Dragonfly at Mill Creek Confluence in South Salt Lake.

NATURE

Our creeks flow from high-alpine coniferous forests to the scrub oak and maple forests of the foothills and into the human-impacted ecosystems within our cities. These ecosystems are vital habitat, providing food, water, shelter, and space, for our wildlife in the Salt Lake Valley and neotropical migratory birds traveling to and from South America to Canada every year. Greenways carry wildlife through riparian corridors to provide a refuge for rest and refuel.

OUR URBAN CREEKS HAVE THE POTENTIAL TO BECOME AN EQUITABLE, INNOVATIVE, AND RESILIENT SYSTEM OF GREENWAY CORRIDORS.

VALUES

Utahns want to maintain and improve ecosystem and watershed health and ensure access to low-impact recreation, like wildlife watching, hiking, and biking. They allocated 39 points of 100 to these topics. These improvements were two of the three highest public lands categories in the "Your Utah, Your Future" survey.

The *Reimagine Nature* survey further highlights the desire for additional riparian and natural areas in Salt Lake City and beyond. Approximately 65 percent of respondents wanted to increase the size of existing habitats and connect wildlife corridors. Over half wanted to acquire lands adjacent to our creeks to support riparian health and reduce flooding.[1]

According to the *Watershed Public Opinion Survey*, six times more Salt Lake County residents felt an above-average commitment, compared to a below-average commitment, to conservation of the natural environment. Residents would like to see more wildlife habitat, natural stream corridors, and protection of open space. They strongly supported public policies that would require landowners to preserve and restore vegetation along waterways and require new developments to preserve habitat and create green infrastructure. Finally, there was overwhelming support for four strategies to increase public funding for these efforts:

- Fees for canyon and trail usage;
- A small property or sales tax increase;
- Bonding; and
- A small household fee.[2]

HABITAT

The Wasatch Range hosts the most frequented national forest in the United States, receiving nine million visitors per year. This equates to the visitation rate of all five of Utah's national parks combined.[3] Our creeks flow through this wildland-urban interface, connecting the Wasatch Range to the Jordan River. They act as key wildlife corridors connecting habitats along the Wasatch and Oquirrh Mountains to the Jordan River and Great Salt Lake.

In 1848, to reduce predators and pests, a hunt in the Salt Lake Valley included, "two bears, two wolverines, two wildcats, 783 wolves, 409 foxes, 31 minks, nine eagles, 530 magpies, hawks, and owls, and 1,026 ravens." This was one of the only inventories of wildlife in early colonial settlement of the Valley. These larger mammals and predators could freely travel from the mountains to the valley along with the seasons. Additionally, the Salt Lake Valley was a seasonal or year-round home to bighorn sheep, mule deer, coyote, beaver, muskrat, jackrabbits, rodents, waterfowl, wading birds, shorebirds, and various migratory birds. Many of the animals found in the Salt Lake Valley have changed as a result of hunting, habitat fragmentation, and predation by domestic pets.[4]

Riparian areas, such as those along our creeks, are habitat located along the banks of a waterway. In the western United States, riparian areas occupy less than two percent of the landscape.[5] In Salt Lake City, they represent only 1.2% of land cover. However, they provide critical ecosystem services for human and wildlife populations. An estimated 80 percent of Utah species rely on riparian areas for a portion of their lifecycle.[6] There are an estimated 114 acres of riparian habitat and 777 acres of wetlands within ¼ mile of the seven creeks.

Figure 4: Mill Creek at Fitts Park in South Salt Lake.

The Salt Lake Valley features hemispherically significant habitat for neotropical migratory birds. The Great Salt Lake, along with the seven creeks and Jordan River corridor, is an important piece of the Central Flyway, connecting ecosystems between South America and Canada. The area is important for breeding, migration, and wintering. Birds utilized the area to molt, fatten, court, and stage for migration.

Raptors take the opportunity to forage on high concentrations of migrant birds. Over 257 bird species utilize these ecosystems—over 7.5 million individual birds. They feature the largest staging concentration of phalaropes, approximately 1/3 of the world population, and over half the North American population of eared grebes (over 2.5 million birds).[7]

It is not uncommon to see wildlife in our cities—many of which have adapted to our urban ecosystems. However, the 2014 Mountain Accord identified a lack of baseline data describing existing habitat and ecosystem function in the area.[8] Key indicators of a healthy wildlife population include:

- Herd size and demographics
- Recruitment
- Range trend
- Roadkill / human conflicts
- Active territories
- Habitat condition
- Population estimates

1 - Salt Lake City, *Reimagine Nature Engagement Window #1 Summary Report* (2020).

