Protecting wildlife movement in the face of rapid urbanization: the Chatfield basin (Colorado) experience

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Abstract

This paper presents the real-world experience of 35 public and private groups and their efforts to conserve an interconnected system of corridors for wildlife movement, recreation, and water quality/flood control protection across 140 square miles on the southern edge of metropolitan Denver, Colorado. Most of the basin is located in one of the fastest growing counties in the United States. Network members range from highway and homebuilders to environmentalists and conservationists. Everyone, regardless of perspective, is welcome to participate.

Green infrastructure **is the term we use to describe the interconnected and buffered open space system that must be retained in our region, if ecological integrity and biological diversity are to be preserved, as development occurs. The concept recognizes that small, isolated, species-poor natural areas surrounded by development are not conducive to wildlife movement and other landscape-scale natural functions.**

Work to date was funded by the lottery-supported Fund for Great Outdoors Colorado, which has enabled the Network to develop as an effective organization and produce a "home-grown" network concept plan for the 140-square mile Chatfield Basin. The plan identifies broad public- and private-sector steps for protecting an interconnected system of open space. Its main objective relates to wildlife, but recreational trails, water quality, and flood control protection are also considered.

In the Chatfield Basin, many spectacular wildlife, visual, geologic, and other natural features are still intact. Some of these are of statewide and national significance. Opportunities to protect these resources still exist because large areas of the basin are undeveloped and do not yet face severe pressure from development. As new houses and roads are built, however, the landscape will become more fragmented and some wildlife will disappear. Preserving connections and buffering across an area as large as the Chatfield Basin, requires unprecedented levels of cooperation. But, without connections, the basin's existing system of parks and other open spaces faces a possible serious decline in the number of wildlife species.

The concept plan is helping coordinate actions to buffer and connect the basin's natural areas. Such coordination makes it more likely wildlife corridors will be left intact as the area develops and that an integrated regional hiking trail system will be created. Our project approach is to work together to coordinate vision and activities and then let stakeholders (as individuals or in groups) implement components of the plan in a coordinated way. This strategic approach, coupling regional thinking/planning and local action, has proven very effective in achieving our goals.

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INTRODUCTION

Sometimes we don't know what we have until it's gone. We move to an area because of its wide-open spaces and opportunities to see wildlife and, before we know it, they start to disappear. Fortunately, with forethought and follow-through we can save significant parts of our natural environment close at hand.

For this reason, more than 35 public and private agencies, organizations, and companies have banded together to conserve an interconnected system of open space for wildlife and people in southwestern metro Denver, surrounding Chatfield Reservoir and Chatfield State Park. This collaboration, known as the Chatfield Basin Conservation Network, has created an ambitious plan to coordinate the efforts of developers and conservationists in protecting connections and conserving major parts of the ecological vitality of the 360-square km Chatfield Basin. (See Table 1.)

WHY CONNECTIONS ARE SO IMPORTANT

Currently, large areas of the Chatfield Basin are undeveloped and wildlife tends to move freely. As new houses and roads are built, however, the landscape will become more fragmented and some wildlife will disappear. The challenge in preserving connections across as large an area as the Chatfield Basin is that it will take unprecedented levels of cooperation. Without these connections, the basin's existing system of parks and other open spaces faces a serious decline in the number of wildlife species.

The Opportunities

In the Chatfield Basin many spectacular wildlife, visual, and geologic resources are still intact, some of statewide and national significance. There are opportunities to protect these resources in a sustainable manner because large areas of the basin are undeveloped and do not yet face severe pressure from development. In particular, we believe this plan will be very beneficial for 1) conserving wildlife habitat and movement corridors and native vegetation, 2) protecting water quality and reducing the impacts of floods, and 3) providing opportunities for people to experience nature firsthand.

The Conservation Network Concept Plan

The Chatfield Basin Conservation Network working group (Network) has developed a Concept Plan to help coordinate actions to buffer and connect the basin's natural areas. This will mean a greater likelihood that wildlife corridors will be left intact as the area develops and that an integrated regional hiking trail system will be developed.

