and perennial grasses, must compete with annual grasses, and are not likely to reach maturity in time for the next fire. The aggressive annual grasses are also highly opportunistic, thriving in disturbed areas from development and ATV use –or recently burnt areas where annual grass growth appears in abundance the following spring.

Problems following wildfire include more ground surface exposure to rain and wind erosion, soil erosion that flows into streams, and increased risk of mudslides on slopes, including developed areas where homes may become more vulnerable to slope failure. After being largely ignored for decades, the now ubiquitous weed is emerging as an ecological threat during summer months to public and private lands in Washington County. The ominous presence of annual grasses threaten the health and safety of humans, as well as the survival of native animals and plant life. In addition to the threat of fire, dormant cheatgrass provides less cover for wildlife such as grouse and pheasant, and less food later in the season for larger ungulate species such as deer and big horn sheep.¹³

Annual grass control measures include tilling or chemically treating an area, and then replanting with native species that are better for wildlife cover and less of a fire hazard. The former BLM director Kathleen Clark invited "everyone to partner with us in combating noxious and invasive weeds that threaten the economic productivity of millions of acres of public land across the West."¹⁴

The Washington County Water Conservancy District has sponsored a number of studies dealing with vegetation management in Washington County. The Virgin River Management Plan and other documents can be accessed at:
<http://wcwcd.state.ut.us/Plans,%20Studies%20&%20Reports.htm>

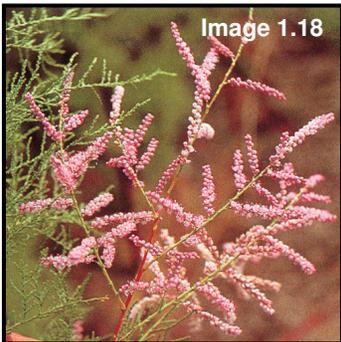
Riparian Water Loss from Invasive Species



Tamarisk (Saltcedar)

Native to southern Eurasia, Tamarisk is a streamside plant that was first brought into the U.S. in the early 19th century for ornamental, bank stabilization, and wind break uses. It escaped cultivation in the late 1870's, and had infested stream banks in the American Southwest by the 1920's and 1930's. Tamarisk is a large shrub or small tree with reddish brown bark color that grows below elevations of 7,500 feet, and

can grow in size from 5 feet to 25 feet at maturity. It is characterized by feathery, needle like leaves on multiple stems and long spindly branches with flowers that range in color from reddish pink to white. Flowers from a large tree can produce up to 600,000 windblown seeds each year.



Tamarisk's aggressive growth can be attributed in part to its ability to spread by seed, root, trunk and branch sprouts, and its ability to survive prolonged flooding and droughts. A Tamarisk tree can survive more than a century, and grows a deep tap root that siphons ground water from depths of up to 100 feet. Although the long spindly branches and thin leaves would appear to be well adapted to arid climates and require less water, a single tamarisk plant siphons and transpires to over 300 gallons of water per day (or the weight of its foliage every hour at 80° F) through its stems and leaves. The Colorado Department of Natural Resources

estimated that tamarisk has consumed 55,000 acres in the state, and draws 170,000 acre feet of water beyond what the native plants would use. This equates to 3 to four acre feet of water loss per acre of dominant tamarisk vegetation stand.¹⁵ The loss of water also translates into economic losses, such as an estimated annual hydropower generation loss of \$16 to \$44 million dollars in the United States due to the salt cedar invasion.¹⁶

Tamarisk also thrives in saline and nutrient poor soils, and contributes to increase soil and water salinity as it exudes salt concentrations onto its leaves, and the leaves later fall to the ground. This further degrades growing conditions for native plants, and increases the rate of soil degradation through out the western United States. The plant also can also tolerate extended flooding, where most other plants die if root crowns are inundated with water more than 500 days.¹⁷



Despite excessive water consumption, the branches, foliage and seeds of Tamarisk become highly flammable, and increase the risk for wildfire along riparian corridors, as well as higher drier sites where the plant can establish with a deep root system that reaches ground water. Its capacity to thrive in post-fire conditions also contributes to its ability to replace native plants with a monoculture of noxious vegetation. A thick stand of Tamarisk not only impedes recreation access and enjoyment of water edges, but also restricts high water flows and increases river channel speeds which result in bed scouring and sedimentation.