2 - Salt Lake County, *Watershed Public Opinion Survey Report of Findings* (2015).
3 - Wild Utah Project, *Wasatch Wildlife Watch* (2021).
4 - National Audubon Society, *Jordan River Natural Conservation Corridor Report* (2000).

5 - Poff, *Threats to Western United States Riparian Ecosystems* (2012).
6 - BIO-WEST, Inc., *Salt Lake City Riparian Corridor Study: City Creek Management Plan* (2010).

7 - Utah Division of Wildlife Resources, *Great Salt Lake Waterbird Survey* (2001).
8 - Mountain Accord, *Final Report* (2016).

Table 3: Sensitive Species

	SCIENTIFIC NAME	COMMON NAME
1	*Iotichthys phlegethontis*	least chub
2	*Rana luteiventris*	Columbia spotted frog
3	*Anaxyrus boreas*	western boreal toad
4	*Opheodrys vernalis*	smooth green snake
5	*Picoides dorsalis*	American three-toed woodpecker
6	*Haliaeetus leucocephalus*	bald eagle
7	*Cypseloides niger*	black swift
8	*Dolichonyx oryzivorous*	bobolink
9	*Athene cunicularia*	burrowing owl
10	*Buteo regalis*	ferruginous hawk
11	*Accipiter gentilis*	northern goshawk
12	*Charadrius nivosus*	snowy plover
13	*Danaus plexippus*	monarch butterfly
14	*Bombus occidentalis*	western bumblebee

Source: Bureau of Land Management, *Utah Sensitive Wildlife Species List* (2018).

SENSITIVE SPECIES

Utah ranks 10th in biological diversity and 5th in species only found in the state, when compared to all 50 states. However, it also ranks 5th in species extinction risk and 17th in actual extinctions.[9] The Salt Lake Valley's wildlife diversity comes from its various biomes from high alpine mountains to our wooded foothills and beyond to broad grasslands.

PARKS & NATURAL AREAS

Parks and natural areas are important infrastructure for the flora, fauna, and people that call the Salt Lake Valley home. The seven creeks flow through 29 parks and 3 golf courses. They provide varying levels of significance from turf grass with little habitat value to healthy riparian forests with high value.

Public lands play an important role in achieving numerous community goals, such as opportunities for outdoor recreation, enjoyment and relaxation, water quality protection, and wildlife habitat. The 2015 Integrated Watershed Plan states, "Recognizing and managing for residents' desire for open space, and the recreation that goes along with it, can also provide opportunities for water quality protection... undeveloped open space provides areas that can naturally filter more storm water and reduce more runoff compared to more-developed areas."[10] There are an estimated 280,000 acres of natural areas in Salt Lake County—55 percent of the total land area.[11] However, urbanization continues to encroach on natural areas, and past disturbances impact the health of our ecological systems.

Wasatch Hollow provides an example of protecting our creeks and achieving conservation goals. The 13-acre nature preserve features a half-mile of Emigration Creek, wildflower meadows, towering Fremont cottonwoods, trails, and a spring-fed wetland. Parts of the area had been privately-owned for 45 years and, over the years, a handful of multi-unit development projects were proposed.

In 2009, community advocates, Salt Lake County, Utah Open Lands, and the Church of Jesus Christ of Latter-day Saints worked to purchase and protect this area in perpetuity through a conservation easement. In 2015, Salt Lake City underwent a restoration project to develop pathways, re-establish riparian function, restore habitat value, and reconnect Hodgson's Spring to Emigration Creek. "It's a little oasis on a creek in the city," said Lewis Kogan, Salt Lake City Trails and Natural Lands Division Director. "It's a remnant ecosystem that still looks like it did back when the pioneers entered the valley."[12]

9 - Utah Division of Wildlife Resources, *Utah Wildlife Action Plan* (2015).

10 - Salt Lake County, *Integrated Watershed Plan* (2015).
11 - Salt Lake County, *Natural Areas Land Management Plan* (2007).
12 - Klopsch, *Wasatch Hollow Preserve, A Jewel in the Neighborhood* (2018).