This plan identifies 7 key conservation corridors and 6 broad conservation areas that deserve special attention and a range of supportive educational activities. The plan is very ambitious and takes a long-term view. It will take more than just a few people and a few years to achieve even a small part of this vision. Conservation organizations and open space departments cannot be solely responsible either.

THE GREAT OPPORTUNITY AT CHATFIELD

There are probably no greater opportunities to keep large parts of vibrant natural systems intact along metro Denver's expanding edge than in the Chatfield Basin. The basin contains natural resources of statewide and national significance. For that very reason, it also is attractive as a place to live and work.

Learning from South Platte Park

At the northernmost edge of the Chatfield Basin is 260-ha South Platte Park. Changes in the numbers and kinds of wildlife species there and increased urbanization along the park's edge, illustrate what more of the basin may face unless significant steps are taken. Thus, South Platte Park may offer a preview of the issues and concerns facing the larger basin.

As recently as 1986 (and nearly every previous year), black bears (*Ursus americanus*) were seen in South Platte Park. Since that year, only one has been seen. Similarly, until 1990, herds of 15 - 25 mule deer (*Odocoileus hemionus*) regularly were observed in the park. Only a few mule deer have been seen in the last 5 years.

The disappearance of these large mammals may be a signal that the park and the region are becoming less hospitable for wildlife. Both park visitation and adjacent development have increased in recent years. As they expand, other species, such as hawks (*Buteo* spp.), eagles (*Haliaeetus leucocephalus* and *Aquila chrysaetos*), and falcons (*Falco* spp.), also may be displaced.

In 1989, South Platte Park had 9,000 visitors. With the extension of the South Platte Greenway trail into the park, that number increased to 90,000 the next year. Today, there are between 300,000 and 350,000 visitors to the park each year.

As few as 5 years ago, there was no major development near South Platte Park. Nearly 400 ha of undeveloped land surrounded the park. Today, however, over half that land has been developed or is slated for development.

The Park was acquired between 1971 and 1983 (for nearly $2 million) as a place for passive recreation, environmental protection, and education. As the palette of species is reduced, it becomes harder to provide the same quality of recreation or environmental education. This means the most significant resources of the park could largely disappear over time. Probably the changes, however, would be gradual and not obvious to the typical visitor.

Some say losses of natural resource are inevitable in an urbanizing area. The fundamental thesis of the Chatfield Basin Plan is that, while some losses cannot be avoided, with planning and strategic actions, biological diversity and opportunities to experience nature close at hand can be preserved in the face of urbanization.

At an Ecological Crossroads

The Chatfield Basin lies at an ecological crossroads, where the Rocky Mountains meet the High Plains and the southern desert lands meet the northern boreal forests. This melting-pot effect (called an ecotone) creates a great diversity of plants and animals. It means, for example, that some plants and animals found here, such as the ring-tailed cat (*Bassariscus astutus*), are at their northern extent. Another characteristic is that some of the basin's grasslands are remnants of what was once common across the plains before they were replaced by agriculture.

Resources of Statewide and National Significance

The plants, animals, geology, and other features of the basin are of great significance.

- Over 1,100 species of plants and animals have been identified in the basin.

  Species include those designated as rare, threatened, or endangered. Three birds are listed as federal and/or state endangered, 1 mammal has been listed as federal endangered, 4 fish are state rare or imperiled, 2 butterflies are globally rare or imperiled, and 8 butterflies are state rare or imperiled.

- During spring migrations, an average of 7,000 raptors are spotted along the Dakota Hogback and Morrison Formation on the western edge of the basin, which act as a natural landmark for migrating birds of prey. Air, as it passes over these ridges provides additional lift for the birds, while adjacent lands provide places for feeding. Peregrine falcon (*Falco peregrinus*) and at least 16 other species of birds of prey move along the hogback.