Tamarisk also provides poor wildlife habitat compared to other riparian trees and shrubs although some migratory birds nest in thick stands (including the endangered Southwest Willow Flycatcher which has adapted to this invasive habitat cover). Tamarisk dominates and takes up space that would otherwise grow cottonwood, willow, misquite, and other native riparian plants.

A brief summary of Tamarisk threats to a region include:

1. Excessive water consumption
2. Crowding out native vegetation
3. Degraded wildlife habitat
4. Increased soil salinity
5. Increased wildfire frequency
6. Degraded recreational use for humans

Tamarisk Control

Tamarisk plants can be removed by digging, pulling and cutting, and by use of herbicide application to foliage or stem stubs. The most common method of control of growth is to cut stems near ground level, and then apply herbicide to the freshly cut stem surface to prevent new sprouts from emerging. To prevent stream destabilization, removal of large stands of tamarisk should be phased over several years to allow the introduction of new native species.

The United States Department of Agriculture and the U.S. Fish and Wildlife service have been testing leaf eating beetles from China and Kazakhstan that target the tamarisk foliage. Testing has taken place in field cages since 1999, with the hope of providing a natural enemy to the otherwise unimpeded plant that has little natural opposition. The goal is to gradually allow willow plants to replace tamarisk without threatening Southwest Willow Flycatcher nesting areas.¹⁸ The testing sites are also being monitored to assure that the beetle taste preferences do not adapt to also feed on native plants, or turn to feed on a new plant species if tamarisk is eradicated.¹⁹



Russian Olive

Russian Olive is a spiny deciduous tree that can grow up to 25 feet tall. It has dull green to grey leaves, rigid and wrinkled bark, yellow flowers in summer, red berry like fruit, and thorny branches. Like Tamarisk, it has a deep tap root that helps it survive during drought seasons by drawing from ground water reserves.

Similar to Tamarisk, Russian Olive is overtaking riparian areas throughout the United States, and Washington County's waterways have not been spared. Native to Southern Europe and Asia, Russian

Olive was introduced in the U.S. during colonial times, and promoted for plantings in the west starting in the early 1900's. It was used extensively for windbreaks, shelterbelts and wildlife habitat because of its high drought tolerance and adaptability to grow in saline environments. Russian olive was reported as escaping from cultivation in the 1940's to 1960's, and it has moved aggressively along water ways, irrigation ditches, and fence lines ever since.

Russian olive presents many of the same problems as Tamarisk to humans and wildlife. Its aggressive growth out competes native willow, cottonwood, and other riparian plants, replacing native vegetation with an inferior habitat for birds and fish. In addition to consuming high quantities of water compared to native plants, Russian olive creates a monoculture that chokes out native plants, and excessively thickens stream banks. This wall of vegetation restricts high water flows and intensifies flood scouring to the stream bed and intensifies stream flows channeling. In contrast, native vegetation allows a more natural flood event that re-deposits stream bank erosion, and helps plants to reproduce by spreading seeds and providing new fertile soil deposits.²⁰



1.6 – Public Lands



Dixie National Forest

The Dixie National Forest is loved for its spectacular scenery, from high mountain meadows and lakes to multicolored cliffs and steep-walled gorges. Vegetation on the Dixie changes from sparse, desert plants at the lower elevations to stands of low-growing piñon Pine and juniper dominating the mid-elevations. At higher elevations, aspen and conifers such as pine, spruce and fir predominate. A diversity of recreation demands are met by three designated wilderness areas, and camping facilities available across the Forest.

Starting in 1876, Congress began to assess the state of forests in the United States, and by 1881 had formed the Division of Forestry. The Forest Reserve Act of 1891 authorized the potential withdrawal of “forest reserves” from public domain land to manage and protect public interests. The need to prevent deforestation and protect water quality near community settlements became apparent after decades of unmanaged grazing, timber harvesting and mining.