URBAN FOREST

Urban forests come in many different forms. They include trees in and along urban parks and natural spaces, waterways, streets, landscaping, and on our buildings. Our urban forest helps filter pollutants, especially important with the Salt Lake Valley's poor air quality—often some of the worst in the United States.[13] In the "Your Utah, Your Future" survey, residents ranked air quality as the third-highest priority and level of concern for the future.[14]

Poor air quality impacts our residents. Asthma incidents increase in neighborhoods with fewer trees.[15] The urban forest can help. A single tree absorbs ten pounds of air pollutants yearly.[16] The total value of air pollution reduction by Sacramento's 6 million trees is estimated at almost $30 million.[17]

The urban forest provides shade, reducing the urban heat island effect and protecting us from harmful ultra-violet radiation. Trees sequester carbon and provide oxygen. A single tree produces nearly 260 pounds of oxygen—enough to support two individuals.[18]

Research shows that trees near roads slow down traffic, making our streets safer.[19] Trees create jobs, from entry-level landscaping and nursery work to skilled arborists. An additional 100 million trees in the United States could save $2 billion in energy costs annually—that's three additional trees per building.[20] Trees on the west side of a building reduce electric bills by an average of $47 a year.[21] Urban forests create a sound buffer, reducing noise pollution. Moreover, the urban forest provides a buffer for our creeks to filter pollutants in urban runoff.[22]

One 20-year old tree can:

- Remove 3,100 pounds of carbon dioxide from the atmosphere;
- Save 570 kWh of electricity;
- Intercept 27,000 gallons of rainfall; and
- Filter 15 pounds of air pollution.[23]

In Salt Lake City, the urban forest consists of an estimated 85,000 public trees—63,000 on streets and 22,000 in parks and open spaces.[24] Holladay implemented a tree preservation ordinance to protect the existing urban forest and require replacement of protected trees that are removed.[25] Holladay, Murray, Sandy, Salt Lake City, and South Salt Lake are designated on the Tree City USA list.[26]

CLIMATE CHANGE

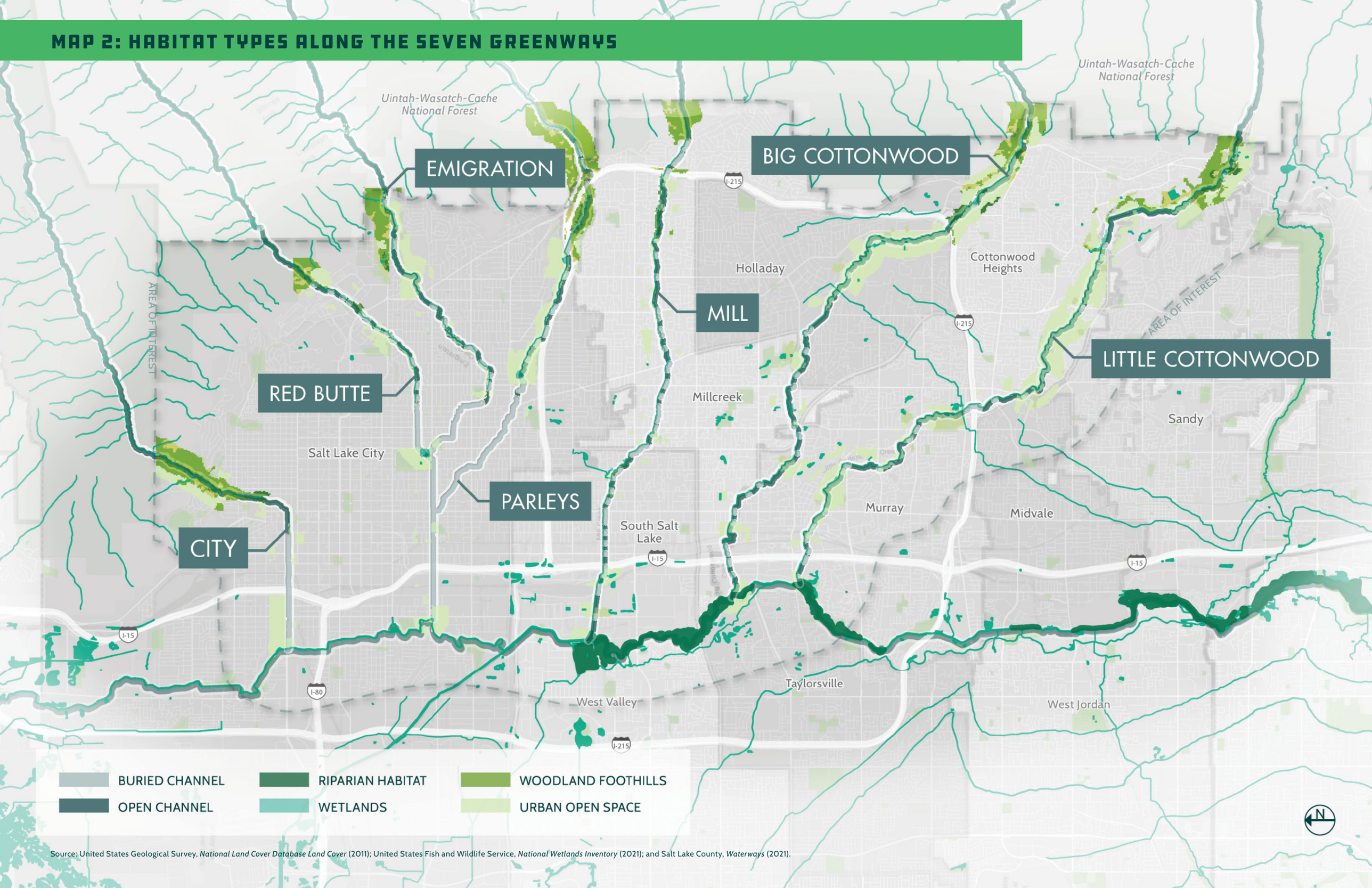
The Salt Lake Valley is already experiencing impacts of climate change. Increases in frequency and severity of extreme weather events have significant costs to governments, community members, and our ecosystems.