- Remnants of tallgrass prairie, with big bluestem (*Andropogon furcatus*) and Indiangrass (*Sorghastrum nutans*), are found in this part of Colorado. Increased precipitation due to the mountain interface creates conditions in which tallgrass prairies dominate areas adjacent to the hogback. To walk through other tallgrass prairies, you need to visit Illinois, Iowa, or parts of Oklahoma, Kansas, or Nebraska.

- The basin provides ideal habitat for over 150 species of butterflies. During June and July, more than 100 species can be seen in a single day, more than anywhere else in the United States. Ten species of rare, state imperiled, or globally rare butterflies, including the rare Hop's Blue (*Celastrina humulus)*, can be seen along the Front Range. This is the second most important area in the United States for butterfly conservation.

- Sharp-tail Ridge, near the village of Louviers, has a breeding site (lek) for sharp-tail grouse (*Tympanchus phasianellus*), a species of state concern that needs expansive areas of shrubby grassland.

- Preble's meadow jumping mouse (*Zapus hudsonius preblei*) is found along Plum and Willow Creek. Last year, this species was federally listed as endangered.

- Four rare fish have been found along Plum Creek, 2 of these are listed as state imperiled. The common shiner (*Notropis cornutus*), Iowa darter (*Etheostoma exile*), northern redbelly dace (*Phoxinus eos*), and brassy minnow (*Hybognathus hankinsoni*) are in need of protection.

- The basin is home to herds of deer (*Odocoileus* spp.), elk (*Cervus elaphus*), and bighorn sheep (*Ovis canadensis*).

Other Natural Features

- Front Range geology has intrigued visitors throughout history. Members of the 1820 Stephen Long Expedition were the first white men to describe the red rocks of the Fountain Formation in what is present-day Roxborough State Park.

- To the south of the basin, the Palmer Divide separates the South Platte River and Arkansas River drainages. Clouds accumulate along the divide, and the resulting heavy rains have, in the past, triggered flooding along Plum Creek and the South Platte River.

- This heavy precipitation along the Divide feeds Plum Creek. The creek is undammed and unchannelized, its hydrology intact, the only such stream along the Front Range between Fort Collins and Colorado Springs.

A Wide Range of Recreational Opportunities

- Recreational opportunities abound in the basin, enriching the lives of residents and visitors. Hiking, boating, picnicking, nature study, photography —all are popular in the basin.
- With more than 170 km of soft-surface trails and 95 km of hard-surface trails, residents and visitors can explore, exercise, and enjoy the richness of this environment.
- Already with more than 3,000,000 visitors to the basin (in 1996), the use and popularity of the trails, open spaces, 870 ha of water and 450 km of streams will only grow as the metro population increases.
- In 1996, more than 125,000 educational contacts were made by staff and the almost 400 volunteers who contributed 20,000 hours of educational opportunities helping visitors to plant trees, create trails, and study plants and animals.

Preserving Water Quality and Flood Control

- Chatfield Reservoir was built by the U.S. Army Corps of Engineers to reduce the impacts of heavy floods, which have devastated the Denver area in the past.
- The unchannelized streams of the basin, with their wide flood plains and wetlands, contribute greatly to controlling floods in the region.
- Wetlands also help protect water quality by filtering out pollutants before they reach streams and reservoirs.

THE CHALLENGE IN URBANIZING AREAS

The longer people live in an area, the more the landscape becomes subdivided into ever smaller and more isolated pieces. This leaves habitat that, at least for some species, is too fragmented to be of use.

For a person's house to function properly, each room must be designed as a part of the whole —a kitchen for food preparation and meals, bedrooms for sleeping, the family room for activities—all interconnected by hallways or stairs. Within the walls of the house, many systems must function together—the electrical system, heating and cooling systems, plumbing—all these systems, work together across the framework of the house to give us a safe, comfortable place to live.