In 1901, the Bureau of Forestry was created to manage national forest reserves, later known as the USDA Forest Service, which also managed a growing national interest in outdoor recreation. The mission of balancing a diversity of private and public forest interests while protecting the health of the forest remains the primary goal of the Forest Service today. The National Forest Management Act of 1976 mandates the protection and balance of ecosystems for a healthy forest system, such that “where appropriate and to the extent practicable, the Act will preserve and enhance the diversity of plant and animal communities.” Additionally, sec. 219.12(g) requires the maintenance of viable populations of native vertebrates in national forests.



The Bureau of Land Management - BLM

In 1946, the federal Grazing Service was merged with the General Land Office to form the Bureau of Land Management within the Department of the Interior. When the BLM was initially created, there were over 2,000 unrelated and often conflicting laws for managing the public lands. The BLM had no unified legislative mandate until Congress enacted the Federal Land Policy and Management Act of 1976 (FLPMA). In FLPMA, Congress recognized the value of the remaining public lands by declaring



that these lands would remain in public ownership. Congress also gave us the term "multiple use" management, defined as "management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people." ²¹

The Federal Land Policy and Management Act of 1976 requires that ". . . the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological value; that . . . will preserve and protect certain public land in their natural condition; (and) that will provide food and habitat for fish and wildlife . . ." Furthermore, it is the policy of the Bureau of Land Management "to manage habitat with emphasis on ecocsystems to ensure self-sustaining populations and a natural abundance and diversity of wildlife, fish, and plant resources on public lands." ²²

Although the policy of federal lands disposal was superseded by a policy of retention and management in 1976 (FLPMA), interest in land trading, and interest in policies favoring additional land disposal will continue to enter into local, state, and national policy discussions. Anticipating future land trades, the BLM has developed a preliminary map that identifies lands that could be considered for disposal. The BLM also completed a Resource Management Plan for the Dixie Resource Area in 1998. The complete document can be accessed at:

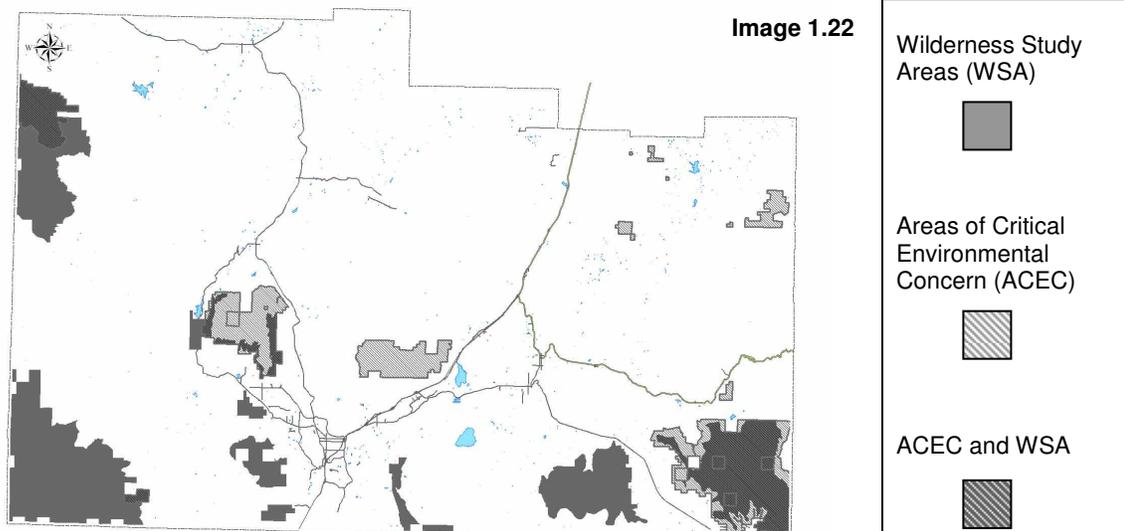
http://www.blm.gov/ut/st/en/prog/planning/existing_plans.html

BLM - ACEC's

The BLM has created special management areas called "Areas of Critical Environmental Concern" or an ACEC. This BLM designation requires special focus and management to protect unique landscape features, including scenic, wildlife, prehistoric or historic cultural, or to protect human life and safety from natural hazards, and other resources.