Over 100 homes were flooded and 5,000 customers in Salt Lake County experienced power outages during a 200-year precipitation event in 2017.[27] The storm overwhelmed Salt Lake City's storm water system in areas surrounding our underground creeks, primarily the Ballpark and Sugar House neighborhoods, as well as across the Jordan River corridor. Damages required costly stream restoration efforts, as well as repair of a public library and two schools, estimated at $5 million.[28]

13 - Neugebauer, *Salt Lake City has the worst air quality in the nation* (2017).
14 - Envision Utah, *Your Utah, Your Future Survey* (2014).
15 - Southern Group of State Foresters, *Health Benefits of Urban Trees* (2021).
16 - American Forests, *Clean Air & Water* (2021).
17 - McPherson, *Atmospheric carbon dioxide reduction by Sacramento's urban forest* (1998).
18 - American Forests, *Clean Air & Water* (2021).
19 - Wolf, *Safe Streets – A Literature Review. In: Green Cities: Good Health* (2010).
20 - Nowak, *Sustaining America's Urban Trees and Forest* (2010).
21 - Energy.gov, *Energy Saver 101 Infographic* (2021).

22 - California Urban Forests Council, *Why Urban Forests* (2021).
23 - i-Tree, *Tree Benefits* (2019).
24 - Salt Lake City, *Urban Forestry* (2021).
25 - Holladay, *Holladay's Sentinels* (2019).
26 - Arbor Day Foundation, *Utah 2018 Tree City USA List* (2018).
27 - Williams, *Waist-deep water floods homes, cuts power in Salt Lake* (2017).
28 - Mims, *'Torrential' thunderstorms flood East High School, SLC's Sprague Branch, Wasatch Front intersections* (2017).

MAP 2: HABITAT TYPES ALONG THE SEVEN GREENWAYS



Source: United States Geological Survey, *National Land Cover Database Land Cover* (2011); United States Fish and Wildlife Service, *National Wetlands Inventory* (2021); and Salt Lake County, *Waterways* (2021).

By 2050, Salt Lake City's temperatures are predicted to rise ten degrees—what Las Vegas feels like today.[29] This will severely impact our flora and fauna species as air and water temperatures increase, precipitation regimes change, and drought is extended. Roughly half of the species on the plant are on the move—those on land at an average of 10 miles per decade.[30]

The Salt Lake Valley's ecosystems will shift over time as new species colonize, while other species may not be able to adapt in time. New arrivals can outcompete indigenous flora and fauna. Pests and diseases are also migrating, moving into new areas, and impacting natural ecosystems and agriculture.[31]

Pests also impact humans. According to the Centers for Disease Control and Prevention, Lyme disease is trending upward in Utah due to the warming climate. Confirmed cases jumped from three in 2000 to 19 in 2016. West Nile Virus and other mosquito-borne illnesses are also on the rise.[32]

Wildfires are predicted to increase with climate change. In 2020, over 1,500 fires burned over 300,000 acres, the worst on record for human-caused fire starts.[33] The forest area susceptible to wildfire has doubled since 1984 due to higher temperatures and less rainfall. Furthermore, the fire season has been extended by six weeks, compared to a few decades ago.[34] Hospital visits spike as air pollution from smoke gets trapped in the Salt Lake Valley.[35]