A house with separate, interconnected rooms is a useful model for planning and educating the public about the Chatfield Basin ecosystem. The basin will continue to have viable wildlife populations if there are core reserve areas where animals and plants can live undisturbed, wider areas for food gathering and shelter, and connections between them. Without hallways, or in the basin's case, wildlife corridors, the system loses its integrity and efficiency. Some animals are no longer able to move among the resources they need. Over time some of these isolated populations diminish and disappear. Only those wildlife species tolerant of nearby development thrive with the new configuration. On a landscape scale, species diversity declines.

When most people see a few deer or elk—species that adapt to living around people—they think everything must be okay. They usually don't notice when there is a gradual decline in the overall number of species around them if they can still see even a few kinds of animals.

Concepts for Keeping the Pieces Together

Noss and Cooperrider (1994) have developed a model for regions and wildlife that is similar to the earlier analogy of a house. In their model, they describe core reserve areas as the areas where nature largely has reign. Connecting core areas are corridors that serve both for movement and habitat. The balance of the region is made up of buffers for the core areas. Buffers can vary in the amount of human activity they contain, but there should be less human activity closer to core areas.

Approximately 39% of the Chatfield Basin is conserved as a state or local park, or some other kind of protected open space. The more natural parts of these open spaces, away from major recreational activities, serve as the core reserves in the Chatfield Basin Conservation Network.

The conservation thrust for the basin is to determine where these reserves need expanding, buffering, and wildlife movement connections.

CHATFIELD VISION AND APPROACH

The Chatfield Basin Conservation Network vision is of an interconnected and buffered system of open space for nature and people. Envisioned are healthy protected areas that are sustainable and rich in indigenous species because they are buffered and connected. This project vision is supported by 5 goals:

1. Conserve and enhance areas of significant wildlife habitat and protect a connected system in support of wildlife movement.
2. Conserve and enhance areas of significant vegetation.
3. Conserve open lands, stream corridors, and wetlands to protect water quality and help reduce damage from flooding.
4. Create an interconnected, non-motorized trail system for the Chatfield Basin.
5. Coordinate open space systems across jurisdictions in the basin.

ELEMENTS OF THE PLAN

The Conservation Network Concept Plan identifies the broad elements of a conservation network for the Chatfield Basin. The Plan includes 6 broad conservation areas and 7 major conservation connections. Protecting these connections and significant portions of the conservation areas will have a major impact on the ecological integrity of the basin. Further study will be needed to define finer-scale elements of the network, but enough is already known to take steps to conserve key elements of these connections and habitat areas.

Conservation Corridors

Two major and several minor stream corridors cross the Chatfield Basin. These form the basis of 4 of the 7 conservation connections identified in the network. The South Platte River, the main riparian connector, flows through the Chatfield Basin and Denver toward Colorado's northeastern plains. A secondary connector, Plum Creek, flows from the southeast into Chatfield Reservoir. A number of smaller streams supplement the South Platte and Plum Creek. These riparian zones provide important habitat and allow a variety of wildlife to move among the basin's conservation areas.

In the plan, 3 primary upland corridors that make cross-country connections across the basin complement these 4 riparian corridors. The hogback, near the western edge of the basin, is the basin's major north-south connection. Sharp-tail Ridge is a secondary north-south corridor that stretches from Roxborough State Park north to Chatfield Reservoir. A series of smaller ridges and drainages make up a broad east-west landscape linkage from the western foothills across Highway 85 to the woodland areas of Cherokee Ranch, Daniels Park, and the Highlands Ranch Open Space Conservation Area.

Riparian Corridors

The lush riparian vegetation along the South Platte River and Plum, Deer, and Willow Creeks plays an important role in providing movement corridors and habitat for wildlife. Riparian corridors in the Chatfield Basin are typically characterized by forests of cottonwood (*Populus* spp.), willow (*Salix* spp.), box-elder (*Acer negundo*) and many small shrubs and grasses that provide food and shelter for wildlife.