BLM – Wilderness Study Areas

Study to designate BLM areas containing wilderness like qualities. Although these areas have not been designated by congress as protected wilderness, they are managed with additional protection compared to other BLM areas.



National Park Service (Zion National Park)

Woodrow Wilson signed the Organic Act in 1916 to create a National Park Service in response to growing public interest to conserve America's scenery, natural historic objects and wildlife for future enjoyment and recreation. The National Park Service was created to promote and regulate national parks, monuments, and other unique areas.

The Zion Canyon area was not well known until the Federal Land Survey was completed in 1908. Nearly a decade before the Organic Act, President William Howard Taft was made aware of the survey findings, and declared over 15,000 acres of the main canyon area as a national monument. The monument was called by the name of "Mukuntuweap" in 1909 - named after the Southern Paiute. Only 1,000 visitors managed to visit the monument over the next ten years due to the lack of developed roads. Even with very few visits, word of the beautiful monument spread, and influenced its expansion to more than 76,000 acres, as well as an upgrade to National Park Status in 1919.

Plans were made with local communities in 1921 to pave roads in Washington County, which led to a significant increase of visits to the park. Later, the 5,613 Mt. Carmel Tunnel was built to increase tourism travel on a new road loop that connected Zion Park to the North Rim of the Grand Canyon, Bryce Canyon National Park, and Cedar Breaks National Monument. The Union Pacific Railroad created a subsidiary business called the Utah Parks Company, and invested over \$1.7 million into infrastructure and improvements around Zion Park. Improvements included a new rail track to Cedar City and railway station, advertising in magazines, and the addition of a bus-touring service from Cedar City to Zion National Park with other stops along the Grand Circle. Also, construction of the Zion National Park Lodge and 46 rental cabins further increased the Park's popularity, which today draws over 1 million annual visits.²³

SITLA

The Utah School and Institutional Trust Lands Administration (SITLA) is an independent state agency that is responsible for managing approximately 3.5 million acres of land granted to Utah by Congress at statehood to provide financial support to Utah's public schools and other state institutions, including the Utah School for the Blind, the University of Utah, and Utah State University. The Utah Constitution requires that these "trust" lands be managed solely for the support of their intended beneficiaries – principally the state's public schools. Revenue from the use and development of school trust lands is deposited in the State's Permanent School Fund, a perpetual endowment fund that distributes income annually to each K-12 public and charter school in Utah.

The original congressional grants of trust lands to Utah were for over 7,000,000 acres. Approximately half of these lands have been sold or transferred since statehood; former trust lands make up some one third of the private land in Utah.

In Washington County, SITLA manages approximately 85,000 acres of trust lands. These lands include scattered one square mile (640 acre) parcels distributed in a checkerboard pattern among BLM lands in rural portions of the County as well as several larger blocks of land in and adjacent to urban areas in St. George, Washington and Hurricane. SITLA maintains a Planning and Development group that has attempted



to use principles similar to the Vision Dixie principles to plan its lands to provide for high quality development that is beneficial to local communities and economies. SITLA typically partners with the private sector in the ultimate development of state trust lands; current developments in which SITLA has an interest include Coral Canyon, Kayenta, the Ft. Pierce Industrial Park, Sienna Hills, and Ivory Homes/Hidden Valley.

A critical issue involving state trust lands in Washington County is how to enable acquisition of state trust lands that have significant environmental values. SITLA manages over 6,000 acres of school trust lands within the Red Cliffs Desert Reserve, as well as thousands of acres of open space and wildlife habitat in more rural areas of the County. The Vision Dixie principles encourage preservation of these critical school trust lands through a program of voluntary exchanges for public land more suitable for development. Such exchanges could both protect sensitive lands and allow suitable development that would benefit local communities and Utah's public schools.