Wildfires in our natural areas in the Salt Lake Valley are especially dangerous and costly with development and infrastructure nearby. In 2020, the 13,000-acre Knolls Fire spread into residential areas in Saratoga Springs, destroying a home and displacing many. In 2018, wildfires burned 500,000 acres across Utah at a cost of $150 million in suppression.[36]

CHALLENGES

By the 1980s, the Utah Division of Wildlife Resources estimates approximately 30 percent of Utah's riparian, wetland, and aquatic habitats were destroyed.[37] As the Salt Lake Valley's population grows an additional 600,000 people by 2065, wildlife habitat impacts will be further compounded.[38] Water consumption and the subsequent alteration of aquatic habitats are the most significant source of stress for wildlife in Utah, according to the *Utah Wildlife Action Plan*.

Introduced species pose the second largest threat to indigenous wildlife. Introduced species become noxious when they out-compete indigenous species. Their populations often explode when there are no natural predators to keep populations in check. There are 54 species on the Salt Lake County Noxious Weed List. Many are found along our creeks.

More wildfires due to climate change increase the impact on wildlife habitat. An acre of a restoration project at the Mill Creek Confluence burned in 2017 and 2020. Desirable vegetation, such as Woods' rose and coyote willow, was burned in the fire. In addition to the fires themselves, the loss of habitat impacted a skulk of red fox at the site.[39] Urbanization further threatens our wildlife habitat as natural, open spaces are replaced with development.

BARRIERS

Our creeks are wildlife corridors. Species use them to navigate from one patch of habitat to another in the Salt Lake Valley between the Wasatch and Oquirrh Mountains to the Jordan River and Great Salt Lake. Along our open creeks, they are less likely to encounter hazards, such as roads, fences, pets, and people. These corridors are vital to the long-term health of wildlife.

However, hazards create dangerous encounters between wildlife and development. Wildlife may be forced to cross busy roads, jump over fences, and travel through human developments. Automobile collisions are often deadly for wildlife and dangerous for humans. Scared wildlife can become aggressive, as humans and wildlife compete for space in the urban environment.

Fragmentation is the primary threat for aquatic species. Many need connected streams to migrate and complete their lifecycle. Barriers jeopardize their survival. They may be natural, like waterfalls. . Others are anthropogenic—culverts, buried streams, dams, or physio-chemical (temperature or toxicity). [40]

According to the *Utah Fish Passage Barrier Assessment and Inventory*, there is one barrier on City Creek, two on Red Butte, one on Emigration, nine on Parleys, eight on Mill, six on Big Cottonwood, and 11 on Little Cottonwood. In an analysis of land cover within 1/4 mile of our creeks, Little Cottonwood Creek has the most intact wildlife habitat with the most open space adjacent. Mill Creek is the worst with over 80 percent of its land cover developed. As the Salt Lake Valley continues to increase in population, along with a rise in popularity of outdoor recreation, conflicts may increase if space is not provided for wildlife.

WASATCH WILDLIFE WATCH

The Wasatch Wildlife Watch program seeks to fill our data gap in understanding urban wildlife populations, habitats, and responses to urban development. Over 1,000 camera traps are scattered throughout the Wasatch Range and Salt Lake Valley green spaces. Volunteers pour over thousands of images to identify wildlife captured.

Thus far, almost two million individual wildlife have been photographed across 46 different species. The top wildlife species detected are mule deer, northern raccoon, wild turkey, elk, red fox, moose, and rock squirrel.[41] Camera trapping identifies key habitat for future restoration and identifies important corridors for migration and movement. Additionally, efforts monitor trends in populations of urban wildlife species to make recommendations for future management.

29 - Alberty, *Climate study predicts in 30 years, Salt Lake City weather will be like the Nevada desert's is today* (2019).
30 - Chen, *Rapid Range Shifts of Species Associated with High Levels of Climate Warming* (2011).
31 - Welch, *Half of All Species Are on the Move—And We're Feeling It* (2017).
32 - Penrod, *Lyme-carrying ticks and other dangerous pests are creeping into Utah, thanks to climate change* (2018).
33 - Williams, *Wildfire season recap: 2020 produced most human-caused fires on record in Utah, $60M in costs* (2020).
34 - Gehrke, *A changing climate demands a holistic response to preventing wildfires — not a partisan one* (2020).
35 - Biskupski, *Testimony before the Committee on Energy and Commerce Subcommittee on Environment and Climate Change* (2019).
36 - Maffly, *The coronavirus pandemic is behind Utah's record number of human-caused wildfires, officials say* (2020).
37 - Utah Division of Wildlife Resources, *Utah Wildlife Action Plan* (2015).
38 - Perlich, *Utah's Long-Term Demographic and Economic Projections Summary* (2017).
39 - Seven Canyons Trust, *Mill Creek Confluence Adaptive Weed Management Plan* (2020).
40 - Utah Wildlife Migration Initiative, *Barriers* (2021).
41 - eMammal, *Wasatch Wildlife Watch Summary* (2020).