South Platte River Conservation Connection

The South Platte River, Chatfield Basin's largest riparian corridor, provides access to several habitats. It flows from the west through the foothills in Waterton Canyon, crossing shrublands, hogback, and grasslands, entering the wetland habitat before continuing north through South Platte Park.

Plum Creek Conservation Connection

Plum Creek has not been dammed or channelized, and is considered by the Colorado Division of Wildlife and the Nature Conservancy to be 1 of the 17 most important areas for conserving diversity in the state. It is home to several rare and potentially endangered species.

Deer Creek Conservation Connection

The Deer Creek corridor crosses the study area in the north, emerging from the mountains through the hogback and into Chatfield Reservoir.

Willow Creek Conservation Connection

Willow Creek and its tributary, Little Willow Creek, are relatively small, intermittent drainages in the west-central portion of the study area. Although small, they provide a vital link between southern shrublands and northern wetlands areas.

Upland Corridors

Along with these riparian areas, several other key corridors are significant for wildlife movement in the Chatfield Basin. The intersection of habitats along the Dakota Hogback provides an important north-south corridor along the base of the foothills. The cover provided by Sharp-tail Ridge allows for north-south movement across the grassland plain. Several east-west corridors allow movement between the woodlands and foothills habitats on either side of the basin. These corridors are essential for wildlife movement among the various habitat types found in the basin, giving the region its unique natural character.

Dakota Hogback Conservation Connection

This formation is the most recognizable corridor in the Chatfield Basin. Vegetative cover varies considerably along the hogback, from forested areas dominated by ponderosa pine and shrubs to grasslands between the ridges. As a result, a large variety of wildlife use the corridor by ground and by air.

Sharp-tail Ridge Conservation Connection

Sharp-tail Ridge forms a secondary north-south movement corridor. This grassy plain extends from the shrublands around Roxborough State Park north along a low topographic rise toward Chatfield State Park.

East-West Conservation Connection

To some degree, the east and west portions of the study area are fragmented by Highway 85. This increasingly busy road interrupts traditional elk, deer and other wildlife movement into the eastern woodlands.

Major Conservation Areas

The 7 conservation corridors described above pass through, and take on the character of, various habitat types, including prairies, forests, and more

open woodlands. The Network has identified 6 broad areas in the basin of similar habitat and conservation importance. Conserving large portions of these areas will be important to conserving the ecological integrity of the Chatfield Basin. Significant parts of several of the areas are already protected as state and local parks or other open space.

The goal of this project, however, is not to remove each conservation area from private ownership, but rather to work collaboratively—with public agencies and private landowners/developers—to protect the most important habitat and connections throughout these areas. Each of these areas is described below.

Hogback and Grassland Conservation Area

Characterized by colorful and dramatic rock outcrops, the parallel upthrusts of the Dakota Hogback and Morrison Formations give both scenic and ecological character to the region. Situated near the western edge of the Chatfield Basin between the grassland and foothills habitat areas at 1676 and 1890 m above sea level, the Hogback and Grassland Conservation Area plays a significant role in connecting the basin as a system.

Wetlands Conservation Area

The largest areas of wetlands habitat within the Chatfield Basin are found along its riparian corridors below 1676 m. The Wetlands Conservation Area encompasses the broad plain of wetland and riparian habitat around Chatfield Reservoir and the South Platte River. These areas are characterized by a wide array of wetland habitats from shallow, open water to marshes, and wet meadows to streamside forests.

Grassland Conservation Area

The expanse of grassland between Plum Creek and Willow Creek between 1676 - 2752 m in elevation is characterized by rolling hills of mixed grasses and intermittent shrubs, providing habitat for a number of species, especially butterflies and birds.

Woodland Conservation Area

Located between 1768 - 2042 m in elevation on the eastern side of the basin, the highlands of the Woodland Conservation Area are characterized by rough, rolling terrain crowned by rocky bluffs. The vegetation in this area is dominated by dense thickets of Gambel oak (*Quercus gambelii*) and ponderosa pine (*Pinus ponderosa*) and grassy meadows of blue grama (*Bouteloua gracilus*), little bluestem (*Schizachyrium scoparium*), and sand dropseed (*Sporobolus cryptandrus*), with a few weedy species.

Shrublands Conservation Area

Toward the southern end of the Chatfield Basin, the diverse Shrublands Conservation Area is situated in a transition area between 1829 - 1981 m in elevation. In this area the hogback and grassland communities intermix with the forest and shrubland communities of the foothills. Because of this blend of habitats, the Shrublands Conservation Area is home to a diversity of wildlife, and is a focal point for corridors interconnecting Chatfield Basin.

Forest and Shrublands Conservation Area

The Forest and Shrublands Conservation Area is located on the western edge of the Chatfield Basin at about 1981 meters and higher. The shrublands of this conservation area give way to lower montane forests as elevations increase to about 2438 meters. These forests are interspersed with thickets of shrubland vegetation, providing summer range for deer and elk.

FURTHER STUDY

With further study and as individual development and conservation opportunities arise; greater definition will be given to the specific natural resources in each of these conservation areas. Using the conservation model defined by Noss and Cooperrider (1994), it is important to delineate areas for strict conservation (core areas) and others suited for a mixture of conservation and development (buffer areas). A more detailed network of corridors must also be identified.

Core protection areas are the parts of a conservation area that can make the greatest contribution to ecological, geological, water, visual, or other natural resource protection. Development is limited to facilities for managing resources or supporting complementary recreation, or existing utilities. Core areas are the heart of the conservation network. Most, but not all, of the conservation areas of the Chatfield Basin already have some protected lands, such as Cherokee Ranch in the Woodlands Conservation Area and Roxborough State Park in the Shrublands Conservation Area, that are managed as core areas. Further research is needed to determine whether the existing protected areas are big enough to serve as effective core areas.

Buffers make up most of the remaining areas within a conservation area. There may be more than 1 level of intensity of use for buffers, with the least intensive uses closest to core protection areas in inner buffers. Smaller-scale corridors (e.g. smaller drainages) should be identified and protected within buffer areas. These corridors should connect to the larger system of corridors. There also will be important resource patches, such as wetlands, within buffers that need protection.

REFERENCES

Chatfield Basin Conservation Network. 1998. Conservation network plan. (25-page report available at http:\\www.douglas.co.us)

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Table 1. Protected areas of the Chatfield Basin

Protected Area	Size (hectares)	Visits	Soft Trails (km)	Hard Trails (km)	Volun-teers	Vol. Hours	Educational Contacts
South Platte Park	262	350,000	7.2	5.6	100	5,500	17,000
Roxborough State Park	1325	105,000	19.3	0.0	140	6,000	74,500
Ken-Caryl Ranch	1974	30,000	30.6	9.7	22	443	2,200
Deer Creek Canyon	696	59,726	15.3	0.0	46	474	387
South Valley Open Space	359	0	0.0	0.0			
Pike National Forest	3642	20,000	29.0	0.0	12	200	0
Daniels Park	388	50,000	0.0	0.0			
Highlands Ranch Open Space	890	700,000	8.0	35.4	0	0	0
H R O S Conservation Area	3318	0	0.0	0.0	0	0	0
Waterton Canyon	87	500,000	1.6	16.1			3,500
Woodhouse Property	340	0	0.0	0.0	0	0	0
Cherokee Ranch Easement	1214	0	0.0	0.0	8	0	0
Chatfield Reservoir	314	12,600	0.0	0.0	8	423	2,789
Chatfield Arboretum	303	28,000	2.4	0.8	40	600	22,000
Chatfield State Park	2176	1,500,000	68.4	32.2	29	6,938	5,500
Total	17288	3,355,326	181.8	99.8	397	20,578	127,876

Hectares of Water:	870
Kilometers of Streams	450
S. Platte River/Plum Creek(km)	50