OPPORTUNITY

Encouraging NATURE to thrive

Restoration of riparian ecosystems with beneficial plants will increase habitat value and biodiversity for wildlife and neotropical migratory birds. Biodiversity is an important factor in combating future changes in climate and vegetation shifts. Greenways provide vital wildlife corridors through our urbanized valley between the Wasatch Range and the Jordan River. They decrease habitat fragmentation and improve fish passage by connecting green spaces, removing aging infrastructure, and daylighting streams.

The greenways are significant pieces of infrastructure to support our communities of people, plants, and wildlife. Through the addition of trees to the urban forest, we can better filter air and water, control more urban runoff, and provide additional wildlife habitat. By focusing the canopy increase in areas with low tree density, such as those on the west-side along our buried creeks, we can strengthen communities by filtering air pollution, decreasing pollution-related health impacts, providing shade, reducing noise from nearby freeways and railroads, soaking up carbon emissions, and adding economic value.

Stream restoration and daylighting will further enhance habitat value by re-establish a naturally-functioning waterway and riparian ecosystem—or to the most natural state possible. This depends on factors upstream, surrounding land-use, and the space available. Efforts decrease habitat fragmentation and form wildlife corridors by connecting stream channels and adjacent riparian habitat. By removing dams and culverts and replacing aging infrastructure through stream restoration and daylighting, we can improve fish passage and migration for survival and spawning.

Where appropriate, natural space with limited access would improve wildlife corridors by mitigating conflict with humans and pets. In the *Blueprint Jordan River Refresh Survey Findings*, respondents ranked natural areas with limited access in their top two improvements.[42] Limited-access natural areas give space for wildlife to find food, water, shelter, and space for migration between summer and winter habitats. They also take wildlife out of dangerous interactions with humans, requiring relocation or, in some cases, extermination.

With space to travel and the elimination of barriers with proper road crossing, wildlife collisions could be reduced. Car collisions with deer cost an average of $8,190, while collisions with elk and moose cost $25,319 and $44,546. Crossings that guide wildlife under or over busy roads, in key areas, can reduce collisions by 85 to 95 percent.[43] Well-connected corridors also give residents improved wildlife viewing opportunities—an activity more than 65 percent of Wasatch Front residents were interested in.[44]

In the Salt Lake Valley, all of our urban ecosystems have been altered by humans. The term "novel ecosystems" is often used to describe the unique assembly of species and environmental conditions from intentional or unintentional alterations, such as introduced species or hydrologic changes to our creeks. This creates a new ecosystem trajectory and makes returning to a previous trajectory nearly impossible. Novel ecosystems are self-sustaining in composition, structure, and ecosystem services.[45]

Our natural areas in Salt Lake Valley have become novel ecosystems. Many introduced species would require costly and land-intensive mitigation to remove. They are likely here to stay.

42 - Envision Utah, *Blueprint Jordan River Refresh Survey Findings* (2020).
43 - Vartan, *How wildlife bridges over highways make animals—and people—safer* (2019).
44 - Envision Utah, *Blueprint Jordan River Refresh Survey Findings* (2020).
45 - Morse, *Novel ecosystems in the Anthropocene* (2014).

Considering that, vegetation should be managed based on their habitat value, rather than the native versus non-native dichotomy. When noxious weeds or other vegetation is removed, a diversity of species in different sizes and ages should be used to replace. Removal and revegetation efforts should be phased to not undermine habitat value through clear-cutting. Oftentimes, birds can be seen using Russian olive and tamarisk, two notorious noxious weeds along our creeks, in absence of indigenous vegetation.

Biodiversity is an important factor to combat the effects of climate change for wildlife as species migrate and others are not able to adapt. Stream daylighting creates new riparian habitat, and biodiversity, in areas that were once developed or degraded. Restoration repairs impacted ecosystems to increase biodiversity.

Figure 5: Restoration seeding at Mill Creek Confluence in South Salt Lake.